Flight Crew Operating Manual

FCOM

A310

Volume 2

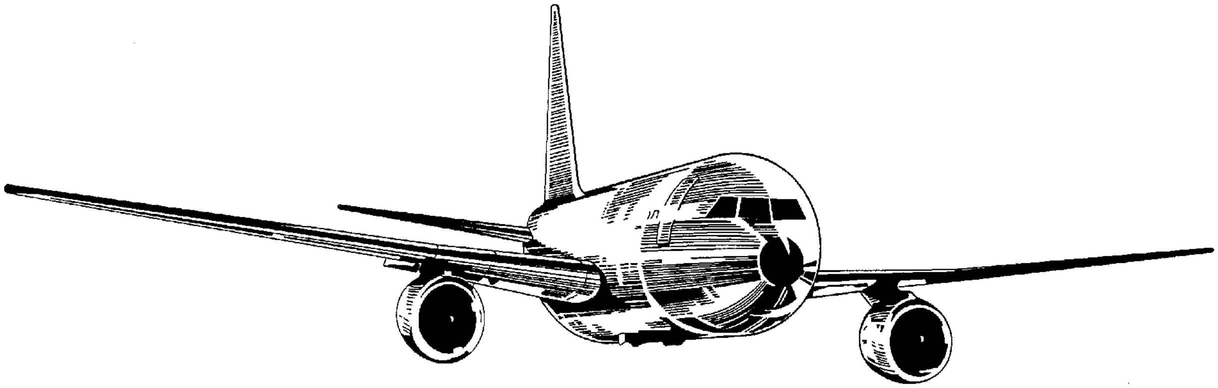
AIRBUS

AIRBUS TRAINING

A310

SIMULATOR

A310



FLIGHT CREW OPERATING MANUAL

AI/V-F 4000

SIMU S4 for training only 1PM

COMMENTS - QUESTIONS - SUGGESTIONS

All manual holders and users are encouraged to forward their questions and suggestions regarding the Flight Crew Operating Manual.
Any questions with respect to use of this manual or information contained herein shall be directed to :

R **AIRBUS – BP 33**
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX - FRANCE
TELEX TLSBI7X or 530526F
R **FAX : 33/5.61.93.29.68**
R **ATTN. Flight Operations Support - STLW**

FOR TECHNICAL OR PROCEDURAL CONTENT

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R **ATTN. Technical Data Support & Services – SDC**

FOR PRINTING AND DISTRIBUTION

GENERAL

The purpose of this letter of transmittal is to provide some general information on the revision. It is used also in order to highlight the main changes introduced with the revision (additionally, each page revised contains its own highlight as listed in subchapter 2.00.02).

MAIN TOPICS OF REVISION 36

With the revision 36 the main topics are as follow.

1. This revision implements a new process for OEB in the QRH.

The objective is to ease the OEB review that is recommended during preliminary cockpit preparation. **Starting with this revision, an extract of the OEB procedure part is published in QRH for each OEB.**

In that frame of the following FCOM/QRH modifications have been done :

- The ″OEB General Description″ section (FCOM 2.19.10) gives **all details on OEB definitions and handling in both FCOM and QRH**.
  Note that in this chapter, the section ″SUBJECT″ (FCOM 2.19.30) has been removed since the List Of Effective OEB (LEOEB) has been enhanced and provides now the title of each OEB.
- The SOP section for Flight Preparation (FCOM 2.03.02) recommends that the flight crew access the OEB section in the QRH and carefully review all OEBs (particularly red OEBs) that are applicable to the aircraft.
- In the FCOM ″Emergency & Abnormal″ Chapters, section ″Introduction″ (FCOM 2.04.10 & 2.05.10) have been amended to be in line with the definitions provided in chapter 2.19.
- In the ″General″ chapter of QRH (QRH 0.04), an ″OEB PROC″ paragraph is added to provide the Operators with explanations about the organization of the OEB QRH chapter (QRH 19.00).

2. Recommendation when performing Flexible Takeoff (2.03.07 page 01 and 2.10.20 page 1 and 2) :

To avoid any misinterpretation and to clearly reflect AIRBUS recommendation, this paragraph is reworded to recommend that the highest FLEX temperature should be used. However, when the FLEX temperature difference between two FLAPS configuration is less than 5°C, choosing the highest FLAPS configuration is recommended because it provides lower speeds while not decreasing significantly the benefit of the Flexible thrust (save engine life).

3. SOP Takeoff with crosswind greater than 20kt (2.03.12 page 01)

- The previous revision introduced specific takeoff thrust setting for strong crosswind conditions. This was a precautionary measure following report of suspected engine surge at low speed due to crosswind.

The current revision removes this procedure.
Reasons are explained here below :

- The objective of the previous procedure was to minimize the effect of crosswind during takeoff roll on engine stability. Thus the objective was to apply thrust manually in order to get an higher ground speed with a relatively slower engine acceleration compared to the A/THR thrust setting.
- The revision induced an increased crew workload, and, in some cases, could lead to apply the power more rapidly than with the A/THR.
- The impact of the previous procedure on performance was not negligible while engine surge prevention was not confirmed in all cases.
- For some aircraft configurations, the previous procedure was not compatible with the crew decision to use FLEX TO and could lead to undesired A/THR behavior.
- Today on the A310/A300-600 fleet, no event of engine surge at low speed due to strong crosswind condition has been reported and documented.
- Experience has shown that the difficulties to apply the revised procedure invalidate its benefits. Consequently we have decided to remove it.

4. SOP Takeoff roll (2.03.12 page 01)

Recommendation on PF input on the control column is added to the takeoff procedure. This is to improve Nose Landing Gear adherence to the ground and to ensure a good on-ground controllability of the aircraft. PF must thus apply forward control column until 80 kts depending on CG position (in order to counteract the pitch up moment during thrust application), runway and crosswind conditions keeping in mind that too much forward input on the control column might lead to possible vibrations of the nose wheels.

5. PW4000 (only) : starter reengagement limit increased (2.01.40 p 05, 2.03.08 p 02, 2.05.70 p 11/13/14)

The starter re-engagement limit has been reviewed by Hamilton Sundstrand which is the starter manufacturer for PW 4000 engines. This study concludes that the starter re-engament limit can be increased from 15%N2 in normal cases but not exceeding 20%N2 in abnormal situations up to 30%N2 in any and all cases. This change has been reflected in PW4000 Operating Instructions. With this revision, Operating Limitations, Standard Operating Procedures and Abnormal Procedures have been amended to cope with this new limit.

6. EGPWS (only) : Recommendations regarding the use of TERR on ND (2.03.10 p 02 and 2.03.17 p 02)

On aircraft fitted with EGPWS, it is now recommended to set TERR on ND during TAXI and during DESCENT when external conditions are poor in order to improve situational awareness. The TERR on ND should preferably be set on PF side. However, should the weather radar be required in the meantime, TERR should be selected on PNF ND and weather radar information on PF ND.

7. QFU and threshold check after line up (2.03.10 p 02 and 2.03.17 p 02)

To be in line with the FAA Safety Alert For Operators SAFO 06013 and SAFO 07003, AIRBUS standard operating procedures (SOPs) request flight crews to ensure that the airplane is at the selected takeoff runway and recommend the use of ND and airport charts.

8. IRS alignment check for FMS data confirmation (2.02.21 p 05 and 2.02.31 p 05)

The standard operating procedures request the flight crew to confirm the FMS data. Among the checks, the crew has to verify the IRS alignment by confirmation of the coordinates. The procedures and techniques now provides actions to perform in order to obtain this confirmation. It consists in ensuring that position entered in the FMS and sent to the IRS are consistent with the SID and surrounding NAVAIDS. In addition, on aircraft fitted with the POSITION MONITOR page on the FMS, a cross-check of the IRS position against the FMS is necessary.

The objective of these additional steps is to emphasize, regardless of the aircraft equipment (e.g. GPS), the importance of the navigation starting point done through the IRS alignment.

9. GPWS memory item enhancement (2.04.34 p 01)

When a call containing "PULL UP" is triggered, the memory item regarding the BANK could have been misunderstood and misleading. This memory item is reworded to remind that the best climb gradient is obtained when the bank is close to wings level, and to clarify that climb initiation should not be delayed until wings are leveled.

FOREWORD

This manual is complementary to the approved Flight Manual. While every endeavour is made to ensure that the data contained herein and that in the Flight Manual are in agreement, in the event of disagreement the Flight Manual is the final authority.

CONTENT

The Flight Crew Operating Manual is the support documentation for flight crew operations.

The Flight Crew Operating Manual provides operating crews with the technical, procedural and performance characteristics of the A310 aircraft to ensure a safe and efficient operation during normal and/or abnormal/ emergency situations on ground and in flight.

However, the Flight Crew Operating Manual is not intended to provide basic jet aircraft piloting techniques or information that are considered as basic airmanship for trained flight crews familiar with that type of aircraft and with its general handling characteristics.

The Flight Crew Operating Manual is intended :

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

The contents are divided into two volumes :

- Vol. 1 : SYSTEMS DESCRIPTION
  Volume 1 contains description of the aircraft and the systems.
- Vol. 2 : PROCEDURES AND PERFORMANCE.
  Volume 2 contains operating and performance information plus loading data.

The material included in this volume has been extracted from the Flight Manual as far as the certified parts, are concerned.

If any of the procedures or performance data contained in Vol. 2 are not in agreement with the Flight Manual, the latter will supersede.

Airline experience and flight test inputs have been taken into account.

WARNINGS, CAUTIONS AND NOTES

WARNING

Text of the warning

Used to denote important notice that, if not immediately applied, would affect safety.

CAUTION

Text of the caution.

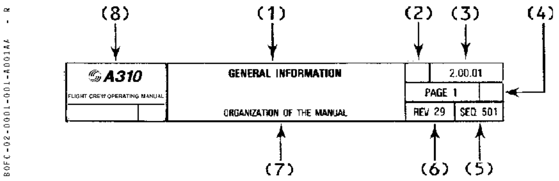
Used to precise certain procedures or to avoid a misusing.

Note : Text of the note.

Used to underline the corresponding point or give a supplementary explanation.

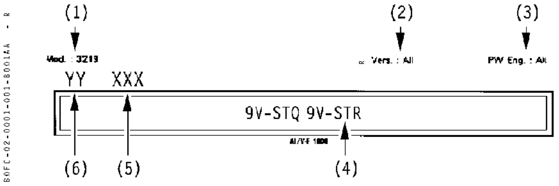
PAGINATION

TOP OF THE PAGE



(1) Chapter title
(2) Blank space
(3) FCOM Volume/Chapter/Section number
(4) Page number followed by L which indicates weights are given in pounds. If there is no indication, the page is valid for both pounds and tons.
When a new page must be inserted between two existing pages, a suffix letter is added to the page number.
Ex. : Page 24-A must be inserted between page 24 and page 25.
(5) Sequence number :
It allows an easier management of the pages for Airbus Industrie and allows to enter the List of Effective Pages. It may be used by each manual holder to simplify manuals updating.
(6) Number of the revision.
(7) Section title.
(8) Airbus logo or airline logo.

BOTTOM OF THE PAGE



(1) This zone contains :
- either, applicable modification (MOD) or/and modification proposal (MP) number(s) (validation criteria).
- or, a « Code » number (ex : 0029) (validation criteria) when a combination of various modifications applies.
  A table of correspondance between « Code » numbers and MOD/MP number(s) is given in this chapter 2.00.25.

(2) Indicates page specific to the particular aircraft version (validation criteria). When there is no indication or ALL indication, the page is valid for all versions restricted by others validation criteria.
(3) Indicates page specific to type of engine installed (validation criteria). When there is no indication or ALL indication, the page is valid for all engines, restricted by others validation criteria.

(4) This zone is used for listing operator's aircraft MSN or tail number if this option has been taken.

(5) Airline three-letter abbreviation (e.g.XXX) if page only applicable to XXX airline.

(6) The two-letter abbreviation (e.g.YY) indicates a specific page written to comply with local regulations, eg :
- AA : for Australian regulations
- UK : for C.A.A. regulations
- US : for F.A.A. regulations

REVISIONS

NORMAL REVISIONS

Issued periodically to cover non-urgent corrections, changes or/and to add new data.
They are accompanied by filing instructions and an updated List of Effective Pages including customized pages.
Highlight are also provided to give background information on the changes introduced with the revision.
A normal revision record sheet is provided at the front of each volume.
In addition, a « List of MOD/MP affecting the manual » is provided, giving a simple explanation of the technical content of each MOD/MP incorporated and their validity per aircraft.

TEMPORARY REVISIONS

Printed on yellow paper, issued to cover urgent matters arising between normal revisions, they are accompanied by filing instructions.

R The applicability of each temporary revision is given on the customized list of effective temporary revisions issued with each new temporary revision.

INTERMEDIATE REVISIONS

Intermediate revisions of the FCOM/QRH are used when the need occurs to :

- supply the contractual allocation of manuals to a new operator between two normal revisions
- validate aircraft configuration changes by retrofit of Airbus Industrie Service Bulletins between two normal revisions (on request of the operator)
- validate fleet composition changes (new aircraft) between two normal revisions.

EXAMPLE

A suffix after the revision number indicates an intermediate revision, between two normal revisions e.g. 023A issued between normal revision 023 and 024.

This service allows Airbus Operators to use at any time up-to-date manuals. It is quicker than issuing a Temporary Revision and allows direct replacement in the manuals of only the affected white pages instead of inserting yellow pages.

INCORPORATION OF SERVICE BULLETINS IN THE FCOM

When a Service Bulletin has been accomplished on one or more aircraft of the operators fleet, and notified to AIRBUS, all affected manuals will reflect the new aircraft configuration at the next revision. If judged necessary by AIRBUS, or requested by the operator, a "Temporary Revision" will be issued between normal revisions.

OPERATIONS ENGINEERING BULLETINS

Issued as the need arises to advise operators of revised or new technical or procedural information between normal revisions of the manual.
OEBs are provided with an OEB record sheet. This record sheet is re-issued with each normal revision to update the bulletin embodiment status.

HOW TO INSERT A REVISION

GENERAL

FCOM and checklists are customized in such a way to allow an airline to elaborate :either, an envelope airline manual (available in a library)

or, an airplane manual valid for a particular airplane (on board of this airplane).

Two documents added to each revision allow this work :

- the « Filing instructions ».
- the « List of Effective Pages – LEP ».

FILING INSTRUCTIONS

Use the filing instructions as follows :

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

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

LIST OF EFFECTIVE PAGES (LEP)

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

R

BEST WAY TO GET UPDATED DOCUMENTATION

The best way, for an airline, to be sure getting, regularly, correct updated documentation is to advise :

R AIRBUS
BP 33
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FRANCE

Telex : TLSBP7X.. or 530526F

FAX : (33) 5 61.93.28.06

ATTN : Customer Service Directorate – Technical
R Data Support and Services (SDC)

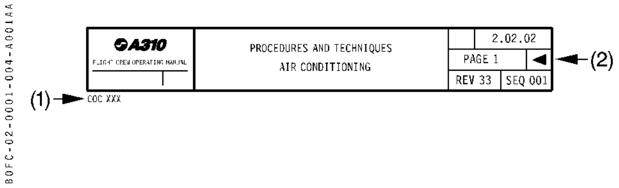
or via e-mail at : sb.reporting@airbus.com

as soon as any Airbus Service Bulletin is completely performed on any airplane.

CUSTOMER ORIGINATED CHANGE (COC) UPDATE

COC IDENTIFICATION

Customer Originated Changes, incorporated into the FCOM at customer request to reflect data or procedures originated by and peculiar to that specific customer, will be identified by the COC reference number (1). As from REV 33, the COC information is indicated by triangles in the margin of the individual pages. As from REV 33, a triangle in the header indicates that the complete page is impacted by the COC (2).



RESPONSIBILITY

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AIRBUS will not undertake to test or evaluate in any form the validity or the technical accuracy of the customer originated material, and the customer shall have the sole and exclusive responsibility for the validity and accuracy of materials submitted for incorporation into the FCOM.

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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
0596	SIMU-S4'04

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V CH SEC ---PAGE-- SEQ- --REV-- ----VALIDATION CRITERIA-----
                        ----------------------REASONS OF CHANGE--------------------
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2 02 21  001       100  REV033  M:6789

                      - INCORPORATION OF MOD 06789

2 02 21  002       100  REV033  M:6789

                      - INCORPORATION OF MOD 06789

2 02 26  001       100  REV033  M:6789

                      - INCORPORATION OF MOD 06789
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	2	00	02	LEP	001	REV036	LIST OF EFFECTIVE PAGES
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	2	02	14	004	001	REV035	
						ALL	
	2	02	14	005	001	REV036	
	2	02	14	006	001	REV035	
						ALL	
	2	02	14	007	001	REV019	
	2	02	14	008	001	REV024	
						ALL	
	2	02	14	009	001	REV036	
	2	02	14	010	001	REV035	
						ALL	
	2	02	14	011	001	REV036	
	2	02	14	012	001	REV035	
						ALL	
	2	02	14	013	001	REV027	
	2	02	14	014	120	REV020	CODE 0214D
						ALL	
	2	02	15	001	205	REV030	M:(3221+4672)=(4672+6505)
	2	02	15	002	002	REV033	
						ALL	
	2	02	15	003-4	100	REV035	CODE 0047
						ALL	
	2	02	15	005	001	REV031	
	2	02	15	006	110	REV031	M:4672
						ALL	
	2	02	15	007	001	REV026	
	2	02	15	008	115	REV033	M:11320=11364=(11320+11364)
						ALL	
	2	02	15	009	115	REV032	M:11320=11364
	2	02	15	010	001	REV030	
						ALL	
	2	02	15	011	001	REV030	
	2	02	15	012	001	REV026	
						ALL	
	2	02	15	013	001	REV026	
						ALL	
	2	02	16	001	001	REV031	
	2	02	16	002	100	REV033	M:12557 OR 12715
						ALL	
	2	02	17	001	001	REV032	CODE 0061
	2	02	17	002	020	REV019	ALL-PW
						ALL	
	2	02	19	001	100	REV036	M:6789
	2	02	19	002	001	REV033	
						ALL	
	2	02	20	001	001	REV033	
	2	02	20	002	100	REV033	M:06789
						ALL	
	2	02	20	003	100	REV033	M:6789
	2	02	20	004	001	REV033	
						ALL	
	2	02	21	001	100	REV033	M:6789
	2	02	21	002	100	REV033	M:6789
						ALL	
	2	02	21	003	100	REV033	M:6789
	2	02	21	004	300	REV033	M:11320=11364=12044=12045
						ALL	
	2	02	21	005	100	REV036	M:11320=11364=12044=12045
	2	02	21	006	001	REV033	
						ALL	
	2	02	21	007	001	REV033	
	2	02	21	008	110	REV033	M:4801+6789
						ALL	

M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
			----------EFFECTIVITY----------	
2 02 21	009	110	REV033	M:4801+6789
2 02 21	010	001	REV033	
			ALL	
2 02 22	001	001	REV033	
2 02 22	002	001	REV033	
			ALL	
2 02 23	001	001	REV033	
2 02 23	002	001	REV033	
			ALL	
2 02 23	003	100	REV035	M:6789
2 02 23	004	100	REV035	M:6789
			ALL	
2 02 24	001	100	REV033	M:6789
2 02 24	002	100	REV035	M:6789
			ALL	
2 02 24	003	100	REV033	M:6789
2 02 24	004	300	REV033	M:11320=11364=12044=12045
			ALL	
2 02 24	005	100	REV033	M:6789
2 02 24	006	200	REV033	M:11320=11364=12044=12045
			ALL	
2 02 24	007	200	REV036	M:11320=11364=12044=12045
2 02 24	008	100	REV033	M:6789
			ALL	
2 02 24	009	100	REV033	M:6789
2 02 24	010	100	REV033	M:6789
			ALL	
2 02 25	001	200	REV033	M:11320=11364=12044=12045
2 02 25	002	300	REV033	M:11320=11364=12044=12045
			ALL	
2 02 25	003	001	REV036	
2 02 25	004	100	REV033	M:6789
			ALL	
2 02 25	005	100	REV033	M:6789
2 02 25	006	001	REV033	
			ALL	
2 02 25	007	001	REV033	
2 02 25	008	001	REV033	
			ALL	
2 02 26	001	100	REV033	M:6789
2 02 26	002	100	REV033	M:6789
			ALL	
2 02 26	003	100	REV033	M:6789
2 02 26	004	200	REV033	M:11320=11364=12044=12045
			ALL	
2 02 26	005	100	REV033	M:6789
2 02 26	006	001	REV033	
			ALL	
2 02 27	001	100	REV033	M:6789
2 02 27	002	001	REV033	
			ALL	
2 02 27	003	001	REV033	
2 02 27	004	001	REV033	
			ALL	
2 02 28	001	100	REV033	M:6789
2 02 28	002	100	REV033	M:6789
			ALL	
2 02 28	003	100	REV033	M:6789
2 02 28	004	100	REV033	M:6789
			ALL	
2 02 29	001	220	REV033	CODE 0420
2 02 29	002	170	REV033	MOD6789/PW4000
			ALL	
2 02 29	003	150	REV033	MOD 6789 PW 4000
2 02 29	004	150	REV033	MOD 6789 PW 4000 / T
			ALL	
2 02 29	005	160	REV033	MOD 6789 PW 4000 / T
2 02 29	006	160	REV033	MOD 6789 PW 4000 / T
			ALL	

M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
			----------EFFECTIVITY----------	
2 02 29	007	150	REV033	MOD 6789 PW 4000 / T
2 02 29	008	100	REV033	MOD 6789/T
			ALL	
2 02 29	009	170	REV033	MOD6789/PW4000
			ALL	
2 03 00	001	001	REV030	
2 03 00	002	001	REV029	
			ALL	
2 03 01	001	001	REV031	
2 03 01	002	001	REV035	
			ALL	
2 03 01	003	100	REV031	M:11454
2 03 01	004	001	REV028	
			ALL	
2 03 02	001	001	REV036	
2 03 02	002	001	REV028	
			ALL	
2 03 03	001-2	001	REV035	
			ALL	
2 03 04	001	001	REV033	
2 03 04	002	200	REV035	CODE 0505
			ALL	
2 03 04	003	001	REV036	
2 03 04	004	001	REV028	
			ALL	
2 03 05	001	001	REV023	
2 03 05	002	070	REV022	PW4000
			ALL	
2 03 05	003	100	REV031	M:4801
2 03 05	004	070	REV024	PW4000
			ALL	
2 03 06	001	001	REV030	
2 03 06	002	001	REV034	
			ALL	
2 03 06	003	001	REV034	
2 03 06	004	001	REV031	
			ALL	
2 03 06	005	200	REV033	M:3881+4801
2 03 06	006	070	REV033	PW 4000
			ALL	
2 03 06	007	001	REV033	
2 03 06	008	001	REV023	
			ALL	
2 03 07	001	205	REV036	CODE 0492
2 03 07	002	001	REV028	
			ALL	
2 03 08	001	070	REV035	PW 4000
2 03 08	002	070	REV036	PW 4000
			ALL	
2 03 08	003	001	REV028	
2 03 08	004	001	REV028	
			ALL	
2 03 09	001	170	REV029	M:7694/PW 4000
2 03 09	002	001	REV028	
			ALL	
2 03 10	001	100	REV035	M:5443=6233=6591=(5443+6591)
2 03 10	002	207	REV036	M:7172+11894
			ALL	
2 03 10	003	001	REV022	
2 03 10	004	001	REV036	
			ALL	
2 03 11	001	259	REV036	CODE:0246/PW
2 03 11	002	001	REV028	
			ALL	
2 03 12	001	070	REV036	PW 4000
2 03 12	002	001	REV034	
			ALL	
2 03 12	003	001	REV024	
2 03 12	004	001	REV028	
			ALL	

M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
M V CH SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
			----------EFFECTIVITY-----------	
2 03 13	001	100	REV024	M:7172
2 03 13	002	001	REV028	
			ALL	
2 03 14	001	020	REV035	PW 4000
2 03 14	002	001	REV028	
			ALL	
2 03 15	001	150	REV032	M:11894/PW
2 03 15	002	001	REV028	
			ALL	
2 03 16	001	109	REV034	M:4801
2 03 16	002	001	REV028	
			ALL	
2 03 17	001	001	REV035	
2 03 17	002	103	REV036	M:11894
			ALL	
2 03 18	001	170	REV032	M:11894/PW
2 03 18	002	300	REV035	CODE 0269
			ALL	
2 03 18	003	001	REV036	
2 03 18	004	001	REV030	
			ALL	
2 03 19	001	001	REV036	
2 03 19	002	001	REV029	
			ALL	
2 03 20	001	001	REV035	
2 03 20	002	001	REV035	
			ALL	
2 03 20	003	001	REV030	
2 03 20	004	001	REV029	
			ALL	
2 03 22	001	001	REV035	
2 03 22	002	001	REV031	
			ALL	
2 03 22	003	001	REV023	
2 03 22	004	100	REV030	M:4863
			ALL	
2 03 22	005	170	REV034	M:5757/PW 4000
2 03 22	006	001	REV028	
			ALL	
2 03 23	001	001	REV034	
2 03 23	002	001	REV028	
			ALL	
2 03 24	001	171	REV033	CODE:0064/PW 4000
2 03 24	002	001	REV028	
			ALL	
2 03 25	001	270	REV032	M:4672+4801/PW 4000
2 03 25	002	001	REV028	
			ALL	
2 03 26	001	001	REV028	
2 03 26	002	001	REV028	
			ALL	
2 03 30	001	001	REV035	
2 03 30	002	001	REV036	
			ALL	
2 03 30	003	001	REV035	
2 03 30	004	001	REV035	
			ALL	
2 03 30	005	001	REV035	
2 03 30	006	001	REV036	
			ALL	
2 03 30	007	001	REV035	
2 03 30	008	001	REV035	
			ALL	
2 03 30	009	001	REV036	
2 03 30	010	001	REV035	
			ALL	
2 04 00	001	200	REV034	M:4801+5911
2 04 00	002	001	REV028	
			ALL	
2 04 10	001	001	REV033	
2 04 10	002	001	REV035	
			ALL	
2 04 10	003	001	REV036	
2 04 10	004	001	REV027	
			ALL	
2 04 21	001	100	REV036	M:3881
2 04 21	002	100	REV032	M:6269
			ALL	
2 04 24	001	370	REV032	M:4801+5910+5911 / PW 4000
2 04 24	002	300	REV033	M:3881+4801+5911
			ALL	
2 04 24	003	300	REV029	M:3881+4801+5911
2 04 24	004	100	REV029	M:5911
			ALL	
2 04 26	001	001	REV034	
2 04 26	002	001	REV035	STD=M:12134
			ALL	
2 04 26	003	001	REV035	
			ALL	
2 04 26	003A	570	REV033	CODE 0332/PW 4000
			ALL	
2 04 26	003B	300	REV036	M:4801+6368+8648
			ALL	
2 04 26	004	502	REV035	CODE 0460
			ALL	
2 04 26	005	200	REV034	M:2989+3881
2 04 26	006	001	REV028	
			ALL	
2 04 27	001	001	REV033	
2 04 27	002	200	REV033	CODE 0343
			ALL	
2 04 27	003	001	REV033	
2 04 27	004	001	REV033	
			ALL	
2 04 28	001	100	REV030	M:4801
2 04 28	002	100	REV028	M:4801=(4801+10806)
			ALL	
2 04 29	001	001	REV036	
2 04 29	002	300	REV036	CODE 0099
			ALL	
2 04 29	003	001	REV036	
2 04 29	004	001	REV036	
			ALL	
2 04 32	001	001	REV033	
2 04 32	002	001	REV033	
			ALL	
2 04 34	001	220	REV036	CODE:0423
2 04 34	002	001	REV027	
			ALL	
2 04 70	001	070	REV034	PW 4000
2 04 70	002	110	REV034	M:4801
			ALL	
2 04 70	003	110	REV036	M:4801
2 04 70	004	001	REV036	
			ALL	
2 04 70	005	001	REV034	
2 04 70	006	001	REV036	
			ALL	
2 04 70	007	070	REV034	PW 4000
			ALL	
2 04 80	001	100	REV031	M:4801
2 04 80	002	200	REV031	M:3881+4801
			ALL	
2 04 80	003	001	REV034	
2 04 80	004	001	REV027	
			ALL	

M	V	CH	SEC	---PAGE--	SEQ-	--REV-- ----------EFFECTIVITY----------	-----VALIDATION CRITERIA----
2	04	80		005	001	REV033	
2	04	80		006	001	REV033	
						ALL	
2	04	80		007	001	REV033	
						ALL	
2	05	00		001	301	REV034	CODE 0065
2	05	00		002	070	REV035	PW 4000
						ALL	
2	05	10		001	001	REV033	
2	05	10		002	001	REV035	
						ALL	
2	05	10		003	001	REV036	
2	05	10		004	001	REV027	
						ALL	
2	05	21		001	001	REV030	
2	05	21		002	100	REV034	M:6007=(6007+6120)
						ALL	
2	05	21		002A	100	REV036	CODE 0454
						ALL	
2	05	21		003	100	REV031	M:7460
2	05	21		004	105	REV034	M:2989 OR (2989+5119+5713)
						ALL	
2	05	21		005	001	REV033	
2	05	21		006	100	REV029	M:3881
						ALL	
2	05	24		001	300	REV029	CODE 0040
2	05	24		002	460	REV035	M:3881+4801+5911+6368/PW4000
						ALL	
2	05	24		002A	100	REV031	M:5911
						ALL	
2	05	24		003	330	REV034	CODE 0023/PW 4000
2	05	24		004	530	REV034	CODE 0218/PW 4000
						ALL	
2	05	24		005	100	REV028	CODE 0142
2	05	24		006	300	REV036	CODE 0293
						ALL	
2	05	24		007	770	REV036	CODE 0307/PW 4000
2	05	24		008	200	REV033	M:5911+12557=5911+12715
						ALL	
2	05	26		001	001	REV034	
2	05	26		002	001	REV028	
						ALL	
2	05	26		003	100	REV032	M:2254
2	05	26		004	100	REV028	M:2254=FDX
						ALL	
2	05	27		001	410	REV033	CODE 0108
2	05	27		002	200	REV033	CODE 0126
						ALL	
2	05	27		002A	103	REV033	M:6865
						ALL	
2	05	27		003	050	REV029	PW 4152
2	05	27		004	110	REV029	M:6041=6865
						ALL	
2	05	27		005	210	REV035	CODE 0121
2	05	27		006	001	REV033	
						ALL	
2	05	27		007	001	REV035	
2	05	27		008	001	REV033	
						ALL	
2	05	27		009	100	REV035	M:4801
2	05	27		010	001	REV035	
						ALL	
2	05	27		010A	100	REV035	M:5904
						ALL	
2	05	27		011	001	REV033	
2	05	27		012	001	REV033	
						ALL	
2	05	27		013	200	REV033	CODE 0339
2	05	27		014	001	REV033	
						ALL	
2	05	28		001	203	REV036	M:4801+4803
2	05	28		002	001	REV033	
						ALL	
2	05	28		002A	001	REV032	
						ALL	
2	05	28		003	200	REV033	M:4801+4803
2	05	28		004	050	REV033	PW
						ALL	
2	05	28		005	210	REV033	M:4801+7259
2	05	28		006	110	REV028	M:4801
						ALL	
2	05	28		007	110	REV029	M:4801=(4801+7576)
2	05	28		008	100	REV028	M:4801 OR (4801+7576)
						ALL	
2	05	29		001	100	REV028	M:5911
2	05	29		002	103	REV031	M:5911
						ALL	
2	05	29		003	001	REV031	
2	05	29		004	001	REV031	
						ALL	
2	05	30		001	050	REV027	PWALL
2	05	30		002	060	REV033	PW 4000
						ALL	
2	05	30		003	100	REV027	M:2753
2	05	30		004	100	REV029	M:2753 = 3588
						ALL	
2	05	32		001	100	REV036	M:4801
2	05	32		002	105	REV036	M:4801
						ALL	
2	05	32		003	105	REV036	M:4801
2	05	32		004	200	REV036	CODE:0275
						ALL	
2	05	32		005	200	REV031	CODE 0326
2	05	32		006	110	REV029	CODE 0270
						ALL	
2	05	34		001	001	REV029	STD=M:5846+11123
2	05	34		002	110	REV032	M:4801
						ALL	
2	05	34		003	100	REV029	M:MP S5063=6523
2	05	34		004	170	REV036	M:MP S5063=6523/PW 4000
						ALL	
2	05	34		005	001	REV033	
2	05	34		006	001	REV028	STD=11319=11702=(11319+11702
						ALL	
2	05	34		007	100	REV035	CODE 0047
2	05	34		008	001	REV036	
						ALL	
2	05	49		001	001	REV027	
2	05	49		002	001	REV028	
						ALL	
2	05	70		001	427	REV034	M:4801+5336+5917+5918/PW
2	05	70		002	020	REV034	STD OR 5725/PW4000
						ALL	
2	05	70		003	070	REV031	PW 4000
2	05	70		004	070	REV034	PW 4000
						ALL	
2	05	70		005	020	REV034	PW4000
2	05	70		006	010	REV034	PW 4000
						ALL	
2	05	70		007	020	REV034	PW 4000
2	05	70		008	030	REV029	PW4000
						ALL	
2	05	70		009	020	REV032	PW 4000
2	05	70		010	025	REV029	CODE 0034
						ALL	

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
M	V	CH	SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
						----------EFFECTIVITY----------	
	2	05	70	010A	170	REV036	M:4863/PW 4000
						ALL	
	2	05	70	011	070	REV036	PW 4000
	2	05	70	012	050	REV034	PW
						ALL	
	2	05	70	013	070	REV036	PW 4000
	2	05	70	014	070	REV036	PW 4000
						ALL	
	2	05	70	015	001	REV034	
	2	05	70	016	001	REV028	
						ALL	
	2	05	80	001	001	REV034	
	2	05	80	002	001	REV032	
						ALL	
	2	05	80	003	200	REV030	M:5779+7172
	2	05	80	004	001	REV030	
						ALL	
	2	05	80	005	001	REV030	
	2	05	80	006	001	REV031	
						ALL	
	2	05	80	007	001	REV027	
	2	05	80	008	001	REV027	
						ALL	
	2	05	80	009	001	REV028	
	2	05	80	010	070	REV031	PW 4000
						ALL	
	2	05	80	011	070	REV031	PW 4000
	2	05	80	012	100	REV033	M:12557=12715
						ALL	
	2	05	80	013	001	REV033	
	2	05	80	014	001	REV033	
						ALL	
	2	05	90	001	100	REV028	M:6041
	2	05	90	002	170	REV032	M:7259/PW4000
						ALL	
	2	05	90	003	001	REV028	
	2	05	90	004	001	REV028	
						ALL	
	2	06	00	001-2	001	REV004	ALL/ALL
						ALL	
	2	06	10	001-2	001	REV004	ALL/ALL
						ALL	
	2	06	20	001	001	REV005	ALL/ALL
	2	06	20	002	001	REV005	ALL/ALL
						ALL	
	2	06	20	003	001	REV007	ALL/ALL
	2	06	20	004	001	REV029	STD OR (M:4010/FDX)
						ALL	
	2	06	30	001	040	REV033	M:4801
	2	06	30	002	210	REV034	M:4801+6874
						ALL	
	2	06	30	003	212	REV036	M:4801+6605
						ALL	
	2	06	30	003A	040	REV033	M:4801
						ALL	
	2	06	30	004	001	REV004	ALL/ALL
						ALL	
	2	06	30	005	001	REV004	ALL/ALL
	2	06	30	006	001	REV004	ALL/ALL
						ALL	
	2	06	30	007	040	REV036	M:4801
	2	06	30	008	100	REV023	M:4801
						ALL	
	2	06	40	001	100	REV033	CODE:0364
	2	06	40	002	100	REV033	CODE:0364
						ALL	
	2	06	40	002B	100	REV033	CODE:0364
						ALL	
	2	06	40	003	100	REV033	CODE:0364
	2	06	40	004	001	REV029	STD OR M:4801 OR RJA
						ALL	
	2	06	40	005	100	REV033	CODE:0364
	2	06	40	006	100	REV033	CODE:0364
						ALL	
	2	08	00	001-2	001	REV020	
						ALL	
	2	08	10	001	001	REV004	ALL/ALL
	2	08	10	002	001	REV004	ALL/ALL
						ALL	
	2	08	10	003	001	REV014	
	2	08	10	004	001	REV031	
						ALL	
	2	08	10	005	001	REV004	ALL/ALL
	2	08	10	006	001	REV004	ALL/ALL
						ALL	
	2	08	10	007	001	REV004	ALL/ALL
	2	08	10	008	001	REV004	ALL/ALL
						ALL	
	2	08	10	009	001	REV020	
	2	08	10	010	001	REV020	
						ALL	
	2	09	00	001-2	050	REV025	PW4000
						ALL	
	2	09	10	001	040	REV029	PW 4000
	2	09	10	002	040	REV020	PW 4000
						ALL	
	2	09	10	003-4	040	REV020	PW 4000
						ALL	
	2	09	20	001	040	REV031	4152
	2	09	20	002	040	REV021	PW 4152
						ALL	
	2	09	20	003	040	REV031	4152
	2	09	20	004	040	REV021	PW 4152
						ALL	
	2	09	20	005	060	REV031	PW 4000
	2	09	20	006	050	REV021	PW 4000
						ALL	
	2	09	20	007-8	060	REV021	PW 4000
						ALL	
	2	09	30	001	025	REV018	PW 4152
	2	09	30	002	025	REV021	PW 4152
						ALL	
	2	09	30	003	025	REV021	PW 4152
	2	09	30	004	025	REV021	PW 4152
						ALL	
	2	09	30	005	025	REV021	PW4000
	2	09	30	006	025	REV032	PW 4000
						ALL	
	2	09	30	007	025	REV025	PW4000
	2	09	30	008	070	REV025	PW 4000
						ALL	
	2	10	00	001-2	070	REV033	CODE:0376
						ALL	
	2	10	10	001	003	REV035	CODE 0030
	2	10	10	002	003	REV024	CODE 1010B
						ALL	
	2	10	10	003	140	REV024	M:4863
	2	10	10	004	100	REV029	M:4863
						ALL	
	2	10	20	001	020	REV036	PW ALL
	2	10	20	002	002	REV036	
						ALL	
	2	10	30	001	020	REV034	PW
	2	10	30	002	020	REV033	80A3/80C2A2=7R4D1/7R4E1/4152
						ALL	

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

  2 10 30  003       020   REV008   ALL/ALL-PW
  2 10 30  004       025   REV035   CODE 0052/4152
                           ALL

  2 10 30  005       001   REV022
  2 10 30  006       025   REV022   PW 4152
                           ALL

  2 10 30  007-8     001   REV004   ALL/ALL
                           ALL

  2 10 40  001       070   REV031   PW 4000
  2 10 40  002       040   REV036   CODE 0044/PW 4152
                           ALL

  2 10 40  003       090   REV033   CODE 0378/PW 4152
  2 10 40  004       090   REV033   CODE 0378/PW 4152
                           ALL

  2 10 40  005       090   REV033   CODE 0378/PW 4152
  2 10 40  006       090   REV033   CODE 0378/PW 4152
                           ALL

  2 10 40  007       090   REV033   CODE 0378/PW 4152
  2 10 40  008       090   REV033   CODE 0378/PW 4152
                           ALL

  2 10 40  009       090   REV033   CODE 0378/PW 4152
  2 10 40  010       090   REV033   CODE 0378/PW 4152
                           ALL

  2 10 40  011       090   REV033   CODE 0378/PW 4152
  2 10 40  012       001   REV033   CODE 0381
                           ALL

  2 10 40  013       135   REV029   M:4863/4152
  2 10 40  014       135   REV029   M:4863/4152
                           ALL

  2 10 40  015       135   REV029   M:4863/4152
  2 10 40  016       135   REV029   M:4863/4152
                           ALL

  2 10 40  017       135   REV029   M:4863/4152
  2 10 40  018       135   REV029   M:4863/4152
                           ALL

  2 10 40  019       290   REV034   CODE:0182/PW 4152
  2 10 40  020       290   REV034   CODE:0182/PW4152
                           ALL

  2 10 40  021       290   REV034   CODE:0182/PW4152
  2 10 40  022       290   REV034   CODE:0182/PW4152
                           ALL

  2 10 40  023       290   REV034   CODE 0182/PW 4152
  2 10 40  024       290   REV034   CODE 0182/PW 4152
                           ALL

  2 10 40  025       290   REV034   CODE 0183/PW 4152
  2 10 40  026       290   REV034   CODE 0183/PW 4152
                           ALL

  2 10 40  027-28    290   REV034   CODE 0183/PW 4152
                           ALL

  2 11 00  001-2     020   REV004   ALL/PW
                           ALL

  2 11 10  001       001   REV014
  2 11 10  002       050   REV021   MOD 4863   PW 4000
                           ALL

  2 11 10  003       050   REV021   MOD 4863   PW 4000
  2 11 10  004       050   REV021   MOD 4863   PW 4000
                           ALL

  2 11 10  005       050   REV021   MOD 4863   PW 4000
  2 11 10  006       050   REV021   MOD 4863   PW 4000
                           ALL

  2 11 10  007       050   REV021   MOD 4863   PW 4000
  2 11 10  008       050   REV021   MOD 4863   PW 4000
                           ALL

  2 11 10  009-10    050   REV021   MOD 4863   PW 4000
                           ALL

  2 12 00  001-2     120   REV033   M:4801=(4801+CSA)/PW
                           ALL
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```
M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA----
M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA----
                           ----------EFFECTIVITY----------
-----------------------------------------------------------------

  2 12 10  001       120   REV021   MOD4801 PW 4000
  2 12 10  002       104   REV033   CODE 0398/PW 4000
                           ALL

  2 12 10  003       104   REV033   CODE 0398/PW4000
  2 12 10  004       104   REV033   CODE 0398/PW4000
                           ALL

  2 12 10  005       104   REV033   CODE 0398/PW4000
  2 12 10  006       104   REV033   CODE 0398/PW4000
                           ALL

  2 12 10  007       104   REV033   CODE 0398/PW4000
  2 12 10  008       104   REV033   CODE 0398/PW4000
                           ALL

  2 12 10  009       104   REV033   CODE 0398/PW4000
  2 12 10  010       104   REV021   MOD 4863  PW 4000
                           ALL

  2 12 10  011       104   REV021   MOD 4801 + 4863  PW 4000
  2 12 10  012       074   REV021   MOD 4863   PW 4000
                           ALL

  2 12 10  013       104   REV021   MOD 4801 + 4863  PW 4000
  2 12 10  014       074   REV021   MOD 4863   PW 4000
                           ALL

  2 12 10  015       104   REV021   MOD 4801 + 4863  PW 4000
  2 12 10  016       074   REV021   MOD 4863   PW 4000
                           ALL

  2 12 10  017       230   REV021   MOD 4801 + 4863  PW 4000
  2 12 10  018       001   REV029   STD=80C2/7R4E1/PW 4000
                           ALL

  2 13 00  001-2     001   REV006   ALL/ALL
                           ALL

  2 13 10  001       001   REV014
  2 13 10  002       074   REV021   MOD 4863   PW 4000
                           ALL

  2 13 10  003       074   REV021   MOD 4863   PW 4000
  2 13 10  004       074   REV021   MOD 4863   PW 4000
                           ALL

  2 13 10  005       085   REV021   MOD 4863   PW 4000
                           ALL

  2 14 00  001       070   REV031   PW 4000
  2 14 00  002       001   REV014
                           ALL

  2 14 10  001       074   REV020   MOD 4863   PW 4000
  2 14 10  002       105   REV033   CODE 0353/PW4000
                           ALL

  2 14 20  001       070   REV031   PW 4000
  2 14 20  002       170   REV031   M:4863/PW 4152
                           ALL

  2 14 20  003-4     170   REV031   M:4863/PW 4152
                           ALL

  2 14 20  005       150   REV027   MOD 4863  PW 4152
  2 14 20  006       150   REV027   MOD 4863  PW 4152
                           ALL

  2 14 20  007       170   REV031   M:4863/PW 4152
  2 14 20  008       170   REV031   M:4863/PW 4152
                           ALL

  2 15 00  001-2     001   REV024
                           ALL

  2 15 10  001-2     120   REV026   M:4863
                           ALL

  2 15 20  001       200   REV033   CODE 0355  PW ALL
  2 15 20  002       001   REV033   CODE 0356
                           ALL

  2 15 20  003       001   REV033   CODE:0357
  2 15 20  004       100   REV028   M:3219 OR 4863
                           ALL

  2 15 30  001       060   REV033   CODE 0361/PW7R4E1/4152
  2 15 30  002       001   REV033   CODE:0358
                           ALL
```

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
M	V	CH	SEC	---PAGE--	SEQ-	--REV--	-----VALIDATION CRITERIA----
						----------EFFECTIVITY----------	
2	16	00		001	001	REV024	
						ALL	
2	16	10		001-2	001	REV024	
						ALL	
2	16	20		001-2	150	REV031	M:4863/PW 4000
						ALL	
2	16	30		001	150	REV021	MOD 4863 PW 4000
2	16	30		002	150	REV021	MOD 4863 PW 4000
						ALL	
2	16	30		003	150	REV021	MOD 4863 PW 4000
2	16	30		004	150	REV021	MOD 4863 PW 4000
						ALL	
2	16	30		005	150	REV021	MOD 4863 PW 4000
2	16	30		006	150	REV021	MOD 4863 PW 4000
						ALL	
2	16	30		007-8	150	REV021	MOD 4863 PW 4000
						ALL	
2	16	40		001	150	REV021	MOD 4863 PW 4000
2	16	40		002	150	REV021	M:4863 PW 4000
						ALL	
2	16	40		003-4	001	REV020	
						ALL	
2	16	50		001	150	REV024	MOD 4863 PW 4000
2	16	50		002	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		003	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		003A	150	REV024	PW4000 MOD4863
						ALL	
2	16	50		004	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		005	150	REV024	MOD 4863 PW 4000
2	16	50		006	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		007	150	REV024	MOD 4863 PW 4000
2	16	50		008	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		009	150	REV024	MOD 4863 PW 4000
2	16	50		010	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		011	150	REV024	MOD 4863 PW 4000
2	16	50		012	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		013	150	REV024	MOD 4863 PW 4000
2	16	50		014	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		015	150	REV024	MOD 4863 PW 4000
2	16	50		016	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	50		017	150	REV024	MOD 4863 PW 4000
2	16	50		018	150	REV024	MOD 4863 PW 4000
						ALL	
2	16	60		001	150	REV021	MOD 4863 PW 4000
2	16	60		002	150	REV021	MOD 4863 PW 4000
						ALL	
2	16	70		001-2	001	REV020	
						ALL	
2	17	00		001-2	001	REV023	
						ALL	
2	17	10		001	040	REV029	PW 4000
2	17	10		002	001	REV029	STD=80C2A2
						ALL	
2	17	20		001	001	REV029	
2	17	20		002	030	REV024	CODE 0078
						ALL	
2	17	20		003	082	REV024	MOD 4801 + 4863 PW 4000
2	17	20		004	102	REV024	CODE 0072 PW 4000
						ALL	
2	17	20		005	030	REV025	CODE 0074
2	17	20		006	030	REV024	CODE 0074
						ALL	
2	17	20		007	001	REV024	CODE 0075
2	17	20		008	030	REV024	CODE 0074
						ALL	
2	17	20		009	001	REV024	CODE 0075
2	17	20		010	001	REV024	CODE 0075
						ALL	
2	17	20		011	001	REV024	CODE 0075
2	17	20		012	001	REV024	CODE 0077
						ALL	
2	17	30		001	240	REV025	M:4801+4863 PW 4000
2	17	30		002	020	REV025	CODE 0137
						ALL	
2	17	30		003	020	REV029	CODE 0319
2	17	30		004	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		005	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		006	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		007	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		008	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		009	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		010	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		010A	270	REV025	MOD 4801+4863 PW 4000
						ALL	
2	17	30		010B	270	REV025	MOD 4801+4863 PW 4000
						ALL	
2	17	30		011	001	REV024	CODE 0085
2	17	30		012	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		013	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		014	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		015	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		016	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		017	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		018	085	REV025	MOD 4801 + 4863 PW 4000
						ALL	
2	17	30		019	085	REV025	MOD 4801 + 4863 PW 4000
2	17	30		020	105	REV024	CODE 0092
						ALL	
2	17	30		020A	200	REV022	MOD 4801 + 4863
						ALL	
2	18	00		001	105	REV035	CODE 0417
2	18	00		002	001	REV035	
						ALL	
2	18	10		001-2	001	REV004	ALL/ALL
						ALL	
2	18	20		001	110	REV029	M:8199=11641=11717
2	18	20		002	001	REV029	
						ALL	
2	18	20		003	170	REV029	M:4863/PW 4000
2	18	20		004	170	REV029	M:4863/PW 4000
						ALL	
2	18	30		001	275	REV031	M:4863+5443/PW 4152
2	18	30		002	055	REV025	MOD 4863 + 5443 PW 4000
						ALL	
2	18	30		003-4	275	REV031	M:4863+5443/PW 4152
						ALL	

```
M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA---- | M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA----
M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA---- | M V CH SEC ---PAGE-- SEQ-  --REV--  -----VALIDATION CRITERIA----
                           ----------EFFECTIVITY----------       |                            ----------EFFECTIVITY----------
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  2 18 40  001        001  REV030   STD=M:5229=5606
  2 18 40  002        270  REV030   M:4863+8616/PW 4000
                           ALL

  2 18 40  003        170  REV030   M:4863/PW 4000
  2 18 40  004        160  REV021   MOD 4863  PW 4000
                           ALL

  2 18 40  005        160  REV031   M:4863/PW 4000
  2 18 40  006        160  REV031   M:4863/PW 4000
                           ALL

  2 18 40  007        060  REV024   MOD 4863  PW 4000
  2 18 40  008        060  REV021   PW4000   4863
                           ALL

  2 18 50  001        001  REV035
  2 18 50  002        064  REV025   MOD 4863 + 5443 PW 4152
                           ALL

  2 18 50  003        050  REV025   MOD 4863 + 5443  PW 4152
  2 18 50  004        050  REV025   MOD 4863 + 5443  PW 4152
                           ALL

  2 18 50  005        050  REV025   MOD 4863 + 5443  PW 4152
  2 18 50  006        050  REV025   MOD 4863 + 5443  PW 4152
                           ALL

  2 18 50  007        065  REV025   MOD 4863 + 5443  PW 4152
  2 18 50  008        001  REV025
                           ALL

  2 18 50  009-10     065  REV029   M:4863+5443/4152
                           ALL

  2 18 70  001        001  REV024
  2 18 70  002        001  REV024
                           ALL

  2 18 70  003        001  REV029
  2 18 70  004        001  REV029
                           ALL

  2 18 70  005        001  REV035
  2 18 70  006        120  REV029   M:4863/PW 4000
                           ALL

  2 18 70  007        120  REV022   PW ENG:4000  MOD4863
  2 18 70  008        120  REV022   PW ENG:4000 MOD4863
                           ALL

  2 18 70  009        120  REV022   PW ENG:4000 MOD4863
  2 18 70  010        120  REV022   PW ENG:4000  MOD4863
                           ALL

  2 18 70  011-12     120  REV022   PW ENG:4000  MOD4863
                           ALL

  2 18 90  001        001  REV035
  2 18 90  002        001  REV025
                           ALL

  2 18 95  001        110  REV033   CODE:0417
  2 18 95  002        110  REV033   CODE:0417
                           ALL

  2 18 95  003        110  REV033   CODE:0417
  2 18 95  004        110  REV033   CODE:0417
                           ALL

  2 19 00  001        001  REV036
  2 19 00  002        001  REV036
                           ALL

  2 19 10  001        001  REV036
  2 19 10  002        001  REV036
                           ALL

  2 19 20  001-LEBBU 001   REV033   LIST OF OEB & FCOM BULLETINS
                           ALL
```

M V T	REV	MOD	MP	SB	TITLE	VALIDITY
.	033	2254	......	....	FIRE DETECTION - DOUBLE THE NUMBER OF AMBIENT SMOKE DETECTORS	ALL
.	033	2753	......	....	INSTALL AN EXTERIOR ICING WARNING SYSTEM	ALL
.	033	2965	......	....	OXYGEN - FLIGHT CREW SYSTEM - INCREASE CAPACITY OF CYLINDER	ALL
.	033	2989	......	....	FWD CARGO COMPARTMENT - ADD VENTILATION AND HEATING	ALL
.	033	3221	......	....	INSTALL A JAEGER METRIC ALTIMETER	ALL
.	033	3703	......	....	AIRCRAFT CERTIFICATION FOR INCREASED DESIGN WEIGHTS - MTOW 138.6T - MLW 121.5T, MZFW 111.5T	ALL
.	033	3721	......	....	INSTALL FANS FOR MESSIER BRAKES	ALL
.	033	3881	......	....	CABIN PRESSURE CONTROL SYSTEM - INTRODUCE NEW PRESSURE REGULATING SYSTEM COMPONENTS	ALL
.	033	4357	......	....	FIRE PROTECTION - CARGO COMPARTMENT - CHANGE FIRE EXTINGUISHER BOTTLE	ALL
.	033	4672	......	....	NAVIGATION - INSTALL 3 HONEYWELL IRS	ALL
.	033	4801	......	....	FUEL - INSTALL TRIM TANK SYSTEM	ALL
.	033	4803	......	....	EQUIPMENT/FURNISHINGS - FLIGHT COMPARTMENT - MODIFY DESIGN	ALL

```
M
V REV   MOD  MP        TITLE
T          SB                              VALIDITY



. 033   4857  ......  EXHAUST - IMPROVE THE SELECTION LOGIC OF THE
     ...........       FLIGHT IDLE
                             ALL

. 033   4863  ......  WINGS - INTRODUCE NEW WING TIP
     ...........             ALL

. 033   4941  ......  AUTOFLIGHT - ACHIEVE CAT. 3 FAIL OPERATIVE
     ...........       AUTOMATIC LANDING
                             ALL

. 033   5051  ......  INDICATING/RECORDING SYSTEMS - ECAM -
     ...........       DELETE WLDP
                             ALL

. 033   5124  ......  DESIGN WEIGHTS - AIRCRAFT CERTIFICATION
     ...........       FOR INCREASED DESIGN WEIGHT (142T)
                             ALL

. 033   5146  ......  PNEUMATIC - BLEED AIR - MODIFY OVERHEAT
     ...........       DETECTION
                             ALL

. 033   5163  ......  PNEUMATIC - INCREASE PRECOOLER COOLING
     ...........       AIR OUTLET
                             ALL

. 033   5336  ......  ICE AND RAIN PROTECTION - WING ANTI ICE
     ...........       SYSTEM - RELAY 119DM - DELETE SELF HOLD
                       FUNCTION
                             ALL

. 033   5370  ......  FLIGHT CONTROLS - AILERON, RUDDER AND
     ...........       ELEVATOR SERVO CONTROLS - REPLACE JAMMING
                       BALL BEARINGS BY NEDDLE BEARINGS
                             ALL

. 033   5388  ......  STARTING - MODIFY IGNITER POWER SUPPLY
     ...........             ALL

. 033   5429  ......  AUTOFLIGHT - AUTOTHROTTLE - INTRODUCE
     ...........       T.C.C. BATCH "C" SOFTWARE
                             ALL
```

M V T	REV	MOD	MP	SB	TITLE	VALIDITY
.	033	5435	......	....	DESIGN WEIGHTS - AIRCRAFT CERTIFICATION FOR INCREASED DESIGN WEIGHTS	ALL
.	033	5443	......	....	LANDING GEAR - REPLACE STEEL BRAKES BY CARBON BRAKES AND ASSOCIATED WHEELS -	ALL
.	033	5502	......	....	AUTOFLIGHT - AUTO PILOT - MODIFY FAC, FCC, FCU SUPPLY BUSBAR	ALL
.	033	5528	......	....	AUTOFLIGHT - AFS - UPDATE CAT 3 CERTIFICATION STANDARD	ALL
.	033	5562	......	....	FUEL - MODIFY FEED SYSTEM LOGIC DURING TAXI/TAKE OFF PHASE	ALL
.	033	5606	......	....	FLIGHT CONTROLS - INTRODUCE ANTI HIGH ANGLE OF ATTACK	ALL
.	033	5697	......	....	NAVIGATION - GPWS - IMPROVE FUNCTION	ALL
.	033	5725	......	....	INDICATING/RECORDING SYSTEMS - FLIGHT WARNIN COMPUTER - INTRODUCE L12 BATCH IMPROVEMENT	ALL
.	033	5757	......	....	AUTOFLIGHT - AFS - UPDATE FCC AND MTP CAT.3 CERTIFICATION STANDARD	ALL
.	033	5779	......	....	INDICATING/RECORDING SYSTEMS - ECAM - MODIFY SGU SOFTWARE	ALL
.	033	5875	......	....	FUEL - INSTALL FUEL TEMPERATURE INDICATION SYSTEM	ALL
.	033	5904	......	....	FLIGHT CONTROLS - JAMMING DETECTION SYSTEM - MODIFY JAMMING DETECTION UNIT	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	033	5910	....	ELECTRICAL POWER - INSTALL SYSTEM PROVISION FOR INSTALLATION OF AN AC/DC STANDBY GENERAT HYDRO-ELECTRICAL UNIT	ALL
.	033	5911	....	ELECTRICAL POWER - INSTALL AN AC/DC STANDBY GENERATION HYDRO ELECTRICAL UNIT	ALL
.	033	5917	....	AIRBORNE AUXILLIARY POWER - STARTING - EXTEND RELIGHT ALTITUDE	ALL
.	033	5918	....	FUSELAGE - APU AIR INTAKE - INSTALL FIXED DIVERTER AND MODIFY FLUID BARRIERS	ALL
.	034	5944	....	GENERAL - CERTIFY AIRCRAFT FOLLOWING F.A.A. REQUIREMENTS (AS PART)	ALL
.	033	5953	....	AUTO FLIGHT - AP LOSS PROBABILITY - REPLACE	ALL
.	036	5994	....	POWER PLANT - INSTALL P.& W. ENGINES 4152 - (ST7 ONLY)	ALL
.	033	6007	....	PNEUMATIC - ENGINE BLEED AIR SUPPLY SYSTEM - MODIFY TRIGGERING THRESHOLD OF BLEED VALVE FAULT WARNING	ALL
.	033	6041	....	INDICATING/RECORDING SYSTEMS - ECAM - INTRODUCE NEW SGU SOFTWARE	ALL
.	033	6106	....	AIR CONDITIONING - MODIFY PACK DISCHARGE TEMPERATURE LOW LIMIT IN MAX COOL MODE	ALL
.	033	6120	....	PNEUMATIC - ENGINE BLEED AIR SUPPLY SYSTEM - INCREASE MINIMUM ENGINE IDLE	ALL

M V T	REV	MOD	MP	SB	TITLE	VALIDITY
.	033	6233	......	....	LANDING GEAR - INSTALL A320 GOODYEAR CARBON BRAKES AND RELATED WHEELS	ALL
.	033	6234	......	....	NAVIGATION - GPWS - INSTALL FLAP SELECTOR SWITCH	ALL
.	033	6269	......	....	INDICATING/RECORDING SYSTEMS - MODIFY ECAM SGU SOFTWARE	ALL
.	033	6354	......	....	AUTO FLIGHT - AFS - INTRODUCE FAC CERTIFICATION STANDARD FOR ST7	ALL
.	033	6368	......	....	FUEL - FUEL PUMP SYSTEM - MODIFY ELECTRICAL POWER SUPPLY	ALL
.	033	6403	......	....	FIRE PROTECTION - INSTALL A FLOW METERING SYSTEM FOR FIRE EXTINGUISHING IN CARGO COMPARTMENT	ALL
.	033	6428	......	....	FUEL - FUEL QUANTITY INDICATING - MODIFY COMPUTER POWER SUPPLY	ALL
.	033	6445	......	....	INDICATING/RECORDING SYSTEMS - ECAM - INTRODUCE FWC SOFTWARE S4	ALL
.	033	6523	......	....	AUTO FLIGHT - INSTALL A SECOND TCC	ALL
.	033	6548	......	....	FLIGHT - INTRODUCE COMMON TCC	ALL
.	033	6605	......	....	FUEL - FQI SYSTEM - INTRODUCE MODIFIED COMPUTER ON A310-300 A/C	ALL
.	034	6681	......	....	AUTO FLIGHT - ELECTRONICS RACK 80VU - REPLACE TCC FOR P & W SERIE ENGINE	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	033	6727	....	INDICATING/RECORDING SYSTEMS - FWC - INTRODUCE S5 SOFTWARE	ALL
.	033	6789	....	NAVIGATION - SPERRY FMS - INTRODUCE I7-2 SOFTWARE	ALL
.	033	6865	....	INDICATING/RECORDING SYSTEMS - ECAM MODIFY SGU SOFTWARE	ALL
.	033	6874	....	FUEL - INTRODUCE NEW TYPE OF LEVEL AMPLIFIER	ALL
.	033	6908	....	NAVIGATION - MODIFY EFIS SGU	ALL
.	033	7088	....	DESIGN WEIGHTS - AIRCRAFT CERTIFICATION FOR INCREASED DESIGN WEIGHTS MTOW 157T. MLW 124T. MZFW 114T. -	ALL
.	033	7171	....	AUTO FLIGHT - FAC - INTRODUCE NEW EQUIPMENT -	ALL
.	033	7172	....	FUEL - MODIFY FUEL PUMP SEQUENCE CONTROL -	ALL
.	033	7187	....	AUTO FLIGHT - GENERAL - INSTALL COMPONENTS WITH AIRBORNE WINDSHEAR WARNING SYSTEM CAPACITY	ALL
.	033	7208	....	INDICATING/RECORDING SYSTEMS - FWC - MODIFY S5 SOFTWARE	ALL
.	033	7258	....	AUTO FLIGHT - FAC - MODIFY SOFTWARE	ALL
.	033	7259	....	INDICATING/RECORDING SYSTEMS - ECAM - MODIFY SGU SOFTWARE	ALL

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M
V REV   MOD  MP        TITLE
T          SB                             VALIDITY



. 033   7460  ......  PNEUMATIC - OPTIMIZE ENGINE BLEED AIR SUPPLY
     ...........       SYSTEM
                             ALL

. 033   7588  ......  AUTO FLIGHT - REPLACE TCC
     ...........             ALL

. 033   7694  ......  AUTOFLIGHT - TCC - MODIFY STANDARD FOR
     ...........       PW 4000 -
                             ALL

. 034   7899  ......  HYDRAULIC POWER - R.A.T - INSTALL MODIFIED
     ...........       EQUIPMENT
                             ALL

. 033   8199  ......  OXYGEN - PAX COMPARTMENT - PROVIDE OXYGEN
     ...........       SUPPLY FOR 22 MIN.
                             ALL

. 033   8364  ......  AUTO FLIGHT - FAC - MODIFY SOFTWARE.
     ...........             ALL

. 033   8616  ......  NAVIGATION - INSTALL BENDIX TCAS II -
     ...........       (A310) -
                             ALL

. 033   8648  ......  ELECTRICAL POWER - MODIFY ESSENTIAL
     ...........       BUSBAR DISTRIBUTION -
                             ALL

. 033  10107  ......  NAVIGATION - MODIFY TCAS/VSI SOFTWARE
     ...........       (SEXTANT) -
                             ALL

. 033  10402  ......  AUTO FLIGHT -AFCS - A310 - INTRODUCE
     ...........       IMPROVEMENT TO AVOID OUT OF TRIM
                       SITUATION IN GO AROUND MOD
                             ALL

. 036  11320  ......  NAVIGATION - MODIFY FMS FOR GPS
     ...........       C1 CAPABILITY -
                             ALL

. 036  11364  ......  NAVIGATION - FMS - MODIFY HONEYWELL
     ...........       AFMS FOR PW ENGINES
                             ALL
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M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	033	11454	....	AUTO FLIGHT - AUTO PILOT - PROVIDE PITCH DISCONNECTION BY STICK-FORCE APPLICATION IN ALL FLIGHT PHASES	ALL
.	033	11894	....	NAVIGATON - EGPWS - ACTIVATE ENHANCED FUNCTIONS OF EGPWS	ALL
.	033	11900	....	AUTO FLIGHT-AUTOPILOT/FLIGHT DIRECTOR-INTRODUCE A310-A300/600 STANDARD P/N B 470ADM	ALL
.	033	12025	....	NAVIGATION - TCAS - INSTALL ALLIED SIGNAL COMPUTER P/N 066-50000-2220 (WITH CHANGE 7.0) (WITH DATA LOADER)	ALL
.	036	12045	....	NAVIGATION - FMS - CORRECT FMS "GPS STANDARD" (PW ENGINES)	ALL
.	033	12291	....	NAVIGATION - EFIS - INSTALL NEW SGU - EFIS E21 STANDARD	ALL
.	033	12557	....	DOORS - FIXED INTERIOR DOORS IN PAX COMPARTMENT - INSTALL ELECTRICAL COCKPIT DOOR RELEASE (SHORT COCKPIT)	ALL

LIST OF NORMAL REVISIONS

Revision Number	Issue Date	Date Filed	Initials
01	JUL 82		
02	DEC 82		
03	MAR 83		
04	OCT 83		
05	FEB 84		
06	JUN 84		
07	NOV 84		
08	MAR 85		
09	MAY 85		
10	OCT 85		
11	APR 86		
12	AUG 86		
13	DEC 86		
14	FEB 87		
15	DEC 87		
16	JUL 88		
17	DEC 88		
18	AUG 89		
19	MAR 90		
20	JAN 91		
21	JAN 92		
22	JUN 93		

Revision Number	Issue Date	Date Filed	Initials
23	FEB 94		
24	NOV 95		
25	OCT 96		
26	SEP 97		
27	AUG 98		
28	DEC 98		
29	FEB 2000		
30	FEB 2001		
31	MAR 2002		
32	FEB 2003		
33	JAN 2005		
34	MAR 2006		
35	MAR 2007		
36	MAY 2008		R

Note 1 : This list of normal revisions also applies to the QRH.

Note 2 : The next normal revision 37 is scheduled by the beginning of 2009. R R

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M	TR NO	-DATE--	-----------TITLE----------- ----------EFFECTIVITY----------
	218	DEC1991	TR APPLICABLE TO ALL
	248	MAR1994	TR APPLICABLE TO ALL
	535-2	FEB2007	TR APPLICABLE TO ALL
	565-1	JUL2007	TR APPLICABLE TO ALL
	599-1	FEB2008	TR APPLICABLE TO ALL
	606-1	JUN2008	TR APPLICABLE TO ALL

M	TR NO	-DATE--	-----------TITLE----------- ----------EFFECTIVITY----------

TEMPORARY REVISION N° 535-2

This Temporary Revision has been issued after REV N° 35

Remove this TR only when instructed to do so by the FILING INSTRUCTIONS TEMPORARY REVISIONS and the LIST OF EFFECTIVE TEMPORARY REVISIONS.

VALIDITY : All aircraft

SUBJECT : CROSSWIND TAKEOFF PROCEDURE

REASONS FOR ISSUE 1 : This TR publishes performance penalty to be considered in case of takeoff with crosswind greater than 20 knots.

REASONS FOR ISSUE 2 :
- Issue 2 provides a revised crosswind takeoff procedure in order to reduce the associated crosswind takeoff performance penalties.
- This issue also cancels and replaces TR 536-1 for affected aircraft (fitted with MOD 12011).
- This new procedure which is common for PW and GE engines leads to similar performance penalties on both engines. Therefore this issue also cancels and replaces TR 537-1 and 538-1.

INSTRUCTIONS :

Insert the following pages in the FCOM Vol 2 and update the RECORD OF TEMPORARY REVISIONS.

TR N° 535-2 page 1 of 6 after the LIST OF EFFECTIVE TEMPORARY REVISION (LETR) in 2.00.04
TR N° 535-2 page 2 of 6 facing 2.03.07 page 1
TR N° 535-2 page 3 of 6 facing 2.03.12 page 1
TR N° 535-2 page 4 of 6 facing 2.10.00 page 1/2
TR N° 535-2 page 5 of 6 after 2.10.30 page 7/8
TR N° 535-2 page 6 of 6 facing 2.10.40 page 1

This Temporary Revision has been issued after REV N° 35

Remove this TR only when instructed to do so by the FILING INSTRUCTIONS TEMPORARY REVISIONS and the LIST OF EFFECTIVE TEMPORARY REVISIONS.

VALIDITY : Aircraft fitted with SPERRY FMS

SUBJECT : Procedures and Techniques
Use of Sperry FMS, FMS Performance Charts

REASONS FOR ISSUE : This TR is issued to add a note indicating that, in specific cases, FMS MAX FL can be higher than Flight level limitations given in FCOM 2.01.20 page 3.

INSTRUCTIONS :

Insert the following pages in the FCOM Vol. 2 and update the RECORD OF TEMPORARY REVISIONS.

TR N° 565-1 page 1 of 2 after the LIST OF EFFECTIVE TEMPORARY REVISION (LETR) in 2.00.04
TR N° 565-1 page 2 of 2 facing 2.02.29 page 6

TEMPORARY REVISION N° 599-1

This Temporary Revision has been issued after REV N° 35

Remove this TR only when instructed to do so by the FILING INSTRUCTIONS TEMPORARY REVISIONS and the LIST OF EFFECTIVE TEMPORARY REVISIONS.

VALIDITY : All aircraft

SUBJECT : SOP Landing

REASONS FOR ISSUE : This temporary revision is issued in order to emphasize the importance of applying the Landing Standard Operating Procedure.
As a result, procedure and comments are expanded to provide the flight crew with applicable information on the autothrust, the ground spoilers and the autobrake.

INSTRUCTIONS :

Insert the following pages in the FCOM Vol 2 and update the RECORD OF TEMPORARY REVISIONS.

TR N° 599-1 page 1 of 2 after the LIST OF EFFECTIVE TEMPORARY REVISION (LETR) in 2.00.04
TR N° 599-1 page 2 of 2 facing 2.03.22 page 5

This Temporary Revision has been issued after REV N° 36

Remove this TR only when instructed to do so by the FILING INSTRUCTIONS TEMPORARY REVISIONS and the LIST OF EFFECTIVE TEMPORARY REVISIONS.

VALIDITY : All aircraft

SUBJECT : Radio altimeter(s) fault – systems lost

REASONS FOR ISSUE : This TR is issued to correct a misprint

INSTRUCTIONS :

Insert the following pages in the FCOM Vol 2 and update the RECORD OF TEMPORARY REVISIONS.

TR N° 606-1 page 1 of 2 after the LIST OF EFFECTIVE TEMPORARY REVISION (LETR) in 2.00.04
TR N° 606-1 page 2 of 2 facing 2.05.34 page 8

R Refer to the "List of effective temporary revisions" listing for effective TR issued after the current normal revision. This
R listing is automatically sent and updated with each new TR.

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CODE	DESIGNATION
0001	Mod : 4801 + 4863 + 5875 + 6920 + 7468
0002	Mod : 4801 + 6644 + 6702 + 6874 + 6920 + 8131
0003	Mod : 3703 + 5435 + 5616 + 7088 + 11103
0004	Mod : 4801 + 4863 + 5875 + 6920 + 7468
0005	Mod : (3791 + 6662) or (3791 + 6662/PW 4D1/4E1) or (3791 + 6662/PW4000) or (3791 + 6967/PW 4152) or (3791 + 6662/GE 80A3) or (3791 + 6662/GE 80C2)
0006	Mod : (4801 + 10806) or (MP S7988 + 4801 + 10806) or (4801 + 7259 + 10806) or (MP S7988 + 4801 + 7259 + 10806)
0007	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 6662 + 6967)
0008	Mod : (4672 + 4978) or (4672 + 4978 + 5051 + 6415)
0009	Mod : 4801 + 6644 + 6874 + 6920 + 7468 + 8131
0010	Mod : 3703 + 5435 + 5616 + 7088 + 7218
0011	Mod : (4941 + 5757 + 11899) or (4941 + 5757 + 11900)
0012	Mod : (4801 + 6644 + 6874 + 6920 + 8131 + 8342) or (4801 + 6644 + 6874 + 6920 + 7468 + 8131 + 8342)
0013	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 4801 + 6662) or (3791 + 4801 + 6967) or (3791 + 4801 + 6662 + 6967)
0014	Mod : 8260 or (6195 + 10393) or (8260 + 10393) or (5051 + 6195 + 10393)
0015	Mod : 8260 or (6195 + 10393) or (5051 + 6195 + 10393) or (6195 + 8260 + 10393)
0016	Mod : 4628 or 5697 or 6234 or (4628 + 5697) or (5697 + 6234)
0017	Mod : (5051 + 6368) or (5051 + 6368 + 8260)
0018	Mod : 4184 + 4801 + 6644 + 6874 + 6920 + 7468 + 8131 + 8342
0019	Mod : (11592 + 12454) or (11592 + 12455) or (12016 + 12454) or (12016 +12455) or (12248 + 12454) or (12248+12455)
0020	Mod : 4628 or 5697 or 6234 or (4628 + 5697) or (5697 + 6234)
0021	Mod : 4801 + 4863 + 5875 + 6920 + 7468
0022	Mod : (5051 + 6368) or (6368 + 8260 + 10393)
0023	Mod : (4801 + 5051 + 6368) or (4801 + 5051 + 6368 + 10393)
0024	Mod : 3881 + 4801 + 6920 + 7468 + 7576 + 10806
0025	Mod : 4801 + 4863 + 6920 + 7468
0026	Mod : (3703 + 6527) or (3703 + 6527 + 7290)
0027	Mod : 8976 or 8977 or (6789 + 8976) or (6789 + 8977) or (6789 + 8976 + 8977)
0028	Mod : (3721 + 5443) or (3721 + 6233) or (3721 + 6591) or (5443 + 6645) or (6233 + 6645)
0029	Mod : (3881 + 4801 + 10806) or (3881 + 4801 + 7576 + 10806)
0030	STD or Mod : 4863 or UK
0031	Mod : 3703 + 5435 + 5616 + 7218
0032	Mod : (3703 + 6527 + 7218 + 8130 + 8469) or (3703 + 5435 + 5616 + 7088 + 7218 + 8469)
0033	Mod : (5875 + 11365) or (5875 + 11697)
0034	GE 80C2A2/A8 or PW 4000 or Mod : (6393/GE 80A3) or (6375/PW 7R4)
0035	Mod : 8976 or 8977 or (6789 + 8976) or (4801 + 6789 + 8976) or (4801 + 6789 + 8977) or (6789 + 8976 + 8977) or (4801 + 6789 + 8976 + 8977)
0036	Mod : 4801 + 4863 + 5875 + 6920 + 7468

	CODE	DESIGNATION
	0037	Mod : (5051 + 6368 + 8260) or (6368 + 8260 + 10393)
	0038	Mod : (3881 + 8260) or (3881 + 6195 + 10393) or (3881 + 8260 + 10393) or (3881 + 5051 + 6195 + 10393)
	0039	Mod : 4863 + 5443 + 8244 + 10848
	0040	Mod : (3881 + 5051 + 6368) or (3881 + 5051 + 6368 + 8260) or (3881 + 5051 + 6368 + 10393) or (3881 + 5051 + 5846 + 6368 + 11123)
	0041	Mod : (7460 + 7885) or (7177 + 7460 + 7885)
	0042	Mod : 8260 or (6195 + 10393) or (8260 + 10393) or (5051 + 6195 + 10393)
	0043	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443 + 6591)
	0044	STD or Mod : (4863 + 5443)
	0045	Mod : 3703 + 5435 + 5616 + 6527 + 7088 + 7218 + 7659
	0046	Mod : 3881 + 4801 + 5910 + 8648 + 12134
	0047	Mod : 12025 or 12034 or 12043 or 12094 or 12339 or 12354
R	0048	Mod : 4672 or (4672 + 8287) or (4672 + 8287 + 8524)
	0049	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (4863 + 5443) or (4863 + 5443/GE 80CA2/A8) or (4863 + 6233/80C2A2)
	0050	STD or GE 80C2
	0051	STD or GE 80C2A8
	0052	STD or Mod : (4863 + 5443) or (4863 + 5443 + 8244)
	0053	STD or Mod : (4863 + 5443 + 8244)
	0054	STD or Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 6233 + 8244)
	0055	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (4863 + 5443) or (4863 + 5443/GE 80C2A2) or (4863 + 5443 + 5973) or (4863 + 5443 + 5973/GE 80C2A2)
	0056	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (3219 + 6591) or (4863 + 5443) or (4863 + 5443/GE 80C2) or (4863 + 5443 + 6591/GE 80C2A2) or (4863 + 5443/GE 80C2A2/UK)
	0057	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (3219 + 6591) or (4863 + 5443) or (4863 + 5443/GE 80C2) or (4863 + 5443 + 6591/GE 80C2A2)
	0058	Mod : (3881 + 6368) or (3881 + 5051 + 6368 + 6415)
	0059	Mod : 3219 or 6591 or (3219 + 6591)
	0060	Mod : 3881 + 4801 + 5911 + 6368 + 11319
	0061	STD or Mod : (5388/PW4000) or (5388 + 6792)
	0062	Mod : (4863 + 5443/GE 80C2) or (4863 + 6233/GE 80C2A2) or (4863 + 5443 + 6591/GE 80C2A2)
	0063	STD or Mod : (3219/GE 80A3) or (4863 + 5443/GE 80A3/80C2A2)
	0064	Mod : 5443 or 6233 or (3219 + 6591) or (5443 + 6591)
	0065	Mod : (2254 + 3881 + 4801) or (2254 + 3881 + 4801 + 7576)
	0066	Mod : (2254 + 3881 + 4801 + 10806) or (2254 + 3881 + 4801 + 7576 + 10806)
	0067	Mod : 2254 + 3881 + 4801 + 6920 + 7468 + 7576
	0068	Mod : 2254 + 3881 + 4801 + 5910 + 8648 + 12134
	0069	Mod : 2254 + 3881 + 4801 + 6920 + 7468 + 7576 + 10806
	0070	Mod : 5124 or (3703 + 5124) or (3703 + 4008 + 5124)
	0071	Mod : (3703 + 5616) or (3703 + 5435 + 5616)
	0072	Mod : 4863 or (4801 + 4863)

CODE	DESIGNATION
0073	STD or PW 7R4 or Mod : (4863/PW 4E1) or (4801 + 4863/PW 4E1)
0074	GE 80C2 or Mod : or (4801/PW 4000) or (4863/GE 80C2A2) or (4801 + 4863/GE 80C2/PW 4000)
0075	STD or PW 7R4 or Mod : 4863 or (4863/PW 4E1) or (4801 + 4863) or (4801 + 4863/PW 4E1/4152)
0076	PW 4E1 or Mod : (4801 + 4863) or (4801 + 4863/PW 4152)
0077	STD or PW All
0078	GE 80C2 or Mod : 4801 or (4801/PW 4000/GE 80C2)
0079	GE 80C2 or Mod : (4801/PW 4000/GE 80C2A2)
0080	NGA, SIA or Mod : 4801/PW 4152/SIA
0081	Mod : (3703 + 5435 + 7088 + 7218) or (3703 + 5435 + 5616 + 7088 +7218)
0082	Mod : (3703 + 5435 + 7218 + 7614) or (3703 + 5435 + 5616 + 7218 + 7614)
0083	Mod : 4863 or (4801 + 4863/GE 80C2A8)
0084	Mod : 3703 + 5435 + 5616 + 6527 + 7088 + 7218 + 7659
0085	STD or GE All
0086	CY1,CY2 or (GE 80A3/CY1) or Mod : (4863/GE 80C2A2/CY2)
0087	CY2 or Mod : 4863/CY2
0088	PW 7R4 or PW 7R4E1/L
0089	STD or L
0090	Mod : 2254 + 3881 + 4801 + 6920 + 7576 + 10806
0091	STD or PW 7R4 or GE 80A3 or (PW 4E1/L) or (GE 80A3/L)
0092	Mod : (4801 + 4863/PW 4000) or (4801 + 4863/PW 4152/L)
0093	Mod : (4801 + 4863/GE 80C2) or (4801 + 4863/GE 80C2A2/L)
0094	Mod : (3791 + 6967) or (3791 + 5124/GE 80A3) or (3791 + 5616/PW 4000) or (3791 + 6662/GE 80A3 / 80C2A2) or (3791 + 6662/PW 4D1) or (3791 + 6662/PW 4000) or (3791 + 5124 + 6662 / GE 80A3) or (3791 + 5124 + 6662 / PW 4E1) or (3791 + 5616 + 6662 / GE 80C2A2/A8) or (3791 + 5616 + 6662/PW 4E1) or (3791 + 5616 + 6662/PW 4000) or (3791 + 5616 + 6967/PW 4152)
0095	Mod : 4978 or (4978 + 5051 + 6415)
0096	Mod : 3703 + 5435 + 5616 + 7088 + 7218
0097	Mod : (3881 + 6428) or (3881 + 5388 + 6428 + 6792)
0098	Mod : (4801 + 6920) or (4801/MSN 421, 422)
0099	Mod : (4801 + 5697 + 6041) or (4801 + 6041 + 6352)
0100	Mod : (MP S5063 + 12134 + 12144 + 12291) or (6523 + 12134 + 12144 +12291)
0101	Mod : (4803 + 5562 + 6865) or (4803 + 5562 + 6865 + 7576)
0102	Mod : (4801 + 4803 + 5562 + 6920 + 7576) or (4801 + 4803 + 5562 + 6865 + 6920 + 7576)
0103	Mod : 3219 or 6591
0104	Mod : (4863 + 5443) or (4863 + 6233)
0105	Mod : (4209 + 5913) or (4209 + 5913 + 6234) or (4209 + 5913 + 6352) or (4209 + 5697 + 5913 + 6234)
0106	Mod : (5697 + 5913) or (5697 + 5913 + 6234)
0107	Mod : (5697 + 8960) or (5697 + 5913 + 8960) or (5697 + 6234 + 8960) or FDX
0108	Mod : (4801 + 4803 + 5562 + 6865) or (4801 + 4803 + 5562 + 7576) or (4801 + 4803 + 5562 + 6865 + 7576)
0109	Mod : (5846 + 6195 + 10393) or (5846 + 8260 + 10393) or (5051 + 5846 + 6195 + 10393)

	CODE	DESIGNATION
	0110	Mod : (4863 + 5443/GE 80C2A8) or (4863 + 6233/GE 80C2A2) or (4863 + 5443 + 6591/GE 80C2A2)
	0111	Mod : 3219 or 6591 or (3219 + 6591)
	0112	Mod : (3881 + 5051 + 5846 + 6368) or (3881 + 5051 + 5846 + 6368 + 8260) or (3881 + 5051 + 5846 + 6368 + 10393)
	0113	Mod : (3881 + 5846 + 6195) or (3881 + 5846 + 6195 + 10393) or (3881 + 5846 + 8260 + 10393) or (3881 + 5051 + 5846 + 6195 + 10393)
	0114	Mod : (5051 + 5846 + 6368 + 8260) or (5846 + 6368 + 8260 + 10393)
	0115	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443 + 6591)
	0116	Mod : (4863 + 5443 + 8244) or (4863 + 5443 + 10848)
	0117	Mod : (4863 + 5443 + 10848) or (4863 + 5443 + 8244 + 10848)
	0118	Mod : 3881 + 4801 + 5910 + 6256 + 8648 + 12134
	0119	Mod : (4801 + 6920 + 8342) or (4801 + 6920 + 7468 + 8342)
	0120	Mod : (5697 + 6041) or (5697 + 6865) or (6041 + 6234) or (5697 + 6041 + 6865) or (6041 + 6234 + 6865) or (6041 + 6352 + 6865)
	0121	Mod : (5697 + 6041) or (5697 + 6865) or (6041 + 6234) or (5697 + 6041 + 6234) or (5697 + 6041 + 6865) or (6041 + 6234 + 6865) or (6041 + 6352 + 6865) or (5697 + 6041 + 6234 + 6865)
	0122	Mod : (5124 + 6662) or (5124 + 6967) or (5616 + 6662) or (5616 + 6967)
	0123	Mod : (5616 + 6662 + 7421) or (5616 + 6967 + 7421)
	0124	Mod : 10264 or 11318 or (10264 + 11318)
	0125	Mod : (11320 + 11592) or (11320 + 12016) or (11320 + 12248) or (11364 + 11592) or (11364 + 12016) or (11364 + 12248) or (11592 + 12044) or (11592 + 12045) or (12016 + 12044) or (12016 + 12045) or (12044 + 12248) or (12045 + 12248)
	0126	Mod : (4803 + 6865) or (4803 + 7576) or (4803 + 6865 + 7576)
	0127	Mod : (6403 + 7483) or (4357 + 6403 + 7483)
	0128	Mod : (4357 + 6439 + 7483) or (4357 + 6445 + 7483) or (4357 + 6439 + 6445 + 7483)
	0129	Mod : (6403 + 6445 + 7483) or (4357 + 6403 + 6439 + 7483) or (4357 + 6403 + 6445 + 7483) or (6403 + 6439 + 6445 + 7483) or (4357 + 6403 + 6439 + 6445 + 7483)
	0130	Mod : (4978 + 6267) or (4978 + 5051+ 6267 + 6415)
	0131	Mod : 6702 or (3482 + 3779)
R	0132	Mod : (4672 + 13355) or (4672 + 12304 + 13355) or (4672 + 8287 + 12304 + 13355)
R	0133	Mod : (4672 + 12304) or (4672 + 8287 + 12304) or (4672 + 8287 + 8524 + 12304)
	0134	MSN 316, 318, 331
	0135	FDX or MSN 425 434 441 444 482 484 522 523
	0136	Mod : (6439 + 7483 + 12134) or (6445 + 7483 + 12134)
	0137	PW All or (GE All/CSA)
	0138	Mod : (4803 + 5562 + 6865 + 12134) or (4803 + 5562 + 6865 + 7576 + 12134)
	0139	Mod : 6365 or (5917 + 5918 + 6365)
	0140	Mod : (5336 + 6365) or (5336 + 5917 + 5918) or (5336 + 5918 + 6365)
	0141	Mod : (5336 + 6365) or (5336 + 5917 + 5918) or (5336 + 5917 + 5918 + 6365)
	0142	Mod : 5917 or 6365 or (5917 + 5918) or (5918 + 6365) or (5917 + 5918 + 6365)
	0143	Mod : (3703 + 6527 + 7415) or (3703 + 5124 + 6527+ 7415)
	0144	Mod : (4292 + 5057 + 5757) or (4293 + 5143 + 5757) or (4294 + 5144 + 5757)

	CODE	DESIGNATION
	0145	Mod : 4801 + 4803 + 5562 + 6865 + 6920 + 7576 + 12134
	0146	Mod : (4803 + 6865 + 12134) or (4803 + 7576 + 12134) or (4803 + 6865 + 7576 + 12134)
	0147	Mod : (6727 + 6865 + 12134) or (6269 + 6727 + 6865 + 12134)
	0148	Mod : 4941 or (4941 + 5757)
	0149	Mod : (6789 + 8976 + 11320 + 12248) or (6789 + 8977 + 11364 + 12248)
	0150	Mod : (11319 + 11592 + 11702) or (11319 + 11702 + 12248)
	0151	Mod : (4863 + 5443 + 10925) or (4863 + 6233 + 10925)
	0152	Mod : 4863 + 5443 + 8244 + 10848 + 10925
	0153	MSN 539, 542
	0154	Mod : (11320 + 11454) or (11364 + 11454)
	0155	Mod : (5697 + 11894) or (5913 + 11894) or (5697 + 5913 + 11894) or (5697 + 8960 + 12523) or (5697 + 5913 + 8960 + 11894)
	0156	Mod : (6007 + 12134) or (6007 + 6120 + 12134)
	0157	Mod : 10264 or 11318 or (5725 + 10264) or (5725 + 11318)
	0158	Mod : (4801 + 4803 + 5562 + 6865 + 12134) or (4801 + 4803 + 5562 + 7576 + 12134) or (4801 + 4803 + 5562 + 6865 + 7576 + 12134)
	0159	Mod : (4801 + 7259 + 10806 + 12134) or (MP S7988 + 4801 + 7259 + 10806 + 12134)
	0160	Mod : (4978 + 6267) or (4978 + 5051 + 6267 + 6415)
	0161	Mod : (3791 + 4978) or (3791 + 4978 + 5051 + 6415)
	0162	Mod : 3881 or (2254 + 3881) or (3881 + 7576) or (2254 + 3881 + 7576)
	0163	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 4801 + 6662) or (3791 + 4801 + 6967) or (3791 + 6662 + 6967) or (3791 + 4801 + 6662 + 6967)
	0164	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 6662 + 6967)
	0165	Mod : 11320 or 11364 or (6789 + 11320) or (6789 + 11364) or (6789 + 11320 + 11364)
	0166	Mod : (11319 + 11592 + 11702) or (11319 + 11702 + 12248) or (11651 + 11702 + 12248)
	0167	Mod : (5757 + 12454) or (5757 + 11320 + 12455) or (5757 + 11364 + 12454)
R	0168	Mod : (4672 + 12304) or (4672 + 13355) or (4672 + 8287 + 12304) or (4672 + 12304 + 13355) or (4672 + 8287 + 8524 + 12304) or (4672 + 8287 + 12304 + 13355)
R	0169	STD or Mod : 4672 or (4672 + 5477) or (4672 + 6777) or (4672 + 7087) or (4672 + 8003) or (4672 + 5477 + 6058) or (4672 + 5477 + 6777) or (4672 + 6777 + 7087) or (4672 + 5477 + 12688 + 12689) or (4672 + 6058 + 6777 + 7087 + 8003) or (4672 + 5477 + 6058 + 6777 + 7087 + 8003) or (4672 + 5477 + 6777 + 12687 + 12688 + 12689) or (4672 + 6058 + 6777 + 7087 + 8003 + 10113) or (4672 + 6058 + 6777 + 7087 + 8003 + 10113 + 10595 + 11743)
R	0170	Mod : 5477 or (5472 + 5477) or (5477 + 6777) or (5477 + 6777 + 8002 + 8003) or (6777 + 8002 + 8003 + 10509) or (5477 + 6058 + 6777 + 7087 + 8003) or (5477 + 6058 + 8002 + 8003 + 10113) or (5477 + 6777 + 8002 + 8003 + 10113) or (5477 + 6777 + 8002 + 8003 + 10509) or (5472 + 5477 + 7087 + 8002 + 8003 + 10113) or (5477 + 6058 + 6777 + 7087 + 8003 + 10113) or (5477 + 6777 + 7087 + 8002 + 8003 + 10113) or (5477 + 6777 + 8002 + 8003 + 10113 + 10509) or (6777 + 7087 + 8002 + 8003 + 10113 + 10509) or (5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10113) or (5477 + 6058 + 6777 + 7087 + 8003 + 10113 + 10595) or (5477 + 6777 + 7087 + 8002 + 8003 + 10113 + 10509) or (5472 + 5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10113) or (5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10113 + 10509) or (5477 + 6058 + 6777 + 7087 + 8003 + 10113 + 10595 + 11743)
R	0171	Mod : (5477 + 6777 + 8002 + 8003 + 10113 + 12688) or (5477 + 6058 + 6777 + 7087 + 8003 + 10113 + 12688) or (5477 + 6777 + 7087 + 8002 + 8003 + 10113 + 12688) or (5477 + 6777 + 8002 + 8003 + 10113 + 10509 + 12688) or (5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10113 + 12688) or (5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10509 + 12687) or (5477 + 6058 + 6777 + 7087 + 8003 + 10113 + 12687 + 12688) or (5477 + 6058 + 6777 + 7087 + 8002 + 8003 + 10113 + 10509 + 12688)

	CODE	DESIGNATION
	0174	STD or Mod : (5429 + 5502 + 5528) or (5502 + 5528 + 5757) or (5429 + 5502 + 5528 + 5757)
	0175	Mod : 4801 or (4801 + 5429 + 5502 + 5528 + 5757)
	0176	Mod : 4941 or (4941 + 5429) or (4941 + 5429 + 5528) or (4941 + 5429 + 5502 + 5528)
	0177	Mod : 4941 + 5429 + 5502 + 5528 + 5757
	0178	Mod : 4801 + 4941 + 5429 + 5502 + 5528 + 5757
	0179	Mod : (6395 + 6662) or (6395 + 6967)
	0180	Mod : (4801 + 10806) or (4801 + 6874 + 10806) or (4801 + 8131 + 10806) or (4801 + 6874 + 8131 + 10806)
	0181	Mod : (11364 + 12248) or (6789 + 11320 + 11592) or (6789 + 11320 + 12248) or (6789 + 11364 + 11592) or (6789 + 11364 + 12248)
	0182	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443 + 6233) or (4863 + 5443/AIC)
	0183	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443 + 6233)
	0184	Mod : (4863 + 5443 + 8244) or (4863 + 5443 + 10848) or (4863 + 5443 + 8244 + 10848)
	0185	Mod : 4941 + 5429 + 5502 + 5528 + 5757
	0188	Mod : (3703 + 7218 + 8130) or (3703 + 7088 + 7218 + 8130) or (3703 + 5435 + 7088 + 7218 + 8130) or (3703 + 5616 + 7088 + 7218 + 8130) or (3703 + 5435 + 5616 + 7088 + 7218 + 8130) or (3703 + 5435 + 5616 + 7088 + 7218 + 8130/HLF)
	0189	Mod : (3703 + 8130) or (3703 + 5435 + 8130) or (3703 + 5435 + 5616 + 7088 + 8130)
R	0190	Mod : 8144 or (5616 + 7088 + 8144)
	0191	Mod : (3219 + 6365 + 6591) or (5443 + 5917 + 5918) or (5917 + 5918 + 6233) or (5443 + 5917 + 5918 + 6591)
	0192	Mod : (3219 + 5917) or (3219 + 6365) or (3219 + 5917 + 5918) or (3219 + 5917 + 5918 + 6365)
R	0193	Mod : 7088 or (5616 + 7088)
R	0194	Mod : 8002 or 8003 or 10113 or 10509 or 10595 or 11743
	0195	Mod : 6789 or (4801 + 6789)
R	0196	Mod : 12972 or (5697 + 12972) or (FDX + 5697 + 12972)
R	0197	Mod : 7088 or (5616 + 7088) or (5616 + 6527 + 7088)
R	0198	Mod : 8130 or (7088 + 8130) or (5616 + 7088 + 8130)
R	0199	Mod : 8144 or (5616 + 8144) or (5616 + 7088 + 8144)
R	0200	Mod : 11103 or (5616 + 7088 + 11103)
R	0201	Mod : 12304 or 12687 or 12688 or 12689 or 13310 or 13355
R	0202	Mod : 2254 + 3881 + 4801 + 5910 + 12134 + 12691
R	0203	Mod : 2254 + 3881 + 4801 + 5910 + 8648 + 12134 + 12691
R	0204	Mod : 3881 + 4801 + 5910 + 6256 + 8648 + 10554 + 12134 + 12691
R	0205	Mod : 4801 + 10806 + 12134 + 12144 + 12691
R	0206	Mod : (3881 + 5051 + 6368 + 12691) or (3881 + 5051 + 6368 + 8260 + 12691) or (3881 + 5051 + 6368 + 10393 + 12691) or (3881 + 5051 + 5846 + 6368 + 11123 + 12691)
R	0207	Mod : 3881 + 4801 + 5911 + 6368 + 12134 + 12691
R	0208	Mod : (4801 + 5051 + 6368 + 12691) or (4801 + 5051 + 6368 + 10393 + 12691)
R	0209	Mod : 3881 + 4801 + 5917 + 5918 + 6368 + 12691
R	0210	Mod : 4801 + 4803 + 5562 + 6865 + 6920 + 7576 + 12134 + 12691
R	0211	Mod : 4803 + 6865 + 7576 + 12134 + 12691
R	0212	Mod : 4801 + 5336 + 5917 + 5918 + 11318 + 12691

	CODE	DESIGNATION
R	0213	Mod : 7177 + 7460 + 12134 + 12691
R	0214	Mod : 5875 or (5875 + 12011 + 13336) or (5875/US)
R	0215	Mod : (11319 + 11592 + 11702 + 13271) or (11319 + 11702 + 12248 + 13271) or (11651 + 11702 + 12248 + 13271)
	0216	Mod : (6365 + 6368) or (5917 + 5918 + 6365 + 6368)
	0217	Mod : (3881 + 6365 + 6368) or (3881 + 5917 + 5918 + 6368) or (3881 + 5917 + 5918 + 6365 + 6368)
	0218	Mod : 3881 + 4801 + 5917 + 5918 + 6368
R	0219	Mod : 4292 + 4939 + 5057 + 5757 + 12248 + 12454
R	0220	Mod : (4941 + 11899) or (4941 + 11900) or (4941 + 5757 + 11899) or (4941 + 5757 + 11900) or (4941 + 5757 + 11899 + 11900)
	0221	Mod : (3881 + 4801) or (3881 + 4801 + 7576)
R	0222	Mod : 2254 + 3881 + 4801 + 5910 + 8629
R	0223	Mod : (3881 + 4801 + 5911 + 6368 + 12134) or (3881 + 4801 + 5911 + 6368 + 11319 + 12134)
R	0224	Mod : (10610 + 13173) or (10610 + 13214) or (12085 + 13173) or (12085 + 13214)
R	0225	Mod : (MP S8559 + 10610 + 13173) or (MP S8559 + 10610 + 13214) or (MP S8559 + 12085 + 13173) or (MP S8559 + 12085 + 13214)
R	0227	Mod : 4801 + 8911 + 10806 + 12134 + 12144 + 12691
	0229	Mod : (3791 + 5443) or (3791 + 6233) or (3791 + 6591)
	0233	Mod : (5051 + 6599 + 6644) or (5051 + 6605 + 6644)
	0234	Mod : (5051 + 6599 + 6644) or (5051 + 6605 + 6644) or (5051 + 6605 + 6644 + 13203) or (5051 + 6599 + 6644 + 12785 + 13203) or (5051 + 6605 + 6644 + 12785 + 13203)
	0235	Mod : (3703 + 5435 + 5616 + 7088 + 8130)
	0236	Mod : (5697 + 6041 + 6865 + 12134) or (5697 + 6041 + 6234 + 6865 + 12134)
	0237	Mod : 4801 + 4941 + 5429 + 5502 + 5528 + 5757
	0240	Mod : (3881 + 4801 + 5213) or (3881 + 4801 + 7288)
	0242	Mod : 11320 or 11364 or (6789 + 6929 + 11320) or (6789 + 6929 + 11364) or (6789 + 8976 + 11320) or (6789 + 6929 + 8976 + 11320) or (6789 + 6929 + 8977 + 11364) or (6789 + 8976 + 8977 + 11320 + 11364) or (6789 + 6929 + 8976 + 8977 + 11320 + 11364)
	0245	Mod : 5443 or 6233 or 6591 or (3219 + 6591) or (5443 + 6591)
	0246	Mod : (3721 + 5443) or (3721 + 6591) or (6233 + 6645)
	0247	GE 80A3 or Mod : (6548 or 7588/GE) or (6548 + 7174/GE) or (6548 + 7588/GE) or (7174 + 7588/GE) or (6548 + 7174 + 7588/GE) or (6548 + 7174 + 8246/GE) or (7174 + 7588 + 8246/GE) or (6548 + 7174 + 7588 + 8246/GE)
	0256	Mod : 11320 or 11364 or (6789 + 11320) or (6789 + 11364)
	0260	Mod : 8976 or (6789 + 6929) or (6789 + 8976) or (6789 + 8977) or (6929 + 8976) or (6789 + 6929 + 8976) or (6789 + 6929 + 8977)
	0261	Mod : (6789 + 8976 + 11320 + 11592) or (6789 + 8977 + 11364 + 11592) or (6789 + 6929 + 8976 + 11320 + 12248) or (6789 + 6929 + 8977 + 11364 + 11592)
	0262	Mod : 11454 or (5953 + 11454) or (5953 + 10402 + 11454)
	0263	Mod : (5124 + 6789) or (5616 + 6789) or (6528 + 6789) or (6764 + 6789) or (5124 + 6789/FDX) or (6764 + 6789/FDX)
	0264	Mod : 11320 or 11364 or (6789 + 11320) or (6789 + 11364)
	0265	Mod : (10610 + 11320) or (10610 + 11364) or (6789 + 10610 + 11320) or (6789 + 11320 + 11364)
	0266	Mod : 11320 or 11364 or (6789 + 11320) or (6789 + 11364)

CODE	DESIGNATION
0267	Mod : (5562 + 6865) or (5562 + 7576) or (5562 + 6865 + 7576)
0268	Mod : (4628 + 5562) or (5562 + 5697) or (5562 + 6234) or (5562 + 5697 + 6234)
0269	Mod : (5562 + 5697 + 11899) or (5562 + 5697 + 11900) or (5562 + 6234 + 11899) or (5562 + 6234 + 11900) or (5562 + 5697 + 6234 + 11899) or (5562 + 5697 + 6234 + 11900) or (5562 + 5697 + 11899 + 11900)
0270	Mod : 5443 or 6233 or (3219 + 6591) or (5443 + 6591)
0271	Mod : 12480 or (3219 + 12480) or (6591 + 12480) or (3219 + 6591 + 12480)
0272	Mod : (4801 + 5336 + 5917 + 5918 + 10264) or (4801 + 5336 + 5917 + 5918 + 11318)
0273	Mod : 4801 + 5336 + 5917 + 5918 + 10264
0274	STD or Mod : 6269 or 6727 or 6865 or 7037 or (6269 + 6865)
0275	Mod : (6269 + 6727) or (6727 + 6865) or (6865 + 7037) or (6269 + 6727 + 6865) or (6727 + 6865 + 7037)
0276	Mod : (5697 + 6041 + 12691) or (6041 + 6352 + 12691)
0293	Mod : (MP S5063 + 5910 + 5911) or (5910 + 5911 + 6523)
0294	Mod : (4536 + MP S5063 + 5910 + 5911) or (4536 + 5910 + 5911 + 6523)
0295	Mod : (3881 + 6368) or (3881 + 5388 + 6368 + 6792)
0296	Mod : (3881 + 5910 + 5911 + 6368) or (3881 + 4705 + 5388 + 5910 + 5911 + 6368 + 6792)
0297	Mod : 3881 + 4801 + 5910 + 6368 + 6428
0298	Mod : 3881 + 4801 + 5910 + 5911 + 6368
0300	Mod : 3881 + 5910 + 5911 + 6368 + 6428
0301	Mod : (3881 + 5388 + 5910 + 5911 + 6368) or (3881 + 4705 + 5388 + 5910 + 5911 + 6368)
0302	Mod : 3881 + 4801 + 5910 + 5911 + 6368 + 6428
0303	Mod : 3881 + 5910 + 5911 + 6368 + 6428 + 8648
0304	Mod : 3881 + 4801 + 5388 + 6368 + 6428 + 6792
0305	Mod : (3881 + 4801 + 5910 + 5911 + 6368 + 6428) or (3881 + 4801 + 5388 + 5910 + 5911 + 6368 + 6428)
0306	Mod : 3881 + 4801 + 5910 + 5911 + 6368 + 6428 + 8648
0307	Mod : (3881 + 4801 + 5910 + 5911 + 6368 + 6428 + 8648) or (3881 + 4801 + 5388 + 5910 + 5911 + 6368 + 6428 + 8648)
0308	Mod : 3881 + 4705 + 5388 + 5910 + 5911 + 6368 + 6792 + 8648
0309	Mod : 3881 + 4801 + 5388 + 5910 + 5911 + 6368 + 6428 + 6792
0310	Mod : 3881 + 4801 + 5388 + 5910 + 5911 + 6368 + 6428 + 6792 + 8648
0311	Mod : 3881 + 4705 + 5388 + 5910 + 5911 + 6368 + 6428 + 6792 + 8648
0312	Mod : 3219 or 6591 or (3219 + 6591)
0313	Mod : 3219 or 6591 or (3219 + 6591) or (3219/UK)
0316	Mod : (4863 + 5443 + 10848) or (4863 + 5443 + 8244 + 10848)
0319	PW ALL or Mod : 4863 or (GE ALL/CSA)
0321	Mod : 4863 or (4801 + 4863)
0322	Mod : (4863/GE 80C2A2) or (4801 + 4863) or (4801 + 4863/GE 80C2A2)
0323	Mod : 5124 or 6395 or (5124 + 6395)
0324	Mod : 4863 or (4863 + 5124) or (4863 + 5616) or (4863 + 6528) or (4863 + 8130)
0325	STD or Mod : 6269 or 6727 or 6865 or 7037 or (6269 + 6865)

CODE	DESIGNATION
0326	Mod : (6269 + 6727) or (6269 + 7037) or (6727 + 6865) or (6865 + 7037) or (6269 + 6727 + 6865) or (6727 + 6865 + 7037)
0327	Mod : 4939 or (4939 + 5229) or (4939 + 5606)
0328	Mod : (5562 + 11899) or (5562 + 11900) or (5562 + 11899 + 11900)
0329	Mod : (4628 + 11899) or (4628 + 11900) or (5697 + 11899) or (5697 + 11900) or (6234 + 11899) or (6234 + 11900) or (4628 + 11899 + 11900) or (5697 + 11899 + 11900) or (6234 + 11899 + 11900)
0330	Mod : 3881 + 4801 + 5911 + 6368 + 12134
0331	Mod : 2254 + 3881 + 4801 + 5507 + 5910
0332	Mod : 2254 + 3881 + 4801 + 5910 + 8648
0333	Mod : 2254 + 3881 + 4801 + 5910 + 8629 + 8648
0334	Mod : 2254 + 3881 + 4801 + 5507 + 5910 + 8648
0335	Mod : (6599 + 6702) or (6605 + 6702) or (3482 + 3779 + 6599) or (3482 + 3779 + 6605)
0336	Mod : 4628 or 5697 or 6234 or (4628 + 5697) or (5697 + 6234)
0337	Mod : 6794 or 7019 or 7122 or 7402 or 7787 or MSN 425 434 441 444 482 484 522 523
0338	Mod : (4801 + 5562 + 6865 + 6920) or (4801 + 5562 + 6920 + 7576)
0339	Mod : (7172 + 11899) or (7172 + 11900) or (7172 + 11899 + 11900)
0340	Mod : PW4E1/(11320 or 11364 or 12044 or 12045)
0341	Mod : DLH/(11320 or 11364 or 12044 or 12045)
0342	FDX or MSN 162 217 224 251 260 425 434 441 444 448 482 484 522 523 550 551 672
0343	Mod : (5697 + 6041) or (5697 + 6865) or (6041 + 6234) or (5697 + 6041 + 6865) or (6041 + 6234 + 6865) or (6041 + 6352 + 6865) or (5697 + 6041 + 6234) or (5697 + 6041 + 6234 + 6865)
0344	Mod : (7032 + MPS8559) or (8976 + MPS8559) or (8977 + MPS8559)
0345	Mod : 6365 or (5917 + 5918) or (5918 + 6365) or (5917 + 5918 + 6365)
0346	Mod : (6365 + 12819) or (5917 + 5918 + 12819) or (5918 + 6365 + 12819) or (5917 + 5918 + 6365 + 12819)
0347	Mod : 4801 + 4863 + 5875 + 6920
0348	Mod : (5443 +11974) or (5443 + 11480 + 11974) or (5443 + 6591 + 11480 + 11974)
0349	Mod : (5443 + 11480 + 11894) or (6233 + 11480 + 11894)
0350	Mod : (5443 + 11894 + 11974) or (5443 + 11480 + 11894+ 11974) or (5443 + 6591 + 11480 + 11894 + 11974)
0351	Mod : (4801 + 4863 / PW 4000) or (4801 + 4863/ CSA /PW4156A)
0352	Mod : 4863 or (4863 + 5124) or (4863 + 5616) or (4863 + 6528) or (4863 + 8130) or (4863 + 5124 + 6528)
0353	Mod : 4863 or (4863 + 5124) or (4863 + 5616) or (4863 + 6528) or (4863 + 8130) or (4863 + 5616 + 8130)
0355	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443/AIC)
0356	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (3219 + 6591) or (4863 + 5443) or (4863 + 5443/GE 80C2) or (4863 + 5443 /PW 4152) or (4863 + 5443 + 6591/GE 80C2A2) or (4863 + 5443 /AIC/PW 4152)
0357	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (3219 + 6591) or (4863 + 5443) or (4863 + 5443/GE 80C2) or (4863 + 5443/PW 4152) or (4863 + 5443 + 6591/GE 80C2A2) or (4863 + 5443/GE 80C2A2/UK) or (4863 +5443/AIC/PW 4152)
0358	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (4863 + 5443) or (4863 + 5443/GE 80C2A2) or (4863 + 5443/GE 80C2A8) or (4863 + 5443 + 5973) or (4863 + 5443 + 5973/GE 80C2A2)
0359	Mod : 4863 or (4863 + 5443)

CODE	DESIGNATION
0361	Mod : 4863 or (4863/AIC)
0362	Mod : (4863/GE 80C2) or (4863/AIC/GE 80C2A2)
0363	Mod : (4863 + 6297) or (4863 + 6297/AIC) or (4863 + 6297/RJA)
0364	Mod : 4801 or (4801 + MSN 448)
0365	STD or MSN 267
0366	STD or Mod : (4801 + 6920) or (4801 + 6920 + 7468 + 8342)
0367	Mod : (4801 + 6920 + 8342) or (4801 + 6920 + 7468 + 8342) or (4801 + 6920 + 7468 + 8342/ARG)
0368	Mod : (4801 + 6920 + 7468) or (4801 + 6920 + 7468/AFL)
0369	Mod : (4801 + 6920 + 8342) or (4801 + 6920 + 7468 + 8342)
0370	Mod : (5757 + 11320 + 11454) or (5757 + 11364 + 11454)
0376	Mod : PW 4000 or (PW 4152/AIC)
0377	Mod : UAE or (GE 80C2A8/UAE)
0378	Mod : (4863 + 5443) or (4863 + 6233) or (4863 + 5443/PIA)
0379	Mod : (4863 + 5443 + 10848) or (4863 + 5443 + 10848/PIA) or (4863 + 5443 + 8244 + 10848)
0380	Mod : (4863 + 5443 + 8244) or (4863 + 5443 + 8244/PIA)
0381	STD or GE 80A3 or Mod : 3219 or (3219/GE 80A3) or (4863/GE 80C2A2) or (4863 + 5443) or (4863 + 5443/GE 80CA2/A8) or (4863 + 6233/80C2A2) or (4863 + 5443/PIA)
0382	Mod : (4863 + 5443 + 10848) or (4863 + 5443 + 8244 + 10848)
0383	Mod : (3219 + 5917) or (3219 + 6365) or (3219 + 5917 + 5918) or (3219 + 5917 + 5918 + 6365) or (3219 + 5918 + 6365)
0384	Mod : 6599 or 6605 or (6599 + 12557) or (6599 + 12715) or (6605 + 12557) or (6605 + 12715)
0385	Mod : (5051 + 6599) or (5051 + 6605) or (5051 + 6599 + 12557) or (5051 + 6605 + 12557) or (5051 + 6599 + 12715) or (5051 + 6605 + 12715)
0386	Mod : (5051 + 6599 + 6644 + 12557) or (5051 + 6605 + 6644 + 12557) or (5051 + 6599 + 6644 + 12715) or (5051 + 6605 + 6644 + 12715)
0387	Mod : (5051 + 6415 + 6599 + 6644 + 12557) or (5051 + 6415 + 6599 + 6644 + 12715)
0388	Mod : (4705 + 5911 + 12557) or (4705 + 5911 + 12715)
0389	Mod : 6528 or 5616 or 7088 or (7088 + 5616)
0390	Mod : 7088 or 8144 or 8616 or 11103
0391	MSN 162 217 224 251 260
0392	Mod : (5443 + 11894 + 12259) or (6233 + 11894 + 12259)
0393	Mod : (5443 + 11974 + 12259) or (5443 + 11480 + 11974 + 12259) or (5443 + 6591 + 11480 + 11974 + 12259)
0394	Mod : (5443 + 11480 + 11894 + 12259) or (6233 + 11480 + 11894 + 12259)
0395	Mod : (5443 + 11480 + 11894 + 11974 + 12259) or (5443 + 6591 + 11480 + 11894 + 11974 + 12259)
0396	Mod : (3703 + 5435 + 5616 + 7088 + 7218) or (3703 + 5435 + 5616 + 7088 + 7218 + 7614)
0397	Mod : (3703 + 5435 + 5616 + 8144) or (3703 + 5435 + 5616 + 7088 + 8144)
0398	Mod : (4801 + 4863) or (4801 + 4863/CSA)
0399	Mod : (5336 + 6365 + 11318) or (5336 + 5917 + 5918 + 11318) or (5336 + 5918 + 6365 + 11318)
0400	Mod : (5336 + 6365 + 11318) or (5336 + 5917 + 5918 + 11318) or (5336 + 5918 + 6365 + 11318) or (5336 + 5917 + 5918 + 6365 + 11318)
0401	Mod : (3881 + 4801 + 5910 + 6256)/MSN 434 484
0402	Mod : (3881 + 4801 + 5910 + 6256 + 8648)/MSN 522 523
0403	Mod : (2254 + 3881 + 4801 + 5910 + 8648)/MSN 425 441 444 482

CODE	DESIGNATION
0404	Mod : (5757 + 12248 + 12454) or (4293 + 4939 + 5143 + 5757 + 12248 + 12454)
0405	Mod : (5757 + 11320) or (5757 + 11364) or (5757 + 11320 + 11364)
0406	Mod : (4292 + 5057 + 5757 + 11320) or (4292 + 5057 + 5757 + 11320 + 11364)
0407	Mod : 6528 or 5616 or 7088 or (5616 + 7088) or (6527 + 6528) or (5616 + 6527 + 7088)
0408	Mod : 5616 or 7088 or 8144 or 11103 or (5616 + 7088) or (5616 + 8144) or (5616 + 7088 + 11103)
0409	Mod : 5616 or 7088 or 8144 or 11103 or (5616 + 7088)
0410	Mod : 6365 or (5918 + 6365) or (5917 + 5918) or (5917 + 5918 + 6365)
0411	Mod : 5917 or 6365 or (5917 + 5918) or (5918 + 6365) or (5917 + 5918 + 6365)
0412	Mod : 5124 or 5616 or (5124 + 6527) or (5124 + 6527 + 6528)
0413	Mod : Std or 8130 or (5616 + 7088 + 8130)
0414	Mod : 5616 or 7088 or 8144 or 11103 or (5616 + 7088) or (5616 + 8144) or (5616 + 7088 + 8144) or (5616 + 7088 + 11103)
0415	Mod : 7088 or 8130 or (5616 + 7088) or (7088 + 8130) or (5616 + 7088 + 8130)
0416	Mod : (5875 + 11760) or ((5875 + 11760)/US)
0417	Mod : 11320 or 11364 or 12044 or 12045 or 12454 or 12455
0418	Mod : (11592 + 12454) or (11592 + 12455) or (12248 + 12454) or (12248 + 12455)
0419	Mod : 11592 or 12016 or 12248 or (11320 + 11592) or (11320 + 12016) or (11320 + 12248) or (11364 + 11592) or (11364 + 12016) or (11364 + 12248) or (11592 + 12044) or (11592 + 12045) or (12016 + 12044) or (12016 + 12045) or (12044 + 12248) or (12045 + 12248
0420	Mod : (5124 + 6789) or (5616 + 6789) or (6528 + 6789) or (6764 + 6789) or (5124 + 6528 + 6789)
0421	Mod : (3881 + 5846 + 6195) or (3881 + 5051 + 5846 + 6195) or (3881 + 5846 + 6195 + 10393) or (3881 + 5846 + 8260 + 10393) or (3881 + 5051 + 5846 + 6195 + 6415) or (3881 + 5051 + 5846 + 6195 + 10393)
0422	Mod : (3881 + 6368) or (3881 + 5051 + 6368 + 6415) or (3881 + 5051 + 6368 + 6415 + 8260)
0423	Mod : (5697 + 11894) or (5913 + 11894) or (5697 + 5913 + 11894) or (5697 + 8960 + 11894) or (5697 + 8960 + 12523) or (5697 + 5913 + 6234 + 11894) or (5697 + 5913 + 8960 + 11894) or (5697 + 6234 + 8960 + 11894) or (4209 + 5697 + 5913 + 6234 + 11894)
0424	Mod : (3219 + 12480) or (3219 + 6591 + 12480)
0425	Mod : 8260 or (5051 + 6195) or (6195 + 10393) or (5051 + 6195 + 10393) or (6195 + 8260 + 10393)
0426	Mod : (5051 + 6368) or (5051 + 6368 + 8260) or (5051 + 6368 + 6415 + 8260)
0427	Mod : 6195 or 8260 or (6195 + 10393) or (8260 + 10393) or (5051 + 6195 + 6415) or (5051 + 6195 + 10393)
0428	Mod : (3219 + 6591 + 11480 + 12259) or (3219 + 6591 + 11480 + 12259 + 12480)
0429	Mod : (4863 + 11320) or (4863 + 12044) or (4863 + 11320 + 12044) or (4863 + 11320 + 11364 + 12044)
0430	Mod : (4863 + 11320) or (4863 + 12044) or (4863 + 11320 + 12044)
0431	Mod : 12785 or (5051 + 6415 + 12785) or (5051 + 6605 + 12785)
0432	Mod : (6007 + 12134 + 12691) or (6007 + 6120 + 12134 + 12691)
0433	Mod : 6007 + 6120 + 7177 + 12134 + 12691
0434	Mod : 11320 or 11364 or 12044 or 12045 or (11320 + 12044) or (11364 + 12045)
0435	Mod : (3703 + 5435 + 5616 + 7088) or (3703 + 7088 + 7218 + 13157) or (3703 + 5435 + 5616 + 7088 + 7218) or (3703 + 5435 + 5616 + 7088 + 7218 + 7614)
0436	Mod : 12691 or (6269 + 12691) or (6727 + 12691) or (6865 + 12691) or (12134 + 12691) or (6727 + 6865 + 12691) or (6865 + 7037 + 12691) or (6727 + 6865 + 7037 + 12691) or (6727 + 6865 + 12134 + 12691)

CODE	DESIGNATION
0437	Mod : 12691 or (6269 + 12691) or (6727 + 12691) or (6865 + 12691) or (12134 + 12691) or (6865 + 7037 + 12691) or (6727 + 6865 + 7037 + 12691) or (6865 + 7037 + 12134 + 12691) or (6727 + 6865 + 7037 + 12134 + 12691)
0438	Mod : (3219 + 12691) or (3219 + 12134 + 12691)
0439	Mod : (5443 + 12691) or (3219 + 6591 + 12691) or (5443 + 12134 +12691) or (3219 + 6591 + 12134 + 12691)
0440	Mod : (3219 + 6591 + 12480 + 12691) or (3219 + 6591 + 12134 + 12480 + 12691)
0441	Mod : (3881 + 12691) or (3881 + 12134 + 12691)
0442	Mod : (2254 + 12691) or (2254 + 12134 + 12691)
0443	Mod : (5910 + 12691) or (5910 + 12134 + 12691)
0444	Mod : 2254 + 3881 + 5910 + 12691
0445	Mod : 3881 + 4801 + 5910 + 12691
0446	Mod : 7177 + 7460 + 7885 + 12134 + 12691
0447	Mod : 5443 or 6233 or 6591 or (3219 + 6591) or (5443 + 6591) or (3219 + 12480) or (3219 + 6591 + 12480)
0448	Mod : 11320 or 11364 or 12044 or 12045 or (11320 + 12044)
0449	Mod : (4863 + 11320) or (4863 + 11364) or (4863 + 12044) or (4863 + 12045) or (4863 + 11320 + 12044) or (4863 + 11364 + 12045) or (4863 + 11320 + 11364 + 12044)
0450	Mod : (4863 + 11320) or (4863 + 12044) or (4863 + 11320 + 12044) or (4863 + 11364 + 12045)
0451	Mod : 10800 + 11318 + 11695 + 12691
0452	Mod : 4801 + 7259 + 10806 + 12134 + 12691
0453	Mod : (5443 + 12691) or (3219 + 6591 + 12691)
0454	Mod : 5917 or 6365 or (5917 + 5918) or (5918 + 6365) or (5917 + 5918 + 6365)
0455	Mod : (6041 + 12691) or (6041 + 6865 + 12691)
0456	Mod : (5697 + 6041 + 12691) or (5697 + 6865 + 12691) or (6041 + 6234 + 12691) or (5697 + 6041 + 6234 + 12691) or (5697 + 6041 + 6865 + 12691) or (6041 + 6234 + 6865 + 12691) or (6041 + 6352 + 6865 + 12691) or (5697 + 6041 + 6234 + 6865 + 12691)
0457	Mod : (2254 + 3881 + 12691) or (2254 + 3881 + 12134 + 12691)
0458	Mod : (3881 + 4801 + 5910 + 12691) or (3881 + 4801 + 5910 + 12134 + 12691)
0459	Mod : (2254 + 3881 + 5910 + 12691) or (2254 + 3881 + 5910 + 12134 + 12691)
0460	Mod : 4357 + 5944 + 6041 + 6403 + 6445
0461	Mod : (5944 + 6041 + 6403 + 6445 + 7483) or (4357 + 5944 + 6041+ 6403 + 6445 + 7483
0462	Mod : 5944 + 6041 + 6403 + 6445 + 7483 + 12134
0463	Mod : 4801 + 4803 + 5562 + 6865 + 7576 + 12134 + 12691
0464	Mod : (10264 + 12691) or (11318 + 12691)
0465	Mod : (10264 + 12691) or (11318 + 12691) or (5725 + 10264 + 12691) or (5725 + 11318 + 12691)
0466	Mod : (5876 + 12259) or (5723 + 5876 + 12259)
0467	Mod : (5443 + 5723 + 5876 + 11480 + 12259) or (5443 + 5723 + 5876 + 7899 + 11480 + 12259)
0468	Mod : (3219 + 5723 + 11480 + 12259) or (3219 + 5876 + 11480 + 12259) or (3219 + 5723 + 5876 + 11480 + 12259)
0469	Mod : (5443 + 5723 + 5876 + 11894 + 12259) or (5443 + 5723 + 5876 + 7899 + 11894 + 12259) or (5723 + 5876 + 6233 + 7899 + 11894 + 12259)
0470	Mod : (5443 + 5723 + 5876 + 11974 + 12259) or (5443 + 5723 + 5876 + 7899 + 11974 + 12259) or (5443 + 5723 + 5876 + 11480 + 11974 + 12259) or (5443 + 5723 + 5876 + 7899 + 11480 + 11974 + 12259)
0471	Mod : (5443 + 12259 + 12972) or (5443 + 5723 + 5876 + 7899 + 12259 + 12972)

CODE	DESIGNATION
0472	Mod : (3219 + 5723 + 5876 + 6591 + 11480 + 12259) or (3219 + 5723 + 5876 + 6591 + 11480 + 12259 + 12480)
0473	Mod : (3219 + 5723 + 5876 + 11480 + 11894 + 12259)
0474	Mod : (5443 + 5723 + 5876 + 11480 + 11894 + 12259) or (5723 + 5876 + 6233 + 11480 + 11894 + 12259) or (5443 + 5723 + 5876 + 7899 + 11480 + 11894 + 12259)
0475	Mod : (3219 + 5723 + 5876 + 11480 + 12259 + 12480)
0476	Mod : (5443 + 5723 + 5876 + 11894 + 11974 + 12259) or (5443 + 5723 + 5876 + 7899 + 11894 + 11974 + 12259)
0477	Mod : (5443 + 5723 + 5876 + 11480 + 11894 + 11974 + 12259) or (5443 + 5723 + 5876 + 6591 + 11480 + 11894 + 11974 + 12259) or (5443 + 5723 + 5876 + 7899 + 11480 + 11894 + 11974 + 12259)
0478	Mod : (5443 + 5723 + 5876) or (5443 + 5723 + 5876 + 7899)
0479	Mod : (3219 + 5723 + 11480) or (3219 + 5723 + 5876 + 11480)
0480	Mod : (5443 + 5723 + 5876 + 11480) or (5443 + 5723 + 7899 + 11480) or (5443 + 5723 + 5876 + 7899 + 11480)
0481	Mod : (5443 + 5723 + 5876 + 11894) or (5443 + 5723 + 5876 + 7899 + 11894)
0482	Mod : (5443 + 5723 + 5876 + 11480 + 11974) or (5443 + 5723 + 5876 + 7899 + 11480 + 11974)
0483	Mod : (5443 + 5723 + 5876 + 11480 + 11894) or (5443 + 5723 + 5876 + 7899 + 11480 + 11894)
0484	Mod : (5443 + 5723 + 5876 + 11480 + 11894 + 11974) or (5443 + 5723 + 5876 + 7899 + 11480 + 11894 + 11974)
0485	Mod : 3881 + 4801 + 5910 + 6256 + 8648 + 10554 + 12134
0486	Mod : (3881 + 4801 + 5910 + 6256 + 10554)/MSN 434 484
0487	Mod : (3881 + 4801 + 5910 + 6256 + 8648 + 10554)/MSN 522 523
0488	Mod : 3881 + 4801 + 5910 + 6256 + 8648 + 10554
0489	Mod : 2254 + 3881 + 4801 + 5507 + 5910 + 8648 + 10554
0490	Mod : (3791 + 4541) or (3791 + 4801)
0491	Mod : 3503 or 4541 or 4801 or (4801 + 6536)
0492	Mod : (4801 + 12557) or (4801+ 6536 + 12557)
0493	Mod : 3881 + 5051 + 5846 + 6368 + 12691
0494	Mod : 3881 + 4801 + 5911 + 6368 + 12134 + 12691
0495	Mod : 3881 + 4801 + 5917 + 5918 + 6368 + 12691
0496	Mod : 4801 + 5336 + 5917 + 5918 + 11318 + 12691
0497	Mod : (4801 + 4803 + 5562 + 6865 + 6920) or (4801 + 4803 + 5562 + 6920 + 7576) or (4801 + 4803 + 5562 + 6865 + 6920 + 7576)
0498	Mod : (5697 + 11894 + 13095 + 13174) or (5913 + 11894 + 13095 + 13174) or (5697 + 5913 + 11894 + 13095 + 13174)
0499	Mod : 3881 + 4801 + 5910 + 8648
0500	Mod : 3881 + 4801 + 5910 + 8648 + 12134
0501	Mod : 2254 + 3881 + 4801+ 5910 + 8629 + 8648
0502	Mod : 2254 + 3881 + 4801 + 5910 + 8648 + 12134
0503	Mod : 2254 + 3881 + 4801 + 5507 + 5910 + 8648 + 10554 + 12134
0504	STD or Mod : (5051 + 6415) or (12785 + 13203) or (5051 + 6415 + 12785 + 13203)
0505	Mod : (5051 + 6599) or (5051 + 6605) or (5051 + 6599 + 12785 + 13203) or (5051 + 6605 + 12785 + 13203)

CODE	DESIGNATION
0506	Mod : (3703 + 5124 + 5435 + 7088) or (3703 + 5435 + 5616 + 7088) or (3703 + 7088 + 7218 + 13157) or (3703 + 5435 + 5616 + 7088 + 7218) or (3703 + 5435 + 5616 + 7088 + 7218 + 7614)
0203B	STD or Mod : 5757
0203D	Mod : (4293 + 5143) or (4293 + 5143 + 5757) or (4293 + 5143 + 5144 + 5757)
0203G	Mod : (4293 + 5143 + 5757) or (4293 + 5143 + 5144 + 5757)
0203H	Mod : 4294 or (4294 + 5757)
0203I	STD or Mod : 5757 or (4294 + 5757 + 8415) or (4294 + 5144 + 5757 + 8415)
0203K	STD or Mod : 5757 or (4294 + 5757) or (5144 + 5757) or (4294 + 5757 + 8415) or (4294 + 5144 + 5757 + 8415)
0214B	Mod : 5443 or 6233 or 6591 or (3219 + 6591) or (5443 + 6591)
0214D	Mod : 5443 or (3219 + 6591) or (5443 + 6591)
0219B	Mod : 6789 or (4672 + 6789)
0219C	Mod : 6789 or (4801 + 6789)
0219E	Mod : 3791 or (3791 + 4801)
0219G	Mod : (5124 + 6789) or (5616 + 6789) or (6528 + 6789) or (6764 + 6789) or (5124 + 6528 + 6789)
0219I	Mod : (PW 7R4D1/3791 + 6662) or (GE 80A3/3791 + 6662) or (GE 80C2A2/3791 + 4863 + 6662) or (3791 + 5124 + 6662) or (3791 + 6662 + 6827) or (GE 80A3/3791 + 5124 + 6662) or (PW 4000/3791 + 4863 + 6662) or (PW 7R4E1/3791 + 5124 + 6662) or (PW 7R4E1/3791 + 4863 + 5616 + 6662) or (PW 4000/3791 + 4863 + 5616 + 6662) or (GE 80A3/3791 + 5124 + 6662 + 6827) or (GE 80C2A2/3791 + 4863 + 5616 + 6662) or (GE 80C2A8/3791 + 4863 + 5616 + 6662) or (3791 + 4863 + 5616 + 6967) or (PW 4152/3791 + 4863 + 5616 + 6967) or (3791 + 4863 + 6662 + 6967) or (3791 + 4863 + 5916 + 6662 + 6967)
0219M	STD or Mod : 4801
0219N	Mod : (3791 + 6967) or (3791 + 6662)
0219P	Mod : (3791 + 4801 + 6662) or (3791 + 4801 + 6967)
0219Q	Mod : (3791 + 6662 + 7421) or (3791 + 6967 + 7421)
0219R	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 5124 + 6662) or (3791 + 5124 + 6967) or (3791 + 5616 + 6662) or (3791 + 5616 + 6967)
0219S	Mod : 6662 or 6967 or (6662 + 6827) or (6827 + 6967)
0219T	Mod : 6662 or 6967
0219U	Mod : (6662 + 7421) or (6967 + 7421)
0219V	Mod : (5735 + 6662) or (5735 + 6967)
0219W	Mod : (5124 + 6662) or (5124 + 6967) or (5616 + 6662) or (5616 + 6967) or (5616 + 6662 + 6967)
0219X	Mod : (5616 + 6662 + 7421) or (5616 + 6967 + 7421)
0219Y	Mod : (5091 + 6662) or (5091 + 6967)
0219Z	Mod : (6395 + 6662) or (6395 + 6967)
0219AA	Mod : (5124 + 6662) or (5124 + 6967)
0219AB	Mod : (4863 + 6662) or (4863 + 6967) or (4863 + 6662 + 6967)
0219AC	Mod : (4863 + 5616 + 6662) or (4863 + 5616 + 6967) or (4863 + 5616 + 6662 + 6967)
0219AD	Mod : (4863 + 6662 + 7421) or (4863 + 6967 + 7421)
0219AE	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 4672 + 6662) or (3791 + 4672 + 6967) or (3791 + 4672 + 6662 + 6967)
0219AF	Mod : (3791 + 6662) or (3791 + 6967) or (3791 + 6662 + 6967)
0219AH	Mod : 8976 or 8977 or (6789 + 8976) or (6789 + 8977) or (6789 + 8976 + 8977)
0306C	Mod : (3881 + 5213) or (3881 + 7288)

CODE	DESIGNATION
0311B	Mod : (3721 + 5443) or (3721 + 6591) or (6233 + 6645)
1010A	STD or Mod : 4863
1010B	STD or Mod : 4863 or UK
1040A	Mod : (4863 + 5443) or (4863 + 6233)
1040B	Mod : 3219 or 6591 or (3219 + 6591)
1520B	Mod : 3219 or 6591
1830B	Mod : 3219 or 6591
1850A	Mod : (4863 + 5443) or (4863 + 6233)

1. GENERALITIES

Aircraft and system limitations in this section include the limitations required by the regulations and contained in the FLIGHT MANUAL.

IMPORTANT

ALL THE LIMITATIONS OF THE DGAC APPROVED FLIGHT MANUAL ARE REPRODUCED HERE IN BOXES.

– THE ADDITIONAL LIMITATIONS ARE INDICATED AS A GUIDE IN ORDER TO HAVE AN OPTMIZED UTILIZATION OF THE AIRCRAFT.

– ALL REFERENCES TO AIRSPEED OR MACH RELATE TO INDICATED AIRSPEED OR INDICATED MACH UNLESS OTHERWISE NOTED.

– ALL REFERENCES TO ALTITUDE RELATE TO PRESSURE ALTITUDE UNLESS OTHERWISE NOTED.

2. KINDS OF OPERATIONS

This airplane is certificated in the transport category for the following kinds of operation when the appropriate instruments and equipment required by the airworthiness and/or operating regulations are approved, installed and in operable condition.

- Carriage of passengers (maximum number of passengers seats : 275)
- Carriage of cargo
- Icing conditions
- Extended over water flight and ditching
- Day and night VFR
- IFR
- For operation with AFS, limitations are given in the Auto Flight System section.

Note : *The airworthiness regulations do not allow CAT II and CAT III operations unless the operator has received the agreement from his national appropriate authorities.*

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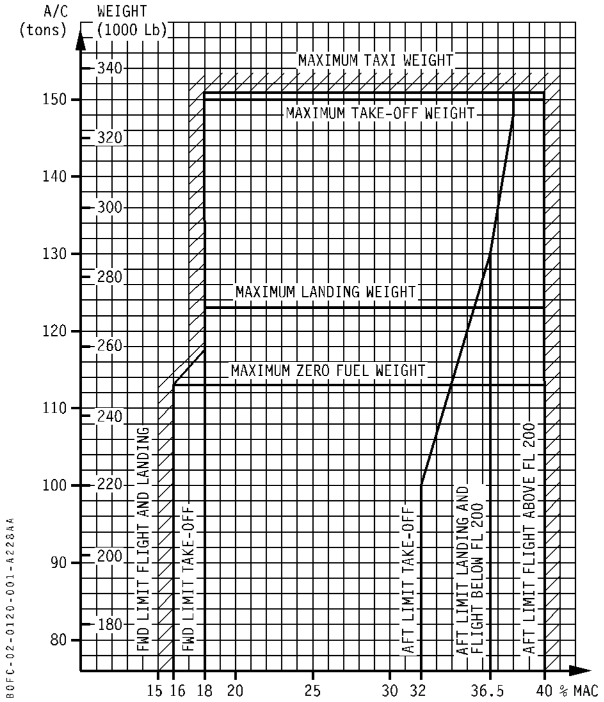
1 – WEIGHTS/CENTER OF GRAVITY

A – CENTER OF GRAVITY LIMITS

The limits of the center of gravity are given in percentage of the mean aerodynamic chord, landing gear extended. The MAC is 5.8287 meters long (229.48 inches). Station 0 is located 6.3825 meters (251.28 inches) forward of fuselage nose.



Note : Aircraft Center of gravity must always be within presented limits regardless of fuel load.

B – WEIGHT LIMITATIONS

	KG	POUNDS
MAXIMUM TAXI WEIGHT	150 900	332 735
MAXIMUM TAKE-OFF WEIGHT (BRAKES RELEASE)	150 000	330 750
MAXIMUM LANDING WEIGHT	123 000	271 215
MAXIMUM ZERO FUEL WEIGHT	113 000	249 165
MINIMUM WEIGHT	80 000	176 400

Under exceptional conditions following a takeoff at any weight within max takeoff weight and max landing weight, an immediate landing is permitted provided overweight landing procedure is adhered to.

Exceptional conditions are :

. emergencies

. abnormalities wherein continuance of flight to destination is not possible.

Note : Autoland above MLW has not been demonstrated. R

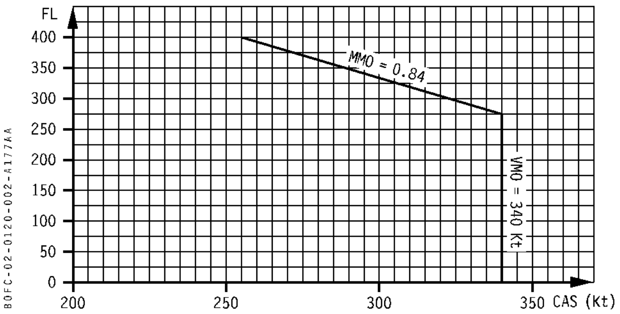
2 – SPEEDS

A – VMCA-VMCG

VMCG . . . . 111 KT CAS (113 KT IAS)
VMCA . . . . 115 KT CAS (117 KT IAS)

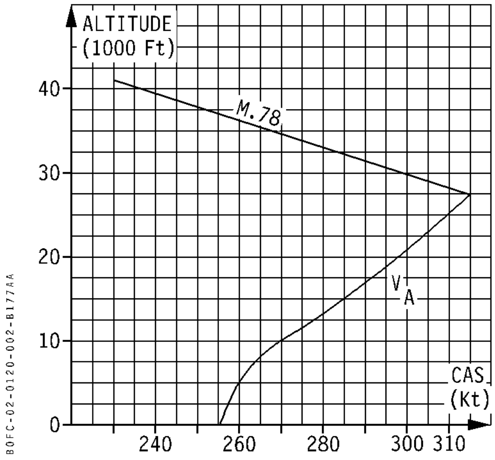
B – MAXIMUM OPERATING SPEEDS (V_{MO})

The maximum operating limit speed V_{MO} may not be deliberately exceeded in any regime of flight (climb, cruise or descent).



C – MAXIMUM DESIGN MANEUVERING SPEED (V_A)

Full application of rudder and aileron controls, as well as maneuvers that involve angles of attack near the stall, should be confined to speeds below V_A.



CAUTION

Rapid and large alternating control intputs, 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 V_A.

D – MAXIMUM SLATS/FLAPS SPEEDS (V_{FE})

(1) Maximum slats/flaps extended speeds or operating speeds for takeoff, approach and landing :

Maximum operating altitude : 20000 ft

	SLATS	FLAPS	SPEED (IAS)
TAKEOFF	15	0	245 KT
TAKEOFF AND APPROACH	15	15	210 KT
TAKEOFF, APPROACH AND LANDING	20	20	195 KT
LANDING	20 30	20 40	195 KT 180 KT

(2) Maximum slats extended speed for holding and en route :

HOLDING AND « EN ROUTE »	15	0	245 KT/M 0.54

E – GEAR OPERATING SPEEDS

Maximum speed at which the landing gear may be extended or retracted :
V_{LO} = 270 KT or M 0.59

Maximum speed with landing gear locked down :
V_{LE} = 270 KT or M 0.65

F – KRUGER

If Kruger cannot be retracted :
do not exceed 300 KT/M0.65

G – MANUAL PITCH TRIM

When operating with manual pitch trim only :
do not exceed 285 KT/M0.78

3 – MISCELLANEOUS

A – MINIMUM FLIGHT CREW

The minimum flight crew consists of 2 pilots.

B – DISPATCHIBILITY

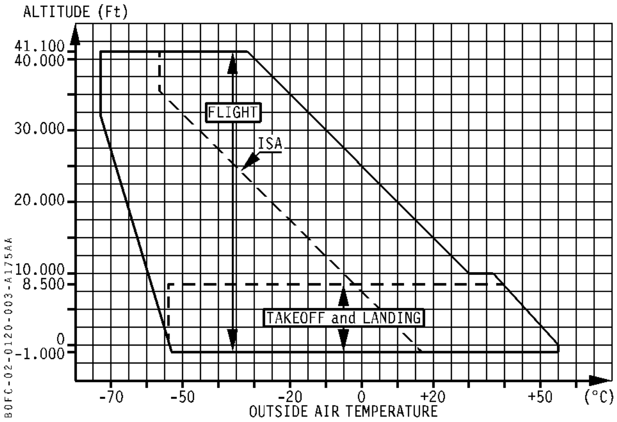
For dispatch in the event of equipment failure or missing parts, refer to MEL/CDL.

C – FLIGHT MANEUVERING LOAD ACCELERATION LIMITS

Clean configuration : + 2.5 g to – 1 g
Slats extended configuration : + 2 g to 0 g

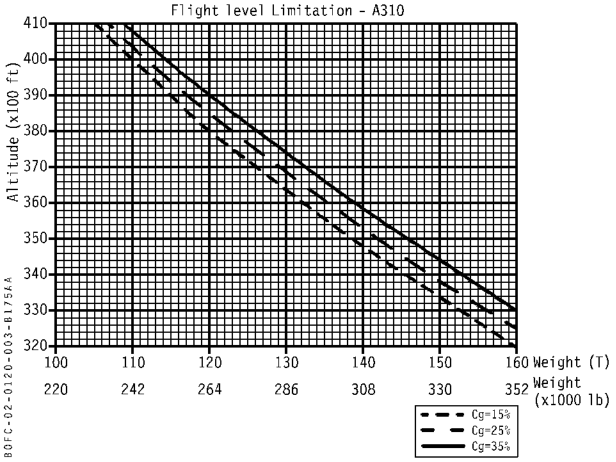
D – OPERATING PERFORMANCE LIMITATIONS

(1) Environmental envelope



(2) Flight level limitations

In order to reduce the possibility of pitch over control in case of heavy turbulence, the following limitations of the flight envelope must be permanently applied, regardless of actual weather conditions.



(3) Airport Operation limitations

Runway slope (mean) . . . . ± 2 %

Runway altitude . . . . 8,500 ft

Wind :
. Tail wind component (Takeoff and landing) . . . . 15 kt

- Cross wind (takeoff and landing) : maximum demonstrated on dry runway . . . . 28 kt
- Computed crosswind capability on dry and wet runway . . . . 37 kt
- Max wind for passenger and cargo doors operation . . . . 60 kt

E – TIRES

MAXIMUM TIRE SPEED
. . . . . . GROUND SPEED = 195.5 kt (225 mph)

F – WINDSHIELD WIPERS IN USE

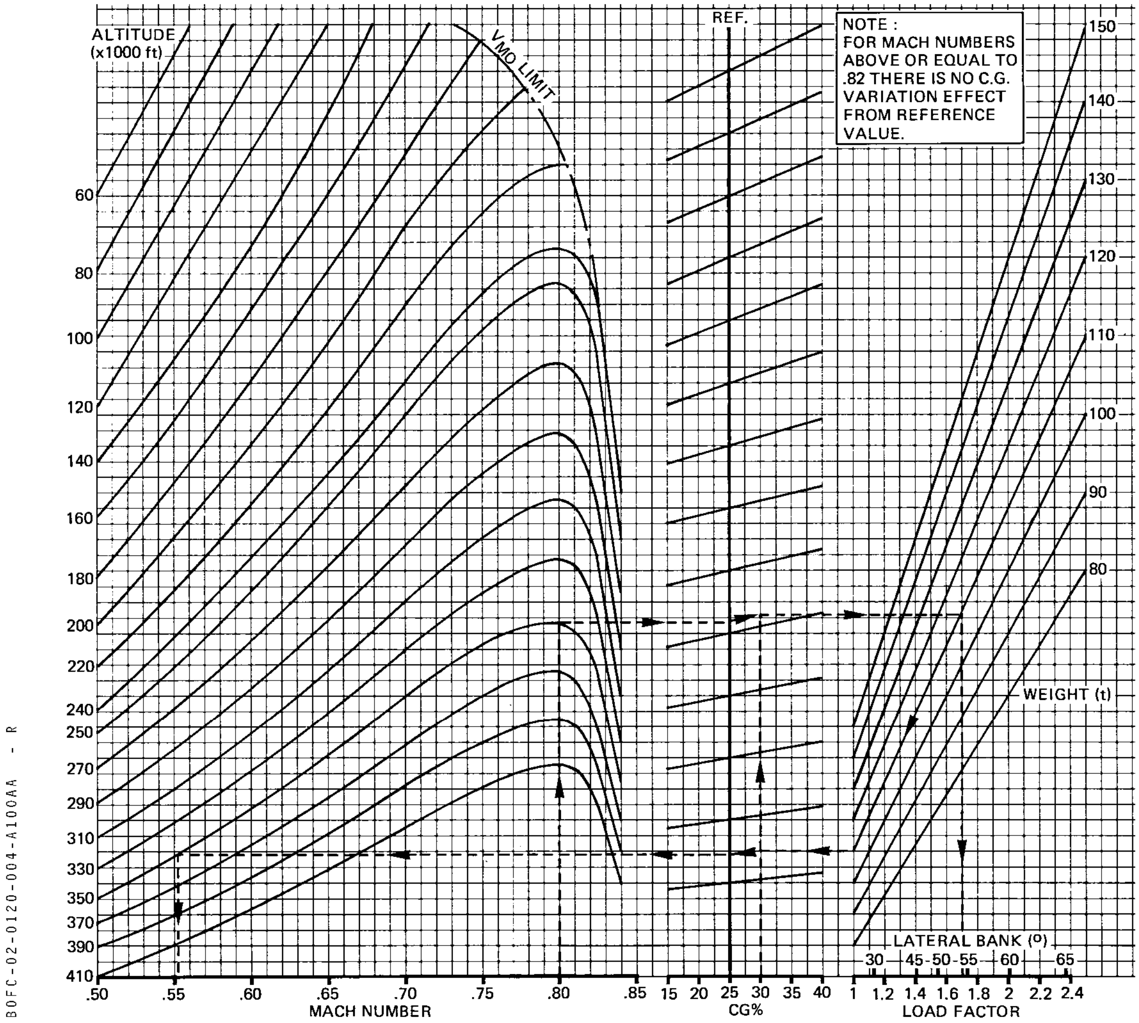
Maximum operating speed . . . . 230 kt

G – COCKPIT WINDOWS OPEN

Maximum speed . . . . 225 kt

4. BUFFET ONSET

BUFFET ONSET
clean configuration



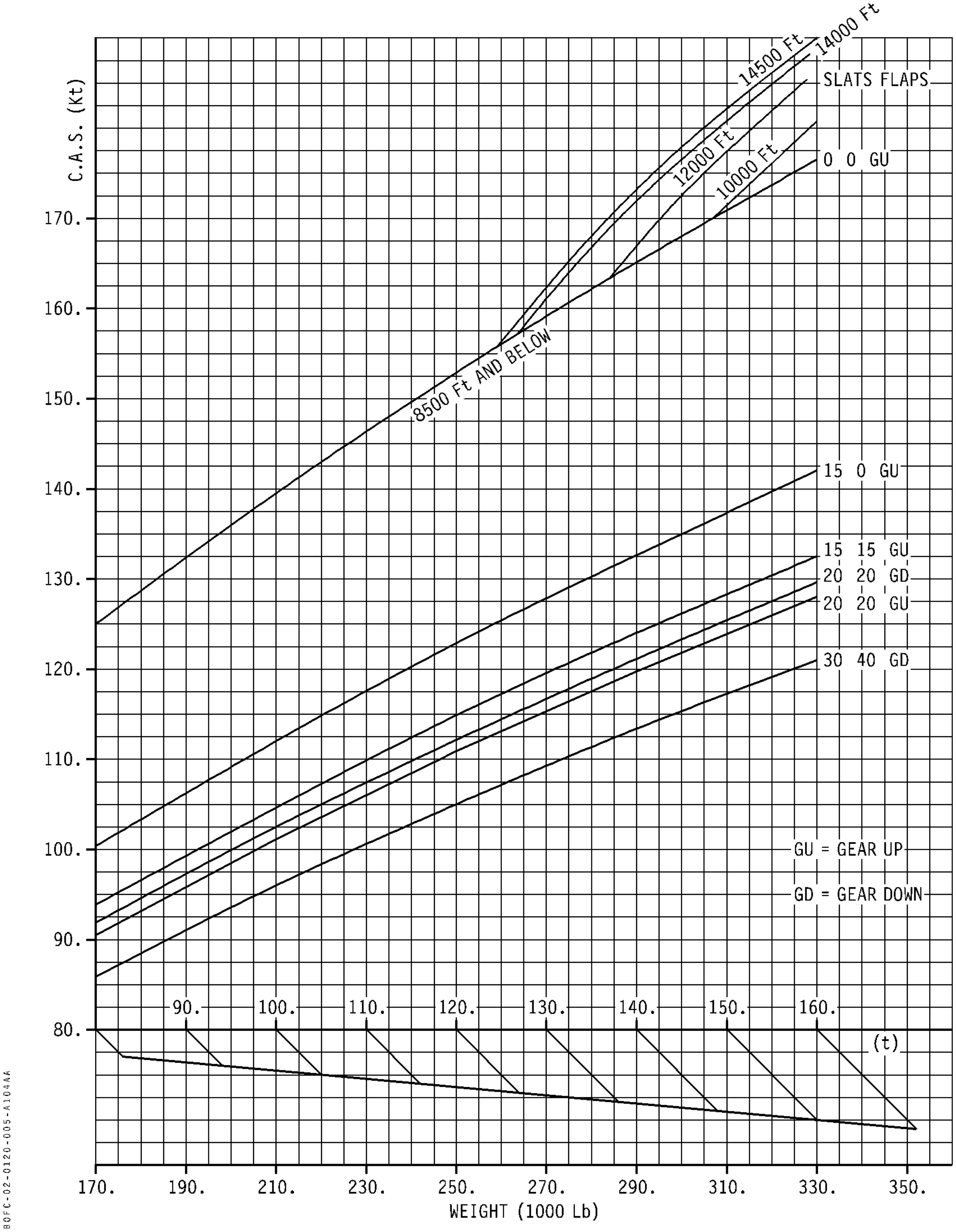
Data : M = .80
FL = 350
Weight = 110 tons
CG = 30 %

Results : Buffet onset at

- M = .80 with 54° bank angle or at 1.7 g
- Low speed (1 g) : M = .555
- High speed : Above M.84

Mod : 4863

5. VS MINIMUM



Mod : 4863

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STD or Mod : 4863

AUTOPILOT :

- Minimum altitude for use of the autopilot in a cruise mode : 500 ft.
- Minimum altitude for use of VERTICAL SPEED mode in approach : 200 ft.

AUTOLAND

AIRPLANE CONFIGURATION :

Certified configuration : slats 30°/flaps 40°.

The approach speed (Vapp) is Vref + 5 kt + CDU WIND CORR.

ALTITUDE EFFECT :

The altitude effect on Autoland above 2 500 ft has not been evaluated.
Therefore, for autoland operation above 2 500 ft elevation, it is recommended that each operator assesses the autoland capability in good visibility conditions for each runway prior to performing CAT 2 or CAT 3 operation.
This should be done in the frame of each operator operational approval and does not preclude complying with other applicable local operational regulations.

AUTOLAND ON A CAT 1 ILS BEAM :

Automatic landing system performance has been demonstrated on CAT 2 and CAT 3 ILS runways. However automatic landing in CAT 1 or better weather conditions is possible on CAT 1 ground
R installations on CAT II/III ground installations when
R ILS sensitive areas are not protected, if the following precautions are taken :

- the airline has checked that the ILS beam quality and the effect of the terrain profile before the runway has no adverse effect on A.P. guidance. In particular the effect of terrain discontinuities within 300 m before runway threshold must be assessed.
- the crew is aware that LOC or GS beams fluctuations independent of the aircraft system may occur and the PF is prepared to immediately disconnect the AP and to take the appropriate action, should unsatisfactory guidance occur.
- at least CAT 2 capability is displayed on FMA and CAT 2/3 procedures are used.
- visual references are obtained at a DA/DH appropriate for the CAT 1 approach being flown or a go-around is performed.

CATEGORY II APPROACH AND AUTOMATIC LANDING

Minimum decision height : 100 ft.
AP in CMD at least.
Certified capability : CAT 2, CAT 3.

CATEGORY III APPROACH AND AUTOMATIC LANDING WITH DECISION HEIGHT

Minimum decision height : 15 ft.
2 AP in CMD and 1 autothrottle at least.
Certified capability : CAT 3.

CATEGORY III APPROACH AND AUTOMATIC LANDING WITH NO DECISION HEIGHT

2 AP in CMD and 1 autothrottle at least.
Certified capability : CAT 3.
Minimum runway visual range : 75 m.
Minimum height demonstrated for approach interruption : 15 ft.

MAXIMUM WIND CONDITIONS FOR AUTOMATIC LANDING AND ROLL OUT

R – DEMONSTRATED WIND CONDITIONS :
R Head wind . . . . 30 kt
R Cross wind . . . . 20 kt
R Tail wind . . . . 10 kt
R – Performance of ROLL OUT mode has been
R demonstrated on dry and wet runway.
R – Performance of ROLL OUT mode on snow
R covered or icy runway has not been demonstrated.

FMS

The FMS can be used in the RADIO mode for advisory purpose only.

NAV + PROF modes may be used for non precision approaches only. PROF mode use in approach beyond FAF is not allowed. Respect of obstacle clearance and constraints remain normal crew responsability.

An approach procedure cannot be conducted if the associated navaids are unserviceable.

Code : 0405

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(Northrop Grumman IRU not installed)

Code : 0169

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(Northrop Grumman IRU not installed)

Code : 0169

AUTOMATIC LANDING WITH HONEYWELL IRU

The following table provides the list of the affected airport. For each listed airport, the following limitations apply at the beginning of the associated year :

- AUTOLAND is not allowed
- Automatic ROLL OUT is not allowed.

CAT II approaches without AUTOLAND are still allowed.

Airport Code	Airport Name	Year
BIKF	KEFLAVIK	as of 2007
CYHZ	HALIFAX	as of 2010
CYVR	VANCOUVER	as of 2007
CYWG	WINNIPEG	as of 2014
CYYT	ST JOHN'S NF	as of 2007
DAAG	ALGIERS	as of 2007
DAAT	TAMANRASSET AGUENAR	as of 2007
DABB	ANNABA EL MELLAH	as of 2008
DAOO	ORAN	as of 2007
DBBB	COTOUNDOU CADJEHOUN	as of 2007
DFFD	OUAGADOUGOU	as of 2007
DFOO	BOBO-DIOULASSO	as of 2007
DIAP	ABIDJAN	as of 2007
DIBK	BOUAKE	as of 2007
DNMM	LAGOS	as of 2007
DRRN	DIORI HAMANI NIAMEY	as of 2007
DTKA	TABARKA	as of 2009
DTMB	TUNIS HABIB BOURGUIBA	as of 2012
DTTA	TUNIS CARTHAGE	as of 2011
DTTJ	JERBA ZARZIS	as of 2012
DTTZ	TOZEUR NEFTA	as of 2008
DXNG	NIAMTOUGOU	as of 2007
DXXX	LOME TOKOIN	as of 2007
EBBR	BRUSSELS	as of 2007
EBLG	LIEGE BIERSET	as of 2007
EDDB	BERLIN SCHONEFELD	as of 2008
EDDC	DRESDEN	as of 2009
EDDE	ERFURT	as of 2007
EDDF	FRANKFURT/MAIN	as of 2007
EDDG	MUNSTER-OSNABRUCK	as of 2007
EDDH	HAMBURG	as of 2007
EDDK	COLOGNE-BONN	as of 2007
EDDL	DUSSELDORF	as of 2007
EDDM	MUNICH	as of 2009
EDDN	NURNBERG	as of 2008
EDDP	LEIPZIG HALLE	as of 2008
EDDS	STUTTGART	as of 2007
EDDT	BERLIN TEGEL	as of 2008
EDDV	HANNOVER	as of 2007
EDDW	BREMEN	as of 2007
EDFH	HAHN	as of 2007
EDLW	DORTMUND WICKEDE	as of 2007
EDNY	FRIEDRICHSHAFEN	as of 2007
EFHK	HELSINKI VANTAA	as of 2010
EFOU	OULU	as of 2007
EFRO	ROVANIEMI	as of 2007
EGAA	BELFAST	as of 2007
EGBB	BIRMINGHAM	as of 2007
EGCC	MANCHESTER	as of 2007
EGGD	BRISTOL	as of 2007
EGGP	LIVERPOOL	as of 2007
EGGW	LUTON	as of 2007
EGKK	GATWICK	as of 2007
EGLL	HEATHROW	as of 2007
EGNM	LEEDS	as of 2007
EGNT	NEWCASTLE	as of 2007
EGNX	EAST MIDLANDS	as of 2007
EGPF	GLASGOW	as of 2007
EGPH	EDINBURGH	as of 2007
EGSS	LONDON STANSTED	as of 2007
EHAM	AMSTERDAM	as of 2007
EICK	CORK	as of 2007
EIDW	DUBLIN	as of 2007
EINN	SHANNON	as of 2007
EKAH	AARHUS TIRSTRUP	as of 2007
EKBI	BILLUND	as of 2007
EKCH	COPENHAGEN KASTRUP	as of 2007
EKKA	KARUP	as of 2007
EKYT	AALBORG	as of 2007
ELLX	LUXEMBOURG	as of 2007
ENGM	OSLO GARDERMOEN	as of 2007
EPWA	WARSAW	as of 2014
ESGG	GOTEBORG LANDVETTER	as of 2007
ESMS	MALMO STURUP	as of 2007
ESSA	STOCKHOLM ARLANDA	as of 2007
FACT	CAPETOWN	as of 2007
FAEL	EAST LONDON	as of 2007
FAJS	JOHANNESBURG	as of 2007
FCBB	BRAZZAVILLE	as of 2007
FEFF	BANGUI M'POKO	as of 2010
FKKD	DOUALA	as of 2007
FKKR	GAROUA	as of 2010
FKYS	YAOUNDE	as of 2007

Code : 0048

Airport Code	Airport Name	Year
FOOL	LIBREVILLE	as of 2007
FOON	FRANCEVILLE	as of 2007
FQBR	BEIRA	as of 2010
FTTJ	N'DJAMENA	as of 2012
FZAA	KINSHASA	as of 2007
FZIC	KISANGANI BANGOKA	as of 2011
GABS	BAMAKO	as of 2007
GBYD	BANJUL	as of 2007
GGOV	BISSAU	as of 2007
GLRB	MONROVIA	as of 2007
GMAD	AGADIR	as of 2007
GMMN	CASABLANCA	as of 2007
GMMZ	OUARZAZATE	as of 2007
GOOY	DAKAR YOFF	as of 2007
GQNN	NOUAKCHOTT	as of 2007
GQPP	NOUADHIBOU	as of 2007
GVAC	SAL AMILCAR CABRAL	as of 2007
HLLT	TRIPOLI	as of 2014
KATL	HARTSFIELD ATLANTA	as of 2013
KBHM	BIRMINGHAM ALA	as of 2012
KBNA	NASHVILLE	as of 2013
KCHA	CHATANOOGA LOVELL	as of 2013
KEUG	EUGENE MAHLON SWEET	as of 2011
KGEG	SPOKANE	as of 2010
KHSV	HUNSTVILLE	as of 2013
KJAN	JACKSON	as of 2011
KJAX	JACKSONVILLE	as of 2011
KLIT	LITTLE ROCK	as of 2014
KMCO	ORLANDO	as of 2008
KMEM	MEMPHIS	as of 2012
KMSY	NEW ORLEANS	as of 2010
KPDX	PORTLAND	as of 2010
KSEA	SEATTLE-TACOMA	as of 2008
KSHV	SHREVEPORT	as of 2015
KSTL	ST LOUIS LAMBERT	as of 2014
KTCM	TACOMA	as of 2008
KTLH	TALLAHASSEE	as of 2010
KTPA	TAMPA	as of 2008
KTYS	KNOXVILLE	as of 2015
LDZA	ZAGREB	as of 2012
LEBL	BARCELONA	as of 2007
LEMD	MADRID BARAJAS	as of 2007
LEST	SANTIAGO	as of 2007
LEVT	VITORIA	as of 2007
LFBD	BORDEAUX MERIGNAC	as of 2007
LFBL	BELLEGARDE	as of 2007

Airport Code	Airport Name	Year
LFBM	MONT-DE-MARSAN	as of 2007
LFBO	TOULOUSE BLAGNAC	as of 2007
LFBP	PAU/PYRENEES	as of 2007
LFJL	METZ NANCY LORRAINE	as of 2007
LFLC	CLERMONT-FERRAND	as of 2007
LFLL	LYON SATOLAS	as of 2007
LFLY	LYON BRON	as of 2007
LFML	MARSEILLE/PROVENCE	as of 2007
LFMY	SALON	as of 2007
LFOE	EVREUX	as of 2007
LFOK	CHALONS VATRY	as of 2007
LFPG	PARIS CDG	as of 2007
LFPO	PARIS ORLY	as of 2007
LFPV	VILLACOUBLAY	as of 2007
LFQQ	LILLE	as of 2007
LFRB	BREST	as of 2007
LFRH	LORIENT	as of 2007
LFRS	NANTES	as of 2007
LFSB	BASLE-MULHOUSE	as of 2007
LFST	STRASBOURG ENTZHEIM	as of 2007
LHBP	BUDAPEST	as of 2014
LIMC	MILAN MALPENSA	as of 2007
LIME	BERGAMO	as of 2007
LIMF	TORINO CASELLE	as of 2007
LIML	MILAN LINATE	as of 2007
LIPE	BOLOGNA	as of 2010
LIPQ	RONCHI DEI LEGIONARI	as of 2010
LIPZ	VENICE TESSERA	as of 2010
LIRF	ROME	as of 2012
LJLJ	LJUBLJANA	as of 2011
LKPR	RUZYNE	as of 2010
LOWG	GRAZ	as of 2011
LOWL	LINZ	as of 2010
LOWS	SALSBURG	as of 2009
LOWW	VIENNA SCHWECHAT	as of 2012
LPPR	PORTO	as of 2007
LPPT	LISBON	as of 2007
LSGG	GENEVA	as of 2007
LSZH	ZURICH	as of 2007
LZIB	BRATISLAVA IVANKA	as of 2012
PAFA	FAIRBANKS	as of 2007
PANC	ANCHORAGE	as of 2007
SAEZ	BUENOS AIRES	as of 2007
SBGR	SAO PAULO	as of 2010
SCEL	SANTIAGO	as of 2007
ULLI	ST-PETERSBURG	as of 2012

Code : 0048

1 – AIR CONDITIONING AND PRESSURIZATION

A – AIR CONDITIONING WITH LP GROUND UNIT

When aircraft is supplied by external LP air, air conditioning supply from the packs should not be used simultaneously.

B – RAM AIR INLET

OPEN ONLY IF DIFFERENTIAL PRESSURE IS LOWER THAN 1 PSI.

C – MAXIMUM CABIN DIFFERENTIAL PRESSURE

- Positive differential pressure limitation . 8.40 PSI

- MAXIMUM NEGATIVE DIFFERENTIAL PRESSURE . . . . MINUS 1 PSI
- SAFETY RELIEF MAXIMUM DIFFERENTIAL PRESSURE . . . . 8.85 PSI

- Maximum cabin differential pressure for landing . . . . 1 PSI
- Cabin signs « ON » . . . . 11,300 ± 500 ft
- Passengers oxygen mask drop . $14{,}000\begin{cases}+\ \ \ 0\text{ ft}\\-500\text{ ft}\end{cases}$

D – WARNINGS

- Maximum cabin altitude (CAB ALT) . 9,550 ± 350 ft

2 – APU

A – STARTING

- In flight APU starting is allowed up to :
  - 41 000 ft within the whole flight envelope when electric supply is by engine generator(s).
  - 20 000 ft when electric supply is by batteries only.

- Minimum oil quantity indication before start . 1/4

- Minimum oil quantity indication when APU operates at 100 % N (stabilized conditions) . . . . . . MIN

- Minimum cooling intervals between start cycles . . . . 1 min

Notes : 1 – These minimum oil indication requirements allow a normal APU operation for further 60 hours.

2 – On ground :
After 3 start attempts separated by 1 min cool down a 60 min cooling period must be allowed for.

3 – In flight :
Within any one hour period
– 3 start attempts are permitted below 37,000 ft
– 5 start attempts are permitted above 37,000 ft
Best starting capability is ensured up to 37,000 ft

4 – Use of JET B may impair APU capability to perform high altitude air start.

B – OPERATIONS R

- AIR BLEED EXTRACTION :
  Allowed for AIR COND or/and WING ANTI ICE or ENG START up to . . . . 20 000 ft

Note : APU air bleed allows to supply either :
– 2 air conditioning packs or
– 1 air conditioning pack + wing anti ice system

- *ELEC POWER EXTRACTION :*
  - At or below 35 000 ft . . . . 1 (90 kVA)
  - Above 35 000 ft up to 41 000 ft :
    ISA and below . . . . 1 (90 kVA)
    ISA + 20 . . . . 0.83 (75 kVA)
    ISA + 35 . . . . 0.44 (40 kVA)

C – ROTOR SPEED

Maximum N . . . . 109 %

D – EGT

Maximum EGT . . . . 585° C

3 – COMMUNICATIONS

No limitations.

4 – ELECTRICAL

A – AC POWER

NOMINAL LOAD PER GENERATOR :
(CONTINUOUS) . . . . 1 (90 KVA)

B – DC POWER

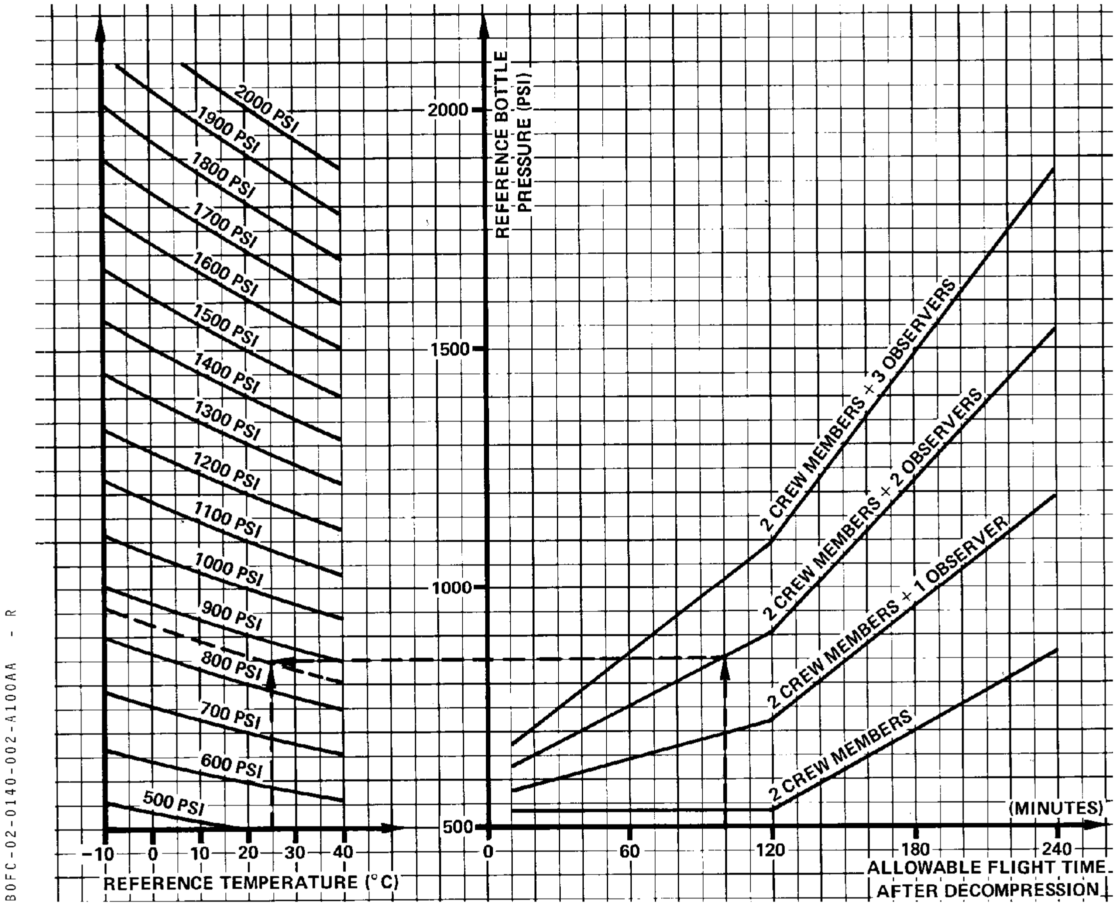
NOMINAL LOAD PER T.R. (CONTINUOUS) . 150 AMP

Code : 0411

5 – EMERGENCY EQUIPMENT

CREW OXYGEN

Minimum flight crew oxygen pressure.



Reference temperature (°C) :

$= \frac{\text{OAT + Cabin temp}}{2}$ (on ground)

= Cabin temp – 10°C (in flight)

Minimum bottle pressure required to provide :

. Crew protection after loss of cabin pressure (100 % 0_2 during emergency descent + diluted 0_2 during cruise at FL between 100 and 150)

Provision is made to cover :

. unusable quantity
. normal system leakage
. reference temp. errors
. pre-flight checks
. usage of 0_2 when only 1 pilot is in cockpit.

Mod : 2965

Minimum required oxygen for dispatch depends on the local Airworthiness Authorities.

R

6 – FUEL

A – FUEL AND FUEL ADDITIVES (ENGINES AND APU)

Refer to : – P and W Service Bulletin n 2016
– A310 Flight Manual chapter 2-04

B – USABLE FUEL TANK CAPACITY

TANK	LITER	US GAL
OUTER TKS	7 400	1 955
INNER TKS	27 900	7 371
CTR	19 640	5 189
TRIM	6 150	1 625
Total	61 090	16 140

C – FUEL QUANTITY INDICATIONS

Tank fuel remaining when the respective quantity indicator reads zero, cannot be safely used in flight.

D – FUEL LOADING

Maximum refueling pressure . . . 50 psi (3.5 bar)
Maximum defueling pressure . . 11 psi (0.75 bar)

Dispatch with fuel in CTR TK and wing tanks not full is allowed provided the sum of ZFW plus fuel in CTR TK does not exceed MAX ZFW (fuel in CTR TK usable).

R MAXIMUM ALLOWED WING FUEL IMBALANCE

R (Please refer to 2.01.40 page 4A).

E – FUEL TEMPERATURE IN TANKS

- Do not take-off with a fuel tank temperature lower than :
  - the actual fuel freezing point + 2°C if an appropriate anti-icing additive is used as per PW SB 2016.

  or
  - the highest of the fuel freezing point + 2°C or – 47°C, if an appropriate anti-icing additive is not used,
- Do not fly with a tank fuel temperature lower than the :
  - Actual fuel freezing point – 1°C when fuel is fed from INR or CTR tanks.
  - Actual fuel freezing point + 2°C when fuel is fed from OUTR tanks.

- If the actual fuel freezing point of the fuel being used for the flight is unknown, the minimum fuel specification values provided hereafter must be used :

JET A	JP 5	JET A1	JP 8	JET B	RT	JP 4	TS-1
–40°C	–46°C	– 47°C	–47°C	–50°C	–55°C	–58°C	–60°C

F – FUEL MANAGEMENT

– Operations with outer tank empty are not allowed.

G – TAKE-OFF RESTRICTIONS

1 – Take-off on center tank is prohibited.
2 – Take-off with inner tanks and center tank and trim tank empty is prohibited when the fuel quantity in each outer tank is below 700 kg (1545 lb).

H – LANDING RESTRICTIONS

– Except under abnormal conditions, landing with more than 2000 kg (4400 lb) in trim tank is not allowed.

7 – HYDRAULICS

A – APPROVED FLUIDS

Approved hydraulic fluids are according to specification NSA 307110 :

TYPE IV
HYJET IV and IV-A SKYDROL 500 B4 SKYDROL LD4

Note : The intermixing of these fluids is permitted.

B – PWR TRANSF OPERATION IN FLIGHT

PWR TRANSF operation is possible if green system is powered by 2 engine driven pumps or by 1 engine driven pump and the electric pumps.

C – SYSTEM PRESSURE

Normal pressure range : 2800 to 3300 psi

Note : When PTU is in use, 3500 psi may be reached.

R ### D – RAT

R RAT maximum operating speed : 320 kt

8 – ICE AND RAIN PROTECTION

A – ANTI-ICE

It is recommended that extended flight in icing conditions with slats extended should be avoided.

B – RAIN REPELLENT

Approved rain repellent is type 3 repellent RAIN BOE. Rain repellent must be applied only on wet windshields.

Note : Windshield wipers must not be used if rain repellent has been applied to a dry windshield.

9 – LANDING GEAR/BRAKES

A – LANDING GEAR

Towbarless operations on nose landing gear (towing and pushback) are allowed using towbarless towing vehicles that are specifically accepted for Airbus aircraft and are listed in Airbus SIL 09-002.

B – BRAKES

Maximum brake temperature allowed for take-off (with brake fans off - if installed) . . . . 300°C

10 – NAVIGATION

Operation above latitudes of 72° 30′ N and beyond 60° S is not permitted.

A – EGPWS

- Aircraft navigation is not to be predicated upon the use of the terrain display.
- The Terrain Display is intended to serve as a situation awareness tool only, and may not provide the accuracy on which to solely base terrain avoidance maneuvering.
- The EGPWS database, display and alerting algorithms currently do not account for man made obstructions.
- The EGPWS enhanced function should be inhibited (TERR MODE pushbutton switched to OFF on the Captain's switching panel) for operations from/to runways not incorporated into the EGPWS database when the aircraft position is less than 15 NM from the airfield.
- The EGPWS enhanced function should be inhibited (TERR MODE pushbutton switched to OFF on the Captain's switching panel) when QFE Procedures are used.

Mod : (5443 + 11894) or (6233 + 11894)

6 – FUEL (Cont'd)

MAXIMUM ALLOWED WING FUEL IMBALANCE

AT TAKEOFF AND IN FLIGHT

- INNER TANKS (OUTER BALANCED)

Tank fuel quantity (Heavier tank)	Maximum Asymmetry
Full 11 180 kg (24 647 lb)	2 200 kg (4 850 lb)
Half 5 590 kg (12 323 lb)	2 100 kg (4 630 lb)
2 400 kg (5 291 lb)	2 400 kg (5 291 lb)

With linear variation between these values
No limitation below 2 400 kg (5 291 lb)

- OUTER TANKS (INNER BALANCED)

R Maximum allowed imbalance in the outer tanks :
R 700 kg (1 543 lb)

AT LANDING (from TOP of Descent)

- INNER TANKS (OUTER BALANCED)

Tank fuel quantity (Heavier tank)	Maximum Asymmetry
Full 11 180 kg (24 647 lb)	1 700 kg (3 748 lb)
Half 5 590 kg (12 232 lb)	1 600 kg (3 527 lb)
1 900 kg (4 189 lb)	1 900 kg (4 189 lb)

With linear variation between these values
No limitation below 1 900 kg (4 189 lb)

- OUTER TANKS (INNER BALANCED)

R Maximum allowed imbalance in the outer tanks :
R 650 kg (1 433 lb)

11 – POWER PLANT

A. THRUST SETTING/EGT LIMITS

CONDITION	TIME (min) LIMITATION	EGT (° C) LIMITATION	NOTE
MAKE TAKE OFF AND GO AROUND	5	625	
	10	625	Only in case of engine failure
MAX CONTINUOUS	Unlimited	600	
ACCELERATION	*	625	
MAX CLIMB	Unlimited	600	
MAX CRUISE	Unlimited	600	
STARTING		535	On ground
	**	625	In flight

* Stabilized EGT must be at or below the operating limit for the applicable operating condition within 2 minutes of advancing the throttle.

** For in flight starts that result in exceedance of the ground start limit, the maximum temperature and duration must be recorded for maintenance action.

B. RPM

N1 MAX . . . . 111.4 %
N2 MAX . . . . 104 %

C. OIL TYPE

Following type II oils are fully approved for use in PW 4000 engines

ESSO TURBO OIL 2380/EXXON TURBO OIL 2380
AERO SHELL TURBO OIL 500
AERO SHELL TURBO OIL 555
CASTROL 205/STAUFFER JET II
MOBIL JET OIL II
CASTROL 5000
MOBIL JET OIL 254

Note : *Different brands or types of oils should not be mixed except where the same oil formulation is marketed under separate brand names which have been approved by Pratt and Whitney Aircraft.*

Note : *For possible use other brands of oils, refer to :*

P and W SERVICE BULLETIN N 238

D. OIL TEMPERATURE

MAX TRANSIENT (20 MINUTES) . . . . . 177° C
MAX CONTINUOUS . . . . 163° C

MIN FOR STARTING . . . . – 40° C

E. OIL PRESSURE

MIN . . . . 70 psi

NORM . . . . 90-400 psi

F. STARTER

– Duty cycle limits :

- 2 consecutive aborted start attempts may be conducted.

  Note : *Engine motoring for 30 seconds is required following an aborted start.*

- After 2 aborted start attempts, a 30 minutes starter cooling down period must be observed prior to further starter operation.

– Re-engagement speed limit : R

- Maximum re-engagement speed : 30 % N2. R

G. REVERSE THRUST

THE SELECTION OF THE THRUST REVERSERS IN FLIGHT OR THEIR PRESELECTION BEFORE TOUCHDOWN IS PROHIBITED

BACKING THE AIRCRAFT WITH USE OF REVERSE THRUST IS NOT PERMITTED

Max reverse thrust should not be used below 80 Kt IAS or IAS fluctuations, whichever occurs first.

– If reverse unlocked or reverse stowed is selected do not reselect the opposite position before light indication shows end of transit.

PW Eng. : 4152

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PW Eng. : All

1. SPEED SYMBOLS AND DEFINITIONS

– VS : Minimum stalling speed for a specified configuration. It is a function of the aircraft weight and altitude.

– VMCG : Minimum control speed on ground at which the aircraft can be controlled by use of the primary flight controls only, in case of a sudden failure of the critical engine (the other engine remaining at takeoff power).

– V1 : Speed at which the pilot can make the decision, following failure of critical engine :

- either to continue takeoff,
- or to stop the aircraft.

Represented by « 1 » on airspeed scale (or V1 value when out of range).

– VR : Speed at which rotation is initiated to reach V2 at an altitude of 35 feet.

– V2 : Takeoff safety speed reached before the altitude 35 feet with one engine failed. Represented by the SPEED SELECT symbol on airspeed scale as any speed selected on FCU.

– VMCA : Minimum control speed in flight at which aircraft can be controlled with 5° max bank, in case of failure of the critical engine, the other engine remaining at takeoff power (takeoff flaps setting and gear retracted).

– F : Equal to 1.25 VS Slats 15 /Flaps 0 . It is the minimum speed at which the flaps may be retracted to 0°.

Represented by « F » on airspeed scale, when the SLAT/FLAP handle is in the 15/15 or 20/20 configuration.

– S : Equal to 1.25 VS Slats 0 /Flaps 0 . It is the minimum speed at which the slats may be retracted to 0°.

Represented by « S » on airspeed scale, when the SLAT/FLAP handle is in the 15/0 configuration.

– O (« GREEN DOT ») : ENGINE OUT OPERATING speed (BEST LIFT TO DRAG RATIO speed or DRIFT DOWN speed) in clean configuration. It corresponds also to the FINAL TAKE OFF speed. It is equal to 220 kts at 120 t ± 1 kt per ton + 2 kt per 1000 ft above 20000 ft.

Represented by a « O » (green dot) on airspeed scale, when the SLAT/FLAP handle is in the 0/0 configuration.

Note : *O, F and S speed displayed are only valid, as manoeuvring speeds, when the SLATS/FLAPS are in the commanded position.*

– VFE : Maximum speed for each slats/flaps configuration

– VREF : Reference speed used for a normal final approach, it is equal to 1.3 VS Slats 30 /Flaps 40 configuration.

– VLS : Lowest Selectable speed. It is represented by an amber strip along the airspeed scale whichappears 5 seconds after lift-off.

In the T.O schedule VLS = 1.2 VS of the actual T.O configuration.
In the LANDING Schedule VLS = 1.3 VS of the actual landing configuration.

Change from T.O to landing schedule is triggered by SLATS/FLAPS handle displacement (either retraction or extention).

Change from landing to T.O schedule is triggered by LDG GEAR SHOCK absorber compression (A/C on ground).

Above 25000 ft VLS is calculated so that there is 0.3 g margin with respect to BUFFETING.

In case of SLATS or/and FLAPS JAMMING, VLS represents 1.3 VS of the actual (ABNORMAL) configuration.

– VSS : Stick shaker speed : The speed at which the stick shaker is activated.
It is represented by ared and black strip along the airspeed scale.

– VAPP : Final approach speed,

◆ VAPP can be computed based on VREF or VLS :

- VAPP = VREF + VREF CORRECTION + WIND CORR,
- VAPP = VLS + VLS INCREMENT + WIND CORR.

In S30/F40 configuration, VLS = VREF,

VREF corrections are considered in case of failures affecting the maneuverability or the stall margin,

VLS increments are considered whenever the failure is not accounted in the VLS computation (i.e. kruger retracted or roll spoilers inoperative).

– VA : Maximum design maneuvering speed. This R
corresponds to the maximum structural speed R
permitted for full control deflection. R

2. VAPP DETERMINATION

V_{REF}																
WEIGHT (*1000 kg)	80	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160
V_{REF} IN 30/40	111*	118	121	125	128	131	134	137	140	142	144	147	150	153	156	158

+

V_{REF} CORR.		
+ 10 Kt IF LDG IN 20/20	+	V_{REF} CORR. IN QRH 15.03 AND 15.04

+

WIND CORRECTION	
IF V_{REF} CORR. $>$ 20 Kt OR IF TAIL WIND	IF V_{REF} CORR. $\leqslant$ 20 Kt
NO WIND CORRECTION	WIND CORR. = (1/3 TOWER AVERAGE WIND) OR (GUST INCREMENT, IF HIGHER) MAX WIND CORR. = 15 Kt . IF A/THR ON OR IN CASE OF ICE ACCRETION IF WIND CORR. $<$ 5 Kt, TAKE WIND CORR. = 5 Kt V_{REF} CORR. + WIND CORR. LIMITED TO 20 Kt

=

$V_{APP} = V_{REF} + V_{REF}$ CORRECTION + WIND CORRECTION
*Minimum V_{APP} = 115 Kt

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Example :

Landing configuration	:	20/20	Flight condition	:	Autothrust
Landing weight	:	120 t	Tower average wind	:	20 kt
Failure	:	No failure	Gust	:	25 kt

VREF determinated from the landing weight : VREF = 137 kt
VREF CORRECTION due to the landing configuration : + 10 kt
VREF CORRECTION = 10 ⩽ 20

As VREF CORRECTION is less than 20 kt, a wind correction should be applied :
(1/3 of tower average wind) or (gust increment, if higher) = (1/3 of 20) or (25-20, if higher) = (7) or (5, if higher)
WIND CORR = 7 kt (< 15)

A/THR used, but WIND CORR > 5 kt, no additional correction

VREF CORRECTION + WIND CORR = 10 + 7 = 17 kt < 20, the total correction of 17 kt must be applied.

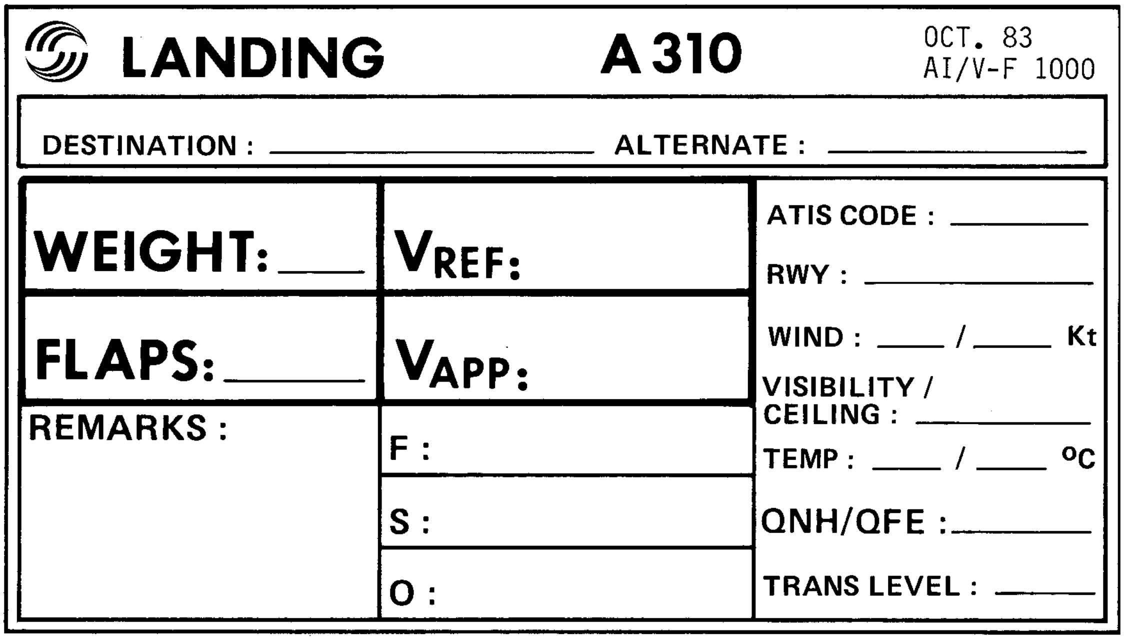
VAPP = 137 + 17 = 154 kt

Note : 1. *The tower wind is the wind speed value reported by the ATIS or tower, irrespective of its direction.*

2. *The gust increment is the difference between the maximum wind speed and the average wind speed, e.g. for a wind of 20 kt/gusting 25 kt, the average wind speed is 20 kt and the gust increment is (25-20) = 5 kt.*

3. *FMS VAPP (on APPROACH page) is defined as : VAPP = VREF + (10 kt, if landing in 20/20) + 5 kt + (CDU WIND CORR).*
The FMS VAPP is limited to 120 kt minimum.

R Code : 0449

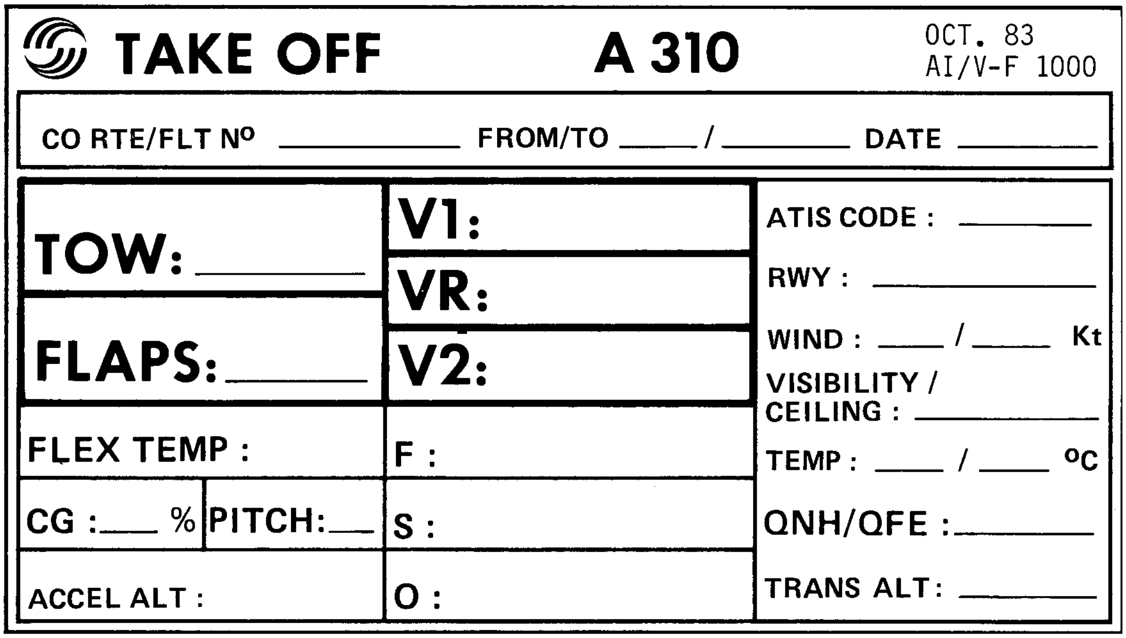


LANDING **A 310**

OCT. 83
AI/V-F 1000

DESTINATION : ______ ALTERNATE : ______

WEIGHT: ____	**V_{REF}:**	ATIS CODE : ____ RWY : ____
FLAPS: ____	**V_{APP}:**	WIND : ___ / ___ Kt VISIBILITY / CEILING : ____
REMARKS :	F :	TEMP : ___ / ___ °C
	S :	QNH/QFE : ____
	O :	TRANS LEVEL : ____



TAKE OFF **A 310**

OCT. 83
AI/V-F 1000

CO RTE/FLT Nº ______ FROM/TO ___ / ___ DATE ______

TOW: ____	**V1:**	ATIS CODE : ____ RWY : ____
	VR:	
FLAPS: ____	**V2:**	WIND : ___ / ___ Kt VISIBILITY / CEILING : ____
FLEX TEMP :	F :	TEMP : ___ / ___ °C
CG : ___ % PITCH: ___	S :	QNH/QFE : ____
ACCEL ALT :	O :	TRANS ALT : ____

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This procedure provides information for one engine taxi.

In some operational environments, such as an uphill slope, slippery taxiways or very high gross weight, it may be advisable to taxi on both engines.

Caution must be exercised when taxiing on one engine to avoid excessive jet blast.

DEPARTURE

- START ENGINE 2
- AIR BLEED X FEED . . . . MAN/IN LINE
  to supply both packs from engine 2
- Apply "AFTER START" normal procedures except :
  - R It is recommended to keep APU running to avoid additional electrical transients and to allow galley R operation. If APU is not running, all three batteries R must be operative to avoid a degraded EMER R ELEC situation in case of IDG failure of the R operating engine.
  - ENG ANTI-ICE and ECAM status check.

    Note : . APU BLEED should be switched OFF to prevent ingestion of engine exhaust gases in the air conditioning system.
    . Engine anti-ice should be OFF for non running engine.
- Apply "TAXI" normal procedures except :
  - FLIGHT CONTROLS checks
- Before engine 1 start :
  - APU BLEED . . . . ON
- START ENGINE 1

CAUTION

- If engine has been shut down for two hours or more, refer to "AFTER START" normal procedures for warm-up recommendations.
- If engine has been shut down for less than two hours, no warm-up is necessary.

- APU . . . . AS RQRD
- AIR BLEED X FEED . . . . AUTO
- Proceed with "AFTER START" checklist (engine anti-ice and ECAM status)
- FLIGHT CONTROLS checks

ARRIVAL

- After landing, start APU
- Shut down ENG 1 after operating at, or near idle for at least a 5 minute cooling period after landing.

  Note : If the taxi time to the parking gate is less than 5 minutes, the engine may be shutdown at gate arrival.

PW Eng. : 4000

A standard runway is 45 meters wide. Considering the turn radius of the aircraft, AIRBUS INDUSTRIE recommends a procedure to make that turn in the most efficient way.

Note : *Frequent tight 180 ◦ turns on the runway have an influence only in fatigue of the landing gear which is subject to high pivoting couples during these turns.*
For these calculations of fatigue, it has been assumed that three tight turns would be made at each flight.

PROCEDURE

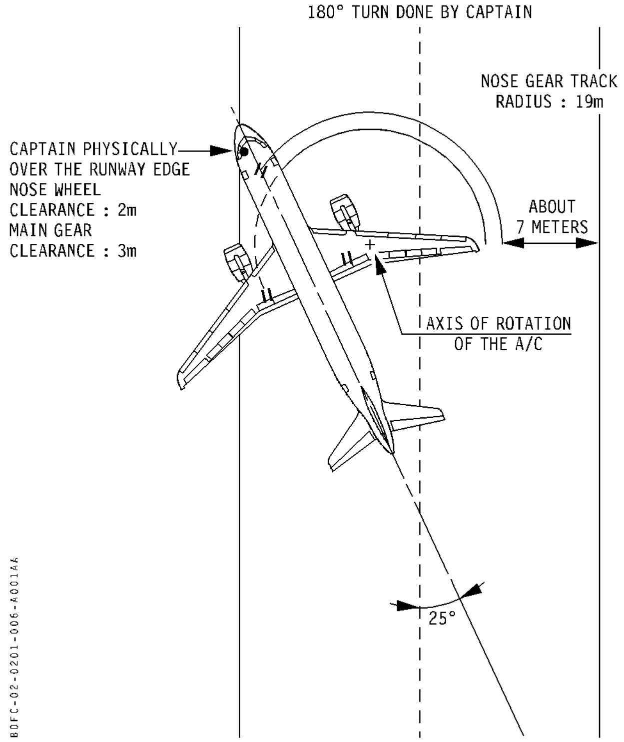
. *FOR THE CAPTAIN*

- Taxi on the right hand side of the runway up to about 150 m from the end of the runway.
- Turn left, maintaining 25 ◦ divergence with runway axis.
- When the captain is physically over the runway edge, he applies full deflection as quick as possible on the nose wheel and set about 50 % to 55 % N1 for GE engines or 1.05 EPR for PW engines.
  The nose wheel will stay about 2 m from the runway edge and the main gear 3 m from the runway edge. The aircraft will turn around his axis of rotation, with a nose gear track radius of 19 m, leaving a 7 m clearance to the other edge of a 45 m wide runway.

. *FOR THE COPILOT*

The procedure is symmetrical.
The copilot taxies on the left hand side of the runway, turns right (25 ◦ with regard of axis) and begins the 180 ◦ turn when he is physically over the runway edge.

Note : *To avoid the skidding of the nose wheel on a wet runway it is recommended to perform the turn at very low speed, using asymmetrical thrust and differential braking as necessary.*



REJECTED TAKEOFF

DECISION TO REJECT THE TAKEOFF

General

The decision to reject the takeoff and the stop action shall be made by the captain.

It is therefore recommended that the captain keeps his hand on the thrust levers until V1 is reached whether he (she) is PF or PNF.

As soon as he (she) decides to abort, he (she) calls « stop », takes over and performs the stop actions.

R It is not possible to list all the factors which could lead to the decision to reject the takeoff, but in order to help in the decision process, the ECAM inhibits the warnings/cautions which are not paramount from 70 kt to 400 ft (or 1 minute after lift-off, whichever occurs first).

Decision management

Below 100 kt

The decision to reject the takeoff may be taken at the discretion of the captain, according to the circumstances.

R Discontinuing the takeoff should be serioulsy considered if any ECAM warning/caution is activated.

Note : *The speed of 100 kt is not critical and was chosen in order to help the captain make his decision and avoid unnecessary stops from high speed.*

Above 100 kt and below V1

Rejecting the takeoff is a more serious matter, particularly on slippery runways and could lead to a hazardous situation when speed is close to V1.

The decision to reject the takeoff should only be taken for a very few causes the main ones being :

- Fire warning or severe damage
- Sudden loss of engine thrust
- Conditions of malfunctions where there are unambiguous indications the aircraft will not fly safely.
- R ECAM warnings/cautions (which are not inhibited above 70 kt) :
  - · Engine or APU fire,
  - · Engine failure,
  - · T.O. configuration warning,
  - · Engine reverse unlock.

Note 1 : *Nose gear vibration should not lead to an RTO above 100 kt.*

Note 2 : *Case of a tyre failure in the V1 minus 20 to V1 range :*

Unless debris from the tyres has caused serious engine anomalies, it is far better to get airborne, reduce the fuel load and land with a full runway length available.

Note 3 : *The call V1 has precedence over any other call.*

Above V1

Takeoff must be continued as it might be impossible to stop the aircraft on the remaining runway length.

No action shall be taken (apart from audio warning cancel) until :

- The appropriate flight path is stabilized,
- The normal procedures are applied,
- At least 400 ft AGL, in case of failure during takeoff, approach or go-around.
  - · A height of 400 ft is recommended as a good compromise between :
    - * the time required for flight path stabilization,
    - * the initiation of the procedure without excessive delay.
  - · In some emergency conditions, provided the appropriate flight path is established, the PF may initiate actions before reaching 400 ft AGL.

TAKEOFF DECISION SPEED V1

Experience has evidenced that rejected takeoffs were sometimes hazardous even though the performance was correctly calculated, based on flight tests.

This may be due to the following factors :

- Delay in intiating stopping procedure is increased,
- Tyres are damaged,
- Brakes worn or not working correctly, initial temperature higher than normal,
- Brakes not fully applied,
- Runway friction coefficient is lower,
- Error in gross weight determination,
- Runway line up not considered.

Since above 100 kt, rejecting the takeoff becomes a serious action which may lead to a hazardous situation in particular as speed approaches V1, be "Go-minded" if none of the main failures quoted above has occurred.

TASKS SHARING DURING A REJECTED TAKEOFF

Captain	F/O
CALL ”STOP” simultaneously THRUST LEVERS IDLE A/THR DISCONNECT REVERSE THRUST MAX AVAIL	BRAKE RESPONSE MONITOR REVERSE CONFIRM ANY AUDIO CANCEL
Aircraft stopped Consider positioning the aircraft so that any possible fire is kept away from the fuselage.	
– After aircraft has stopped PARKING BRAKE APPLY – PA call ”CABIN CREW AT STATIONS”	ATC INFORM ON GROUND EMER/EVACUATION LOCATE check list (or ON GROUND ENG FIRE)
– Call for ECAM actions	ECAM ACTIONS ACHIEVE
The aircraft should remain stationary while the crew evaluates the situation.	
Evacuation phase If required refer to ”on ground emergency evacuation check-list” for evacuation	inform tower of intention and assistance required.

Note 1 : *No attempt should be made to clear the runway until it is absolutely certain that an evacuation is not necessary and that it is safe to do so.*

Note 2 : *In the event of an unserviceable autobrake, the captain will simultaneously reduce the thrust and fully depress both pedals.*

Minimum stopping distance can only be achieved if the brake pedals are kept fully depressed until the aircraft comes to a stop.

ATS A/THR function is disengaged (ATS levers remain armed) by pressing A/THR DISCONNECT p.b. or as soon as throttles are at idle position 5°.

Note : *Cycle TRP from FLEX (or TOGA) to either CL, MCT or CR to reset the A/THR declutch. This will recover A/THR for a second takeoff.*

REVERSERS The aircraft may be stopped using full reverse. If sufficient runway length is still available at the end of the deceleration it is preferable to reduce reverse thrust – passing 80 kt – (Refer to STANDARD OPERATING PROCEDURES chapter – LANDING).

FLAPS/SLATS RETRACTION

BOTH ENGINES OPERATIVE

During the climb out at V2 + 10 Kt, a normal bank of 30° can be applied (stick shaker would be reached with a 40° bank angle in level flight in the most limiting case of V2 = 1.2 Vs).

The change to 15°/0° configuration can be done at « F » speed minimum for all takeoff configurations.

The change to clean configuration can be done at « S » speed minimum. During the acceleration phase from V2 + 10 to « green dot » speed a normal bank of 30° can be applied.

ONE ENGINE INOPERATIVE

With one engine out during climb out at V2 a normal bank of 15° can be applied (in the case of V2 = 1.2 Vs, stick shaker would be reached with 30° of bank in level flight).

The change to 15°/0° configuration can be done at « F » speed and change to clean configuration can be done at « S » speed.

During the acceleration phase from V2 to « green dot » speed a normal bank of 15° can be applied.

If 15°/15° configuration is maintained, to apply a bank of 30° requires to accelerate (at least) to « F » speed (stick shaker would be reached with a 45° bank in level flight).

If 15°/0° configuration is maintained, to apply a bank of 30° requires to accelerate (at least) to « S » speed (at this speed stick shaker would be reached with a 55° bank in level flight).

In clean configuration, the recommended speed one engine out is « green dot » (engine out operating speed) since it corresponds to the final takeoff speed or best lift to drag ratio. It allows a normal bank of 30° (stick shaker would be reached with a 55° bank in level flight).

APPROACH AND LANDING

The standard approach is the decelerated approach which can be performed in manual flying as well as with the autopilot engaged using an ILS guidance.

The advantages of such a procedure are :

- autothrottle excursions minimized,
- a better compatibility with ATC constraints (keep high speed as long as possible),
- fuel and time saving,
- decrease of aircraft noise during the approach.

The minimum speed (VLS) displayed on the speed scale of the PFD being 1.3 VS of the actual configuration allows a normal bank of 30° (stick shaker would be reached with a 40° bank in level flight).

BOUNCING AT LANDING

In case of a light bounce (5 ft or less), maintain pitch attitude and complete the landing. Use power as required to soften the touchdown. Do not increase pitch attitude, as this could lead to a tailstrike.

In case of a high bounce (more than 5 ft) maintain pitch attitude and configuration, and initiate a go-around by advancing throttle levers while triggering the go-levers. This will soften the second touchdown that will most probably occur and prevent damage to the aircraft.

Retract flaps one step and landing gear only when safely established in the go-around and no risk of further touchdown exists.

A landing should not be attempted after a high bounce, as the remaining runway length might not be enough to stop the aircraft.

REJECTED LANDING

A rejected landing is defined as a go-around manoeuvre initiated below the minima.

Once the decision is made to reject the landing, the flight crew must be committed to proceed with the go-around manoeuvre and not be tempted to retard the thrust levers in a late decision to complete the landing.

If the aircraft is on the runway when thrust is applied, a TO CONFIG warning will be generated if flaps are in conf full and/or trim is out of takeoff range.

In any case, if reverse thrust has been selected, a full stop landing must be completed.

ENGINE PARAMETERS MONITORING

In addition to thrust setting adjustments made by the PNF during take off and landing phases a special attention must be exercised by the PNF to the monitoring of engine parameters (N1/EPR, N2, EGT) in particular during the take off and go around phases.

Variation of reverse thrust versus speed at sea level, ISA conditions.

NOSE WHEEL STEERING INOPERATIVE

Request for a tow truck should be made preferably to taxi with differential braking, if no experience with such a specific technique. The request of the tow truck should be made early in approach, to minimize the runway occupation time.

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1. GENERAL

- The following material provides operational recommendations and procedures for aircraft operation from/to airports with elevation above 8500 ft pressure altitude.
- The FLIGHT MANUAL, Section 2, LIMITATIONS, should be refered to, so as to confirm the certified T/O and LANDING environmental envelope applicable to the operator's aircraft model.

2. PRESSURIZATION AND PASSENGER OXYGEN

OPERATION ABOVE 8000 ft

The aircraft pressurization system will regulate the CAB ALT to the selected landing elevation, or theoretical cabin altitude whichever is higher.
At take-off the take-off CAB ALT is memorized and maintained until either, the theoretical cabin altitude is above the take-off cabin altitude, or the aircraft V/S is less than 750 ft/min for more than 1 min. Until this time any change of landing elevation selection will have no effect on the CAB ALT.
The following procedure is recommended if take-off is performed from an airport above 8000 ft.

- Before take-off, select departure field elevation as per Standard Operating Procedures.
- At Top of climb, select destination field elevation.
- During descent preparation, or in case of turn back, select destination field elevation before commencing descent.

  Note : *This procedure may be used when taking-off from airports at lower elevation and not cruising at max cruise altitude, in order to regulate at the theoretical cabin altitude and improve passenger comfort.*

OPERATION ABOVE 9 200 FT

The "EXCESS CAB ALT" warning is activated when cabin altitude is above 9 550 ft ± 350 ft, in this case :

- Check CAB ALT is not above departure/landing field elevation,
- Disregard ECAM message,
- Cancel aural warning by pressing AUDIO CANCEL pushbutton on center pedestal.

OPERATIONS ABOVE 13 500 ft

Passenger oxygen masks will drop automatically when cabin altitude exceeds 14 000 ft (+ 0, – 500 ft).

To avoid automatic release of oxygen masks when landing/taking-off to/from an airport above 13 500 ft, the circuit breaker "PASSENGER OXYGEN CTL AND WARN" must be pulled during descent before cabin altitude reaches 13 500 ft and must remain pulled until CAB ALT is less than 13 000 ft after take off.

Note : *The passenger oxygen manual control remains operative when the MAN OVRD push-button is pressed.*

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AVIONICS VENTILATION ON GROUND WITH AIR CONDITIONING PACKS SHUT DOWN

On ground with air conditioning packs shut down, ambient air of the avionics compartment is used for equipment ventilation. Consequently the permitted operating time may be limited as a function of :

- OAT,
- Avionics compartment door open or closed,
- GND COOL installed and operating or not.

Refer to respective EQUIPMENT OPERATING TIME graphs.

The graphs show the time that the avionics equipment may remain powered, following aircraft arrival, once the air conditioning is OFF.
For an aircraft that has been parked with all equipment switched OFF, after powering the aircraft, the avionics equipment may be left powered for the times shown on the graph provided the OAT is above -15°C. The avionics compartment door should be closed with OAT below O°C. If the OAT is below -15°C, it is recommended to pre-heat the avionics bay to maintain at least - 15°C, prior to powering any equipment.

Note : *With OAT + 15° C or higher, without GND COOL unit, the avionics compartment door should be opened to improve equipment cooling.*

PRE CONDITIONING WITH LP EXTERNAL SUPPLY

External LP bleed air supply. . . . . .CONNECT

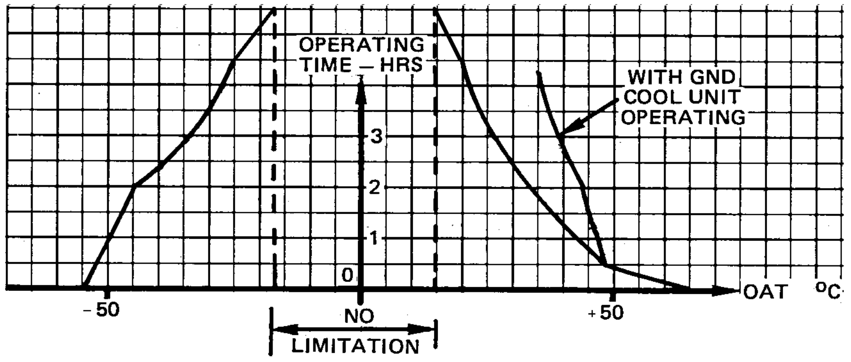
CAUTION

When aircraft is supplied by external LP air, air conditioning supply from the packs should not be used simultaneously.

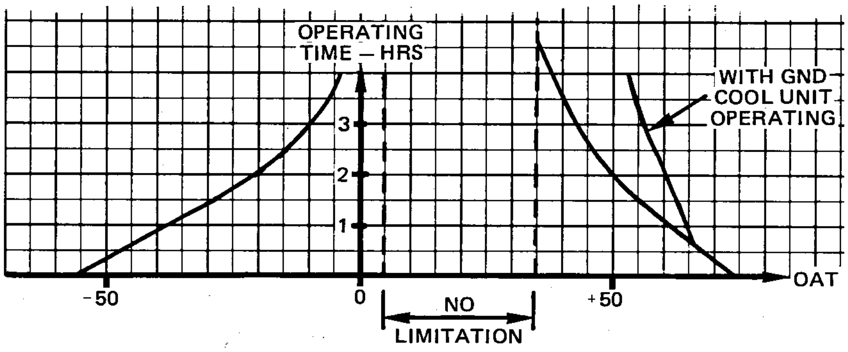
Note : *1. It is recommended not to use external HP air for conditioning due to possible refrigeration pack contamination.*
2. With external LP air supply it is not possible to control cabin temperature from the cockpit.
3. For hot day conditions, in order to quickly cool R
down the cabin temperature, the aircraft can R
be pre-conditioned via the LP external supply R
with the cabin fans OFF, provided there are no R
passengers into the cabin. Switch back cabin R
fans ON for boarding. R

EQUIPMENT OPERATING TIME
(ON GROUND, WITHOUT AIR CONDITIONING)

AVIONICS COMPARTMENT DOOR CLOSED



AVIONICS COMPARTMENT DOOR OPEN



ECON FLOW CONTROL

- When selected on, the pack valves are controlled to provide 68 % of normal flow. (active only in flight).
- ECON FLOW may be selected ON, if required, for flight with less than 160 pax.
- ECON FLOW must be selected OFF when in flight air conditioning is supplied by APU.

MAX COOL CONTROL

- MAX COOL should be selected OFF for normal air conditioning operations.
- When selected ON, the pack discharge temperature limit is decreased from + 4°C to - 7°C, to provide additional cooling.
- With MAX COOL on, in High humidity conditions adjust temperature to a comfortable level rather than selecting a low temperature in order to cool the cockpit quickly. This will avoid water condensation on overhead circuit breakers panel by water vapour coming out from air conditioning outlets.

OPTIMUM USE OF THE AIR CONDITIONING SYSTEM IN HOT AND HUMID ENVIRONMENT

1. GENERAL

The following provides operational recommendations and procedures for aircraft ground operations in hot and humid environment.

The optimum use of the air conditioning system PACK TEMP and COMPT TEMP controls during transits, particularly when operating in hot and humid environment, is essential in order to prevent :

- APU auto-shutdown,
- water condensation in the cockpit (and cabin).

2. OPERATING PROCEDURES

A. APU auto-shutdown :

APU auto-shutdown on ground usually results from high temperature and/or high air conditioning demand.

The following operational recommendations minimize the total demand on the APU and minimize the potential for an APU auto-shutdown during transit or during engine start.

- Reduce electrical loads to the required minimum,
- Reduce air conditioning demand by using the COMPT TEMP control in :
  - AUTO mode with a limited cooling demand or
  - MAN mode for all compartments.
- At high OAT (above 40°C) and high relative humidity (typically above 80 %), the use of a LP ground pneumatic power unit is recommended.

Note : The installation of operator's-developed door curtains is an effective means for managing the cabin temperature during transits, while limiting the packs and APU demand.

B. Water condensation in the cockpit (and cabin) :

The following operational recommendations minimize water condensation in the cockpit (and cabin) under extreme hot and humid conditions :

- Control COMPT TEMP in AUTO mode, with MAX COOL OFF and a limited cooling demand (typically not lower than the 11 o'clock position).

or,

- Control the air conditioning packs in PACK TEMP MAN CTL mode, and
- Increase the pack discharge temperature up to, typically, + 15°C.

  Note : Increasing the pack discharge temperature limits the cooling capability.

Note : The PACK TEMP MODE SEL pushbutton switch is returned to AUTO at the end of the transit stop.

1. GENERAL

A. PRELIMINARY NOTE

In this section, the following is described :

- USE OF AFS described without taking into account the possible coupling to the FMS.
  Coupling of the AFS to the FMS, will be described in USE OF FMS section
- USE OF FPV.
- USE OF DFA AND WGD if these systems are installed.

B. INTRODUCTION

The A310 is equipped with a high performance digital Automatic Flight System (AFS). The use of this system is highly recommended to the crew because it :

– reduces crew work load
– maintains a high level of safety
– increases the precision in guidance and tracking of the airplane in all weather conditions down to landing.

The AFS can be used from TAKEOFF, through all phases of flight and down to landing, including roll out.

C. AUTOPILOT/FLIGHT DIRECTOR (AP/FD)

The AP/FD shall normally be used throughout the whole flight either with both FD's* engaged (Manual control of the A/C through the FD BARS on PFD's) or with an AP engaged in CMD** (automatic control of the A/C).

* An AP can also be engaged in CWS (semi-automatic control of the PITCH ATTITUDE and BANK ANGLE).

** Two AP's can be engaged in CMD with LAND or GO AROUND mode.

The FMA (Flight Mode Annunciator) is the normal reference for the actual state of the AP/FD. A FMA is integrated in the upper part of each PFD (PRIMARY FLIGHT DISPLAY).

MAIN RULES OF USE

1 – NO PUSHBUTTON EXISTS TO ENGAGE OR DISENGAGE THE FD's.
Their engagement is automatic as soon as electrical power is supplied to the computers (FCC's).

2 – HOWEVER ONE FD CAN BE DISENGAGED BY SETTING THE CORRESPONDING « FD/FPV » SWITCH TO OFF or FPV, if no AP is engaged in CMD. (The corresponding FD BARS are out of view).

If an AP is in CMD the FD BARS are out of view when the switch is in OFF or FPV position, but the FD remains engaged.

3 – If no AP is engaged in CMD, FMA and FD BARS ON PFD 1 are associated with FD1, FMA and FD BARS on PFD2 are associated with FD2.

If an AP is engaged in CMD BOTH FMA's ARE ASSOCIATED WITH THIS AP, but the FD BARS ON THE PFD's REMAIN ASSOCIATED WITH THE CORRESPONDING FD.

4 – A mode is engaged by pressing the corresponding pushbutton on FCU or by pressing either GO-LEVER (for TAKEOFF or GO AROUND mode only).

5 – A mode is disengaged by pressing a second time the corresponding pushbutton or by pressing another pushbutton (of an incompatible mode).

6 – Each AP is engaged in CMD (in flight) or in CWS (on ground) by means of an AP lever on FCU.
In flight, switching from CMD to CWS or CWS to CMD is made by pressing the CWS/CMD pushbutton.

7 – It is possible to switch over from one AP to the other. The first AP disconnects when the second is engaged (except in LAND or GO AROUND mode where both AP's can be engaged in CMD).

<u>Note :</u> *In P.ALT mode, AP changeover or engagement* R
of one AP while the other is OFF should be R
avoided as it may lead to altitude overshoot. R
However, AP changeover or engagement of R
one AP while the other is OFF can be done out R
of PROFILE mode. Then PROFILE mode can
be re-engaged after the AP has engaged.

8 – Each AP can be disconnected by setting the corresponding AP lever to OFF. Both AP's are disconnected by pressing either AP instinctive disconnect p/b on the control wheels or when a force above a threshold is applied on the stick in pitch.

9 – In case of failure, overriding the action of the AP, by exceeding a pre-set force on the flight controls, is possible when AP is in CMD or CWS.
But working against the AP, is definitely not a normal procedure and should be avoided.

Code : 0262

10 – CWS, PARTICULAR USE AT TAKE OFF AND GO AROUND
The function of an AP engaged in CWS is to maintain the A/C attitudes (PITCH and ROLL) when the pilot releases the control wheel, ***provided no force is applied*** on the control wheel.

When an attitude is set by the pilot, the force applied on the control wheel is automatically cancelled by the AUTOTRIM, but in certain dynamic phases (rotation at TAKE OFF or GO AROUND) this force cancellation is not immediate.

Consequently one of the following two procedures must be applied to avoid a non desired increase in PITCH

- either holding the control wheel until there is no longer opposite force on it.
- or using ELECTRIC PITCH TRIM to obtain a faster force cancellation.

Note : Refer to FCOM 1-03-60 for full description of AP/FD.

TASK SHARING

1 – With only the FD's (and with or without an AP in CWS), the pilot flying shall call for the modes to be selected by the non flying pilot.

2 – With an AP in CMD, the pilot flying will select the references and engage the modes necessary to achieve the desired task.

3 – The use of either of the two AP's or FD's is possible from either crew seat ; however it is recommended to use the AP or FD associated to the side of the pilot flying because the reference parameters for guidance, altitude, heading course, are directly related to the respective AP or FD.

D. AUTOTHROTTLE SYSTEM (ATS)

The ATS shall normally be used throughout the whole flight in conjunction with the AP/FD.

The FMA (Flight Mode Annunciator) is the normal reference for the actual state of the ATS.

MAIN RULES OF USE

1 – ATS is armed by setting the ATS lever (on overhead panel) to on.

2 – Full automatic control of the ATS by the AP/FD is assured when A/THR function is engaged (by pressing A/THR p.b. on FCU or, at TAKE OFF or GO AROUND, by pressing either GO LEVER).

3 – If no AP and no FD is available, engaging A/THR function also engages SPD/MACH mode in the ATS. In this case SPD/MACH is the only mode available with A/THR function.

4 – Action on either GO LEVER engages THR L (THRUST LATCH mode) at each time this action does not cause THR (THRUST mode) engagement by the AP/FD.

(This is the case for example in APPROACH if SLATS are not extended. In this case GO-AROUND mode does not engage in AP/FD and so THR mode cannot be engaged).

5 – A/THR function (and the corresponding active mode) is disengaged by a second action on A/THR p.b. or by pressing either ATS instinctive disconnect, p.b.

THR L is disengaged by pressing either ATS instinctive disconnect, p.b.

6 – ATS is disarmed by setting ATS lever to OFF.

CAUTION

With a throttle lever stuck, whenever the ATS R
commands a thrust change, the free throttle lever R
can move to an unexpected position leading to R
a thrust asymmetry and a possible flight path R
deviation. Therefore : R
R
– When a thrust reduction is commanded, the ATS R
will command the free throttle lever to retard, R
until the idle position (in the worst case), R
R
– When a thrust increase is commanded, the ATS R
will command the free throttle lever to advance R
until the new target position is reached. R

2 – PREPARATION BEFORE TAKE OFF

A. DURING COCKPIT PREPARATION

FPV/FD switches. . . . . .ON/FD

PITCH TRIM. . . . . .ARM

YAW DAMPER/ATS LEVERS (if required) . . . . . . ARM

B. BEFORE PUSHBACK OR START

SPD/MACH setting knob. . . . . . .TURN TO SELECT V2

SPD/MACH setting knob. . . . . . . .PUSH TO ACTIVATE PRESET

SPD/MACH setting knob. . . . . . .TURN TO PRESELECT INITIAL CLIMB SPEED

TRP. . . . . .SELECT TO or FLEX TO

C. DURING TAXIING

ALT knob. . . . . .SELECT FIRST CLEARED ALTITUDE

HDG SEL knob. . . . . . . .SELECT INITIAL DEPARTURE HEADING

3 – TAKE OFF, CLIMB, CRUISE

A Typical vertical profile which includes the majority of in flight cases from TAKE OFF to CRUISE is presented.

The lateral modes are described later.

This profile is based upon the use of :

– the autothrottle and both FD's at take off.
– the engagement of one AP in CMD after take off (gear up and stabilized flight path).

But this profile is equally valid for the use of the FD only in manually controlled flight (with or without the use of an AP in CWS).

RECOMMENDATION : For any altitude change (after TAKE OFF) use LVL/CH mode, except for small altitude changes (less than 2000 ft) where use of V/S mode is more advisable.

A. WHEN READY FOR TAKE OFF

GO-LEVERS. . . . . .PRESS

- At the same time :
  The FD's engage in SRS mode.
  A/THR function is engaged (A/THR p.b. illuminates on FCU).
  THRUST mode is engaged in ATS (green THR on both FMA's).
- The FD PITCH BAR on each ADI will move up to indicate A/C acceleration.
- The FD ROLL BAR, remains centered on each ADI.
  HDG mode becomes active only at 30 ft (A/C heading at 30 ft will be maintained).

Note : *If a localizer signal is received, (RWY FREQUENCY and HDG selected), depressing GO-LEVERS will engage RWY mode and the YAW BAR will indicate the commands to be executed to maintain the localizer center line (ROLL BAR disappears when YAW BAR appears).*

At 30 ft RWY mode disengages and HDG re-engages, YAW BAR disappears and ROLL BAR appears (A/C heading at 30 FT will be maintained).

If the take off is performed using the localizer backbeam (or for aircraft heading more than 40° different from ILS selected course) RWY mode is not engaged.

- As soon as the throttles are at the desired thrust or at 100 KT maximum the A/THR is declutched (blue THR on FMA's).
- At VR, initiate the rotation with a positive control column input to achieve a continuous rotation rate of about 3°/sec, towards a pitch attitude of 15° (12.5° if one engine is failed). R R
- After lift off, follow the SRS pitch command bar.

B. INITIAL CLIMB

When the landing gear is selected up :
A/THR is reclutched, THR mode reengages.

Note : *A/THR will be reclutched 5 sec at minimum after lift off when LANDING GEAR is selected up or when another mode than TO or FLEX TO is selected on TRP.*
THR or SPD mode cannot be engaged before one of these 2 conditions is satisfied.

– AP lever 1 (or 2). . . . . .SET TO ON

Notes : *1. If AP is already engaged in CWS, press CWS/CMD pushbutton to switch to CMD.*

2. AP will take into account the engaged modes.

– In case of ENGINE FAILURE :
  - If the AP is engaged in CMD, it will compensate the engine failure.
    The AP will maintain V2 or the existing speed if greater than V2.
  - If the AP is not yet engaged in CMD it is preferable to first stabilize the A/C on its climb trajectory before engaging the AP in CMD.

– When initial turn is desired :
  HDG SEL knob. . . . .PULL TO SELECT HDG/S MODE

C. AT ACCELERATION ALTITUDE

– With two engines :

LVL/CH p.b.. . . . . .PRESS
TRP. .SELECT CL (or CR)

The AP will acquire and maintain the PRESET speed. The ATS will acquire and maintain the thrust as
selected on the TRP.

– With one engine out :

- At acceleration altitude :

  ALT HLD p.b. . . . . .PRESS
  ATS will acquire and maintain the PRESET speed.

- At « GREEN DOT » speed

  LVL/CH p.b. . . . . .PRESS
  SPD/MACH setting knob. . .SELECT «GREEN DOT»
  TRP. . . . . .SELECT MCT

D. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

ALT * mode automatically engages (green ALT * on both FMA's).

ATS automatically engages in SPD mode (green SPD on both FMA's) and will maintain the selected SPD (here 250 KT).

When reaching the selected level (here FL50), AP automatically engages in ALT mode (green ALT on both FMA's).

Note : *SPD/MACH mode will not engage if A/THR is still declutched (Gear not retracted and TO or FLEX TO still selected on TRP).*

E. CLIMB FROM FL50 TO FL60 AT 250 KT (typical path)

In this case a 1000 ft/min. climb is sufficient. Use V/S mode.

ALT SEL knob. . . . . .TURN TO SELECT 6000 FT

V/S knob. . . . . .PULL TO SELECT V/S MODE

ATS remains in SPD mode.

V/S display window synchronizes on A/C actual V/S (here 0 ft/min.).

V/S knob. . . . . .SELECT + 10

The AP will acquire and maintain this V/S.

As in §3.D when ALT * illuminates.

F. CLIMB FROM FL60 TO FL100 AT 250 KT (typical path)

ALT SEL knob. . . . . .TURN TO SELECT 10000 FT

ALT SEL knob. . . . . .PULL TO SELECT LVL/CH MODE

The ATS automatically engages in THRUST mode and will acquire and maintain the thrust as selected on the TRP.

The AP maintains 250 KT.

Note : *LVL/CH mode can also be engaged by pressing LVL/CH p.b.*

As in 3.D when ALT * illuminates.

G. RECLEARED TO FL310. COMMENCING CLIMB WHILE INCREASING SPEED TO 300 KT (typical path)

ALT SEL knob. . . . . .TURN TO SELECT 31000 FT

ALT SEL knob. . . . . . .PULL TO SELECT LVL/CH MODE

SPD/MACH setting knob. . . .TURN TO SELECT 300 KT

The ATS automatically engages in THRUST mode.

The AP will acquire and maintain 300 KT.

H. PRESET OF MACH 0.79 (to be done only when cleared for a high level, above FL300 – here FL310) R

SPD/MACH setting knob. . . . . PUSH TO ACTIVATE PRESET

SPD/MACH selecting knob. . . . . . . PRESS TO SELECT MACH DISPLAY

SPD/MACH setting knob. . . . . . TURN TO SELECT 0.79

CAUTION

Be sure that PRESET is activated before PRESELECTING the MACH

At the transition IAS/MACH (FL300 for the typical path), MACH mode engages in ATS. Preselected MACH becomes the active MACH.

Note : *Switching from SPD to MACH can also be done by pressing SPD/ MACH selecting knob when desired MACH is reached.*

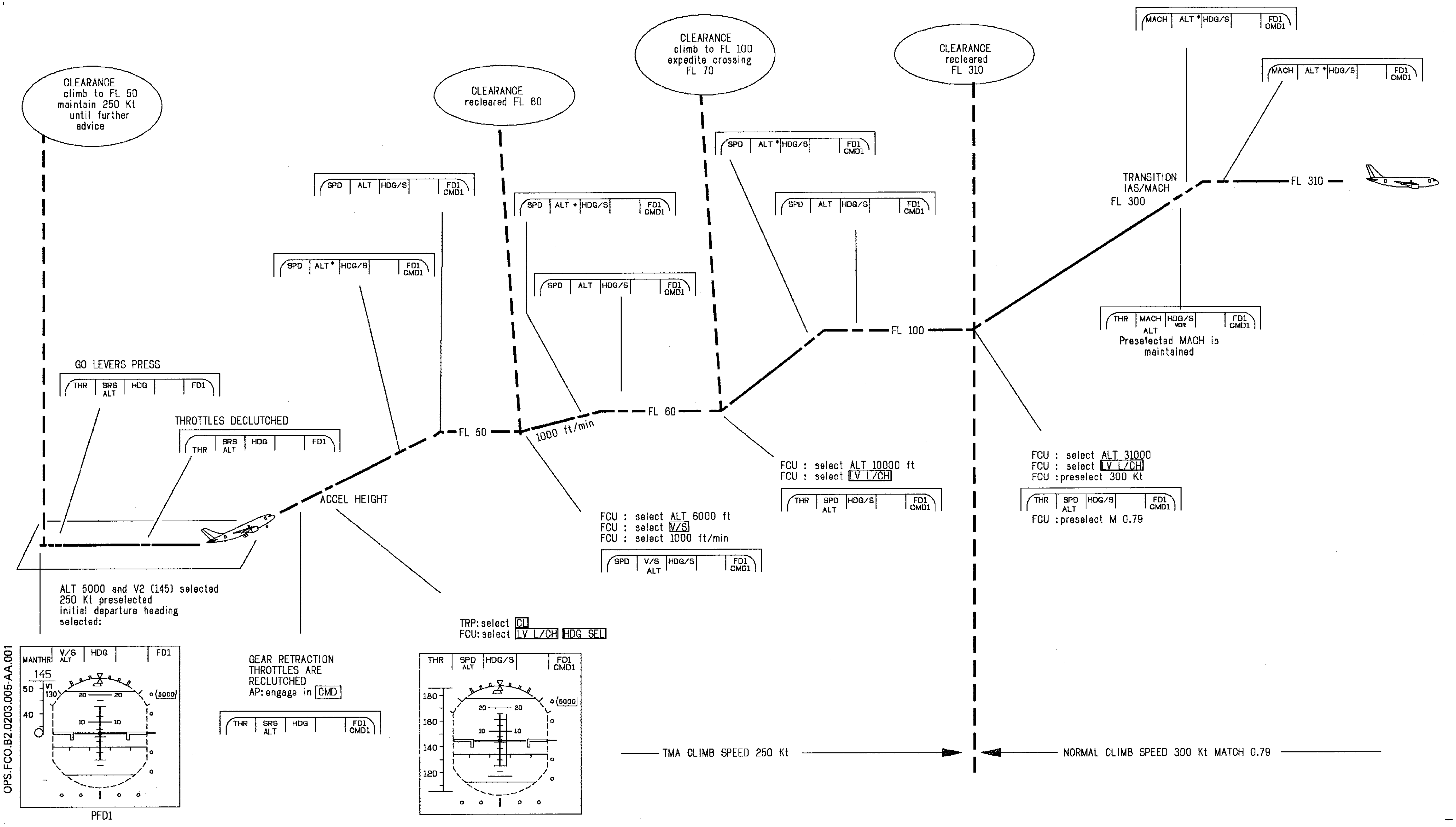
As in 3.D when ALT * illuminates. Except that MACH mode engages in ATS instead of SPD mode.

I. CRUISE

The AP maintains FL310 and the ATS maintains MACH 0.79

TRP. . . . . SELECT CR

TAKE - OFF, CLIMB, CRUISE



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4 – LATERAL MODES

The following modes are available with both FD's only (with or without an AP in CWS) or with both FD's and an AP in CMD. Described procedures assume that at least both FD's are engaged which is the case in normal operation.

A. HDG mode

There is no specific HDG pushbutton.
HDG mode is engaged when another lateral mode is disengaged by pressing a second time the corresponding p.b.

B. HDG SEL mode

HDG SEL knob. . . . . .TURN TO SELECT THE HDG

Max bank angle selector . . . . Set as required

. NORM (25°) if close to OPT ALT
. 15 (15°) if close to MAX ALT

SELECT HDG SEL MODE :

. HDG SEL knob . . . . PULL
or
. HDG SEL pb . . . . PRESS

HEADING ACQUISITION LOGIC :

- Before HDG SEL engagement :
whatever the difference is between A/C HDG and selected HDG, the A/C will acquire the selected HDG in such a way that the minimum turn will be done.
- When HDG SEL mode is engaged :
When the HDG is modified, whatever the new selected value is, the A/C will turn towards the left if the HDG SEL knob has been rotated towards the left (and towards the right if the HDG SEL knob has been rotated towards the right), to acquire the new HDG.

C. VOR mode

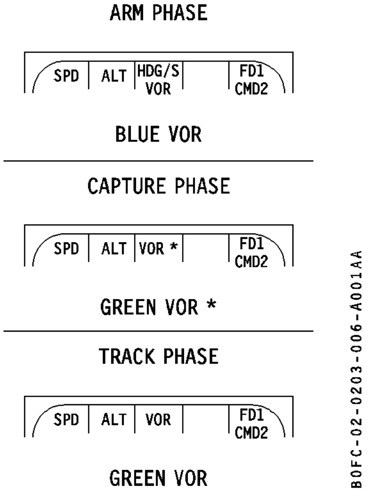
The convergence of the A/C towards the selected VOR radial must be manually selected.

VOR/NAV/ILS switch. . . . . .SELECT VOR

VOR CONTROL PANEL. . . . . . .SELECT VOR frequency and VOR CRS

V/L p.b. . . . . .PRESS TO SELECT VOR MODE

- Intercept at an angle lower than 90°. If the distance to the station is smaller than 30 NM, use smaller (30° or less) intercept angle.
- To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.
- When passing over the station, selected VOR course can be changed by as much as 30° on the VOR control panel.
- With slats extended, VOR mode is not recommended, if the distance to the station is less than 30 NM.
- The VOR mode comprises 3 phases :



D. LOC mode

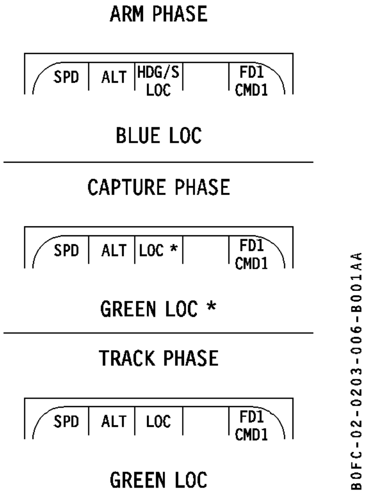
The convergence of the A/C towards the LOC beam must be manually selected.

VOR/NAV/ILS switch. . . . . .SELECT ILS

ILS CONTROL PANEL. . . . . .SELECT ILS frequency and RWY CRS

V/L p.b. . . . . .PRESS TO SELECT LOC MODE

- Intercept at an angle lower than 115°.
- It is recommended to use this mode to track a localizer when no glide slope is available or when the glide is of poor quality. In this case the proper descent will be established with the V/S mode.
- SUPERVISORY OVERRIDE is possible during CAPTURE phase when AP is in CMD. R
- To capture the LOC beam, bank angle is limited to 30°.
- The LOC mode comprises 3 phases :



5 – DESCENT – HOLDING

A typical descent flight path which includes most of the in-flight cases is presented with the same objective as for the climb.

This profile is based upon the use of :
– an AP engaged in CMD with ALT HLD mode.
– the ATS, since we are at a high level, engaged in MACH mode.
But this profile is equally valid for the use of the FD only in manually controlled flight (with or without the use of an AP in CWS).

RECOMMENDATION :

For any altitude change use LVL/CH mode. The only exception is for small altitude changes (less than 2000ft) or when a given vertical speed is requested by ATC. In this case use V/S mode.

A. DESCENT FROM FL350 AT MACH 0.79 (typical path)

The descent is initiated at a constant Mach number (the same as in cruise).

ALT SEL knob . . . . SELECT THE CLEARED FL (FL200 in typical path)
ALT SEL knob . . . . . PULL TO SELECT LVL/CH MODE

Note : *LVL/CH mode can also be engaged by pressing LVL/CH p.b.*

The AP maintains M 0.79

Since the selected level is lower than the present one, ATS automatically engages in RETARD MODE (green RTAR on both PFD's). The throttles are automatically reduced towards the idle position.

THROTTLES . . . . FULLY IDLE

When throttles are stopped automatically at idle position, RETARD is disengaged and ATS is only armed (blue A/THR on PFD's).

APPROACH BRIEFING. Decision height . . . . . SELECT

Note : *In case of engine failure, the throttle linked to the inoperative engine must be reduced to idle before HP valve shut off.*
Then this throttle must be aligned with the other one. Otherwise the already reduced throttle will come to the mechanical stop at throttle retraction when RETARD MODE engages and both throttles will be declutched.

B. PRESET OF 300 KT SPEED

SPD/MACH setting knob . . . . PUSH TO ACTIVATE PRESET

SPD/MACH selecting knob . . . . . . PRESS TO SELECT SPEED DISPLAY
SPD/MACH setting knob . . . . TURN TO SELECT 300 KT

CAUTION
Be sure that PRESET is activated before PRESELECTING the SPEED

At the MACH/IAS transition (FL300 for typical path), SPD mode engages in ATS. Preselected SPEED becomes the active SPEED.

C. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

ALT * mode automatically engages (green ALT * on both FMA's).

The ATS automatically engages in SPD mode (green SPD on both FMA's) and will maintain the selected SPD (here 300 KT).

When reaching the selected level (here FL200), ALT HLD mode automatically engages (green ALT on both FMA's).

D. DESCENT FROM FL200 TO FL100 AT 300 KT AND 2500 FT/MIN

ALT SEL knob . . . . SELECT 10000

V/S knob . . . . PULL TO SELECT V/S MODE

ATS remains in SPD mode

V/S display window synchronizes on A/C actual V/S (here 0 ft/min.).

V/S knob . . . . SELECT – 25

The AP will acquire and maintain this V/S

Use speed brakes if necessary to maintain the desired speed.

As in §5.C when ALT* illuminates.

E. DESCENT FROM FL100 TO 4000 FT AND SPEED REDUCTION T0 250 KT

ALT SEL knob . . . . SELECT 4000

ALT SEL knob . . . . . PULL TO SELECT LVL/CH MODE

SPD/MACH setting knob . . . TURN TO SELECT 250 KT

The ATS automatically engages in RETARD mode (then is only armed – blue A/THR)

The AP will acquire and maintain 250 KT

As in 5.C when ALT * illuminates.

F. DESCENT FROM 4000 ft TO 3000 ft

In this case a 1000 ft/min. descent is sufficient. This can be achieved by using V/S mode.

ALT SEL knob. .SELECT 3000

V/S knob. . . . . .PULL TO SELECT V/S MODE

ATS remains in SPD mode

V/S display window synchronizes on A/C actual V/S (here 0 ft/min.).

V/S knob. . . . . .SELECT – 10

The AP will acquire and maintain this V/S

As in 5.C when ALT * illuminates.

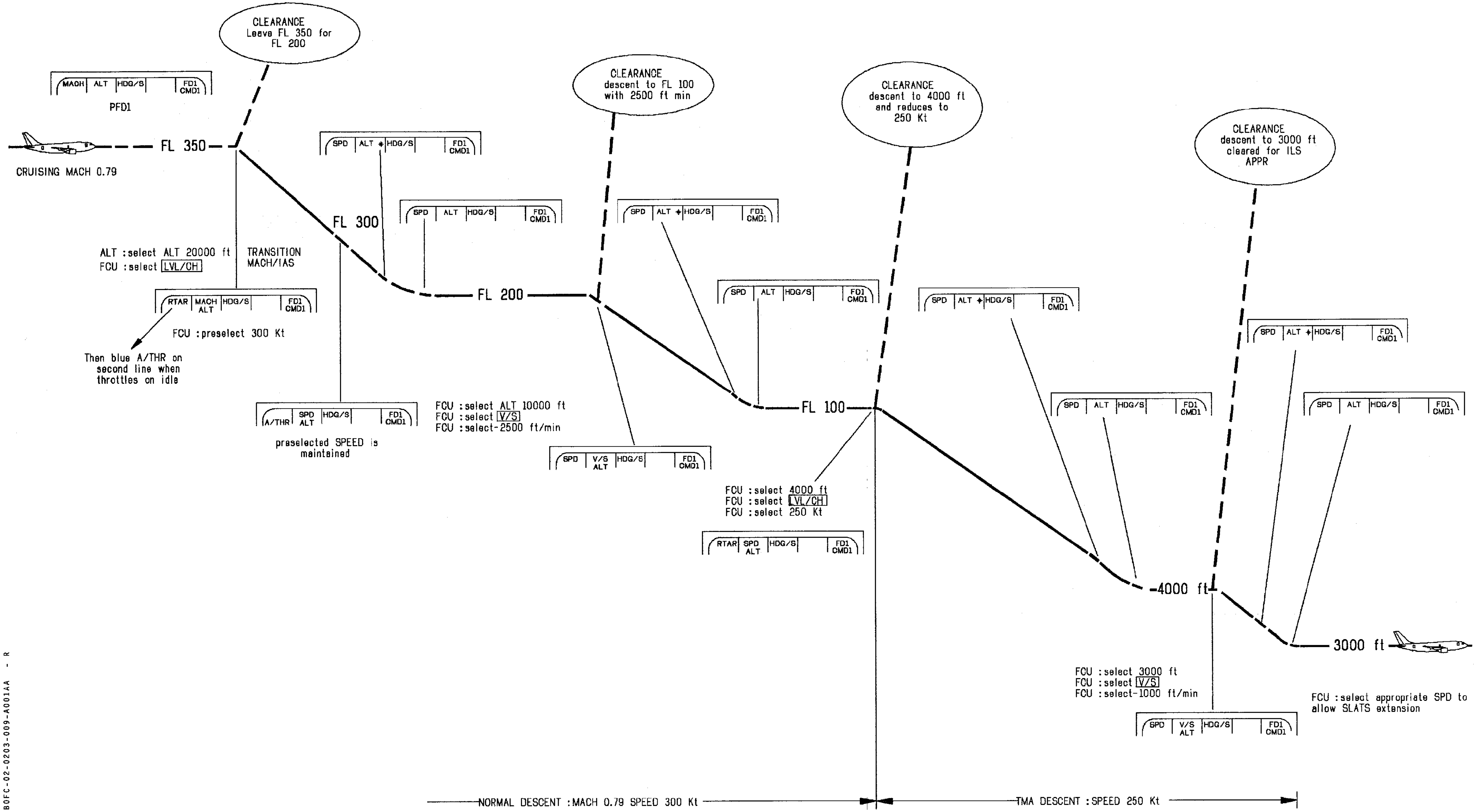
R The USE of AP and FD in LVL/CH mode is not permitted
R in FINAL APPROACH.

G. HOLDING AT 3000 ft AND SPEED REDUCTION TO ALLOW SLATS EXTENSION

SPD/MACH setting knob. . . . . .SELECT THE APPROPRIATE SPEED

The ATS will acquire and maintain this speed.

DESCENT



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6 – APPROACH AND LANDING

A. GENERAL

An approach and/or automatic landing in low visibility conditions is possible providing the aircraft is equipped with :

- a qualified flight crew,
- an AFS with relevant capability,
- a suitably equipped runway.

The most penalizing of the three following parameters defines the capability :

flight crew – aircraft system – runway facilities

and this capability defines the applicable weather minima.

The weather conditions in which approaches and/or automatic landings may be made are classified by category according to :

- decision height (DH)
- runway visual range (RVR)

Decision height : is the height of the landing gear wheels above the ground at which the pilot must initiate a missed approach if the required visual references, to continue the approach to land, are not established.

Runway visual range : is the horizontal visibility measured along runway.

CAT I : Operations down to a decision height of not less than 200 ft and runway visual range not less than 2400 ft (RVR = 1800 ft if touchdown zone and runway center line are provided with a lighting system).

CAT II : Operations down to minima of less than DH 200 ft/RVR 2400 ft to as low as DH 100 ft/RVR 1200 ft.

CAT III :

- US definition :
  CAT IIIA – A precision instrument approach and landing with no decision height, or a decision height below 100 feet, and controlling runway visual range not less than 700 ft (200 meters).
  CAT IIIB – A precision instrument approach and landing with no decision height, or a decision height below 50 ft, and controlling runway visual range less than 700 ft (200 meters), but not less than 150 ft (50 meters).
- JAR CAT III definition : Operations with a decision height between 100 ft and 0 ft or with no decision height and with a RVR which assures a high probability of successful approaches.
  RVR should be in the region of 200 to 150 m if neither an automatic ground roll control nor a ground roll guidance display system is used.
  RVR should be in the region of 100 m if one of the above mentionned system is fitted on the A/C.

Note : *The autopilot installed on the Airbus is « fail operational » capable of performing automatic approaches, landings and roll out's in category I, II, III weather conditions.*

Following procedures do not constitute approval to conduct CAT II or CAT III operations. Such authorization and associated minima must be obtained by the operator from appropriate operational authorities.

B. MINIMUM EQUIPMENT REQUIRED (BY AIRWORTHINESS AUTHORITIES) TO BE OPERATIONAL TO MEET CAT 2 or CAT 3 APPROACH AND LANDING CRITERIA

CAPABILITY → EQUIPMENT ↓	CAT 2	CAT 3
AP/FD	1 AP IN CMD (with LAND mode engaged)	2 AP in CMD + 1 FD (with LAND mode engaged)
AP DISCONNECT P.B.	2	2
AUTOTHROTTLE	— *	IN SPEED MODE
AFS FLIGHT MODE ANNUNCIATOR (FMA)	1	2
ILS RECEIVER	2	2
BEAM EXCESSIVE DEVIATION WARNING	2	2
HORIZON	N°1 + N°2 + STANDBY	N°1 + N°2 + STANDBY
EFIS CRT's	3	4
RADIO ALTIMETER	1 (But two displays)	2
AUTO CALL OUT RADIO ALTIMETER	0	1**
DH INDICATION	1 ***	1***
FWC	1	2
« AP OFF » warning	1	2
« AUTOLAND » light	1	2
« ATS » warning	0	1
WINDSHIELD WIPERS OR RAIN REPELLENT (if activated)	1 ****	1 ****
WINDOW HEAT	1	1
ANTI-SKID SYSTEM	0	1 *****

* ATS is mandatory in CAT 3 only but is recommended even in CAT 1 or CAT 2.
** AUTO CALL OUT Radio altimeter setting must be in accordance with approved airline procedures.
*** One unit required for the CM2.
**** One unit required for CM1.
***** One unit required in CAT 3 with no DH.

Note : *Compliance with CAT 2 (respectively CAT 3) approach and landing criteria has been demonstrated with CAT 2 and CAT 3 (respectively CAT 3) performance quality ILS beams only.*

C. EQUIPMENTS REQUIRED TO BE OPERATIONAL FOR LAND MODE ENGAGEMENT

(In addition of AP or FD engagement conditions)

CAPABILITY * → EQUIPMENTS ↓	CAT 1	CAT 2	CAT 3
AP/FD	1FD ** or 1AP in CMD	1AP IN CMD	2AP IN CMD AND 1 FD
AUTOTHROTTLE	—	—	ENGAGED IN SPEED MODE
ILS receiver	N° 1 if FD 1 N° 2 if FD 2	N° 1 and N° 2	N° 1 and N° 2
PFD (PRIMARY FLIGHT DISPLAY)	N° 1 if FD 1 N° 2 if FD 2	N° 1 and N° 2	N° 1 and N° 2
IRS (INERTIAL REFERENCE SYSTEM)	*** N° 1 and one of the two others if FD1. N° 2 and one of the two others if FD2.	*** N° 1 and one of the two others if AP1. N° 2 and one of the two others if AP2	N° 1 and N° 2 and N° 3
RADIO ALTIMETER	N° 1 if FD 1 N° 2 if FD 2	N° 1 if AP1 N° 2 if AP2	N° 1 and N° 2
HYDRAULIC SYSTEMS	—	G and B (or G and Y) if AP1. Y if AP2	G and B and Y
ELECTRIC POWER	GEN1 or GEN2 or APU GEN	GEN1 or GEN2 or APU GEN	Two among GEN1, GEN2 and APU GEN
YAW DAMPER	—	N° 1 or N° 2	N° 1 and N° 2
PITCH TRIM	—	N° 1 or N° 2	N° 1 and N° 2
Flight Warning Computer	—	N° 1 if AP1 N° 2 if AP2	N° 1 and N° 2

* Capability is indicated on FMA's (Flight Mode Annunciator)

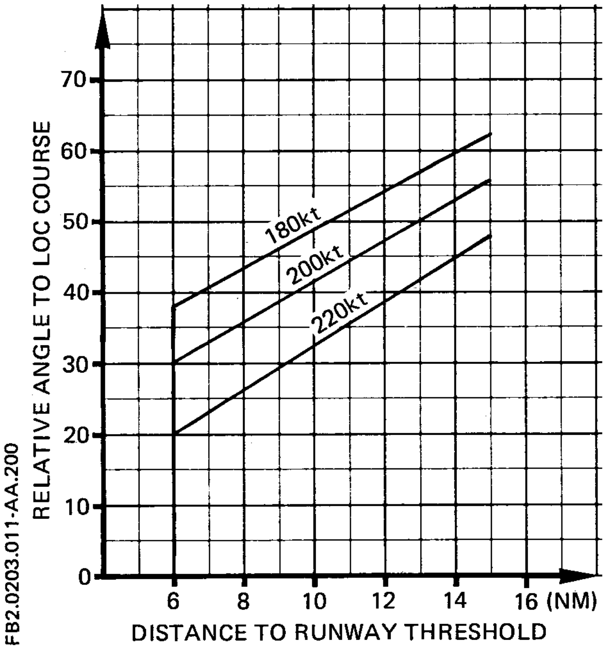
** Engagement of an AP in CWS together with the FD is possible. This does not change the capability.

*** If 2 IRS are in ATT mode the AP/FD may desengage in case of cross wind during approach.

Mod. : 4941 + 5757

D. APPROACH AND LANDING PERFORMANCE ENVELOPE

– LOC beam capture : the following graph gives the angle of interception of the beam function of speed and distance to the threshold.
The LOC beam capture starts only at 2 dots deviation. It is performed with a first overshoot and a minor second one. Within the following envelope, the first overshoot is limited to 1.3 dot.



– GLIDE beam capture :
GLIDE interception between 1000 ft and 5000 ft.
Vertical speed should be between + 500 ft and - 1250 ft.
Maximum speed should be 200 kt IAS.

E. ILS APPROACH (DECELERATED APPROACH ALONG THE GLIDE SLOPE)

OBJECTIVE : Landing configuration (FLAPS 40°/VAPP) established at a height depending on the airline policy (Minimum 500 ft above ground level). This height is further named : **STABILIZATION HEIGHT**

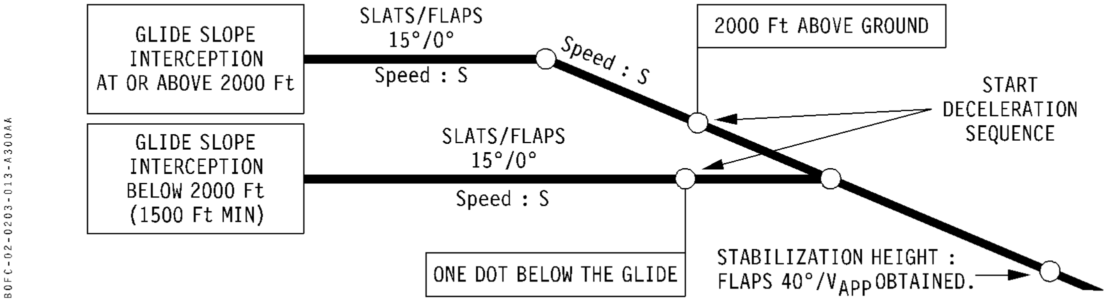
ADVANTAGES :
- a better compatibility with ATC constraints (keep high speed as long as possible).
- Fuel and time savings (100 kg and 2 minutes in average).
- Decrease of A/C noise in approach.

APPLICABILITY :
- In CAT 1 or better and CAT 2 or CAT 3 weather conditions.
- For any glide slope angle.
- with one FD, two FD's, one AP in CMD or two AP's in CMD engaged with LAND mode.

Note : One FD at least is required to obain CAT 1 capability. One AP in CMD at least is required to obtain CAT 2 capability. Two AP's in CMD are required to obtain CAT 3 capability.

	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 AND CAT 3 WEATHER CONDITIONS
APPR PREPARATION	ATS . . . . CHECK A/THR FUNCTION ACTIVE* * Recommended in any case. Mandatory for a CAT 3 APPROACH. ILS CONTROL PANEL . . . . SELECT ILS FREQUENCY and RWY HDG VOR/NAV/ILS selector . . . . SELECT ILS DECISION HEIGHT . . . . CHECK** ** For CAT 3 with no decision height, select - 5 ft. « SLATS 15°/S speed » configuration should be obtained at G/S INTERCEPTION and, in any case, before starting FINAL DECELERATION SEQUENCE.	
APPR	– PF (Pilot Flying) controls the flight path through the FD (or AP if engaged), the SPEED through the ATS (or manually if necessary) asks PNF for FLAPS SETTING, GEAR EXTENSION and selects speeds on FCU. – PNF (Pilot Non Flying) monitors A/C position and flight parameters. He announces mode changes on FMA.	– CM1 is Pilot Flying (PF) He controls the flight path through the AP, and the SPEED through the ATS (or manually, if necessary). He asks CM2 for FLAPS SETTING, GEAR EXTENSION and selects speeds on FCU. – CM2 is Pilot Non Flying (PNF) He monitors A/C position and parameters. He announces mode changes on FMA.
BASE LEG CLEAR TO INTERCEPT	HDG SEL knob . . . . SELECT INTERCEPT HDG LAND p.b. . . . . SELECT LAND MODE IF MAP MODE used for ND's . . . . SELECT RANGE 15 on both sides	– AUTOLAND lights . . . . TEST* * This also tests the LOC and GLIDE EXCESSIVE DEVIATION WARNINGS on the PFDs.
	● CHECK LOC and GS illuminate blue on both FMA's. ● CHECK desired CAPABILITY is obtained (Violet CAT 1, CAT 2 or CAT 3 on both FMA's). ● LAND mode must be selected before interception of the LOC beam, but not too early to avoid false LOC capture. The AP/FD will start LOC capture at about 2 dot from LOC axis (when within the linear range of the beam). *Note : 1) It is always possible to get out of LAND mode by pressing a second time LAND p.b., except if LAND mode is in LAND TRACK phase (green LAND on PFD's). In this case the only way to get out of LAND mode is to press the GO-LEVERS (this engages GO-AROUND mode).* R *2) In LAND MODE, dot not start APU when both autopilot are engaged.*	

Mod. : 4941 + 5757

	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 AND CAT 3 WEATHER CONDITIONS
LOC*	HDG SEL knob . . . . SELECT RWY HDG	
FINAL DECEL SEQUENCE	DECELERATION from « SLATS 15°/S SPEED » to « FLAPS 40°/V_{APP} » : FLAPS 20° . . . . SELECT V_{APP}/GO AROUND ALTITUDE . . . . SELECT If ATS not used, THROTTLES immmediately . . . . FULL IDLE As soon as FLAPS are 20°, LDG GEAR/GRND.SPLRS . . . . DOWN/ARM As soon as GEAR DOWN, FLAPS 40° . . . . SELECT When approaching target speed, if ATS not used, THRUST . . . . ADJUST  *Note : 1. Deceleration sequence is initiated at 2000 FT AGL if G/S INTERCEPTION is AT or ABOVE 2000 FT and at 1 DOT BELOW the GLIDE if INTERCEPTION is BELOW 2000 FT (MIN 1500 FT).* *2. FLAPS 40°/V_{APP} will normally be obtained 1000 FT below DECELERATION SEQUENCE initiation, and must be obtained at the latest by 1000 FT AGL in IMC (500 ft in VMC).*	
FLAPS 40° SELECTED	FINAL CHECK LIST . . . . .PERFORM PNF reads the CHECKLIST : LANDING ALL LANDING GEAR . . . . DOWN ALL ANTI SKID . . . . CHECK ALL SLATS/FLAPS . . . . SET ALL SPOILERS . . . . ARMED	CM2 reads the CHECKLIST : LANDING ALL LANDING GEAR . . . . DOWN ALL ANTI SKID . . . . CHECK ALL SLATS/FLAPS . . . . SET ALL SPOILERS . . . . ARMED ALL AUTOLAND . . . . TESTED
1000 FT AGL	PNF announces « ONE THOUSAND »	CM2 announces « ONE THOUSAND » CM1 puts his hand on the THROTTLE levers, controls or monitors the SPEED (as appropriate) and looks for external visual references

R Code : 0220

<table>
<tr><th></th><th>CAT 1 OR BETTER WEATHER CONDITIONS</th><th>CAT 2 WEATHER CONDITIONS</th><th>CAT 3 WEATHER CONDITIONS WITH DECISION HEIGHT</th></tr>
<tr><td>700 FT QFE</td><td colspan="3">Each pilot checks the selected CRS on his ND
CM2 announces « COURSE SET »</td></tr>
<tr><td>500 FT QFE</td><td>PF announces « LAND GREEN » at 400 FT above ground (altimeter).
PNF monitors AUTO CALL OUT (or announces « HUNDRED ABOVE » at DH + 100 FT altimeter).</td><td colspan="2">CM2 announces « LAND GREEN » at 400 FT above ground (altimeter).
CM2 monitors AUTO CALL OUT (or announces « HUNDRED ABOVE » at DH + 100 FT altimeter).
<i>Note : AUTO CALL OUT R/A is mandatory for a CAT 3 with two men crew.</i></td></tr>
<tr><td rowspan="6">DH</td><td>● PNF monitors AUTO CALL OUT (or announces « MINIMUM »).</td><td>● CM2 monitors AUTO CALL OUT (or announces « MINIMUM »).</td><td>● CM2 monitors AUTO CALL OUT</td></tr>
<tr><td colspan="3">EXTERNAL VISUAL REFERENCES SUFFICIENT</td></tr>
<tr><td>● PNF announces « VISUAL »
● PF confirms the acquisition of visual references and announces « LANDING » (this means that he controls or monitors both FLIGHT PATH and THROTTLES)</td><td colspan="2">● CM1 announces « LANDING » , and performs the landing (he monitors FLIGHT PATH and controls or monitors THROTTLES).
<i>Note : ATS IN SPEED MODE is mandatory for a CAT 3.</i></td></tr>
<tr><td>● PNF monitors AUTO CALL OUT or announces 200 FT, 100 FT, 50 FT, 30 FT «RETARD», 10 FT.</td><td>● CM2 monitors AUTO CALL OUT or announces 100 FT (if below DH), 50 FT, 30 FT « RETARD », 10 FT.</td><td>● CM2 monitors AUTO CALL OUT</td></tr>
<tr><td>● At 30 FT, when PNF announces « RETARD », PF monitors or controls throttle reduction and maintains throttles on idle position until end of ROLL OUT phase</td><td colspan="2">● At 30 FT, when CM2 announces « RETARD », CM1 monitors or controls (as appropriate) throttle reduction and maintains throttles on idle position until end of ROLL OUT phase.</td></tr>
<tr><td colspan="3">EXTERNAL VISUAL REFERENCES INSUFFICIENT
Execute a GO AROUND</td></tr>
<tr><td rowspan="4">TOUCH DOWN</td><td colspan="3">CM2 announces « ROLL OUT »</td></tr>
<tr><td>● PF monitors the ROLL OUT mode (through the AP) or disconnects the AP and manually controls the A/C during the roll out phase.
<i>Note : When landing on snow covered or icy runway, disconnect the AP at nosewheel touchdown.</i>
PF controls THROTTLE position.</td><td colspan="2">● CM1 monitors the ROLL OUT mode (through the AP) or disconnects the AP and manually controls the A/C during the roll out phase.
<i>Note : When landing on snow covered or icy runway, disconnect the AP at nosewheel touchdown.</i>
CM1 controls THROTTLE position.</td></tr>
<tr><td>● PNF monitors engine parameters and announces speeds.</td><td colspan="2">● CM2 monitors engine parameters and announces speeds.</td></tr>
<tr><td colspan="3">If ROLL OUT mode is engaged, disconnect both AP/FD before exiting the runway.</td></tr>
</table>

Note : A call out (indicating that a flight parameter is exceeded) must be done by the PNF if :

- *During GLIDE beam capture.*
  - *pitch attitude becomes lower than O° or greater than 10° nose up.*
  - *vertical speed exceeds + 500 ft/min or – 1250 ft/min.*
- *During the final approach.*
  - *speed becomes lower than VAPP – 5 KTS or greater than VAPP + 10 KTS.*
  - *pitch attitude becomes lower than O° or greater than 10° nose up.*
  - *bank angle becomes greater than 7°.*
  - *descent rate becomes greater than 1000 ft/min.*
  - *excessive LOC or GLIDE deviation occurs :*
R *1/4 dot LOC excess dev*
R *1 dot GS excess dev*
  - *any significant changes in ground speed that might indicate windshear.*

Anyway, if the pilot has any doubt on autopilot guidance, the autopilot should be disconnected using the instinctive disconnect pushbutton or an automatic go around must be initiated during the approach.

Mod. : 4941

	CAT 3 WEATHER CONDITIONS WITH NO DECISION HEIGHT
700 FT QFE	● Each pilot checks the selected CRS on his ND CM2 announces « COURSE SET »
500 FT QFE	● CM2 announces « LAND GREEN » at 400 FT above ground (altimeter). ● CM2 monitors AUTO CALL OUT (or announces « HUNDRED ABOVE » at 100 FT radio altimeter). ● At 30 FT, CM2 announces « RETARD », CM1 monitors or controls (as appropriate) throttle reduction and maintains throttles on idle position until end of ROLL OUT phase. *Note : AUTO CALL OUT R/A is mandatory for a CAT 3 with two men crew.*
TOUCH DOWN	● CM1 announces « LANDING » and monitors lateral guidance. CM1 controls THROTTLE position. *Note : When landing on snow covered or icy runway, disconnect the AP at nosewheel touchdown.* ● CM2 announces « ROLL OUT » ● CM2 monitors engine parameters and announces speeds. If ROLL OUT mode is engaged, disconnect both AP/FD before exiting the runway.

Note : A call out (indicating that a flight parameter is exceeded) must be done by the PNF if :

- *During GLIDE beam capture.*
  - *pitch attitude becomes lower than 0° or greater than 10° nose up.*
  - *vertical speed exceeds + 500 ft/min or – 1250 ft/min.*
- *During the final approach.*
  - *speed becomes lower than VAPP – 5 KTS or greater than VAPP + 10 KTS.*
  - *pitch attitude becomes lower than 0° or greater than 10° nose up.*
  - *bank angle becomes greater than 7°.*
  - *descent rate becomes greater than 1000 ft/min.*
  - *excessive LOC or GLIDE deviation occurs.*
  - R *any significant changes in ground speed that might indicate windshear.*

R *Anyway, if the pilot has any doubt on autopilot guidance, the autopilot should be disconnected using the instinctive disconnect pushbutton or an automatic go around must be initiated during the approach.*

E.1 PROCEDURE FOR LOC BACK-COURSE APPROACH

- tune frequency and set front-course on ILS control panel.
- check approx. approach slope (300 ft/mile is 3°).
- select ND to ROSE or ARC, and VOR/NAV/ILS switch to ILS
- refer to localiser deviation indicated by ND to intercept and maintain localiser back-beam.

CAUTION

R Disregard localiser deviation on PFD, this is
R reversed.
R Disregard glide slope indications.

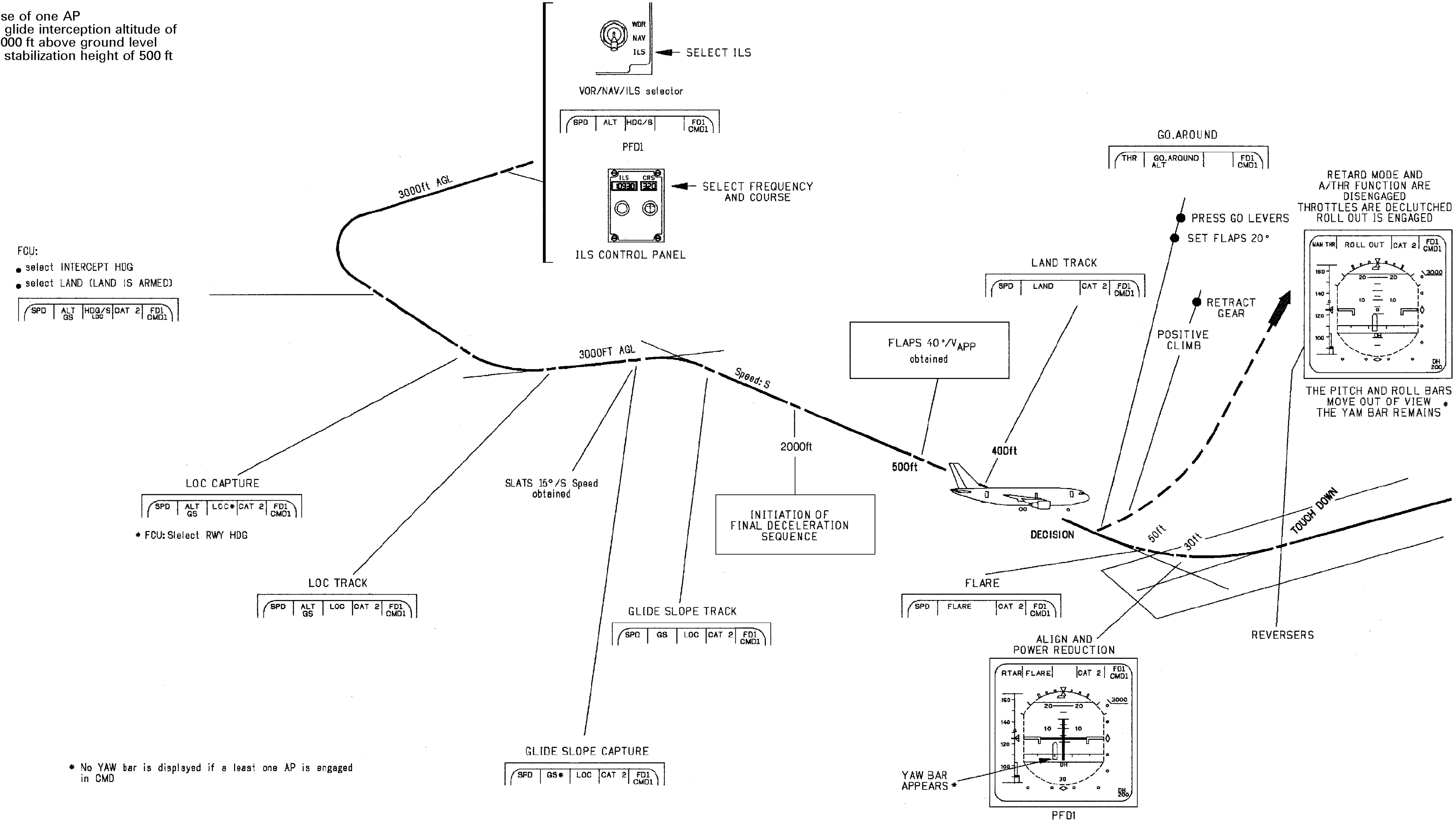
- Leave final approach fix stabilised in landing configuration
R at Vapp
- Do not use FD in LAND or V/L mode ; it is recommended to select FPV to assist in maintaining the required glide slope. The « FLIGHT PATH TARGET » is not usable since it is referenced to the front-course.

Note : *If desired the approach may be flown with AP in CMD using H/SEL to maintain the localizer back-course and V/S to maintain the FPV at the required angle (normally – 3°) on the pitch scale. In this case the AP should be disengaged by 200 ft (see AFS limitations). Another technique is to use AP in CWS in conjunction with FPV. In either case it is advantageous to have auto-throttle engaged.*

STANDARD ILS APPROACH

described here with :

- use of one AP
- a glide interception altitude of 3000 ft above ground level
- a stabilization height of 500 ft



R

* No YAW bar is displayed if a least one AP is engaged in CMD

Mod. : 5757

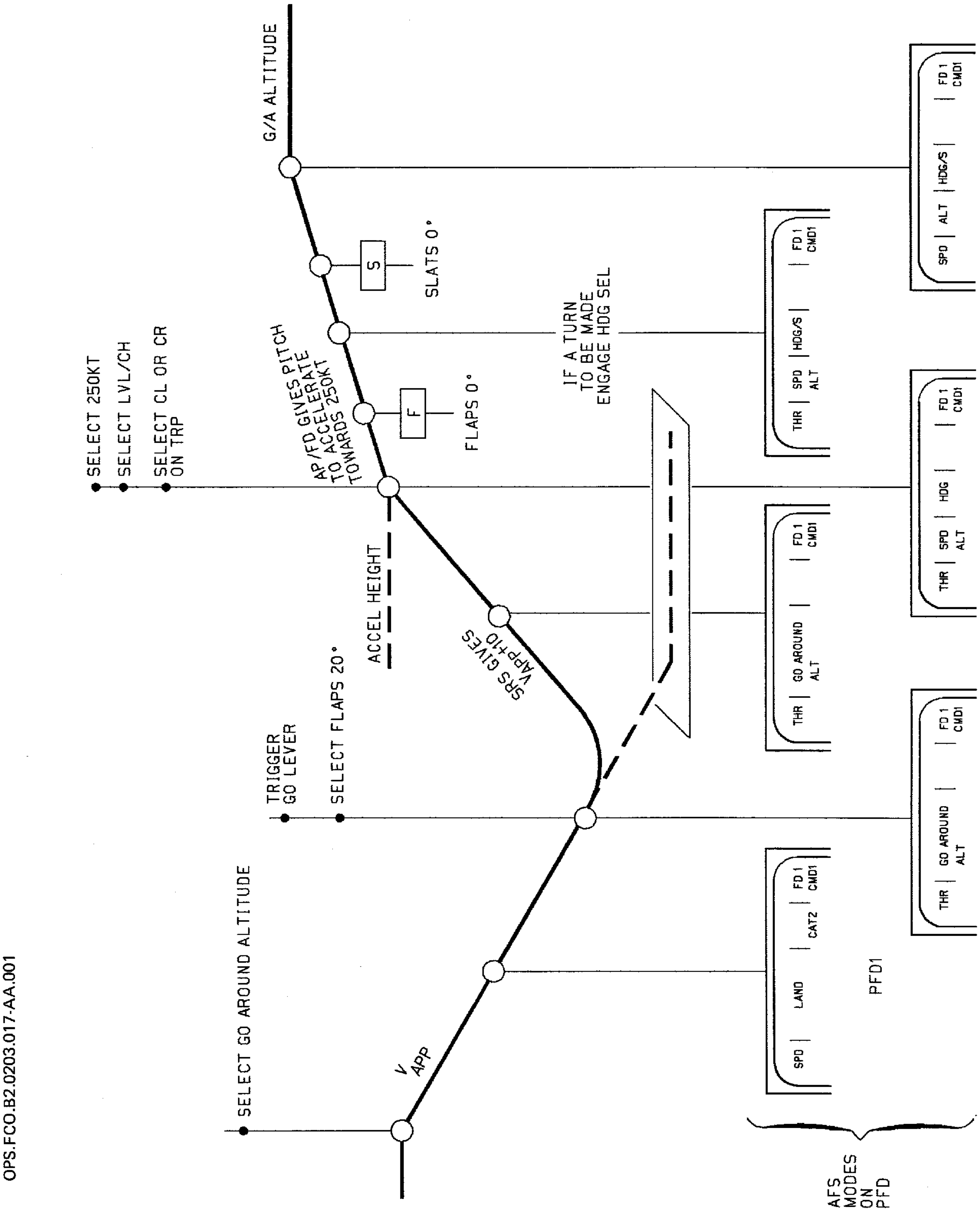
F. GO AROUND

<table>
<tr><th rowspan="2"></th><th rowspan="2">CAT 1 OR BETTER WEATHER CONDITIONS</th><th rowspan="2">CAT 2 WEATHER CONDITIONS</th><th colspan="2">CAT 3 WEATHER CONDITIONS</th></tr>
<tr><th>WITH DH</th><th>WITH NO DH</th></tr>
<tr><td>DH</td><td>● PNF announces « NO CONTACT ».
● PF announces « GO-AROUND, FLAPS », presses the GO-LEVERS, monitors THROTTLE advancement and controls or monitors (as appropriate) the FLIGHT PATH.
<i>Note : If ATS is not armed, PF pushes throttles full forward.</i>
● PNF retracts FLAPS one step and monitors engine parameters.
● As soon as rate of climb is positive :
PNF announces « POSITIVE CLIMB ».
PF asks for GEAR retraction
PNF retracts the gear and confirms « GEAR UP ».</td><td colspan="3">● CM1 announces « GO-AROUND, FLAPS », presses the GO-LEVERS, monitors THROTTLE advancement, checks PITCH ATTITUDE with STANDBY HORIZON, monitors flight path and makes the necessary selections on FCU.
<i>Note : If ATS is not armed, CM1 pushes throttles to adjust go-around power.</i>
● CM2 retracts FLAPS one step and monitors engine parameters.
● As soon as rate of climb is positive :
CM2 announces « POSITIVE CLIMB ».
CM1 asks for GEAR RETRACTION
CM2 retracts the gear and confirms « GEAR UP ».
● CM2 announces 200 FT, 300 FT.
<i>Note : IF AT DH, NO CALL FROM CM1, CM2 PERFORMS A GO-AROUND.</i></td></tr>
<tr><td></td><td colspan="4">CAUTION
At each time a GO AROUND is initiated, even if manually done, PRESS THE GO LEVERS IN ORDER TO GET OUT OF LAND MODE</td></tr>
<tr><td>ACCEL ALT</td><td colspan="4">See also Patterns in following pages.
● With TWO ENGINES
At acceleration altitude :
SPD/MACH setting knob . . . . SELECT 250 KT
LVL/CH p.b. . . . . SELECT LVL/CH MODE
TRP . . . . SELECT CL OR CR THRUST
● With ONE ENGINE OUT
At acceleration altitude :
SPD/MACH setting knob . . . . SELECT 250 KT
ALT HLD p.b. . . . . SELECT ALT MODE
At « GREEN DOT » speed
LVL/CH p.b. . . . . SELECT LVL/CH MODE
TRP . . . . SELECT MCT THRUST
SPD/MACH setting knob . . . . SELECT « GREEN DOT »</td></tr>
</table>

WARNING

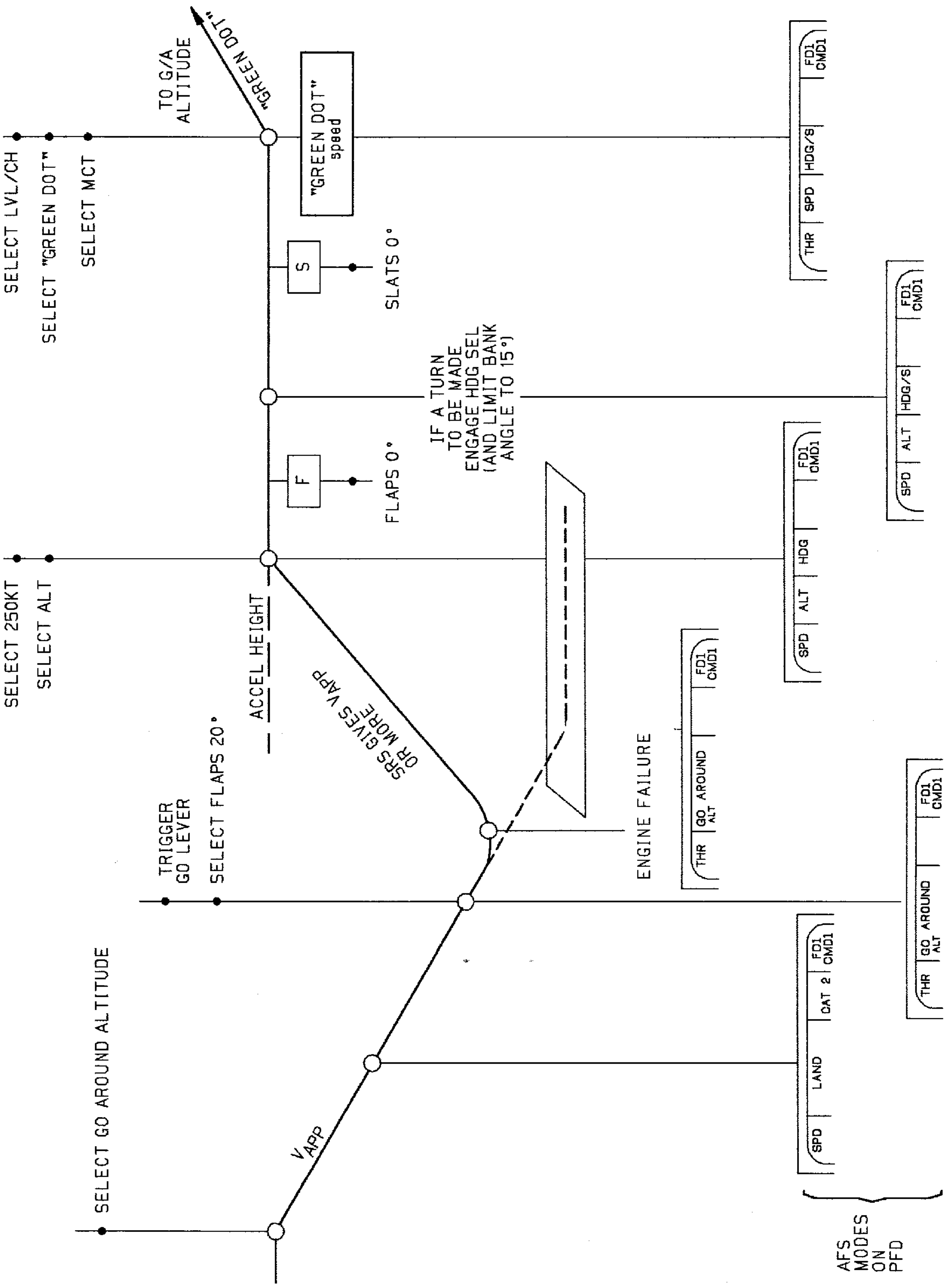
R 1) During a GO AROUND, an ENGINE FAILURE may lead to the disconnection of one or both AP :
R – If 1 AP remains engaged, go on in automatic control.
R – If no AP remains engaged, CM1 manually takes over and refers to the MAIN and STANDBY
R HORIZONS and to the FD BARS (if they are available).
R 2) In the case of a manual GO AROUND the pitch trim should be adjusted as soon as possible to
R counteract the strong nose up tendency.

TWO ENGINE GO AROUND



ENGINE FAILURE DURING GO AROUND

R
R
R



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G. PROCEDURES FOLLOWING FAILURES (LAND MODE ENGAGED)

ENGINE FAILURE DURING THE APPROACH

<table>
<tr><th rowspan="2">1 AP IN CMD
(CAT 1 OR CAT 2 WEATHER CONDITIONS)</th><th colspan="2">2 AP's IN CMD (CAT 3 WEATHER CONDITIONS)</th></tr>
<tr><th>WITH DH</th><th>WITH NO DH</th></tr>
<tr><td colspan="3">– The ATS mode remains engaged.</td></tr>
<tr><td>– In case of RIGHT ENGINE FAILURE :
YAW DAMPER 2 disconnects.
AP 2 may disconnect if engaged (preferably use AP 1)
– In case of LEFT ENGINE FAILURE :
YAW DAMPER 1 disconnects
AP does not disconnect provided at least 1 YAW DAMPER remains engaged.</td><td colspan="2">– In case of RIGHT ENGINE FAILURE :
YAW DAMPER 2 disconnects.
– In case LEFT ENGINE FAILURE :
YAW DAMPER 1 disconnects.
– AP does not disconnect provided at least 1 YAW DAMPER remains engaged.</td></tr>
<tr><td colspan="3">R **Above 1000 ft** : the approach can be continued down to CAT 2* minima.
Approach speed is VLS + 5KT + WIND CORRECTION in AUTOMATIC approach and VLS + WIND CORRECTION in MANUAL approach.</td></tr>
<tr><td colspan="3">**Below 1000 ft and above 100 ft**
IF EXTERNAL VISUAL REFERENCES ARE NOT SUFFICIENT execute a GO AROUND.
R Make a new approach (single engine approach) down to CAT 2* minima with the A/C correctly trimmed.
It is preferable to engage 1 AP in CMD. (if available). Keep autothrottle.
Approach speed is as described above.
R * This procedure (single engine approach) has not been demonstrated for a CAT 2 approach. However for safety reasons, if an AP is still available, it can be continued down to CAT 2 minima rather than to divert to another airport.</td></tr>
<tr><td colspan="3">**Below 100 ft**
Continue the approach. Keep the autothrottle if engaged.</td></tr>
<tr><td colspan="3">**At landing**</td></tr>
<tr><td colspan="2">Continue the automatic langing if the single engine automatic approach is continued.</td><td>Continue the automatic landing</td></tr>
</table>

FAILURE OF HYDRAULIC SYSTEM WITHOUT HYDRAULIC FLUID LOSS

ABOVE 1000 FT :

By means of transfer units and electropumps if necessary, it is possible to restore the operational capability of the failed hydraulic system and recover all AFS capability.

BELOW 1000 FT :

No transfer will be done – A GO-AROUND will be initiated if the desired capability is lost and the EXTERNAL VISUAL REFERENCES ARE NOT SUFFICIENT.

Mod : 4941 + 5757

FAILURES AND ASSOCIATED ACTIONS DURING A CAT 2 APPROACH

	SINGLE WARNINGS	ACTIONS (AT TIME OF WARNING DETECTION)						OBSERVATIONS	
			1000 ft	700 ft	400 ft	200 ft	DH		R
A/C SYSTEMS	FLAPS failure	REVERT TO CAT 1 MINIMA	NOT APPLICABLE					FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT2 MINIMA, IF FLAP JAMMED AT OR ABOVE 20°/20°.	
	ANTI-SKID SYSTEM FAILURE	NOT APPLICABLE						DISENGAGE AP AT TOUCHDOWN	
	HYDRAULIC FAILURE (WITHOUT FLUID LOSS)	TRANSFER. NO CAPABILITY LOSS	GO AROUND IF INSUFFICIENT VISUAL REFERENCES				LAND (1)		
	ALPHA FLOOR ACTIVATION	DISENGAGE A/THR MODE. CHECK SPEED AND RE-ENGAGE A/THR							
	ENGINE FAILURE	REVERT TO CAT 1 MINIMA						FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT 2 MINIMA.	
FLT INSTRUMENTS	STBY HORIZON FLAG	REVERT TO CAT 1 MINIMA							
	red « RA » (radio altimeter) on two PFD's	REVERT TO BASIC MODES MINIMA (CAT1)						AP/FD NOT AVAILABLE IN LAND. DISENGAGE A/THR AT 30 FT AND MANUALLY REDUCE POWER	
	red « CHECK ATT » on two PFD's *	TRANSFER : – IF WARNING DISAPPEARS, A CAT 2 IS STILL POSSIBLE – IF NOT, REVERT TO CAT 1 MINIMA						* THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY HORIZON. BELOW 1000 FT, CM 1 PERFORMS A MANUAL GA USING STBY HORIZON. ** THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY COMPASS. DO NOT MAKE ANY SWITCHING BELOW 1000 FEET	
	red « ATT » on one PFD								
	Diagonal line on one PFD and ND								R
	red « CHECK HDG » on two ND's **								
	red « HDG » on one ND								
	red « SPD » on one PFD								R
AFS and FMA	NO « LAND » at 400 FT	NOT APPLICABLE							
	« AP OFF » warning	TRY TO RECOVER. IF IMPOSSIBLE REVERT TO CAT 1 MINIMA							
	LOSS of « CAT 2 »								
	LOC or G/S EXCESSIVE DEVIATION on PFD	MONITOR ILS TRACK							
	« AUTOLAND » light	NOT APPLICABLE							
	INCORRECT selected CRS on ND's at 700 ft	NOT APPLICABLE		DISENGAGE AP AT 50 FT AT THE LATEST					
	NO « FLARE » at 30 FT	AT 30 FT, DISCONNECT AP AND MANUALLY COMPLETE THE LANDING							
	FOR MULTIPLE WARNINGS MOST LIMITING APPLIES		1000 ft	700 ft	400 ft	200 ft	DH		R

(1) If external visual references sufficient. R

Mod. : 5757

FAILURES AND ASSOCIATED ACTIONS DURING A CAT 3 WITH DH APPROACH

	SINGLE WARNINGS	ACTIONS (AT TIME OF WARNING DETECTION)	1000 ft 700 ft 400 ft 200 ft	100 ft	DH	OBSERVATIONS
A/C SYSTEMS	FLAP failure	REVERT TO CAT 1 MINIMA	NOT APPLICABLE			FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT 2 MINIMA, IF FLAP JAMMED AT OR ABOVE 20°/20°.
	ANTI-SKID SYSTEM FAILURE	NOT APPLICABLE				DISENGAGE AP AT TOUCHDOWN
	HYDRAULIC FAILURE (WITHOUT FLUID LOSS)	TRANSFER. NO CAPABILITY LOSS	GO AROUND IF INSUFFICIENT VISUAL REFERENCES		LAND (1)	
	ALPHA FLOOR ACTIVATION	DISENGAGE A/THR MODE. CHECK SPEED AND RE-ENGAGE A/THR				
	ENGINE FAILURE	REVERT TO CAT 1 MINIMA		CONTINUE		FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT 2 MINIMA.
FL INSTRUMENTS	STBY HORIZON FLAG	REVERT TO CAT 1 MINIMA				
	AUTO CALL OUT RA failure	NOT APPLICABLE				
	red « RA » (radio altimeter) on two PFD's	REVERT TO BASIC MODES MINIMA (CAT1)				AP/FD NOT AVAILABLE IN LAND. DISENGAGE A/THR AT 30 FT AND MANUALLY REDUCE POWER
	red « CHECK ATT » on two PFD's *	TRANSFER : – IF WARNING DISAPPEARS, A CAT 2 IS STILL POSSIBLE (2) – IF NOT, REVERT TO CAT 1 MINIMA				* THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY HORIZON. BELOW 1000 FT, CM 1 PERFORMS A MANUAL GA USING STBY HORIZON ** THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY COMPASS. DO NOT MAKE ANY SWITCHING BELOW 1000 FEET
	red « ATT » on one PFD			CONTINUE		
	Diagonal line on one PFD and ND					
	red « CHECK HDG » on two ND's **					
	red « HDG » on one ND			CONTINUE		
	red « SPD » on one PFD					
AFS and FMA	NO «LAND» at 400 FT	NOT APPLICABLE				
	«AP OFF» warning	TRY TO RECOVER. IF IMPOSSIBLE REVERT TO THE AVAILABLE CAPABILITY (CAT 2 or CAT 1)				
	Capability decrease from «CAT 3» to «CAT 2» (except if due to ATS loss).			CONTINUE		
	Total loss of ATS («CAT 3» decreases to «CAT 2»).	CONTINUE TO CAT 2 MINIMA				
	LOC or G/S EXCESSIVE DEVIATION on PFD	MONITOR ILS TRACK				
	«AUTOLAND» light	NOT APPLICABLE				
	INCORRECT selected CRS on ND's at 700 ft	NOT APPLICABLE	REVERT TO CAT II MINIMA DISENGAGE THE AP AT 50 FT AT THE LATEST			
	NO «FLARE» at 30 FT	AT 30 FT, IF VISUAL REFERENCES ARE SUFFICIENT, DISENGAGE AP AND MANUALLY COMPLETE THE LANDING. IF NOT, EXECUTE A GO AROUND.				
	FOR MULTIPLE WARNINGS MOST LIMITING APPLIES		1000 ft 700 ft 400 ft 200 ft	100 ft	DH	

(1) If external visual references sufficient.

R (2) In case of diagonal line on one PFD and ND due to SGU failure, a CAT 3 is still possible after SGU switching.
R If warning does not disappear, then revert to CAT 1.

Mod. : 4941 + 5757

FAILURES AND ASSOCIATED ACTIONS DURING A CAT 3 WITHOUT DH APPROACH

	SINGLE WARNINGS	ACTIONS (AT TIME OF WARNING DETECTION)							OBSERVATIONS
			1000 ft	700 ft	400 ft	200 ft	100 ft	0 ft	
A/C SYSTEMS	FLAP failure	REVERT TO CAT 1 MINIMA	NOT APPLICABLE						FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT 2 MINIMA, IF FLAP JAMMED AT OR ABOVE 20°/20°.
	ANTI-SKID SYSTEM FAILURE	REVERT TO CAT 3 WITH DH MINIMA (15 ft/200 m or airline policy)					CONTINUE		
	HYDRAULIC FAILURE (WITHOUT FLUID LOSS)	TRANSFER. NO CAPABILITY LOSS	**GO AROUND IF INSUFFICIENT VISUAL REFERENCES**					**CONTINUE THE LANDING (1)**	
	ALPHA FLOOR ACTIVATION	DISENGAGE A/THR MODE. CHECK SPEED AND RE-ENGAGE A/THR							
	ENGINE FAILURE	REVERT TO CAT 1 MINIMA					CONTINUE		FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT 2 MINIMA.
FLT INSTRUMENTS	STBY HORIZON FLAG	REVERT TO CAT 1 MINIMA							
	AUTO CALL OUT RA failure	NOT APPLICABLE							
	red « RA » (radio altimeter) on two PFD's	REVERT TO BASIC MODES MINIMA (CAT1)							AP/FD NOT AVAILABLE IN LAND. DISENGAGE A/THR AT 30 FT AND MANUALLY REDUCE POWER
	red « CHECK ATT » on two PFD's *	TRANSFER : – IF WARNING DISAPPEARS A CAT 2 IS STILL POSSIBLE (2) – IF NOT; REVERT TO CAT 1 MINIMA							* THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY HORIZON. BELOW 1000 FT, CM 1 PERFORMS A MANUAL GA USING STBY HORIZON. ** THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY COMPASS. DO NOT MAKE ANY SWITCHING BELOW 1000 FEET
	red « ATT » on one PFD						CONTINUE		
	Diagonal line on one PFD and ND								
	red « CHECK HDG » on two ND's **								
	red « HDG » on one ND						CONTINUE		
	red « SPD » on one PFD								
AFS and FMA	NO «LAND» at 400 FT	NOT APPLICABLE							
	«AP OFF» warning	TRY TO RECOVER, IF IMPOSSIBLE REVERT TO THE AVAILABLE CAPABILITY (CAT 2 or CAT 1)							
	Capability decrease from «CAT 3» to «CAT 2» (except if due to ATS loss).						CONTINUE		
	Total loss of ATS («CAT 3» decreases to «CAT 2»).	CONTINUE TO CAT 2 MINIMA							
	LOC or G/S EXCESSIVE DEVIATION on PFD	MONITOR ILS TRACK							
	«AUTOLAND» light	NOT APPLICABLE							
	Incorrect selected CRS on ND's at 700 ft	NOT APPLICABLE		REVERT TO CAT II MINIMA DISENGAGE THE AP AT 50 FT AT THE LATEST					
	Inadvertent disconnection of both AP's during ROLL OUT	NOT APPLICABLE							CONTINUE BY USING WGD (IF INSTALLED) OR EXTERNAL VISUAL REFERENCES
	NO «FLARE» at 30 FT	AT 30 FT, IF VISUAL REFERENCES ARE SUFFICIENT, DISENGAGE AP AND MANUALLY COMPLETE THE LANDING. IF NOT, EXECUTE A GO AROUND.							
	FOR MULTIPLE WARNINGS MOST LIMITING APPLIES		1000 ft	700 ft	400 ft	200 ft	100 ft	0 ft	

(1) If external visual references sufficient.

R (2) In case of diagonal line on one PFD and ND due to SGU failure, a CAT 3 is still possible after SGU switching.
R If warning does not disappear, then revert to CAT 1.

Mod : 4941 + 5757

1 – GENERAL

The FPV (Flight Path Vector) system provides to the crew a complementary way of flying the A/C.

FPV use is basically different from FD (FLIGHT DIRECTOR) use.

The FPV can be used in two different ways which correspond to two different operational conditions :

R – With the FLIGHT PATH VECTOR (FPV) only. In this case the FPV allows the crew to know the actual A/C slope and lateral drift.

R The « FPV » provides a precise and immediate reference for either controlling or monitoring the flight path. Because it displays the inertial trajectory (relative to ground), **there is no need to compensate for the effect of wind.**

- The vertical displacement from the horizon, read against the pitch scale, is the slope of climb or descent relative to the ground.(γ)
- The lateral displacement from the centre of the fixed aircraft symbol is the drift. (D)

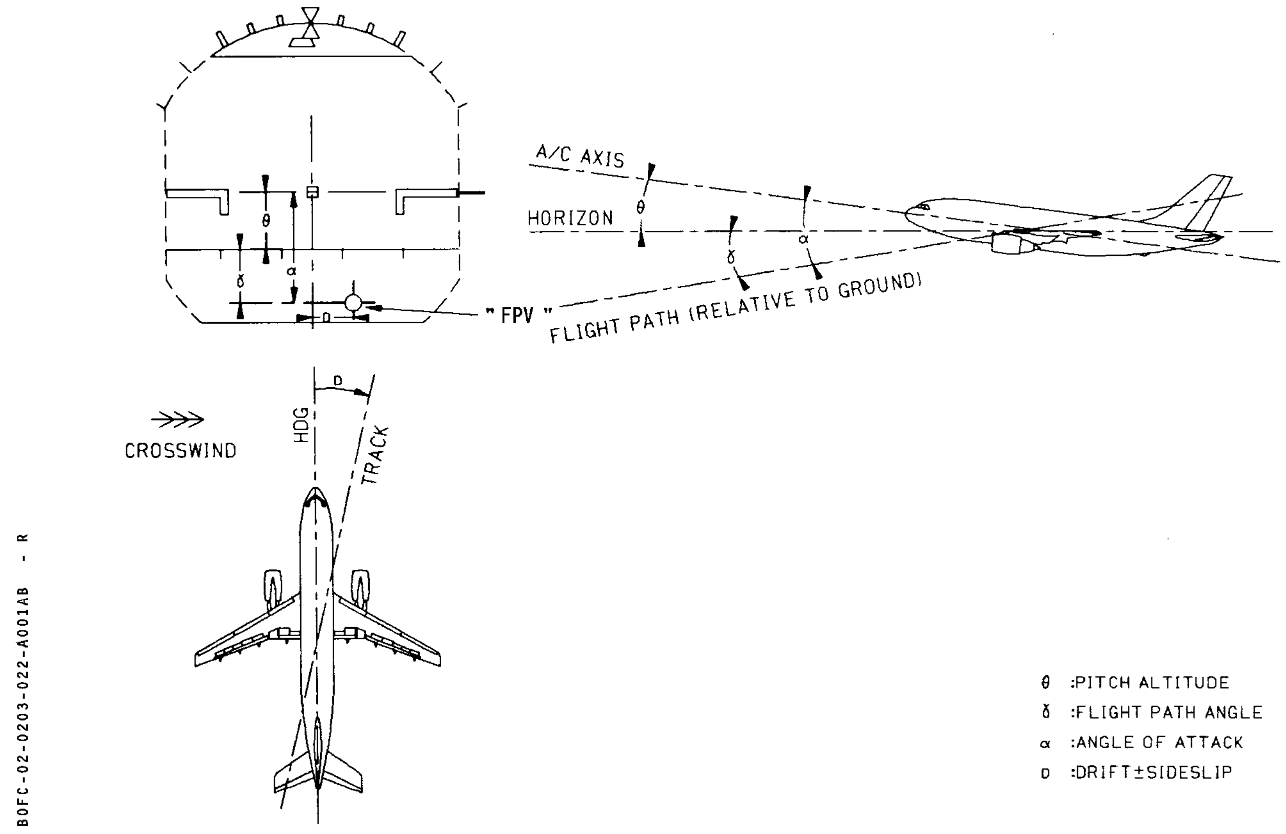
But this doesn't give the crew any reference to fly

– With the FLIGHT PATH VECTOR + the FLIGHT PATH TARGET. R
In this case the FPV allows the crew, at the same time to :

- still know its actual slope and lateral drift,
- and fly the references (SLOPE and COURSE) selected through the FLIGHT PATH TARGET.

Use of the FPV is primarily recommended for approaches without precise glide-slope guidance, i.e. non-precision and visual approaches. (For other phases of flight, the Flight Director should in general be used. The FD is the optimum « tool » to fly a precision approach or a take-off climb profile).

PRIMARY INFORMATION GIVEN BY THE FPV (« BIRD »)



R 2 – VISUAL APPROACH (USE OF THE FPV ALONE)

APPLICABILITY :

In VISUAL conditions, when no ILS exists, to know the A/C slope and drift. The FPV, in this case, helps in maintaining a stabilized descent path.

R The FLIGHT PATH TARGET (« FPT ») cannot be used, since usually in the case of a VISUAL APPROACH there is not any FIX from which the target slope and course can be referenced.

COMPARISON WITH THE FD :

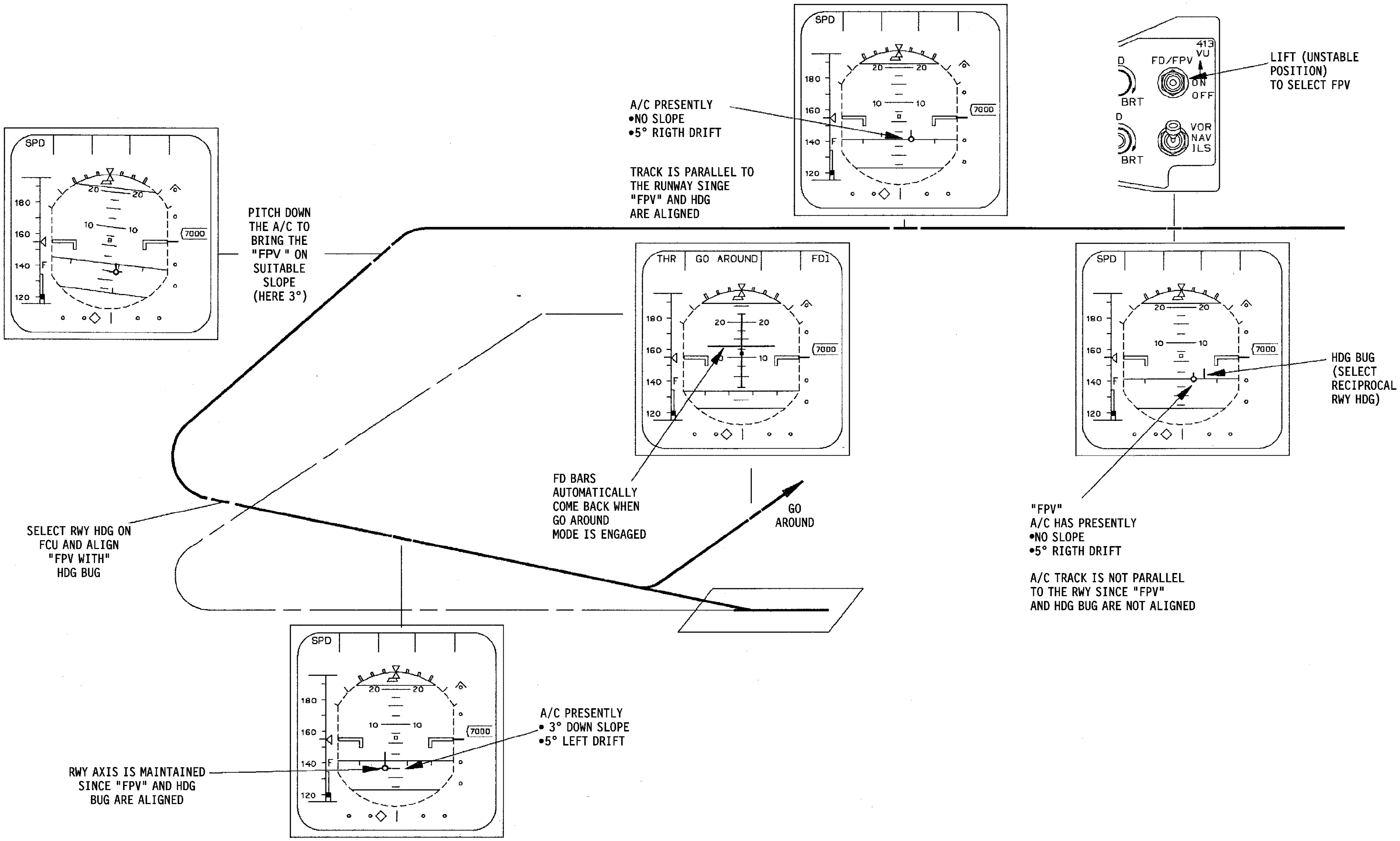
Allows to get information on the A/C path without the need of selecting references (vertical speed, heading).

OPERATION (FOR A STANDARD CIRCUIT PATTERN)

START OF PATTERN	FD/FPV switch . . . . LIFT TO SELECT FPV The FLIGHT PATH VECTOR symbol appears on the PFD. It indicates to the crew the present A/C slope and drift. A HDG BUG also appears against the HDG scale of the PFD. It indicates the HEADING selected on FCU. *Notes : 1 - A second action (lift) on the FD/FPV switch will clear the FPV symbol and the HDG BUG and bring back the FD BARS.* *2 - If no AP is engaged in CMD the AP/FD mode indication on the FMA disappears on the side where the FPV is on.*
DOWNWIND LEG	HDG SEL KNOB . . . . SELECT RECIPROCAL (ON FCU) RWY HDG This reference will appear on the PFD through the HDG BUG. Flying the FPV aligned with the HDG BUG will ensure that the **TRACK IS PARALLEL TO THE RWY**. R FPV . . . . KEEP IT ON HORIZON TO MAINTAIN CONSTANT ALTITUDE R
BASE LEG	PITCH DOWN THE A/C to bring the FPV on the suitable descent angle. R HDG SEL knob . . . . SELECT RWY HDG
ALIGNED ON RWY AXIS	FPV . . . . KEEP IT ON DESIRED SLOPE R FPV . . . . KEEP IT ALIGNED WITH THE HDG BUG. R This ensure that drift is corrected and RWY AXIS is maintained. If judged to be TOO HIGH : MAKE A CORRECTION BY PLACING the FPV BELOW the target descent angle on the PITCH SCALE. R When desired path is RESTORED, BRING FPV back to target descent angle. R Conversely if judged to be too low.

Note : The information provided by the FPV is particularly valuable for visual approaches when the visual cues are degraded (e.g. in heavy rain or into sun) or misleading (sloping terrain or runway, or abnormal length/width ratio) or at night with no approach or foreground lights (the « black hole » approach).

VISUAL APPROACH WITH THE FPV (« BIRD » ONLY)



A/C PRESENTLY
•NO SLOPE
•5° RIGTH DRIFT

TRACK IS PARALLEL TO
THE RUNWAY SINGE
"FPV" AND HDG
ARE ALIGNED

LIFT (UNSTABLE
POSITION)
TO SELECT FPV

PITCH DOWN
THE A/C TO
BRING THE
"FPV" ON
SUITABLE
SLOPE
(HERE 3°)

HDG BUG
(SELECT
RECIPROCAL
RWY HDG)

FD BARS
AUTOMATICALLY
COME BACK WHEN
GO AROUND
MODE IS ENGAGED

GO
AROUND

"FPV"
A/C HAS PRESENTLY
•NO SLOPE
•5° RIGTH DRIFT

A/C TRACK IS NOT PARALLEL
TO THE RWY SINCE "FPV"
AND HDG BUG ARE NOT ALIGNED

SELECT RWY HDG ON
FCU AND ALIGN
"FPV WITH"
HDG BUG

A/C PRESENTLY
• 3° DOWN SLOPE
•5° LEFT DRIFT

RWY AXIS IS MAINTAINED
SINCE "FPV" AND HDG
BUG ARE ALIGNED

R

R

R

3 – NON PRECISION APPROACH (USE OF THE FPV COMBINED WITH THE FPT)

APPLICABILITY

For a NON PRECISION APPROACH, e.g. NDB, VOR LOCALIZER ONLY approach. It allows to have a continuous indication of the flight path being achieved.

COMPARISON WITH THE FD :

For a NON PRECISION APPROACH allows a better accuracy of the track (in slope).

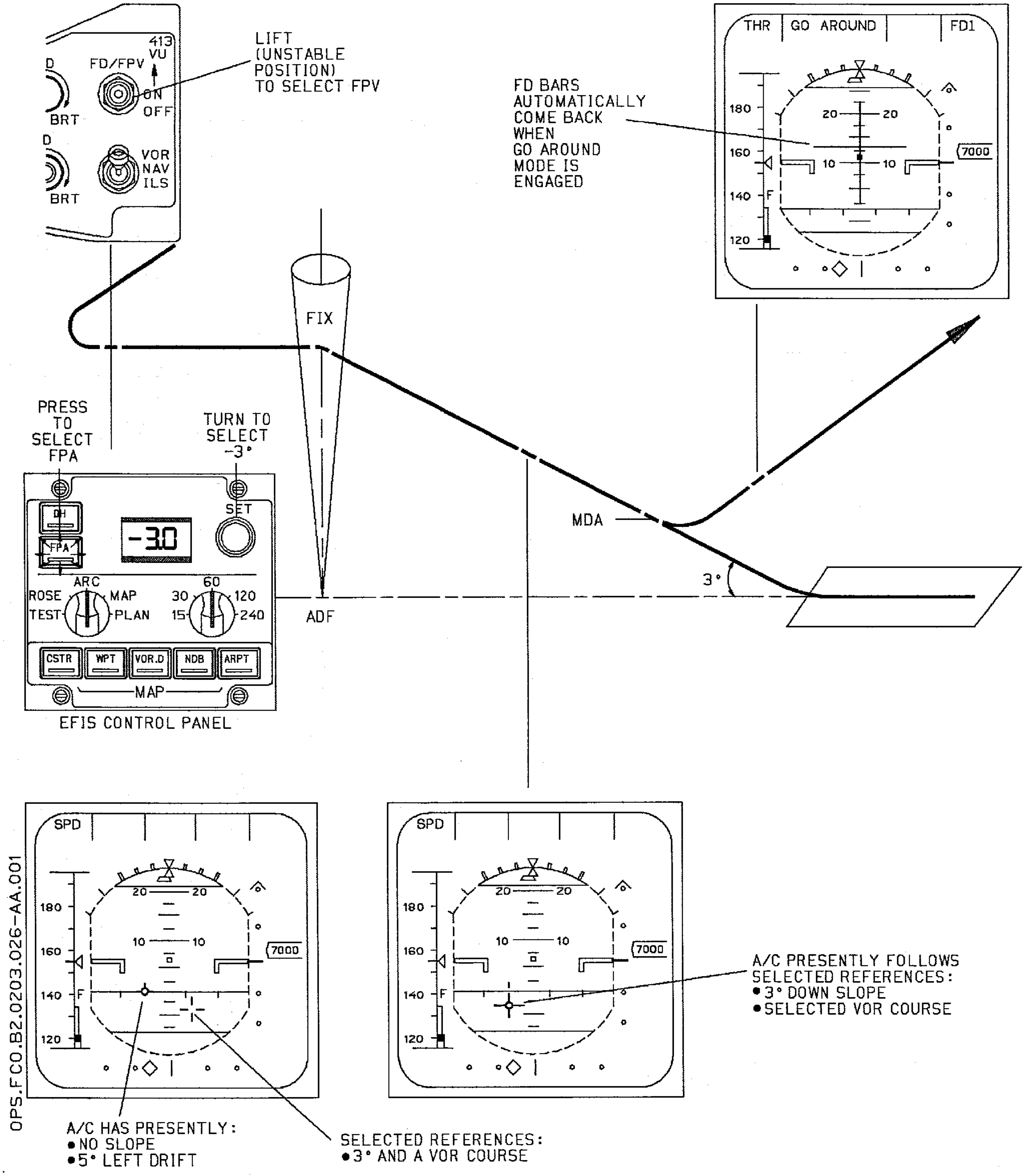
OPERATION

START OFF APPR	FD/FPV switch . . . . LIFT TO SELECT FPV The FLIGHT PATH VECTOR symbol appears on the PFD - It indicates to the crew the present A/C slope and drift. A HDG BUG also appears against the HDG scale of the PFD. It indicates the heading selected on FCU. *Note : 1 - A second action (lift) on the FD/FPV switch will clear the FPV symbol and the HDG BUG and bring back the FD BARS.* *2 - If no AP is engaged in CMD, the AP/FD mode indication on the FMA disappears on the side where the FPV is on.* FPA p.b. . . . . PRESS TO LIGHT THE p.b. The FLIGHT PATH TARGET symbol appears. It indicates : ● The last selected SLOPE on the EFIS CONTROL PANEL ● The VOR course selected on VOR C.P., if VOR/NAV/ILS switch is on VOR. The LOC course selected on ILS C.P., if VOR/NAV/ILS switch is on ILS. The FLIGHT PATH TARGET symbol is not displayed if VOR/NAV/ILS switch is on NAV. The FLIGHT PATH TARGET symbol is cleared by a second press on the FPA p.b. or a press on the DH p.b.
PRIOR TO FIX	SET knob . . . . ROTATE TO SELECT DESIRED SLOPE RWY COURSE . . . . SELECT ON VOR or ILS C.P. as appropriate.
PASSING FIX	PITCH DOWN The A/C to bring the FPV into the FPT. Maintaining FPV vertically centered in FPT will ensure that the required slope is maintained with respect to ground. Maintaining FPV laterally centered in the « FPT », provided A/C was on the RWY axis when overflying the FIX, will ensure that the required COURSE (RWY axis) is maintained.
	CAUTION The SLOPE selected through the FLIGHT PATH TARGET is not linked to the ground as a GLIDE SLOPE. This means that this SLOPE TARGET must be carefully followed, otherwise a parallel slope may be flown. Same thing for the selected COURSE, a parallel course may be flown.
MDA	**EXTERNAL VISUAL CONDITIONS SUFFICIENT** CONTINUE THE APPROACH **EXTERNAL VISUAL CONDITIONS INSUFFICIENT** EXECUTE A GO AROUND. BY PRESSING GO LEVERS FD BARS ARE RECOVERED.

4 – OTHER POSSIBLE USES OF THE FPV :

- Monitoring automatic precision approach, in conjunction with raw ILS data ;
- It allows, particularly, an immediate and direct indication of flight path deviation due to wind-shear or other abnormality. Note that the GS index indicates position, whereas the FPV indicates rate of change of position, i.e. is predictive and therefore provides an earlier indication than the deviation of the GS.
- Cross-check of the achieved climb gradient when obstacle clearance is critical.
- In case of unreliable or failed airspeed indication, in which case the angle of attack (given on the pitch scale of the PFD by the displacement between the centre-dot and the FPV) can be used as relative pitch altitude. Refer to 2.05.80. R

NON PRECISION APPROACH WITH THE FPV



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EXTERNAL ELECTRICAL POWER SUPPLY

PROCEDURE

EXT PWR AVAIL lt . . . . CHECK ON

EXT PWR parameters . . . . CHECK

(When external power parameters are out of tolerance, the EXT PWR AVAIL light will not illuminate and the aircraft cannot be supplied).

EXT PWR . . . . ON
. ON light illuminates.
ELECTRICAL PWR distribution . . . . CHECK

(When APU GEN and EXT PWR supplies are both available, the external power has priority. The ENG driven GENs always have priority.

CAUTION

> Before disconnecting the EXT ELECT PWR unit from the aircraft, check :
>
> EXT PWR sw . . . . OFF
> . ON light extinguished and AVAIL light illuminated.

ELECTRICAL SUPPLY FOR MAINTENANCE AND CLEANING

To avoid supplying unnecessary electrical equipment during maintenance and cleaning activities, a limited number of circuits may be supplied from the external power unit via the maintenance bus.

PROCEDURE

EXTERNAL POWER UNIT . . . . CONNECTED

EXT PWR AVAIL light . . . . CHECK ON

MAINT BUS sw . . . . ON

Note : Check that the batteries are OFF, otherwise, they will discharge.

The following equipment will be supplied :

- Refuelling system
- Cargo loading system
- Cargo lighting
- Cabin lighting
- Cockpit DOME lights
- Maintenance lighting
- Pressure water system
- Toilet flush
- Vacuum cleaner plugs

CIRCUIT BREAKER USE

- **CIRCUIT BREAKER TRIPPING** :

  Due to the systems redundancy the safety of the aircraft is not affected by the loss of one system caused by tripped C/B's. Consequently there is no requirement to reset an open C/B.

IN FLIGHT

Do not re-engage a tripped C/B, unless the Captain (using his emergency authority) judges it necessary for the safe continuation of the flight. This procedure should be adopted only as a last resort, and only one re-engagement should be attempted.

ON GROUND

If the flight crew coordinates the action with maintenance, he may re-engage a tripped C/B, provided the cause of the tripped C/B is identified.

On the ground, if the pilot coordinates the action with maintenance, he/she may reengage a tripped C/B provided the cause of the tripped C/B is identified.

- **SYSTEM RESET** :

  Digital computers and systems abnormal behaviour, as a result of an electrical transient for example, may be stopped in some cases by interrupting the power supply of its processing part for a short time.

  Generally, this may be achieved with the normal cockpit controls (engagement levers, pushbuttons) by selecting the related control OFF then ON.

  However for some systems the cockpit normal controls do not cut off electrical power supply. The only way to reinitialize such a system is to pull and reset the corresponding circuit breaker.

PROCEDURE

To perform a system reset :

- Select the related normal cockpit control OFF, or pull the corresponding reset button or circuit breaker.
- Wait at least 3 seconds if a normal cockpit control is used, or 5 seconds if a circuit breaker is used (unless a different time is indicated).
- Select the related normal cockpit control ON, or push the corresponding reset button or circuit breaker.

CAUTION

> Do not reset more than one computer at the same time, unless instructed to do so.

SYSTEM RESET TABLE

The following table indicates which C/B may be used for this purpose, with the associated reset procedure or FCOM reference, when applicable.

In flight, as a general rule, before taking any action, the flight crew must consider and fully understand the consequences.

SYSTEM RESET TABLE (CONT'D)

ATA	Affected system	Reset
22 AUTO FLIGHT SYSTEM	FCC (AP/FD)	Before engine start only : – Reset the C/B H03 on 21VU for FCC 1. – Reset the C/B H06 on 21VU for FCC 2. *Note : After reset, power up test of computer will restart with corresponding FD fault flag displayed for 1 min. Wait until this flag has disappeared before re-engaging AP/FD.*
	FAC (Yaw damper, Pitch trim, ...)	Before engine start only : – Reset the C/B G03 on 21VU for FAC 1. – Reset the C/B G12 on 21VU for FAC 2. *Note : After reset, power up test of computer will restart with corresponding SPD LIM fault flag displayed for 1 min. Wait 30 s after this flag has disappeared before re-engaging pitch trim lever and yaw damper lever.*
	TCC (ATS)	Before engine start only : – Reset the C/B H08 on 21VU for SYS 1. – Reset the C/B H12 on 21VU for SYS 2 (if installed). *Note : After reset, power up test of computer will restart with corresponding dashes on TRP displayed for 30 s. Wait until these dashes have disappeared before re-engaging ATS lever.*
23 COMMUNICATION	VHF	On ground or in flight : – Reset the C/B B16 on 22VU for VHF 1. – Reset the C/B D07 on 21VU for VHF 2. – Reset the C/B D08 on 21VU for VHF 3 (if installed).
	HF	On ground or in flight : – Reset the C/B D03 on 21VU for HF 1. – Reset the C/B D12 on 21VU for HF 2 (if installed).
	ACARS	On ground or in flight : – Reset the C/B C09 on 21VU for ACARS. – Reset the C/B C08 on 21VU for DFIDU.
27 FLIGHT CONTROLS	FLC (Artificial feel)	On ground or in flight : – Reset the C/B J02 on 21VU for FLC 1. – Reset the C/B J04 on 21VU for FLC 2.
	SFCC (Slats & Flaps)	On ground only : Slats system (FCOM 2.05.27 p 1) : – Reset the C/B T63 on 133VU for SYS 1. – Reset the C/B T64 on 133VU for SYS 2. Flaps system (FCOM 2.05.27 p 2) : – Reset the C/B U61 on 133VU for SYS 1. – Reset the C/B V61 on 133VU for SYS 2.
	EFCU (Spoilers)	On ground or in flight : (FCOM 2.05.27 page 5) : – Reset the related SPLR pushbutton (OFF then ON) to recover the affected spoiler(s). If reset unsuccessful (on ground only) : – Reset the C/B V62 on 133VU for spoiler 1 and 4. – Reset the C/B T62 on 133VU for spoiler 2 and 3. – Reset the C/B T65 on 133VU for spoiler 5. – Reset the C/B U62 on 133VU for spoiler 6 and 7. *Note : If/when EFCU reset successful on ground, the flight crew must perform a Flight Control Check, as per SOP.*

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SYSTEM RESET TABLE (CONT'D)

ATA	Affected system	Reset
28 **FUEL**	AUTO FEED CTL	On ground or in flight : – Reset the C/B M55 on 132VU. **CAUTION : Do not take off within 3 min. after the reset.**
	FQI	On ground or in flight : – Reset the C/B P60 on 132VU for CHAN SUPPLY 1. – Reset the C/B P61 on 132VU for CHAN SUPPLY 2. **CAUTION : Do not take off within 3 min. after the reset.**
30 **ICE PROTECTION**	WINDOW ANTI-ICE	On ground or in flight : – Reset the C/B P67 on 132VU for window heat left. – Reset the C/B N66 on 132VU for window heat right.
31 **INDICATING/ RECORDING SYSTEMS**	FWC	On ground or in flight : – Reset the C/B B08 on 21VU for FWC 1. – Reset the C/B A08 on 21VU for FWC 2. *Note : After reset, FWC restart lasts 25 s.*
	SDAC	On ground or in flight : – Reset the C/B A05 on 21VU.
32 **LANDING GEAR**	L/G PROXIMITY DETECTORS	On ground or in flight : **CAUTION: Do not move aircraft during this reset due to nose wheel steering and braking systems being temporarily lost.** – Reset the C/B U52 on 133VU for SYS 1. – Reset the C/B V52 on 133VU for SYS 2. *Note : Refer to FCOM 2.02.14 page 4 for effect of landing gear proximity detector malfunctions on ground or in flight.*
34 **NAVIGATION**	FMC	On ground or in flight : – Pull the C/B J11 on 21VU for SYS 1. – Wait 15 s before pushing the C/B. – Pull the C/B J14 on 21VU for SYS 2. – Wait 15 s before pushing the C/B.
	EFIS SGU	On ground or in flight : – Reset the C/B F04 on 21VU for CAPT EFIS SGU 1. – Reset the C/B F11 on 21VU for F/O EFIS SGU 2. – Reset the C/B F06 on 21VU for EFIS SGU 3.
	ADF (If installed)	On ground or in flight : – Reset the C/B D01 on 21VU for ADF 1. – Reset the C/B D14 on 21VU for ADF 2.
	VOR	On ground or in flight : – Reset the C/B C02 on 21VU for VOR 1. – Reset the C/B C13 on 21VU for VOR 2.
	DME	On ground or in flight : – Reset the C/B C04 on 21VU for DME 1. – Reset the C/B C11 on 21VU for DME 2.
	ILS (if MMR not installed)	On ground or in flight : – Reset the C/B C03 on 21VU for ILS 1. – Reset the C/B C12 on 21VU for ILS 2.
	MMR (if installed)	On ground only : **CAUTION : Do not move aircraft during this reset.** – Reset the C/B C03 on 21VU for MMR 1. – Reset the C/B C12 on 21VU for MMR 2.

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SYSTEM RESET TABLE (CONT'D)

ATA	**Affected system**	**Reset**
34 **NAVIGATION** **(cont'd)**	RAD ALTM	On ground or in flight : – Reset the C/B C05 on 21VU for RAD ALTM 1. – Reset the C/B C10 on 21VU for RAD ALTM 2.
	GPWS	On ground or in flight : – GPWS FAULT may be cleared by resetting associated radio altimeter C/B C05 on 21VU.
	VSI	On ground only : – Reset the C/B F18 on 22VU for CAPT VSI. – Reset the C/B E11 on 21VU for F/O VSI.
	TCAS (if installed)	On ground or in flight : – Reset the C/B F07 on 21VU.

AIRCRAFT LATERAL TRIMMING

The minimum drag is obtained when the ailerons and control wheel are in the neutral position. This condition is obtained by the following procedure, provided slats are retracted :

- Ensure symmetric fuel loading,
- Disconnect A/THR (using instinctive disconnect pushbutton)
- Ensure accurate symmetric thrust,
- Engage the autopilot in CMD, if not already engaged, in HDG SEL mode and in ALT HLD mode,
- Adjust the rudder trim in order to obtain a zero control wheel position (aileron deflection scale on the wheel),

  If the required rudder trim deflection exceeds 1.5°, a log book entry should be performed for maintenance action.
- Check bank angle, if bank angle is estimated to exceed 2°, a log book entry should be performed for maintenance action,
- Check again the lateral trimming conditions and retrim if necessary when ever there is a noticeable change in flight conditions (e.g. step climb).

RECOVERY FROM STALL WARNING (STICK SHAKER)

Whenever a stall warning (i. e. Stick Shaker activation) is experienced at low altitude, this should be considered as an immediate threat to maintaining a **safe flight path.**

■ **At lift off** :

THRUST LEVERS . . . . TOGA

PITCH ATTITUDE . . . . 12.5°

Note : When a safe flight path and speed are achieved and maintained, if stall warning is still activated, consider a spurious stall warning and refer to the procedure INADVERTENT STICK SHAKER (QRH 6.04).

■ **During any other flight phases after lift off** :

THRUST LEVERS . . . . TOGA

PITCH ATTITUDE . . . . REDUCE

CAUTION

If a risk of ground contact exists, do not reduce the pitch attitude more than necessary to allow airspeed to increase. R R R

● **After initial recovery :**

Maintain the speed close to the stick shaker speed until it is safe to accelerate (closely monitor both the speed and the speed trend arrow)

BANK ANGLE . . . . WINGS LEVEL

SPEED BRAKES . . . . CHECK RETRACTED

● **If in clean configuration and below 20 000 ft** :

SLATS . . . . EXTEND

● **When out of stall and if no threat of ground contact** :

LANDING GEAR (If DOWN) . . . . UP

Recover normal speed and select flaps as required

● **If one engine inoperative** :

POWER AND RUDDER . . . . USE WITH CARE

RECOVERY TECHNIQUES FROM UPSET SITUATIONS

FOREWORD

The information contained in this chapter provides recommended piloting techniques, maneuvers and guidelines for recovery from upset situations.

These are basic airmanship techniques already developed in various training materials that are recommended to be endorsed by operators in their overall pilot training program for this type of aircraft.

Although these techniques are considered as basic piloting skills for trained flight crews, they are summarized in this chapter for reference purposes.

INTRODUCTION

An upset can generally be defined as unintentionally exceeding the following conditions :

- Pitch attitude more than 25° nose up, or
- Pitch attitude more than 10° nose down, or
- Bank angle more than 45°, or
- Within the above parameters, but flying at airspeeds inappropriate for these conditions.

AERODYNAMIC FUNDAMENTALS

Pitch control :

When an airplane is at a balanced "in-trim" angle of attack, it will seek to return to the trimmed angle of attack if upset by external forces or momentary pilot inputs. This is due to the longitudinal stability of the airplane.

Changes of airplane configuration affect pitch attitude :

- Flap extension usually generates a nose-down pitching moment.
- Flap retraction usually generates a nose-up pitching moment.
- When extended, speedbrakes usually produce a nose-up pitching moment.

Pitch attitude is also affected by thrust variation. Reducing thrust generates a nose-down pitching moment, and conversely, increasing thrust generates a nose-up pitching moment.

Lateral and directional control :

Unusually large amounts of aileron and spoiler input may be required to recover from an upset.

If during this upset, the angle of attack increases beyond a certain value (stick shaker and buffeting), then the airflow over the wing separates and the efficiency of ailerons and spoilers decreases. The angle of attack must R
be decreased to regain aileron and spoiler effectiveness. R
Since the rudder is rarely aerodynamically stalled, it is still possible to generate induced roll rate using the rudder.

CAUTION

At high angle of attack, pilots must be extremely careful when using the rudder for assisting lateral control. Excessive rudder can cause excessive sideslip, which could lead to departure from controlled flight.

RECOVERY TECHNIQUES

The techniques assume that the airplane is not stalled. If it is, recovery from the stall must be accomplished first.

Stall recovery :

To recover from the stall, angle of attack must be reduced.

Nose down pitch control must be applied and maintained until wings are unstalled. Under certain conditions, it may be necessary to reduce thrust in order to increase the nose-down pitching moment necessary to reduce the angle of attack.

Once unstalled, upset recovery actions may be taken and thrust reapplied as needed.

Recovery from a nose high, wings level upset :

- Pitch attitude is unintentionally more than 25 degrees nose-up and increasing,
- the airspeed is decreasing rapidly.

As airspeed decreases, the pilot's ability to maneuver the airplane also decreases. If the pitch trim setting is nose-up, as for low speed flight, it partially reduces the nose-down authority of the elevator. As the airspeed decreases, the pilot could intuitively make a large thrust increase ; this will cause an additional pitch up effect further complicating the situation. At full thrust setting and very low airspeed and with pitch trim set for low speed, the elevator may have only very limited ability to reduce pitch attitude.

In this situation the pilot should trade altitude for airspeed. This is accomplished by an input of up to full nose-down elevator accompanied by some nose-down pitch trim.

Note : Pilots should not fly the airplane using pitch trim only.

If altitude permits, reducing thrust may help to achieve a nose-down pitch rate

If normal pitch control inputs do not stop an increasing pitch rate, it may be necessary to roll the aircraft to a bank angle sufficient to bring the nose down. A bank angle of between 45 and 60 degrees could be needed.

Finally, if normal control is ineffective, careful rudder input in the direction of the desired roll may be required to induce a rolling maneuver recovery.

CAUTION

Only a small amount of rudder is needed. Too much rudder applied too quickly or held too long may result in loss of lateral and directional control. Because of the low energy condition, pilots should exercise caution when applying rudder.

Recovery from a nose low, wings level upset :

- Pitch attitude is unintentionally more than 10 degrees nose down and going lower,
- the airspeed is increasing rapidly.

At moderate pitch attitude, applying nose-up elevator-reducing thrust and extending speedbrakes, if necessary – will recover the aircraft to a normal attitude.

At extremely low pitch attitude and high airspeed (well above VMO/MMO), the ability to command a nose-up pitch rate with elevator alone may be reduced because of extreme aerodynamic loads on the elevator. Nose-up elevator and nose-up pitch trim may be required to establish a nose-up pitch rate.

Recovery from high bank angle :

- Though the bank angle for an upset has been defined as unintentionally more than 45 degrees, it is possible to experience bank angles greater than 90 degrees.

A smooth application of up to full lateral control should provide enough roll control to establish a very positive recovery roll rate. If full roll control application is not satisfactory, it may then be necessary to apply some rudder in the direction of the desired roll.

CAUTION

Only a small amount of rudder is needed. Too much rudder applied too quickly or held too long may result in loss of lateral and directional control or structural failure.

Recovery from nose high, high bank angle

Pilots must apply nose down elevator but maintain bank angle in order to quickly reduce pitch attitude. As the nose approaches the horizon, bank angle should be reduced to zero and pitch attitude adjusted to recover normal airspeed.

Recovery from nose low, high bank angle

The nose-down, high bank angle upset requires prompt action from the pilot since altitude is rapidly exchanged for airspeed. Airspeed in that situation can rapidly increase beyond airplane design limits.

It is important to roll the aircraft to wings level before applying nose-up elevator, especially if bank angle exceeds 90 degrees.

Simultaneous application of roll control and thrust reduction may be necessary.

The pilot should also extend the speedbrakes as necessary.

SUMMARY

- The techniques assume that the airplane is not stalled. If it is, recovery from the stall must be accomplished first.
- It is possible to consolidate and incorporate recovery techniques into the two basic scenarios described on page 4 of this chapter :

- **Nose-high recovery** :

PF	PNF
Recognize and confirm the situation	
AP . . . . DISCONNECT A/THR . . . . OFF	
	CALL OUT ATTITUDE, AIRSPEED and ALTITUDE throughout the recovery
APPLY Nose-down elevator up to FULL deflection APPLY Nose-down trim as appropriate REDUCE Thrust ROLL to obtain a nose down pitch rate	Verify all required actions have been completed and call out any omissions.
COMPLETE the recovery : ● When approaching the nearest horizon, roll to wings level ● CHECK airspeed and adjust thrust ● ESTABLISH pitch attitude.	

CAUTION

Excessive use of PITCH TRIM or RUDDER may aggravate an upset situation or may result in loss of control and/or structural failure.

- **Nose-low recovery** :

PF	PNF
Recognize and confirm the situation	
AP . . . . DISCONNECT A/THR . . . . OFF	
	CALL OUT ATTITUDE, AIRSPEED and ALTITUDE throughout the recovery
ROLL in the shortest direction to wings level (unload and roll if bank angle is more than 90 degrees) REDUCE Thrust	Verify all required actions have been completed and call out any omissions.
RECOVER to level flight : ● APPLY Nose-up elevator ● APPLY Nose-up trim, if required ● ADJUST thrust and drag, as required	

CAUTION

Excessive use of PITCH TRIM or RUDDER may aggravate an upset situation or may result in loss of control and/or structural failure.

OPERATIONS WITH HOT JP4

In case of use of hot JP4, temporary OUTR TK feeding while fuel being available in CTR TK might be experienced. The following procedure has to be applied when OUTR TK fuel quantity is below 2500 kg while CTR TK is not empty.

OUTR TK FUEL QTY . . . . MONITOR

- **If OUTR TK FUEL QTY decreases below 2000 kg** :

  CTR TK PUMPS . . . . CHECK ON

  OUTR TK PUMPS . . . . OFF

  INR TK PUMPS . . . . OFF

  CTR TK FUEL QTY . . . . MONITOR

CAUTION

Avoid negative load factors

- **When CTR TK FUEL QTY below 1000 kg** :

  OUTR TK PUMPS . . . . ON

  INR TK PUMPS . . . . ON

CGCC ABNORMAL OPERATION ON GROUND

a) Checks during refueling

During the refueling, the CGCC checks the validity of the FQI fuel weight data depending on signals from the calibration sensors in trim tank, inner tanks and center tank. As soon as the calibration sensors in the inner tanks, center tank and trim tank are wet, the corresponding fuel weight is computed by the CGCC (taking into account aircraft attitude) and a comparison is made with the FQI fuel weight data. The CGCC monitors also abnormal steps in the fuel weight data received from FQI.
In case of unsuccessful checks the CGCC goes to Alternate mode (refer to page 6)

Note : *When refueling with aircraft supplied by batteries only, the CGCC may go to alternate mode in case of low battery voltage . Reset through maintenance panel (after BITE reading) is possible.*

Recommendation : When refueling is completed, the flight crew should check the status of the CGCC on the left ECAM CRT. If CGCC has gone to Alternate mode following message is displayed on left ECAM CRT :

FUEL
TRIM TK AFT XFR NOT AVAIL.

This check allows to inform ground crew, as soon as possible, if a reset of the CGCC is necessary.

b) ZFW or ZFCG disagree

On ground a message is sent by the CGCC to the FWC in case of problem detected during initialization of ZFW and ZFCG.
The CGCC compares ZFW and ZFCG values received from both FMS.
The CGCC triggers the ZFW or ZFCG DISAGREE message in the following conditions :

- If the difference between values received from FMS 1 and FMS 2 exceeds a certain tolerance in case of dual FMS operation (independent operation).
- If only one FMS in operative, the CGCC accepts the first insertion of ZFW but the next change in ZFW or ZFCG leads to the ZFW or ZFCG DISAGREE message (as there is no possibility of cross check with other FMS).

The following information is provided to the crew :

· MASTER CAUTION lights
· Message on left ECAM CRT :
FUEL
ZFW OR ZFCG DISAGREE
PROC : TRIM TK SYST INIT
associated with the STATUS message :
PROC : TRIM TK SYS INIT.

The flight crew procedure requests to compare TOGW and TOCG computed by the CGCC (and displayed on ECAM FUEL page) with the load and trim sheet data. If the differences are within tolerances (1.5 % for TOCG and 1000 kg (2200 lbs) for TOGW) no further action is required. If the differences are out of tolerance, a new insertion of ZFW and ZFCG is requested. A new comparison between CGCC computation and load and trim sheet data is made. If the differences are within tolerances, no further action is required. The ECAM message is inhibited at slats retraction. If the differences are still out of tolerances, the trim tank system must not be used and both TRIM TK PUMP p/b switches must be selected OFF to deactivate the CGCC.

Mod. : 4801 + 6874

1. GENERAL

- A severe/extreme turbulence is identified as turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in airspeed. Passengers and crew are moved violently against their seat belts and loose objects will move around the aircraft.

  Note : Operational recommendations are the same for severe and extreme turbulence.

- Moderate to severe turbulence may be expected under the following weather conditions :
  - inside and close to thunderstorm cells,
  - close to frontal surfaces,
  - in mountain wave or dynamic gravity waves (even in the absence of lenticular clouds),
  - on the polar side of a jet-stream (particularly if the jet stream core velocity exceeds 100 kt).
- Clear Air Turbulence (CAT) may be experienced in any of the following conditions :
  - vertical wind gradient (rate of change or shear rate) greater than 5 kt/1000 ft,
  - horizontal wind gradient (rate of change) greater than 40 kt/100 nm,
  - horizontal temperature gradient (OAT/SAT rate of change) greater than 4° C/100 nm,
  - route is close to the polar side of a jet stream exceeding 100 kt,
  - route is close to an altitude trough of low pressure.
- The following information can be used, together with the above guidance, to assess the potential for experiencing severe turbulence :
  - significant weather charts (surface and altitude),
  - upper winds forecast (winds aloft),
  - AIRMET (report) or SIGMET (forecast) messages.

2. PLANNING THE FLIGHT

- Whenever possible, the flight should be planned to avoid areas of forecast severe turbulence.
- If avoiding areas of severe turbulence is not practical, the cruise altitude and MN should be selected at or below the optimum altitude to provide sufficient buffet margin (FCOM FLIGHT PLANNING chapter – CRUISE LEVEL CHART).

3. PREPARATION FOR SEVERE TURBULENCE

Whenever experiencing or anticipating moderate or severe turbulence, the following readiness actions should be performed :

SEAT BELT SIGN . . . . ON

NO SMOKING SIGN . . . . ON

IGNITION . . . . CONT RELIGHT

AP . . . . KEEP IN CMD

- **If in PROFILE mode :**

  SPD/MACH setting knob . . . . PULL/ADJUST

  - Pulling the SPD/MACH setting knob results in a manual reversion from PROFILE to LVL/CH (if in climb or descent) or to ALT HLD (if in cruise) and provides more auto-pilot authority to cope with turbulence.

- **In all AP modes :**
  - Do not resist or override AP orders ; this would result in an unintended AP disconnection and possibly further upset of the aircraft attitude and flight path.
  - If AP disconnection is desired or required, use the AP instinctive-disconnect push-button on the control wheel.
  - Be aware that large g-load variations are the result of the turbulence vertical gusts but not of the AP inputs.
  - Do not use CWS mode, this mode is designed to provide a sensitive pitch response and is not recommended for flight in turbulence.

A/THR . . . . KEEP ENGAGED

TARGET SPEED AND THRUST . . . . READ AND NOTE

SPD/MACH . . . . SET TARGET SPEED

ALTITUDE . . . . . CONSIDER DESCENT AT OR BELOW OPTIMUM ALTITUDE

- When flying in severe turbulence at the turbulence penetration target speed, consider flying at or below optimum altitude to provide sufficient margin buffet.

TRIM TK MODE (if applicable) . . . . FWD

- Selecting the TRIM TK MODE FWD will move the CG forward at a rate of approximately 1 % CG/minute, thus increasing the aircraft stability and response to the turbulence.

LOOSE EQUIPMENT IN FLIGHT DECK . . . . . . SECURE
SEAT BELT/SHOULDER HARNESS . . FASTEN/TIGHTEN

TARGET SPEED AND THRUST SETTING

Refer to the TARGET SPEED AND TARGET N1 table in QRH 13.04.

4. WHEN IN SEVERE TURBULENCE

In addition to the preparation actions, perform the following :

A/THR . . . . DISCONNECT
THRUST . . . . SET TARGET THRUST

– Minimize thrust changes and allow airspeed excursions as long as within operating and buffet margin limits.

ALTITUDE . . . . . DESCENT AT OR BELOW OPTIMUM ALTITUDE

CAUTION

At the turbulence penetration target speed, the altitude must provide sufficient margin to buffet to face severe turbulence. Flying at or below optimum altitude ensures at least 1.4g buffet margin

- **If AP does not perform as desired :**

  AP . . . . DISCONNECT
  PITCH ATTITUDE/WINGS LEVEL . . . . . . MAINTAIN

  – Use moderate pitch control inputs.
  – Do not change pitch trim setting once established.
  – Do not chase altitude, give priority to maintaining pitch attitude rather than altitude.

  - **When the turbulence is over or the upset has been recovered :**

    AP . . . . . CONSIDER RE-ENGAGEMENT IN CMD (ALT HLD or LVL/CH)

- **If SPD BRK are used :**

  SPD BRK . . . . USE WITH CARE/KEEP HAND ON HANDLE

5. WHEN OUT OF TURBULENCE

A/THR . . . . RE-ENGAGE
TRIM TK MODE (if applicable) . . . . AUTO
IGNITION . . . . OFF
SIGNS . . . . AS RQRD

6. REPORTING

A turbulence encounter must be reported at pilot’s discretion or if load factor is suspected to have reached + 2.5/– 1.0 g in clean configuration or + 2.0/0.0 g with slats and/or flaps extended.

1. GENERAL

- In severe turbulence, exceeding VMO or MMO may be experienced before or despite following the turbulence penetration target speed. Speed excursions are the result of sudden and significant horizontal gusts.
- In FMS PROFILE mode, exceeding VMO/MMO may be observed (particularly during climb and descent) in case of high and increasing head-wind component. A high Cost Index increases the FMS target speed and, therefore, the potential for a VMO/MMO exceedance.

2. PREVENTING VMO/MMO EXCEEDANCE

- In all flight conditions, monitor the airspeed and the speed trend arrow on the PFD.
- If in PROFILE Climb or Descent and speed is close to VMO/MMO with an increasing speed trend, select a lower target speed on the FCU and pull the SPD/MACH setting knob to revert to LVL/CH mode.
- If in PROFILE Cruise and speed is close to MMO with an increasing speed trend, select a lower Mach number target on the FCU and pull the SPD/MACH setting knob to revert to ALT HLD mode.
- VMO/MMO exceedance in descent can be prevented by using either one or a combination of the following techniques :
  - In PROFILE mode :
    - by reducing the Cost Index prior to the top-of-descent point in order to reduce the FMS target speed (refer to the DESCENT SPEED graph provided in FCOM PROCEDURE and TECHNIQUES chapter - USE OF FMS),

      or
    - by selecting the TACT mode with the desired MN or IAS as selected speed.
  - In LVL/CH mode, by selecting on the FCU a Mach number value offering a margin relative to MMO and by using the PRESET function to preset a speed value offering a margin relative to VMO. This will prevent exceeding VMO when the target speed switches over from MACH (MN) to SPD (IAS).

3. RECOVERY FROM VMO/MMO EXCEEDANCE

- If in PROFILE mode, select a lower Mach number or speed target on the FCU and pull the SPD/MACH setting knob to revert from PROFILE to ALT HLD (cruise) or LVL/CH (climb or descent).
- If in ALT HLD or LVL/CH, reduce the Mach number or speed target on the FCU.
- If necessary, disconnect the A/THR (using the instinctive disconnect push-button) and set thrust manually, as required.

CAUTION

NEVER OVERRIDE THE AUTOPILOT BY APPLYING FORCE ON THE CONTROL COLUMN

- Do not use the CWS mode, this mode features a sensitive pitch response and is not recommended for flight in severe turbulence or for recovery from a turbulence or overspeed upset.
- If deemed necessary, disconnect the Auto-pilot (using the AP instinctive disconnect push-button on the control wheel) and fly the aircraft manually with small control inputs.
- If SPD BRK are used, use with care and keep hand on handle.

4. REPORTING

- Any overspeed reaching or exceeding VMO + 20 kt or MMO + 0.02 must be reported for maintenance action.
- Exceedances, not reaching VMO + 20 kt or MMO + 0.02, must be reported only if the load factor is suspected to have reached 1.2 g or more.

1. GENERAL

- Mach number buffet (buffet onset) may be experienced at high speed (typically above MN 0.6) and high altitude.
- Mach number buffet may be experienced at both ends of the cruise speed operating range.
  - At the low speed end, VLS provides a 0.3 g margin relative to the Mach number buffet onset.
  - At the high speed end, the margin relative to the Mach number buffet onset must be managed by selecting the cruise altitude or Mach number, as a function of the gross-weight, in order to maintain a 0.3 g buffet margin (refer to the CRUISE LEVEL CHART and BUFFET MARGIN graph provided in the FCOM FLIGHT PLANNING chapter).
- Mach number buffet onset may be experienced whenever :
  - flying below VLS at high altitude,
  - flying above the MN value providing 0.3 g buffet margin (for the prevailing gross weight and altitude),
  - increasing the load factor (turn or pull-up maneuver), at any speed, thus decreasing the available buffet margin.

2. PREVENTING MACH NUMBER BUFFET

- Preventing Mach number buffet involves a careful planning and management of the buffet margin (margin relative to the Mach number buffet onset).
- The following FCOM references are available in order to assess and manage the buffet margin :
  - LIMITATIONS : BUFFET ONSET graph,
  - FLIGHT PLANNING : CRUISE LEVEL CHART and BUFFET MARGIN graph.
- Whenever flying above the Optimum Altitude, the Maximum Bank Angle Selector should be set to 15° (as recommended in the FCOM PROCEDURES and TECHNIQUES - USE OF AFS), in readiness for a possible manual reversion from NAV to HDG SEL.

3. RECOVERY FROM MACH NUMBER BUFFET

- Keep AP engaged in CMD, unless otherwise required.
- Should Mach number buffet onset be experienced as the result of flying below VLS, check the FMS target speed or the FCU target speed and set a target speed providing adequate margin relative to VLS (e.g. Green Dot or turbulence penetration speed).
- Should Mach number buffet onset be experienced as the result of flying at high MN (e.g. high Cost Index, high headwind component or high selected MN), reduce the selected or target MN (Refer to Recovery from VMO/MMO exceedance).
- Should Mach number buffet onset be experienced during a turn, reduce slowly the bank angle demand using small roll inputs (large roll inputs would result in roll spoilers deflection and would, thus, further increase the buffeting level). Should the pitch attitude have decreased during the turn, apply small pitch inputs (large pull-up inputs would further increase the load factor and, therefore, the buffeting level).
- Consider reducing the altitude to correspondingly increase the buffet margin.

1 - GENERAL

- Moderate to heavy rain, hail or sleet precipitations may be encountered in thunderstorm cells, in a broad region ahead of warm fronts, in the vicinity of cold fronts as well as in squall lines which can form ahead of a fast moving cold front.
- Hail may be also encountered in clear sky on the downwind side of a thunderstorm.

2 - AVOIDANCE

- Flights should be conducted to avoid thunderstorm activity and - to the maximum extent possible - any area of anticipated moderate to heavy precipitation, by overflight or circumnavigation.
- Ground based weather radar reports, on board weather radar (enhancing gain, tilt and range management), other pilot reports and direct observation may be used by the flight crew to determine when moderate to heavy rain, hail or sleet precipitation is anticipated.

3 - EFFECT OF WATER INGESTION ON HIGH BY-PASS TURBOFAN ENGINES OPERATION

- Considering given weather conditions, the water/air ratio ingested by the engine is in direct relation with the engine power level and the aircraft airspeed.
- The ingested water/air ratio is significantly increased when operating at the minimum thrust level and high airspeed (typical idle descent conditions).
- During idle descent through heavy rain, hail or sleet, massive water ingestion may result in engine surge, roll-back or flame-out.
- Adhering to the following operational recommendations, will provide the necessary level of protection against engine instability, thrust loss and/or flame-out.

4 - OPERATION IN OR NEAR MODERATE TO HEAVY PRECIPITATION

- Should flight in or near moderate to heavy rain, hail or sleet be encountered or anticipated, the following preventive crew actions should be carried out :

IGNITION . . . . CONT RELIGHT

– Selecting the continuous ignition will enhance the flame-out protection and maximize the rapid relight capability in the event of a roll-back or flame-out.

ENG ANTI ICE . . . . AS REQD

– ENG ANTI ICE should be selected ON only if icing conditions exist.

WING ANTI ICE . . . . AS REQUIRED

– WING ANTI ICE should be selected ON only if icing conditions exist.

A/THR . . . . DISCONNECT

– Rapid throttle levers movement should be avoided, unless excessive airspeed variations occur.

– If thrust changes are required, throttle levers movements should be performed smoothly.

– Changing throttle levers position should be avoided until the engines have stabilized at a selected setting.

– The engines may exhibit a slow throttle response, the engine response will return to normal upon leaving the area of heavy precipitation. No crew action is required unless abnormal engine parameters and/or engine behaviour is observed.

ENGINE PARAMETERS . . . . MONITOR

– Engine parameters fluctuations may occur but will subside immediately upon leaving the area of heavy precipitations. No throttle levers action should be made to correct these fluctuations.

THRUST (conditions permitting) . . . . . . INCREASE

– Although maintaining a minimum N1 is not required, flight profile permitting, engine operation above the idle level will significantly increase the engine tolerance to water ingestion and consequently its protection level against surge, roll-back or flame-out.

APU . . . . START

– If available, the APU may be started in readiness for a starter assisted relight in the event of an engine flame-out.

AIRSPEED (conditions permitting) . . . . DECREASE

– Conditions permitting, decreasing the aircraft airspeed results in a corresponding decrease in the ingested water/air ratio, thus providing additional surge and flame-out protection.

5 - RAPID RELIGHT ATTEMPT IN CASE OF ENGINE ROLL-BACK OR FLAME-OUT

- The potential for engine roll-back or flame out, when operating in moderate to severe rain or hail, is mainly R associated with idle descent and approach or any phase of operation at minimum thrust.
- When operating under the above conditions, flight crews should be alert to recognize any indication of thrust loss, surge, roll-back or flame-out.
- Engine roll-back or flame-out will be indicated by the activation of the ENGINE FAIL message and procedure.
- If a single or double engine power loss (roll-back or flame-out) is experienced :

ENGINE FAIL procedure . . . . APPLY

- Should the immediate relight attempt be unsuccessful, the engine should be shutdown and a normal windmilling or starter assisted in flight restart attempted :

ENG RESTART IN FLIGHT procedure . . . . . APPLY

R
R
R
R
R
R
R
R
R
R
R
R
R

IMPORTANT

. Water ingestion has been shown to degrade engine starting characteristics, repeated inflight start attempts may be necessary to restore engine power. Start attempts should be initiated immediately.

. A successful engine restart may not be possible until the aircraft has exited the area of moderate to heavy rain, hail or sleet.

. Upon restart, the engine acceleration up to stabilized idle may be very low and should not be misinterpreted as a failure to start or an engine malfunction.

1 – ICING CONDITIONS

Icing conditions may be expected when the OAT (on the ground and for take-off) or the TAT (in flight) is below 8° C and there is visible moisture in the air (such as clouds, fog with low visibility, rain, snow, sleet, ice cristals) or standing water, slush, ice or snow is present on the taxiways or runways.
In addition to the above conditions, be alerted by ice buildup on unheated portions of the airplane visible from the cockpit.

An ECAM MEMO : TAT IN ICING RANGE appears when the TAT is between + 5°C and – 15°C.

2 – PROCEDURES

CAUTION

Extended flight in icing conditions with slats extended should be avoided.

2.1. ENGINE ANTI-ICE

A. Use of ENG ANTI ICE

WARNING

Use the criteria of temperature and visible moisture as the primary means for selecting on the anti ice system without waiting for ice build up.

The ENG ANTI ICE system must be selected ON during all ground and flight operations when icing conditions exist or are anticipated, except during climb and cruise when SAT is below – 40°C.

R ENG ANTI ICE must be selected ON when icing conditions
R exist or are anticipated, prior to the top-of-descent and during descent, even if SAT is below – 40°C.

IGNITION must be set to CONT RELIGHT before selecting the ENG ANTI ICE to ON. After engine parameters have stabilized, ignition may be set to OFF.

WARNING

If ice accretion is suspected to have built-up on the engine air inlet, retard throttle lever on one engine at a time, select CONT RELIGHT and set ENG ANTI ICE ON, readvance throttle lever to desired thrust level.

Retarding the throttle lever will reduce the engine N1/N2 speeds and will minimize the risk of internal damage to the engine should the ice build-up break loose and be ingested by the engine.

Selecting ignition to CONT RELIGHT will minimize the potential for engine flame out due to ice ingestion.

If the engine is at ground idle when ENG ANTI ICE is selected during descent, it will advance to flight idle.

Notes : 1. *Electrical power supply failure will cause the nose cowl anti-ice valve to open when air pressure is available, independently of control switch position.*
2. *Unnecessary use of the engine anti-ice system should be avoided as performance is adversely affected.*

B. Ice shedding on ground

During ground operation when engine anti-ice is required, periodic engine run-ups should be performed to shed ice from the spinner, fan blades and low pressure compressor stators. Run-ups must be to a minimum of 50% N1. There is no requirement to maintain the high N1.

Run-ups should be performed at intervals no greater than 15 minutes, and are equally important during taxi-out, ground holding, and taxi-in.

The first run-up during taxi-out should be done as soon as practical, but not more than 15 minutes after engine start.

All takeoffs when anti-ice is required must be preceded by a static run-up to a minimum of 50% N1 with observation of all primary engine parameters to ensure normal operation.

C. Ice shedding in flight

If during flight in icing conditions, ice build up on fan spinner and fan blades is suspected (as evidenced by increasing or high engine vibration level), the following ice shedding procedure should be carried out :

IGNITION . . . . CONT RELIGHT

THROTTLE (affected engine) . . . . SET 70 % N1

NOTE : Flight profile permitting, more than 70 % N1 may be set for more complete ice shedding.

ENGINE PARAMETERS . . . . MONITOR

ENGINE VIB LEVEL . . . . MONITOR

NOTE : ENGINE VIB level may peak up to full scale, during shedding, before it decreases and stabilizes.

- When vibration level decreases and stabilizes :

RESUME NORMAL ENGINE OPERATION

IGNITION . . . . AS REQUIRED

The above ice shedding procedure may be carried out on a preventive basis, on one engine at a time, by spooling up the engine at 70 % N1 or above (flight profile permitting) for 10 to 30 seconds every 10 to 15 minutes.

PW Eng. : All

2.2. WING ANTI-ICE

- WING ANTI-ICE may be used either to prevent ice formation or to remove an ice accumulation from the wing leading edges.
  WING ANTI-ICE supply should be selected ON whenever there is an indication that airframe icing exists. This can be evidenced by ice accumulation around the cockpit windows or on the windshield wipers.
- Wing anti-ice supply by the APU is possible up to 20000 ft, providing one air conditioning pack only is used.

CAUTION

- Extended flight in icing conditions with slats extended should be avoided.
- If there is evidence of significant ice accretion and to take into account ice information on non heated structure, the minimum speed should be :
  - · in clean configuration, VLS + 15 kt
  - · in other configurations, VLS + 5 kt
  - · for landing, multiply landing distance by 1.1

Notes : 1. *Electrical power supply failure will cause the wing anti-ice valves to close, independently of control selector position.*

2. *THR LIMIT corrections and performance penalties are applicable only when wing anti-ice system is supplied by engine bleed air.*

CAUTION

- If WING ANTI-ICE is inoperative and ice accumulation is detected, the minimum speed should be :
  - · In clean configuration, VLS + 15 kt,
  - · In other configurations, VLS + 10 kt, R
  - · for landing, multiply landing distance by 1.2.

2.3 USE OF ICE DETECTION SYSTEM (IF INSTALLED)

Ice detection system does not anticipate ice conditions and therefore it should not be considered as a primary device for detecting icing conditions. The use of ice detection system leads to DE-ICE and not to ANTI ICE protection.

As the engine anti-ice system has been certified as an anti-ice protection, the criteria of temperature and visible moisture must be used as the primary means for selecting ENG ANTI-ICE without waiting for illumination of the « ICE » light on the overhead panel.

Wing anti-ice protection has been certified as a DE-ICING system, and therefore the selection of WING ANTI-ICE system can be based on the illumination of the « ICE » light on overhead panel.

1. GENERAL

- The following material provides operational recommendations and procedures concerning aircraft preparation for cold weather operation.
- Cold weather operation is understood to cover the following operating conditions :
  - – aircraft cold-soaked after stop-over in very low outside air temperature (typically below minus 15°C / plus 5°F),
  - – accumulation of frost, ice or snow on airplane surfaces.
- **The following recommendations and procedures are to be used in conjunction with the applicable company policy or national operational requirements.**
- The various procedural steps are presented hereafter in a typical sequence. This sequence may be adapted so as to suit specific operating requirements.
- For operations with OAT below – 40° C, it should be ensured that the specific cold weather maintenance procedures before and after cold soak have been applied in accordance with the Aircraft Maintenance Manual (AMM) chapter 12.31.

2. APU START

- Check that the APU air intake and air conditioning packs deflect doors and modulating flaps are free from snow and ice ; de-ice as necessary.
- Remove all protective covers.
- Complete PRELIMINARY COCKPIT PREPARATION in accordance with normal procedures.
- Start-up APU.

Note : After cold soak in very low temperatures (below minus 15°C) it is recommended to start APU using External Ground Power Unit electrical supply.

Note : For APU start :
If 30 sec after MASTER SW ON the APU FLAP FAULT indication appears on ECAM :
• Wait for 30 sec
• If APU FLAP FAULT disappears :
APU START . . . . depressed

3. CABIN WARM-UP AND WINDOW/PROBE PRE-HEATING

- Set air conditioning (COMP TEMP Selectors) as required.
- Select PROBE HEAT and WINDOW HEAT (white lights extinguished).

4. EXTERIOR WALKAROUND SAFETY INSPECTION

- Check that ALL SURFACES of the airplane (wings including slats/flaps and all control surfaces, horizontal stabilizer and elevators, fin and rudder) are FREE OF FROST, ICE AND SNOW.
- As required, FROST, ICE AND SNOW MUST BE CLEARED FROM ALL ABOVE SURFACES BEFORE TAKE-OFF (refer to § 5 hereafter, GROUND DE-ICING/ANTI-ICING).
- A thin layer of rime (thin hoar-frost) or a light coating of powdery (loose) snow is acceptable on the upper surface of the fuselage.

Note : Thin hoarfrost is a typical white cristalline deposit which usually develops uniformally on exposed surfaces during cold and cloudless nights; which is thin enough to distinguish surfaces features underneath (lines or markings).

- Frost on the underside surface of the wing, in the area of fuel tanks, is acceptable, if due to cold fuel (low fuel temperature, OAT above freezing and high humidity).
  - – A frost layer not exceeding 3mm (1/8") is acceptable without effect on take-off performance.

- Check that the following AREAS or EQUIPMENT are FREE OF FROST, ICE AND SNOW :
  - – Radome
  - – Probes (Pitot tubes, TAT sensor, Angle-of-Attack sensors, static ports),
  - – Engine inlets (nose cowl lip, fan spinner, fan free rotation, engine probes and sensors)
  - – Engine cowlings and reverser assemblies,
  - – Landing gear assemblies (tires, wheels and brakes, actuating and locking mechanisms, doors),
  - – Outflow valves, Water drains,
  - – Fuel tank vents,
  - – Commercial water equipment : the potable water tank should be drained and refill in accordance with the following requirements :

Configuration			Exposure time	Water tank drain
air cond.	Cabin temp.	OAT		
ON	Above 10°C	Between 0 and -15°C	Any	Not required
		Below -15°C	1 h 15 min	Required
OFF		Between 0 and -7°C	1 h 30 min	
		Between -7 and - 15°C	0 h 45 min	
		Below -15°C	any	
After required draining, refilling shall be performed 30 minutes before engine start with warm water (30°C)				

R 5. GROUND DE-ICING/ANTI-ICING

DE-/ANTI-ICING FLUIDS/HOLDOVER TIMES

R All information related to de-/anti-icing fluids and holdover
R times are published by the Association of European
R Airlines (AEA) in the brochure : "RECOMMENDATIONS
R FOR DE-ICING/ANTI-ICING OF AIRCRAFT ON THE GROUND".

PROCEDURE

Under all circumstances, it is the Captain's responsibility to decide on the need to de-/anti-ice the aircraft, or to order a repeated treatment.

CAUTION

If repeated anti-icing is necessary, the surfaces must first be de-iced with a hot fluid mix before a further application of anti-icing fluid is made.

De-/anti-icing fluids should be used in accordance with applicable company requirements and Aircraft Maintenance Manual Instructions.
Good communication with the ground personnel, responsible for de-/anti-icing should be established before commencing the procedure.
Aircraft de-icing may be performed with engines and APU stopped, with APU running or with engines running. However, Engines or APU should not started while de-/anti-icing fluid is being sprayed on the aircraft.

CAUTION

- Indiscreminate usage or ingestion of de-icing fluid into the engine or APU air intake should be avoided.
- Do not move flaps/slats, flight control surfaces and trims if they are not free of ice
- The aircraft must always be treated symmetrically : the left and right hand side must receive the same and complete treatment.

The following table summarizes the crew actions associated with each de-icing option :

	Engines and APU stopped	APU Running	Engines Running
– Close APU BLEED VALVE (before starting spraying operation).		X	
– Close engine BLEED VALVES (before starting spraying operation).			X
– Close PACK VALVES.		X	X
– Check that throttles/engines are at idle.			X
– Upon completion of spraying operation,			
* ensure pitch trim is in take-off position.	X	X	X
* restore APU bleed or engine bleed, as required,		X	X
* Set PACK VALVES on,		X	X
* As applicable, turn off the PTU's and GREEN ELEC PUMPS.	X	X	

CAUTION

With passengers on board it is not recommended to exceed 20 minutes without air conditioning supply.

The lack of fresh air supply will reduce cabin air quality significantly.

- ● After de-icing is completed, request ground crew to confirm that the aircraft is cleared from any ground equipment.
- ● Perform TAXI Check-List, while taxying out after de-icing.

– Ground equipment . . . . REMOVE

– DE-ICING/ANTI-ICING REPORT . . . . RECEIVED

The information from ground personnel who carried out de-icing and post application check must include (ANTI-ICING CODE) :

. What Type of fluid used R

. What the mix ratio of fluid to water was (e.g. 75/25)

. When the holdover time began

. Result of post application check : aircraft critical parts are clean.

– NORMAL PROCEDURE . . . . RESUME

Apply appropriate normal procedures ; special attention should be paid to flight controls check.

When freezing precipitation exists, consider the appropriate checks to assess the aircraft contamination.

Decision on whether to take-off or to re-protect the aircraft should be based on the actual contamination of the critical surfaces which is judged by checks from inside or outside the aircraft prior to exceeding the holdover time or just prior to take -off.

Note : If the fuselage has been sprayed, there is a risk of ingestion of de-icing fluid into the APU air intake, resulting in specific odors and/or smoke warnings (e.g. : upper deck cargo smoke,...). Thus, consider APU bleed off during takeoff.

LEFT INTENTIONALLY BLANK

1. GENERAL

- The following material provides operational recommendations and procedures for aircraft operation in forecasted or suspected windshear / down burst condition.
- Flight crew awareness and alertness are key factors in the successful application of the following precautionnary recommendations and recovery techniques.

2. PRECAUTIONS INTO SUSPECTED WINDSHEAR

- Before TAKE-OFF :
  - DELAY TAKE OFF until conditions improve.
  - ASSESS CONDITIONS for SAFE TAKE-OFF based on :
    - * visual observations,
    - * most recent weather reports, and forecast,
    - * crew experience with the airport environment and the prevailing weather conditions.
  - SELECT the MOST FAVOURABLE RUNWAY (considering the location of the likely windshear/ downburst condition).
  - SELECT the LOWEST POSSIBLE FLAPS SETTING compatible with takeoff requirements, to maximize the climb-gradient capability.
  - USE the WEATHER RADAR before the take-off run to ensure the flight path is clear of potential hazard.
  - SELECT MAXIMUM TAKE-OFF POWER (TOGA).
  - CLOSELY MONITOR AIRSPEED during the take-off RUN to detect any early evidence of windshear.
  - After triggering the go Levers, SELECT FPV on PFD of PNF.
- During APPROACH :
  - DELAY LANDING until conditions are more favourable or DIVERT to another suitable airport.
  - ASSESS CONDITIONS for SAFE LANDING based on :
    - * outside observations,
    - * most recent weather reports,
    - * crew experience.
  - SELECT the MOST FAVOURABLE RUNWAY in conjunction with an appropriate approach aid.
  - SELECT FPV on PFD of PNF.
  - USE the WEATHER RADAR before the APPROACH to ensure the flight path is clear of potential clues.
  - R SELECT FLAPS 20° FOR LANDING.
  - ENGAGE AUTO PILOT in CMD, for more accurate approach and earlier information of BEAM deviation, when ILS is available.
  - SELECT VAPP (WIND CORR based on reported surface wind).
  - MONITOR GROUND SPEED :
    - * If GROUND SPEED reaches VAPP - 10 Kts, advance throttles to maintain GS ⩾ VAPP- 10 Kts (IAS will increase accordingly).
  - MONITOR INDICATED AIRSPEED :
    - * Maintain IAS > VAPP.

3. RECOVERY TECHNIQUE AND PROCEDURES

- TAKE-OFF
  - Before V1 :
    - * The take-off should be rejected only if unacceptable airspeed variations occur (not exceeding target V1) and pilot decides there is sufficient runway remaining to stop the airplane.
  - After V1 :
    - * Disconnect Autothrottle and set or maintain throttle levers to MAXIMUM TAKE-OFF thrust.
    - * Rotate normally at VR.
    - * Follow SRS commands. If FD pitch bar not available maintain pitch attitude close to (but not exceeding) 17.5°.
  - During initial climb :
    - * Disconnect Autothrottle and set or maintain throttle levers to MAXIMUM TAKE-OFF thrust.
    - * If AP is engaged in CMD, keep AP engaged.
    - * If AP is not engaged, do not engage AP. Follow SRS commands. If FD pitch bar is not available, maintain pitch attitude close to 17.5°.
    - * CLOSELY MONITOR the FLIGHT PATH (using FPV on PFD of PNF) and the AIRSPEED,
    - * ALLOW AIRSPEED to DECREASE to INTERMITENT STICK-SHAKER activation, while checking SPEED MARGIN on PFD.
    - * DO NOT CHANGE CONFIGURATION (gear, flaps) until OUT OF SHEAR condition.
    - * RECOVER SMOOTHLY to NORMAL CLIMB when OUT OF SHEAR condition.
    - * INCREASE AIRSPEED when POSITIVE CLIMB confirmed.
- LANDING :
  - * TRIGGER « GO » LEVERS, set and maintain MAXIMUM GO-AROUND THRUST.
  - * If AP is engaged in CMD, keep AP engaged.
  - * If AP is not engaged, do not engage AP. Follow SRS commands. If FD pitch bar is not available, maintain pitch attitude close to 17.5°.
  - * DO NOT CHANGE CONFIGURATION (gear, flaps) until OUT OF SHEAR condition.

Mod : 7187

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* ALLOW AIRSPEED to DECREASE to INTERMITTENT STICK-SHAKER activation, while checking SPEED MARGIN and SPEED TREND on PFD.

* CLOSELY MONITOR the FLIGHT PATH (using FPV on PFD of PNF) and AIRSPEED.

* RECOVER SMOOTHLY to NORMAL CLIMB when OUT OF SHEAR condition.

* INCREASE AIRSPEED when POSITIVE CLIMB confirmed.

1. GENERAL

Following recommendations should be applied when operating from/to airports contaminated with loose/abrasive particles.

Possibility of loose (abrasive) particles ingestion should be considered when operating from sandy and dusty desert airports, coastal airports or from airports where sand is used to improve braking efficiency during (e.g) winter operation (Airport de-icing chemicals may also be erosive).

Recommended procedure would allow to minimize vortices which generate beneath the engine inlets and cause the ingestion of loose (abrasive) particles that blast fan and compressor blades, resulting in degrated engine performance and increase in fuel consumption.

Note : Vortices and foreing object ingestion commonly occur during :
- Throttle advance during cross-bleed starts
- Taxi break away thrust
- Initiation of take-off roll
- Reverse thrust at low airspeed

2. OPERATING TECHNIQUES

A. General considerations

- Minimize operation in particle contaminated air (when operational maneuvers of another aircraft that cause debris and fine particles to become airborne, all jeasable precautions should be taken
to avoid ingestion of such contaminant).
- Start engines on clean surfaces where possible.
- Campaign for good airport housekeeping.

B. Taxi

- Following brakes release, advance the throttles in a smooth, deliberate manner to the minimum required for breakaway.
- Return the throttles to ground idle when rolling.
- On airports areas where drifting contaminant is present, avoid sharp or high speed turns.
- Avoid engine overhang.
- Following a backtrack on the runway, wait for dust to clear before beginning the take-off.
- Judgement also suggests that reverse thrust not be used during taxi unless aircraft safety is endangered.

C. Take-off

- Make optimum use of the rolling take-off technique.
- Enter runway while rolling and slowly but without hesitation advance the throttles to take-off power setting.

  Note : If ATS is used for take-off, slightly delay triggering GO levers to prevent engine spool-up while aircraft is still at low speed.

D. Landing

- Limit reverse thrust use as much as possible.
- If use of max reverse thrust is anticipated, then apply reverse thrust upon main gear touchdown.
- At 80 kt IAS or IAS fluctuations, return reverse levers to reverse idle position.
- Set reverse levers to the stowed position when engines reach idle (approximately 60 kt IAS), unless use of reverse down to low speed is required for safe aircraft braking.
- For taxi, limit engine operation to ground idle as much as praticable.

E. Parking

- When an aircraft stays over at any airport where blowing loose (abrasive) particles are in evidence, engine inlet covers should be inslalled.

1. GENERAL

- . The following material provides operational recommendations and procedures for aircraft operation into areas of known or potential volcanic activity.
- . Considering the potential adverse effects, operation from or to airports contaminated with volcanic ash should be avoided, if possible.
- . Should volcanic ash exposure be unadvoidable, the following recommendations and procedures should be applied.

2. GROUND OPERATION

Parking

- . Aircraft exposed surfaces should be cleared of the ash layer which may contaminate the lubricated parts, penetrate the seals or enter the engines gas path, air conditioning system and other aircraft orifices.
- . During preflight, insure that the inlet and exhaust areas have been cleared of volcanic ash as much as possible. This ash may be removed by using brooms and vacuum cleaners.
- . Inspect and clean away (as far as practical) any volcanic ash within 25 feet of the engine inlets.
- . Prior to starting, dry motor the engine at maximum motoring speed for two minutes prior to turning the fuel on. This will help to blow out any ash that may have entered the booster area.
- . Do not use windshied wipers for ash dust removal.
- . Do not use APU for air conditioning and electrical power supply. Restrict ground use of APU to engine starts, as required.

Taxi

- . Following brakes release, advance the throttles in a smooth, deliberate manner to the minimum thrust level required for breakaway.
- . Return the throttles to ground idle when rolling.
- . Maintain the BLEED VALVES closed.
- . On airports areas where drifting contaminant is present, avoid sharp or high speed turns.
- . Following a backtrack on the runway, allow ash and dust to settle prior to initiating the take-off roll.
- . Avoid taxiing aircraft in contaminated areas wherever possible by the use of tugs to tow to clean or cleaner areas for engine start and preparation for TAKEOFF. On LANDING, again limit taxi to an area where tugs can be used to move around the airport.

Take-off

- . Make optimum use of the rolling take-off technique.
- . Enter runway while rolling and slowly but without hesitation, advance the throttles to take-off power setting.

  Note : *If ATS is used for take-off, slightly delay triggering GO levers to prevent engine spool-up while the aircraft is still at low speed.*

3. FLIGHT OPERATION

- . Flight into areas of known volcanic activity must be avoided. This is particularly important during hours of darkness or in meteorological conditions when volcanic dust may not be visible.
- . Avoidance is the only effective protection. Active NOTAM's, SIGMET's and recent information from meteorological broadcasting stations or ATC should be carefully considered by flight crews.

  Note : *Volcanic ash is composed of very small and dry particles and therefore do not provide any weather radar return.*
- . If a volcanic eruption is reported while in flight, the flight should remain well clear of the affected area and, if possible stay on the upwind side of the volcanic dust (typically 20NM upwind of the erupting volcano).
- . Volcanic ash cloud encounter may be suspected, should one or several of the following indications be observed :
  - – Smoke or dust appearing in the cockpit,
  - – Acrid odor similar to electrical smoke,
  - – At night, St. Elmo fire/static discharges appearing around the windshield,
  - – Bright white/orange glow appearing in the engine inlets,
  - – Landing lights casting sharp, distinct, shadows,
  - – Multiple engine malfunctions, such as increasing EGT, power loss, stall or flame out.
- . Should a volcanic ash cloud be encountered accomplish the following while initiating a 180° turn (so as to exit the volcanic ash cloud in the supposely shortest time) :

ATC . . . . NOTIFY

CREW OXYGEN MASKS . . . . ON / 100 %
– As smoke, dust or acrid odor similar to electrical smoke may be present/appear in the cockpit.

PASSENGERS OXYGEN . . . . AS RQRD
– Depending on contamination.

A/THR . . . . DISCONNECT
– This will prevent the autothrottle from generating throttles activity.

THRUST (conditions permitting) . DECREASE TO IDLE R
– So as to reduce ash ingestion, limit the EGT rise and, thus, limit the build-up of molten ash on turbine vanes. This will assist in maintaining the engine surge margin. Damage to rotating parts, due to erosion, will be also minimized.

IGNITION . . . . CONT RELIGHT
– Selecting the continuous ignition will enhance the flame-out protection and maximize the rapid relight capability in the event of a roll-back or flame-out.

PW Eng. : All

ENG ANTI ICE . . . . ON

WING ANTI ICE . . . . ON

AIR CONDITIONING . . . . NORM FLOW
– Increasing the bleed air extraction significantly increases the engine surge margin but also slightly decreases the engine acceleration capability.

APU . . . . START
– If available, the APU may be started in readiness for a starter assisted relight in the event of an engine flame-out and to provide electrical power in case of main engine power loss.

ENGINE PARAMETERS . . . . MONITOR

– EGT should be particularly monitored for any exceedance tendency.

– To prevent exceeding EGT limits it may become necessary to consider a precautionary engine shut-down and ENG RESTART IN-FLIGHT.

R R R *Notes : . For engine restart, switch off ENG ANTI ICE and WING ANTI ICE to optimize engine starting capability.*

. If first engine restart attempt is unsuccessful, repeated successive attempt should be made immediately.

. A successful engine restart may not be possible until the aircraft has exited the volcanic ashcloud.

. Upon restart, the engine acceleration may be very low and should not be misinterpreted as a failure to start or an engine malfunction.

. When clear of the volcanic ash cloud, and if engines have been restarted, avoid rapid thrust lever movement if possible. If compressor and or turbine blades have been eroded, an increase in fuel flow and EGT may be noticed.

AIRSPEED INDICATIONS . . . . MONITOR

– If unreliable or loss of airspeed indication is observed, establish the appropriate pitch attitude (and/or angle of attack) and thrust level (as required), as per the abnormal procedure for SPEED CONTROL WITH UNRELIABLE AIRSPEED INDICATION.

4. REPORTING

. Whenever operating in areas affected by volcanic activity, flight crews should be aware of volcanic activity reporting procedures and familiar with the use of the ICAO Special Air-Report of Volcanic Activity (Model VAR).

. Should a volcanic ash cloud be encountered, flight conditions and crew duties permitting, the ATC should be notified, providing information concerning the location, altitude and drift direction of the ash cloud.

5. APPROACH AND LANDING

. Communication difficulties may be experienced due to electrostatic conditions.

. Because of the abrasive effect of the volcanic ash on windshields and landing lights, the visibility for approach and landing may be significantly reduced.

. During landing, limit the use of reverse thrust as much as possible, as reverse flow may impair visibility.

. If use of maximum reverse thrust is anticipated, then apply reverse thrust upon main landing gear touchdown.

. At 80 Kts IAS or IAS fluctuations, return reverse levers to the reverse idle position.

. Set reverse levers to the stowed position when engines reach idle level (approximately at 60 kts IAS), unless use of reverse thrust down to low speed is required for safe aircraft braking.

PERFORMANCE PENALTY

Braking efficiency may be degraded by the layer of ash on the runway.
Landing performance data for wet runway (dry ash) or slush (wet ash) should be considered.

6. TAXI AND PARKING

. For taxi, limit engine operation to ground idle level, as much as practicle.

. Whenever an aircraft is planned to stay over at an airport contaminated with volcanic ash, engine inlet covers as well as other protective covers and plugs shoud be installed.

1 - WIPERS

The wipers may be selected to SLOW, FAST or OFF. When selected to OFF the wipers will automatically park.

Note : *The WIPERS must not be operated on a dry windshield.*

LIMITATION : MAX OPERATING SPEED 230 kt IAS

2 - RAIN REPELLENT

When the pushbutton is pressed, a timer applies a measured quantity of rain repellent fluid to the windshield. To repeat the cycle the pb must be released and pressed again.

- The Rain Repellent system performance,
  . are diminished by the simultaneous operation of the windshield wipers
  . are better at higher holding speeds than at slow approach speeds.

Rain repellent is normally used to aid visibility during heavy rain when the wipers are no longer effective.
It should be applied with the wipers OFF, the nozzle system giving an even coverage over the windshield area.

Note : *It should not be used on a dry or semi dry windscreen as the fluid will congeal and impare visibility. As a precautionary measure, the rain repellent should be applied only to one windshield at a time, preferably the CM2 first.*

CAUTION
RAIN REPELLENT MUST NOT BE USED AS WINDSHIELD WASHER, AND NEVER BE APPLIED TO A DRY WINDSHIELD.

3 - ICE ACCRETION ON UPPER WING SURFACE LIMITED AT OUTER TANKS SURFACE

It may happen that following prolonged flight and passing through moisture during descent, an ice accretion appears on the upper surface of wing limited on the outer tanks surface.

If noticed during the flight, it may be helpful to burn fuel from the outer tanks up to 1500 kg per tank, which will provide an air gap between the cold soaked fuel and wing upper skin and thus allow it to warm up quicker when the ambient temperature increases. In this case reduce the VMO by 5 kt.

Note : *For aircraft with a trim tank system, this may cause an alternate mode.*

If noticed during the turn around, the area must be de-iced prior to the next takeoff.
If the turn around time is sufficient and ambient temperature above zero, it is recommended to transfer the outer tank fuel to the inner or center tanks prior to refuelling. Removal of the cold soaked fuel and refuelling with fuel at ambient temperature may increase the temperature enough to melt the ice.

4 - OPERATION FROM FLUID CONTAMINED RUNWAY

Refer to chapter 18, SPECIAL OPERATIONS

5 - CROSSWIND

- In order to optimize directional control during the low speed phase of the takeoff and landing roll and according to the reported braking action given by the control tower it is not recommended to takeoff or to land with a crosswind component higher than : R

MAX CROSSWIND	REPORTED BRAKING ACTION	REPORTED FRICTION COEFFICIENT	EQUIVALENT RUNWAY CONDITION **
37 kt*	GOOD	0,40 and above	1
30 kt	GOOD/MEDIUM	0,39 to 0,36	1
25 kt	MEDIUM	0,35 to 0,30	2 / 3
20 kt	MEDIUM/POOR	0,29 to 0,26	2 / 3
15 kt	POOR	0,25 and below	3 / 4
5 kt	UNRELIABLE		4 / 5

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* : This is the maximum computed crosswind capability on dry and wet runway.

** : Equivalent runway condition (only valid for maximum crosswind determination). R R

1 : Dry, damp or wet runway (less than 3 mm water depth) without risk of hydroplaning.

2 : Runway covered with slush

3 : Runway covered with dry snow.

4 : Runway covered with standing water with risk of hydroplaning or wet snow.

5 : Icy runway or high risk of hydroplaning. R

Note : *For landing with one engine inoperative, max crosswind capability must be reduced by 2 kt.*

Note : *For landing with one thrust reverser inop, the remaining thrust reverser should not be used above idle when the crosswind component is higher than 20 kt.*

Note : *The maximum computed crosswind is greater than the maximum demonstrated crosswind (28 kt). This is due to the fact that no crosswind higher than the maximum demonstrated, was encountered during the flight test period. The maximum demonstrated crosswind should not be considered as a limitation.*

- During crosswind landing, a wings-level / crabbed approach is recommended. Just prior to touchdown, a normal cross control smooth action on the rudder and on the yoke is recommended in order to achieve the following operational objectives :
  - On the rudder, in order to zeroe the crab angle (or significantly reduce the crab angle in case of high crosswind)
  - Laterally on the yoke, in order to keep wings level (and if needed prevent the aircraft to drift away from runway centerline with slight into-wind wing down).

STD or Mod : 11974 or (11480 + 11974)

1 – GENERAL

For many forms of inclement weather, such as heavy rain, hail or sleet usually associated with thunderstorm activity, AVOIDANCE is the most effective protection.

Active SIGMET'S, ground based weather radar data, advisory information issued by ATC or other aircraft should be carefully considered by flight crews in addition to direct observation and/or on-board weather radar information.

The on-board weather radar system should be used and managed to maximize weather detection, with view of assuring a timely planning of avoidance or diversion maneuvers.

The on-board weather radar should be considered as an effective tool for in-flight weather detection and avoidance.

By no means, it should be considered as an incentive to penetrate thurderstorms or any other area of identified high weather activity.

The following material will provide flight crews with summarized information regarding the optimum use of on-board weather radars.

2 – DETECTION CAPABILITY

Only weather condition featuring reflective (wet) particles can be detected by means of the on-board weather radar.

As a consequence, the following conditions will be typically detected by the on-board weather radar :

- rain fall,
- wet hail
- wet snow or sleet,
- turbulence associated with rainfall shear.

Conversely the following conditions will provide little or no radar return :

- clouds and fog (droplets being too small),
- ice crystals, dry hail and dry snow,
- clear air turbulence (absence of precipitations)
- windshear (unless associated with precipitations, like in microbursts),
- volcanic ash (small and dry particles).

3 – TILT, RANGE AND GAIN MANAGEMENT

Because of the narrower beam and smaller side lobes featured by modern X-band/flat antenna weather radars, careful management of the system in term of tilt, range and gain is paramount to prevent overscanning or underscanning the weather cells and, thus assure the desired weather detection.

The center of the radar beam is referenced to the horizon, whatever the aircraft attitude, by the aircraft vertical reference system, the radar antenna tilt control should be, therefore, adjusted (as a function of the flight phase and/or selected range) so as to adequately scan for weather along the flight path.

As required the range and tilt should be periodically adjusted so as to keep track of detected weather cells as the flight progresses, and aim the radar beam at or below the weather cell maximum rainfall areas (typically below the feezing level).

The gain control should always be left in the automatic mode, unless specific display enhancement is deemed necessary.

4 – READING AND INTERPRETING WEATHER RADAR IMAGERY

The weather returns are displayed in different colors depending on the intensity of the detected precipitations, as follows :

- black : absence of or low precipitations,
- green : light rain,
- yellow : moderate rain fall,
- red : heavy rain,
- magenta : very severe rain fall and/or turbulence.

Hail may be expected in red and magenta areas.

Turbulence may be expected primarily in magenta areas but also in any area where high gradients in display intensity (e.g. close thin bands of different colors) are observed.

Independently of display color, high weather activity can be expected in areas exhibiting the following characteristics :

- weather contours featuring U-shapes, hooks, fingers or spirals,
- fast changing display (developing storm).

As indicated earlier, the radar energy is attenuated when penetrating weather cells with high levels of precipitations. In case of very high rain fall, the radar energy may be completely attenuated and, thus, be enable to detect the weather conditions behind the heavy rain fall area.

The undetected weather will therefore appears as a black (clear sky) bowed area surrounded by a red shoreline. Although painted black, such a weather display should never be approached or penetrated as it may in fact be an area of extreme weather activity and precipitations.

Should a weather cell be avoided by circumnavigation, the weather cell should be cleared by approximately 20 NM, avoiding the downwind side of the storm as hail may be present even in clear sky.

TIRES – GENERAL OPERATING PROCEDURES

An in-service surveillance of the tires, including pressure and wear checks, is strongly recommended to increase tire longevity and reliability. Avoid short turn manoeuvers which can cause bead separation from the wheel flanges, resulting in partial or complete loss of tire pressure. Large radius turns at low speed help preventing tire shoulder scrubbing and overdeflection.

TAXI WITH DEFLATED TIRES

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

- Maximum of 2 deflated tires on each main gear (one per axle) and/or 1 deflated tire on the nose landing gear :
  - · Nose gear steering angle less than 20° :
    - Speed limited to 20 kt.
  - · Nose gear steering angle of 20° or more :
    - Speed limited to 10 kt.
- 3 deflated tires on the same main gear :
  - · Nose gear steering angle limited to ± 50°
  - · Speed limited to 10 kt.
- 4 deflated tires on the same main gear :
  - · Nose wheel steering is not permitted.

USE OF BRAKE FANS

GENERAL

Brake fans are installed to improve heat dissipation and brake cooling. By reducing the time for cool-down they may prevent on short turn-around a takeoff delay caused by high residual brake temperature.
There are no limitations for brake fan operation.

Note : Indicated brake temperature on ECAM is significantly lower than actual brake temperature, when brake fans are activated.
The difference ranges from approx. 50°C at 100°C actual brake temperature up to approx. 150°C at 300°C actual brake temperature. Consequently an increase of indicated brake temperature will occur when selecting brake fans OFF.
With LDG GEAR retracted, brake fan operation is inhibited.

RECOMMENDED OPERATION

Preliminary Cockpit preparation

When AC BUS 1 and DC NORM BUS are powered (EXT PWR ON or APU operating-GEN on-line), select WHEEL page on ECAM SYS display and check brake temperature. If above 200°C without brake fan operating, select BRK FAN to ON.

Taxi

If residual brake temperature is indicated (arc displayed around the wheel) or if extended taxiing is expected, select BRK FAN to ON.

Before Take-off

Check brake temperature on SYS display.

- If BRK FAN is ON, indicated temperature must be below 150°C to ascertain actual brake temperature below 300°C.
- If above 150°C with BRK FAN is ON, delay takeoff and continue brake fan operation until indication drops below 150°C.

  Note : 300°C actual brake temperature constitutes the BRAKE TEMP HI threshold. Takeoff is only permitted with temperatures below.

BRK FAN select OFF.

Parking

Check brake temperature on SYS display.

- If below 100°C with brake fan operating, BRK FAN select OFF.
- If above 100°C leave brake fan ON.

Leaving the Aircraft

Select BRK FAN OFF regardless of temperature, if time delay to next takeoff is 2 hrs or more.

CAUTION

In case of brake/wheel fire, brake fans have to be selected OFF.

Code : 0028

CARBON BRAKES WEAR

- Steel brakes are such that wear is directly proportional to the energy applied – the stronger the brake demand, the greater the wear.

  This no longer applies for Carbon brakes where friction and wear characteristics are affected by a number of environmental parameters, such as temperature. Some of them must be underlined due to their great contribution to brakes wear :

  - Around 50 % of Carbon brakes wear appears when taxiing with cold brakes prior to takeoff.
  - Cold Carbon brakes are very touchy to numerous sollicitations.
  - Wear is proportional to the number of brake applications and not to the energy applied.
- This is why, when taxiing before takeoff, brakes should not be sollicited too often and nosewheel steering must be done with the appropriate cockpit command and not through the brake pedals.

UTILIZATION OF THE AUTOBRAKE SYSTEM

1. GENERAL

The autobrake system permits to maintain a constant deceleration rate during landing roll or to apply maximum braking to cover the case of an aborted takeoff.

Main advantages given by the autobrake system are :

- Reduction of pilot action during landing.
- Obtention of optimized deceleration rate fonction of runway length available.
- Smooth deceleration during landing roll.
- Performance improvement at takeoff due to the reduction of the delay of brake application in case of aborted takeoff.
- Brakes and tyre saving : the brakes only supply the torques necessary to maintain the selected deceleration.

2. OPERATION

The system is initiated by ground spoilers extension order (at throttles reduction if ground spoilers are armed). The pilot can take over at any moment by depressing one or both brake pedals (with different load threshold). Autobrake system is operative with GREEN hydraulic braking system only.
Selection of the deceleration rate is by the autobrake panel.

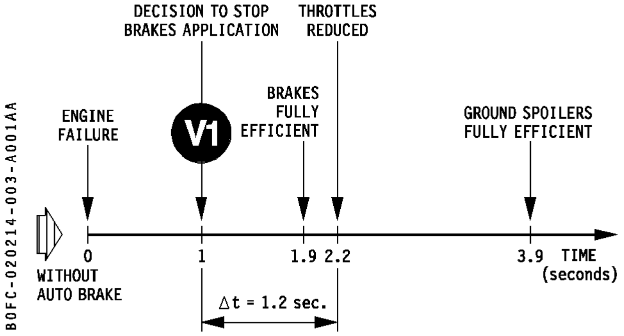
MODE	DECELERATION RATE	TIME DELAY
MAX	Max pressure is applied	none
MED	3.0 m/s^2	none
LO	1.7 m/s^2	8 sec.

- BEFORE TAKEOFF

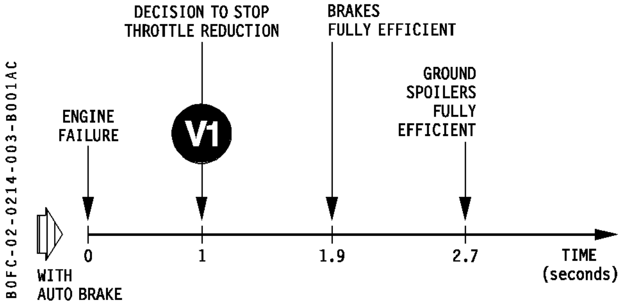
Selection of MAX mode before takeoff will improve safety in the event of an aborted takeoff.

When takeoff must be aborted, the autobrake system will apply the maximum braking as soon as the throttles are closed which represents a single action done without delay (refer to graph below).

SEQUENCE OF EVENTS IN CASE OF ABORTED TAKEOFF



Note : Δt = 1.2 s : this time splits up into
– 1 second delay to comply with FAA requirement
– 0.2 second delay which represents the time to reduce the throttles.



- BEFORE LANDING

When landing on short runway or when operating in low visibility weather conditions the autobraking system will help the pilot. It permits also a straight roll out and optimized landing distances on contaminated runway (see 2.15.30). R

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN COMPRESSED (ON GROUND) CONDITION

AFFECTED SYS/ DETECTOR		SYS 1			SYS 2		
		LH	FWD	RH	LH	FWD	RH
L/G	RETRACTION	Inop on SYS 1	Inop on SYS 1	Inop on SYS 1	Inop on SYS 2	Inop on SYS 2	Inop on SYS 2
	ANTI SKID			Release Symbols Out on ECAM	Release Symbols Out on ECAM		
ICE AND RAIN	PROBES HEAT	CPT PITOT Light on heating low	STBY PITOT Light on heating low	F/O PITOT Light on heating high	CPT PITOT Light on heating high	STBY PITOT Light on heating high	F/O PITOT Light on heating low
		CAPT TAT light on No heating		F/O TAT Light Inop	CPT TAT Light Inop		F/O TAT light on No heating
	WINDOW HEAT				L PWR/FAULT Light on Low heating		R PWR/FAULT Light on Low heating
	WING ANTI ICE	FAULT Light on when set to ON		FAULT Light on when set to ON			
FLT CTL	SLATS			Retraction inhibition (α – Lock) inop	Retraction inhibition (α – Lock) inop		
	SPOILERS	Ground spoilers non inhibited		Ground spoilers non inhibited	Ground spoilers non inhibited		Ground spoilers non inhibited

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN COMPRESSED (ON GROUND) CONDITION

AFFECTED SYS/ DETECTOR		**SYS 1**			**SYS 2**		
		LH	**FWD**	**RH**	**LH**	**FWD**	**RH**
AFS	PITCH TRIM	PITCH TRIM 1 disengages	PITCH TRIM 1 disengages	PITCH TRIM 1 disengages	PITCH TRIM 2 disengages	PITCH TRIM 2 disengages	PITCH TRIM 2 disengages
	AP/FD	AP/FD 1 trips	AP/FD 1 trips	AP/FD 1 trips	AP/FD 2 trips	AP/FD 2 trips	AP/FD 2 trips
	ATS	ATS 1 trips	ATS 2 (if installed) trips	ATS 1 trips	ATS 2 (if installed) trips	ATS 1 trips	ATS 2 (if installed) trips
AIR	PRESSU-RIZATION	REG 1/ FAULT		REG 1/ FAULT	REG 2/ FAULT		REG 2/ FAULT
	AIR COND.	ECON FLOW PACK 1 Inop although ON light On		ECON FLOW PACK 2 Inop although ON light On			
	VENTILATION				If EQT COOL FLOW warning ground horn sounds		
NAV	ATC	ATC will only operate in mode S		ATC will only operate in mode S			
FUEL	F/U				Reset if shutdown and restart		
	FQI						1 to 2 % error

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN COMPRESSED (ON GROUND) CONDITION

AFFECTED SYS/ DETECTOR			**SYS 1**			**SYS 2**		
			LH	**FWD**	**RH**	**LH**	**FWD**	**RH**
ENGINE	IDLE	JT 9D and CF6	MIN (GND) Idle engine 1 and 2 inop					
		PW4000					APP Idle inop at slats out	
	THRUST REVERSER					T/R 1 deployment inhibition inop (1)		T/R 2 deployment inhibition inop (1)
LIGHTS								STROBE Lights inop in AUTO mode
GPWS				GPWS FAULT if failure condition > 60 s and speed > 290 kts				
M4801	TRIM TANK		ECAM STATUS « AFT XFR NOT AVAILABLE » as normal FWD XFR valve inop		ECAM STATUS « AFT XFR NOT AVAILABLE » as normal FWD XFR valve inop			
M6920	ACT					ACT FAULT after T/O as XFR valve not opening in AUTO mode		

(1) . Single detector failure sufficient with CF6-80,
. Double detector failure required on JT9D and PW4000.

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN COMPRESSED (ON GROUND) CONDITION

AFFECTED SYS/ DETECTOR		**SYS 1**			**SYS 2**		
		LH	**FWD**	**RH**	**LH**	**FWD**	**RH**
M5911	STAND BY GENERATOR		STBY GEN inop in both AUTO and OVRD modes « DC ESS ON BAT » and « AC EMERG ON INV » Lights would stay on				

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

2. DOWN – LOCK PROXIMITY SENSOR (S) FAILED IN « NOT DOWN – LOCKED » CONDITION

AFFECTED SYS/ SENSOR	SYS 1			SYS 2		
	LH	FWD	RH	LH	FWD	RH
LANDING GEAR	Green ▽ out, on CTR panel UNLK light on, on CTR panel L/G ECAM warning if SYS 1 selected	Green ▽ out, on CTR panel UNLK light on, on CTR panel L/G ECAM warning if SYS 1 selected	Green ▽ out, on CTR panel UNLK light on, on CTR panel L/G ECAM warning if SYS 1 selected	Green ▽ out, on OVHD panel UNLK light on, on OVHD panel L/G ECAM warning if SYS 2 selected	Green ▽ out, on OVHD panel UNLK light on, on OVHD panel L/G ECAM warning if SYS 2 selected	Green ▽ out, on OVHD panel UNLK light on, on OVHD panel L/G ECAM warning if SYS 2 selected
BRAKES			MLG wheels braking during retraction inop	BRK FANS inop (If installed)		
EFIS	No VLE data on PFD 1			No VLE data on PFD 2		
PASSENGER NOTICES			NO SMOKING inop			
GPWS					GPWS warning "TOO LOW GEAR" will be activated on approach	
LIGHTS					NLG TAXI/TAKE-OFF LIGHTS INOP	

LANDING GEAR DETECTORS MALFUNCTIONS IN-FLIGHT

3. DOWN – LOCK PROXIMITY SENSOR (S) FAILED IN « DOWN – LOCKED » CONDITION

AFFECTED SYS/SENSOR	**SYS 1**		**SYS 2**	
	LH	**RH**	**LH**	**RH**
LANDING GEAR	Green ▽ stays on, on CTR panel UNLK light inop on CTR panel Landing gear not downlocked warnings inop	Green ▽ stays on, on CTR panel UNLK light inop on CTR panel Landing gear not downlocked warnings inop	Green ▽ stays on, on OVHD panel UNLK light inop on OVHD panel Landing gear not downlocked warnings inop	Green ▽ stays on, on OVHD panel UNLK light inop on OVHD panel Landing gear not downlocked warnings inop
R R R **BRAKES**			BRK FANS (if installed) not inhibited	
EFIS	Vmax limit at VLE on PFD 1		Vmax Limit at VLE on PFD 2	
R R R **ATS**	ATS 1 SPD mode inop		ATS 2 (if installed) SPD mode inop	
APU without Mod 6299				Flap stays fully open
PASSENGER NOTICES			NO SMOKING stays on	

LANDING GEAR DETECTORS MALFUNCTIONS ON GROUND

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN UN–COMPRESSED (IN–FLIGHT) CONDITION

AFFECTED SYS/ DETECTOR		**SYS 1**			**SYS 2**		
		LH	**FWD**	**RH**	**LH**	**FWD**	**RH**
L/G	STEERING	Nose wheel steering Inop	Nose wheel steering Inop	Nose wheel steering Inop			
ICE AND RAIN	PROBES HEAT	CPT PITOT Light on heating high	STBY PITOT Light on heating high	F/O PITOT Light on heating low	CPT PITOT Light on heating low	STBY PITOT Light on heating low	F/O PITOT Light on heating high
		CAPT TAT heating on light off		F/O TAT light on No heating	CPT TAT light on No heating		F/O TAT heating on light off
	WINDOW HEAT				NO FAULT LH window heating high		NO FAULT RH window heating high
	WING ANTI ICE	FAULT light on if set to ON		FAULT light on if set to ON			
FLT CTL	SPOILERS	Ground spoiler inhibited		Ground spoiler inhibited	Ground spoiler inhibited		Ground spoiler inhibited

LANDING GEAR DETECTORS MALFUNCTIONS ON-GROUND

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN UN-COMPRESSED (IN-FLIGHT) CONDITION

AFFECTED SYS/ DETECTOR		**SYS 1**			**SYS 2**		
		LH	**FWD**	**RH**	**LH**	**FWD**	**RH**
AFS	PITCH TRIM	PITCH TRIM 1 disengages	PITCH TRIM 1 disengages	PITCH TRIM 1 disengages	PITCH TRIM 2 disengages	PITCH TRIM 2 disengages	PITCH TRIM 2 disengages
	AP/FD	AP/FD 1 trips	AP/FD 1 trips	AP/FD 1 trips	AP/FD 2 trips	AP/FD 2 trips	AP/FD 2 trips
	ATS	ATS 1 trips	ATS 2 (if installed) trips	ATS 1 trips	ATS 2 (if installed) trips	ATS 1 trips	ATS 2 (if installed) trips
AIR	PRESSURIZATION	REG 1 FAULT but depressurization operative		REG 1 FAULT but depressurization operative	REG 2 FAULT but depressurization operative		REG 2 FAULT but depressurization operative
	AIR COND.	Pack 1 flap stay open ECON FLOW pack 1 non inhibited		Pack 2 flap stay open ECON FLOW pack 1 non inhibited			
	VENTILATION	Stay at low speed after shutdown		No horn if LOW FLOW			
NAV	IRS	No IRS 1 and 3 alignment		No IRS 2 alignment			
	ATC	Non inhibited		Non inhibited			

LANDING GEAR DETECTORS MALFUNCTIONS ON GROUND

1. SHOCK ABSORBER PROXIMITY SENSOR (S) FAILED IN UN-COMPRESSED (IN-FLIGHT) CONDITION

AFFECTED SYS/ DETECTOR			SYS 1			SYS 2		
			LH	FWD	RH	LH	FWD	RH
FUEL	F/U					No F/U reset at start-up		
	FQI							1 to 2 % error
ENGINE	IDLE	JT 9D and CF6	APP (FLT) Idle on both engines	APP (FLT) Idle on both engines				
		PW4000						
	T/R	GE				T/R1 Inop		T/R2 Inop
		P and W				T/R 1 and 2 Inop		T/R 1 and 2 Inop
APU			Auto S/D inop if fire		Possible undue auto S/D or deactivated auto S/D			
APU FIRE PROTECTION			Auto Fire Exting Sys Inop if Fire		Fire external Horn Warning and APU Fire Light on Interphone box 3WC Inop if fire			
RECORDERS						CVR/ ERASE inop		CVR/ ERASE inop
EFIS			Flag on PFD 1 Speed scale when < 30 Kts		Flag on PFD 2 Speed scale when < 30 Kts			
MISCELLANEOUS				GPWS FAULT if RA < 100 ft	MECH CALL inop	Main Galley Shed		STROBES stay on if in AUTO mode

MINIMUM TURN AROUND TIME

1. GENERAL

The following material is given as a guidance only. The chart allows to determine as a function of next take off conditions and actual brake temperature, the minimum turn around time ensuring that the brakes will have the capability to absorb the energy built up during a potential rejected take-off.

Since during a rejected take-off the energy is partially absorbed by the reversers, the turn around time is shortened when both reversers are operative.

If brake fans are installed and operative, the minimum turn around time is reduced.

Note : *The temperature of the brakes depends on the way the applications are done. In particular, during taxi, in order to keep the aircraft at low speed, it is recommended to slow down the aircraft by short firm inputs on the brakes rather than applying a continuous pressure on the brakes.*

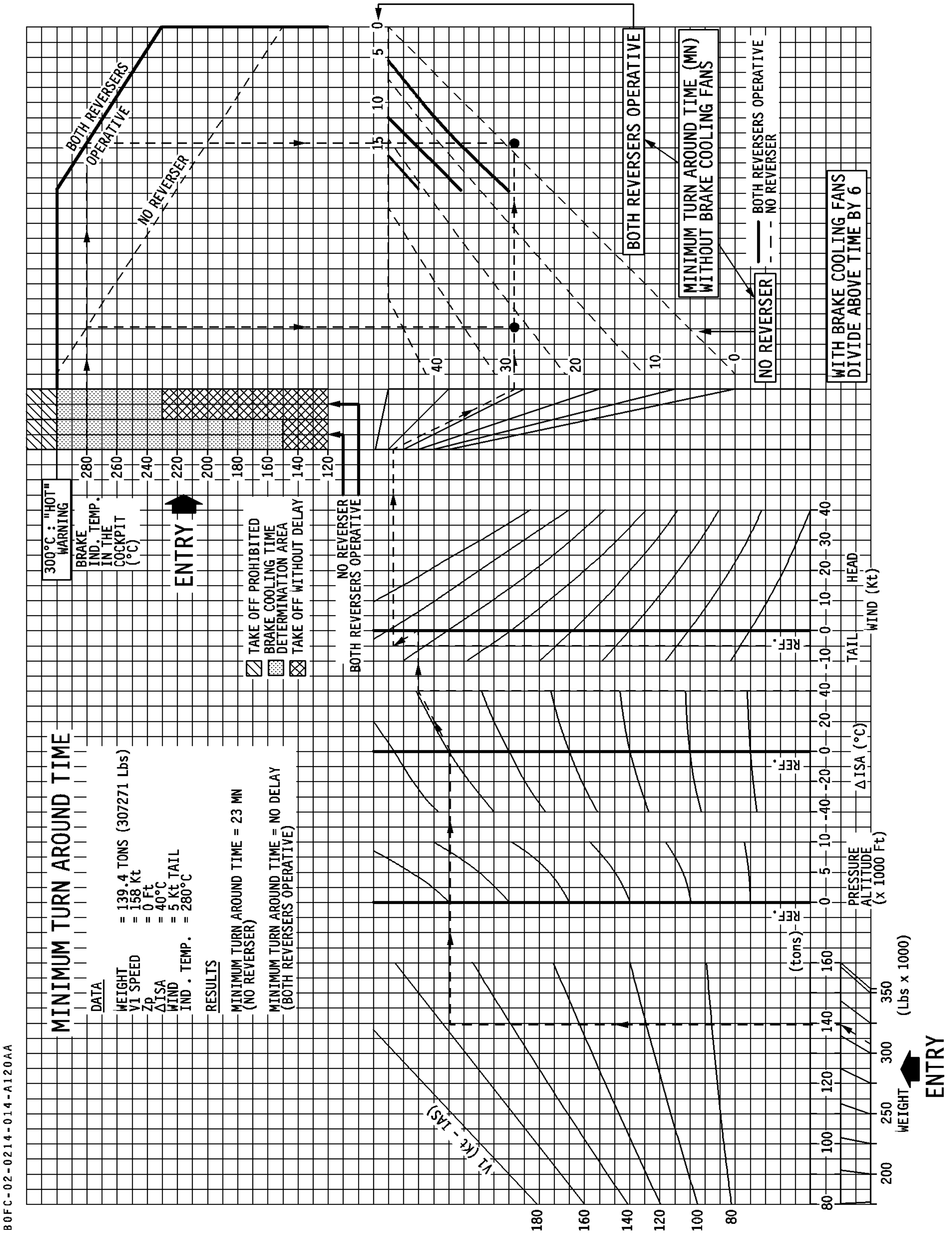
2. HOW TO PROCEED

Read the temperature of the hotest brake on the ECAM
R (WHEEL PAGE), with BRK FAN switched OFF (if installed).

Depending of the availability of the fan thrust reversers, enter the graph with the indicated temperature in the cockpit.

Then, enter with aircraft weight and associated V1 speed and apply corrections due to airport pressure altitude, △ISA, and wind data to determine the minimum turn around time.

These corrections take into account the effect of runway slope within the certified limits of (– 2% to + 2%).



MINIMUM TURN AROUND TIME

DATA

WEIGHT = 139.4 TONS (307271 Lbs)
V1 SPEED = 158 Kt
Zp = 0 Ft
ΔISA = 40°C
WIND = 5 Kt TAIL
IND. TEMP. = 280°C

RESULTS

MINIMUM TURN AROUND TIME (NO REVERSER) = 23 MN
MINIMUM TURN AROUND TIME = NO DELAY (BOTH REVERSERS OPERATIVE)

Code : 0214 D

FLIGHT INSTRUMENTS : INDICATIONS AND TOLERANCES

The values given below apply to an aircraft in symmetrical flight (no side slip), in clean configuration, in straight and level flight.

A. Altimeters tolerances :

- ALT 1 or ALT 2 at ground check . . . . ± 30 ft
- STBY ALT at ground check . . . . ± 25 m
- Maximum differences between altimeters :

Note : *For aircraft with STBY ALT vibrator not supplied on ground (VIB flag displayed on ground), STBY ALT tolerance at ground check is ± 300 ft and STBY ALT should not be compared to ALT 1 or ALT 2 at ground check.*

FL	SPEED	ALT 1 and ALT 2	STBY ALT to any ALT 1 or ALT 2
at ground check	–	50 ft	100 ft
FL 50	250	55 ft	125 ft
FL 100	250	65 ft	170 ft
FL 200	300	90 ft	250 ft
FL 300	0.78±0.02	150 ft	310 ft
FL 400	0.78±0.02	180 ft	390 ft

B. ASI tolerances

- Maximum differences between ASI :

IAS/Mach		PFD 1 and PFD 2	STBY ASI to any PFD 1 or PFD 2
IAS	130 to VMO	4 kt	8 kt
Mach	0.4 to 0.5	0.02	–
	0.5 to MMO	0.01	–

C. Heading tolerances

- Maximum differences between ND magnetic heading indications . . . . 4°

IRS . ATT mode

- **ATT mode should be used in case of :**
  - Temporary loss of electrical supply
  - Partial failure within the IRS (indicated by « IRS WARN » amber annunciator flashing)
- **Following procedure should be applied :**
  - Related MSU mode rotary selector . . . . ATT
  - Indicated headings . . . . Check
  - ▪ **If heading appears incorrect :**
    - ISDU SYS rotary selector . . . select related SYS

With wings level for at least 30 seconds :

- ISDU DSPL rotary selector . . . . HDG STS
- Enter H then enter 4 digits for magnetic heading (in degrees and tenths of degrees) on the ISDU keyboard with reference to another IRS in NAV mode, or STD BY compass if there is not IRS in NAV mode.
- Press ENTER

Repeat heading entry every 15 minutes to keep heading accuracy within ± 3°.

LOSS OF ONE OR BOTH FMS

A. GENERAL

In most cases, when one or both FMS are lost, navigation can be conducted with the remaining FMS (if available) and/or with conventional radionavigation (VOR, ADF, ILS MARKERS, DME).

B. LOSS OF ONE FMS

The remaining FMS is used. Crosscheck position by navaids if available. In the event of a significant discrepancy, disregard the FMS information and apply the procedure recommended in case of loss of both FMS.

C. LOSS OF BOTH FMS

VOR-NAV-ILS switch . . . . VOR

▪ If the aircraft is heading straight towards a VOR :

On VOR/DME panel :

VOR frequency . . . . SET
COURSE . . . . SET

Even if the aircraft is too far away from the VOR to capture it, this procedure allows to get FPV on PFD and to conduct the flight by maintaining the Flight Path Vector on the Flight Path Target up to VOR reception.

▪ If the aircraft route includes one or several turns before heading straight towards a VOR :

VOR/DME panel :

COURSE . . . . Set required TRACK

This track will be followed by maintaining the Flight Path Vector centered in the Flight Path Target.

At each turning point, set the next track as course on VOR/DME panel.

Notes : *1. The geographic position should be checked on ISDU, as each waypoint is approached.*

2. AP modes can be used.
MAP display cannot be used. ARC or ROSE displays must be used.

Mod. : (3221 + 4672) or (4672 + 6505)

TCAS II

A. Conflict resolution principles

- Traffic Advisory (TA)

  If an intruder is detected within the outer protection volume, a visual and aural TRAFFIC ADVISORY is issued. This advisory aids the crew to visually acquire the intruder. Also it prepares the crew for a possible RESOLUTION ADVISORY. However a RA can occur without any preceding TA.

- Resolution Advisory (RA)

  If the intruder gets within the inner protection volume, it is considered as a threat and an aural and visual Resolution Advisory is issued.
  The TCAS determines the optimum vertical maneuver which ensures effective separation with the minimum change of the vertical speed.
  Depending on each situation, the TCAS will generate :

  - preventive advisory i.e. the actual vertical speed may be maintained.
    A range of vertical speed to avoid is displayed.
  - corrective advisory i.e. the actual vertical speed is within the range to be avoided and a range of recommended vertical speed (fly to) is displayed.
  - modified corrective advisories which are issued to change an already displayed RA (for example if the intruder changes its vertical speed).

B. Operational recommendations

- Avoidance generalities :

  Always follow the RA orders, even if they lead to cross the altitude of the intruders, as they ensure the best global separation.

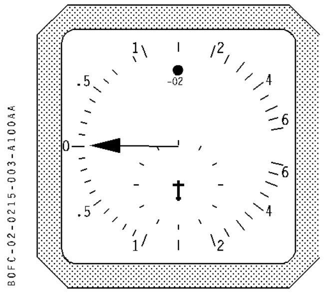
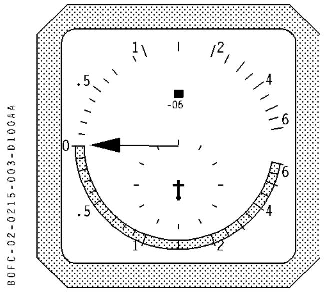
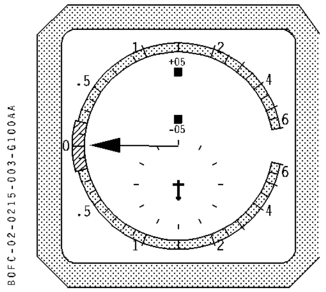
CAUTION

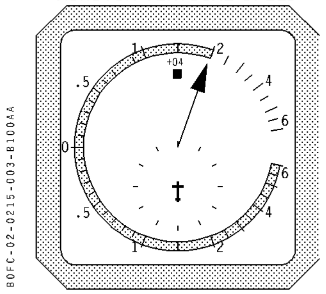
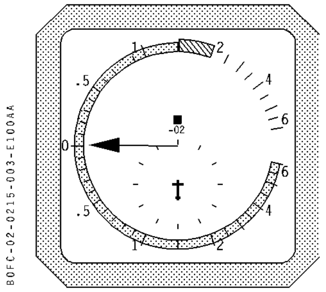
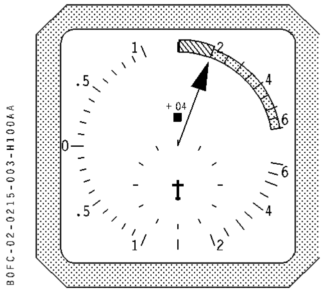
Once an RA has been issued, safe separation could be compromised if current vertical speed is changed, except as necessary to comply with the RA.
This is because TCASII-to-TCASII coordination may be in progress with the intruder airplane, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the other aircraft's compliance with the RA.

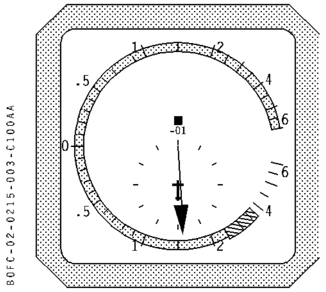
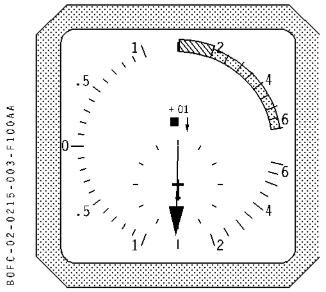
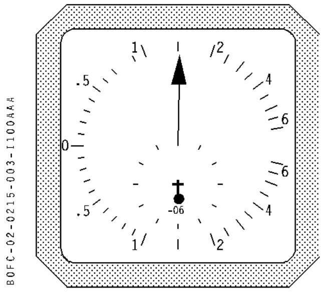
Pilots should comply with the vertical speed limitations during the last 2000 ft of a climb or descent. In particular, pilots should limit vertical speeds to 1500 ft/min during the last 2000 ft of a climb or descent, especially when they are aware of traffic that is converging in altitude and intending to level off 1000 ft 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 or inappropriate RAs (closely spaced parallel runways, converging runways ...)

C. Indications - Aural messages - Typical scenarios

	AURAL WARNING AND TYPICAL DISPLAY	SCENARIO	CREW RESPONSE
TRAFFIC ADVISORY	TRAFFIC, TRAFFIC 	One intruder is ahead at 12:00 o'clock, beyond 5 miles, 200 feet below you.	Do not maneuver on the Traffic Advisory symbol. Attempt to see the intruder. Be prepared to maneuver if the TA changes to an RA.
RESOLUTION ADVISORY (PREVENTIVE)	MONITOR VERTICAL SPEED 	One intruder is ahead at 12 : 00 o'clock beyond 4 miles 600 feet below you.	Do not descend.
RESOLUTION ADVISORY (CORRECTIVE)	MONITOR VERTICAL SPEED 	One intruder is ahead at 12 : 00 o'clock, 500 ft above you. Another intruder is ahead at 12 : 00 o'clock 500 ft below you.	Remain in level flight Do not climb or descend.

	AURAL WARNING AND TYPICAL DISPLAY	SCENARIO	CREW RESPONSE
RESOLUTION ADVISORY (CORRECTIVE)	MONITOR VERTICAL SPEED 	The intruder is ahead at 12 : 00 o'clock 400 feet above you and you are already climbing at 2 000 feet per minute.	Maintain climb at recommended rate
RESOLUTION ADVISORY (CORRECTIVE)	CLIMB, CLIMB 	The intruder is ahead at 12 : 00 o'clock 200 ft below you.	Promptly and smoothly establish a climb rate of 1 500 ft per minute within 5 seconds.
	ADJUST VERTICAL SPEED, ADJUST 	The intruder is ahead at 12 : 00 o'clock 400 ft above you. You are already climbing at 2000 feet per minute.	Adjust vertical speed to reach the green arc on the VSI by reducing climb vertical speed as appropriate.

	AURAL WARNING AND TYPICAL DISPLAY	SCENARIO	CREW RESPONSE
RESOLUTION ADVISORY (ADDITIONAL CORRECTIVE)	INCREASE DESCENT INCREASE DESCENT 	The intruder ahead has stopped climbing. It is now 100 ft below you.	Immediately and smoothly increase your descent rate to 2 500 feet per minute.
	CLIMB, CLIMB NOW CLIMB, CLIMB NOW 	The intruder ahead and above changes from level flight to a rapid descent. The TCAS now changes from a descent RA to a climb RA.	Initiate a change from a descent to a climb maneuver within 2.5 seconds.
RA CLEARED	CLEAR OF CONFLICT 	The intruder has passed behind and is now 600 feet below you. It is no longer a threat	Return promptly to the previous ATC clearance.

▒ red ▨ green ● (amber) TA ■ (red) RA

Note : This table presents typical scenarios and crew responses applicable to all TCAS. Actual TCAS displays may be slightly different depending VSI standard installed.

CAUTION

R When below 2500 ft AGL, exercise caution before
R following "Increase descent" and "descent" RAs.

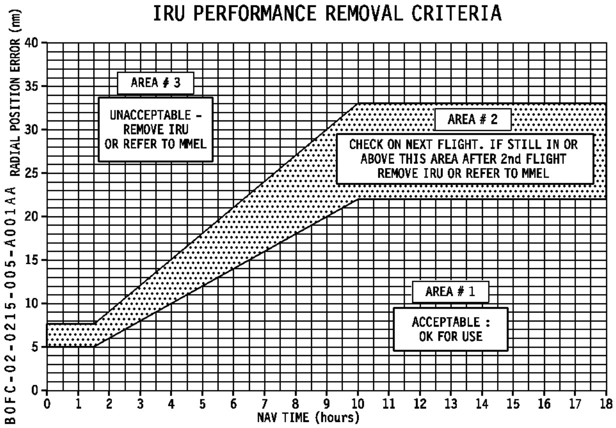
Code : 0047

IRS MONITORING

It is recommended that each IRS is monitored to ensure that the position error (or drift rate) and/or residual ground speed is not excessive. Specific IRS removal criteria have been developed for this purpose.

A. IRS RADIAL POSITION ERROR MONITORING

The following graph shows the removal criteria for radial position error, dependent on the NAV time (the time in which the IRS operated in NAV mode since being aligned).

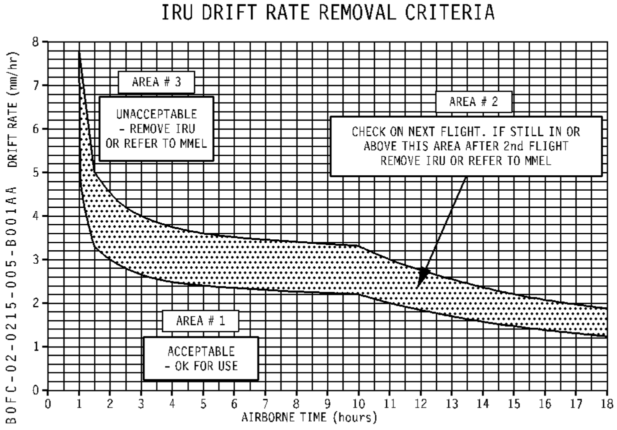


HOW TO FIND THE RADIAL POSITION ERROR

a. : On the overhead Inertial System Display Unit (ISDU), record the LAT/LONG of the 3 IRS.
b. : Press the CDU key "PROG".
c. : Enter the coordinates of the gate (LAT/LONG) in the CDU scratchpad.
d. : Press LSK < 4L to insert position.
e. : Check that "UPDATE*" appears next to LSK 4R.
f. : Press LSK 4R > to update the FMS position to the entered LAT/LONG.
g. : Enter IRS#1 (#2, #3) coordinates in the CDU scratchpad.
h. : Press LSK 3R > next to BRG/DIST to insert IRS#1 coordinates.
i. : Read the Radial Position Error (DIST) on line #3.
j. : Compare the Radial Position Error with the IRU removal criteria.

B. IRS DRIFT RATE MONITORING

Alternatively the IRS Drift Rate may be used as a removal criteria if the IRS MONITOR option is available on the FMS. In this case the IRS Drift Rate from the FMS for each IRS can be checked directly on the following graph.



R

C. IRS RESIDUAL GROUND SPEED MONITORING

The residual Ground Speed removal criteria is :

a) If the residual Ground Speed is ⩾ 21 Kts after any one flight.

or

b) If the residual Ground Speed is ⩾ 15 Kts on two consecutive flights.

Check of the residual GS can be made :

- On the upper left hand corner of the CAPT (IRS#1) and F/O (IRS#2) Navigation Displays (ND).
  The residual GS of IRS#3 can be read on the CAPT ND by pressing the — ATT HDG CAPT "SYS 3" pushbutton switch.
- On the ISDU :
  . Rotate the Display Selector Switch to "TK/GS".
  . Rotate the System Display Switch to 1 - 2 - 3.
  . Read the respective GS in the ISDU right window.
- On the FMS : (if IRS MONITOR option available)
  . Read the respective GS directly on the IRS MONITOR page.

USE OF ISDU

The following procedures provide operational recommendations for the use of the ISDU.

A. COCKPIT PREPARATION - IRS ALIGNMENT.

. After normal usage of ISDU SYS selector, select a position to be kept during the whole flight (OFF or IRS 3 are recommended positions)

. Check IRS's validity by selecting SENSOR STATUS page on CDU.

B. IN FLIGHT - IRS MONITORING

. Do not move ISDU SYS selector unless required by abnormal procedures or circumstances.

. If IRS monitoring has to be performed :

- select SENSOR STATUS page on one FMS-CDU,
- select IRS1 and POS on ISDU,
- wait 4 seconds,
- Check IRS 1 on SENSOR STATUS page.

■ **If IRS 1 FAIL is displayed :**

. Do not move any more the ISDU SYS selector.

■ **If IRS 1 FAIL is not displayed :**

. Perform IRS 1 reading for IRS monitoring, as appropriate.

. Repeat procedure for IRS 2 and IRS 3

C. ISDU FAULT CODE 08

The display of a fault code 08 requires the removal of the ISDU. To prevent undue removals, the following check must be performed further to a fault code 08 :

- perform a normal power down of all IRS by setting the SYS DSPL selector on the ISDU to OFF,
- wait more than 30 seconds,
- align the IRS that reported the fault code 08 and enter PPOS using the ISDU.

If the IRS enters NAV mode correctly, the check is conclusive and the ISDU should remain on the aircraft.

Mod : 4672

LONG RANGE NAVIGATION MONITORING - GENERAL

The extensive development of ETOPS and oceanic flights with the A310 revealed the need to publish some recommendations with regard to long range navigation monitoring.

This chapter is proposed as one means amongst others to ensure accurate and reliable navigation.

The A310 systems have the capability to perform the navigation function almost automatically but this must not prevent the crew from doing periodic navigation monitoring. Such monitoring is necessary for any kind of flight but needs to be increased for long range flights where the aircraft is for a long period of time in IRS ONLY navigation.

A. RECOMMENDED NAVIGATION DOCUMENTATION

Standard navigation documents such as enroute navigation and approach charts will not be discussed here. Only the documentation related to long range navigation is addressed in this paragraph.

Reference flight log

A reference (computer) flight log (RFL) must be available as for any flight.

The RFL must provide the following data :

. Outbound and Inbound MT (mag. track) between waypoints (1)
. Distance between waypoints
. Waypoint coordinates
. Fuel data for normal F-PLN
. Equitime points (ETP) for enroute alternates and in case of ETOPS :
. ETOPS entry point
. Critical Point (CP) for ETOPS critical fuel scenario
. Fuel data for ETOPS scenario.

(1) The inbound MT between waypoints is a valuable information to check FMS F-PLN versus RFL. Indication of magnetic variation at each waypoint can be useful as well.

Navigation plotting chart

A navigation plotting chart of reasonable scale should be available to the crew.
Small scales below 1 per 10 millions should be avoided.

The navigation plotting chart should be implemented with :

. The planned route (including NAT-OTS clearance if applicable).
. ETP's no wind with a method to apply wind corrections.
. ETOPS circles 60', 90', 120' as applicable at the approved one engine inoperative speed (ISA, no wind) around enroute alternates.
. ETOPS entry point (if applicable)

Course and distance between waypoints on NAT-OTS

On NAT-OTS the oceanic clearance obtained in flight may be different from the planned route. In that case crew might have to compute distances and tracks between these new waypoints. For that purpose, tables to compute TT (true track) and distances between waypoints should be available. Magnetic variation as indicated on navigation chart can be used to convert TT in MT.

B. FLIGHT PROCEDURES

The majority of long range navigation errors are the consequence of a single cause which is a wrong entry into the navigation system. Therefore the airlines are highly encouraged to develop procedures and discipline to check and crosscheck any input to the navigation system.

Full navigation System available

Cockpit preparation

IRS alignments

. Do a full alignment (all three IRS to OFF for more than 5 (7) seconds) before every take-off.

R . One pilot checks coordinates given by FMS data base for the departure airport with the airport chart. If published gates coordinates are available, the airport reference coordinates can be adjusted to gate coordinates. This is not mandatory, however it will be easier to evaluate IRS drift if alignment is done according to the current a/c position.

. The other pilot independently crosschecks on ISDU the position received by the three IRS when alignment is achieved. All ALIGN lights must be extinguished with all MSU rotating selectors in NAV before any aircraft movement.

Flight plan cross check :

. The FMS F-PLN must be checked, one pilot reading the distances between waypoints of the RFL, the other pilot checking corresponding data on FMS F-PLN. (Discrepancies up to 2 NM are acceptable). An overall check comparing total distance FMS F-PLN and RFL must be done.

. For all waypoints which are not identified by a code or a name given by the official documentation, check the coordinates by performing a LAT REV at these waypoints.

. If waypoints have to be manually inserted, then it is recommended to use the DEFINED WAYPOINT function so that each waypoint can be unambiguously identified on ND. For example waypoint at N 50 00.0/W 30 00.0 can be identified as 5030 N. Coordinates of stored waypoints must be checked by both pilots on LAT REV page.

  . When F-PLN is checked :
  – SEC F-PLN, copy ACTIVE F-PLN.

Before take-off

. Check that take-off update occurs when depressing go levers.

In flight

. If a significant F-PLN modification is required, the new route must be carefully crosschecked by both pilots. Coordinates of waypoints manually inserted with the DEFINED WAYPOINT function must be checked on the LAT REV page at these waypoints.

Before leaving radio-navaid coverage

. Validate FMS position using navaid raw data.

When more than one DME is still available select ”on track” and ”cross track” stations to compare DME readings with PROG page indications using the BRG / DIST function. When only one VOR / DME or one VOR or one ADF indication remains usable, take benefit from it to check FMS position as long as possible.

However it should be reminded that in this case the FMS position, even in IRS ONLY, may be more accurate than a distant VOR or ADF bearing.

IRS monitoring

During the flight, a periodic overall check of IRS performance (1 check per hour) can be done by reading and comparing TT and GS of IRS 1, 2 and 3 on the ISDU.

. If differences are greater than :

△ TT > 2°
△ GS > 15 kt

perform a full IRS monitoring which consists in checking the position (or the distance) of each IRS relative to the position of the validated FMS.

The three IRS positions relative to the FMS position can be read on line 5 of the POSITION MONITOR page if the IRSs are in NAV mode.

Mod : 11320 or 11364 or (11320 + 11364)

Outside radio-navaid coverage

The following applies in case of IRS ONLY navigation for a significant period of time.

. Use NAV mode, check cross track error = 0 on ND

. Keep FD bars displayed on both FD to quickly visualize any discrepancy between both FMS. In case of discrepancy, check XTK error on ND.

. Before passing a waypoint

- Read outbound MT and distance to next waypoint on the reference (computerized) flight log. (RFL)
- Set "HDG" BUG on outbound MT
- Compare distance to next waypoint of RFL with the distance given on FMS F-PLN page B.

. Passing a waypoint :

- Verify that the correct outbound MT is steered using MT indications on ND ("HDG" bug on green diamond)

. After passing a waypoint :

- Check cross track error = 0

Nota 1 : In areas with large meridian convergence and / or large magnetic variation rate of change, the great circle route (east-west) will require significantly variable MT between waypoints. Therefore, monitor MT so that it progressively moves from outbound MT to inbound MT.

Nota 2 : To comply with recommendations for operations within MNPS area, the FMS position can be plotted on a nav chart. However this is not required from a system point of view in normal operation.

When coming back in radio-navaid coverage

. Whenever in line of sight of any navaid (NDB, VOR, DME), cross check position by comparing BRG and DME distance with BRG / DIST function of FMS.

Nota : Use remote tuning capability when VOR stations are distant (≃ 250 NM). Automatic tuning is often limited by the figure of merit criteria associated to a navaid in the FMS data base.

. When possible resume normal navigation monitoring. Remain aware that at long distances, VOR or NDB may be less accurate than the FMS position, even after several hours in IRS ONLY.

The FMS will resume VOR / DME updating only if the calculated radio position error is better than the FMS estimated error in IRS only.

. If a VOR / DME is reported as unreliable or known to be wrong, DESELECT it, so that it does not affect FMS radio updating.

After the flight

. It is recommended (required for MNPS operations) to check the overall accuracy performance of each IRS after the flight. Several methods can be proposed.

1. Operations outside MNPS or ETOPS area
   - Check residual GS of each IRS when at the gate and record it in the technical book, as per company policy.
2. Operations within MNPS or ETOPS area

   a) A / C with Mod 7558 or 7032 (SB 34-2047)
      - On CDU select and read the IRS MONITOR page indicating the overall drift rate of each IRS.

Mod : 11320 or 11364

b) If the above mentioned option is not available, the drift of each IRS can be determined in the following way :

Perform a manual update of FMS position at the gate coordinates. Enter IRS coordinates on FMS PROG page in the field for BRG / DIST TO. The distance between FMS position and IRS position divided by the time from the end of IRS alignment to reading gives the drift rate.

c) Since the method given in (b) is time consuming, the IRS drift rate can also be calculated by ground staff provided that the crew records IRS and gate coordinates in the technical book.

Some figures on IRS drift rate for information :

- IRS removal criteria :
  . Total drift > 3 + 3 T in NM in 2 consecutives occurrences
  T is time in hours as defined above
  . Residual GS > 20 kt
- IRS guarantee (95 % probability)
  . drift rate < 2 NM / h
  . GS error < 8 kt

Degraded configuration

Failure of one IRS

. If IRS1 or IRS2 failed :

- Select the best remaining IRS,
- If IRS3 is the best remaining IRS and the other IRS is significantly distant from it :
  . engage the remaining AP in HDG mode.
  Nota : AP associated to the failed IRS is inoperative.
  . select MH (mag. heading) to keep XTK = 0 on the FMS associated to the best remaining IRS.

. If IRS3 failed :

- Select the best remaining IRS,
- Use A.P in NAV mode associated to the FMS using the best remaining IRS,
- Select the failed IRS in ATT mode.
  If operative in ATT, enter current HDG on ISDU. Use this IRS as a free gyro in back-up. Repeat HDG entry approximately every 20 minutes.

Failure of 2 IRS

Both FMS work on the remaining IRS.
Both AP and FD are lost.
F-PLN on ND and XTK indication is still available.

R
- Steer the A/C manually to maintain XTK = 0,
- Use the FPV in the cage technique to assist steering and apply small MT corrections when necessary.
  . Select FPV with the FD/FPV selector,
  . Select MT on ILS CRS selector of ILS control panel,
  . Select ILS position of the VOR/NAV/ILS switch,
  . Select FPA = 0 degree on EFIS control panel.

Failure of one FMS

Failure of one FMS does not affect normal navigation. Nevertheless, be prepared to conduct navigation without FMS should the second FMS fail. The following precautions are recommended for the crew with onside FMS failed.

- select FPV with the FD/FPV selector,
- select average MT on ILS CRS selector to be ready to use the FPV "in the cage",
- select ILS position of the VOR / NAV / ILS switch,
- select FPA = 0 degree on EFIS control panel.

The crew with operative FMS keeps FD on and MAP mode.

If the FMS failure occurs before ETOPS entry point or before entering MNPS area, consider rerouting or turn back. If flight within MNPS area is intended, compliance with MNPS requirements must be observed.

Failure of both FMS

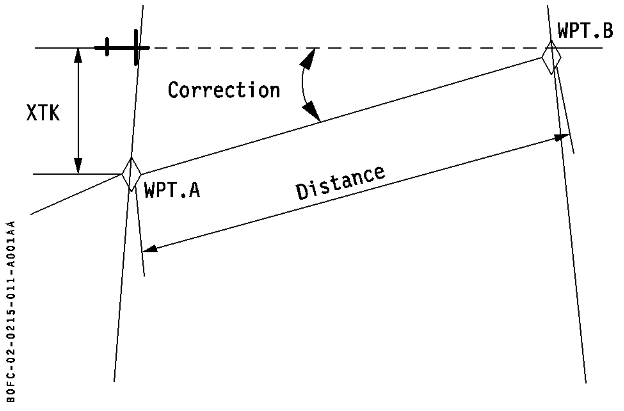
- Select HDG mode on current HDG to restore AP in CMD.
  Note : If AP was in NAV mode and 2nd FMS has failed, the AP will trip out.
- Steer the a/c using the FPV "in the cage" technique, as described above, selecting on VOR or ILS CRS selector the average MT between two waypoints.
- Use GS indication from ISDU to compute ETA to next waypoint.

Note that the procedure to fly at constant MT will bring the a/c some NM off the great circle route. However in most parts of the world, the maximum lateral deviation midway between two waypoint will not exceed 5 NM.

Navigation without FMS requires navigation monitoring by periodically plotting the selected IRS position on a navigation chart after reading ISDU. The selected IRS should be the best IRS as determined by previous IRS monitoring (see above).

R Example : For a west-east route as shown on figure 2 below.

Figure 2



R For example, for a west-east route the position plotting should be performed when crossing the longitude of each waypoint and at a longitude midway between each waypoint.

If a significant crosstrack error is confirmed (> 10 NM), a MT correction should be made so as to be back on track at the next waypoint.

It is recommended to apply only small corrections in order to avoid over corrections.

The track correction can be estimated by the simple formula :

$$\text{Correction (deg)} = \frac{\text{XTK error (NM)}}{\text{Distance to next WPT (NM)}} \text{ X } 60$$

Failure of ISDU

If at least one FMS is operative, the ISDU failure does not change the procedures except that IRS monitoring cannot be performed.

In the extremely unlikely situation of both FMS + ISDU failure, the IRS position is no longer accessible, however the bird and track information are still available on ND.

Summary of procedures with navigation system failures before entering or within MNPS area

FAILURE	Before entering MNPS	Within MNPS
1 FMS	do not enter	continue as per F-PLN
2 FMS	do not enter	continue as per F-PLN advise ATC
1 IRS Remaining IRS pos. diff < 20 nm	continue	continue
1 IRS Remaining IRS pos. diff > 20 nm	do not enter	Operational decision advise ATC
2 IRS	do not enter	Operational decision advise ATC

C. LIMITATIONS OF THE NAVIGATION SYSTEM

It is reminded that the navigation system is limited to operations between latitudes of 72°30′ North and 60° South. R

Above 73° N of latitude the MT indications, will be either lost (Honneywell IRS) or become inaccurate (Litton IRS).

D. FMS MESSAGES

Some messages are relevant when talking about navigation monitoring and are mentioned hereafter.

a) VERIFY A / C POSITION

This message is triggered when distance between MIX IRS position and FMS position is > 12 NM.

This message is most likely to appear while radio updating is being done by the FMS. In order to determine the potential cause of the error :

– validate FMS position : using VOR / DME raw data. If FMS position is accurate, the error is on the MIX IRS side.
The faulty IRS may be determined using the method described hereabove.

. If FMS position is not satisfactory, the radio updating is causing the error.
  * Check which navaids are used for radio updating,
  * Select them for display and determine the wrong navaid,
  * Deselect the wrong navaid.

b) FMC POSITION MISMATCH

This message is triggered when the distance between FMS1 and FMS2 is > 5 nm.

It may appear most probably in 2 cases :

1) 2 IRS only are operating in NAV mode.

   Consequently each FMS operates with its own IRS in case of IRS ONLY navigation.
   . Use FMS data linked to the best IRS,
   . Engage corresponding AP in NAV mode.

2) FMS's are radio-updated

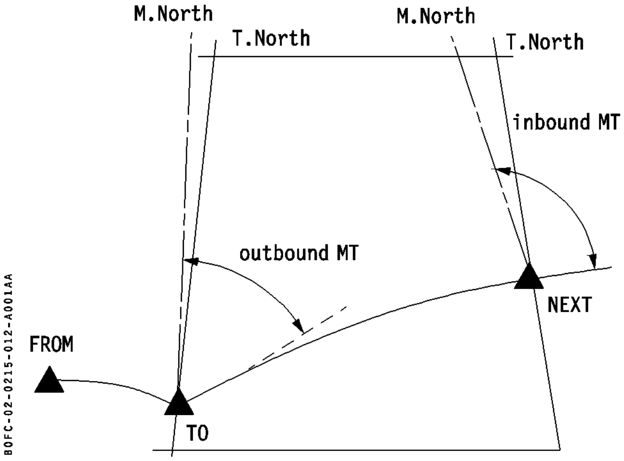
   If both FMS do not use the same navaids for radio updating.
   - Validate FMS positions and determine the accurate one,
   - Check the selected navaid on the inaccurate FMS,
   - Deselect the wrong navaid.

E. BEARING / TRACK DEFINITIONS AND MAP DISPLAY ON ND

Indications FMS CDU

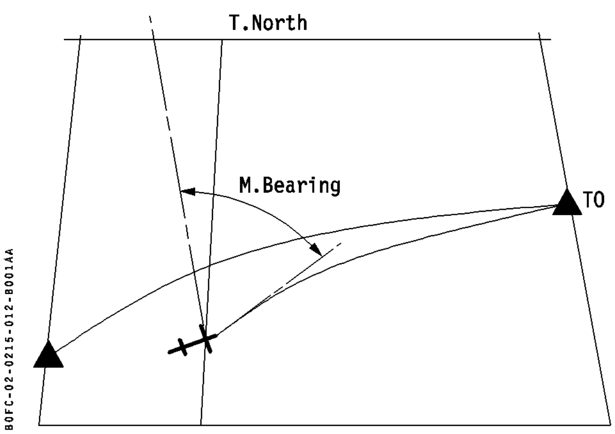
Track between the "TO" and the "NEXT" waypoint on F-PLN page B is an inbound magnetic track (MT). Fig. 3.

Figure 3



Bearing indicated by the BRG / DIST function on PROG page is a magnetic bearing to a waypoint measured at the a/c present position (Fig 4).

Figure 4



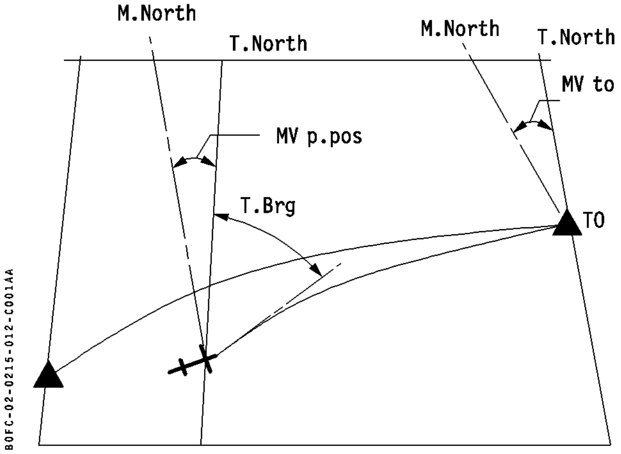
Bearing indication on ND

The bearing indication to the "TO" waypoint in the upper right corner of ND is calculated as follows :

CRS on ND = T.Brg + MVto(Refer to figure 5)

where : T.Brg = True bearing
MVp.pos = Magnetic variation at present position
MVto = Magnetic variation at TO waypoint

Figure 5



Therefore the bearing information on ND should be used only in areas where magnetic variation does not significantly change between present position and the "TO" waypoint (△ MV < 2°)

Outside these areas, and for long distances, it is recommended to use the BRG / DIST function.

Magnetic variation

As magnetic variations are given from different sources (FMS, IRS, nav charts, RFL...) some discrepencies of 1 or 2 degrees can be expected. These sources may have stored magnetic variations which refer to different reference dates.

MAP display on ND

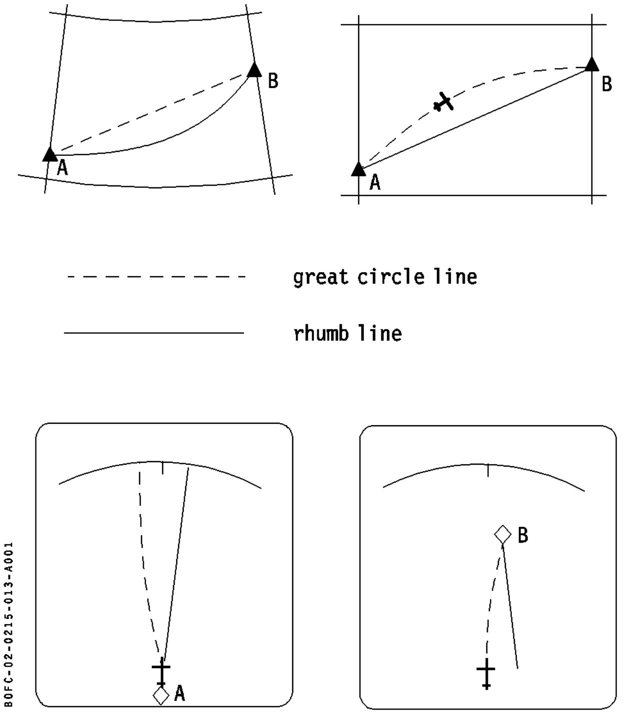
The AP in NAV mode will steer the a/c on a great circle line between two waypoints (XTK error = 0).

The MAP display on ND is a kind of "Mercator" projection where a straight line between two waypoints is a pseudo rhumb line. F-PLN route is drawn as straight lines between waypoints on ND.

Therefore it is quite normal to see the a / c symbole on ND leaving the displayed F-PLN route while maintaining XTK = 0. See figure 6 below.

This effect is greatest at high latitude where meridian convergence is large and on east-west or west-east routes.

Figure 6



F. REMINDER ON FMS POSITION COMPUTATION

When inputs of three IRS's are available, each FMS computes the mixed IRS position provided the IRS position validity test is satisfactory.

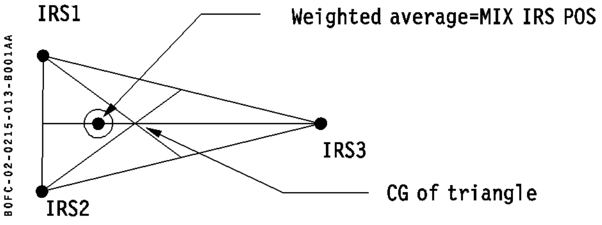
If tests are completed successfully, each FMS computes a new mixed IRS position.

The mixed IRS position is a weighted average. See Figure 7.

If any of the IRSs fails the comparison test, each FMS will use a single IRS for position inputs.

However, as long as the out-of range IRS remains in NAV mode, its position is included in further comparison tests.

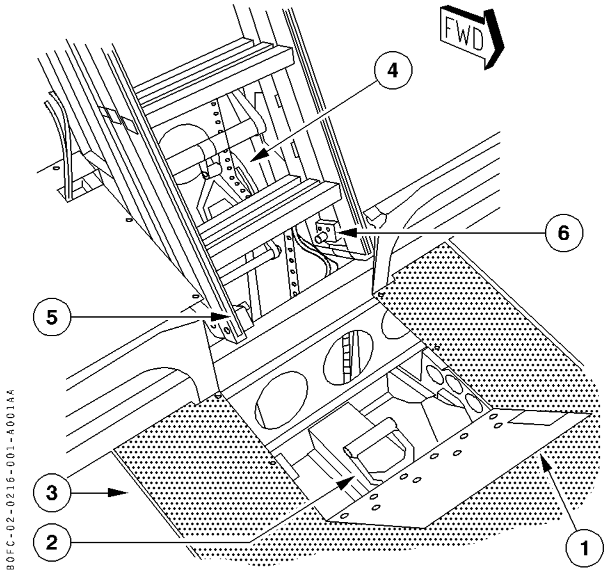
Figure 7



LEAVING THE AIRCRAFT VIA AVIONICS COMPARTMENT ACCESS DOOR (STANDARD CONFIGURATION).

- Open the floor hatch to get access to the avionics compartment.
- Descend into the avionics compartment and take a position right side of the avionics compartment access door.

  Note : Do not try to open the access door while standing on it.
- Open the floor panel (1) which covers the avionics compartment access door handle (2), located at the aft, center part of the access door (coin may be needed to open the lock).
- To open the access door (3) lift the handle (2) and pull the door completely into the bay until it is latched in its upper stop (LH).
- Remove the strap which fixes the ladder assembly against motion.
- Lift the lever (4), located on the right side aft of the lower rung of the aft ladder element, to unlock the ladder assembly and swing it simultaneously towards the opening.
- Release the lower locking device on the right inner side of the first ladder element (5) by pulling the orange handle forward (indicated on a placard next to the locking device). Lower the element until it latches.
- Repeat with the second ladder element (locking device (6) is at the left inner side).
- If the ladder does not touch the ground yet the last element is lowered by pulling forward its orange handle at the lower end on the left outer side.
- If the ladder touches the ground leave the aircraft via the extended ladder.



If local Airworthiness Authorities require that the cockpit door remains closed throughout the entire flight, these procedures must be applied after engine start.

COCKPIT PROCEDURE

ROUTINE ACCESS (requested from the cabin)

The buzzer sounds in the cockpit for 1 to 9 seconds (3 seconds by default).
Prior to unlocking the door, the flight crew should identify the crew member requesting entry through the door spy hole, or using the video cameras (if installed).

■ **If entry is NOT authorized by the flight crew :**
COCKPIT DOOR toggle switch . . . . LOCK
Emergency access, buzzer and keypad are inhibited for a preselected time between 5 to 20 minutes.

■ **If entry is authorized by the flight crew :**
COCKPIT DOOR toggle switch . . . . UNLOCK
The flight crew set and maintain the toggle switch in the UNLOCK position until the cabin crew pushes the door fully open.
Before closing the door, the toggle switch has to be released to NORM position.
COCKPIT DOOR FAULT light . CHECK EXTINGUISHED

Note : If flight crew does not take any action after routine cabin request, cabin crew can open the door using the emergency access procedure.

EMERGENCY ACCESS (initiated from the cabin)

The buzzer sounds continuously in the cockpit and the OPEN light flashes on the cockpit door panel.

COCKPIT DOOR toggle switch . . . . LOCK
Emergency access, buzzer and keypad are inhibited for a preselected time between 5 to 20 minutes.

Note : One flight crew member must immediately respond to the emergency access request by locking the cockpit door. If the flight crew does not take any action, the door unlocks after a preselected time from 15 to 120 seconds.

Then, when the situation in the cockpit permits and prior to unlocking the door, the flight crew must identify the crew member requesting entry through the door spy hole, or using the video cameras (if installed).

- **If entry is authorized by the flight crew :**
  COCKPIT DOOR toggle switch . . . . UNLOCK
  The flight crew set and maintain the toggle switch in the UNLOCK position until the cabin crew pushes the door fully open.
  Before closing the door, the toggle switch has to be released to NORM position.
  COCKPIT DOOR FAULT light . CHECK EXTINGUISHED

CABIN PROCEDURE

ROUTINE ACCESS

CABIN CREW . . . . PRESS #, OR Number + #
Number represents an Operator-defined figure between 0 and 7 digits.

CABIN CREW . . . . . . STAND IN COCKPIT DOOR AXIS
The cabin crew must stand in the axis of the cockpit door to be identified.

■ **If entry is NOT authorized by the flight crew :**
The keypad's red light comes on steady, and indicates that the door is locked. Emergency access, buzzer and keypad are inhibited for a preselected time between 5 and 20 minutes.

■ **If entry is authorized by the flight crew :**
The keypad's green light comes on steady, and indicates that the door is unlocked.
CABIN CREW . . . . PUSH DOOR TO OPEN

- **If there is no reaction from the flight crew after first ROUTINE ACCESS request :**

  CABIN CREW . . . . PRESS #, OR Number + #
- **If there is no reaction from the flight crew after the second request :**
  CABIN CREW . . . . CALL THE COCKPIT
  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 :**
  EMERGENCY ACCESS PROCEDURE. . . . . . . APPLY

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. If there is no reaction from the cockpit, the keypad's green light comes on steady after a preselected time between 15 and 120 seconds.
Then, the buzzer stops indicating that the door is unlocked for 5 seconds and cabin crew can push the door to open.
CABIN CREW . . . . PUSH DOOR TO OPEN

Mod : 12557 or 12715

ENGINE START WITH EXTERNAL PNEUMATIC POWER

APU GEN OR EXT PWR . . . . ESTABLISH

- **Before connecting external pneumatic power** :

  PACK VALVES 1 and 2 . . . . OFF
  (to prevent packs contamination)

- **Before start** :

  ENG BLEED VALVES 1 and 2 . . . . OFF
  AIR X FEED . . . . MAN/IN LINE

  – Closure of both the engines bleed valves eliminate reverse flow leakage.

  - **Cleared to start** :

    For MIN. RECOMMENDED STARTER AIR SUPPLY PRESSURE refer to table below.

    – Two external pneumatic power units may be used in parallel if the pressure/ flow relation is expected to be marginal.

    – Proceed as for normal engine start procedure.

- **After first engine start** :

  ■ **If CROSSBLEED ENGINE START is considered** :

  – Request removal of external pneumatic power unit(s)
  – PACK VALVES 1 and 2 . . . . ON
  – Apply CROSSBLEED ENGINE START procedure as described further in this chapter.

  ■ **If both engines are started on external pneumatic power** :

  – Proceed as for normal engine start procedure

  - **After second engine start** :

    – Request removal of external pneumatic power unit(s)
    R X-FEED . . . . AUTO/CROSS-LINE
    ENG 1 and 2 BLEED VALVE . . . . AUTO
    PACK VALVES 1 and 2 . . . . ON

MINIMUM RECOMMENDED STARTER AIR SUPPLY PRESSURE

AMBIENT CONDITIONS		STARTER AIR
ALTITUDE (FT)	TEMPERATURE (° C)	PRESSURE (PSI G)
0	– 40	35
0	15	30
0	55	25
8000	– 40	25
8000	0	25
8000	40	25

Note : *Pressures are valid with start valve closed.*
During engine start pressure may drop by 10 %.

Code : 0061

BATTERY ENGINE START

CAUTION
– Ensure chocks are in place
– Alert ground staff before engine start R

- **Before start** :

  GEN 1 . . . . ON

- **CLEARED TO START** :

  APU BLEED OR EXTERNAL PNEUMATIC
  POWER . . . . ESTABLISH
  IGNITION . . . . START B

- **ENG 1 START** :

  ENG 1 START button . . . . PRESS AND HOLD

  – Confirm starter operation by observing the control column movement.

  Start clock.
  Announce « 20 SECONDS » when elapsed.
  Note : *20 seconds represents the minimum for fuel lever on.*
  ENG 1 FUEL lever . . . . ON

CAUTION
An EGT rise may occur resulting in an overtemperature.

- **When GEN 1 FAULT light extinguishes** :

  ENG 1 START pushbutton . . . . RELEASE

- **After eng 1 start** :

  Complete the cockpit preparation.
  ENG 2 . . . . START

CROSSBLEED ENGINE START

CAUTION
Engine bleed supply and external pneumatic power supply must not be used simultaneously.

APU BLEED VALVE . . . . OFF
BLEED VALVE (receiving engine) . . . . OFF
AIR X FEED . . . . MAN/IN LINE
BLEED VALVE (supplying engine) . . . . AUTO

– Continue the normal engine start procedure

Note : *To increase airbleed pressure of supplying engine throttle may be advanced, if required. It is recommended not to exceed flight idle N2 (max. 9 % above ground idle). This should normally provide sufficient starter air pressure.*

If min. recommended starter air supply pressure is not obtained at flight idle, before further N2 increase ascertain with ground crew that intake and exhaust areas of supplying engine are clear for the augmenting jet wake.

- **After engine start** :

  X-FEED . . . . AUTO/CROSS-LINE R
  BLEED VALVE (receiving engine) . . . . AUTO

ENGINE VIBRATION

Monitoring

Actual or impending engine problems may be detected by use of vibration monitoring. Since vibration characteristics are different for each engine, a single reading is not very meaningful, except if a sudden significant increase is encoutered.

Vibration trend values are more important provided the readings are taken over a period of time in comparable, stabilized conditions.

Indicated vibration levels (N1 and N2) under stabilized cruise conditions should be recorded at least once a day.

High Vibration Level

Specific limits to define an abnormal, high vibration level are not established, generally a rapid increase is more serious than a steady high value.

The VIB ADVISORY on ECAM (N1 above 3 units, N2 above 5 units) constitutes only a guideline to induce the flight crew to closer parameters monitoring and crosscheck.

Validation

High VIB level indication can be considered valid when any of the following conditions co-exist with high vibration on the affected engine :

- VIB level increases and decreases with corresponding throttle lever movement.
- High fan (N1) vibration perceptible on throttle levers and/or aircraft structure. Abnormal engine noise (rumble) accompanies increase of VIB level.
- High N2 vibration accompanied by changes in other engine parameters (e.g. EGT, N1/N2 relationship, OIL PRESS, OIL TEMP, OIL QUANTITY, and/or NACELLE TEMP).

Any abnormal VIB indication should be recorded for maintenance action.

Sudden Increase during Takeoff or Climb

Higher N1 VIB levels with takeoff or climb thrust settings may be experienced since N1 rotor imbalance will increase as engine speed increases. High N2 VIB indications are usually more apparent during low engine speed operation (ground/flight idle).

VIB transients, even in excess of one unit, can be considered normal during high thrust operation prior to thermal stabilization and during power changes.

However, if a sudden significant increase is accompanied by increased airframe vibration or change in engine noise :

- Check VIB indication and other engine parameters, as soon as circumstances permit.
- If abnormal VIB validated :
  Consider engine shutdown, flight conditions permitting.

Sudden Increase During Cruise

If a sudden increase in vibration in excess of one unit is encountered with stabilized cruise setting and the reading is considered valid :

- Operate throttle lever to reduce VIB level within one unit of the original indication.
- If successful and all other engine parameters normal, continue engine operation not exceeding that thrust setting.
- If unsuccessful, consider engine shutdown, flight conditions permitting.

Increase during Descent

If a significant increase in vibration is encountered when thrust is reduced to IDLE :

- Advancing throttle levers may reduce N2 vibration level.

CAUTION

When throttle levers had to be adjusted to reduce vibration, it is recommended NOT to use reverse thrust on the concerned engine.

PW Eng. : All

Mod : 6789

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A. PRELIMINARY NOTES

- In this section, the use of FMS and its coupling to the AFS (PROFILE and NAV modes engagement...) are described.
  Other AFS modes are described in the « USE of AFS » section 2.02.03.
  General SOPs are not specified, only FMS actions are described.

  The Flight Management System specific vocabulary and acronyms are detailed in chapter 1.20.
- A flight from TOULOUSE (LFBO) to LONDON HEATHROW (EGLL) with AMSTERDAM (EHAM) as alternate airport is taken as example.
- Reminder : the database must be loaded and updated to render the system operational.
  The depicted examples may only be reproduced with the same database.
  Finally it is recalled that the airline is solely responsible for the definition, acquisition, updating, loading and use of its own database.

B. INTRODUCTION

- The FMS shall normally be coupled to the AFS (through PROFILE and NAV modes) whenever possible.
- When this coupling is active, vertical navigation via PROFILE mode and horizontal navigation via NAV mode are fully controlled by the FMS which sends its orders to the AFS.
- NAV mode can be engaged from 30 ft (at takeoff) to LOC capture (case of an ILS approach) or to a minimum authorized altitude (case of a non-precision approach).
- PROFILE mode can be engaged from THRUST REDUCTION ALTITUDE (value stored into the FMC database or 1500 ft AGL by default) to GLIDE capture (case of an ILS approach) or to a minimum authorized altitude (case of a non-precision approach).

C. MAIN RULES OF USE

- Data entry into the FMS can be made on either of the CDUs. It will be taken into account by both FMCs.
- Any data entry must be checked.
- PROFILE and NAV modes are engaged or disengaged, as any other AFS mode, by means of dedicated pushbuttons located on the FCU.
- When PROFILE is active, a flight level cannot be left without at least two positive actions of the crew :
  - turning ALT knob to select a new level
  - pulling this knob to initiate the level change.
- In certain cases (e.g. pilot entry on the CDU not accepted, or format error), a message is displayed in the scratchpad.

D. TASK SHARING

- AP in CMD : PF makes the FMS revisions.
- AP NOT in CMD : PNF makes the FMS revisions.

E. GENERAL RECOMMENDATIONS

PROFILE disengagement

It is recommended to disengage PROFILE by pulling the speed/mach knob on the FCU. The speed window is automatically synchronized and the AFS reverts to LEVEL CHANGE mode.

PROFILE must be disengaged before G/S interception during ILS approaches.

NAV disengagement

It is recommended to disengage NAV by pushing then pulling the HDG SEL knob on the FCU. Pushing the HDG SEL knob will synchronize the FCU heading on actual heading. Pulling the HDG SEL knob causes the AFS to revert to HDG SEL mode.

Leaving the lateral flight plan

It is not recommended to keep PROFILE if NAV is disengaged to leave the lateral F-PLN, especially during climb, approach and go-around. This is because altitude constraints, generally linked to waypoints, will be matched in the corresponding leg even if these waypoints are not overflown.

F-PLN discontinuities

Always check that there are no forecoming discontinuities in the F-PLN. AP disengages as soon as the aircraft enters a discontinuity. Especially for go-around, NAV and PROF should not be reengaged without a F-PLN checking.
A special case is made for a discontinuity following a manual terminated leg. This discontinuity can be cleared only by making a DIRECT TO any waypoint following the leg.
Before performing a F-PLN lateral revision causing a F-PLN DISCONTINUITY, PROFILE should be disengaged in order to avoid the computation of a wrong vertical F-PLN. PROFILE can be reengaged after the F-PLN DISCONTINUITY is cleared.

Reverting to a default value

When a default value has been manually changed, it may be recovered by clearing the manual entry (press the CLR key and the corresponding LS key).

Mod : 6789

Speed tactical mode

Whenever a specific speed is required, it is better to use the SPD TACT mode, rather than leaving PROFILE mode and using FCU. Thus the FMS vertical guidance is kept. This recommendation is not valid for descent where TACT SPD use would induce a misleading descent path recomputation.
If a specific speed has to be used, it must be done through AP.
The cost index should not be changed during flight to change the speed.

Altitude constraints

Altitude constraints are coded in the database and linked to waypoints only. They are provided for advisory and for an optimal flight path construction only.

> **CAUTION**
>
> There are no minimum en route altitude and no safe altitude codes in the database. They remain pilot responsibility.

On ground, raising the FCU altitude above the altitude constraints has no effect on them.
When the aircraft is airborne in descent phase and FCU altitude is lowered below the altitude constraints, they remain valid.
When the aircraft is airborne in climb phase and FCU altitude is raised above the altitude constraints, they are cancelled and replaced by altitude predictions on the CDU.

SID and STAR

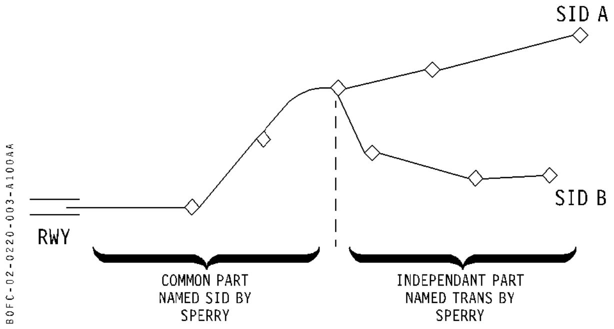
NAV mode must not be used to fly a SID or STAR which has been manually built. Furthermore, it is not recommended to build a SID/STAR manually. SIDs and STARs use specific legs such as DME arcs, VOR radial interceptions, conditional altitude legs which cannot be manually constructed. Only DIRECT TO legs may be manually constructed. Therefore if NAV is engaged to fly a manually constructed SID or STAR, the aircraft will be controlled on DIRECT TO legs instead of the legs to be flown.

According to the specific SPERRY vocabulary :

SID : Common part with other SIDs (same RWY) + TRANS (independent part)

STAR : Common part with other STARs (same RWY) + TRANS (independent part)

So it may be necessary to select a TRANS after a SID/STAR even if no TRANS is mentioned in navigation documents.



Mod : 6789

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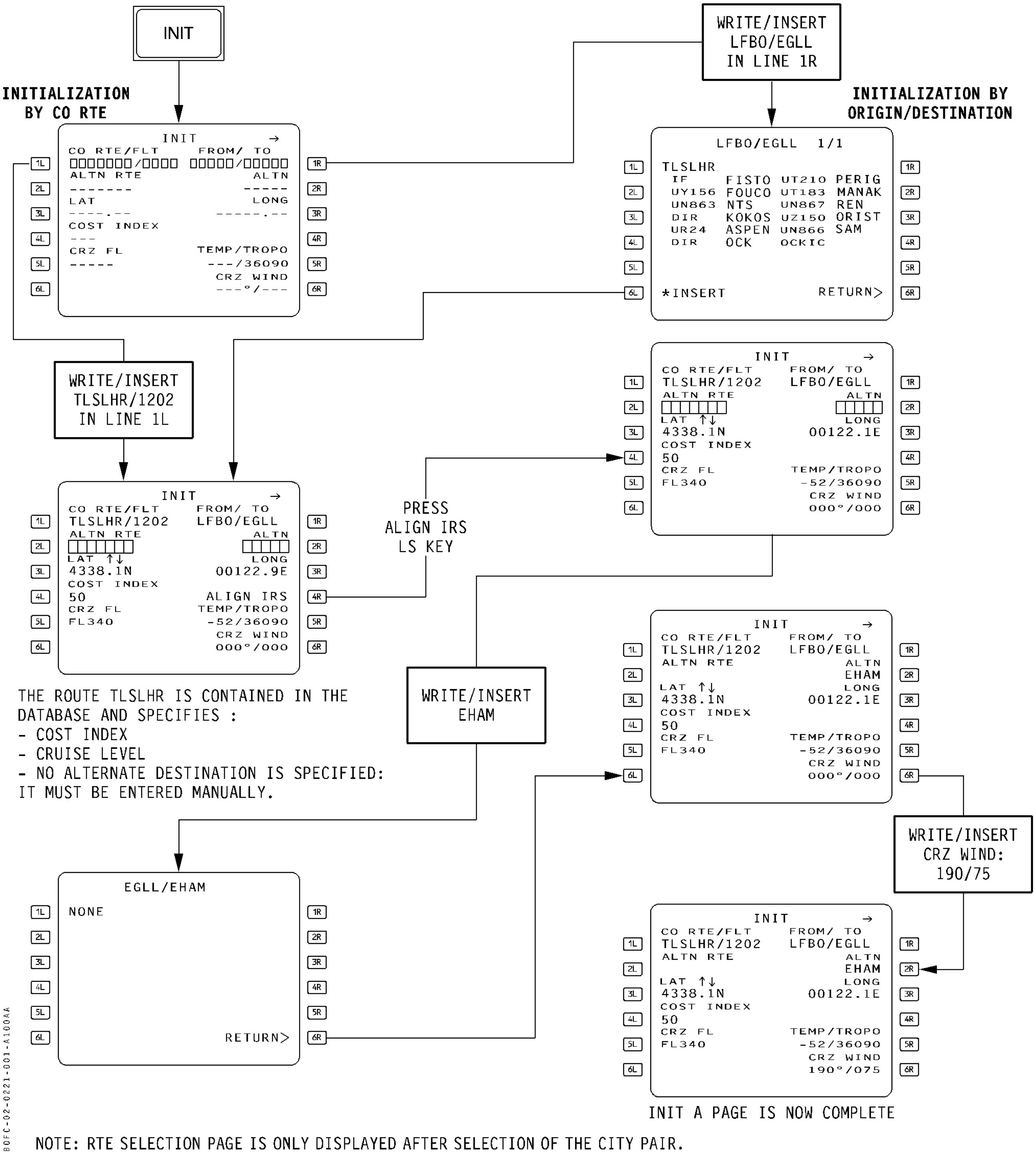
ROUTE DEFINITION



THE ROUTE TLSLHR IS CONTAINED IN THE DATABASE AND SPECIFIES :
- COST INDEX
- CRUISE LEVEL
- NO ALTERNATE DESTINATION IS SPECIFIED: IT MUST BE ENTERED MANUALLY.

INIT A PAGE IS NOW COMPLETE

NOTE: RTE SELECTION PAGE IS ONLY DISPLAYED AFTER SELECTION OF THE CITY PAIR.

Mod : 6789

A. DURING COCKPIT PREPARATION

A/C STATUS page is automatically displayed at power on.

DATABASE VALIDITY . . . . Check
If second database is valid, select it.

PERF FACTOR . . . . Check

This value must not be changed by the crew.
Cross-check this value with the computerized F-PLN.

Navaid deselection

If NOTAMs warn of any unreliable DME or VOR/DME, they must be deselected on the REF INDEX page :

REF key . . . . Press
Navaid identifier . . . . Write
DESELECT . . . . Press

INIT A : FMC initialization

INIT key . . . . .Press to display INIT A

- If a company route code is stored in the database :

Company route initialization

CO RTE . . . . Write/Insert

Cost Index and CRZ FL are normally stored with CO RTE in database and thus are automatically displayed. If not they should be inserted.

FLT NUMBER . . . . Write/Insert

- If no company route code is stored in the database :

Airport pair initialization

ORIGIN/DESTINATION (1R) . . . . . . Write/Insert

As soon as the origin/destination is inserted the RTE SELECTION page is displayed.

First case : there is one or several routes stored in the database between the given airport pair. The first one is displayed on the RTE SELECTION page. Others may be displayed by pressing NEXT key.

* INSERT prompt . . . Press to select the route displayed on RTE SELECTION page

Second case : there is no route (NONE is displayed) on RTE SELECTION page or none of the proposed routes are convenient.

RETURN prompt . . . . Press

It will be necessary to construct the route using AIRWAY page.
In this case cost index and CRZ FL are not given with origin/destination and thus should be inserted.

FLT NUMBER . . . . Write/Insert

Alternate

ALTERNATE (2R) . . . . Check or Write/Insert

or, if a route exists from DES to ALTN :

ALTN RTE (2L) . . . Press to display the ALTN RTE on RTE SELECTION page

If there is no route between DEST and ALTN, NONE is displayed. It should be constructed using the AIRWAY page. Else :

* INSERT prompt . . Press to select the ALTN RTE displayed

Departure coordinates

LAT/LONG (3L, 3R) . . . . Check

If the aircraft is at a gate with published coordinates, these must be used to update the airfield coordinates provided automatically on INIT page A. If the gate coordinates are not published, airfield coordinates will be used.
To change coordinates, use the slew keys to increase or decrease the displayed value, or write/insert a new value.

Check that lat/long values match airport reference coordinates given by airport chart.

COST INDEX (4L) . . . . Check or Write/Insert

If there is a cost index stored in the database with the CO RTE, it should not be changed as it defines the airline cost policy for this route.

If no cost index is stored in the database, use the one given by the airline.
If no cost index is inserted, no predictions for the ECON strategic mode will be computed and a message will be displayed at engine start.

Mod : 6789

IRS alignment

When entering the cockpit, IRS must be aligned.

ALIGN IRS prompt is displayed only if lat/long is filled, one MSU is set to NAV and IRS are not aligned.

ALIGN IRS prompt (4R) . . . . Press

Lat/long are sent to IRS.

ISDU . . . . Check that valid coordinates have been sent

VOR/NAV/ILS switch . . . . Set to NAV

Autotune functions are activated.

Cruise data

CRZ FL . . . . Check or Insert and Change

In our example : FL340.
Normally it is given with CO RTE. CRZ FL is not limited by MAX ALT computed at weight entry.

Modify it if necessary taking into account ATC constraints or gross weight.

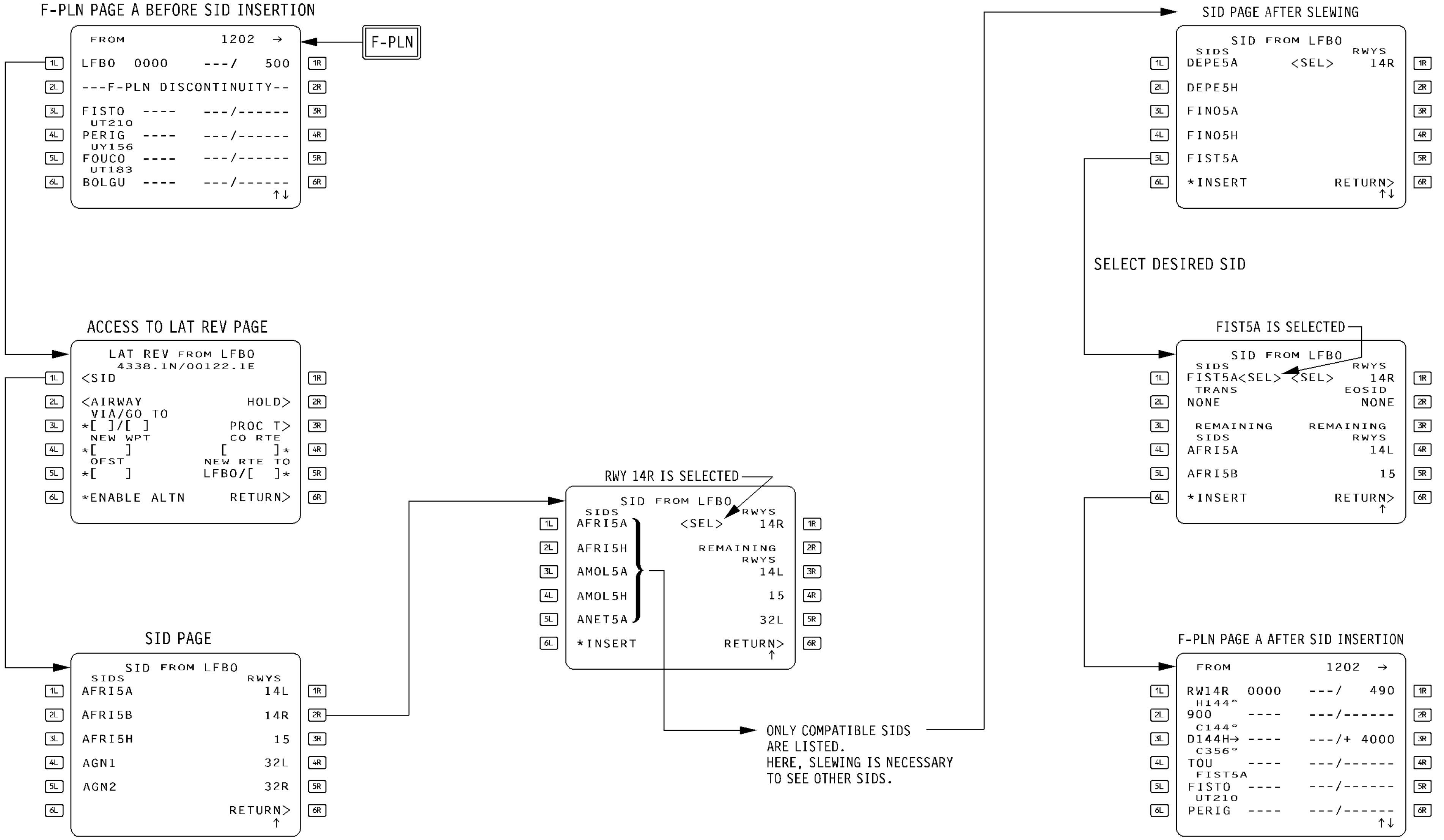
CRZ TEMP/TROPOPAUSE ALT . . . . Change if necessary
Defaulted to ISA at CRZ FL, and 36090 ft.

CRZ WIND DIRECTION/VELOCITY . . . Write/Insert

In our example : 190°/75 kt.
Wind at departure will be inserted on F-PLN page B.

Mod : 6789

RWY AND SID INSERTION



F-PLN PAGE A BEFORE SID INSERTION

```
 FROM              1202  →
LFBO  0000      ---/    500
---F-PLN DISCONTINUITY--
FISTO  ----     ---/------
 UT210
PERIG  ----     ---/------
 UY156
FOUCO  ----     ---/------
 UT183
BOLGU  ----     ---/------
                        ↑↓
```

ACCESS TO LAT REV PAGE

```
   LAT REV FROM LFBO
    4338.1N/00122.1E
<SID
<AIRWAY              HOLD>
 VIA/GO TO
*[ ]/[ ]           PROC T>
 NEW WPT            CO RTE
*[    ]           [     ]*
 OFST             NEW RTE TO
*[    ]          LFBO/[  ]*
*ENABLE ALTN       RETURN>
```

SID PAGE

```
     SID FROM LFBO
 SIDS               RWYS
AFRI5A               14L
AFRI5B               14R
AFRI5H                15
AGN1                 32L
AGN2                 32R
                   RETURN>
                        ↑
```

RWY 14R IS SELECTED

```
     SID FROM LFBO
 SIDS               RWYS
AFRI5A        <SEL>  14R
AFRI5H        REMAINING
                    RWYS
AMOL5A               14L
AMOL5H                15
ANET5A               32L
*INSERT            RETURN>
                        ↑
```

ONLY COMPATIBLE SIDS ARE LISTED.
HERE, SLEWING IS NECESSARY TO SEE OTHER SIDS.

SID PAGE AFTER SLEWING

```
     SID FROM LFBO
 SIDS               RWYS
DEPE5A        <SEL>  14R
DEPE5H
FINO5A
FINO5H
FIST5A
*INSERT            RETURN>
                        ↑↓
```

SELECT DESIRED SID

FIST5A IS SELECTED

```
     SID FROM LFBO
 SIDS               RWYS
FIST5A<SEL>   <SEL>  14R
 TRANS             EOSID
NONE                NONE
 REMAINING     REMAINING
 SIDS               RWYS
AFRI5A               14L
AFRI5B                15
*INSERT            RETURN>
                        ↑
```

F-PLN PAGE A AFTER SID INSERTION

```
 FROM              1202  →
RW14R  0000     ---/    490
 H144°
900    ----     ---/------
 C144°
D144H→ ----     ---/+ 4000
 C356°
TOU    ----     ---/------
 FIST5A
FISTO  ----     ---/------
 UT210
PERIG  ----     ---/------
                        ↑↓
```

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Mod : 11320 or 11364 or 12044 or 12045

F-PLN : revision and checking

F-PLN . . . . Press to display F-PLN page A

RWY/SID is normally stored in the database with the CO RTE and thus is automatically inserted in the F-PLN. This is indicated by the first waypoint being the runway, and not the airport ICAO identifier.
If this is not the case, and a F-PLN DISCONTINUITY is displayed, then a runway and a SID must be entered :

RWY/SID insertion

LFBO key (1L) . . . . Press to display LATERAL REVISION page

SID prompt . . . . Press to display SID page

RWY to be selected . . . . Press to select 14R

Only SIDs corresponding to the selected RWY are now displayed.

SID to be selected . . . . Press to select FISTO 5A

TRANS (if any) . . . . Press to select

TRANS has not the same meaning for SPERRY as for navigation documents. Therefore it may be necessary to select a TRANS even if documents do not mention any transition.
A TRANS may be necessary only if no SID has been chosen. In our example, NONE is displayed under TRANS as no TRANS exists associated to this departure.

EOSID (if any) . . . . automatically selected

NONE is displayed in our example, as no EOSID exists for this departure.

* INSERT prompt . . . . Press to insert RWY/SID/TRANS in the F-PLN

Notes :
- *RWY/SID insertion may be delayed until departure clearance is given.*
- *RWY or SID may be changed by pressing the adjacent LS key or cleared by using the CLR key.*
- *If a new RWY is selected which is not compatible with the selected SID, this SID and the corresponding TRANS are automatically cleared.*

CAUTION

- RWY entry is mandatory for the FMS to update its navigation references on RWY threshold at takeoff when the go-levers are pressed.
- NAV mode must not be engaged to fly a SID manually constructed as it uses specific legs which cannot be manually defined (e.g. VOR radial or altitude interceptions or DME arc)

IRS alignment check for FMS data confirmation R

R

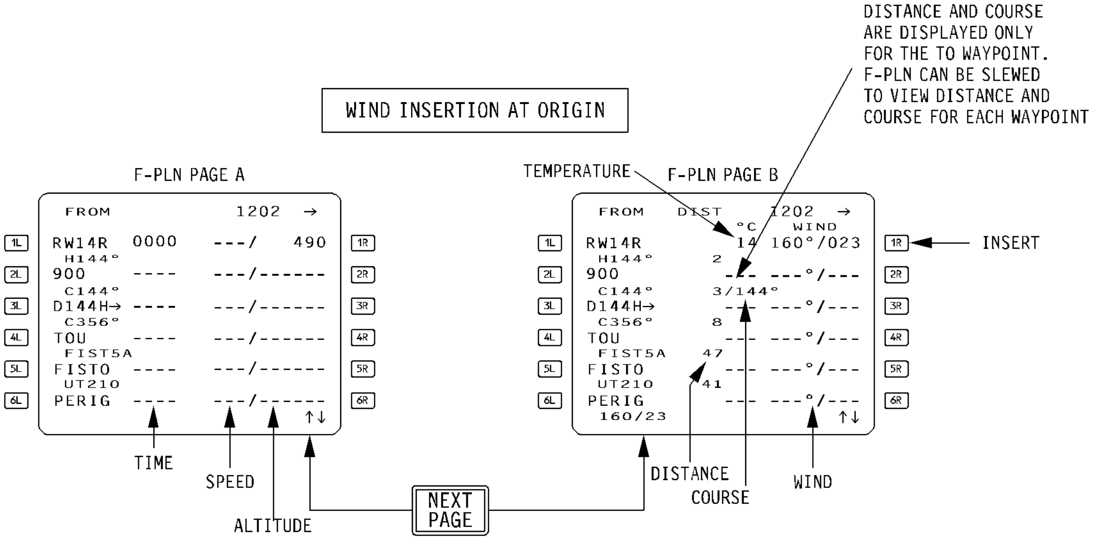
On the POSITION MONITOR page, check that the IRS are in NAV mode, and check that the distance between each IRS and the FMS position is lower than 5 NM. R R R R R

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. R R R R

Mod : 11320 or 11364 or 12044 or 12045

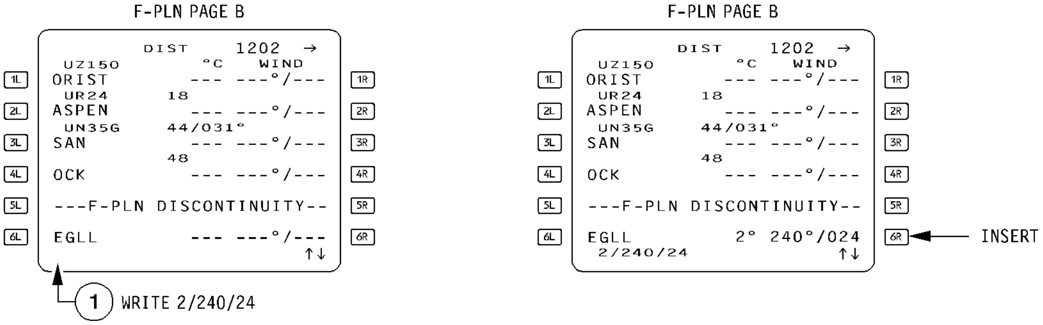
TEMPERATURE AND WIND INSERTION

WIND INSERTION AT ORIGIN


DISTANCE AND COURSE ARE DISPLAYED ONLY FOR THE TO WAYPOINT. F-PLN CAN BE SLEWED TO VIEW DISTANCE AND COURSE FOR EACH WAYPOINT

AT LFBO: WIND 160°/23 KT. TEMPERATURE IS TAKEN FROM SENSORS

TEMP/WIND AT DESTINATION INSERTION



① WRITE 2/240/24

AT EGLL: TEMPERATURE 2°C, WIND 240°/24 KT

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F-PLN PAGE A checking

ND PLAN MODE . . . . Select

SLEW keys (↑) (↓) . . . . Press

The F-PLN is slewed on F-PLN page A and on ND PLAN mode.

Check speed and altitude constraints if any.

Distance and course are displayed only between the FROM and TO waypoints of the screen. The TO waypoint of the screen corresponds to the center of the ND display, in PLAN mode. Check there are no discontinuities in the F-PLN.

Final approach outer marker and destination runway are constrained by dummy altitude constraints. These constraints are inserted in the database in order to prevent the aircraft from descending below them if PROFILE is not disengaged.

PROC T (if any) . . . . Write/Insert a speed constraint at the first waypoint of a procedure turn

HOLDING (if any) . . . . Delete if not necessary

If it is not deleted, insert a speed constaint as for PROC T.

F-PLN PAGE B checking

NEXT PAGE key . . Press to display F-PLN page B

SLEW keys (↑) (↓) . . . . Press

Check waypoints, course, airways, and distance for each leg versus compagny flight log or navigation chart.

WIND DIR/VELOCITY at waypoint . . . . Write

Insert wind at each waypoint where wind change is significant.

This concerns in particular wind direction and velocity at origin and at destination.

Temperature may also be inserted in the same way. Temperature at departure airport is automatically inserted coming from aircraft sensors.

Specific speed to be flown after takeoff

The usual target speed after takeoff is 250 kt (speed limit). It is possible to change it.

TACT MODE key . . . . Press

The current mode is displayed in capitals.

If, for example, the speed to be flown after takeoff is 240 kts :

240 . . . . Write/Insert in 4L

SPEED LS key (4L) . . . . Press to activate TACT SPD mode

This procedure will allow the use of PROFILE mode at the beginning of climb rather than using the FCU speed knob.

Secondary flight plan

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 minimum at the departure airfield the secondary flight plan should be that required for an immediate diversion after takeoff.

c) If there is the possibility of a runway and/or SID change during taxi, this can be prepared for by copying the active and making the necessary modifications.

SEC F-PLN key . . . . Select

Check the content of the secondary flight plan. If not satisfactory, it can be cleared :

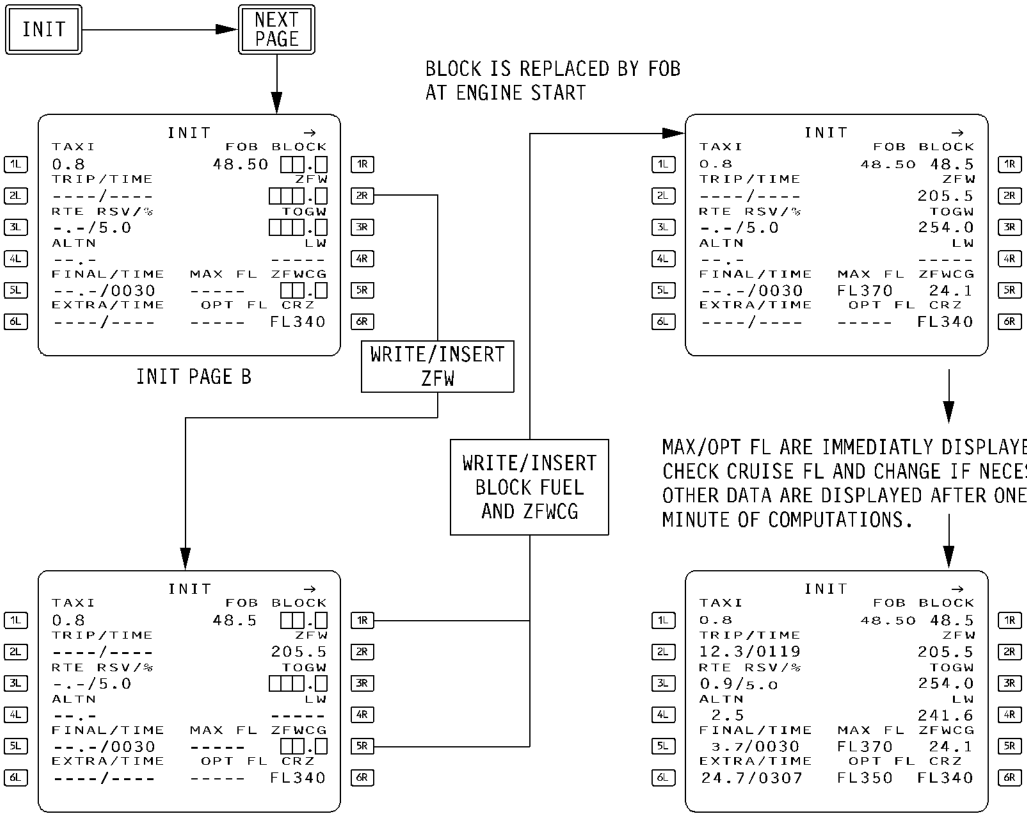
CLR SEC key . . . . Select

If a copy of the active flight plan is needed :

COPY ACTIVE prompt . . . . Select

Else any F-PLN can be entered into the secondary F-PLN in the same way as the active F-PLN.

WEIGHT ENTRIES AND FUEL PLANNING



```
              INIT          →
TAXI                FOB BLOCK
0.8               48.50 □□.□
TRIP/TIME                 ZFW
----/----              □□□.□
RTE RSV/%                TOGW
-.-/5.0                □□□.□
ALTN                       LW
--.-                    -----
FINAL/TIME   MAX FL  ZFWCG
--.-/0030    -----     □□.□
EXTRA/TIME    OPT FL  CRZ
----/----    -----    FL340
```

INIT PAGE B

WRITE/INSERT ZFW

```
              INIT          →
TAXI                FOB BLOCK
0.8                48.5 □□.□
TRIP/TIME                 ZFW
----/----               205.5
RTE RSV/%                TOGW
-.-/5.0                □□□.□
ALTN                       LW
--.-                    -----
FINAL/TIME   MAX FL  ZFWCG
--.-/0030    -----     □□.□
EXTRA/TIME    OPT FL  CRZ
----/----    -----    FL340
```

WRITE/INSERT BLOCK FUEL AND ZFWCG

BLOCK IS REPLACED BY FOB AT ENGINE START

```
              INIT          →
TAXI                FOB BLOCK
0.8                48.50 48.5
TRIP/TIME                 ZFW
----/----               205.5
RTE RSV/%                TOGW
-.-/5.0                 254.0
ALTN                       LW
--.-                    -----
FINAL/TIME   MAX FL  ZFWCG
--.-/0030    FL370     24.1
EXTRA/TIME    OPT FL  CRZ
----/----    -----    FL340
```

MAX/OPT FL ARE IMMEDIATLY DISPLAYED
CHECK CRUISE FL AND CHANGE IF NECESSARY.
OTHER DATA ARE DISPLAYED AFTER ONE
MINUTE OF COMPUTATIONS.

```
              INIT          →
TAXI                FOB BLOCK
0.8                48.50 48.5
TRIP/TIME                 ZFW
12.3/0119               205.5
RTE RSV/%                TOGW
0.9/5.0                 254.0
ALTN                       LW
 2.5                    241.6
FINAL/TIME   MAX FL  ZFWCG
 3.7/0030    FL370     24.1
EXTRA/TIME    OPT FL  CRZ
24.7/0307    FL350    FL340
```

Mod : 4801 + 6789

B. WHEN THE LOAD SHEET IS AVAILABLE

INIT B : weight entries

INIT key . . . . Press to display INIT page A

NEXT PAGE key . . . Press to display INIT page B

ZFW or TOGW . . . . Write/Insert

ZFWCG . . . . Write/Insert

Taxi fuel is defaulted according to the airline policy. It may be changed.

- If CG and ZFW are inserted, the FMS will provide the minimum fuel required for the trip according to fuel policy (Route Reserves, ALTN, FINAL)
- If CG, ZFW and BLOCK FUEL are inserted, the FMS will provide all predictions, as well as the EXTRA fuel if any.

Fuel planning on INIT B

BLOCK is block fuel weight :

BLOCK . . . . Write/Insert

TOGW is deduced from ZFW, BLOCK and TAXI. BLOCK is automatically replaced by FOB (fuel on board) at engine start and thus is needed only for fuel computations before engine start.

MAX FL and OPT FL . . . . Check

They are displayed after BLOCK is inserted. Dashes are displayed while computations are on going.

CRZ FL . . . . May be changed

F-PLN predictions checking

All fields are now available in F-PLN pages and predictions can therefore be revised :

F-PLN key . . . . Select

SLEW keys . . . . Use as necessary

Estimates of en-route times between waypoints are now given.

Mod : 4801 + 6789

C. BEFORE PUSHBACK OR START

Takeoff data

TO/APP key . . . . Press to display TAKEOFF page

F, S, O speeds . . . . Check

V1 . . . . Write/Insert

VR . . . . Write/Insert

V2 . . . . Select on FCU knob

SPD/Mach knob . . . . Push to activate Preset

V2 is copied from FCU to TAKEOFF page.

Preset speed . . . . Select

Select first speed to be flown after takeoff.

THR RED . . . . Check/may be changed

Not lower than 1 500 ft AGL

ACCEL altitude . . . . Check/may be changed

Not lower than THR RED altitude

TO SHIFT LS KEY . . . . Press SELECT prompt if takeoff is initiated beyond the runway threshold : pressing this key inserts a 0.5 NM/970 m shift from runway threshold : ACTIVE is then displayed.

D. TAXI

First clearance is given for 7000 ft (for example).

ALT KNOB (FCU) . . . . Select first cleared altitude

Page selection on CDU

PF . . . . TAKEOFF page

PNF . . . . F-PLN page A

NAV/PROFILE mode arming

PROFILE mode . . . . Arm on FCU

P. CLB blue (armed) . . . . Check on FMA

NAV mode . . . . Arm on FCU

NAV blue (armed) . . . . Check on FMA

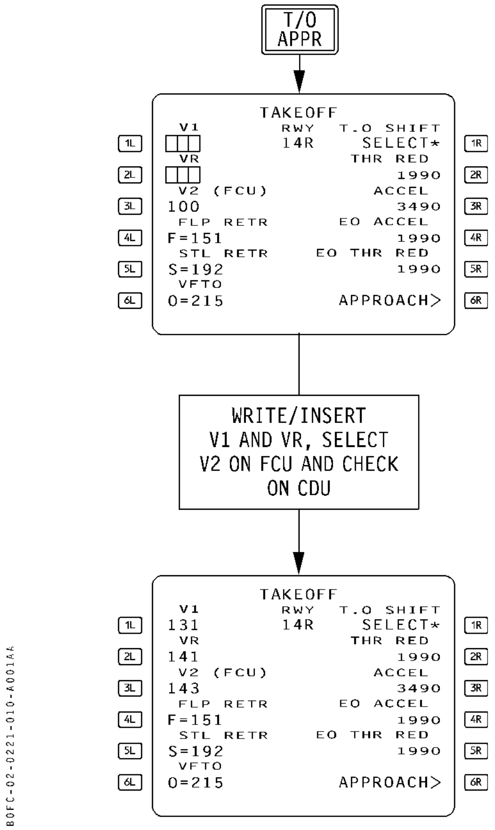
NAV should not be used at takeoff if the SID to be flown is not defined in the database.

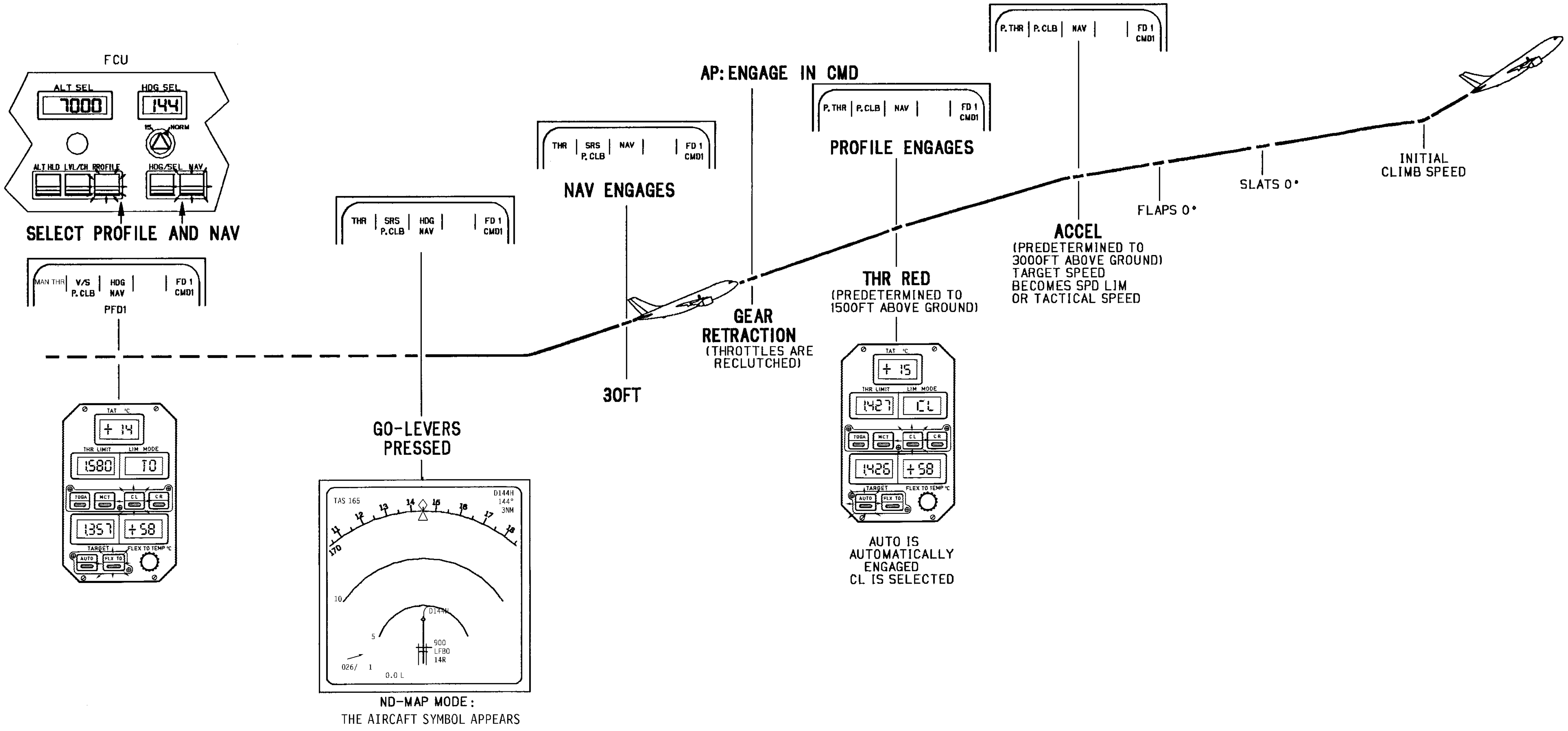
Thrust selection on TRP

FLX TO TEMP . . . . Select on TRP

If a high temperature leads to FLX TO thrust lower than the CL thrust the FMS will gradually increase thrust from the FLX TO thrust to reach the CL thrust before 20 000 ft.
So FLX TO and PROFILE mode are recommended at takeoff.

TAKEOFF DATA INSERTION





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A. WHEN READY FOR TAKEOFF

ND MAP MODE. . . . . .Select

GO LEVERS . . . . Trigger

The FMS updates its navigational reference (aircraft position) on runway threshold coordinates : the aircraft symbol is now displayed on the runway.

FMS NAV UPDATING . . . . Check A/C symbol on RWY threshold

If go levers have been pressed before runway threshold, press go levers again on runway threshold ; the FMS will resynchronize its position on RWY threshold coordinates.

AP/FD . . . . Use it as described in chapter 2.02.03

B. AT 30 FT

FMA . . . . Check NAV engagement

From this moment the lateral navigation is guided by the FMS through AP/FD.

C. AT THRUST REDUCTION ALTITUDE

PROFILE is automatically engaged. From this moment vertical navigation and thrust are controlled by the FMS through AP/FD and ATS. Speed window is dashed.
Target speed is actual speed : usually V2 + 10 kt.

FMA . . . . Check P. THR/P. CLB engagement

TRP . . . . Check AUTO engagement

D. AT ACCEL ALT

TGT SPD (blue on PFD) . . . . Check

It is either 250 kt or the tactical speed entered.

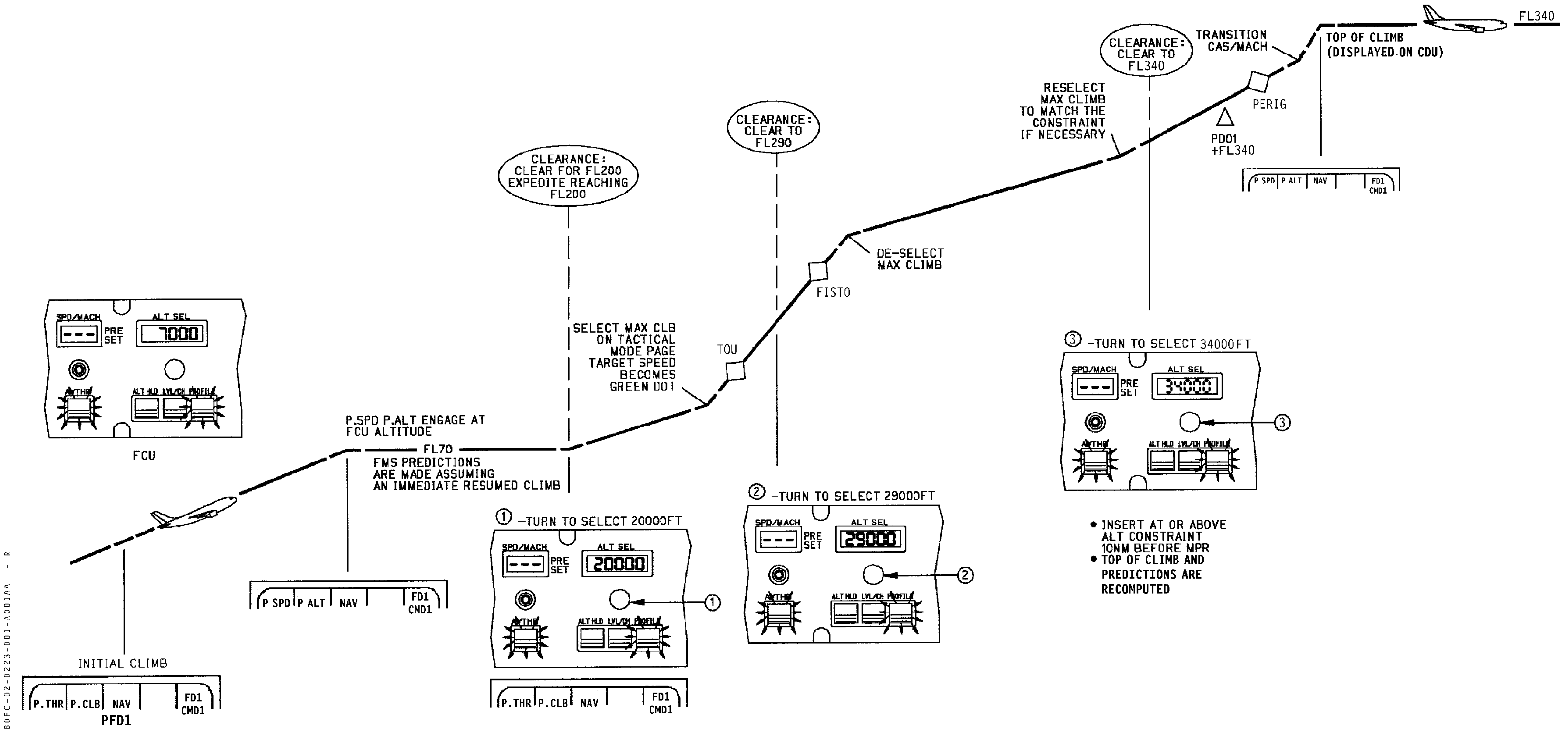
If a TACTICAL SPD has been activated and is greater than the SPD LIM, the message
″SPD LIM EXCEEDED″
will be displayed, when the aircraft speed overshoots the SPD LIM. It is possible to change the SPD LIM and the corresponding altitude on VERT REV page A (see chapter 1.20.73).

At transition altitude :

ALTIMETERS . . . . Set to standard
Check that the highest ALT constraint of the SID has been passed.

The FMS controls the aircraft altitude at the value given by the altimeter and displayed on the PFD. If the baro setting is standard when passing an altitude constraint which is 7 000 ft QNH for instance, it will be passed at FL 70 and not at 7 000 ft QNH.

CONSTRAINTS . . . . . Monitor the FMS guidance



- INSERT AT OR ABOVE ALT CONSTRAINT 10NM BEFORE MPR
- TOP OF CLIMB AND PREDICTIONS ARE RECOMPUTED

A typical vertical path including most of the events which may be encountered is presented.
FMS use according to usual ATC clearances is also presented.
The SPD TACT mode may be used throughout the climb to control the aircraft speed.

A. WHEN INITIAL CLIMB SPEED IS REACHED

- F-PLN page for PF
- PROGRESS page for PNF, or as required.

For climb, modes on FMA are P.THR/P.CLB.

B. AT FCU ALT

Aircraft levels off.
P.SPD/P.ALT are engaged. Predictions are made assuming an immediate return to climb.

C. CLIMB TO FL 200

Clearance for FL 200 is given by ATC. Two positive actions are required to leave FCU ALT.

FCU ALT KNOB . . . . Turn to select 20 000 ft

FCU ALT KNOB . . . . Pull to initiate climb

P. SPD/P. ALT revert to P. THR/P. CLB.

MAX CLIMB TACT mode

Expedite climb to FL 200 is requested by ATC.

TACT MODE key . . . . Press
This displays the TACT MODE page.

MAX CLB . . . . Press
This activates max climb mode.

- Max climb is a max angle of climb mode.
- It is performed at green dot. FMS green dot (target speed on PFD) and FAC green dot (green circle on SPD scale on PFD) may be slightly different. Aircraft will climb at the highest of these two speeds. Predictions are made with FMS target speed.
- Max climb mode is active until next level off.
- Max climb is replaced by the selected strategic mode when the level off is reached.

Predictions (time, distance) to FL 200 for MAX CLB mode are displayed after a delay.

D. CLIMB FROM FL 200 TO FL 290

Clearance to FL 290 is given before reaching FL 200.

FCU ALT KNOB . . . . Turn to select 29 000 ft

Here pulling the knob is not needed as aircraft has not reached FCU ALT.

E. USE OF PD (PLACE DISTANCE) POINTS

During climb, you are requested to be above FL 300 10 NM before PERIG. A PD (Place Distance) point may be inserted then constrained as follows :

PERIG/– 10 . . . . Write on F-PLN page

PERIG key . . . . Press to insert PD

PD 01 waypoint is created and displayed before PERIG.

LS key right in line of PD01 . . . . Press

This displays the VERT REV AT PD01 page.

300 . . . . Write/Insert in AT OR ABOVE field

PD 01 is now constrained by an AT OR ABOVE FL 300 constraint.

Note : This can also be done by writing/inserting /+300 in right LS key in line of PD01.

If this constraint cannot be matched in the present active mode, the message ALT ERROR AT PD 01 – XXX will be displayed, – XXX meaning that A/C will be at 30 000 – XXX ft at PD 01. Moreover an amber FCU level off symbol is displayed on the NDs. MAX CLB tactical mode should be selected in this case.
Dashes are displayed while the FMS recomputes new predictions.

F. CRZ FL CHANGE DURING CLIMB

Increasing CRZ FL :

FCU ALT KNOB . . . . Turn

The CRZ ALT is automatically changed in the F-PLN. Check it on PROGRESS page. The message NEW CRZ ALT is displayed.

Decreasing CRZ FL :

CRZ FL . . . . Change on PROGRESS page

FCU ALT KNOB . . . . Turn

G. TURBULENCE

The SPD TACT MODE should be used with a double speed/mach entry.

Example :

285/.78 (4L) . . . . WRITE/INSERT

LS KEY 4L . . . . PRESS to activate

H. TRANSITION IAS/MACH ALTITUDE

The optimum mach according to the active mode is targeted then held.

Mod : 6789

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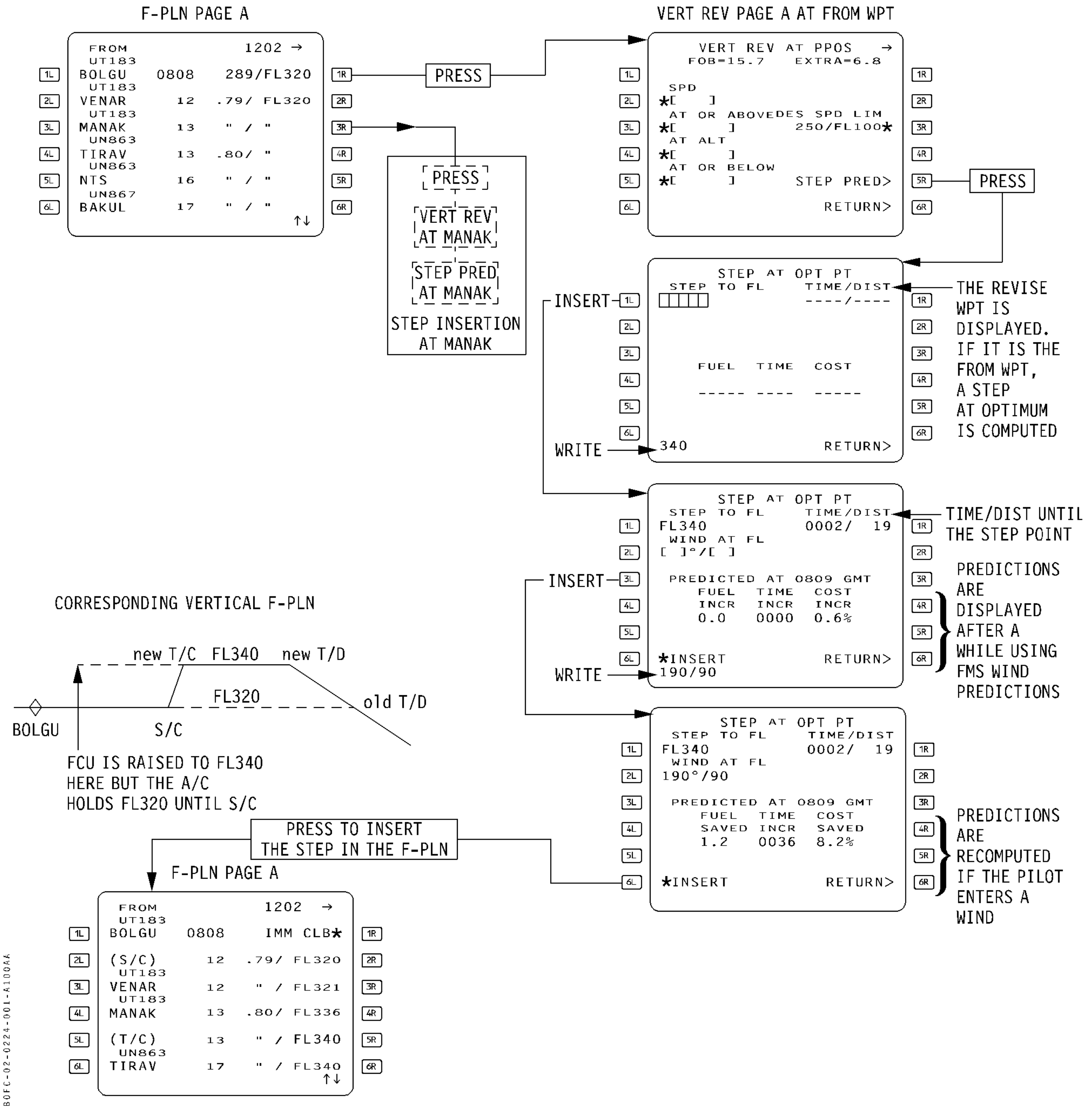
Mod : 6789

STEP CLIMB INSERTION



```
 FROM            1202 →
 UT183
BOLGU   0808    289/FL320
 UT183
VENAR     12   .79/ FL320
 UT183
MANAK     13     " / "
 UN863
TIRAV     13   .80/ "
 UN863
NTS       16     " / "
 UN867
BAKUL     17     " / "
                      ↑↓
```

```
   VERT REV AT PPOS    →
 FOB=15.7    EXTRA=6.8

 SPD
*[    ]
 AT OR ABOVEDES SPD LIM
*[      ]      250/FL100*
 AT ALT
*[      ]
 AT OR BELOW
*[      ]      STEP PRED>

               RETURN>
```

```
     STEP AT OPT PT
 STEP TO FL     TIME/DIST
☐☐☐☐            ----/----



   FUEL   TIME   COST

   -----  ----   -----

340              RETURN>
```

THE REVISE WPT IS DISPLAYED. IF IT IS THE FROM WPT, A STEP AT OPTIMUM IS COMPUTED

```
     STEP AT OPT PT
 STEP TO FL     TIME/DIST
FL340           0002/  19
 WIND AT FL
[ ]°/[ ]

 PREDICTED AT 0809 GMT
   FUEL   TIME   COST
   INCR   INCR   INCR
   0.0    0000   0.6%

*INSERT          RETURN>
190/90
```

TIME/DIST UNTIL THE STEP POINT

PREDICTIONS ARE DISPLAYED AFTER A WHILE USING FMS WIND PREDICTIONS

```
     STEP AT OPT PT
 STEP TO FL     TIME/DIST
FL340           0002/  19
 WIND AT FL
190°/90

 PREDICTED AT 0809 GMT
   FUEL   TIME   COST
   SAVED  INCR   SAVED
   1.2    0036   8.2%

*INSERT          RETURN>
```

PREDICTIONS ARE RECOMPUTED IF THE PILOT ENTERS A WIND

FCU IS RAISED TO FL340 HERE BUT THE A/C HOLDS FL320 UNTIL S/C

```
 FROM            1202 →
 UT183
BOLGU   0808     IMM CLB*
(S/C)     12   .79/ FL320
 UT183
VENAR     12     " / FL321
 UT183
MANAK     13   .80/ FL336
(T/C)     13     " / FL340
 UN863
TIRAV     17     " / FL340
                      ↑↓
```

Mod : 6789

A. REACHING CRZ FL

Aircraft levels off. P. SPD/P. ALT are engaged.
Aircraft CRZ ALT is held by FMS within a ± 50 ft margin in order to avoid throttle activity. It is cost efficient, so PROFILE should be used whenever it is possible.

- F-PLN page for PF
- PROGRESS page for PNF, or as required.

B. STEP CLIMB/DESCENT

STEP prediction at optimum FL

Assuming that optimum flight level (given on PROGRESS page) is different than present CRZ FL, step predictions (time, distance to the step point) can be displayed on STEP PRED page, in order to make a step climb or step descent request to ATC.

On F-PLN page :

LS KEY 1R (FROM WPT) . . . . . . Press to display VERT REV page at FROM WPT

STEP PRED prompt . . . . Press to display STEP PRED page at OPTIMUM POINT

STEP FL, for example OPT FL . . . . . . Write/Insert

WIND AT STEP FL . . . . Write/Insert

If no wind is inserted, the FMS will use its own computed wind.
An optimum step point is computed.

TIME/DISTANCE TO STEP POINT . . . . Read

A delay is necessary while the FMS recomputes all the predictions.

FUEL/TIME/COST SAVINGS/LOSSES . . . . . Read

These predictions are given for an optimum step climb or descent point since STEP PRED page was accessed from the FROM WPT.

Step climb insertion

If the predictions lead to confirm the step climb, for example.

*INSERT prompt on STEP page . . . . Press

FCU ALT KNOB . . . . . Turn to select new altitude

FCU ALT KNOB . . . . Pull

Mod : 6789

P. CLB ARMED . . . . Check on FMA

IMM CLB prompt on CDU . . . . . Check available

The aircraft will stay at present CRZ FL until step point is reached.
At step point, a climb will be initiated without any pilot action.
P. CLB blue on FMA will flash 30 sec before reaching the step point to advise that an altitude change will be initiated without any pilot action.
If the crew does not want to wait until the step point for climbing, IMM CLB prompt should be pressed : an immediate climb is initiated.

If the FCU is not dialed at the step point the step is removed.

If the FCU ALT is below the STEP FL, the step will be performed at the FCU ALT.

A step leading to a level flight less than 5 min cannot R
be inserted . R

Step climb at a given waypoint

If clearance for FL 340 is given by ATC only after passing MANAK, a step can be inserted at this point.

MANAK RIGHT LS KEY . . . . Press to display VERT REV page at MANAK

STEP PRED prompt . . . . Press to display STEP PRED page AT MANAK

STEP FL . . . . Write/Insert

Other actions and informations are similar to STEP AT OPTIMUM POINT.

STEP descent

Same operations as for step climb. STEP FL must be higher than the highest altitude constraint.

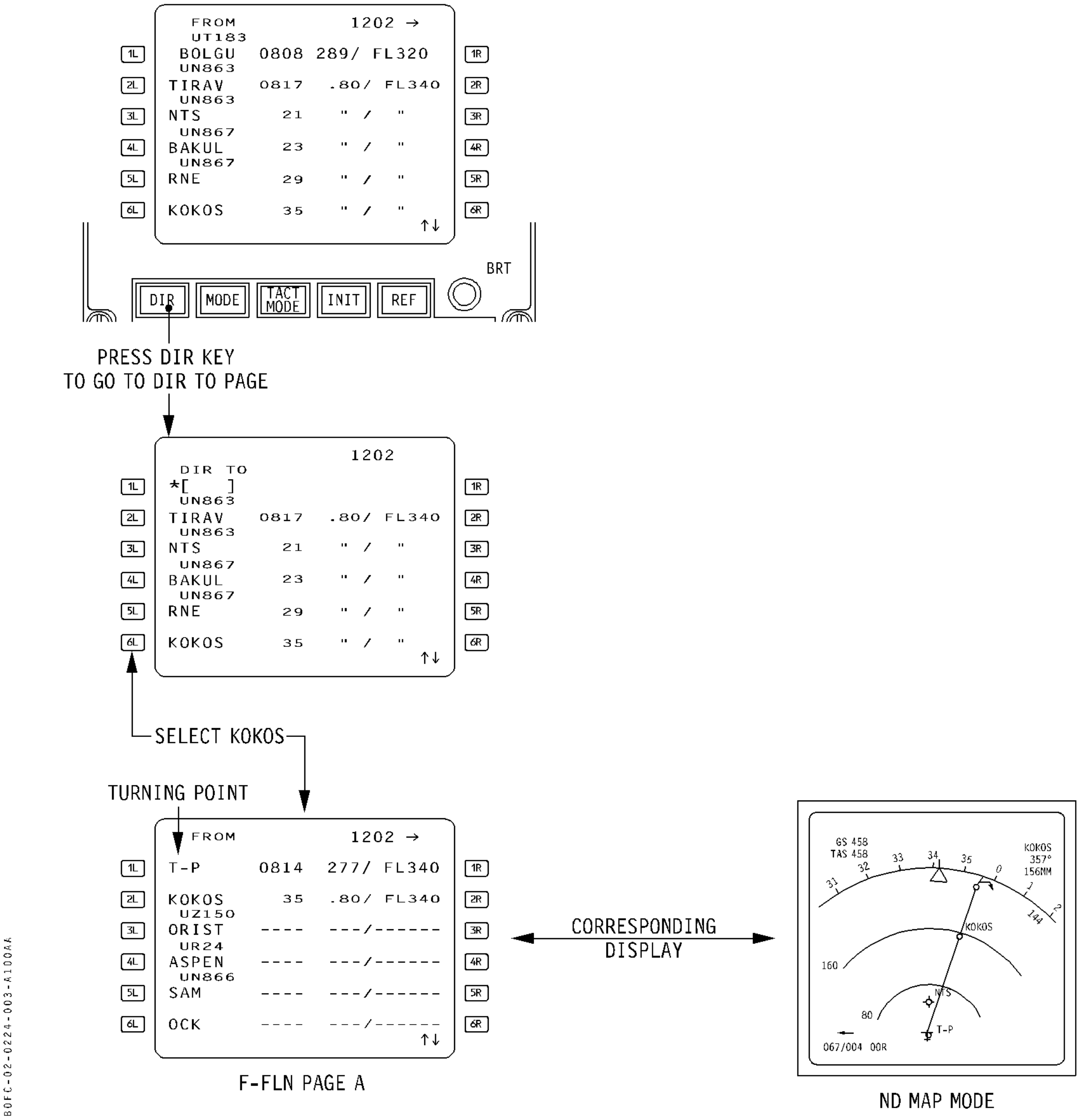
Immediate STEP climb

It is also possible to perform a step in the following way, (without accessing STEP PRED page) and without previewing predictions.

FCU ALT KNOB . . . . Turn/Pull

CRZ ALT is automatically changed. A message NEW CRZ ALT is displayed. Flight predictions are restarted.

DIR TO WAYPOINT INSERTION



PRESS DIR KEY
TO GO TO DIR TO PAGE

SELECT KOKOS

TURNING POINT

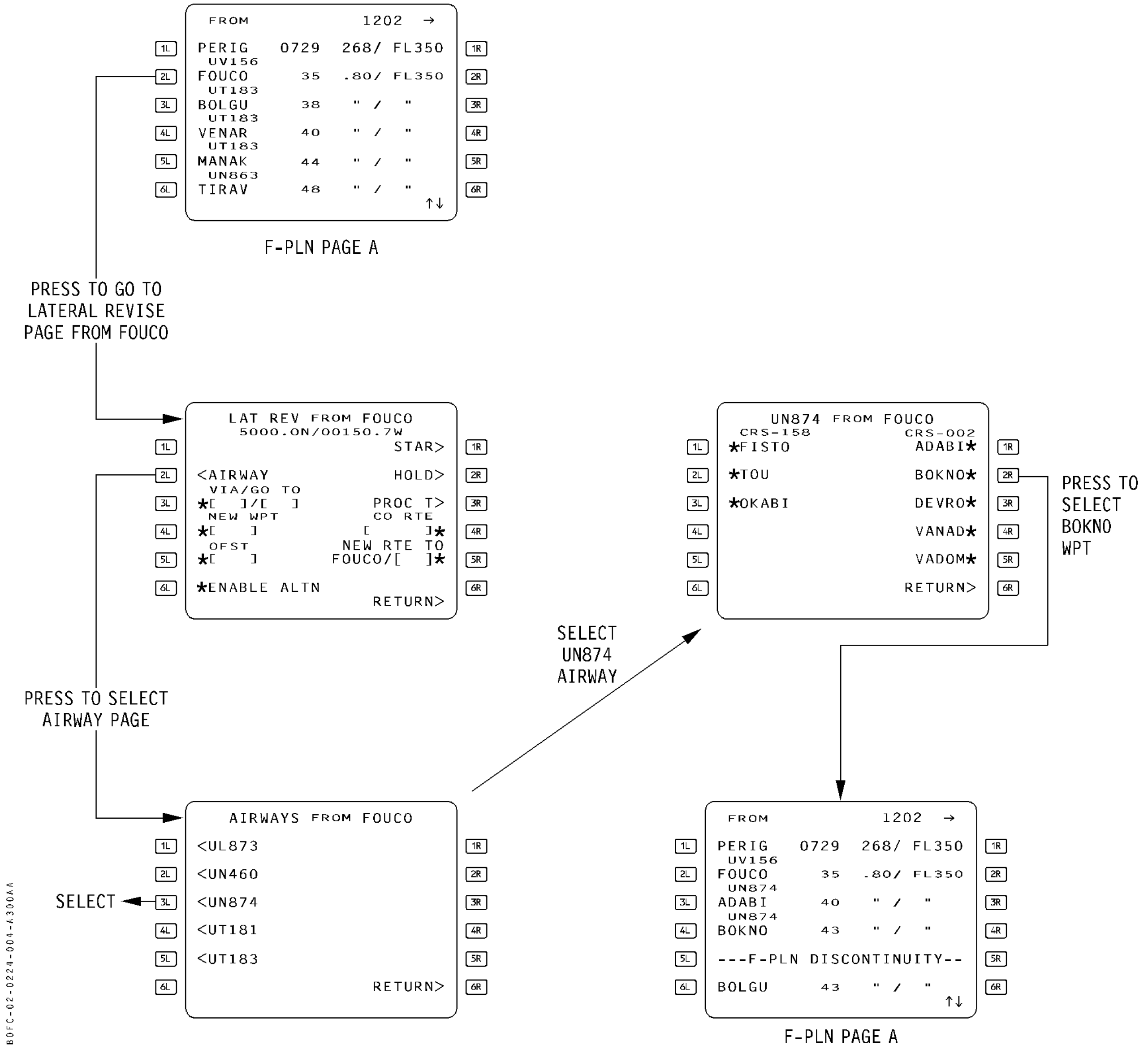
CORRESPONDING
DISPLAY

F-FLN PAGE A

ND MAP MODE

Mod : 6789

AIRWAY INSERTION



```
 FROM               1202  →
PERIG    0729  268/ FL350
 UV156
FOUCO      35  .80/ FL350
 UT183
BOLGU      38   " /  "
 UT183
VENAR      40   " /  "
 UT183
MANAK      44   " /  "
 UN863
TIRAV      48   " /  "
                       ↑↓
```

F-PLN PAGE A

PRESS TO GO TO
LATERAL REVISE
PAGE FROM FOUCO

```
   LAT REV FROM FOUCO
   5000.0N/00150.7W
                     STAR>
<AIRWAY              HOLD>
 VIA/GO TO
*[  ]/[  ]         PROC T>
 NEW WPT            CO RTE
*[    ]            [    ]*
 OFST           NEW RTE TO
*[    ]         FOUCO/[  ]*
*ENABLE ALTN
                   RETURN>
```

```
   UN874 FROM FOUCO
 CRS-158       CRS-002
*FISTO          ADABI*
*TOU            BOKNO*
*OKABI          DEVRO*
                VANAD*
                VADOM*
               RETURN>
```

PRESS TO
SELECT
BOKNO
WPT

PRESS TO SELECT
AIRWAY PAGE

SELECT
UN874
AIRWAY

```
   AIRWAYS FROM FOUCO
<UL873
<UN460
<UN874
<UT181
<UT183
                   RETURN>
```

SELECT

```
 FROM               1202  →
PERIG    0729  268/ FL350
 UV156
FOUCO      35  .80/ FL350
 UN874
ADABI      40   " /  "
 UN874
BOKNO      43   " /  "
---F-PLN DISCONTINUITY--
BOLGU      43   " /  "
                       ↑↓
```

F-PLN PAGE A

Mod : 11320 or 11364 or 12044 or 12045

C. USE OF DIR TO FUNCTION AND AIRWAY PAGE

To fly directly to a waypoint, a lateral revision can be done using the « DIR TO » page.

DIR TO waypoint insertion :

DIR key . . . . Press

Waypoint identifier . . . . . . Write/Insert in line 1L

The display then returns to the F-PLN page with the DIR TO waypoint inserted and a discontinuity between the DIR TO waypoint and the « TO » waypoint of the original F-PLN.

This discontinuity can be cleared by selecting the CLR key then the LS key in line of the discontinuity.

If the DIR TO waypoint is a waypoint belonging to the original F-PLN, it can also be entered by simply pressing the left LS key beside the desired DIR TO waypoint (on the DIR TO page).
In this case no F-PLN DISCONTINUITY will be inserted into the F-PLN.
All waypoints of the F-PLN can be viewed on the DIR TO page by using slewing.

As soon as the DIR TO waypoint is inserted, an immediate turn manoeuver is initiated.

AIRWAY insertion

Access AIRWAY page via LATERAL REVISION page at FOUCO :

FOUCO . . . . Press to display LAT REV FROM FOUCO page

AIRWAY . . . . Press to display AIRWAY page

UN874 . . . . Press to view the UN874 airway

UN874 AIRWAY is displayed with all the waypoints which belong to this airway.

Since we want to introduce the portion between FOUCO and BOKNO we have to :

BOKNO . . . . Press

The display returns to F-PLN page A with the portion of airway (from FOUCO to BOKNO) inserted into the F-PLN, followed by a F-PLN DISCONTINUITY which can be cleared.
This new route will be followed by the aircraft through NAV mode.

D. SELECTION OF ANOTHER MODE (STRATEGIC OR TACTICAL)

For example, if a segment with MAX END mode appears necessary to fulfill the required fuel reserve :

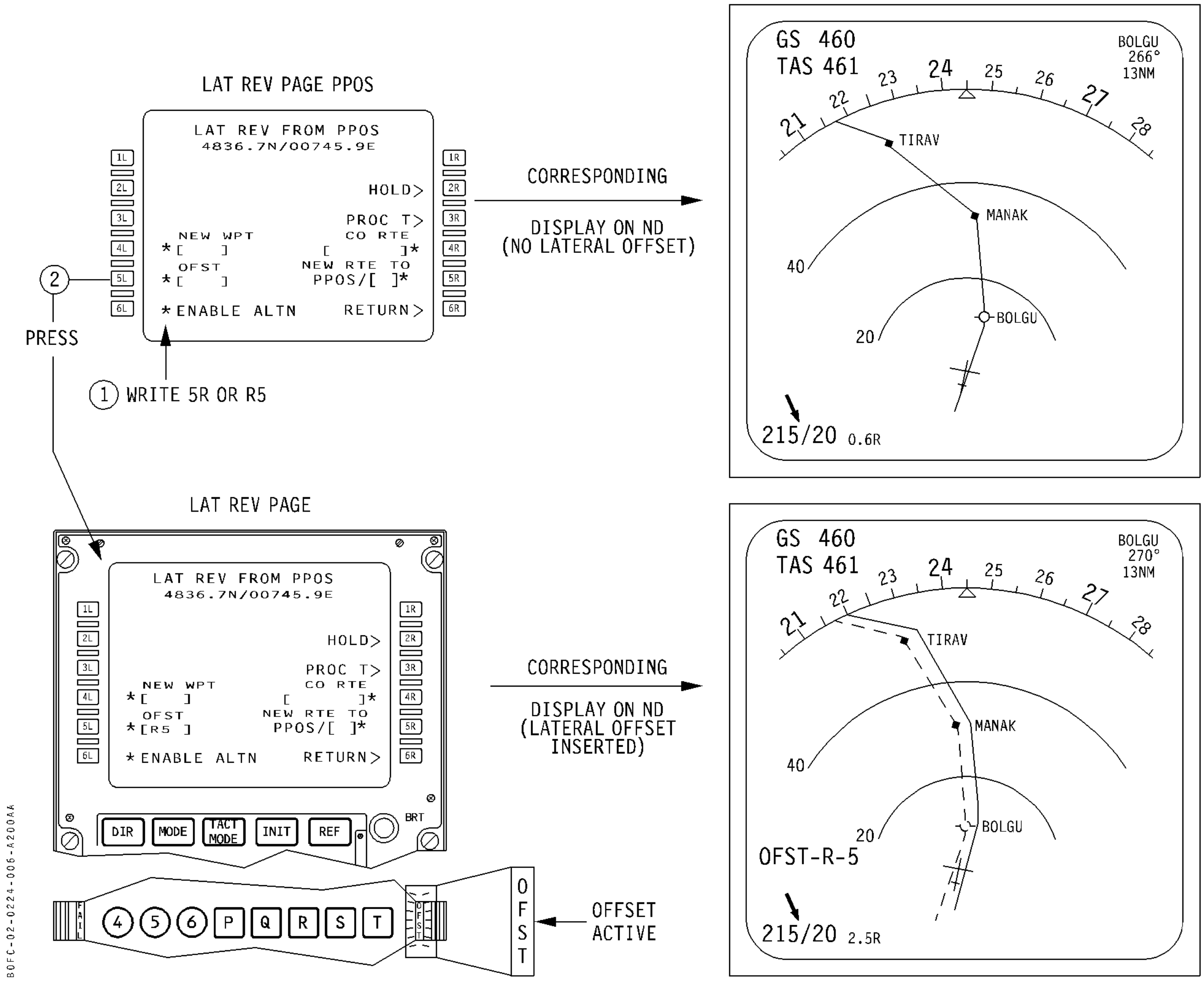
TACT MODE KEY ON CDU . . . . Press

MAX END . . . . Press to activate MAX END mode

Note : *This mode being a TACTICAL mode, it will be active only for this phase of flight.*

Mod : 6789

INSERTING A LATERAL OFFSET



Mod : 11320 or 11364 or 12044 or 12045

E. INSERTION OF A LATERAL OFFSET

R

If ATC requires to fly 5 NM right of the route until further notice :

On LAT REV page from PPOS :

5R or R5 . . . . Write/Insert in line 5L.

In map mode on the ND, the parallel track 5 NM right of the flight plan now displayed in a solid line, and the original flight plan is displayed with a dashed line. The aircraft turns to join the new course 5 NM right of the original flight plan.

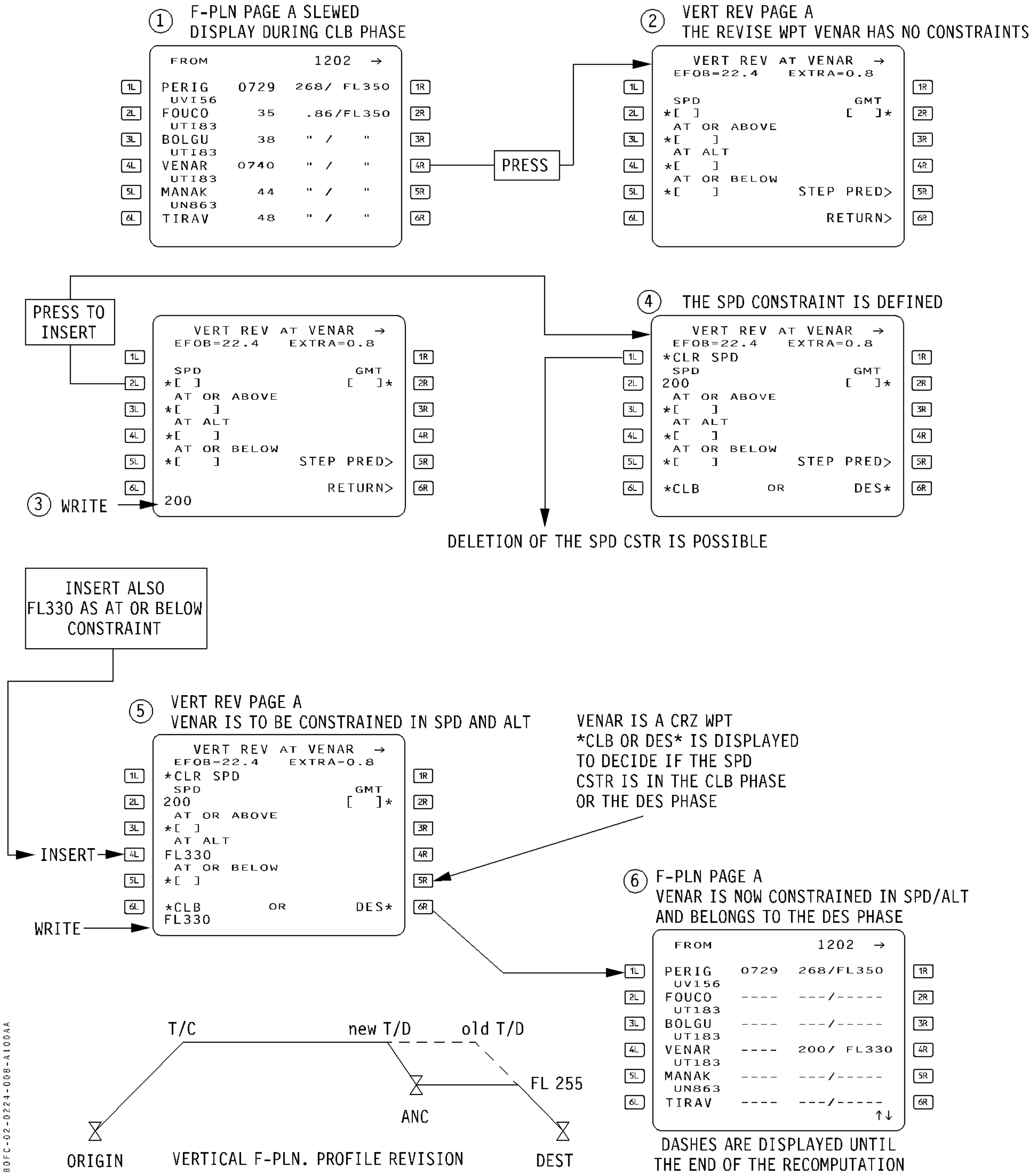
The OFST illuminator on the CDU illuminates.

The OFFSET can be cancelled :

– either by pressing the CLR key then 5L on LAT REV page
– either by inserting a DIR TO leg in the F-PLN from the PPOS.

Mod : 11320 or 11364 or 12044 or 12045

INSERTING A CONSTRAINT THROUGH VERT REV PAGE



① F-PLN PAGE A SLEWED
DISPLAY DURING CLB PHASE

```
 FROM            1202  →
PERIG    0729   268/ FL350
 UV156
FOUCO      35    .86/FL350
 UT183
BOLGU      38     "  /   "
 UT183
VENAR    0740     "  /   "
 UT183
MANAK      44     "  /   "
 UN863
TIRAV      48     "  /   "
```

② VERT REV PAGE A
THE REVISE WPT VENAR HAS NO CONSTRAINTS

```
   VERT REV AT VENAR  →
 EFOB=22.4    EXTRA=0.8
 SPD                  GMT
*[ ]               [   ]*
 AT OR ABOVE
*[    ]
 AT ALT
*[    ]
 AT OR BELOW
*[    ]          STEP PRED>
                    RETURN>
```

PRESS TO INSERT

```
   VERT REV AT VENAR  →
 EFOB=22.4    EXTRA=0.8
 SPD                  GMT
*[ ]               [   ]*
 AT OR ABOVE
*[    ]
 AT ALT
*[    ]
 AT OR BELOW
*[    ]          STEP PRED>
                    RETURN>
200
```

③ WRITE

④ THE SPD CONSTRAINT IS DEFINED

```
   VERT REV AT VENAR  →
 EFOB=22.4    EXTRA=0.8
*CLR SPD
 SPD                  GMT
200                [   ]*
 AT OR ABOVE
*[    ]
 AT ALT
*[    ]
 AT OR BELOW
*[    ]          STEP PRED>

*CLB         OR        DES*
```

DELETION OF THE SPD CSTR IS POSSIBLE

INSERT ALSO
FL330 AS AT OR BELOW
CONSTRAINT

⑤ VERT REV PAGE A
VENAR IS TO BE CONSTRAINED IN SPD AND ALT

```
   VERT REV AT VENAR  →
 EFOB=22.4    EXTRA=0.8
*CLR SPD
 SPD                  GMT
200                [   ]*
 AT OR ABOVE
*[ ]
 AT ALT
FL330
 AT OR BELOW
*[ ]

*CLB         OR        DES*
FL330
```

VENAR IS A CRZ WPT
CLB OR DES IS DISPLAYED
TO DECIDE IF THE SPD
CSTR IS IN THE CLB PHASE
OR THE DES PHASE

⑥ F-PLN PAGE A
VENAR IS NOW CONSTRAINED IN SPD/ALT
AND BELONGS TO THE DES PHASE

```
 FROM            1202  →
PERIG    0729   268/FL350
 UV156
FOUCO    ----   ---/-----
 UT183
BOLGU    ----   ---/-----
 UT183
VENAR    ----   200/ FL330
 UT183
MANAK    ----   ---/-----
 UN863
TIRAV    ----   ---/-----
                        ↑↓
```

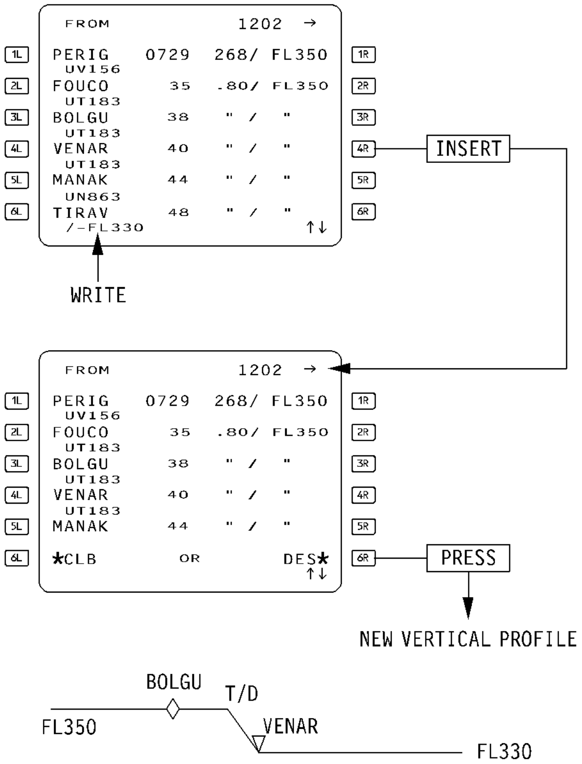
DASHES ARE DISPLAYED UNTIL
THE END OF THE RECOMPUTATION

VERTICAL F-PLN. PROFILE REVISION

Mod : 6789

INSERTING A CONSTRAINT DIRECTLY THROUGH F-PLN PAGE A

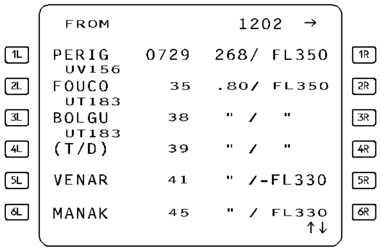
F-PLN PAGE A
INSERTION OF AN AT OR BELOW
ALT CSTR AT WPT VENAR



```
FROM                 1202  →
PERIG     0729   268/ FL350
  UV156
FOUCO       35   .80/ FL350
  UT183
BOLGU       38    " /   "
  UT183
VENAR       40    " /   "
  UT183
MANAK       44    " /   "
  UN863
TIRAV       48    " /   "
  /-FL330                ↑↓
```

```
FROM                 1202  →
PERIG     0729   268/ FL350
  UV156
FOUCO       35   .80/ FL350
  UT183
BOLGU       38    " /   "
  UT183
VENAR       40    " /   "
  UT183
MANAK       44    " /   "
*CLB        OR         DES*
                         ↑↓
```

F-PLN PAGE A
DISPLAY WITH AN AT OR BELOW
ALT CSTR IN THE DES PHASE



```
FROM                 1202  →
PERIG     0729   268/ FL350
  UV156
FOUCO       35   .80/ FL350
  UT183
BOLGU       38    " /   "
  UT183
(T/D)       39    " /   "
VENAR       41    " /-FL330
MANAK       45    " / FL330
                         ↑↓
```

B0FC-02-0224-009-A100AA

Mod : 6789

F. INSERTION OF TIME, SPEED OR LEVEL CONSTRAINT

If ATC requires that, at a given waypoint, the aircraft must be :

– at or above a level (e.g. + FL 250)

– at or below a level (e.g. – FL 250)

– at a level (e.g. FL 250)

– at a given speed (e.g. 280)

– at a given time (e.g. 1249).

This may be done :

- either by inserting a vertical revision at this point. On F-PLN page A :
  - Right LS key besides waypoint . . . . Press to display VERT REV AT waypoint page
  - Constraint . . . . Write/Insert
    The constraint can be displayed on the ND in map mode by selecting CSTR pushbutton.

    Constraints can be cancelled by pressing CLR and the LS key corresponding to the constraint to be erased.
- or by inserting directly the revision on F-PLN page A.

Mod : 6789

PREPARATION BEFORE DESCENT

TO/APPR key . . . . Select

This displays the APPROACH page.

Landing config . . . . Check
(or insert correct config).

A. DESCENT WIND PROFILE INSERTION

This should be made early enough to be sure that the recomputed T/D according to descent wind insertion will still be ahead of the present position. This is especially true in case of an increasing tail wind or decreasing head wind insertion where the recomputed T/D will be moved backwards.
Descent wind direction and speed may be updated manually by CDU entry.

Manual entry of descent forecast winds

On MODE page :

DES FORECAST prompt . . . Press to display DES FORECAST page

Forecasts are for instance

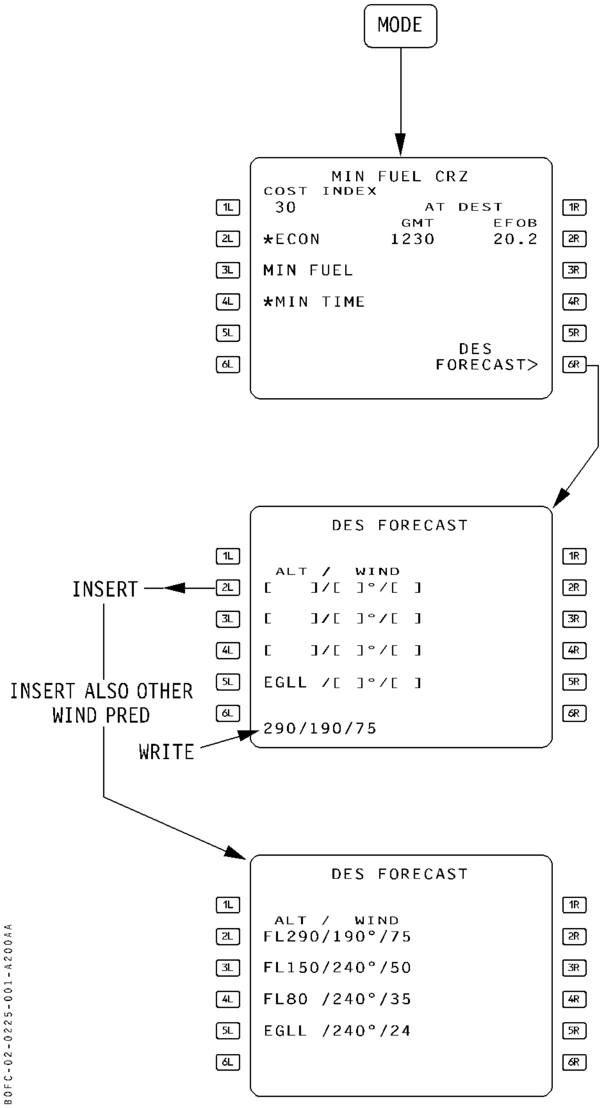
- at FL 290 190°/75 KT
- at FL 150 240°/50 KT
- at FL 80 240°/35 KT
- at destination 240°/24 KT

They may be entered as follows :

290/190/75 . . . . Write/Insert in 2L
150/240/50 . . . . Write/Insert in 3L
80/240/35 . . . . Write/Insert in 4L
240/24 . . . . Write/Insert in 5L

If no wind is inserted, wind is computed by an interpolation between CRZ wind and no wind at destination according to FMS wind models.
Temperature at destination has no influence on T/D computation and therefore is not requested.

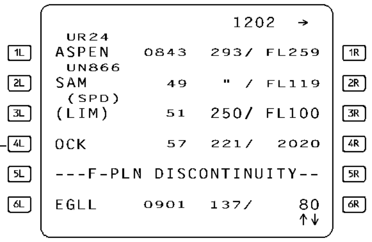
DESCENT WIND PROFILE INSERTION



Mod : 11320 or 11364 or 12044 or 12045

STAR INSERTION

F-PLN PAGE A BEFORE STAR INSERTION



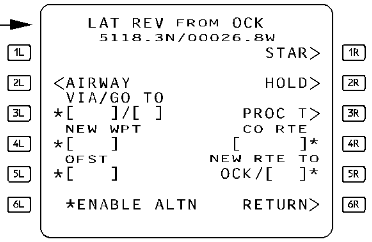
```
                1202  →
 UR24
ASPEN   0843   293/ FL259
 UN866
SAM       49    " / FL119
 (SPD)
(LIM)     51   250/ FL100

OCK       57   221/  2020

---F-PLN DISCONTINUITY--

EGLL    0901   137/    80
                       ↑↓
```

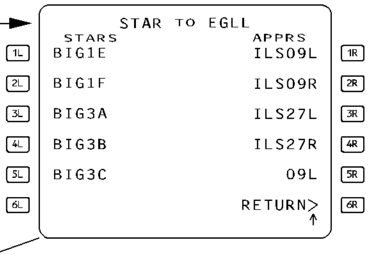
ACCESS TO LAT REV PAGE



```
  LAT REV FROM OCK
   5118.3N/00026.8W
                  STAR>

<AIRWAY           HOLD>
 VIA/GO TO
*[   ]/[ ]      PROC T>
 NEW WPT         CO RTE
*[    ]         [     ]*
 OFST         NEW RTE TO
*[    ]        OCK/[  ]*

 *ENABLE ALTN    RETURN>
```



```
      STAR TO EGLL
 STARS            APPRS
BIG1E            ILS09L

BIG1F            ILS09R

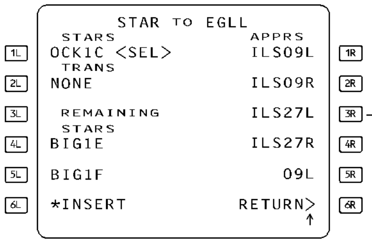
BIG3A            ILS27L

BIG3B            ILS27R

BIG3C               09L

                 RETURN>
                       ↑
```

AFTER SLEWING, STAR OCK1C IS SELECTED



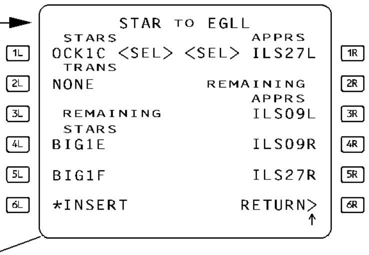
```
      STAR TO EGLL
 STARS           APPRS
OCK1C <SEL>      ILS09L
 TRANS
NONE             ILS09R

 REMAINING       ILS27L
 STARS
BIG1E            ILS27R

BIG1F               09L

*INSERT          RETURN>
                       ↑
```

APPROACH ILS27L IS SELECTED

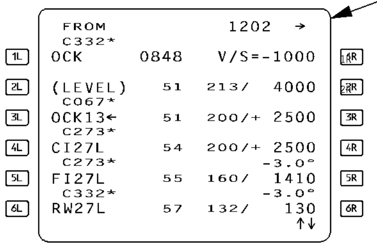


```
      STAR TO EGLL
 STARS             APPRS
OCK1C <SEL> <SEL> ILS27L
 TRANS
NONE           REMAINING
                   APPRS
 REMAINING        ILS09L
 STARS
BIG1E             ILS09R

BIG1F             ILS27R

*INSERT          RETURN>
                       ↑
```

F-PLN PAGE A AFTER STAR INSERTION



```
 FROM           1202  →
 C332*
OCK     0848   V/S=-1000

(LEVEL)   51   213/  4000
 C067*
OCK13←    51   200/+ 2500
 C273*
CI27L     54   200/+ 2500
 C273*            -3.0°
FI27L     55   160/  1410
 C332*            -3.0°
RW27L     57   132/   130
                       ↑↓
```

B0FC-02-0225-002-A300AA

Mod : 11320 or 11364 or 12044 or 12045

B. STAR/APPROACH INSERTION

It may be automatically inserted in the F-PLN when it is stored with CO RTE in the database. On the F-PLN page, from the last en-route waypoint to the destination, the following legs can be displayed :

- en-route transition called TRANS (if any)
- STAR
- approach transition called APPR TRANS
- approach (ILS, VOR, RNAV) which includes the RWY.

En route transitions stored in the database do not have the same meaning as those of official documentation. The common part of several STARs defined in official documents is called STAR by SPERRY, the independent part of the STAR being the TRANS. Therefore it may be necessary to select a TRANS to build completely a STAR while there is no TRANS actually defined in official documents.

If a point of the STAR to be flown belongs to the flight plan, the STAR should be built from this point. In this case it will be strung without any discontinuity. Here this common point is OCK as OCK 1C will be the selected STAR.

If OCK is not the last en-route waypoint all the waypoints after OCK in the F-PLN are deleted.

OCK left LS key . . . . . . Press to display LAT REV FROM OCK

On LAT REV page :

STAR prompt . . . . . . Press to display STAR page

APPROACH . . . . . . Press to select here ILS 27 L

Only STARs being compatible with the selected approach are listed. Slew if necessary.

STAR . . . . Press to select here OCK 1C.

It is possible to select first the STAR then one of the compatible approaches. Yet, it is less efficient as it will not be certain that the approach given by ATC will be compatible to the STAR first selected.

If the number of STARs for an airport exceeds 44, select the STAR before the APPROACH to avoid any possible FMS reset.

TRANS (en route) compatible with the selected STAR are listed.

TRANS (if any) . . . . Press to select

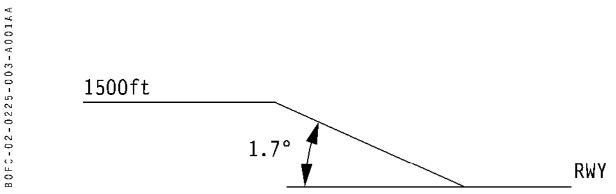
NONE is displayed when there is no TRANS.

* INSERT prompt . . . . Press

When there is only one APPR TRANS compatible with the selected approach, it is automatically selected and the whole TRANS/STAR/APPR is inserted in the F-PLN.
Otherwise the APPR TRANS page is displayed with a menu of APPR TRANS :

APPR TRANS (if any) . . . . Press to select

If no STAR has been inserted in the F-PLN, the defaulted approach computed by the FMS consists of a level off at 1500 ft followed by a 1,7° path angle descent to the runway.



C. IF DESCENT CLEARANCE IS NOT YET GIVEN BY ATC AT TOP OF DESCENT

When passing the altitude the aircraft holds the CRZ ALT as the FCU altitude has not yet been lowered : DECEL prompt is displayed in line 1 R. Pressing this prompt reduces speed to green dot (highest value between FAC and FMS if they are different).

When descent clearance is given by ATC after T/D :

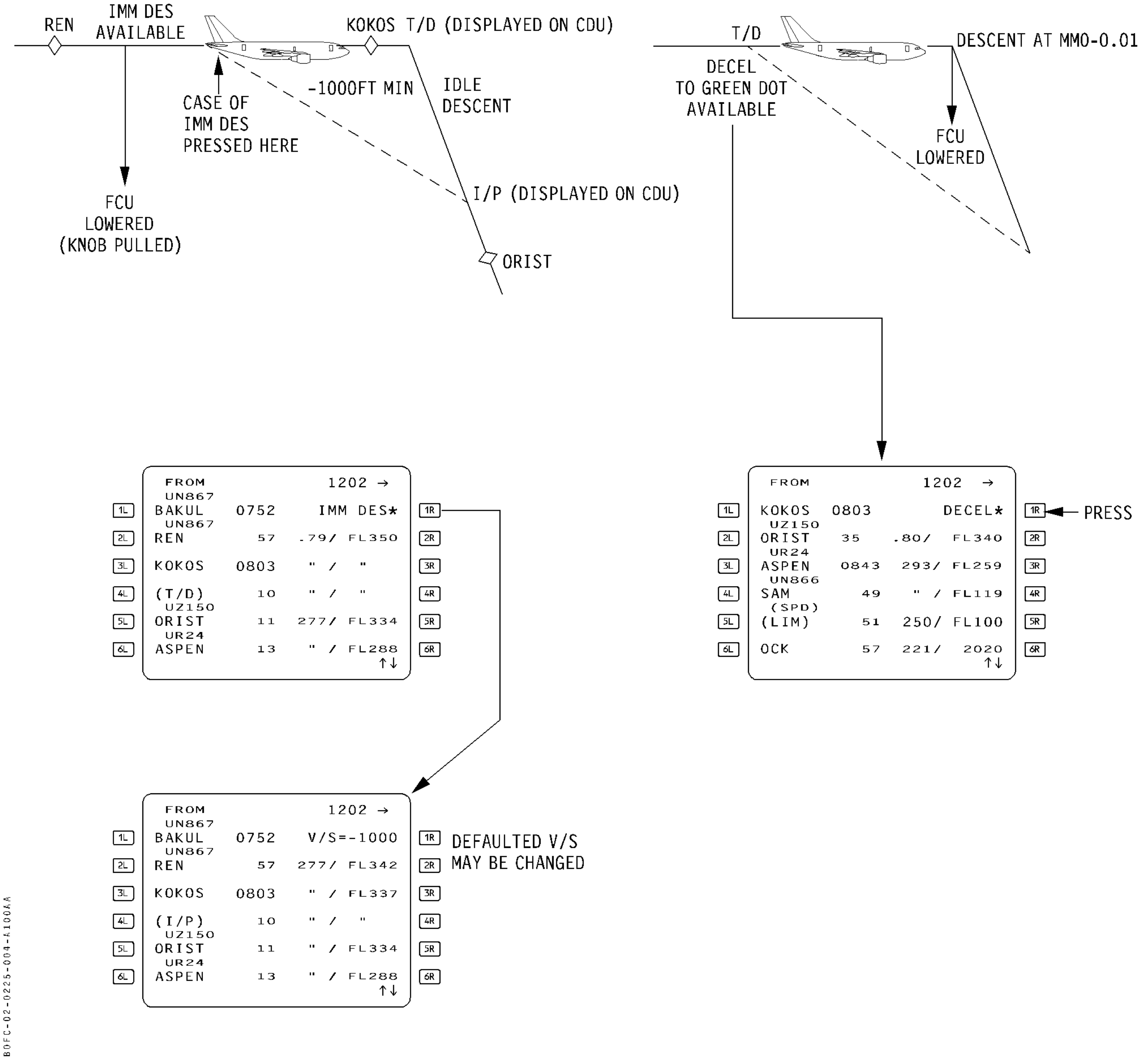
FCU ALT KNOB . . . . . . .Select clearance altitude R
and PULL R
PFD display . . . . Speed check R

Descent in PROFILE will be up to MMO –0.02. R

If PFD displays VAPP, it is an erroneous target sent R
by FMC. R
The display can be rectified by selecting LVL/CH, R
then, after about 10 seconds, re-select PROFILE R
mode on FCU. R

CLEARANCE IS GIVEN
BEFORE THE TOP OF DESCENT

CLEARANCE IS NOT GIVEN
AT THE TOP OF DESCENT

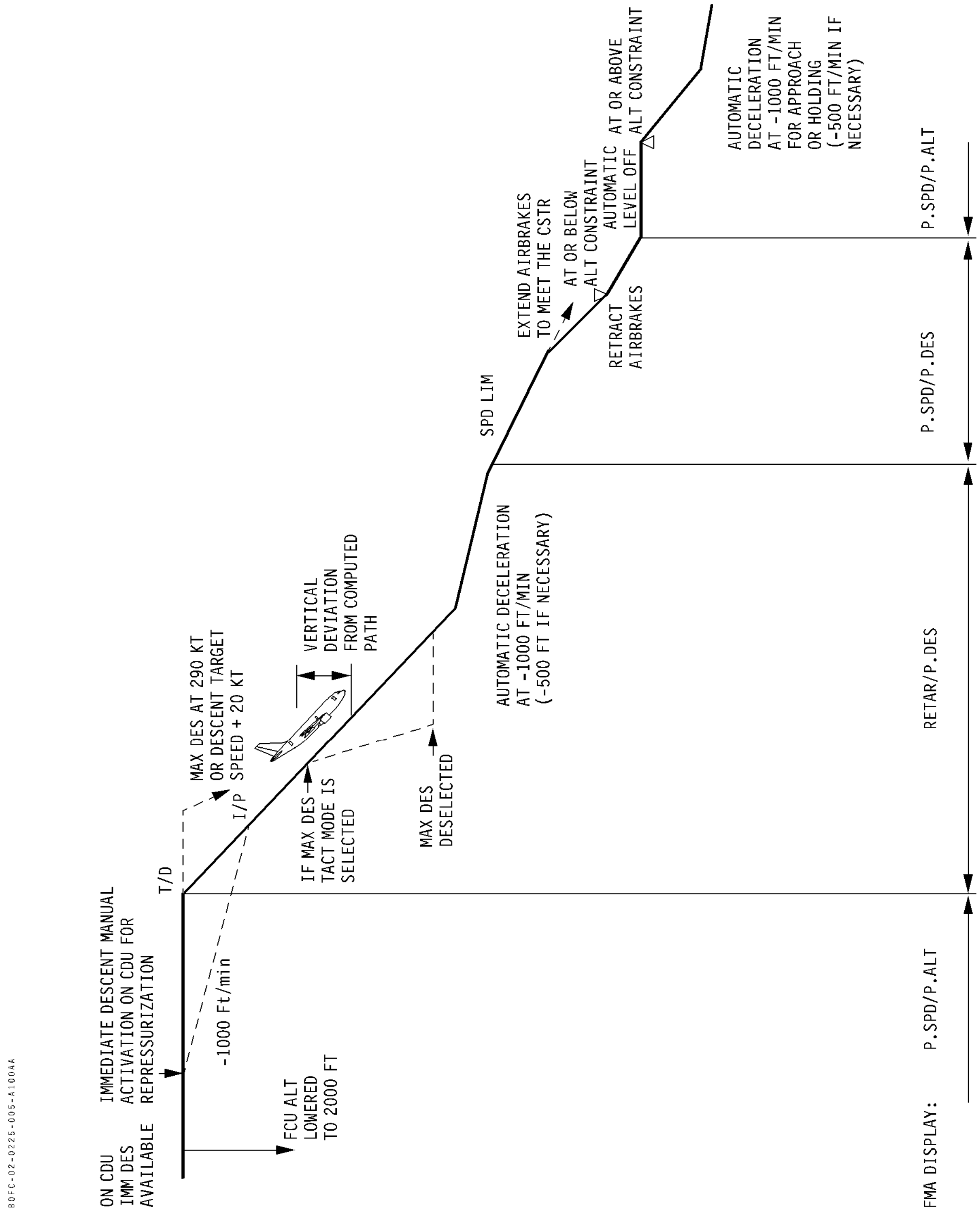


```
FROM              1202 →
UN867
BAKUL   0752     IMM DES*
UN867
REN       57    .79/ FL350
KOKOS   0803     " /  "
(T/D)     10     " /  "
UZ150
ORIST     11    277/ FL334
UR24
ASPEN     13     " / FL288
                        ↑↓
```

```
FROM              1202 →
UN867
BAKUL   0752    V/S=-1000
UN867
REN       57    277/ FL342
KOKOS   0803     " / FL337
(I/P)     10     " /  "
UZ150
ORIST     11     " / FL334
UR24
ASPEN     13     " / FL288
                        ↑↓
```

```
FROM              1202 →
KOKOS   0803       DECEL*
UZ150
ORIST     35    .80/ FL340
UR24
ASPEN   0843    293/ FL259
UN866
SAM       49     " / FL119
(SPD)
(LIM)     51    250/ FL100
OCK       57    221/  2020
                        ↑↓
```

Mod : 6789


B0FC-02-0225-005-A100AA
ON CDU
IMM DES
AVAILABLE
IMMEDIATE DESCENT MANUAL
ACTIVATION ON CDU FOR
REPRESSURIZATION
FCU ALT
LOWERED
TO 2000 FT
-1000 Ft/min
T/D
I/P
MAX DES AT 290 KT
OR DESCENT TARGET
SPEED + 20 KT
IF MAX DES
TACT MODE IS
SELECTED
VERTICAL
DEVIATION
FROM COMPUTED
PATH
MAX DES
DESELECTED
AUTOMATIC DECELERATION
AT -1000 FT/MIN
(-500 FT IF NECESSARY)
SPD LIM
EXTEND AIRBRAKES
TO MEET THE CSTR
AT OR BELOW
ALT CONSTRAINT
RETRACT
AIRBRAKES
AUTOMATIC
LEVEL OFF
AT OR ABOVE
ALT CONSTRAINT
AUTOMATIC
DECELERATION
AT -1000 FT/MIN
FOR APPROACH
OR HOLDING
(-500 FT/MIN IF
NECESSARY)
FMA DISPLAY:
P.SPD/P.ALT
RETAR/P.DES
P.SPD/P.DES
P.SPD/P.ALT

Mod : 6789

DESCENT

A. WHEN DESCENT CLEARANCE IS GIVEN BY ATC

Clearance is given for 2 000 ft.

FCU ALT KNOB . . . . Turn to select 2 000 ft

FCU ALT KNOB . . . . Pull

FMA . . . . Check P.THR/P.DES armed

IMM DES prompt on CDU (1R) .. Check displayed

Any F/PLN altitude constraint must be considered before setting the altitude as cleared by ATC. If the next altitude constraint is higher than the ATC cleared altitude, it should be checked with ATC that this constraint applies.

If confirmed, select FCU altitude to a safe altitude.

The FMS will hold the CRZ FL until the top of descent. 30 sec before reaching the T/D, P. DES will flash to indicate that the descent will be initiated without any further pilot action.

The descent may be initiated immediately (before reaching T/D) by pressing IMM DES prompt on CDU (F-PLN page line 1R) :

IMM DES prompt on CDU (1R) . . . . Press

P. DES ENGAGEMENT . . . . Check on FMA

Descent is initiated at 1 000 ft/min (this value may be changed manually on CDU Line 1R).
Computations are restarted. An Intercept Point (I/P) is computed where the A/C will intercept the precomputed descent path and is displayed in the F-PLN on CDU.

An overspeed protection avoids exceeding VMO :

If A/C speed is above VMO-5kts :
- throttles are retarded to idle
- A/C speed is controlled at cruise Mach
- V/S is not controlled anymore. Nevertheless -1000 ft/min or pilot entered vertical speed remains displayed on CDU F-PLN page.

B. WHEN REACHING THE TOP OF DESCENT

The descent path is initiated without any pilot action.

FMA . . . . Check P.THR/P.DES engaged

When full idle position is reached by throttles :

FMA . . . . Check RETARD engaged

A vertical deviation scale is displayed on ND (in place of G/S scale, in MAP mode with VOR/NAV/ILS switch in NAV or VOR position) and the VDEV value is displayed on PROGRESS page in line 1R. It indicates the eventual vertical distance between A/C position and the computed descent path.

On PROGRESS page and ND VDEV . . . . Monitor

IF ANTI-ICE ON . . . . Extend half airbrakes

Monitor F-PLN and make any revisions if necessary. All constraints of the F-PLN will be taken into account by the FMS.

C. P.THR DESCENT

- RETARD is indicated on the FMA.
- The computed descent path is earth referenced.
- The A/C is controlled on the path with the elevator.
- The path has been computed in order to obtain a glide speed in accordance with the selected strategic mode. However, the speed is monitored by the FMS and if for any reason (unpredicted winds for instance) this speed does not stay in a margin, there will be the following FMS response :
  - A/C speed : target speed + 20 kt, or VMAX – 2 kt,
  - MORE DRAG message flashes on PFD asking the pilot to extend airbrakes.
- If MORE DRAG flashes :

  AIRBRAKES. . . . Extend half (full if anti-ice on)

  If the speed returns to target speed MORE DRAG disappears at target speed + 5 kt
- If MORE DRAG disappears :
  AIRBRAKES . . . . . . Retract (half if anti-ice on)

It may be necessary to keep airbrakes extended to prevent the speed to increase again.

- A/C speed = target speed – 20 kt or
  green dot – 10 kt,
  whichever is the highest.
- ATS reverts to P. SPD to increase thrust. If airbrakes have been extended, the LESS DRAG message is displayed on CDU (not on PFD) instead of P. SPD reversion. If it is not sufficient, a P. SPD reversion occurs.

D. P. SPD DESCENT

There is a P. SPD reversion each time the following conditions occurs :

- A/C speed falls below target – 20 kt or green dot – 10 kt.
- A constraint (speed or altitude) is encountered. Usually it is the SPD LIM (250 kt/10 000 ft).
- During any F-PLN recomputation. After they are made, RETARD is recovered.
- Another performance mode is selected.

P.SPD is indicated on the FMA.

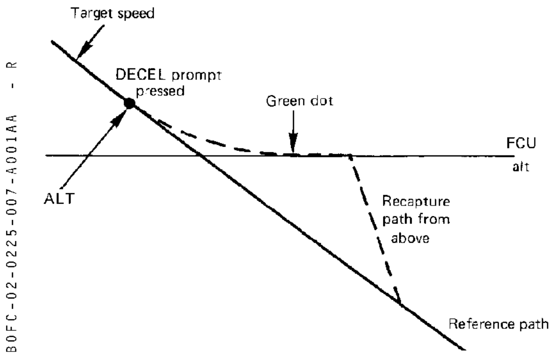
Usually there is a 10 degrees throttles forward motion and the speed is controlled around this thrust value. In P. SPD, MORE DRAG appears when A/C speed is target speed + 15 kt and it disappears when A/C speed returns below target + 2 kt.

E. P. SPD/P. THR REVERSIONS IN IMM DES

With IMM DES initiated, when the A/C speed becomes greater than VMO – 5 kt there is an automatic reversion from P. SPD to P. THR (FMA display changing from P. SPD/P. DES to P. THR/P. DES).
There is a new automatic reversion to P. SPD when the aircraft speed becomes lower than VMO – 6 kt.

F. AT FCU ALT

As ALT * engages, a DECEL prompt is displayed on the F-PLN page. It must be pressed immediately in order to decrease the A/C speed to green dot : the A/C then deviates slower from the FMS descent path.



G. SPEED CONSTRAINT (250 KT/10 000 ft)

The reference path has been computed to meet the constraint. If this speed constraint is lower than the initial target speed (usually it is the SPD LIM), a decel point is computed (at about 12 000 ft for the SPD LIM) and the deceleration is performed at – 1000 ft/min. Monitor the target speed on the F-PLN page A.

TGT SPEED . . . . Check it shifts to speed constraint

H. ALT CONSTRAINT

If the altitude of the constraint is reached before the constrained waypoint, the FMS orders a level off.

P.SPD/P. ALT ENGAGEMENT . . . . Check

If the constraint will not be matched an amber FCU level off symbol is displayed on the ND.

I. MAXIMUM DESCENT

If ATC asks to make a quick descent down to 7 000 ft for instance :

MAX DES MODE . . . Select on TACT MODE page

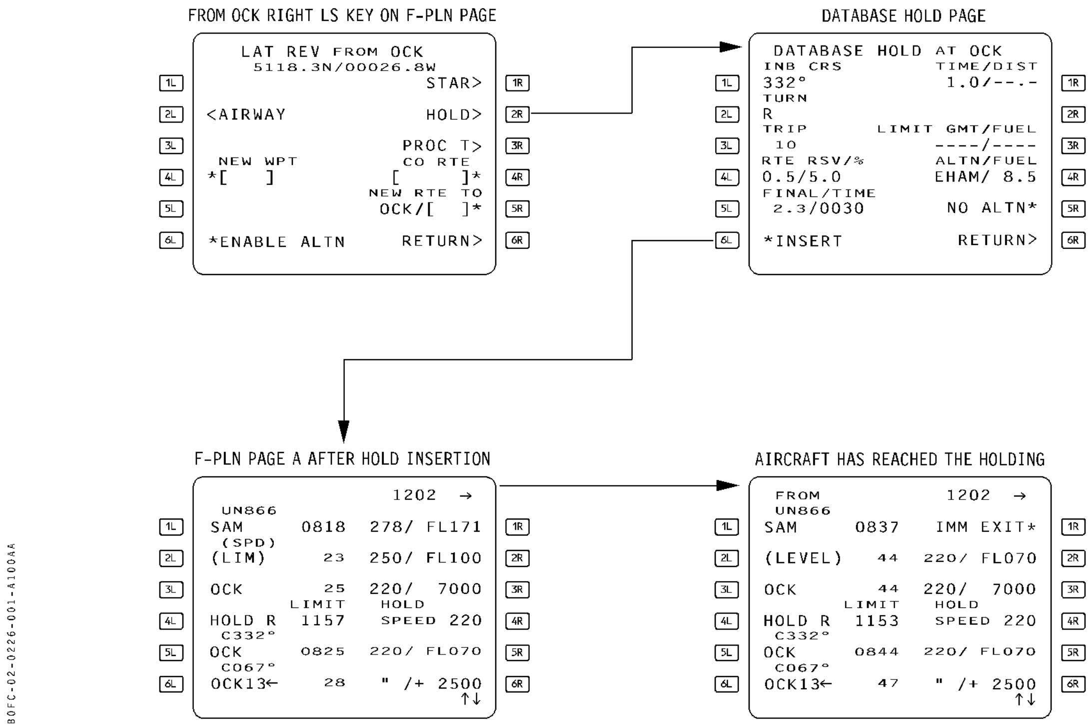
In this case the descent path is not followed anymore.
At 7 000 ft :

PREVIOUS MODE . . . . Reselect

The A/C levels off to return back to the precomputed path.

INTENTIONALLY LEFT BLANK

HOLDING INSERTION



FROM OCK RIGHT LS KEY ON F-PLN PAGE

```
   LAT REV FROM OCK
    5118.3N/00026.8W
                 STAR>
<AIRWAY          HOLD>
               PROC T>
 NEW WPT        CO RTE
*[   ]         [     ]*
           NEW RTE TO
             OCK/[  ]*
*ENABLE ALTN   RETURN>
```

DATABASE HOLD PAGE

```
 DATABASE HOLD AT OCK
INB CRS      TIME/DIST
332°          1.0/---.-
TURN
R
TRIP     LIMIT GMT/FUEL
 10          ----/----
RTE RSV/%     ALTN/FUEL
0.5/5.0      EHAM/ 8.5
FINAL/TIME
 2.3/0030      NO ALTN*
*INSERT         RETURN>
```

F-PLN PAGE A AFTER HOLD INSERTION

```
                1202  →
 UN866
SAM      0818  278/ FL171
 (SPD)
(LIM)      23  250/ FL100

OCK        25  220/  7000
        LIMIT   HOLD
HOLD R   1157   SPEED 220
 C332°
OCK      0825  220/ FL070
 C067°
OCK13←     28   " /+ 2500
                      ↑↓
```

AIRCRAFT HAS REACHED THE HOLDING

```
 FROM            1202  →
 UN866
SAM      0837   IMM EXIT*

(LEVEL)    44  220/ FL070

OCK        44  220/  7000
        LIMIT   HOLD
HOLD R   1153   SPEED 220
 C332°
OCK      0844  220/ FL070
 C067°
OCK13←     47   " /+ 2500
                      ↑↓
```

HOLDING

A. HOLDING MANUAL

The HOLD is terminated manually whenever the IMM EXIT prompt is pressed. When the IMM EXIT function is active, the aircraft flies direct to the holding fix, regardless of the heading at the time of activation, and exits the hold along the flight plan route.

- It may be coded in the database with all its parameters. In this case DATABASE HOLD is displayed on the HOLD page title line.
- If it is not coded in the database it may be inserted manually. In this case all its parameters are defaulted and COMPUTED HOLD is displayed in title line. The defaulted parameters are present course, right turn, one minute, ICAO speed.
- In both cases, parameters may be manually changed on the HOLD page, except speed which may be inserted on F-PLN.
- A manual hold may be done at any waypoint, except the TO waypoint, including PPOS, and are always followed by a F-PLN DISCONTINUITY. It is manually entered by a lateral flight plan change.

B. HOLD PAGE ACCESSING

From F-PLN page :

OCK left LS key . . Press to display LAT REV page from OCK
HOLD prompt . . . . . Press to display HOLD page

DATABASE HOLD AT OCK is displayed and the parameters are defaulted.

C. HOLDING PARAMETERS

INB CRS, TIME/DIST, TURN . . . . Check

They may be changed.

D. HOLDING INSERTION

INSERT prompt . . . . Press

There is no F-PLN recomputation as the manual HOLDING is considered to be in the F-PLN only 3 min before reaching the holding fix.

E. 3 MINUTES BEFORE REACHING THE FIX

The A/C decelerates to match the ICAO speed limit. If it was in descent it reverts to a 1 000 ft/min rate of descent (P. SPD engages if RETARD was engaged). At the same time IMM EXIT command is available on F-PLN page 1R in line. Pressing this command makes the A/C revert to its previous descent path.

A/C SPD . . . . Monitor

AIRBRAKES . . . . Extend if necessary

F. TO LEAVE THE HOLDING

On F-PLN page

IMM EXIT * prompt (1R) . . . . Press

A DIRECT TO FIX is initiated and the A/C returns to the descent path.
IMM EXIT is replaced by RESUME HOLD.
Pressing RESUME HOLD, re-initiates the same holding pattern.

When a holding is entered, VERT DEV from the path is not displayed anymore on the NDs. VERT DEV indication reappears as the A/C leaves the holding pattern and overflies the fix.

G. HOLDING FIX

A fixed waypoint hold terminates when the aircraft first sequences the holding fix after the hold becomes active. The aircraft must make one circuit in the hold, and then exit automatically along the route of flight.

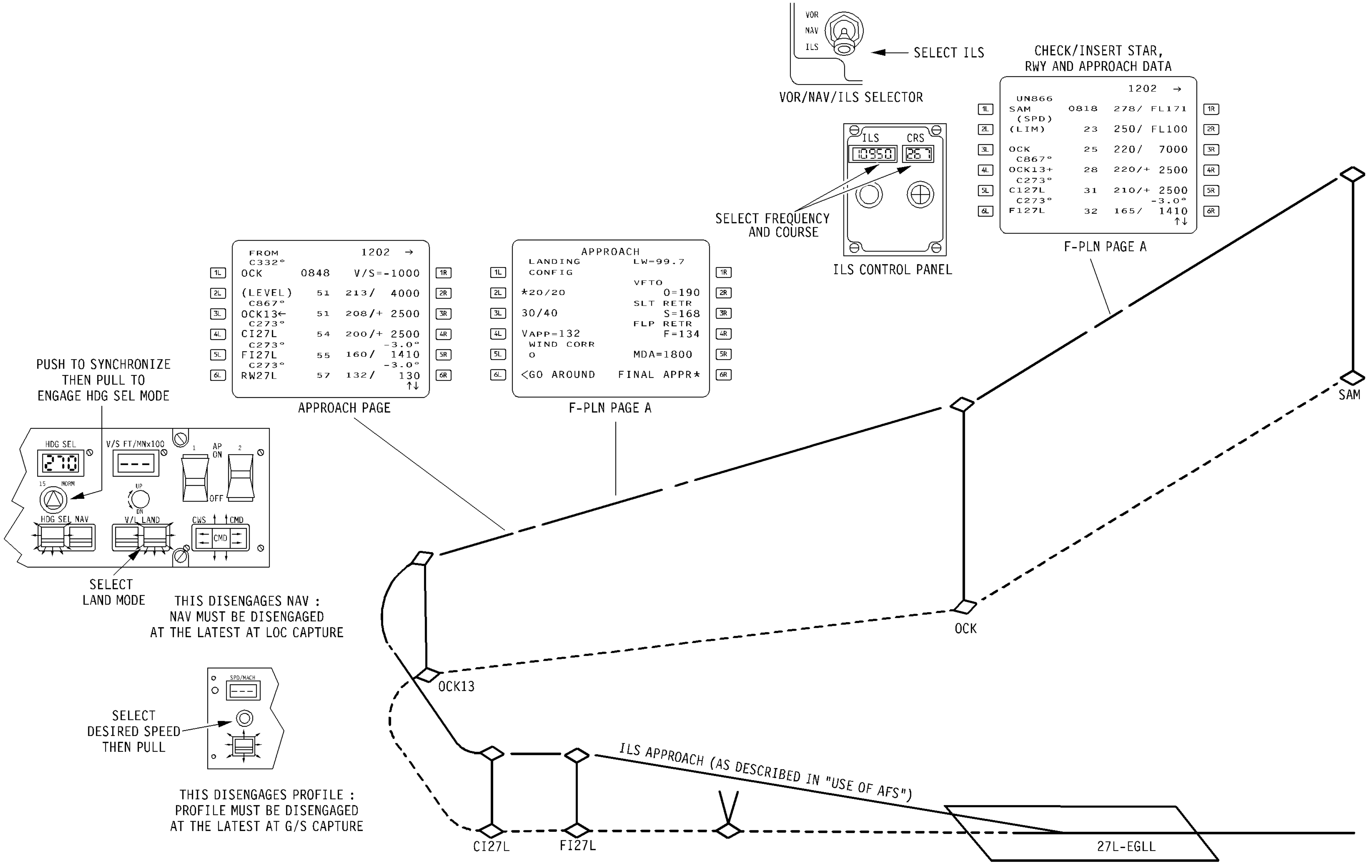
It should be deleted if it is not needed depending on the arrival course.
As for manual holding :

A/C SPD . . . . Monitor

AIRBRAKES . . . . Extend if necessary

Mod : 6789

FMS GUIDANCE DOWN TO ILS CAPTURE



```
                        1202  →
 UN866
SAM          0818   278/ FL171
 (SPD)
(LIM)          23   250/ FL100

OCK            25   220/  7000
 C867°
OCK13+         28   220/+ 2500
 C273°
C127L          31   210/+ 2500
 C273°                  -3.0°
F127L          32   165/  1410
                            ↑↓
```

F-PLN PAGE A

```
 FROM              1202  →
 C332°
OCK      0848    V/S=-1000
(LEVEL)    51   213/  4000
 C867°
OCK13←     51   208/+ 2500
 C273°
CI27L      54   200/+ 2500
 C273°                -3.0°
FI27L      55   160/  1410
 C273°                -3.0°
RW27L      57   132/   130
                        ↑↓
```

APPROACH PAGE

```
          APPROACH
 LANDING          LW=99.7
 CONFIG
                  VFTO
*20/20               O=190
                  SLT RETR
30/40                S=168
                  FLP RETR
VAPP=132             F=134
 WIND CORR
 0                MDA=1800
<GO AROUND     FINAL APPR*
```

F-PLN PAGE A

THIS DISENGAGES NAV :
NAV MUST BE DISENGAGED
AT THE LATEST AT LOC CAPTURE

THIS DISENGAGES PROFILE :
PROFILE MUST BE DISENGAGED
AT THE LATEST AT G/S CAPTURE

BOFC-02-0226-003-A100AA

Mod : 6789

APPROACH

Approaches can be performed using the FMS guidance, with (NAV and V/S) or (NAV and PROFILE) modes, providing HIGH accuracy is displayed on the PROGRESS page.

ILS approaches

- PROFILE mode may be used up to glide capture.
- NAV mode can be used to fly the initial approach until the capture of a LOC for a LOC-only or an ILS approach.

Non-precision approaches

- (NAV and V/S) or (NAV and PROFILE) modes are used for VOR, VOR/DME, NDB, NDB/DME or RNAV approaches only.
- For non-precision approaches, the PROFILE mode must be deselected no later than the final descent point.

Limitations

- The navigation accuracy check must be positive throughout the approach.
- The modification of a published approach procedure or a STAR which is in the FMS database is allowed, only if it is in accordance with an approved flight crew procedure. In this case it cannot be flown with NAV or PROFILE mode.
- Approval of the FMS use is based on the assumption that the content of the navigation database has been validated for the intended use.

On PROGRESS page :

NAV ACCURACY CLASS. . . . . .Check

The navigation accuracy check must be positive to continue using NAV or PROFILE mode.

At the transition level

Altimeters. . . . . .Set to QNH

From this moment, the aircraft is guided by the FMS on a path based on QNH altitudes.
The vertical deviation will slowly go up or down upon QNH value, then will return slowly to zero as the aircraft catches the QNH path.

TO/APPR key (PF). . . .Press to display APPROACH page

LANDING CONFIG. . . . .Select (defaulted to 30/40)

WIND CORR. .Write/Insert

MDA (if RNAV approach). . . . . .Write/Insert

The VAPP, and the point where the aircraft should decelerate, are computed. VAPP will be reached during the final descent if the slats/flaps are extended as follows.

From the deceleration point

TARGET SPEED ON PFD. . . . . .Check it decreases to VAPP

The deceleration is performed at - 1 000 ft/min or if it is not enough at - 500 ft/min. The aircraft levels off at FCU ALT and continues to decelerate.

Mod : 11320 or 11364 or 12044 or 12045

A. ILS APPROACH

PF ND MODE . . . . MAP

PNF ND MODE . . . . MAP may be kept

ND RANGE . . . . Select 15

F-PLN page . . . . Select

STAR, RWY and approach data . . . . Insert

VOR/NAV/ILS SWITCH . . . . Set to ILS

ILS FREQ . . . . Select on ILS Control Panel

APPROACH page . . . . Select

WIND CORR . . . . Write/Insert

In NAV mode, the LOC beam will be captured with an intercept angle of 20°. Thus, if there is a cross track error, the aircraft will fly a leg parallel to the LOC beam making the interception impossible.

At LOC capture, NAV mode is automatically disengaged, and the FMS updates its navigation so as to cancel its cross track error.

VAPP . . . . Select on FCU

FCU SPD/MACH selector knob . . . . Pull

This disengages PROFILE mode.

From this moment, there is no more FMS guidance and the remaining flight is controlled only by AFS until it is disengaged (refer to 2.02.03).

B. NON-PRECISION APPROACH

For a non-precision approach, PF ND must be used in ROSE or ARC.

- After landing data have been obtained :

  F-PLN page . . . . Select

  STAR, RWY and approach data . . . . Insert

  APPROACH page . . . . Select

  WIND CORR . . . . Write/Insert

- Before starting the initial approach :

  F-PLN on ND . . . . Check

  TO WAYPOINT on ND . . . . Check

  NAV mode on FMA . . . . Check

  RADIO navaid . . . . Tune and monitor

  Note : *In case of excessive deviation from raw data, revert to HDG SEL-V/S mode using radio navaid indications for navigation.*

  PF ND mode selector . . . . ROSE or ARC

  PNF ND mode selector . . . . MAP may be kept

  ND RANGE . . . . Select 15

- Deceleration :

  Plan deceleration, so that VAPP and landing configuration are obtained before the final descent point (FAF).

- When cleared for final approach :

  Do not select the FINAL APPR prompt on the APPROACH page of the CDU.

  USE of PROFILE mode is not approved in final approach and must be deselected no later than the final descent point.

  VOR/NAV/ILS switch . . . . ILS

  ILS is selected to clear the V / DEV display from the ND.

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A. GO-AROUND

When the decision to initiate a go-around is taken, the go-around mode is engaged via the go levers :

GO LEVERS . . . . Trigger

Check the mode engagement by the following indications :

FMA : THR, GO AROUND.

TRP : TOGA.

FCU : PROF and NAV lights extinguished.

FMS : GO AROUND page appears.

The FMS continues to output steering orders to be followed by pilot or autopilot.

ND MODE . . . . MAP

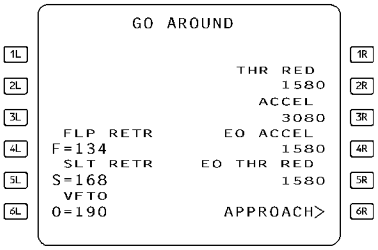
Check carefully the go-around routing on the ND.

- If it is correct :

  NAV pushbutton . . . . Press

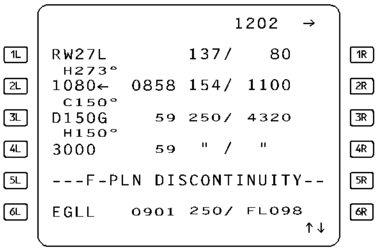
  The NAV mode is re-engaged. PROFILE mode re-engagement is not recommended in this flight phase. In any case, before re-engaging PROFILE, check FMS assumptions : SPD, ALT, THR, FLT PATH and only if satisfactory, when crossing ACCEL ALT, press PROFILE pushbutton.

  If deciding not to re-engage NAV, continue with AFS modes, manually set on FCU panel, to comply with ATC instructions or with the routing.



```
                 GO AROUND
                              THR RED
                                 1580
                                ACCEL
                                 3080
  FLP RETR                   EO ACCEL
 F=134                           1580
  SLT RETR                EO THR RED
 S=168                           1580
  VFTO
 O=190                      APPROACH>
```

GO-AROUND CDU PAGE

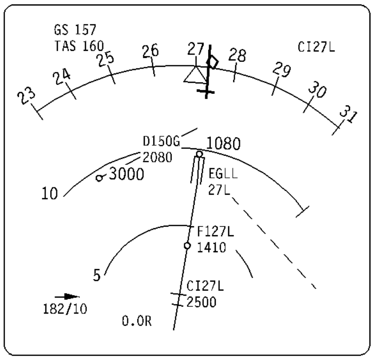


```
                           1202   →
RW27L            137/    80
 H273°
1080←    0858  154/  1100
 C150°
D150G        59  250/  4320
 H150°
3000         59   "  /   "

---F-PLN DISCONTINUITY--

EGLL     0901  250/  FL098
                          ↑↓
```

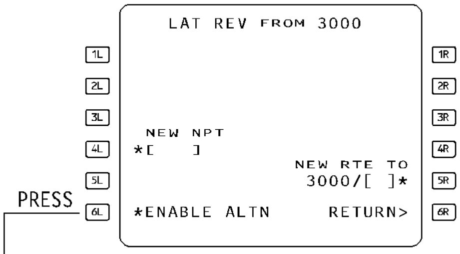
CHECK GO AROUND ROUTING ON F-PLN PAGE A



AND ON ND

Mod : 6789

ENABLE ALTERNATE

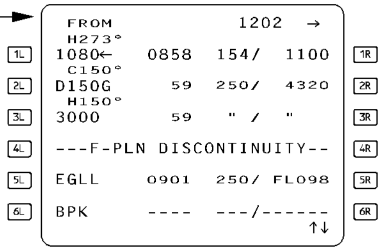


```
    LAT REV FROM 3000




 NEW NPT
*[    ]
                 NEW RTE TO
                 3000/[ ]*
*ENABLE ALTN      RETURN>
```

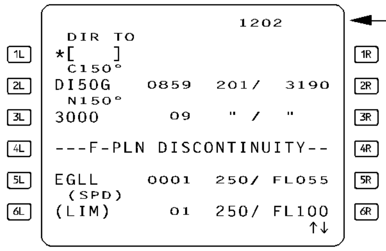
LAT REV FROM 3000 PAGE



```
 FROM              1202  →
 H273°
1080←   0858   154/  1100
 C150°
D150G     59   250/  4320
 H150°
3000      59    " /   "
---F-PLN DISCONTINUITY--
EGLL     0901  250/ FL098
BPK      ----  ---/------
                       ↑↓
```

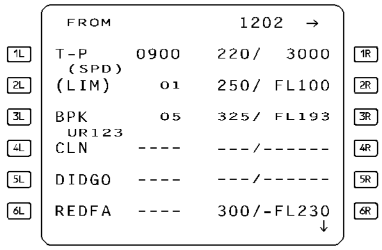
F-PLN PAGE A

PRESS
DIR KEY



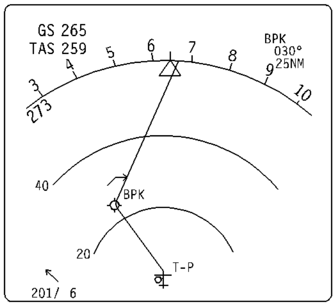
```
                 1202
 DIR TO
*[    ]
 C150°
DI50G    0859  201/  3190
 N150°
3000       09   " /   "
---F-PLN DISCONTINUITY--
EGLL     0001  250/ FL055
 (SPD)
(LIM)      01  250/ FL100
                       ↑↓
```

SLEW AND SELECT BPK AS DIR TO WAYPOINT



```
 FROM             1202  →
T-P     0900   220/  3000
 (SPD)
(LIM)     01   250/ FL100
BPK       05   325/ FL193
 UR123
CLN     ----   ---/------
DIDGO   ----   ---/------
REDFA   ----   300/-FL230
                        ↓
```

A TURNING POINT IS INSERTED
IN THE F-PLN



CHECK DISPLAY ON ND

B0FC-02-0227-002-A001AA

B. ENABLE ALTERNATE

To divert to the alternate destination as entered during the preflight, make a LATERAL REVISION at the point where the current routing is left.

LAT REV page at diversion point. . . . . .Select

In our example, ALTERNATE is enabled in the go around, the diversion point is waypoint ″3000″.

ENABLE ALTN (6L). Press

The alternate flight plan is strung into the primary flight plan with a discontinuity between the diversion point and the first waypoint in the alternate route.

DISCONTINUITY . . . . Clear

or

DIR TO waypoint in the ALTERNATE F-PLN.

INTENTIONALLY LEFT BLANK

A. FMC INDEPENDENT OPERATION

Conditions

- Whenever the FMCs encounter a situation such as :
  - the NAV data bases are different (identified by the message A/C STATUS MISMATCH displayed on the CDU scratchpad),
  - the respective aircraft positions differ by more than 10 nm for over 9 s (identified by a previous message FMC POSITION MISMATCH displayed on the CDU scratchpad),
  - five successive automatic resynchronizations are performed without success,

  then, the FMCs declare themselves in independent mode of operation.

  This condition is identified by the INDEPENDENT OPERATION message displayed on both CDU scratchpads.

- Crosstalk between the two FMCs is interrupted and each FMC assures its own responsibility as the master. Pilots input on the CDU are not transfered from one FMC to the other. Consequently, flight plan, flight phase, modes, guidance targets, waypoint sequencing, etc, are no more synchronized.

Corrective actions

- The corrective actions to the various situations are :
  - NAV data base difference :
    - Load, on the ground, the same NAV data base into both FMCs,
  - aircraft position difference :
    - cross-check the FMCs position with raw data to determine which FMC is responsible for the position discrepancy.
    - perform a position update on the incorrect FMC by selecting the PROG mode key (progress page),
    - reset manually the FMC not coupled to the engaged auto-pilot to revert to the dual mode of operation (see procedure herebelow),
  - resynchronization unsuccessful :
    - reset manually the FMC not coupled to the engaged auto-pilot (see the procedure herebelow).

Manual FMC reset

- The FMC manual reset is performed by using the circuit breaker. Power interruption, longer than 1s but shorter than 10 s, is necessary to revert to a dual mode of operation.

  This will be followed by an automatic FMC resynchronization on the other FMC (sequence described hereafter).

- If the independent operation mode occurs on the ground before engine start, the reset can be done directly via the CDU, by selecting MAINT and SELF TEST. This will be followed by an FMC re-initialisation and an automatic resynchronization on the other FMC (sequence described hereafter).

- If the INDEPENDENT OPERATION message remains, a power interruption (by pulling the C/B) longer than 10 s must be performed. This will allow a complete FMC re-initialisation (the sequence is described hereafter) followed by an automatic FMC resynchronization on the other FMC (sequence described hereafter).

Crew procedure

- As long as the FMCs remain in independent operation mode of operation, the crew must apply the following procedure :
  - set identical range on both NDs,
  - same inputs must be performed be done on both CDUs (to keep the same flight plan).

Mod : 6789

B. FMC FAILURES

General

- Whenever a FMC is temporarily inoperative, this means that an internal failure is self detected, an automatic FMC reset is done, followed by automatic FMC re-initialisation and resynchronization on the other FMC. This interrupts the normal processing of both FMCs.

  If the reset is not successful, this means that the condition for an automatic reset persists, a second reset will be done. After four unseccessful resets, the FMC is latched.

- An automatic FMC reset can be initiated either on the ground or in flight.

  The crew will identify an FMC autoreset by the transient sequences, described hereafter.

FMC re-initialization

- Depending on the failure being detected, part or the totality of the following sequence of events occur during the FMC re-initialisation.

  The total sequence can last up to 1 min and 45 s.

  - FMC FAIL specific page is displayed,
  - FAIL annunciator light is transiently illuminated,
  - VOR/DME tuning (auto and remote) is not available,
  - on master ND, MAP NOT AVAIL is displayed,
  - disengagement of NAV and PROFILE modes, if engaged,
  - disengagement of AP, if NAV or PROFILE mode engaged,
  - reversion to FCU SPD SEL mode when PROFILE mode disengages,
  - A/THR disengagement,
  - A/C STATUS page automatically selected on both CDU with PLEASE WAIT message displayed on the scratchpad (no input can be done),
  - on master ND, MAP NOT AVAIL disappears, and same message appears on the slave ND,
  - on slave ND, MAP NOT AVAIL disappears,
  - on both CDUs, PLEASE WAIT message disappears (input can be done),
  - VOR/DME auto-tuning is resumed, but CDU remote navaid selection can remain lost.

FMC resynchronization

- An automatic FMC resynchronization is performed :
  - after a manual reset
  - after a re-initialisation,
  - whenever the flight plan is different from the one of other FMC,
  - the CDU entry processing by the two FMCs is not synchronized.

- Depending on the failure being detected, part or the totality of the following sequence of events occurs during the FMC resynchronization :

  The total sequence can last up to 25 s.

  - PLEASE WAIT message on both CDU scratchpad. New inputs are ignored,
  - NAV and PROFILE modes, AP and A/THR remain engaged (if previously engaged) and master FMC remains in control,
  - on slave ND, MAP NOT AVAIL message appears (may also transiently appear on the master ND),
  - if PROFILE mode is engaged, the red SPD SEL flag appears on the slave PFD speed scale,
  - VOR/DME tuning (auto and remote) is lost on the slave VOR,
  - PLEASE WAIT message disappears if resynchronization is successful.

- Normally, the FMC should be recovered by itself once the re-initialisation and the resynchronisation is completed. Thus, all FMC functions are restored.

- The crew procedure is :
  - re-engage AP, A/THR as required,
  - re-engage navigation modes as required.

  Whenever the resynchronization fails, the FMC reverts to the independent mode of operation.

Mod : 6789

FMC latched

- The FMC is latched following four unsuccessful automatic reset.

  This condition is identified as follows :

  – FMC FAIL specific page is displayed,

  – FAIL annunciator light is illuminated,

  The consequence are :

  – no dialogue with FMC possible,

  – NAV and PROFILE modes are not available on the affected side.

- The crew procedure is :

  The latched FMC can be recovered by a manual reset by pulling the C/B for more than 10 s. If it is unsuccessful, the manual reset can be repeated twice.

C. LOSS OF ONE FMS

- This occurs whenever a latched FMC is not recovered by a manual reset.

D. BOTH FMSs LATCHED

- Whenever both FMCs are simultaneously latched, both FMCs must not be manually reset simultaneously. This is to avoid the loss of the entire memory content on both sides.

- However, if the entire memory content of both FMC is lost, the crew can re-enter the entire flight plan and all other entries, as described in the following procedure :

  – select DIR mode key (direct to), and insert a waypoint (generally the waypoint the aircraft was flying to, when the failure occured),

  – select F-PLN mode key (flight plan), to rebuilt the flight plan,

  – select LAT REV page, and insert the destination by selecting NEW RTE TO key,

  – select FUEL PRED page from PROGRESS page, and insert the current aircraft gross weight,

  – select PROG mode key (progress page), and insert the current cruise flight level,

  – select MODE mode key, and insert the required cost index,

  – select VERT REV page, and insert the time, speed and altitude constraints as well as the wind forecast,

  – cross-check FMC position with navaids raw data,

  – if FMC position is validated and flight plan is completed, engage NAV and PROFILE modes.

E. LOSS OF BOTH FMCs

- This occurs whenever latched FMCs are not recovered by a manual reset.

- The crew procedure is to conduct the flight using raw data.

F. OTHER FAILURE MODES

- In case the CDU stops responding, the inputs are ignored and the CDU pages can be either frozen, blank or showing the FMC FAIL page. However, ND MAP/PLAN display and FMA modes annunciations are available.

  This condition may appear following a FMC reset or be due to an internal CDU failure.

- Procedure to recover the affected CDU :

  – pull the FMC/CDU circuit breaker longer than 5s but less than 10 s.

An FMC re-initialisation and resynchronisation is performed.

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PURPOSE

The following FMS performance charts allow to know in advance or to check in flight the different FMS speed/mach and altitude targets according to the cost index and flight parameters.

COST INDEX

The COST INDEX $CI = \frac{C_T}{C_F}$ where

C_T = cost of one minute of flight
C_F = cost of one kilogramm of fuel.

When CI = O the ECON strategic mode corresponds to a MIN FUEL mode. When CI = 999 (max value), the ECON strategic mode corresponds to a MIN TIME mode.

CHARTS

There are 8 charts :

1 – Optimum initial climb speed.

2 – Optimum final climb, cruise and initial descent mach.

3 – Optimum cruise altitude.

4 – Optimum descent speed.

5 – Maximum altitude.

6 – Maximum endurance speed (holding clean).

7 – Max slope climb speed (MAX CLIMB MODE).

8 – Flight envelope.

SPD/MACH targets

The FMS computes an optimum climb speed, descent speed and cruise mach.

During climb, when climb speed is equal to cruise mach,the latter becomes the target for the remaining climb segment, for the cruise and for the beginning of the descent until it is equal to the optimum descent speed.

LIMITATIONS

These charts don’t always take care of the operational limitations but these limitations are taken in account by the FMS. These limitations are :

V_{MAX} = 330 kt (even if V_{MO} = 340 kt)
M_{MAX} = 0.82
H_{MAX} = 41 000 ft limited by the 1.2 g buffet margin
V_{MIN} = MAX (GREEN DOT FAC, GREEN DOT FMS)

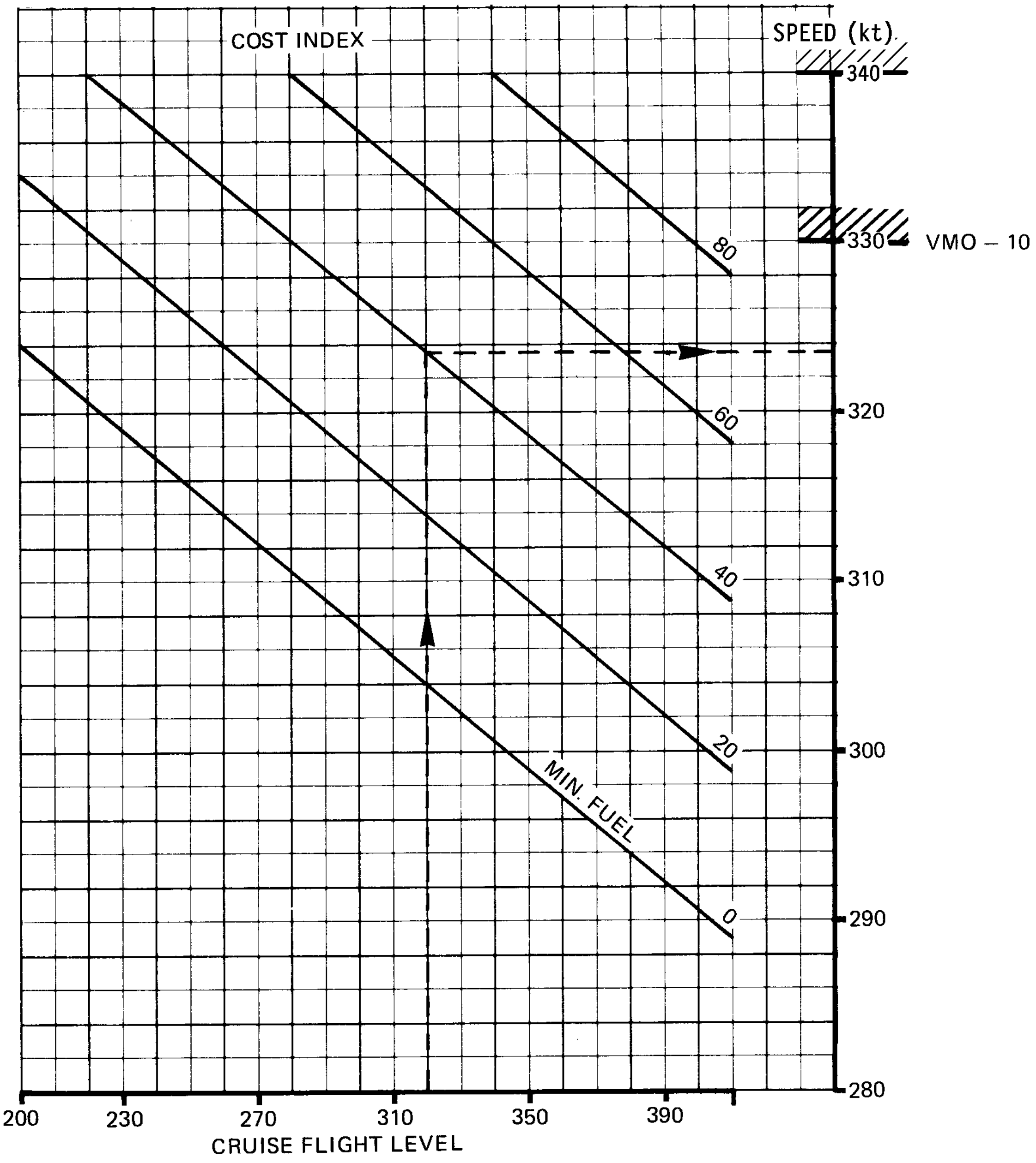
In addition the speed is limited by ICAO rules : 250 kt below 10 000 ft ICAO holding speeds.

ACCURACY

The drawings of these charts give a speed accuracy better than 10 kt.

Code : 0420

INTIAL CLIMB SPEED FOR STRATEGIC MODE
BELOW 10 000 FT CLIMB SPEED ⩽ 250 KT

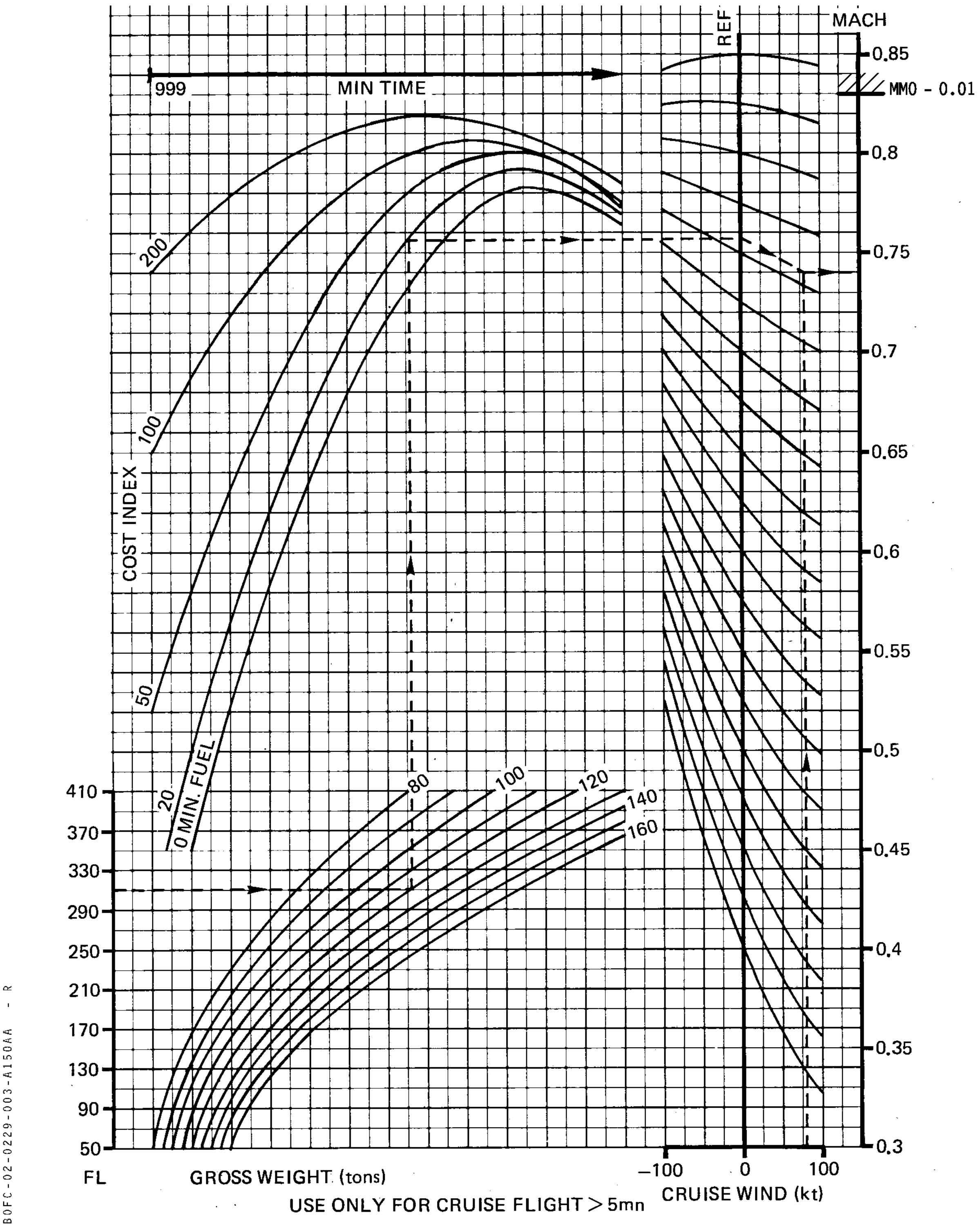


VMAX = 340 kt if VMO = 360 kt
VMAX = 330 kt if VMO = 340 kt

Mod : 6789

PW Eng. : 4000

FINAL CLIMB, CRUISE AND INITIAL DESCENT MACH FOR STRATEGIC MODE

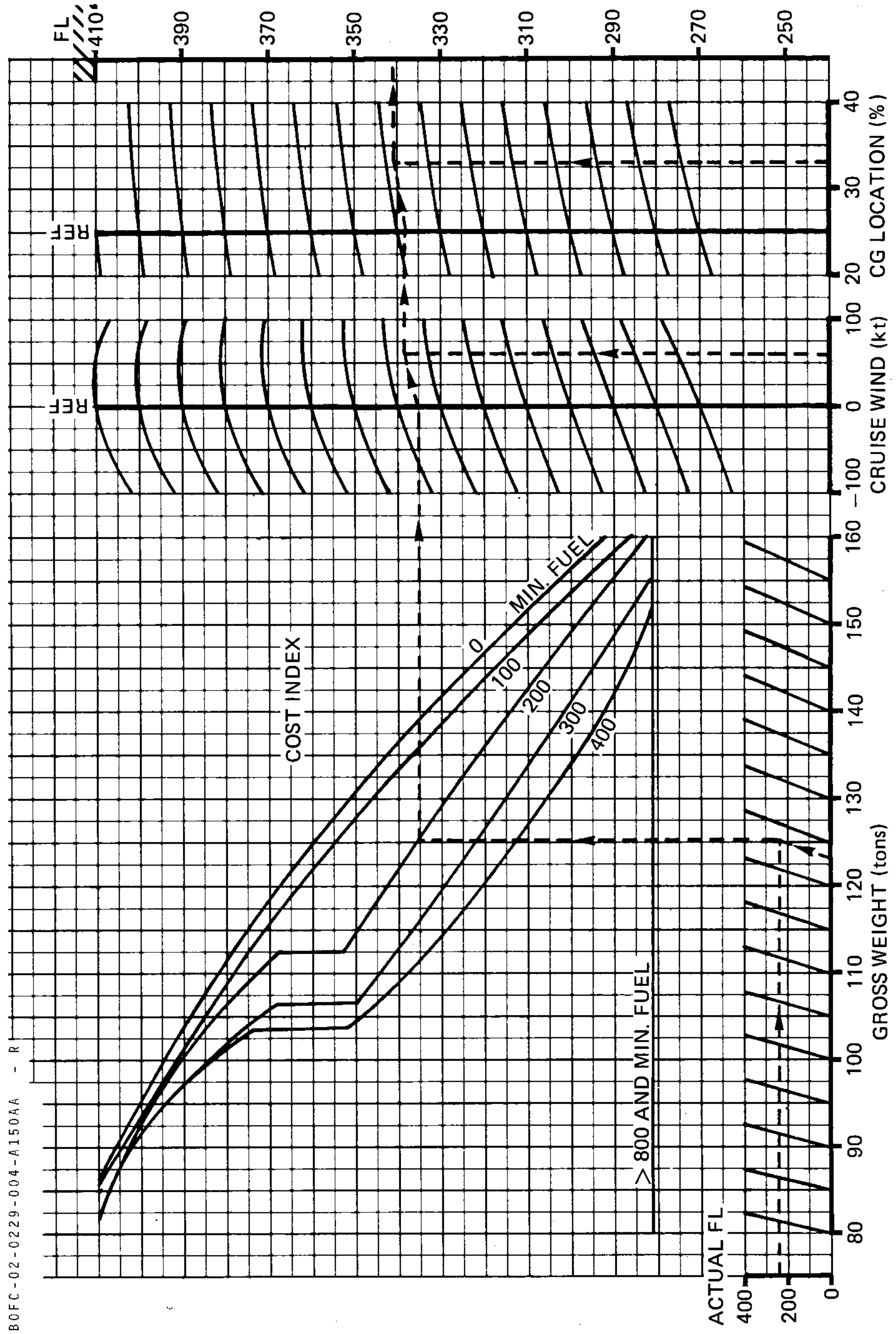


USE ONLY FOR CRUISE FLIGHT > 5mn

Mod : 6789

PW Eng. : 4000

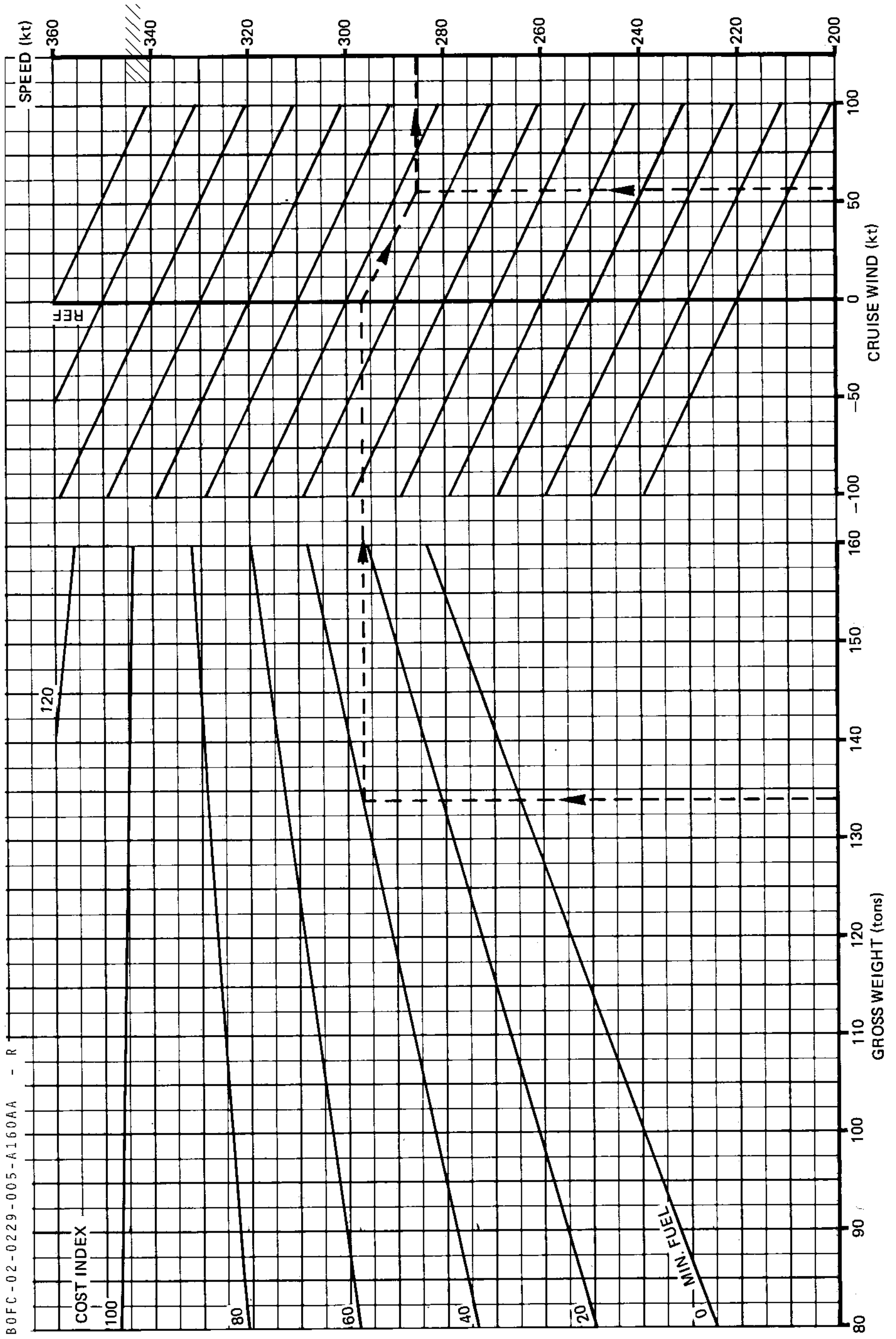
OPTIMUM ALTITUDE FOR STRATEGIC MODE



This chart gives the OPTIMUM FL taking into account the climb segment from ACTUAL FL.
The OPTIMUM ALTITUDE is upper limited to the altitude giving a 5mn cruise phase.

DESCENT SPEED FOR STRATEGIC MODE

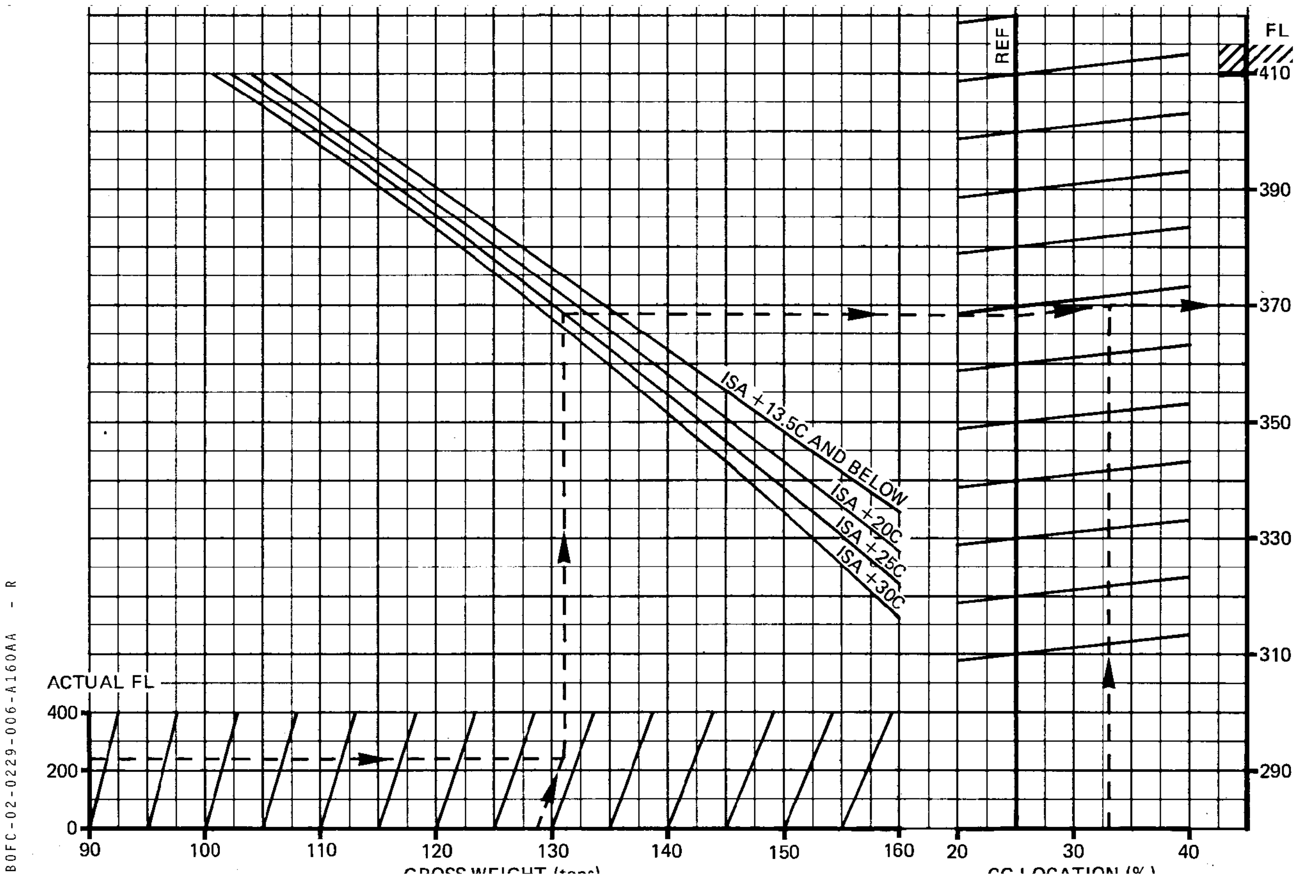
BELOW 10 000 FT CLIMB SPEED ⩽ 250 KT



Mod : 6789

PW Eng. : 4000

MAXIMUM ALTITUDE



This chart gives the MAX FL taking into account the fuel consumption during the climb segment from ACTUAL FL.

NO CHANGE

Note : At high weight and forward CG, the FMS Maximum Altitude may be higher than the Flight level limitations (FCOM 2.01.20) by up to 700 ft. The Flight Envelope limitations must still be applied.

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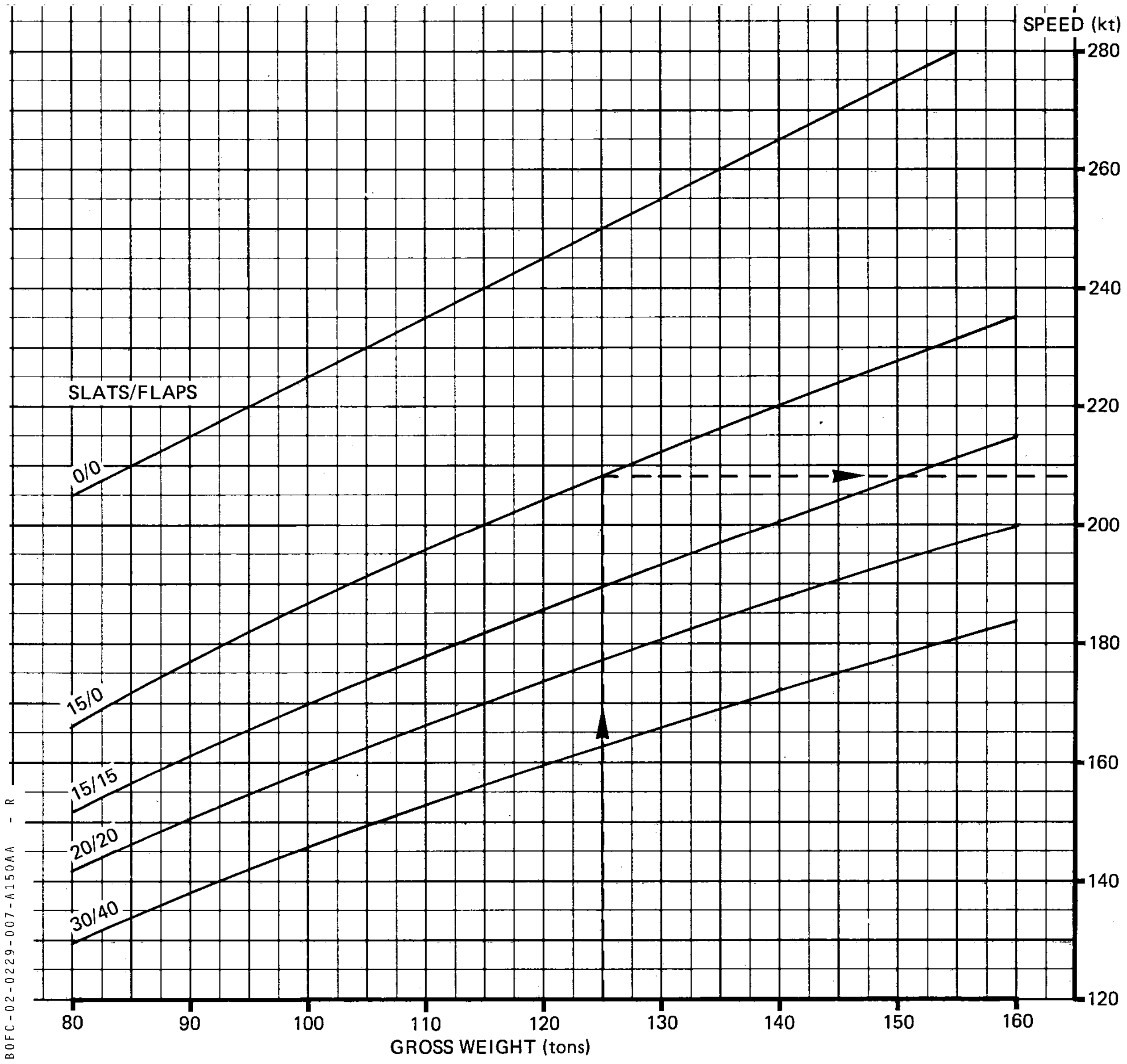
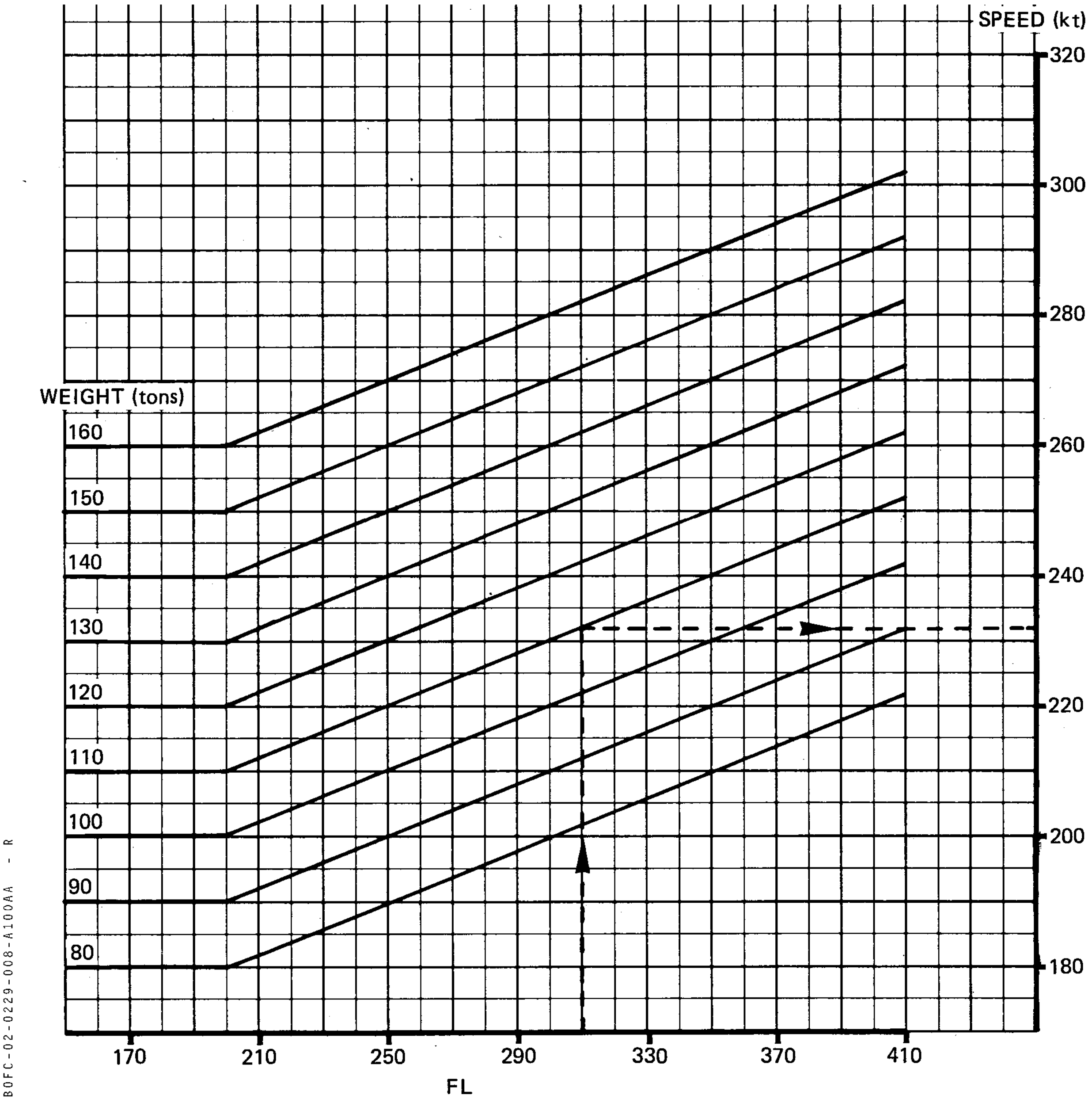
MAXIMUM ENDURANCE SPEED



Mod : 6789

PW Eng. : 4000

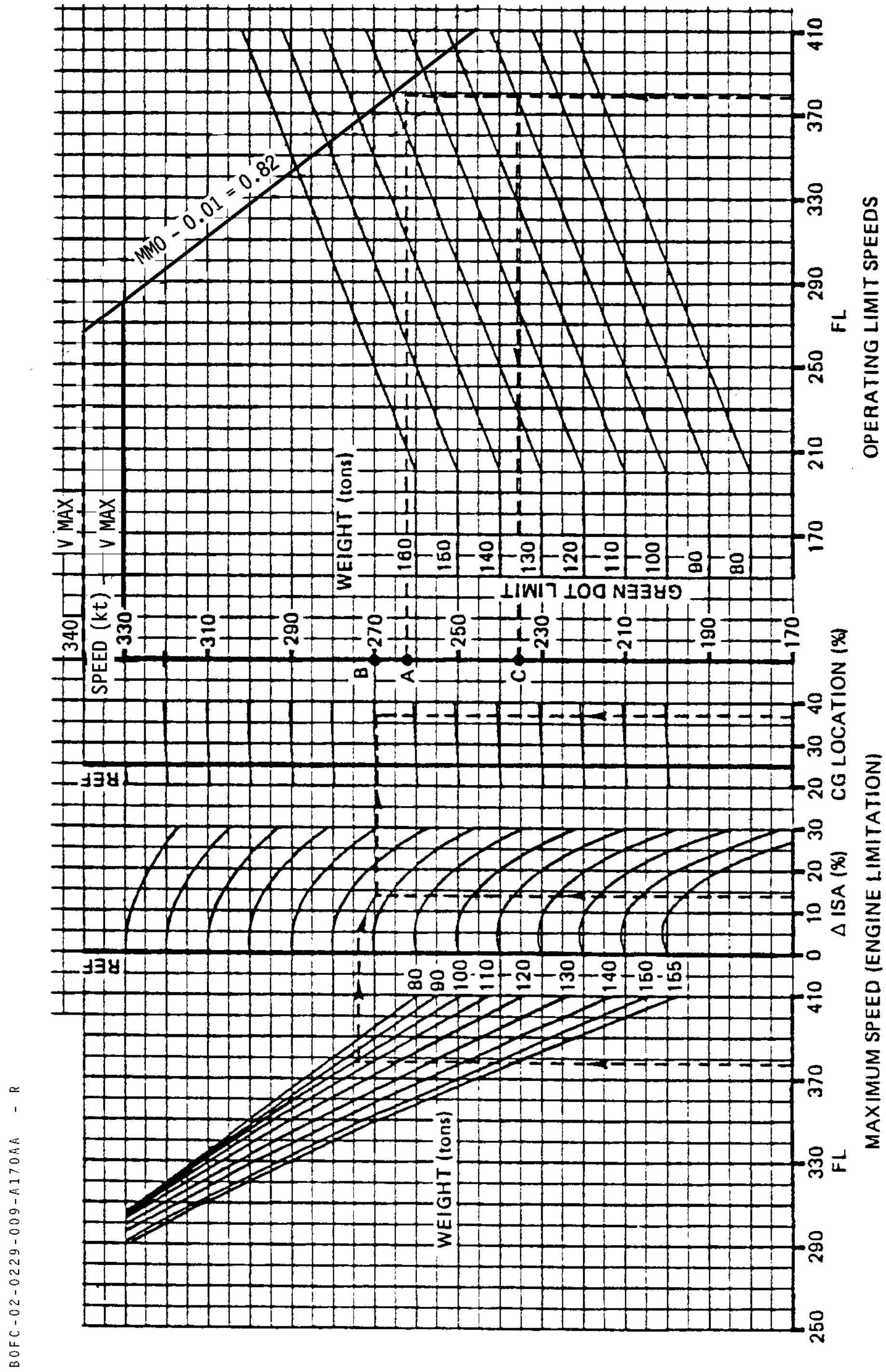
SPEED FOR MAXIMUM CLIMB ANGLE



SPEED is GREEN DOT
GREEN DOT = A/C weight (tons) + 100 below 20000 ft

Mod. : 6789

FMS SPEED ENVELOPE (VMIN, VMAX) IN STRATEGIC MODE



VMAX = MIN (A, B) VMIN = C A = VMAX AIRCRAFT B = VMAX ENGINE
IF VMIN > VMAX, FL IS ABOVE MAX ALTITUDE (SEE MAX ALT CHART)
VMAX = 340 kt if VMO = 360 kt
VMAX = 330 kt if VMO = 340 kt

Mod : 6789

PW Eng. : 4000

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FOREWORD

Procedures contained in this chapter are recommended by AIRBUS INDUSTRIE. They are subject to updating based on operational experience from the manufacturer and all operators.
Updating of the standard operating procedures may be communicated by Temporary Revisions or OEBs if fast dispatch is required, otherwise at the time of the next FCOM revision.
Compliance with standard operating procedures is vital for safe aircraft operation.

APPROVAL

The FCOM is not an approved document. Consequently the standard operating procedures contained in this FCOM are not certified by the regulatory authorities of the manufacturer.
If approval for standard operating procedures is required, the operator must obtain this approval from the relevant regulatory authority.

PRELIMINARY

Standard operating procedures consist of inspections, preparations and normal procedures.

All items are listed in a sequence following a standardized scan of the cockpit panels, except when required by the logic of actions priority, to ensure that all actions are performed the most efficient way.

Standard operating procedures are divided into flight phases and are accomplished by recall.
These procedures assume that all systems are operating normally and that all automatic functions are used normally.
These procedures assume that the basic system description and operation as described in FCOM VOL 1 are fully understood.

Some normal procedures, which are non routine will be found in chapters 2.02 PROCEDURES AND TECHNIQUES and 2.18 SPECIAL OPERATIONS.

NORMAL CHECK LIST

After completion of a given procedure the related normal check list is used to ascertain that the safety points have been checked.

The crew member reading the check list should announce the completion of the check list (eg."LANDING C / L – COMPLETED ".

The normal check list developed by AIRBUS INDUSTRIE takes advantage of the ECAM system and includes only the items that may have a direct impact on safety and efficiency if not correctly accomplished.

All normal check lists are initiated by the PF and read by the PNF.

The normal check lists are of the "CHALLENGE / RESPONSE" type. The appropriate crew member shall respond to the challenge, only after having checked the existing configuration. If the configuration is not in accordance with check list response he will take the corrective action before answering.
If a corrective action is not possible, he will modify the response so as to reflect the actual situation (specific answer). The other crew member will cross check whenever necessary the validity of the response. The challenger will wait for the response before proceeding any further.
For those check list items identified "AS RQRD" the actual condition or configuration of the system will be stated as the check list response eg. ANTI ICE . . . . . ON.

Note : *The normal check list is not a DO LIST.
The actions or checks should be performed prior reading the check list.
Obviously, corrective action should be undertaken if the proper condition is not achieved at the time of reading.*

COMMUNICATION

- Cross cockpit communication :

  Crew communication is **VITAL**. Any time a crew R
  member makes any adjustments, changes, etc. to any information or equipment on the flight deck, he will advise the other crew member of his intentions and get an acknowledgement. This includes but is not limited to such items as FMS alterations, changes in speed / mach, tuning navigation aids, flight plan deviations, and selecting such systems as anti-ice and pack low flow. Use headsets from engine start up to top of climb and from top of decent up to parking.

- Sterile cockpit rule : R

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

SELECTION OF CONTROLS

When selecting a control, ensure that the intended control is selected and is properly set to the intended position and, as applicable, is properly seated in this position.

USE OF THE AUTOPILOT AND FLIGHT DIRECTOR

The design objectives of the autopilot (AP) and flight director (FD) are to provide assistance to the crew throughout the flight.

- In FD mode, by providing the pilot flying (PF) with attitude and flightpath orders via the FD pitch and roll command bars on the Primary flight display (PFD) so as to enable accurate handflying of the aircraft.
- With AP engaged in command (CMD), the AP will follow the FD bars, thus freeing th PF from routine handling tasks and thus giving him the time and resources to access and manage the overall operational situation.
- With the AP engaged in control wheel steering (CWS), where the PF flies through the autopilot to follow the FD bars.

The AP/FD guides the aircraft along the selected flightpath at the selected speed, according to the modes selected by the pilot on the flight control unit (FCU) and flight management system (FMS).

There are two ways to use the autopilot :

- using pilot selected modes and targets, the aircraft is guided according to selections made on the FCU.
- by coupling the AP to the FMS by selection of PROFILE/NAV mode. The aircraft is guided along the FMS lateral and vertical flightplan and speed profile.

Here the FCU is the short term interface between the pilot and the FMS selecting guidance target and arming/engaging guidance modes. Long term guidance changes are made through the FMS CDU.

The task of the PF is to select the desired modes and targets to fly the aircraft on the intended flightpath, at the intended speed.

- If the FD is used, the PF asks the PNF to select the intended modes and targets on the FCU.
- If the AP is engaged, the PF selects the modes and targets on the FCU himself.

The AP/FD armed and engaged modes are indicated on the flight mode annunciator (FMA), at the top of the PFD. The targets (speed, altitude, heading) are indicated on the associated scales on the PFD/ND.

- The crew must check the FCU selected targets on the PFD/ND scales.
- The crew must check and monitor the engaged/armed modes on the FMA and announce any changes.
- Whatever the prevailing conditions, always ensure that one pilot is controlling and monitoring the flight path of the aircraft.

IF THE AP AND/OR FD DOES NOT GUIDE THE AIRCRAFT ON THE INTENDED FLIGHTPATH (OR TRAJECTORY) WHERE THE CREW ARE EXPECTING :

- THE PF MUST DISENGAGE THE AP USING THE INSTINCTIVE DISCONNECT PUSHBUTTON ON THE CONTROL COLUMN (OR BY DISENGAGING THE AP LEVER ON THE FCU)
  THE PF MUST NEVER TRY TO DISENGAGE THE AUTOPILOT BY FORCE ON THE CONTROL COLUMN.
- IF THE FD ONLY IS ENGAGED, THE FD BARS SHOULD BE REMOVED FROM THE PFD USING THE FD/FPV/OFF SWITCH ON THE EFIS CONTROL PANEL

THEN FLY THE AIRCRAFT MANUALLY ON THE INTENDED FLIGHTPATH AT THE INTENDED SPEED.

The AP may be used from takeoff down to a late stage on the approach (including autoland when permitted)

For manual landing, the pilot should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare.

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

- In case of engine failure, without any restriction including Autoland down to CAT 1 minima CAT 2/CAT 3 ILS approaches may be continued to CAT 2 if engine failure is below 1 000 ft, to CAT 3 minima if engine failure is below 100 ft.
- In case of abnormal configuration, down to CAT 1 minima.

When the PF handflies the aircraft using the FD, he must obey the FD orders ; in other words, the pitch and roll command bars must be centered or the FPV must be on the Flight Path Target symbol so as to fly according to the selected modes and targets.

- If the PF does not wish to fly the FD orders, he must remove the FD symbol from the PFD.
- When flying a visual approach, the FD should be deselected.

USE OF AUTOTHRUST (A/THR)

The design objective for the A/THR is to provide assistance to the crew for the thrust management throughout the flight.

The A/THR may be engaged in one of the following modes, which are depending automatically on the vertical modes engaged in the AP/FD :

- THRUST mode : the A/THR maintains a fixed thrust level (e.g. THR or IDLE) when the AP/FD guides the aircraft in Climb or Descent at a constant speed (e.g. LVL CH mode)
- SPEED/MACH mode : the A/THR varies the thrust so as to maintain a target speed, when the AP/FD guides the aircraft on a given trajectory (e.g. V/S, ALT, G/S modes).

The crew must monitor the A/THR to ensure correct operation

- On the PFD, by checking the active mode on the FMA, the current speed versus the target speed, and most importantly the Speed Trend Arrow on the Speed Scale.
- On the ENGINE INSTRUMENTS, by checking the actual thrust against the commanded thrust and thrust limit.

In case the PF is not satisfied with the A/THR operation, he must disengage it using the instinctive disconnect pushbuttons located on the throttle levers and command the thrust manually.

The A/THR may be used from Take Off to touchdown.

USE OF THE FLIGHT MANAGEMENT SYSTEM (FMS)

The design objective for the FMS is to provide assistance to the crew for :

- Navigation
- Flight Planning
- Aircraft performance (optimum speeds/altitudes)
- Predictions

The FMS is an important "long term" planning and management tool, linked to the AP/FD.

When the AP/FD is engaged in PROFILE/NAV modes, the aircraft is guided along the FMS flight plan, using the FMS target speeds.

The Control and Display Unit (CDU) is used to insert and retrieve data to/from the FMS.

The various FMS entries required at successive flight phases should not distract the crew from the general flight conduct and duties.

The prime concern for the flight crew should be :

- Is the aircraft flying as expected NOW ?
- What is the aircraft expected to fly NEXT ?

If any doubt is raised about the aircraft current trajectory, or proposed target speed..., the PF must immediately select the appropriate modes and targets on the FCU (which automatically disengages PROFILE/NAV mode).

Subsequently and if time permits, the PNF will analyze and correct the FMS data.

GENERAL RULES FOR GOOD USE OF THE AP/FD/ATHR/FMS

- FMS navigation accuracy should be cross-checked against navaids raw-data
- Monitor the AP/FD/ATHR modes and engagement status on the FMA
- Any FMA modification must be announced.
- Monitor the result of any target selection performed on the FCU, on the related scales of the PFD (e.g. SPD target, on SPD scale)
- Monitor the AP/FD/ATHR resulting guidance, on the basic flight instrument scales of the PFD/ND and flight instruments (HDG, SPD, ALT, attitude...)
- If the PF is not satisfied with the guidance he must :
  - . REVERT TO BASICS, DISCONNECT THE AP and/or A/THR and fly the aircraft manually on the intendeeed flight path, at the intended speed.

FLIGHT CONTROLS TAKE-OVER

The normal procedure is for the designated pilot flying to handle the aircraft when the AP is not engaged. The PNF should not handle the controls symultaneoulsy except when specifically requested by the PF. If it becomes necessary for the PNF to take over control during the flight the PNF must clearly announce "I have control", the PF should respond with the confirmation "you have control". If the PF whishes to give control to the PNF, the PF should announce "You have control", the PNF then responds "I have control" once he has his hands on the control column.

The crew must not manually override the AP when in CMD mode, except in the case of "Supervisory Control Wheel Operation" :

- in roll when in VOR* / VOR mode or in LOC* mode

If the AP operations are not satisfactory, the AP must be first disconnected and then the PF must fly manually.

Note : *The Supervisory Control Wheel Operation is also available in pitch when in GS* mode but it does not permit AP override.*

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TECHNICAL CONDITION OF THE A / C

R – The crew will verify the technical status of the aircraft (defered defect list), with regard to airworthiness, acceptability of malfunctions (MEL) and influence on the flight plan and operational conditions.

– The list of OEB applicable to an aircraft is part of the technical status of the aircraft. It should therefore be reviewed by the flight crew during flight preparation.

R The OEB section of the QRH enables this review.
The crew should particularly identify :
. red OEB,
. red OEB to be applied before ECAM procedures.

WEATHER BRIEFING

– Crew will receive weather briefing.

– Briefing should include :
  . Actual and expected weather conditions for take-off and climb-out including runway conditions.
  . En route significant weather : 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 planned route.

Weather can affect the choice of routing (e.g. minimum time) and choice of Flight Level.
The possibility of contaminated runways at the departure and destination airfield must be checked. ISA deviation and enroute icing conditions must also be verified as well as the possibility of holding due to weather at the destination.

NOTAMS

– Notams must be examined for changes to routings, navaid unserviceability, runway and approach aid availability etc, all of which may have an impact on the final fuel requirement.

FLIGHT PLAN and OPERATIONAL REQUIREMENTS

– The crew will check the company flight plan, in respect to routing, altitudes and flight time.

– The Captain will check ATC flight plan and ensure :
  . it is filled according to the prescribed procedures,
  . it agrees with the fuel flight plan routing.

– The crew will check the estimated load figures and will calculate max allowed take-off and landing weights.

OPTIMUM FLIGHT LEVEL

Choice of Flight Level should be as near the OPTIMUM as possible. To obtain the optimum Flight Level use the chart in the QRH or refer to 2.17.20.

It is recommended to stay within ± 2000 ft of the Optimum Altitude in order to maintain within 1.5% of the optimum performance level.

If flight 4 000 ft below optimum is contemplated, an increase of about 4 % can be expected in trip fuel (usual contingency is 5 %).

If flight above optimum (up to ceiling) is contemplated the increase in consumption may reach 4 %.

FUEL REQUIREMENTS

COMPUTERIZED FLIGHT PLAN CHECK

In most cases a computer derived flight plan will be used to obtain the correct fuel requirements. Despite the fact that these flight plans are normally accurate, it is still important to check them for GROSS ERRORS.

The easiest way to check for gross error is to use the "Fuel and time to destination table" (refer to 2.17). Although the aircraft will fly at ECON MACH based on cost index, using the 0.80 Mach table gives sufficient accuracy for gross error checking.

Ensure that BOTH Captain AND 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 policy regarding "tankering" of fuel on sectors where a favourable fuel price differential or operational requirement exists must be checked.

Remember the effect of carrying UNNECESSARY EXTRA FUEL is to increase the fuel consumed for that sector and, therefore, affect the economy of the operation (lower flex temperature, tyre and brake wear, climb phase duration, lower optimum flight level etc).

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Completion ensures that A / C and surroundings are not obviously unsafe for operations.

On arriving at the aircraft check for obstructions in the vicinity, engineering activity, refuelling etc...

NOSE WHEEL CHOCKS . . . . CHECK IN PLACE

L / G DOORS . . . . CHECK POSITION

CAUTION

R Do not pressurize the green hydraulic system
R without ground clearance if any gear door is open.

APU AREA . . . . CHECK

– Observe APU inlet and outlet are clear.

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

The following procedure, performed by the PNF, ensures that required safety checks are made prior to the application of electrical power to avoid inadvertent systems operation and danger to A/C and personnel. Included is APU starting and establishement of electrical and pneumatic power.

IGNITION . . . . **OFF**

WIPERS . . . . **OFF**

THROTTLE LEVERS . . . . **Check Idle**

REVERSE LEVERS . . . . **Check Stowed position**

FUEL HP VALVES . . . . **Check OFF**

LANDING GEAR LEVER . . . . **Check DOWN**

REAR and OVERHEAD C/B PANELS :

- Check all C/B are set. If a C/B is found tripped, coordinate with maintenance for reset.

BATTERIES and EMERGENCY INVERTER :

- **BAT 1,2 and 3** . . . . **Check OFF**
- **BAT 1,2 and 3 voltage** . . . . **Check Above 25 V**
  - · If one battery is below 25 V connect external power before attempting to start the APU.
- **BAT 1, 2 and 3** . . . . **AUTO**
  - · Check FLOW BARS in line and observe DOME lt is illuminated.
- **AC EMER ON INV light** . . . . **Check ON**
- **DC ESS ON BAT light** . . . . **Check ON**
- **AC V/FRQ rotary sel** . . . . **EMER**
  - · Check INV parameters in white range.

CAUTION

In case of emergency inverter malfunction, switch off batteries before any other action to avoid damage to the electronic equipment.

HYDRAULIC :

CAUTION

Do not pressurize the green hydraulic system without ground clearance.

APU FIRE PROTECTION

- **APU FIRE handle** . . . . **check IN and Latched**
- **LOOP A and B pb** . . . . **Check IN**
- **SQUIB TEST pb** . . . . **Press**
- **AGENT SQUIB lt** . . . . **Check Illuminated**
- **LOOP TEST pb** . . . . **Press and Hold**

Check : . LOOP A lt comes on with LOOP warning activation.
. After few seconds, LOOP B lt also illuminates associated with APU FIRE warning activation and APU FIRE handle illumination.

- **LOOP TEST pb** . . . . **release**

Check : . LOOP A warning and APU FIRE warning activation disappear.
. After few seconds LOOP B warning disappears.

ELEC

EXT PWR (If AVAIL Lt illuminated) . . . . ON

AVAIL Lt extinguishes

APU START

- **If EXT PWR ON lt illuminated :**
  - **ECAM control panel** . . . . **Adjust brightness**
  - **APU MASTER SW** . . . . **ON**
    - · APU page appears on ECAM
  - **APU START** . . . . **ON**
    - · ON lt illuminates.
    - · Blue ACCEL light illuminates and indicates that APU is accelerating
    - · On ECAM APU page, N and EGT rise

      At 50 % of Speed
      Start PB-Switch is released automatically
      ON white light extinguishes
      At 95 % of speed :
    - · On ECAM APU page, AVAIL indication appears
    - · On APU panel : . ACCEL blue light extinguishes
      . AVAIL lt illuminates
  - **EXT PWR** . . . . **As rqrd**
    - · The EXT PWR may be kept ON to reduce APU load, especially in hot conditions.
- **If EXT PWR ON lt extinguished :**
  - **APU MASTER SW** . . . . **ON**
  - **APU START** . . . . **ON**
    - · ON lt illuminates
    - · Blue ACCEL light illuminates and indicates that APU is accelerating

At 50 % of speed :
START PB-switch is released automatically
ON white light extinguishes

At 95 % RPM :
· AVAIL lt illuminates
· APU GEN on line :
· ECAM APU page appears after 10 seconds.
If required, adjust brightness on ECAM control panel.

STAND BY GENERATOR (if installed)

If a test of the STBY GEN channel is required for ETOPS operations, perform the following procedure as early as possible during the cockpit preparation :

- **ELECTRICAL NETWORK** . . . . **Supplied**
- **If APU is not running :**
  APU MASTER SW . . . . **Check OFF**
- **BAT FLOW BARS**. . . . . **Check extinguished**
- **GREEN HYD ELEC PUMPS** . . . . **ON**
- **PTU** . . . . **Check OFF**
- **FUEL PUMPS** . . . . **Check OFF**
- **STBY GEN** . . . . **OVRD**
  (STBY GEN OVRD function disengages after 2 minutes)

Checks to be performed :

- **STBY GEN FAULT light** . . . . **Extinguished**
- **ESS TR current** . . . . **Approximately 0**
- **DC ESS BUS** . . . . **22-29 VDC**
- **AC ESS BUS and AC EMER BUS** . . . . **110-122 VAC**
  390-410 Hz
- **DC ESS ON BAT light** . . . . **Extinguished**
- **AC EMER ON INV light** . . . . **Extinguished**
- **GREEN HYD ELEC PUMPS** . . . . **OFF**
- **ELECTRICAL NETWORK SUPPLY** . . . . **AS REQ**

Note : On ECAM ELEC DC page (SYSTEM Display)
– DC BUS TIE is not displayed
– DC ESS BUS is amber.

* COCKPIT LIGHTS . . . . AS REQ

Set STBY COMPASS, DOME, STORM and PANEL Lts as required. DOME Light should be selected since it is the only lighting source in EMER ELEC configuration. DIM position is recommended for take-off.

ELEC PWR . . . . Check

- Scan ELEC PWR panel : no amber light illuminated except GEN 1 and GEN 2 FAULT lights.

FUEL :

LEFT INNER PUMP 2 . . . . NORM

- If there is sufficient fuel in the left inner tank, this avoids fuel depletion from the outer tanks which would lead to increased refuelling time.

Note : Pump 1 of Left Inner Tank (and Pump 2 of Right Inner Tank) allows to open a drain valve which drains the fuel trapped in the refuel/defuel line in the respective tank. During refuelling, this drain valve should be closed (and therefore Left Inner Pump No. 1 or Right Inner Pump No. 2 should be OFF) to avoid fueling of the tanks through this drainvalve resulting in loading more fuel than preselected.

PROBE/WINDOW HEAT . . . . Check OFF

VENT

- Check all lights OFF

Note : On ground OVBD green flowbar in line.

ANN LT :

- **AUTO TEST PB** . . . . **ON**
  · Check that all lights are serviceable

The automatic test checks the lights of the overhead panel, instrument panels and pedestal except the following equipment :

OVERHEAD PANEL	INSTRUMENT PANELS	PEDESTAL
	MASTER CAUTION	
	MASTER WARNING	
MSU's	Altimeters	
ISDU	L/G CTL lever	FMCs
FIRE handles	TRP mode selector	ECAM CTL panel
FQI LO LVL lights	keys	ATC control unit
ENG TRIM (GE only)	SFPI	VHF control unit
COCKPIT DOOR	FCU	ADF control unit
(if installed)	EFIS control panels	WLDP
	AUTO LAND lights	

During AUTO TEST operation :

- all the lights not checked by the automatic test are illuminated steady (except α - LOCK, MASTER CAUTION, MASTER WARNING, flashing) : check all the corresponding lights are illuminated.
- all digital displays indicate « ...888... » (except FQI during refuelling).
  In case of low accuracy of fuel quantity in any tank, FQI display indicates « LA » code for corresponding tank (except during refuelling).

Note : Duration of AUTO TEST is approximately 65 sec.

- If Windshear Warning is installed :
  · WINDSHEAR appears in red on the PFD for approximately 15 seconds (If PFD is on)
  · Audio warning "WINDSHEAR" is announced three times.
  · WINDSHEAR ALERT NOT AVAILABLE message is displayed on ECAM STATUS page.

R Code : 0505

AIR BLEED/COMPT TEMP :

- **APU BLEED . . . . ON**

  Do not use APU bleed if a ground personnel confirms that ground air is connected. Pilots should also check the ECAM BLEED page to determine whether an HP ground air is connected (pressure in the system).
- **PACK VALVES 1 and 2 pb switches . . . . Check ON**
  · Check Flowbars in line
- **COMPT TEMP selectors . . . . AUTO/AS REQ**

PARKING BRAKE . . . . ON

- Check ACCU PRESS and recharge if necessary.
- The ACCU PRESS indication must be in the green band. If required, use the electric pump on yellow hydraulic system to recharge the brakes accumulators.

R

- Check PARKING BRAKE pressure is 1500 PSI or more.

  PARKING BRAKE must be applied before performing the Exterior Inspection to allow removal of chocks and to check BRAKE wear indicators.

ALTERNATE BRAKING SYSTEM

Note : The purpose of this check is to verify, before the first flight of the day, the efficiency of the alternate braking (absence of "spongy pedals").

- **CHOCKS . . . . CHECK IN PLACE**
- **BRK/A/SKID . . . . ALTN/ON**
- **PARKING BRAKE . . . . OFF**
- **BRAKE PEDALS . . . . PRESS**
  Apply maximum pressure on both pedals.
- **BRAKE PRESSURE . . . . CHECK**
  On the brake pressure triple indicator, pressure must build up symmetrically without delay on left and right sides.
  With full pedal deflection, pressure must be between 2000 and 2700 psi.
- **BRAKE PEDALS . . . . RELEASE**
- **PARKING BRAKE . . . . ON**
- **BRK/A/SKID . . . . NORM/ON**

SPEED BRAKE HANDLE . . . . Check in RETRACT position and DISARM

CAUTION

If flight control surface positions do not agree with the control handle positions, check with the maintenance personnel before applying hydraulic power.

SLATS/FLAPS HANDLE . . . . Check

- If handle position disagrees with slats/flaps position, set handle to corresponding position.

  At this stage, with no hydraulic pressure and with the slats/flaps handle in 0/0 position, the KRUGER NOT RETRACTED warning on the ECAM and the KRUGER light on the SFPI may be triggered.

R

LATERAL PANEL

- Check ANN LT sel in OFF position.
- Check no light illuminated on lateral panel.

MAINTENANCE PANEL AUDIO SELECTOR :

- Select P.A. reception on audio selector of lateral panel, with volume selection in approx 12 o'clock position.

  This selection will allow recording of cabin attendants announcements on the cockpit voice recorder.

EMERGENCY EQUIPMENT

- Check :
  - · Life jackets stowed
  - · Asbestos gloves stowed
  - · Axe stowed
  - · Flashlights stowed
  - · Smoke goggles stowed
  - · Portable fire extinguisher lockwired and pressure within the green area
  - · Oxygen masks stowed
  - · Portable oxygen equipment and full face masks, bottle pressure within the green area and adapters stowed underneath right aft window
  - · RH and LH evacuation handles stowed
  - · L/G gravity extension handle stowed
  - · Smoke hoods (if carried)

RAIN REPELLENT (If installed)

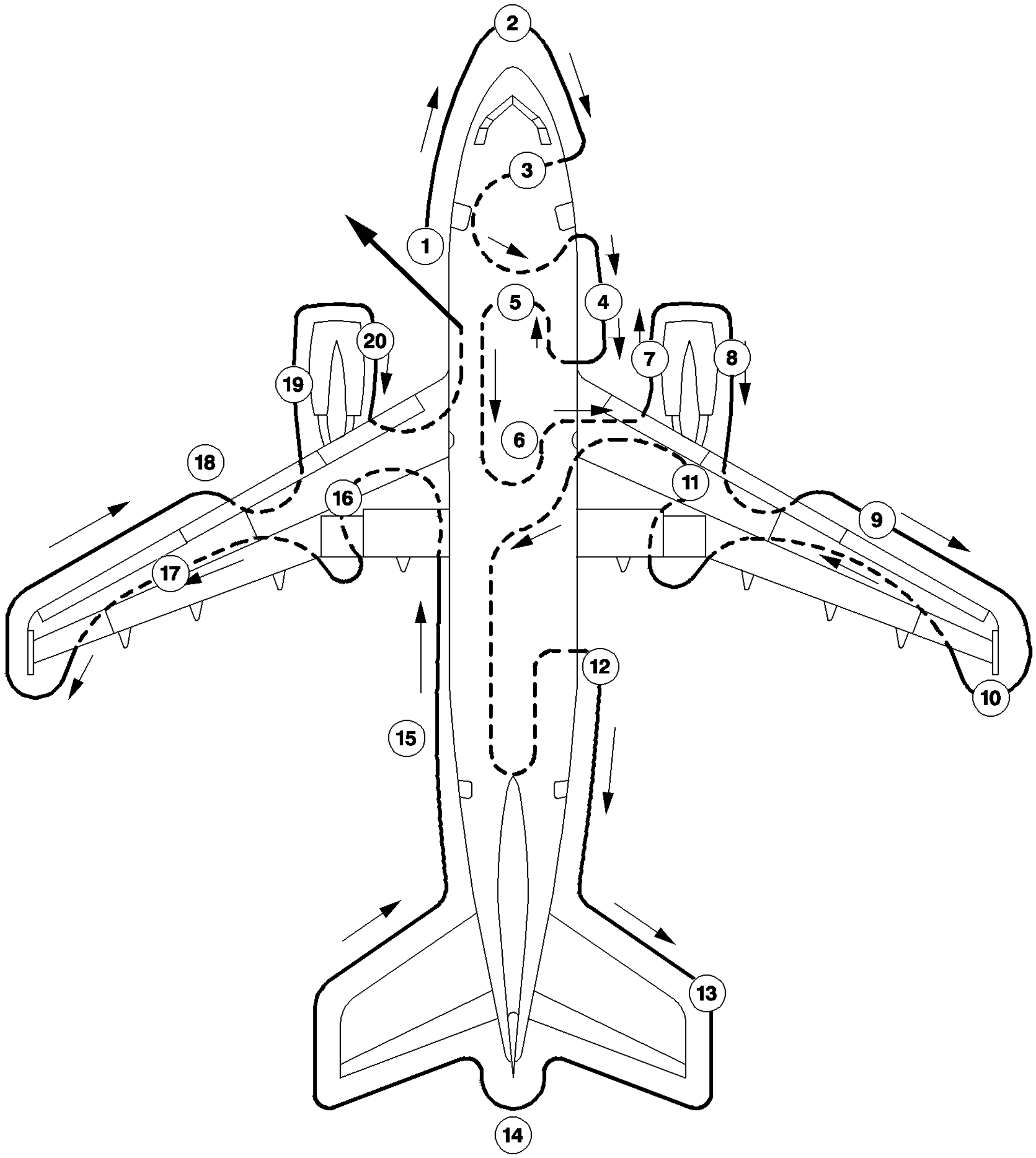
- Pressure and quantity indicators . . . . Check

CAUTION

The rain repellent should never be used as a windshield washer and should never be sprayed on a dry screen.

LEFT BLANK INTENTIONALLY

EXTERIOR WALK – AROUND



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GENERAL

The exterior inspection is primarily a visual check to ensure that the overall condition of the A/C, the visible components and equipment are safe for the flight.

Complete inspection is normally performed by maintenance or in the absence of maintenance by a flight crew member before each originating flight.

Items marked by asterisks (*) will be performed again by a flight crew member prior to each flight.

. If brake wear is checked during exterior inspection, parking brake must be applied.
. Check structure for no impact.

CAUTION

IF A L/G DOOR IS OPEN CONTACT MAINTENANCE CREW BEFORE APPLYING HYDR. POWER.

1) LEFT FORWARD FUSELAGE

* – Static ports . . . . .CLEAR
– Exterior lights . . . . .CONDITION
* – Angle of attack probe . . . . .CONDITION
* – Toilet service access door . . . . .CLOSED

2) NOSE SECTION

* – Pitot probes and covers . . . . . .CHECK/REMOVED
* – TAT probes . . . . .CONDITION
* – Radome and latches . . . . .CHECK
– Oxygen compt venturi . . . . .CHECK
– Oxygen over pressure disk . . . . .GREEN

3) NOSE GEAR

* – Nose wheel chocks . . . . .IN PLACE
* – Wheels and tires . . . . .CONDITION
– Nose gear structure . . . . .CONDITION
– Taxi lights .CONDITION
– External electric PWR access door
(if EXT PWR not necessary) . . . . .CLOSED
* – Nose wheel steering selector
and by-pass pin . . . . .CHECK
– Proximity detectors . . . . .CLEAN
– Hydraulic lines and control cables . . .CONDITION
– Wheelwell . . . . .CHECK
* – Safety pin . . . . .REMOVED

4) RIGHT FORWARD FUSELAGE

* – Cargo doors . . . . .CHECK
* – Cargo loading control door . . . . .CHECK
* – Cargo door selector access door . . . . .CHECK
– Exterior lts . . . . .CONDITION
* – Static ports . . . . .CLEAR
* – Angle of attack probes . . . . .CONDITION
– Lower fuselage access doors . . . . .CLOSED

5) LOWER CENTER FUSELAGE

– Extract valve/fan . . . . OPEN AND RUNNING
– Antennas . . . . CONDITION
– Ground air conditioning door . . . . CLOSED
– Fresh water service door . . . . CLOSED
– Ram air inlet flap . . . . CLOSED
– Ground air conditioning/engine
starting door . . . . CLOSED
– Pack air intakes . . . . CLEAR
– Landing gear door opening on ground
access doors) . . . . CLOSED
* – Refueling electric control panel
access door) . . . . CLOSED
– Packs air outlets and flaps . . . . CLEAR

6) RIGHT CENTER WING

– Wing ventilation air intake . . . . CLEAR
– RH Inner fuel tank water drain valves . . . . CHECK
– Drip sticks . . . . SECURED
– Landing light . . . . CONDITION
– Yellow hydraulic access door . . . . CLOSED
– Ram air turbine doors . . . . CLOSED
* – Slat 1 and kruger . . . . CONDITION

7) ENGINE 2 LEFT SIDE

* – Cowlings . . . . CLOSED/LATCHED
– Latch access doors . . . . CLOSED
– Pressure relief doors . . . . CLOSED
– Engine oil access door . . . . CLOSED
– IDG and starter oil access door . . . . CLOSED
* – Engine drains . . . . CHECK
– Ambient pressure sensor port . . . . CHECK
* – Engine inlet and fan blades . . . . CHECK

8) ENGINE 2 RIGHT SIDE

– Anti-ice exhaust . . . . CLEAR
– Pressure relief doors . . . . CLOSED
– Hydraulic filter access door . . . . CLOSED
– Starter valve manual override opening .. CHECKED
– Engine oil access door . . . . CLOSED
– Turbine exhaust . . . . CLEAR
– Pylon overpressure door . . . . CLOSED
– Fire agent bottles access door . . . . CLOSED
– Pylon drains . . . . CHECK

Eng. PW : 4000

9) RIGHT WING LEADING EDGE

* – Slats 2 and 3 . . . . CONDITION
– Refuel plugs . . . . CHECK
– Drip sticks . . . . SECURED
– RH outer fuel tank water drain valves . . . . CHECK
– Surge tank air inlet . . . . CLEAR
* – Fuel Vent. 0/press disc . . . . INTACT
* – Wing tip . . . . CHECK
– Navigation and strobe lights . . . . CHECK

10) RIGHT WING TRAILING EDGE

– Static dischargers . . . . CHECK
* – Control surfaces . . . . CHECK
– Flap track fairing's . . . . CHECK
* – Flaps . . . . CONDITION

11) MAIN RIGHT LANDING GEAR and FUSELAGE

* – Wheel chocks . . . . REMOVED
* – Wheels and tires . . . . CONDITION
– Brakes and brake wear indicators . . . CONDITION
– Proximity sensors . . . . CLEAN
– Hydraulic lines . . . . CHECK
– Pitch damper pressure drop indicator . . . . CHECK
– Landing gear structure . . . . CHECK
– Gear uplock hook . . . . CONDITION
– Downlock spring . . . . CHECK
– Landing gear downlock safety pin . . . . REMOVED
– Wheelwell . . . . CHECK
– Landing gear door . . . . CLOSED
* – Fuselage Fuel drain mast . . . . CHECK
– Water drain mast . . . . CHECK
– Antennas and beacon . . . . CHECK

12) RIGHT AFT FUSELAGE

– Cargo loading control access door . . . . . . CHECK
– Cargo compartment door hydraulic selector access door . . . . CHECK
– Cargo door lock-unlock control lever . . . . CHECK
– Cargo doors . . . . CHECK
– Outflow valve . . . . CHECK
* – Toilet service access door . . . . CHECK
– Tail cone access door . . . . CLOSED
– RH landing gear down lock indicator pin . . . . EXTENDED
– Tail skid . . . . CHECK

13) TAIL SECTION

* – Stabilizer and elevator . . . . CHECK
* – Fin and rudder . . . . CHECK
– Static dischargers . . . . CHECK
* – Fuel vent O/press disc . . . . INTACT
– Trim tank water drain valves . . . . CHECK
– Tail vent tank water drain valve . . . . CHECK
– Drip stick . . . . SECURED

14) APU

– APU doors . . . . CLOSED
– APU air intake . . . . OPEN
– APU drain and vents . . . . CHECK
– Oil cooler exhaust . . . . CHECK
– APU exhaust . . . . CLEAR
– APU fire agent discharge overpressure red disc . . . . CHECK PRESENT R

15) LEFT AFT FUSELAGE

– LH landing gear downlock indicator pin . . . . EXTENDED
– Stabilizer and elevator . . . . CHECK
* – Fresh water drain . . . . .CHECK
– Green hydraulic access door . . . . CLOSED

16) MAIN LEFT LANDING GEAR

– Wheelwell . . . . CHECK
– Landing gear door . . . . CLOSED
* – Wheels chocks . . . . REMOVED
* – Wheels and tires . . . . CONDITION
– Brakes and brake wear indicator . . . . CONDITION
– Proximity sensors . . . . CLEAN
– Hydraulic lines . . . . CHECK
– Pitch damper pressure drop indicator . . . . CHECK
– Landing gear structure . . . . CHECK
– Gear uplock hook . . . . CONDITION
– Downlock spring . . . . CHECK
– Landing gear downlock safety pin . . . . REMOVED

17) LEFT WING TRAILING EDGE

* – Flaps . . . . CONDITION
– Flap track fairings . . . . CHECK
* – Control surfaces . . . . CHECK
– Static dischargers . . . . CHECK

18) LEFT WING LEADING EDGE

– Navigation and strobe lights . . . . CHECK
* – Wing tip . . . . CHECK
– Surge tank air inlet . . . . CLEAR
* – Fuel vent O/press disc . . . . INTACT
– LH outer fuel tank water drain valves . . . . CHECK
– Drip sticks . . . . SECURED
– Refuel plugs . . . . CHECK
* – Slats 2 and 3 . . . . CONDITION

Mod : 4801

19) ENGINE 1 LEFT SIDE

* – Cowlings . . . . CLOSED/LATCHED
– Latch access doors . . . . CLOSED
– Pressure relief doors . . . . CLOSED
– Engine oil access door . . . . CLOSED
– IDG and starter oil access door . . . . . CLOSED
* – Engine drains . . . . CHECK
– Ambient pressure sensor port . . . . CHECK
* – Engine inlet and fan blades . . . . CHECK

20) ENGINE 1 RIGHT SIDE

– Anti-ice exhaust . . . . CLEAR
– Pressure relief doors . . . . CLOSED
– Hydraulic filter access door . . . . CLOSED
– Starter valve manual override opening . . CHECKED
– Engine oil access door . . . . CLOSED
– Turbine exhaust . . . . CLEAR
– Pylon overpressure door . . . . CLOSED
– Fire agent bottles access door . . . . . . CLOSED
– Pylon drains . . . . CHECK

21) LEFT CENTER WING

* – Slat 1 and Kruger . . . . CONDITION
– Blue hydraulic access door . . . . CLOSED
– Landing light . . . . CONDITION
– Drip sticks . . . . SECURED
– LH inner fuel tank water drain valves . . . CHECK
– Wing ventilation air intake . . . . CLEAR

PW Eng. : 4000

INTRODUCTION

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

The cockpit preparation should be performed by the PF and PNF according to panel scan sequence, defined below, and the task sharing defined in the QRH.

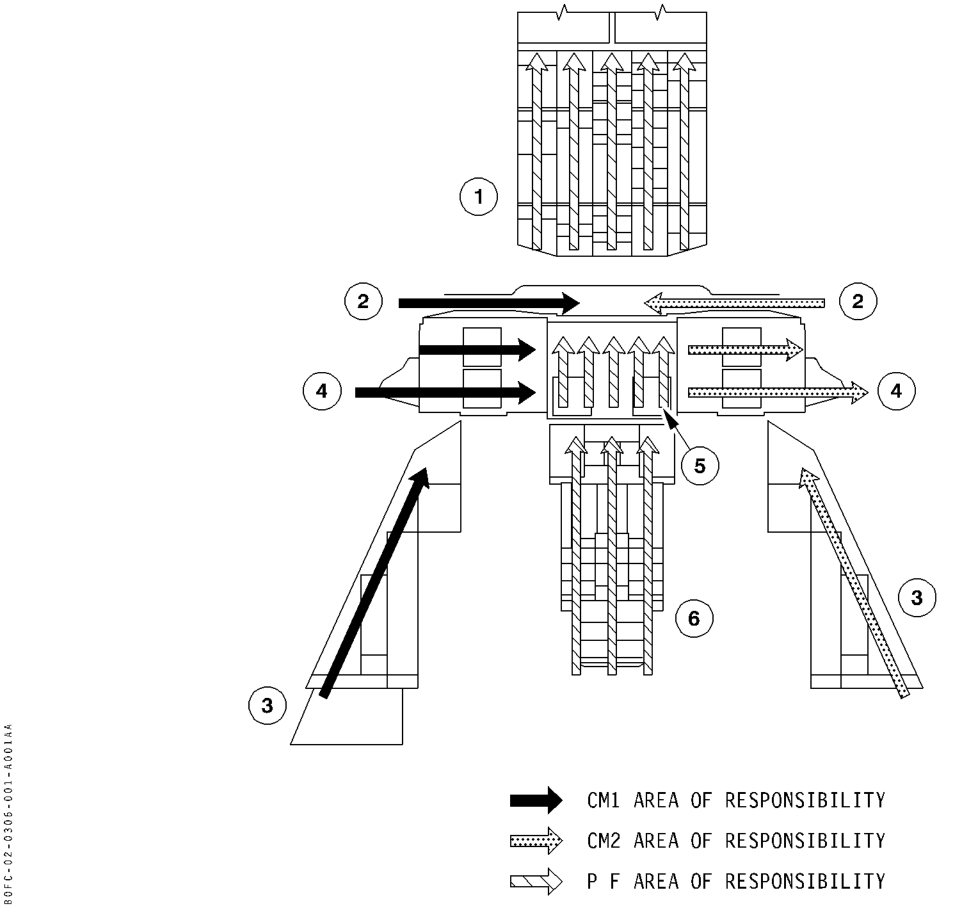
DOCUMENTATION AND MAINTENANCE

On entering the aircraft, obtain the technical (maintenance) log, verify the certificate of maintenance and daily inspection (or similar) are up to date and signed. Check the deferred or carried forward defects. If the refuelling has already been performed check the uplift.

PANELS SCAN SEQUENCE

R

R



Note 1 : IT IS A GENERAL RULE TO EXTINGUISH ALL WHITE LIGHTS FOR ALL SYSTEMS DURING THE SCAN SEQUENCE. THESE ACTIONS ARE THEREFORE NOT LISTED HERE.

Note 2 : FUEL PUMPS MAY BE LEFT OFF UNTIL REFUELLING IS COMPLETED IF REQUIRED.

* GEAR PINS and COVERS . . . . Check

– Check three gear pins on board and stowed.

OVERHEAD PANEL

* IRS MSU 1, MSU 2, MSU 3

– **Mode . . . . NAV**

The IRS MSUs will normally be OFF when entering the cockpit, selecting each MSU to NAV will start the IRS alignment process.

If the MSUs are still in NAV mode, select to OFF for more than 10 seconds, then back to NAV for a complete realignment, which lasts approx 10 minutes.

ALIGN MODE will be illuminated.

Note :
1. *The IRS outputs are used by many systems of the aircraft, so it is essential to align the IRS as early as possible to provide data to the related systems.*
2. *Perform a complete IRS alignment if it is the first flight of the day or if the GPS is not available and long segments with a poor radio navaid coverage are expected.*

   For other flights, perform a rapid 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.
3. *Check IRS ALIGN MEMO on ECAM is no longer displayed before moving the aircraft.*
4. *Do not initiate a rapid realignment within less than 3 minutes after normal alignment.*
5. *If an IRS alignment discrepancy occurs (ALIGN light flashes on MSU), check present position is correct and re-enter the present position using the same tuning source (FMS CDU or ISDU) as the one previously used.*

– **FMS CDU INIT Key . . . . Press**
INIT A page is displayed
LAT/LONG . . . . Check/modify

– **FMS CDU ALIGN IRS prompt . . . . Press**
When any of the IRUs are in the align mode the prompt ALIGN IRS will be displayed. Press the ALIGN IRS prompt to align the IRS on the LAT/LONG entered in the CDU, as soon as MSU mode selectors are selected to NAV.

If another page is selected other than INIT A, the message ALIGN IRS remains in the scratchpad.

Note : If IRS had previously been aligned on ground at the same LAT/LONG, then the ALIGN IRS prompt will not be displayed. If the LAT/LONG are changed, the ALIGN IRS prompt is displayed.

– **ISDU . . . Check valid co-ordinates have been sent**

* CABIN SIGNS

– **NO SMOKING . . . . AUTO/ON**
– **SEAT BELTS . . . . SEAT BELTS/ON**

* CALLS

– Check CALL lts extinguished. Reset as required.

HYD PWR

– **BLUE, GREEN, YELLOW RSVS . . . . . within normal range**
– Check the 3 fluid level indications are normal.

Note : On ground, system not pressurized, qty ind. needle should be in the outer green sector for any OAT. For OAT below - 10°C (above 20°C), the needle may be below (above) the upper small green arc down (up) to two needles width.

* FLT RCDR

GND CTL . . . . ON

Check DFDR and DFDAU Lts extinguished

ISDU . . . . OFF

– Check SYS rotary sel set to OFF.

* EXT LT . . . . As required

– Check STROBE in AUTO position and BEACON in OFF position.

* PITCH TRIM/YAW DAMPER/ATS

PITCH TRIM 1 + 2 . . . . ON

YAW DAMPER 1 + 2 . . . . ON

ATS 1 (+ 2 *If installed*) . . . . ON

ENG 1 FIRE

- **ENG 1 FIRE handle** . . . . **check IN and latched.**

  Engine fire protection test
- **SQUIB TEST pb** . . . . **Press**
  Check AGENT 1+2 SQUIB Lts illuminate
- **LOOP TEST pb** . . . . **Press and Hold**

  Check :
  - LOOP A lt comes on associated with LOOP warning activation.
  - After few seconds, LOOP B light also illuminates associated with ENG 1 FIRE warning activation and ENG 1 FIRE handle illumination (and fuel HP valve light illumination if HP valve open).
- **LOOP TEST pb** . . . . **release**

  Check :
  - LOOP A warning and ENG 1 FIRE warning activation disappear.
    After few seconds LOOP B warning disappears.

EVAC SIGNAL (if installed) . . . . As required

- For aircraft with CAPT+PURSER/CAPT switch, the usual position is CAPT.
- For aircraft with ARM/OFF switch, the usual position is OFF.

LDG GEAR ANNUNCIATOR . . . . Check Normal Indications.

- Cross check with center instrument panel.

* FUEL

- **X-FEED** . . . . **check CROSS-LINE**
- **ISOL VALVES/LP VALVES** . . . . **check in line**
  - Flow bars in line and steady.

Note : ISOL VALVES check must be done with « PED and OVHD PNL » control knob set to BRIGHT.

- For ETOPS Flights only
- **X-FEED** . . . . **Press**
  - Check IN-LINE flow bar illuminated
- **X-FEED** . . . . **Release**
  - Check CROSS-LINE flow bar illuminated.

* COCKPIT VOICE RECORDER

- **CVR TEST**. . . . . **PRESS**
  - Check correct operation.

* CABIN PRESS

- **AUTO PRESS RATE LIMIT knob** . . . . **NORM**
- **RATE LT** . . . . **check extinguished**
- Check CAB ALT, DIFF PRESS and CABIN V/S for logical indication.

* CREW OXYGEN

* **SYSTEM HIGH PRESS** . . . . **check indication between 1 400 PSI and 2 000 PSI.**

Note : If pressure is below 1 400 PSI, check oxygen duration chart to determine that quantity is sufficient for the scheduled flight.

- **SYSTEM LOW PRESS** . . . . . **check in green sector.**

ENG 2 FIRE PROTECTION

- Same as for ENG 1.

* EMER EXIT LT . . . . ARM

- Check that DISARM light extinguishes.

COMPT TEMP

- **ECON FLOW** . . . . **ON/AS REQ**
- **MAX COOL** . . . . **AS REQ**
- **COMPT TEMP Selectors** . . . . **AUTO/AS REQ**
- Select CRT position.

  Note : ECON FLOW may be selected ON, if required, for flight with less than 160 pax. Approx 68 % flow is provided.

* COM

TUNE VHF COM frequencies use VHF 1 for ATC (only VHF 1 is available in emergency elec config), VHF 2 can be used for ATIS and company frequencies. VHF 3 (if installed) is normally used for ACARS.

* AIRFIELD DATA

Obtain necessary data for system initialization and cockpit preparation. This should include RUNWAY IN USE, ALTIMETER SETTING and WEATHER DATA. ATC Tower temperature should be used for all Take-off calculations.

* FMS INITIALIZATION

> **CAUTION**
> If the message "PLEASE WAIT" appears : DO NOT PRESS ANY CDU KEY until the message is cleared.

– **FMS data base validity . . . . Check**

Press REF key and display A/C STATUS page

- Check DATA BASE validity and stored WPT/NAVAID if any review stored data for deletion decision.
- Check PERF FACTOR agrees with Flight Plan.

– **NAVAID DESELECTION . . . . As req**

If NOTAMs warn of any unreliable DME or VOR/DME, access NAVAID page and DESELECT the related navaid.

– **FLIGHT PLAN INITIALIZATION**

– **INIT key . . . . Press**

INIT A page is displayed.

– **CO RTE or city pair code . . . . Insert**

– **INIT PAGE A . . . . Check/complete**

- Check/modify ALTN/ALTN RTE
- Enter FLT number, FLT ID (For aircraft with ATC mode S).
- Enter Cost Index as per airline policy if it was not provided by the data base when a CORTE was inserted.
- Enter intended CRZ FL or check it if it was already provided by data base. Modify it if necessary taking into account ATC constraints or expected gross weight.
- Enter Tropopause altitude and/or modify CRZ FL TEMP according to MET forecast.
- Enter CRZ wind
- The IRS are usually aligned to the departure airport reference point coordinates, however, if the gate coordinates are published, these may be inserted here.

R

– **F-PLN A page . . . . Complete and check**

If CORTE has been inserted, the F-PLN should automatically include the preferential or most probable T/O RWY, approach and landing RWY, associated SIDs, STARs, transition and En Route WPTs. However some data bases will only include departure and arrival airport idents and EN ROUTE WPTs (if appropriate).

The crew must check, modify or insert (as applicable) the F-PLN according to the data given by ATIS, ATC or MET :

- Lateral revision at Departure Airport, Select RWY then SID then TRANS (if appropriate)
- Lateral revision at WPT for ROUTE modification if needed
- Vertical revision : check or enter speed/alt. CONSTRAINTS according to ATC clearance.

– **F-PLN . . . . Check**

- Check the Flight Plan versus computerized flight plan and navigation charts.
- Check Dist to DEST along the F-PLN indicated on PROGRESS page. Compare with the computerized flight plan.

– **F-PLN B page . . . . As req**

- Enter wind/temp for waypoints as provided on the computerized Flight plan. It should be remembered that the more points entered, the better the accuracy of the FMS predictions.

– **SECONDARY FLIGHT PLAN . . . . As req**

This is routinely a copy of the active. 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 minimum at the departure airfield the secondary flight plan should be that required for an immediate diversion after take-off.

c) If there is the possibility of a runway and/or SID change during taxi, this can be prepared for by copying the active and making the necessary modifications.

– **PROG . . . . As req**

Check VOR tuned by FMS, modify if required.

R *** FMS DATA INSERTION**

* FMS GROSS WEIGHT INSERTION

- **ZFCG/ZFW . . . . INSERT**
- **BLOCK FUEL . . . . INSERT**
  - If ZFCG and ZFW are not yet available it is acceptable to enter the expected values in order to obtain predictions. Similarly the expected fuel on board may be entered if refuelling is not already completed at that time.
  - If ZFCG and ZFW are inserted, the FMS will provide the minimum fuel required for the trip according to fuel policy (Route Reserves, ALTN, FINAL)
  - If ZFCG, ZFW and BLOCK FUEL are inserted, the FMS will provide all predictions, as well as the EXTRA fuel if any.

* FMS TAKE OFF DATA INSERTION

- **V1, VR . . . . Insert**
- **THR RED/ACC . . . . Set or check**
  - Check or modify THR RED/ACC ALT as needed
- **TO SHIFT . . . . As req**

GLARESHIELD

* EFIS

- **PFD and ND brightness . . . . As req**
- **FPV/FD . . . . ON/FD**
- **VOR/NAV/ILS sw . . . . As req**

Note : . VOR position : manual tune.
. NAV/ILS positions : auto tune.

- **EFIS control box . . . . As req**
- **ND mode and range . . . . As req**
  - . MODE : It is recommended to use MAP mode for take-off unless the SID is not in the data base, then PF should use ARC or ROSE.
  - . RANGE : It is recommended to set the minimum range to display the first waypoint on departure, or as required for weather radar.

* FCU

- Adjust brightness.

SPD/MACH setting knob . . . . turn to select V2

SPD/MACH setting knob . . . Push to Activate Preset

SPD/MACH setting knob . . . . Turn to Preselect initial climb speed

ALT Sel . . . . Initial cleared ALT

LATERAL CONSOLES

* RAT R

- **HYD RAM AIR TURBINE handle . . . . . . check OFF**

OXYGEN MASK

- Depress INT on audio panel and adjust volume.
- Select interphone transmit.
- Push down and hold RESET/TEST slide control and observe blinker momentarily yellow.
- Notice oxygen flow sounds through loudspeaker.
- Release RESET/TEST slide control.
- Set N/100% manual control to 100%.
- Check system Low Press indication within green band.

GND SERVICE INTPH . . . . OFF

CM1/CM2 INSTRUMENT PANELS

*** GPWS . . . . NORM** R

- Check no FAULT light illuminated.

Note : GPWS FAULT light will be illuminated whilst IRS 1 is in align mode if a GPWS MK III is fitted.

*** ND . . . . Check** R

- Check for correct display.
- Cross check ND and RMI heading with standby compass.
  - ● **If ND/RMI and compass headings disagree** :
    MSU mode selector . . . . OFF
    - ● **After at least 15 seconds** :
      MSU mode selector . . . . NAV
      ALIGN MODE annunciator . Check steady amber
      - ● **Upon completion of the 10-minute alignment period** :
        Cross-check IRS (ND and RMI) and standby compass magnetic heading indications.
- Check radar operation if desired.
- Check ground speed, initial waypoint, VOR indications.

*** STBY ASI . . . . Check** R

- Check speed pointer 0.

*** PFD . . . . Check** R

- Check for correct display.
- Check IAS, FMA, initial target ALT, altimeter readings, attitude.

Mod : 3881 + 4801

R * **VSI** . . . . **Check**

– Check no flag and pointer 0.

* **ALTIMETER** . . . . **Check**

– Check no flag.

– **QNH/QFE** . . . . **Set**

R * **CLOCK** . . . . **Check/Adjust**

– Check time. Adjust if necessary.
Set elapsed time and chrono to zero.

R * **METRIC ALTIMETERS (If installed)** . . . . **Check**

– **QNH/QFE** . . . . **Set**

CTR INSTRUMENT PANEL

* **STBY ALTIMETER** . . . . **Check**

– Check no flag.

– **QNH/QFE** . . . . **Set**

R * **STBY HORIZON** . . . . **Check**

– Check no flag.

– Erect if necessary.

* **ECAM** . . . . **RCL**

R * **BRK-A/SKID** . . . . **NORM-ON**

* **ENG INSTRUMENTS**

– Check :

  · **OIL PRESS** . . . . **check Zero**
  · **OIL QTY** . . . . **Check**
  · MIN OIL quantity before start is 12QT + estimated consumption. (estimated consumption is based on each operator's oil consumption monitoring)
  · **FF ind.** . . . . **check zero**
  · **N2 ind. needles and counter** . . . . **check zero**
  No flags, and red max pointers in front of the red limit marks.
  EGT ind. needles and counter . . . . **check logical temperature**
  No flags and red max pointers in front of the red limit marks.
  · **N1 ind. needles and counter** . . . . **check zero**
  No flags, red max pointers in front of the red limit mark.
  · **EPR ind. needles counter** . . . . **approx 1.000**
  No flag, EPR mode select knobs pushed and counter manual setting masked.
  · **REV and REV UNLK lts** . . . . . **check extinguished**

* **THRUST RATING PANEL**

– **TOGA/FLEX** . . . . **set**

– **TAT** . . . . **check logical**

– **THR LIMIT bugs** . . . . **check correspond to THR LIMIT display**

LANDING GEAR PANEL

– **WARN TEST pb** . . . . **Press**
Observe down arrow illuminates, continuous repetitive chime sounds and ECAM system activates.

– **POSITION DET SYS1 or 2** . . . . **Select**
Select SYS1 on odd days, SYS2 on even days

* **LANDING ELEVATION** . . . . **Set departure field elevation**

Note : If QFE is used set 0 on LANDING ELEVATION counter.

PEDESTAL

* **ADF** . . . . **Check** R

– Check and set as required

* **RADIOS** . . . . **Check** R

– **INT knob** . . . . **check volume**
Make sure that the knob is turned up to enable ground crew contact.

VHF . . . . **Check**

– Check VHF transmission and reception.

HF . . . . **Check**

– Check HF transmission and reception if required for flight.

Note : Do not transmit on HF during refuelling.

* **WEATHER RADAR** . . . . **Check OFF** R

* **PARKING BRK** . . . . **OFF/As req** R

If chocks are in place, release PARKING BRK to increase brake cooling

ATC . . . . **STBY/OFF**

TCAS (if installed) . . . . **STBY/OFF**

VOR/ILS CRS/FREQ . . . . **As req**

FMS DATA CONFIRMATION

* **IRS ALIGN** . . . . **Check**

  – Confirm coordinates

* **FMS GROSS WEIGHT INSERTION** . . . . **Check**

  – The PNF check FMS data

* **FMS TO DATA** . . . . **Calculate/Check**

  – The PNF calculates and check TO data

PW Eng. : 4000

*** FMS F-PLN . . . . Check**

- PNF ensures that inserted F-PLN agrees with planned routes.
- If company policy requires it, thoroughly check the whole F-PLN using the scroll key. Use ND PLAN mode while scrolling the F-PLN on the CDU.

*** AIRFIELD DATA . . . . Confirm**

*** FLT RCDR . . . . Check**

Recheck that DFDR and DFDAU lights are extinguished. DFDR internal test may not be completed for up to 7 minutes following GND CTL selected ON.

*** FUEL QUANTITY . . . . Check**

. After refuelling is completed :

- **FUEL PUMPS . . . . NORM**
- Check fuel quantity corresponds to FLIGHT PLAN fuel, X check with sum of individual tank quantities.
- Check fuel load asymmetry within limits.

R *Note : If a dash is displayed in the last digit of any fuel*
R *tank indicators, the quantity indication accuracy*
R *is fully serviceable.*

* TAKE OFF BRIEFING R

The purpose of the take off briefing is for the PF to inform the PNF of the planned course of action for both normal and abnormal situations during take off. It is also a recall of standard emergency procedures and is the time for the Captain to give any specific instructions to the First Officer. It should be completed prior to engine start.

It is most important that the take off briefing is given at a time when the cockpit workload is low so that both pilots may concentrate on its content and at a time when the take off conditions are likely to be known. The most appropriate time, therefore, is at the end of the Cockpit Preparation, prior to start.

The take off briefing should include the following :

- A review of the emergency procedures relating to the take off.

e.g. for a Captain briefing :
"This will be a left hand seat take off. If any malfunction occurs before V1 I will call STOP or GO (a lack of any response to a malfunction could be considered a subtle incapacitation). If the call is STOP I will apply maximum reverser and bring the aircraft to a stop on the runway bearing in mind the wind direction if there is a fire. You will inform ATC and monitor the deceleration. When the aircraft has come to a stop and parking brake set you will carry out the necessary ECAM actions on my command. If the malfunction occurs after V1 we will continue the take off. No action other than the application of TOGA and silencing any aural warnings will be taken until the aircraft is safely established in the climb and above 400 ft AGL. At that point carry out the ECAM actions on my command up to second agent discharge, if necessary, for an engine fire."

Having completed the emergency briefing (which normally needs only be done in full on the first flight of the day for the crew) a review of the variable procedures must be made, making use of the CDU where possible :

- Runway state, weather expected after take-off, use of anti ice.
- Take off configuration, V1, VR, V2, Flex Temp.
- PACKS ON or OFF
- Single engine acceleration altitude, thrust reduction altitude, normal acceleration altitude, transition altitude and first cleared level.
- Terminal area topography and Minimum Safe Altitudes.
- Action in event of immediate return or diversion after take off. (Engine Out SID)
- SID routing and specific RAD/NAV tuning.
- Use of radar.

As already stated, make use of the FMS CDU wherever possible to confirm and emphasise the briefing.

LEFT INTENTIONALLY BLANK

NO CHANGE

NO CHANGE

- Confirm takeoff weight limitation.

R *Note : For crosswind component greater than 20*
R *knots, refer to 2.10.35.*

NO CHANGE

TR N° 535-2 Page 2 of 6

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, e.g. correct flight, correct aircraft, dry operating index, configuration.

- Check fuel on board and fuel index correction. For aircraft with a trim tank, check the trim tank quantity is as expected on the loadsheet, if not use the actual trim tank quantity to calculate the fuel index correction.
- Check the loadsheet CG, against the ECAM CG.
  In case there is a discrepancy of more than 1.5 %, check that the ZFW and ZFCG have been correctly inserted in the CDU, then rely on the ECAM CG.
  If there is less than 1.5 %, no further action is required. Rely on the ECAM CG.

Check that the takeoff CG is within the LTS operational limits.

TAKEOFF DATA . . . . . **Prepare and Check/revise**

Once the load sheet is checked :

- Check/modify FMS weights/CG
- PNF checks or recomputes the takeoff speeds and Flex Temperature using the RTOLW charts.
- PF then INDEPENDENTLY calculates the takeoff speeds and Flex Temperature as a crosscheck.
  Ensure particular care is taken to determine the takeoff configuration.
- Confirm takeoff weight limitation.

R – To extend engine life and save maintenance costs, the
R use of flaps configuration giving the highest flex temperature
R is recommended. However, when the difference, in
R term of FLEX temperature, between 2 configurations is
R low (less than 5 degrees), the highest takeoff configuration
R is preferable.

- Enter the Flex Temperature and select FLEX on the TRP unless TOGA is required.
- Set V2 and green dot speed on standby ASI (all remaining bugs at 12 o'clock).
- PF enters (or revises) the take off data in the FMS CDU TAKE-OFF and INIT pages.
- Set V2 and Preset initial climb speed on FCU.
- Check CRZ FL is not above MAX FL.

SEAT, SEAT BELTS, HARNESSES, RUDDER PEDALS . . . . **Adjust**

The seat is correctly adjusted when the pilot's eyes are in line with the red and white balls.

CDU . . . . **In TAKE OFF Configuration**

- It is recommended to display F-PLN on PNF side, TAKE OFF on PF side.

EXT PWR . . . . **Check OFF**

Request external power removal

BEFORE START C/L DOWN TO THE LINE . . . . **Completed**

PUSHBACK OR/AND START UP CLEARANCE

- At this stage, the « before start » preparation is stopped to :
  - · obtain ground crew clearance (For pushback, chocks removed, nose wheel steering selector and by-pass pin in place, tow truck connected and area clear for start/pushback).
  - · obtain ATC pushback and start up clearance.

Engines may be started during pushback.

WINDOWS and DOORS . . . . **Check closed**

- Check cockpit windows closed and locked. Check proper locking of sliding windows by pushing the window handle forward into full closed position.
- Check on ECAM DOOR page that all doors are closed.

COCKPIT DOOR toggle switch . . . . **NORM**

- A test of the cockpit door locking system must be done once a day.
- Check that the cockpit door is closed and locked (no cockpit door fault/open indication).
- With the cockpit door spring loaded toggle switch at NORM, the cockpit door is closed and locked.
- For cockpit access request, refer to "procedures and techniques" chapter, "doors" section.

BEACON . . . . **ON/AUTO**

PARKING BRAKE . . . . **As req**

- If no pushback required, check parking brake is on and check brake pressure indication. Chocks may be removed.

CAUTION

If, during engine start with parking brake on, the aircraft starts to move due to a parking brake failure, immediately release the parking brake and restore braking using the pedals.

- If pushback required, release the parking brake.

CAUTION

Do not use brakes during pushback unless required due to an emergency.
Do not use the nose wheel steering during pushback.

- Once pushback is completed apply the parking brake and inform ground crew.

BEFORE START C/L BELOW THE LINE . . . . **Completed**

Code : 0492

LEFT BLANK INTENTIONALLY

- **THROTTLE LEVERS** . . . . **IDLE**
  - Be aware of prevailing surface wind, as tail wind may result in starting difficulties.

Note : *Confirm that probe heats are selected ON. If not FADEC CHANNEL A (or B) FAULT message will be displayed on left ECAM CRT after engine start.*

- **IGNITION** . . . . **START A/B**
  - Set IGNITION to START A (odd days) or START B (even days) and check both ARM lights illuminate on START 1 and 2 pushbuttons.

Note : *PACK VALVE FAULT light illuminates during closure.*

ENG 2 is normally started first.

- **Announce** . . . . **" START ENGINE 2 "**
- **START 2 (1)** . . . . **Press**
  - Check ARM white light extinguishes
  - OPEN blue light illuminates.
- **Announce** . . . . **" VALVE OPEN "**
- **BLEED PRESSURE** . . . . **check increasing**

WHEN N2 INCREASES

- **Announce** . . . . **"N2"**
- **OIL PRESSURE** . . . . **check inreasing.**
- **Announce** . . . . **"OIL Pressure"**

AT MAX MOTORING SPEED

R Note : *For airfields with elevation of 8000 ft and above,*
R *the engine must be motored for 75 seconds.*
R *This recommendation applies pending retrofit of a*
R *further FADEC standard.*

- **FUEL LEVER** . . . . **ON**
  Confirm fuel lever ON and locked/seated in notch.
- **CLOCK** . . . . **START**
  - 20 sec. max from FUEL ON to light up
  - 120 sec. max from FUEL ON to idle N2.

Notes : *1. Max motoring speed is assumed when there is no significant increase in N2.*
2. Do not move FUEL LEVER to ON if max motoring speed is less than 15% N2.

- **Announce** . . . . **"FUEL ON"**
- **FUEL FLOW** . . . . **check in normal range**
- **Announce** . . . . **"Fuel Flow"**

EGT INCREASING

- **Announce** . . . . **"EGT"**

N1 INCREASING

- **Announce** . . . . **" N1 "**
  Note : *N1 rotation must be obtained by 40% N2 at the latest.*

N1, N2, FF, EGT

- Monitor for normal value and rate of increase.

  Note : *If the engine acceleration is slow and/or in case of high residual oil temperature (e.g. short turn around time), the ENG FAIL and/or GEN FAULT and/or the ENG OIL LO PR ECAM warning(s) may be activated.*

  This should not be misinterpreted as a failure to start or an engine malfunction.

  If EGT is within limits and N1/N2 and OIL PRESS are increasing, continue the start attempt.

N2 45 %

- **Announce** . . . . **" N2 45 % "**

When START 2(1) OPEN light extinguished

- **Announce** . . . . **" VALVE CLOSED "**

AT IDLE

- **N1, N2, EGT and FF** . . . . **check**

  (at ISA, sea level typical figures : N1 about 22%, N2 about 64%, EGT 325 to 425°C and FF about 540 to 620 kg/h)

  Note : *Ground idle N2 exceeding 68% with normal bleed extraction, or 70% with ENG ANTI-ICE ON, must be recorded for maintenance action at first suitable facility.*
  Small throttle control lever movements near to idle will cause a transient overshoot. This condition will cause the engine parameters to rise and then to return to idle. Throttle movements beyond this point will result in normal engine operation.

- **CLOCK** . . . . **STOP/RESET**
- **ECAM** . . . . **Check Secondary Parameters.**
- **Announce** . . . . . . **" ALL PARAMETERS CORRECT "**
- **Announce** . . . . **" START ENGINE 1 "**

  Repeat the start sequence as stated above

Note : *Both ARM lights illuminate when ENG 1 N2 reaches 45%.*

CAUTION

1. Monitor both N2 and EGT indicators closely during the start for any abnormal indications. Slow N2 acceleration is an indication of either an impending hot start or a hung start.
   If this indication is accompanied by rapidly increasing EGT, abort the start immediately.
   If slow acceleration is accompanied by slowly increasing EGT, abort the start if idle is not reached within 120 seconds from FUEL ON.
   Should EGT exceed the starting temperature limit the engine should be shut down immediately. The duration of the over-temperature in seconds and the peak temperature reached must be recorded.
   A second start attempt should not be made until the appropriate maintenance action is taken.

2. The start attempt should be discontinued if :
   a) Dense fuel vapor is emitted from the tail pipe while the FUEL lever is still OFF.
   b) An indication of N1 rotation is not obtained by 40 % N2.
   c) An increase in EGT is not obtained within 20 seconds after FUEL ON.
      Note : When the engines have been cold soaked at OATs below – 30°C, up to 30 seconds will be allowed to obtain an increase in EGT provided an increase in N2 is obtained within 20 seconds from FUEL ON.
   d) Fuel or ignition is inadvertently interrupted. After placing the FUEL lever OFF, maintain starter engagement and continue motoring the engine for 30 seconds to clear out trapped fuel or vapors.
   e) The engine requires more than 120 seconds to accelerate from FUEL ON to IDLE N2.

3. Abnormally high or low fuel flow, high tail winds, or low pneumatic duct pressure may result in the requirement to abort the start.

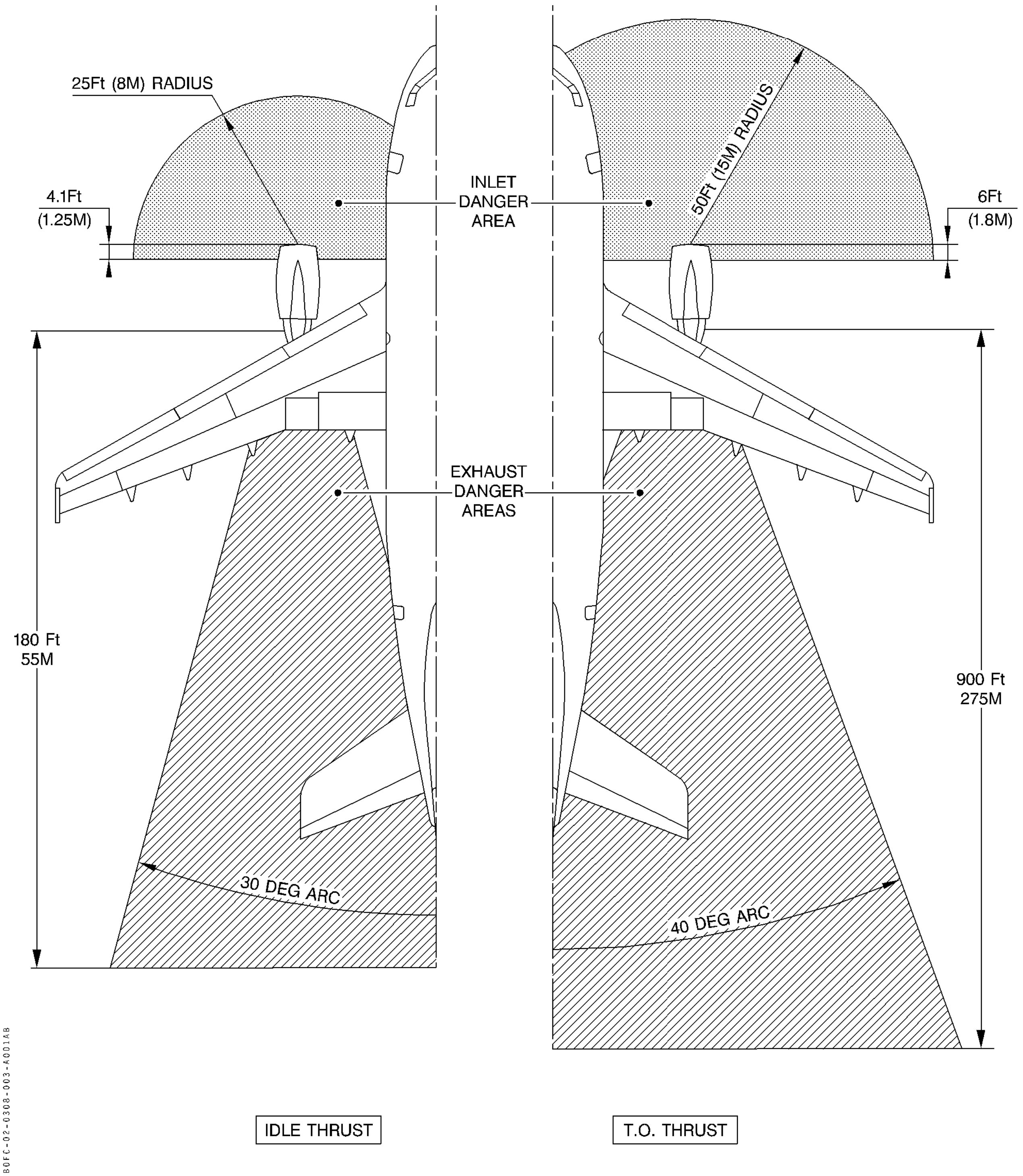
4. If starter engagement is interrupted, set FUEL lever to OFF. Perform second engine start attempt when N2 below 30 %. R

5. If start sequence is discontinued after reaching 48 % N2, allow N2 to decrease below 5 % N2 prior to attempting a restart. This will remove power from the FADEC and thus reset the FADEC overspeed protection logic.

6. OIL CLOG light and ECAM message may be activated during engine warm up with oil temperature below 35° C. Maintain the engine at idle until the light/message disappear.
   Any illumination of the OIL CLOG light or ECAM warning with oil temperature above 35°C must be written in the logbook. This may be an early indication of a possible oil filter clogging.

PW Eng. : 4000

GROUND RUN UP – DANGER AREAS



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IGNITION . . . . **OFF**

- ARM lights extinguish.
- The PF turning the IGNITION rotary selector to OFF is the signal for the PNF to commence the AFTER START actions.

APU BLEED . . . . **OFF**

APU BLEED is selected OFF just after engine start to avoid engine exhaust gas ingestion.

APU

- **MASTER sw** . . . . **OFF**

Note : APU shut down may be delayed if APU BLEED supply is required.

ENGINE WARM-UP :

> **CAUTION**
>
> - No minimum warm-up time is required following an engine shutdown of 2 hours or less.
> - After a shutdown period greater than 2 hours, it is recommended to start the engines at the gate or operate at or near idle for at least 5 minutes prior to advancing the thrust lever to high power. This ensures engine warm-up and minimize any adverse thermal stress. Taxi time at idle may be included in the warm-up period.
>   It is not, however, necessary to delay the takeoff to warm-up the engine, but when it is anticipated that the taxi time will be less than 5 minutes, it is recommended that engines which have been shutdown for more than 2 hours be started at the gate.

ENG ANTI ICE . . . . **AS REQ**

Note 1 : Icing conditions may be expected when OAT or TAT is below + 8°C with visible moisture.

Note 2 :
- *. During ground operation in icing conditions, periodic engine run-ups must be performed to shed any possible ice build-up from the spinner, the fan blades or low pressure compressor stators.*
- *. Periodic engine run-ups must be performed, every 15 minutes, by accelerating the engine to 50 % N1 minimum and then retarding the throttles back to idle.*
- *. Before takeoff a last engine run-up must be performed with observation of all engine parameters to ensure normal engine operation.*

Note 3 : Use of engine anti ice increases the ground idle thrust, care must be taken when taxiing on slippery surfaces.

WING ANTI ICE . . . . **AS REQ**

Note : WING ANTI ICE valves stay closed as long as the aircraft is on the ground.

SLATS and FLAPS . . . . **SET for T/O**

- Set SLATS/FLAPS and KRUGER for T/O, and check position on SFPI.
- If the OAT is below – 40° C extend the SLATS/FLAPS step by step.
- If taxiing in slush conditions, keep slats/flaps retracted until reaching the holding point before take off.

GROUND SPOILERS . . . . **ARM**

AIL TRIM and RUD TRIM . . . . **ZERO**

PITCH TRIM . . . . **Set for T/O**

Note : If the OAT is below – 40° C, check correct operation of the electrical pitch trim prior to setting the PITCH TRIM for T/O.

ECAM . . . . **check STATUS**

ECAM DOOR Page . . . . **Select**

- Check all slides armed
- Deselect DOOR page after slide verification.

Clear to disconnect . . . . **Announce**

- Ground crew must ensure chocks removed, nose wheel steering by-pass pin removed and area clear for taxi. Interphone is disconnected.
- Check for hand signal display on the left/right side to show all clear for taxi.

AFTER START CHECK-LIST . . . . **Completed**

LEFT BLANK INTENTIONALLY

NOSE Light . . . . **TAXI**
Select NOSE Light to TAXI day and night

TAXI CLEARANCE . . . . **Obtained**

PARKING BRAKE . . . . **OFF**
– Release the parking brake and check brake pressure zero.

ELAPSED TIME . . . . **Start**
To record block time

EXTERIOR LTS . . . . **As req**

THRUST LEVERS . . . . **As req**

. In order to get the aircraft moving, little if any power above idle thrust will be required (max 40% N1). Thrust should normally be used symmetrically. Once aircraft is moving little thrust is required.

. The wing mounted engines are close to the ground. Avoid placing engines over unconsolidated or unprepared ground e.g over the edge of taxiways.
Avoid high thrust settings at low ground speeds due to the risk of ingestion (FOD).

BRAKES . . . . **Check**

. Brakes can be checked once the aircraft is moving, or while stopped.
To check the brakes while stopped, depress brake pedals with parking brake ON, select the parking brake OFF and check that the yellow hyd pressure is zero on the brake pressure triple indicator.
The main purpose of the brake check is to check that green pressure has taken over and that yellow pressure is at zero on the brake pressure triple indicator.

Note : *Any indicated pressure below approximately one needle width on the brake pressure triple indicator can be considered as zero.*

. Thereafter the normal maximum taxi speed should be 30 kt in a straight line, 15 kt for a sharp turn. The ground speed is difficult to assess so monitor ground speed on ND. Do not "ride" the brakes, as 30 kt is exceeded, apply brakes smoothly and decelerate to 10 kt, release the brakes and allow the aircraft to accelerate again.

. Below – 40° C, small braking inputs are required during Taxi. XX will be indicated in place of the brake temperatures while the temperatures are below 0°.

CAUTION

If the brakes fail during ground operations, immediately select the BRK/A/SKID sw to ALTN-OFF and modulate the brakes with pedals.
Brake pedals should be released when the A/SKID is switched OFF. Otherwise the pedal braking orders will be taken into account and the aircraft will react strongly.
In an extreme emergency and only if pedals are ineffective with the antiskid OFF the aircraft may be stopped with the parking brake (full pressure application will occur).

CAUTION

– If aircraft has been parked in wet conditions for a long period, efficiency of first brakes application at low speed will be reduced.

ECAM . . . . **Select F/CTL page**

FLIGHT CONTROLS . . . . **Check**

At a convenient stage during taxi :

1. The PNF checks full travel and feel of the elevators and ailerons/spoilers, whilst monitoring on the ECAM F/CTL page.

Note : *If PITCH FEEL pushbutton is selected OFF/R then ON, full travel and feel force of the elevators must be checked.*

2. The PF holds the nosewheel steering handle to maintain the aircraft direction and checks full travel and feel of the rudder, whilst the PNF monitors the ECAM F/CTL page.
Check all indications return to zero position with respective controls at neutral except the ailerons where droop position is indicated.
3. If the OAT is below – 40° C, the PNF should check full extension of the speedbrakes by setting the speedbrake lever notch by notch up to the FULL position whilst monitoring ECAM F/CTL page.

Note 1 : *HYD SYS LO PR warning may occur if test is performed on more than one axis at a time.*

Note 2 : *FLIGHT CONTROL check sould be done with CWS OFF. If CWS is selected, full travel will not be available.*

Note 3 : *During aileron check, rudder deflects left or right coordinating with aileron movement (yaw damper input).*

ECAM . . . . **deselect F/CTL page**

ATC clearance . . . . **obtain/confirm**

TAKE OFF DATA/CONDITIONS . . . **Check/Revise**

– If take off data have become more limiting such as wind change or tower temperature increase, or in case of runway change, prepare updated take off data and as appropriate :

SLAT/FLAP LEVER . . . . **takeoff position**
· Select Take off position

V2 . . . . **reset on FCU**

Initial climb speed . . . . **preset on FCU**

FLX TO temperature . . . . **Reinsert in TRP**

FMS

V1, VR . . . . **Reinsert**

F-PLN (Runway) . . . . **Revise**

. **F-PLN (SID, TRANS)** . . . . **Revise or check**
Check with ND in MAP mode, with a 15 NM range.
Particular care should be taken to confirm the ATC clearance agrees with the FMS if NAV is to be used.

FCU . . . . **As req**
AP cannot be selected in CMD for Take off.

CLEARED ALT . . . . **Set on FCU**
IF PROFILE NAV mode is used

PROFILE . . . . **Arm**

NAV . . . . **Arm**

INITIAL AFTER T.O. HDG . . . . **Set on FCU/As req**
If an ATC HDG is required after take off set the heading on the FCU, NAV will be disarmed

FD . . . . **Check selected ON**

FMA . . . . **Check**

Mod : 5443 or 6233 or 6591 or (5443 + 6591)

FLIGHT INSTRUMENTS . . . . Check

– Scan instruments panels observe no abnormal flag on instruments.

RADAR (if required) . . . . ON

. If the radar is required for the flight the following test procedure is recommended :
Adjust the tilt downward until ground returns appear and then slowly adjust it in 1 to 2 degrees steps, up to 15° UP, for weather returns.
Select tilt at 4° UP for takeoff.

ATC code . . . . Confirm/set

R **EGPWS**

R **– TERR ON ND . . . . As req**
R . In mountainous areas, consider displaying terrain on
R ND.
R . If use of radar is required, consider selecting the radar
R display on the PF side, and TERR ON ND on the PNF side
R only.

TAKEOFF BRIEFING . . . . Confirm

This briefing should normally be only a brief confirmation of the thorough takeoff briefing made at the gate. Any changes in the clearance should be addressed at this time. As extensive use as possible of the displays should be made. eg.

"Takeoff on RWY 07 (TAKE OFF page), weight 150 t (left ECAM), Slat/Flap 15/15 (SFPI + handle), 50 t fuel (L-ECAM), FLEX 50°, 93% N1 (TRP), LMG2D departure (F-PLN page) V1 151, VR 161, V2 164 (TAKE OFF page + PFD) initial cleared ALT (PFD + FCU)."

CABIN REPORT . . . . Received

– Obtain cabin report from purser, as a minimum :
« CABIN SECURED for T.O. »

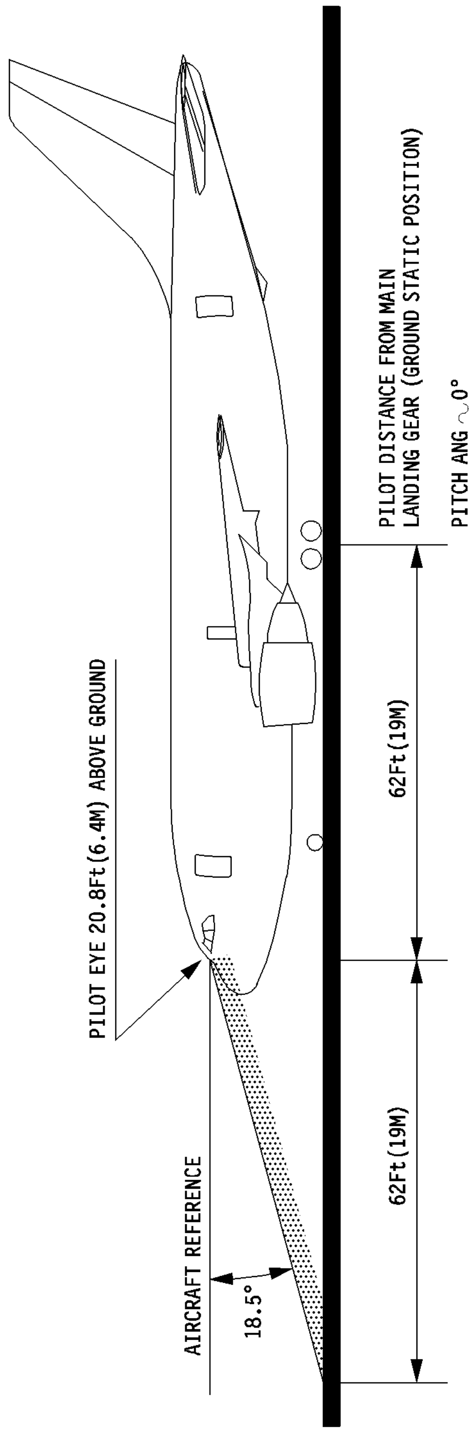
**T.O CONFIG TEST pb . . . . PRESS
for min 3 SEC.**

ECAM . . . . NORM FOR TO

BEFORE T.O. C/L DOWN TO THE LINE . COMPLETE

Mod : 7172 + 11894

VISUAL GROUND GEOMETRY



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TAKEOFF or LINE UP CLEARANCE . . . . . **Obtain**

APPROACH PATH CLEAR OF TRAFFIC . . . **Check**

CABIN CREW . . . . **Advise**

BRAKE YELLOW HYDRAULIC PRESSURE . . . . **CHECK**

- **If residual pressure is indicated** :
  - – Depress several times the brake pedals until release of residual pressure
  - **If residual pressure remains** :
    - – Return to gate
    - – Maintenance action is due

BRAKE Temperature . . . . **Check**

– Check brake temperature on ECAM.

· If brake fans are ON and indicated brake temperatures are above 150°C the takeoff must be delayed. Continue brake fan operation until the indicated temperature drops below 150°C.

Note : With brake fans ON, a temperature indication of 150°C is equivalent to an actual brake temperature of 300°C. Takeoff is only permitted with actual brake temperature below 300°C.

· If brake fans are OFF, takeoff may be continued unless the BRAKE TEMP HI caution appears, which is activated at 300°C.

BRAKE FAN . . . . **OFF**

AUTO BRK . . . . **MAX**

· ON lt illuminates
· AUTO BRK may be armed with parking brake on.
· Selection of MAX mode before takeoff will improve safety in the event of an aborted takeoff.
If takeoff must be aborted, the autobrake system will apply the maximum braking (if the ground speed is above 85 kt) as soon as the thrust levers are set to idle which represents a single action done without delay.

IGNITION . . . . **CONT RELIGHT**

PACK VALVE . . . . **As req**

– If required to increase takeoff performance, select pack valves OFF, or use APU bleed to supply the packs.

– If APU bleed supply is used and wing anti-ice is required one pack must be selected off.

ATC . . . . **ON/As req**

ALT REPORTING . . . . **ON/As req**

TCAS (if installed) . . . . **Set to TA/RA**

TA ONLY mode should be selected at particular airports R
and during particular procedures identified by an operator R
as having a significant potential for unwanted or inappropriate R
RAs (closely spaced parallel or converging runways...) R

EXT LTS . . . . **Set**

– Use NOSE TO, RUNWAY TURN OFF and LANDING lights to minimize bird strike hazard during T.O and set NAV and LOGO as required.

– Set STROBE lights to ON before entering the runway.

QFU and THRESHOLD . . . . **CONFIRM** R

– Check and confirm QFU and THRESHOLD versus the R
airport chart. R

BEFORE TAKEOFF CHECK LIST BELOW THE LINE . . . **COMPLETED**

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NO CHANGE

- **BRAKES . . . . RELEASE**
  - <u>If the crosswind component is greater than 20 knots</u> :
    - PF increases thrust progressively so as to reach takeoff power by 40 knots Ground Speed.
- **GO-LEVERS . . . . TRIGGER**

<u>Note 1</u> : *CM1 keeps his hand on the throttles until V1 is reached without interfering with the throttle movement.*

<u>Note 2</u> : *In case of asymmetric throttle movement, CM1 is ready to override or to disconnect the A/THR.*

- PF applies sufficient forward control column until 80 Kt, then releases progressively to achieve the neutral position by 100 Kt.

<u>Note 1</u> : *CG position, runway and crosswind conditions dictate the necessary forward input. Objective is to conteract the pitch up moment during thrust application and to increase nose wheel aherence.*

<u>Note 2</u> : *In case of vibrations or shimmy of the nose wheels, release the forward pressure progressively and apply slight back pressure on the control column as necessary. Vibrations will probably disappear as the weight on the nose wheel is reduced.*

- **DIRECTIONAL CONTROL . . . . . . USE RUDDER PEDALS**

NO CHANGE

NO CHANGE

- Rolling takeoff is at the discretion of the captain.
- **Announce** . . . . **"TAKEOFF"**
- **CLOCK** . . . . **START**
- **INTERMEDIATE THRUST SETTING** . . . . **SET**
  - PF progressively adjusts and stabilizes engine thrust from idle to between 1.05 and 1.10 EPR with no more than 0.02 EPR difference between both engines.

    Note : In case of Ring Case segmented Case engine intermix configuration, engine acceleration from idle to the intermediate thrust setting may differ significantly between one engine and the other. Whatever both engines configuration, intermediate thrust setting will ensure that both engines will accelerate similarly and will minimize any directional control problem.
- **BRAKES** . . . . **RELEASE**
- **GO-LEVERS** . . . . **TRIGGER**

  Note 1 : CM1 keeps his hand on the throttles until V1 is reached without interfering with the throttle movement.

  Note 2 : In case of asymmetric throttle movement, CM1 is ready to override or to disconnect the A/THR.

R - PF applies sufficient forward control column until 80 Kt,
R then releases progressively to achieve the neutral
R position by 100 Kt.

R *Note 1 : CG position, runway and crosswind conditions*
R *dictate the necessary forward input. Objective*
R *is to conteract the pitch up moment during*
R *thrust application and to increase nose wheel*
R *aherence.*

  Note 2 : In case of vibrations or shimmy of the nose wheels, release the forward pressure progressively and apply slight back pressure on the control column as necessary. Vibrations will probably disappear as the weight on the nose wheel is reduced.

- **DIRECTIONAL CONTROL** . . **USE RUDDER PEDALS**
- **PFD / ND** . . . . **SCAN**
  - Check FMA on PFD
    THR, SRS, RWY (or HDG or HDG/S), FD1 (2)
- **Announce** . . . . **FMA indications**
  - Check FMS position update (A/C symbol on runway threshold)
- **TAKEOFF EPR** . . . . **CHECK**
  - Check takeoff EPR is set prior to reaching 80 kt.

R - **Announce** . . . . **"THRUST SET"**

- **AIRSPEED and ENGINE INSTRUMENTS** . . . . **SCAN**
  - Scan the airspeed and engines instruments throughout the takeoff roll.
  - ● When speed is 100 Kt on PFD :
    - **PNF Announce** . . . . **"ONE HUNDRED KNOTS"**
    - **PF crosscheck speed reading on own PFD.**
    - **PF Announce** . . . . **"CHECK".**

    Note : The FMA mode THR changes to blue indication (ATS declutch by 100 Kt.)

  Below 100 Kt the decision to abort the T.O., may be taken at the discretion of the captain. Above 100 Kt, rejecting the T.O. is a more serious matter and becomes more critical as V1 approaches.

V SPEEDS

- At V1
  Announce . . . . **"V1"**
- At VR
  Announce . . . . **"ROTATE"**

AIRCRAFT HANDLING

- **ROTATION** . . . . **PERFORM**
- At V_R, initiate the rotation with a positive control column input to achieve a continuous rotation rate of about 3°/sec, towards a pitch attitude of 15 degrees (12.5 degrees if one engine is failed).
- Avoid spoiler extension on the ground and during rotation, by minimizing lateral control to that which is required to maintain approximately wings level.
- After lift off, follow the SRS pitch command bar.

CAUTION

High rotation rates may lead to tailstrike

LANDING GEAR

- **Announce** . . . . **« POSITIVE CLIMB »**
  Announce positive climb when the vertical speed indication is positive and the radio altitude has increased.
- **Order** . . . . **« GEAR UP »**
- **L/G lever** . . . . **UP**

GROUND SPOILERS . . . . DISARM

EXTERIOR LTS . . . . SET

- **NOSE AND RWY TURN OFF lights** . . . . **OFF**

RWY TURN OFF LTS and landing lights may be left ON according to the airline policy/local regulations.

AP . . . . AS REQ

AP 1 or AP 2 may be engaged. If AP is already engaged in CWS ; press CWS/CMD pushbutton to engage CMD.

AT THRUST REDUCTION ALTITUDE

- **THROTTLES .. Check symmetrical retard movement**
- **ENGINES THRUST . . . . Check CL setting**
- **TRP . . . . Check LIM MODE Indication "CL" and "AUTO"**

Note : In case of either asymmetrical thrust reduction or thrust reduction below CL, A/THR must be disconnected and thrust manually set.

Announce . . . . FMA indication
Check P.THR and P.CLB engagement

LANDING GEAR lever. . . . . Neutral

- When L/G lights are extinguished, set the L/G lever to neutral.
- **Announce . . . . « GEAR UP »**

PACK VALVE . . . . Select one pack

Check flow bar in-line.

Note 1 : Selecting both packs simultaneously may affect passenger comfort.

Note 2 : Selecting a pack before reducing T/O thrust may lead to an engine overboost.

SLATS/FLAPS (and KRUGER)

Retract FLAPS once above acceleration altitude (or once in CLB phase). This ensures that the aircraft is effectively accelerating towards CLB speed.

- **At F speed minimum (F on PFD) order . . . . « FLAPS ZERO »**
- **SLATS/FLAPS . . . . FLAPS 0**

When SFPI shows FLAPS ZERO

- **Announce . . . . "FLAPS ZERO"**
- **At S speed minimum (S on PFD) order . . . . « SLATS RETRACT »**
- **SLATS/FLAPS handle . . . . SLATS 0**

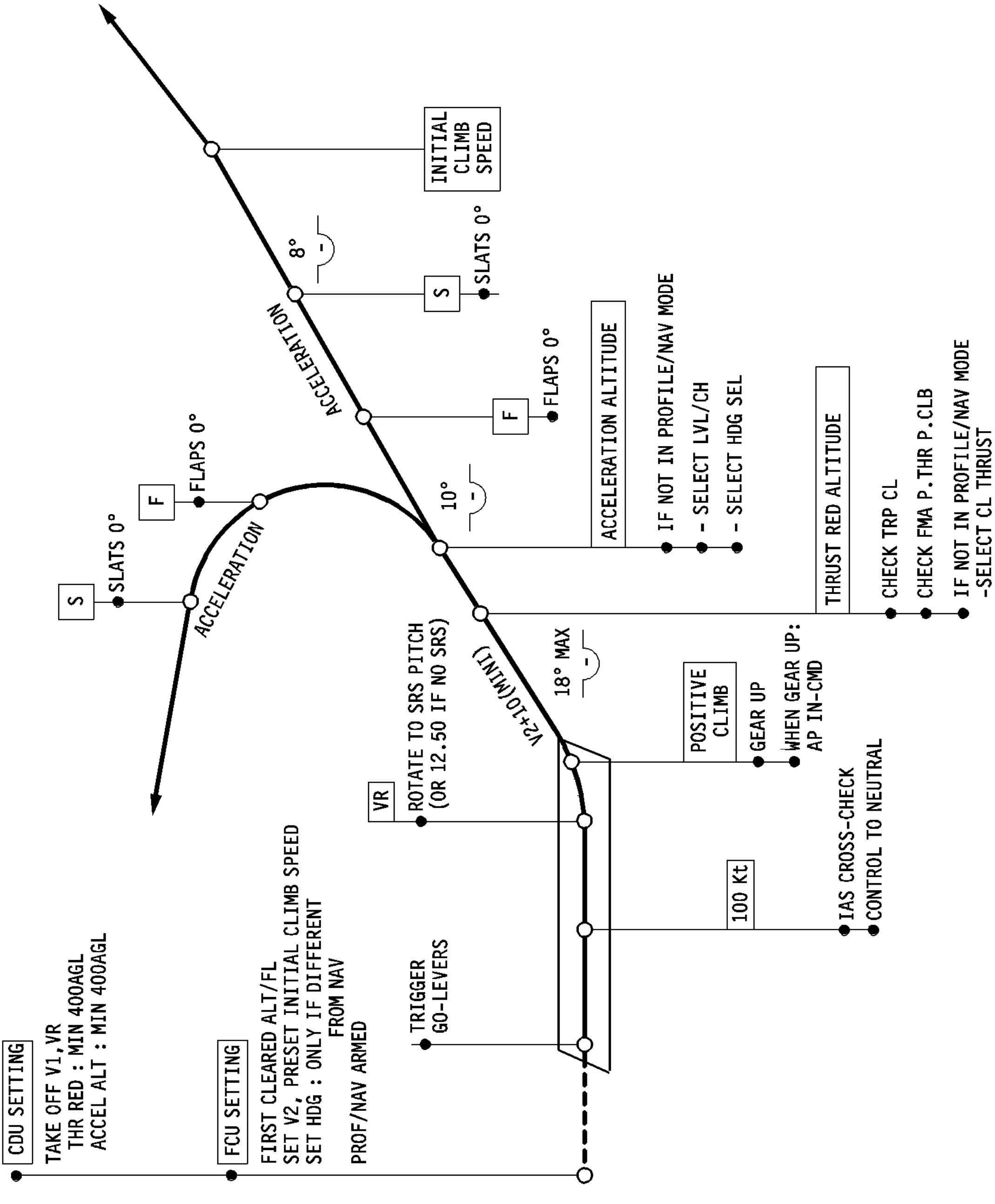
When SFPI shows SLATS ZERO.

- **Announce . . . . "SLATS RETRACTED"**

PACK VALVE . . . . Set second to ON

Check flow bar in-line

NORMAL TAKE OFF PATTERN



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APU BLEED . . . . **As req**

If the APU has been used to supply air conditioning during take off, select APU BLEED to OFF. Use of APU BLEED is limited to 20000 ft.

R **APU** . . . . **As req**

R **IGNITION** . . . . **As req**

- Set CONT RELIGHT only if severe turbulence, heavy icing conditions or heavy rain is encountered.

ICE PROTECTION . . . . **As req**

- ENG ANTI ICE must be ON when icing conditions exist with TAT below + 8 °.

SIGNS . . . .**As req**

- Set SEAT BELTS sw as required.

TCAS (If installed) . . . . **Set to TA/RA**

Action required only if the take off has been performed with TA only.

AFTER TAKE OFF/CLIMB
CHECKLIST DOWN TO THE LINE . . . **Completed**

R Mod : 7172

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ENGINE MONITORING

A difference in EPR between the two engines may be observed during climb up to 14200 ft. This difference has a negligible effect on the aircraft handling.

The EPR difference may be corrected by advancing both throttles levers by at least 2 degrees and then releasing them, returning the thrust control to the A/THR.

This action is sufficient to ensure that both FADEC have switched over from the takeoff phase to the flight phase and, thus, provide consistent EPR CMD computations.

LANDING LTS . . . . OFF/RETRACT

When reaching the appropriate altitude according to airline policy/local regulations turn off RWY TURN OFF LTS and turn off and retract LANDING LTS.

FMA

The normal climb mode is P. THR/P.CLB in profile mode.

When selecting a new cleared FL

- **FMA indication . . . . Check/Announce**
- **Cleared ALT on PFD . . . . Check**

Monitor the progress in climb, particularly when approaching the cleared altitude.

When 1000 ft below the cleared altitude

R – **Announce . . . . "one thousand to go"**

Refer to 2.03.30 page 1 for altitude standard calls

Monitor reduction in V/S as the cleared altitude is reached. In V/S or LVL/CH mode, monitor ALT* engagement, then ALT at cleared altitude.

At level off

- **FMA indication . . . . Check/Announce**

PF CDU . . . . PROG

- PF CDU should be preferably set on PROG page but other pages such as F-PLN may be selected as necessary. With the AP engaged the PF should make any required F-PLN revisions.

PNF CDU . . . . F-PLN

- PNF CDU should be preferably set on F-PLN page (allowing to carry out any ATC long term lateral or vertical revisions).

CLIMB SPEEDS MODIFICATIONS :

If a speed change is required by ATC, for turbulence or operational reasons (e.g. increase climb rate), select new speed using FMS TACT MODE.

ALTIMETERS . . . . Set

- At transition altitude set standard on all altimeters.
- Cross check baro settings and altitude readings.

CRZ FL . . . . Check/Set as req

- If ATC clears the aircraft to intended CRZ FL or above, there is no need to modify the CRZ FL inserted in the INIT A page during cockpit prep. Higher CRZ FL will be taken automatically into account by FCU ALT knob selection.
- If ATC limits CRZ FL to a lower level than the one inserted in the INIT A page (or present on PROG page) it is necessary to insert this lower CRZ FL in the PROG page. Otherwise there is no transition into CRZ phase : consequently the speed targets and Mach are not modified.

The MAX FL displayed on the PROG page gives at least 0.2g buffet margin. It is not recommended to fly above this level. If a level higher than MAX FL is entered as the CRZ FL, then the message "CRZ FL above MAX FL" will appear on the CDU.
The OPT FL displayed is a function of the Cost Index and aircraft weight.

Note : *At high weight and forward CG, the FMS Maximum Altitude may be higher than the Flight Level Limitations (FCOM 2.01.20) by up to 700 ft. The flight envelope limitations must still be applied.* R R R R

AFTER T.O./CLIMB C/L

BELOW THE LINE . . . . Completed

RADAR . . . . As req

Adjust tilt angle depending on aircraft attitude and the selected range of the ND. A slightly negative tilt is required to avoid over-scanning and to provide some ground returns at the top edge of the ND.

FMS

When time permits :

- Recopy the active flight plan in the secondary if an immediate return flight plan has been constructed.
- Check optimum and maximum altitude capability.

PW Eng. : 4000

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THRUST RATING PANEL . . . . Check

– Check LIM MODE indication CL (Set CR if not in PROFILE).

ECAM MEMO/STATUS . . . . Review

ECAM SYS PAGES . . . . Review

Periodically review system pages and in particular :

ENG : Oil Press and temperature
HYD : Fluid quantities. Green sys is lower than on ground following L/G retraction
AC : GEN parameters, IDG OIL temp
DC : Battery charging status
BLEED : BLEED parameters
COND : Check duct temperature compared with zone temperature.
Avoid large difference to improve pax comfort.
PRESS : Check Cabin ALT and V/S.
FUEL : Check distribution
F/CTL : Note any unusual surface position.

FLIGHT PROGRESS . . . . Check

Flight progress should be monitored in the conventional way.

R When overflying a waypoint :
R – Check the track and distance to the next waypoint.

R When overflying a waypoint, or every 30 minutes :
– Check Fuel : check FOB, Fuel PRED (FMS) and compare with computed Flight Plan or in cruise quick check table (2.17.30).

R – 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 smaller than the fuel on board at departure, 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 fuel leak is confirmed, apply the fuel leak procedure.

OPT FL . . . . Check

Periodically check the OPT and MAX FL to ensure that the aircraft flies as close to the OPT FL as practical.
Allowing the CRZ FL to become significantly below the OPT FL may result in a large increase in fuel burn. Check the CRZ FL against that expected in the flight plan, on which the fuel requirements were based.

AIRCRAFT TRIMMING

The minimum drag for cruise flight is obtained when the control wheel is neutral. This condition is obtained by the following procedure :

- Ensure symmetrical fuel loading,
- Ensure accurate symmetrical thrust, autothrottle disengaged,
- Engage the autopilot, if not already engaged, in HDG SEL mode and in ALT mode in CMD,
- Adjust the rudder trim in order to get a zero control wheel position (aileron deflection scale on the wheel), between 1.5°L and 1.5° R is a typical normal range
- Verify that the bank angle is not too large for passengers comfort (1.5° appears to be a reasonable value),
- Check again the lateral trim conditions and retrim if necessary when there is a noticeable change in flight conditions.
- Revert to PROF/NAV mode, as required once trimming is completed.

Note : The same procedure applies to the low speed range of the aircraft including single engine climbout.

NAVIGATION ACCURACY . . . . Check

Navigation accuracy must be monitored, particularly when "I" (IRS only) or "LOW" is displayed on the PROG page.

Insert a VOR/DME ident in the FMS BRG/DIST TO function, check the bearing and distance compared to the same VOR/DME remotely tuned on the PROG page and displayed on the DDRMI.

The check is satisfactory if the difference in the distance is
≤ 3 NM en route
≤ 2 NM in TMA
≤ 1 NM on approach

If the check is satisfactory : FMS position is reliable.

- ND ARC or MAP and FMS NAV MODE may be used.

If the check is unsatisfactory : FMS position is not reliable.

- Refer to raw data for navigation and monitor.
- If a gross mismatch between display and real position is detected : disengage NAV mode and use raw data navigation (possibly switch to ROSE MODE so as not to be mislead by FMS data).
- Switch off the enhanced functions of the EGPWS via the TERR MODE pushbutton switch located on the Captain's switching panel.

RADAR TILT . . . . Adjust

A near zero degree tilt setting should be used upto around 20, 000 ft. If two different ranges are selected on the two NDs, it is recommended to set a downward tilt with the shorter ND range in order to monitor and detect nearby weather activity. A near zero tilt is recommended for the longer range ND in order to identify weather requiring a possible change of course.

At higher altitudes above 20, 000 ft, a slightly downward tilt is recommended for both NDs.

CABIN TEMP . . . . **Monitor**

Regular attention should be paid to the ECAM CRUISE page so that passenger cabin temperatures may be monitored and adjusted as necessary.

Note 1 : It will take upto 20 minutes for the cabin temperature to stabilize after the adjustment of the COMPT TEMP selectors, so do not chase the ECAM cabin temperature indications. Make one change to the COMPT TEMP selectors then wait for the temperature to stabilize prior to any further adjustments.

Note 2 : If the aft galley area temperature becomes too low, the most efficient way to increase the temperature, without making it too hot in the passenger cabin, is to increase the bulk cargo heating (if installed) as long as this is compatible with the load carried.

Descent preparation and approach briefing take approx 10 minutes. So they should be initiated approx 80-100 miles before top of descent.

ECAM MEMO PAGE . . . . Check

– Check STATUS on MEMO page. Review if required. Take particular note of any landing capability downgrade or any other aspect affecting the approach and landing.

WEATHER AND LANDING

INFORMATION . . . . Obtain

– Check weather at alternate and destination, including runway in use.

LANDING ELEVATION . . . . Set

Note 1 : If QFE is used set 0 on LANDING ELEVATION counter.

Note 2 : In case the destination field elevation is higher than the actual cruise CAB ALT, combined with low aircraft cruise FL, set the LANDING ELEVATION counter to landing field elevation before initiating the descent, in order to permit CAB ALT to reach the landing field elevation before landing.

FUEL . . . . Check

– If flight has been performed below FL 200, check on ECAM FUEL page that there is less than 2000 kg (4400 lbs) of fuel in trim tank. If there is more than 2000 kg (4400 lbs) of fuel in trim tank, check TRIM TK PUMPS are selected ON and select TRIM TK MODE push-button to FWD position.

FMS

LANDING DATA . . . . Prepare

– Set speed bugs on STBY ASI, VAPP and Green Dot.

On FMS APPR page

– **LANDING CONFIG . . . . Check**
  If landing in 20/20 config, select 20/20 on FMS APPR page.

– **MDA . . . . Insert**
R *Note : Some authorities may require operators to add*
R *a certain number of feet to the MDA.*

DESCENT WIND PROFILE . . . . Insert
This insertion, on the DES FORECAST page should be made early to ensure optimum Top of Descent point can be re-computed and ensure that it is ahead of the present position.
If no wind is inserted, wind is computed by interpolation between CRZ wind and no wind at destination.

For CAT II or CAT III approach :

– **DH . . . . Set on FCU**

F-PLN . . . . Check/Modify

STAR/APPROACH . . . . Insert
The FMS computes VAPP based on the predicted landing weight, it is equal to VREF + WIND CORR (entered by crew) + 5 kts (This assumes A/THR is engaged for landing).
The DECEL point, where the aircraft should start to decelerate is computed based on the inserted flight plan route and wind profile.

NAVAIDS . . . . Check
Set Navaids as required and check idents.
If a VOR/DME exists close to the airfield, it should be selected systematically and its ident should be set on PROG page BRG/DIST TO field for navigation accuracy monitoring during descent.

GO AROUND page . . . . Check/Modify
Check/modify the THR RED ALT and ACC ALT.

SEC F-PLN page . . . . As req
If weather is OK, SEC F-PLN can be used for setting another possible approach and/or RWY as a backup at destination airfield.
If there is a last minute RWY change, it is then only necessary to activate SEC F-PLN not forgetting to set new MDA/DH and navaids.

APPROACH BRIEFING

It is recommended to use FMS pages and ND as a guide for descent and approach briefing. Main points to be covered are :

Navaid	– ILS, VOR selection procedures and crossing altitudes.
F-PLN page	– STAR, APPR, TRANS, MISSED APPROACH
APPR page	– Landing Config, speeds, MDA,
FUEL PRED	– Fuel needed for diversion, holding fuel available.

– Runway conditions, lighting and dimensions
– Ground Spoiler, reverse operation and autobrake selection
– Terminal area topography, transition level and minimum safe altitudes to ensure a proper terrain awareness.
– Weather at destination
– Go Around :
  · Standard call/task sharing
  · Diversion decision

Note : If AP disengaged, it is recommended to descend at Mach 0.8 or below to avoid alpha-trim activation.

DESCENT CLEARANCE . . . . Obtain

WHEN DESCENT CLEARANCE IS GIVEN BY ATC

– **FCU ALT KNOB . . . TURN to select cleared altitude**
– **FCU ALT KNOB . . . . Pull**
– **P. THR/P. DES armed . . . . Check FMA**
  · IMM DES prompt is displayed on FMS CDU

ANTI ICE . . . . As req

During descent ENG ANTI ICE should be ON when icing conditions are met, or when moderate to severe precipitation is encountered.

IGNITION . . . . As req

Ignition should be selected to CONT RELIGHT prior to ENG ANTI ICE selection.

Mod : 4801

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DESCENT INITIATION

Descent will be initiated automatically in profile mode at the Top of Descent (T/D) point, provided a lower altitude has been preset on the FCU.
The FMS will hold the CRZ FL until the top of descent.

30 seconds before reaching the T/D, P. DES will flash to indicate that the descent will be initiated without any further pilot action.

- **If ATC requires an early descent.**
  The descent may be initiated immediately (before reaching T/D) by pressing IMM DES prompt on CDU. In this case the descent will be performed at 1 000 ft/min (this value can be changed on CDU) until the precomputed path is reached.
- **If the descent is delayed by ATC**
  When passing the T/D the aircraft stays at the CRZ ALT as no lower altitude has been selected on the FCU. DECEL prompt is displayed in line 1R. Pressing this prompt reduces speed to green dot (highest of PFD and FMS values if they are different). As soon as clearance is given by ATC, select the cleared ALT on the FCU, select desired descent speed on the FCU, then pull the FCU speed/Mach knob. The descent will now be initiated in LVL/CH mode.

DESCENT MONITORING

PF CDU . . . . PROG

- PF CDU should preferably be set to PROG page in order to see the VDEV and DIST TO DEST information. Other pages such as F-PLN may be selected as necessary.
  With AP engaged PF should make any required F-PLN revisions.

PNF CDU . . . . F-PLN

- **Descent monitoring can be achieved as follows :**
  - When flying in NAV mode, PROFILE mode is most probably used. P.DES indicated on the FMA.
    The aircraft descends along the descent flight path : VDEV is provided on PROG page, and may be thus monitored. All constraints of the FPLN will be taken in to account by the FMS.
  - When flying in HDG (TRK) mode out of the lateral F.PLN, PROFILE DESCENT should not be used.
    PROG page displays flight plan distance to DESTINATION and can display BRG/DIST to DESTINATION if selected. The comparison of this data is useful to monitor the descent.

    The level ↘→ symbol, on ND may be used to monitor the descent as well.
    The predictions on CDU assume a return to the FPLN path.
  - From time to time, during stabilised descent select FPA on PFD and check that remaining distance to destination is approximately the FL change required divided by FPA in degrees.

$$FPA\ (°) = \frac{\Delta\ FL}{DIST\ (NM)}$$

When each new descent clearance is given by ATC

Cleared level . . . . Set on FCU
FMA indication . . . . Check/Announce
Cleared ALT on PFD . . . . Check
Check MSA and ensure that the aircraft does not descend below MSA. Monitor progress in the descent, particularly when approaching the cleared altitude.

When 1000 Ft above the cleared altitude.

Announce . . . . "one thousand to go" R

Refer to 2.03.30 page 1 for altitude standard calls

Monitor reduction in V/S as the cleared altitude is reached. In V/S or LVL/CH mode, monitor ALT* engagement, then ALT at the cleared altitude.

At level off

FMA indication . . . . Check/Announce

Note : *In PROFILE mode, the descent is performed at idle thrust, maintaining the required descent path by pitch control. Thus the aircraft speed will vary with the pitch and is not directly controlled.*
However, if the speed varies by more than 20 kt from the FMS target speed (most probably due to lack of sufficient, or accurate descent wind inputs) the following will occur :

If the Speed is 20 kt above the target, or reaches VMAX-2Kt, "MORE DRAG" flashes on the PFD. The SPD BRK should be extended. The message will flash until the speed is within 5 kt of the target.

If the speed is 20 kt below the target or 10 kt below Green Dot, and the SPD BRK is extended, the message "LESS DRAG" is displayed on the CDU. The SPD BRK should be retracted. If the SPD BRK is not extended, the aircraft reverts to P. SPD mode, power is increased and the target speed re-captured.

DESCENT ADJUSTMENT

If an increased rate of descent is desired :

- Increase descent speed (by use of LVL/CH and selected speed) if comfort and ATC permit. This is economically better (Time / Fuel).
- Maintain high speed as long as possible (SPD LIM may be cleared, subject to ATC clearance).
- If aircraft is high with high speed, it is more efficient to keep high speed until lever off and then decelerate rather than to mix descent and deceleration.

  If the aircraft goes below the desired profile, use SPD V / S mode to adjust rate of descent.

- **SPEED BRAKE** . . . . **As req**

  In descent speedbrake may be used to increase the rate of descent. Half speedbrake extension may be used to maintain the required rate of descent when engine anti ice is used.
  In Profile descent (P.DES) if the aircraft is on or below the flight path and ATC requires an increased rate of descent, do not use speed brake on its own since rate of descent is dictated by planned flight path. In this case select MAX DES mode on TACT page with speed brake.

Note : 1. *Use of full speedbrake above 0.78 M is uncomfortable for passengers.*
2. *With ANTI-ICE ON engine thrust is increased which will reduce the descent path angle at idle. This can be compensated for by an increase of descent speed, or by extending half speed brake.*
3. *Do not use speedbrake in 30/40 config.*
4. *Do not change speedbrake position during configuration changes.*

RADAR TILT . . . . **Adjust**

Every 10 000 ft during descent down to around 15 000 ft, adjust the tilt angle slightly upwards to eliminate excessive ground clutter on the upper part of the ND.

From 15 000 ft, adjust the tilt angle by one degree upwards per 5 000 ft descent, in order to keep the ND relatively free of ground clutter.

EGPWS

R – **TERR ON ND** . . . . **As req**

R Consider switching TERR pushbutton to ON ND, depending
R on external conditions (mountainous area, low ceiling,
R low visibility).

If the use of radar is required, consider selecting radar display on PF side, and TERR ON ND on PNF side only.

ALTIMETERS . . . . **Set**

. Set QNH (QFE if required) on all altimeters when approaching the transition altitude and when cleared for an altitude.
. Crosscheck baro settings and altitude readings.

Note : When operating in low OAT, altitude corrections as defined in 2.08.10 page 4 should be considered.

Navigation accuracy . . . . **Check**

When reaching Terminal Area, (approximately 50NM from the destination) crosscheck navigation accuracy as defined in 2.03.15 page 1.

Mod : 11894

The following approach procedure assumes AP engaged in PROFILE mode and A/THR engaged, which is the recommended procedure.

INITIAL APPROACH

IGNITION . . . . **CONT RELIGHT**

SIGNS

SEAT BELTS sw . . . . **ON/AUTO**

EXT LTS . . . . **As req**

R – Set RWY TURN OFF lights and LAND lights ON at FL 100. Use LAND lights as per company policy/regulatory recommendation

POSITIONING

Check aircraft positioning for a smooth transition to the approach.

Rule of thumb : 9000 ft at 250 Kt - 30 NM to touchdown

NAV/COM FREQ . . . . **Check/Set**

Set VHF as required

Set ILS frequency and course

Set VOR/NAV/ILS switch to ILS as required

APPROACH SPEED

If ATC requires a particular speed to be flown then use selected speed. When ATC speed constraint no longer applies, return to profile mode.

NAVIGATION ACCURACY . . . . **Check**

Monitor navigation NAV accuracy and be prepared to change approach strategy, particularly when IRS ONLY NAVIGATION is displayed.

Refer to the FCOM 2.03.15 page 1 for the navigation accuracy check method.

If navigation accuracy is greater than 1 NM

ND must be used in ROSE or ARC mode by PF.

NAV mode should not be used, use HDG SEL.

Switch off the enhanced functions of the EGPWS via the TERR MODE pushbutton switch located on the Captain's switching panel.

RADAR TILT . . . . **Adjust**

Increase tilt as required to keep the ND clear of ground clutter.

ND . . . . **Set/Check**

PF ND MODE . . . . **MAP for ILS approach otherwise depending on the FMS accuracy**

PNF ND MODE . . . . **MAP may be kept**

ND RANGE . . . . **Select 15 NM**

DH . . . . **Check**

Both CM1 and CM2 confirm DH setting on EFIS control box in accordance with company policy.

For CAT 1 precision approaches, or non-precision approaches, set the CAT 1 DH or MDA using the altimeter amber index and set a DH = – 5 on the EFIS control panel to cancel the "MINIMUM" auto call-out.

For CAT 2 or CAT 3 approaches, set DH on the EFIS control panel to provide "MINIMUM" auto call-out based on radio altimeter height.

APPROACH CHECK LIST . . . . **Complete**

Mod : 11894

PW Eng. : All

FINAL APPROACH

The following procedure assumes an ILS approach with one AP engaged in CMD and A/THR engaged which is the recommended procedure.

R Conducting a stabilized approach is recommended. The
R objective is to be stabilized on the final descent path at
R VAPP in the landing configuration, at 1000 ft AAL in IMC,
R or at 500 ft AAL in VMC after continuous deceleration on
R the glide slope.
R To be stabilized, all of the following conditions must be
R achieved prior to, or upon reaching this stabilization
R height :

- the aircraft is on the correct lateral and vertical flight path,
- the aircraft is in the desired landing configuration,
- the power is stabilized and the aircraft is trimmed to maintain VAPP on the desired glide path,
- no excessive flight parameter deviation.

The advantages are :

- Lower fuel consumption
- Lower noise levels
- Time saving
- Flexibility and ability to vary speed to suit ATC.

R If the aircraft is not stabilized on the approach path in
R landing configuration at 1000 ft AAL in IMC, or at 500 ft
R AAL in VMC, or as restricted by Operator policy/regulations,
R a go-around must be initiated unless the crew estimates
R that only small corrections are necessary to rectify minor
R deviations from stabilized conditions due, amongst others,
R to external perturbations.

FCU . . . . **Green dot speed**

HDG SEL . . . . **As req**

Airspeed . . . . **Check below VFE**
Order . . . . **"SLATS extend"**
Announce . . . . **"Speed checked"**

SLATS 15 . . . . **Select**

Slats 15 should be extended not later than 3NM prior to the FAF (Final Approach Fix)

When SLATS 15 on SFPI

Announce . . . . **"SLATS extended"**

FCU . . . . **S Speed**

Check deceleration towards S speed.
The aircraft should be established on the glide slope with Slats 15 at S Speed at or above 2 000 ft AGL.

- ● In the event that a/c speed is significantly higher than S on the G/S, or the a/c does not decelerate on the G/S, extend the L/G in order to slow the a/c down.

GPWS

If landing is planned to be performed in S 20°/F 20° landing configuration select GPWS LANDING SLATS/FLAPS switch to 20/20.
Landing with Flaps 20 is recommended in windshear conditions or if approach climb requirements cannot be met with Flaps 40.

WHEN CLEARED FOR FINAL APPROACH

LAND pb on FCU . . . . **Press**

This enables LOC and G/S capture.

Note : Arm the LAND mode only when ATC gives clearance for the ILS approach (clearance for both LOC and G/S capture).
If only LOC capture required, use V/L mode until clearance for full ILS received.

2ND AP . . . . **As req**

AUTOLAND lights . . . . **Test**

For CAT 2 or 3 autolands only, check the AUTOLAND lights illuminate. This test checks the flight warning computer monitoring of autoland functions.

FMA . . . . **Check/announce**

TCAS (If installed) . . . . **Set TA/As req**

TA only mode should be selected in the following cases :

- 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 RAs (closely spaced parallel runways, converging runways, operation in airport with low terrain along the final approach...)

LOC CAPTURE . . . . **Monitor**

Announce . . . . **"LOC*"**

At LOC capture, NAV or HDG is disengaged automatically.
Check correct ILS course set.

RWY HDG . . . . **Set**

G/S CAPTURE . . . . **Monitor**

- ● If above the glideslope

  V/S mode . . . . Select
  FCU altitude . . . . Set above A/C altitude

Announce . . . . **"GS*"**

GO AROUND ALT . . . . **Set**

Between 2500 ft and 2000 ft AGL

RAD ALT . . . . **CHECK**

Announce . . . . **"RAD ALT ALIVE"**

Note : Crew should now keep RA in scan to landing.

At 2000 ft AGL Minimum

Final deceleration sequence from SLATS 15/S speed to FLAPS 40/VAPP

SPD BRK . . . . **Check retracted**
Airspeed . . . . **Check below VFE**
Order . . . . **"FLAPS 20"**
Announce . . . . **"Speed checked"**

FLAPS 20 . . . . **Select**

FCU . . . . **VAPP**

If A/THR is OFF
THROTTLES . . . . **Idle**

When FLAPS 20 on SFPI

Announce . . . . **"FLAPS 20"**
Order . . . . **GEAR DOWN**

L/G LEVER . . . . **DOWN**

GND SPOILERS . . . . **ARM**

When L/G down

Announce . . . . **"GEAR DOWN"**

Check "3 green" on landing gear main indication panel.

BRAKE YELLOW HYDRAULIC PRESSURE . . . . **CHECK**

- If residual pressure is indicated :
  - Depress several times the brake pedals until release of residual pressure
  - If residual pressure remains :
    - Select preferably the AUTOBRAKE system or 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 aircraft touchdown.*

AUTO BRK . . . . **As req**

- The use of autobrake is recommended. Select the appropriate pushbutton according to the runway length and conditions and check related ON light illuminated.
  The use of MAX is not recommended at landing.
- When landing on short or contaminated runway or when operating in low visibility weather conditions use MED mode.
- On a normal runway length LO mode is recommended. It is recommended to use max reverse thrust until 80 kt. Then idle reverse and brakes, as necessary, according to the remaining distance.

Note : *If, on very long runways, the pilot anticipates that braking will not be needed, use of the autobrake is unnecessary.*

Order . . . . **FLAPS 40**

FLAPS 40 . . . . **Select**

BRK/A-SKID . . . . **Check NORM/ON position**

ECAM wheel page . . . . **Check**

Check 8 brake release indications

When Flaps 40 on SFPI

Announce . . . . **"FLAPS 40"**

Check speed approaching VAPP

The approach must be stabilized with FLAP 40/VAPP by 500 ft min. in VMC, 1000 ft min in IMC, otherwise a Go around must be initiated.

If A/THR is not engaged :

THROTTLES . . . . **Adjust**

WING ANTI-ICE . . . . **OFF**

Only use WING ANTI ICE in case of severe icing conditions

EXT LTS . . . . **ON**

Set NOSE sw to TAXI

Selecting lights on even in daylight will minimize bird strike hazard.

CABIN REPORT . . . . **Received**

Obtain cabin report and advise cabin crew of landing.

LANDING CHECKLIST . . . . **Completed**

FLIGHT PARAMETERS . . . . **Check**

PF announces any FMA modification
PNF calls out :
- Pitch attitude becomes lower than 0° or greater than 10° nose up
- Bank angle becomes greater than 7°
- V/S greater than 1 000 ft/min
- Airspeed deviations of more than + 10 kt or – 5 kt
- Excessive LOC or GLIDE deviation occurs :
  1/4 dot LOC
  1 dot GS
- Any significant changes in ground speed that might indicate windshear.

If a call out occurs during the final approach, a go around must be initiated.

At 400 ft AGL

Check/Announce . . . . **"LAND"** R

At DA + 100 ft

Announce . . . . **"ONE HUNDRED ABOVE"**

At DA

Monitor or announce . . . . **"MINIMUM"**

Announce . **"CONTINUE" or "GO AROUND FLAPS"**

Do not "duck under" the G/S. Maintain a stabilized flight path down to the flare.

Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*

AUTO CALL-OUT . . . . **Monitor**

or announce appropriate heights as per company policy
At 50 ft, aircraft one dot below G/S is 7 ft below G/S. R

R R R R R R R R R R R R R R R R R R R R R R R R R

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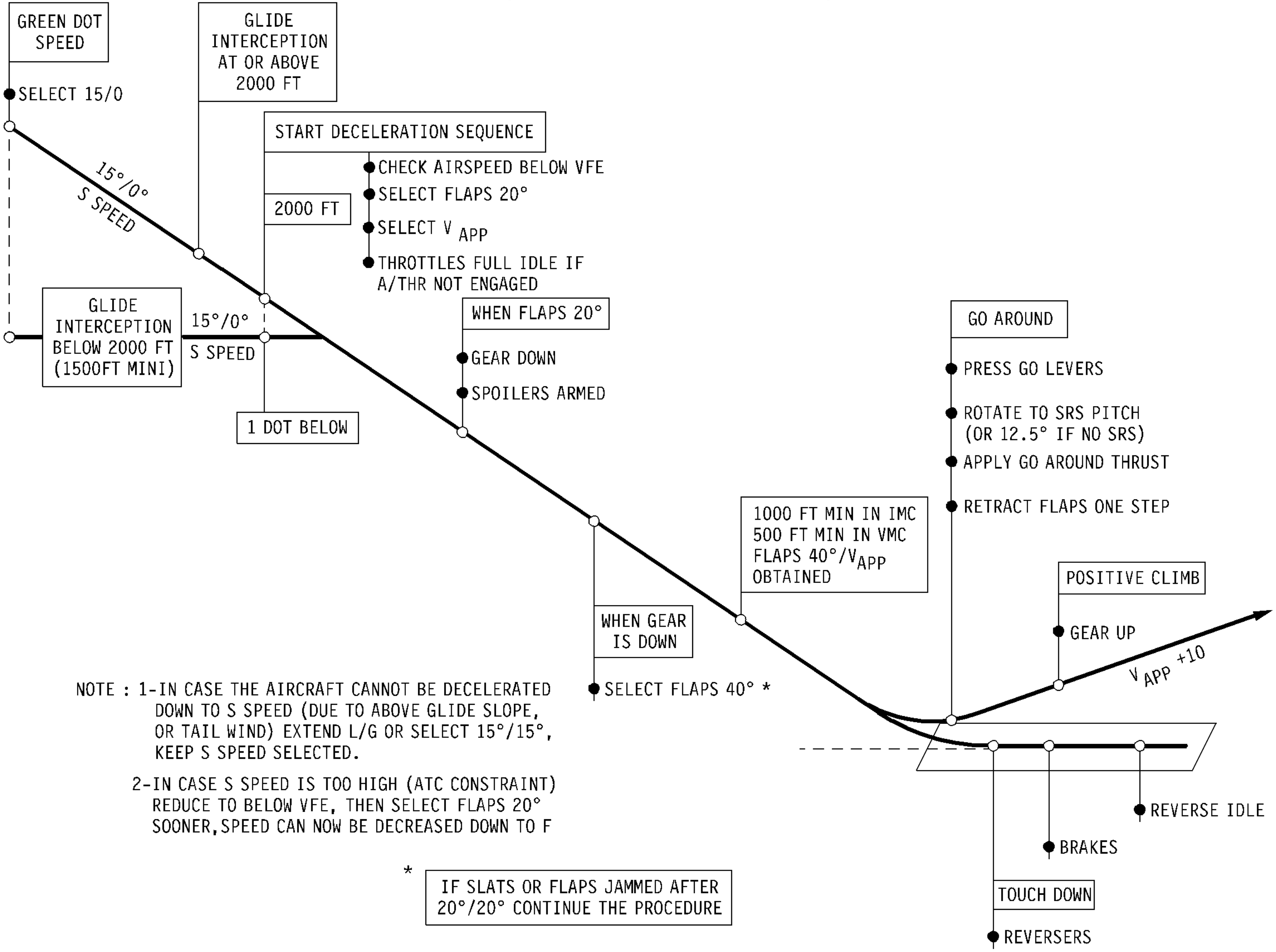
STANDARD APPROACH

PERFORMED MANUALLY OR WITH AP ENGAGED ON A STABILIZED FINAL SLOPE OF ABOUT 3°
(VISUAL OR ILS APPROACH)



NOTE : 1-IN CASE THE AIRCRAFT CANNOT BE DECELERATED DOWN TO S SPEED (DUE TO ABOVE GLIDE SLOPE, OR TAIL WIND) EXTEND L/G OR SELECT 15°/15°, KEEP S SPEED SELECTED.

2-IN CASE S SPEED IS TOO HIGH (ATC CONSTRAINT) REDUCE TO BELOW VFE, THEN SELECT FLAPS 20° SOONER,SPEED CAN NOW BE DECREASED DOWN TO F

* IF SLATS OR FLAPS JAMMED AFTER 20°/20° CONTINUE THE PROCEDURE

INTRODUCTION

This procedure provides general guidelines to perform a visual approach. In every case, if a visual approach has been published for the landing runway, it must be applied.

Note : *Keep in mind the possible risk of optical illusions due to night vision.*

OBJECTIVE

The objective is to approach using visual references on a nominal 3 degree glideslope and to be stabilized at 500 ft AAL.
To be stabilized, all the following conditions must be achieved before or when reaching this stabilization height :

- the aircraft is on the correct lateral and vertical flight path,
- the aircraft is in the desired landing configuration,
- the power is stabilized and the aircraft is trimmed to maintain VAPP on the desired glide path,
- no excessive flight parameter deviation.

If the aircraft is not stabilized on the approach path in landing configuration at 500 ft AAL, or as restricted by Operator policy/regulations, a go-around must be initiated unless the flight crew estimates that only small corrections are necessary to rectify minor deviations from stabilized conditions due, amongst others, to external perturbations.

METHOD FOR VISUAL APPROACH

- The autopilot should be disconnected.
- The use of the FPV is recommended.

R

VISUAL CIRCUIT

INITIAL/INTERMEDIATE APPROACH

The flight plan selected on the CDU should include the selection of the LANDING RWY.

The down wind leg might be also part of the F PLN. This may be a useful indication of the aircraft positionning in the circuit, on the ND. However visual references must be used.

Therefore, at beginning of down wind leg :

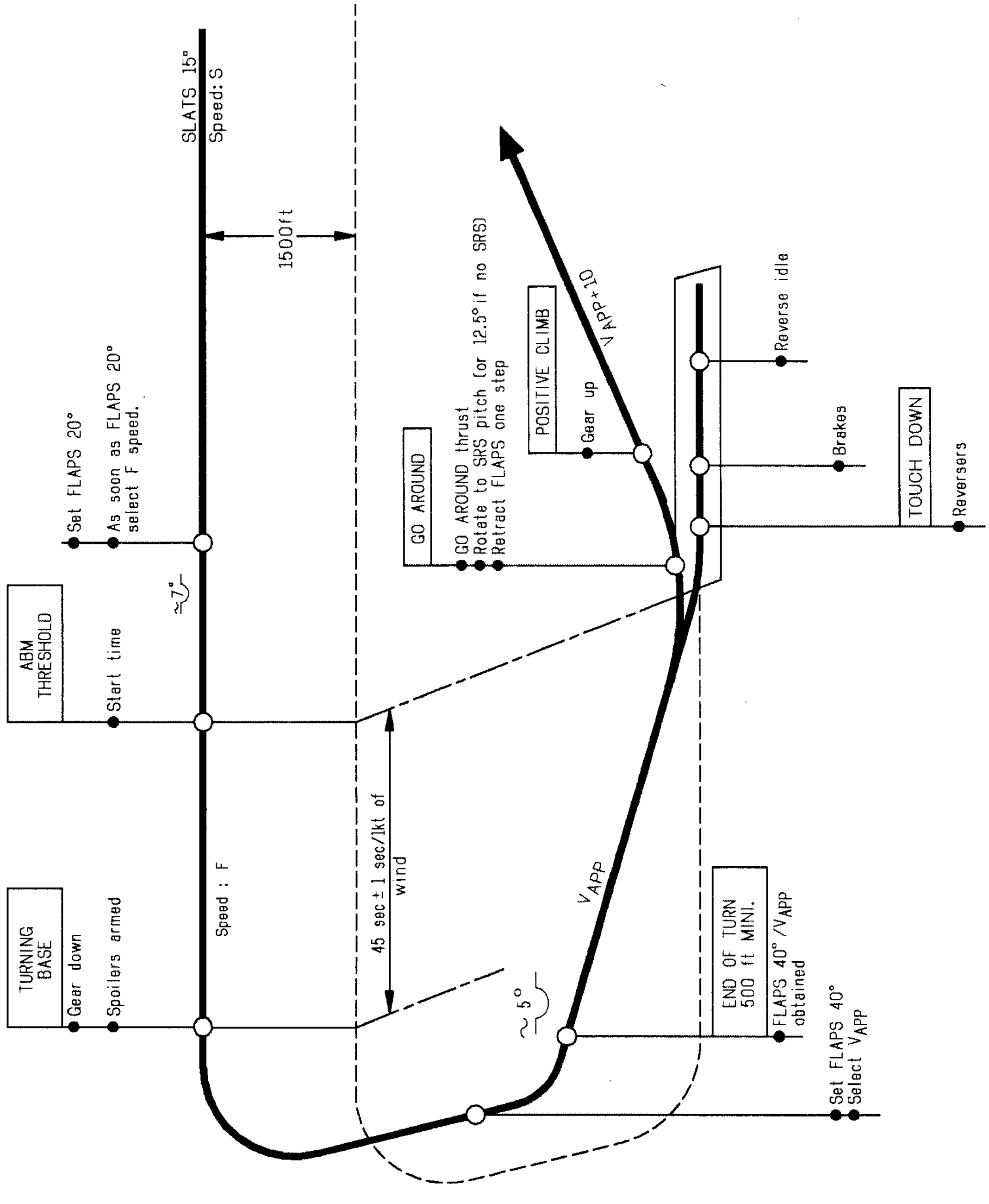
- Select FPV ON
- The use of A/THR is at pilot's discretion.
- Apply the flight pattern (2.03.19 page 2)
  Down wind leg extension 45 seconds (± wind correction)
  Turn into base leg – Bank 30° max.

FINAL APPROACH

- The speed trend arrow and FPV are useful for achieving timely and correct thrust (if in manual thrust) and approach path corrections. Avoid descent through the correct approach path with idle thrust. (Late recognition of this situation without prompt thrust increase may lead to considerable speed decay and altitude loss).
- Avoid any tendency to "duck under" in the latter stages of the approach.
- Avoid destabilization of the approach in the last 100 ft to give the best chance of achieving a good touch down at the desired position.

Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*

STABILIZED VISUAL APPROACH (1 or 2 ENGINES)



IF SLATS OR FLAPS JAMMED AFTER 20° /20° CONTINUE THE PROCEDURE.

*

INTRODUCTION

This procedure contains recommendations that are specific to Non Precision Approaches.
The standard approach procedure steps have not been repeated. They must be completed before the Final Approach Fix.
This procedure provides general guidelines which may be adapted according to the airline policy and/or the actual flight conditions.

APPLICABILITY

This procedure applies to all non-ILS approaches, e.g. NDB, VOR, VOR-DME, LOC ONLY, LOC-DME.
For LOC BACK COURSE refer to Procedures and Techniques chapter Use of AFS.

APPROACH GUIDANCE

Non Precision Approaches can be performed using two different AP/FD guidances :

- FMS guidance :
  - NAV mode down to the MDA or until LOC interception (lateral)
  - PROFILE mode until FAF then V/S mode down to the MDA (vertical).
- Selected guidance :
  - HDG SEL mode down to the MDA (lateral) or until LOC interception
  - V/S mode after leaving the FAF down to the MDA (vertical)

When the approach is stored in the NAV database and the NAV ACCURACY check is positive, the FMS guidance is recommended. Otherwise, the selected guidance must be used.

In both cases, the recommended flight reference display for a Non Precision Approach is the FPV/FPR.

APPROACH SPEED TECHNIQUE

The standard speed technique is a stabilized approach using AP engaged in CMD mode and A/THR engaged in SPD mode. This enables the aircraft to intercept the final descent path in the landing configuration and at VAPP, thrust above idle.

INITIAL APPROACH

NAVIGATION ACCURACY . . . . **CHECK**

Check navigation accuracy using navaids raw data to determine approach strategy.

REFERENCE NAVAIDS . . . . **TUNED/CHECKED**

For VOR approach, tune frequency and course on VOR control panel and check VOR is also tuned on CDU.

MDA (MDH) . . . . **CHECK/SET**

Set MDA (MDH) using the altimeter amber index and set a DH = – 5 on the EFIS control panel to cancel the "MINIMUM" auto call out.

- **If accuracy check is positive** :

  ND . . . . **both in MAP**

  FMS GUIDANCE . . . . **USE**

  VOR/NAV/ILS switches . . . . **BOTH IN NAV**

  For a LOC approach, revert to ILS position prior to LOC interception.

- **If accuracy check is negative** :

  PF ND . . . . **ROSE or ARC**

  PNF ND . . . . **MAP or ROSE or ARC**

  SELECTED GUIDANCE . . . . **USE**

  PF VOR/NAV/ILS switch . . . . **VOR or ILS**

  PNF VOR/NAV/ILS switch . . . . **AS RQRD**

FPA/CRS target . . . . **SET**

For NDB approach, set final approach course on ILS control panel.

APPROACH CHECKLIST . . . . **COMPLETE**

INTERMEDIATE APPROACH

The STANDARD APPROACH steps to prepare the aircraft for landing (L/G down, spoilers armed, Flaps 40, speed Vapp) should be performed before reaching the FAF.

The objective is to be stabilized on the final descent path at VAPP in the landing configuration, at 1000 ft AAL in IMC, or at 500 ft AAL in VMC.
To be stabilized, all of the following conditions must be achieved prior to, or upon reaching this stabilization height :
– the aircraft is on the correct lateral and vertical flight path,
– the aircraft is in the desired landing configuration,
– the power is stabilized and the aircraft is trimmed to maintain VAPP on the desired approach path,
– no excessive flight parameter deviation.

If the aircraft is not stabilized on the approach path in landing configuration, at 1000 ft AAL in IMC, or at 500 ft AAL in VMC, or as restricted by Operator policy/regulations, a go-around must be initiated unless the crew estimates that only small corrections are necessary to rectify minor deviations from stabilized conditions due, amongst others, to external perturbations.

FINAL APPROACH

FD/FPV switch . . . . **SELECT FPV**

Select FPV just before FAF at the latest. The FPR is displayed only if the VOR/NAV/ILS switch is in VOR or ILS position.

- **At FAF** :

  V/S . . . . **SELECT**
  Set pre-calculated V/S required to obtain desired FPA.

  - **If ND is in MAP mode** :

    VOR/NAV/ILS switch . . . . **ILS**
    ILS must be selected to cancel V/DEV scale.

  GA ALTITUDE . . . . **SET**

  Set when below the go around altitude.

- **During final approach** :

  POSITION and FLIGHT PATH . . . CHECK/ADJUST

  - Monitor reference navaid raw data.
  - Monitor altitude in relation with the published descent profile and the distance to the runway.
  - Adjust HDG SEL and V/S accordingly.
  - If FMS NAV is not satisfactory, revert to HDG/SEL.

  LANDING CHECKLIST . . . . COMPLETE

  FLIGHT PARAMETERS . . . . CHECK

  PF announces any FMA modification.

  PNF calls out if :

  - Speed becomes lower than VAPP – 5 kt or greater than speed target + 10 kt.
  - Pitch attitude becomes lower than – 2.5° or greater than 10° nose up.
  - Bank angle becomes greater than 7°.
  - Descent rate becomes greater than 1000 ft/min.
  - Any significant changes in ground speed that might indicate windshear.

  If a call out occurs during the final approach, a go around must be initiated.

- **At MDA (MDH) + 100 ft** :

  HUNDRED ABOVE . . . . ANNOUNCE

- **Reaching MDA (MDH)** :

  - **When visual references are acquired and confirmed by both PF/PNF** :

    R **CONTINUE . . . . ANNOUNCE**

    Continue as visual approach with the standard call outs.

    AP . . . . OFF

    Note : *Close to the ground, avoid important down corrections. Give priority to attitude and sink rate.*

  - **If no visual references are acquired** :

    - **At MDA (MDH) and VDP** :

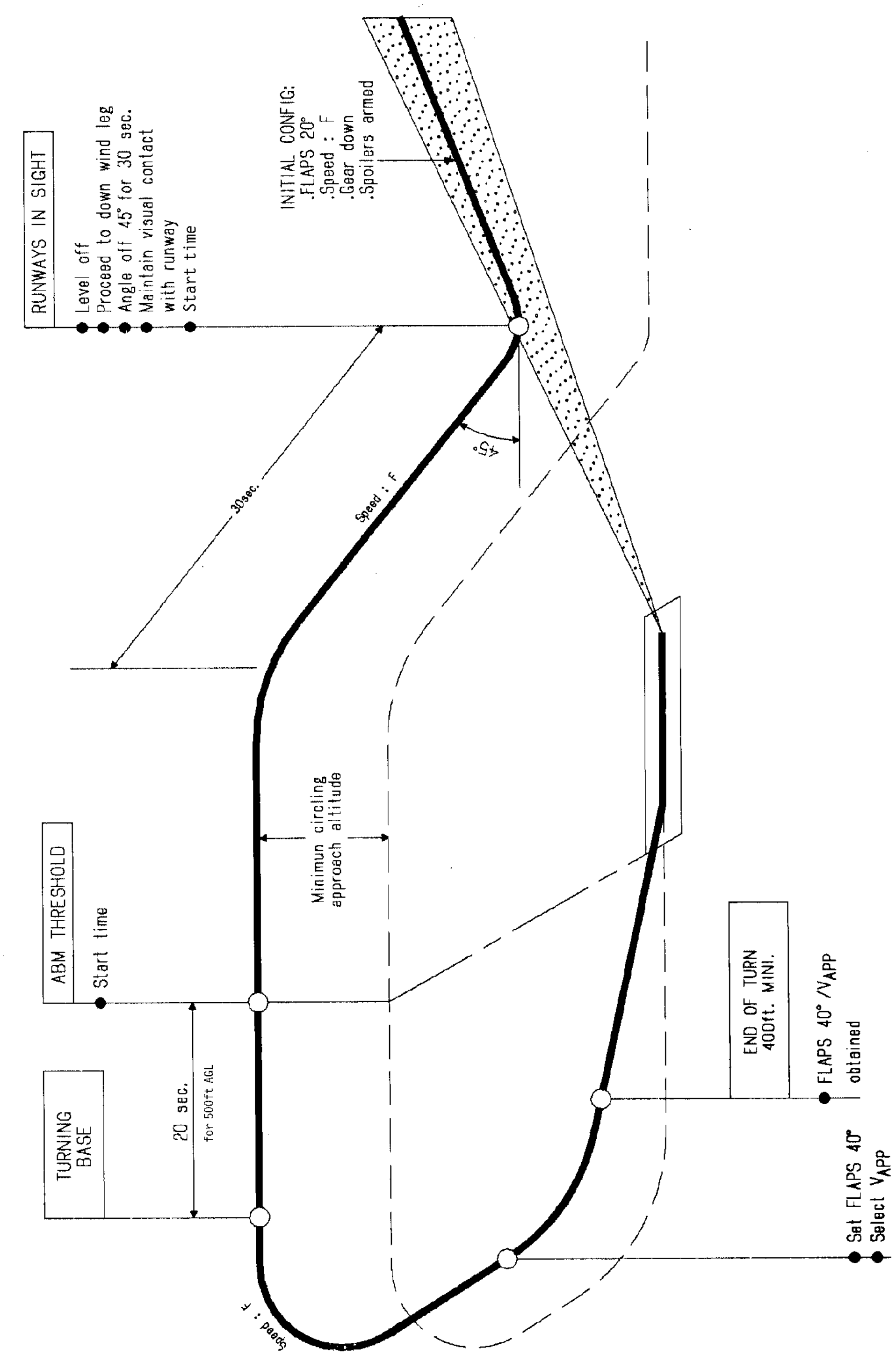
      GO AROUND/FLAPS . . . . ANNOUNCE

      Initiate go around.

Note : *In selected guidance, if ground references are not visible when the aircraft reaches MDA, an immediate go around must be initiated.*

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, using ALT HOLD to level off not lower than MDA, while searching for visual references. If the pilot has no visual reference at MAPt at the latest, he must begin a go around.

R *Note : This pattern illustrates a low visibility circling approach and does not refer to a non precision approach as*
R *described in 2.03.20 p 1 and 2.*



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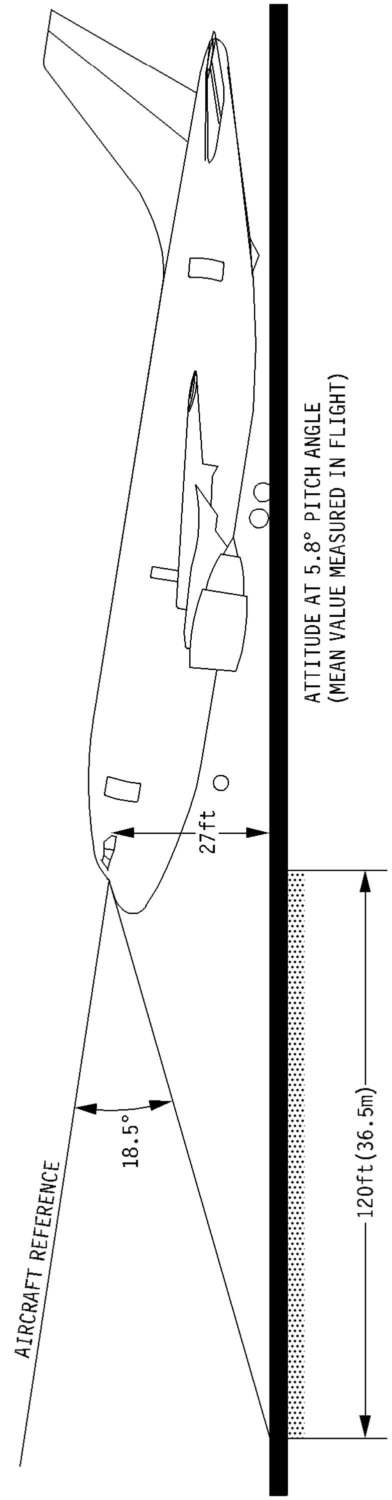
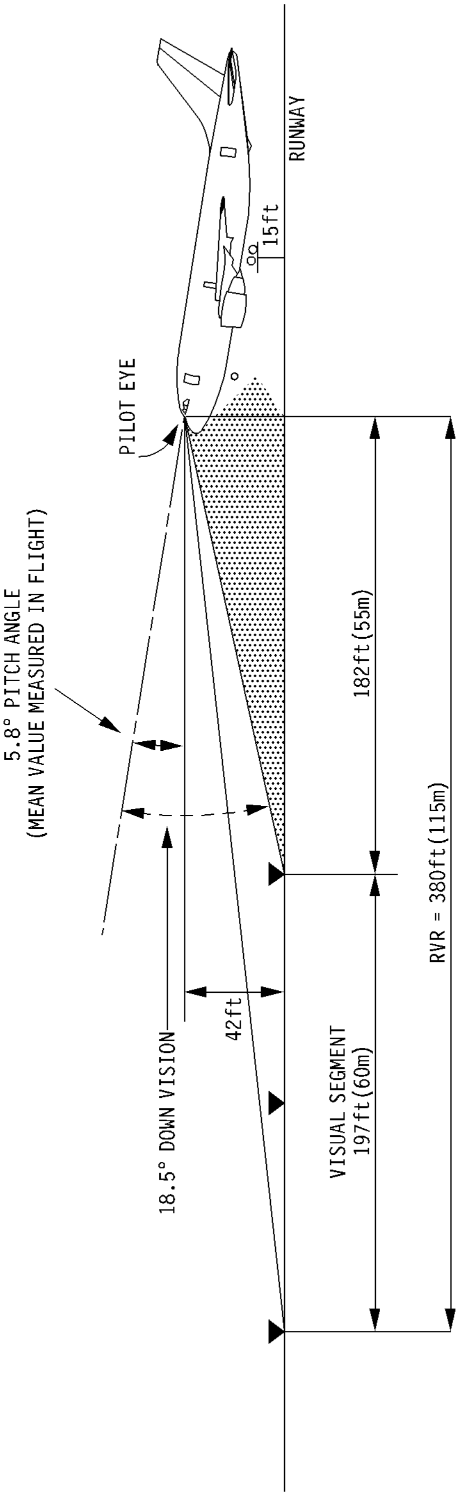
PILOT EYE ORIENTATION WITH GROUND



VISUAL GROUND SEGMENTS
LANDING APPROACH
H=15FT



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R
R
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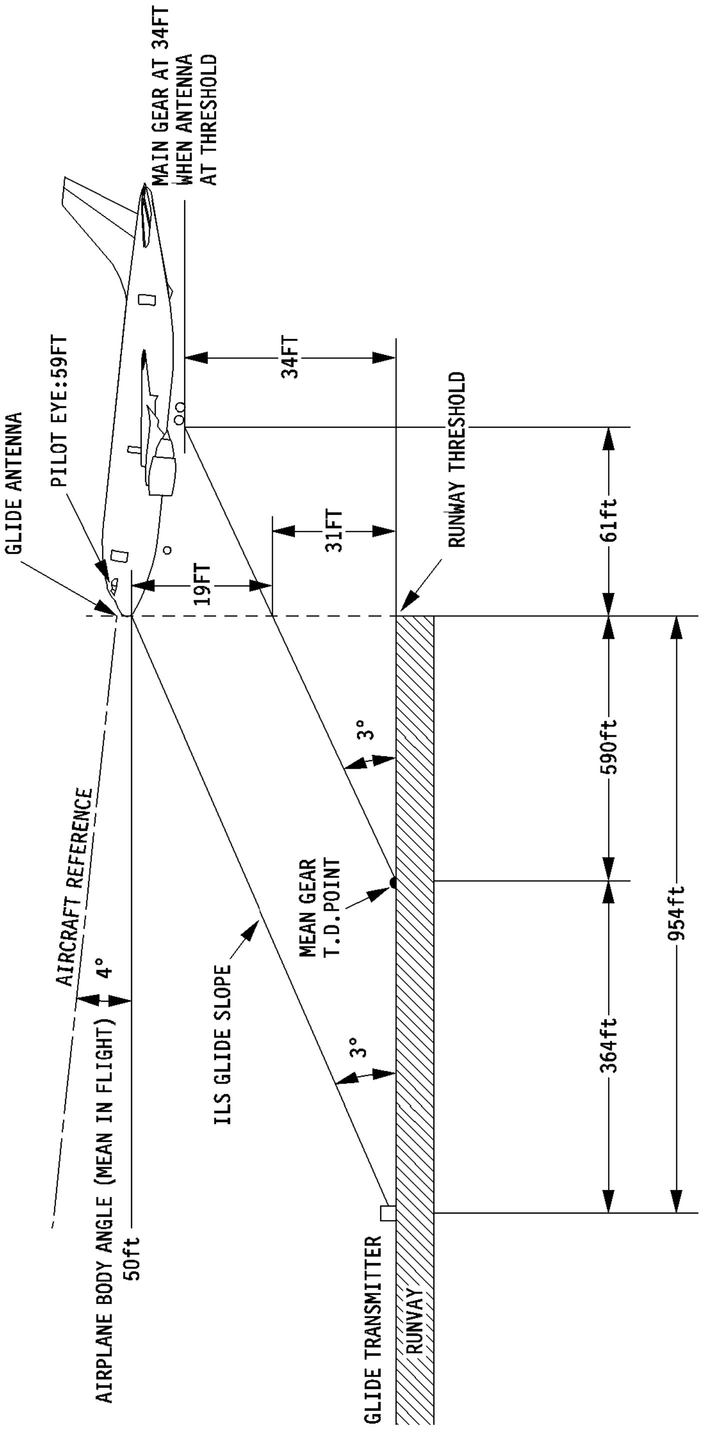
ESTIMATED ILS APPROACH

AIRPLANE FOLLOWING STRAIGHT LINE EXTENSION OF GLIDE AT THRESHOLD



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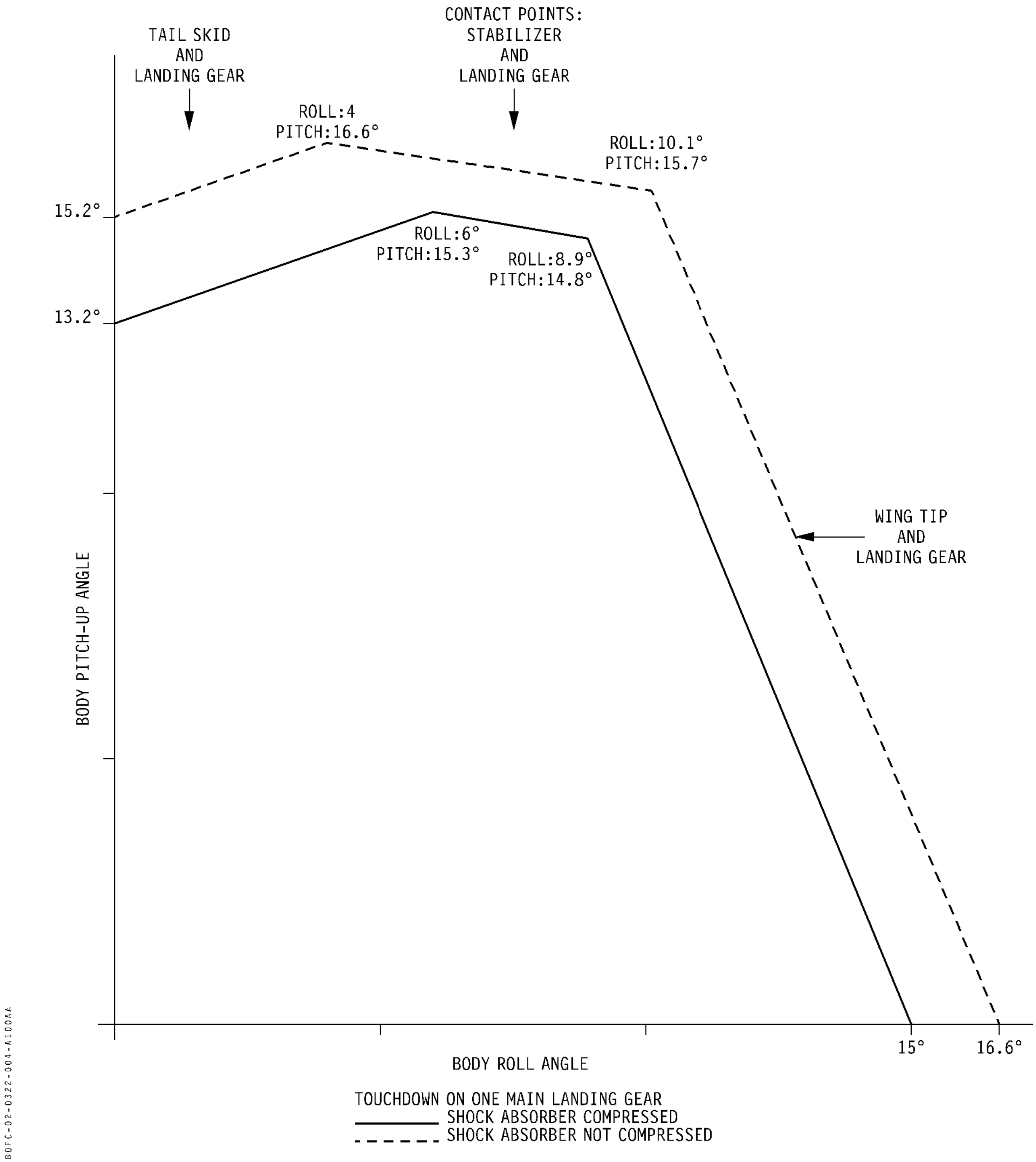
R

GROUND CLEARANCE DIAGRAM



Mod : 4863

NO CHANGE

THROTTLES . . . . **Monitor idle**

- Monitor throttles reduction to idle at 30 ft.
- If A/THR is not engaged, retard throttles to idle.
- R If A/THR is engaged, it automatically disconnects
  R when both throttles are at idle position.

R *Note : If one or both thrust levers remain above*
R *the IDLE position, ground spoilers extension*
R *is inhibited.*

AT TOUCHDOWN

NO CHANGE

GROUND SPOILERS . . . . **Check extension**

- Check ground spoilers extension after touch down on ECAM system display.
  - If no ground spoilers are extended : R
    - Verify and confirm that both thrust levers are R
      at idle position R
    - Set both thrust levers to REV MAX, and fully R
      press the brake pedals. R

Note : If ground spoilers are not armed they extend R
at reverser thrust selection. R

REVERSERS . . . . **CHECK/ANNOUNCE** R

- Check reverse deployment is as expected (REV R
  green). R

DIRECTIONAL CONTROL . . . . . . **Rudder pedals**

- Do not use NWS Control handle before taxi speed is reached

BRAKES . . . . **As req**

- Apply brakes as required or monitor autobrake. When autobrake is used the PF should be ready to takeover and apply manual braking as required.

  Note : If no ground spoilers are extended, the R
  autobrake is not activated. R

CAUTION

If brakes are found inoperative, switch immediately BRK-A/SKID to ALTN/OFF and modulate brake pressure as required at or below 1000 PSI.
Brake pedals should be released when the A/SKID is switched OFF. Otherwise the pedal braking orders will be taken into account and the aircraft will react

DECELERATION . . . .**ANNOUNCE** R

- The deceleration is felt by the flight crew, and R
  confirmed by the speed trend on the PFD. R

AT 80 KTS or IAS FLUCTUATIONS . . . **Announce**

NO CHANGE

FROM STABILIZED APPROACH CONDITIONS, THE FLARE HEIGHT IS ABOUT 30 FT

FLARE . . . . Perform

ATTITUDE . . . . MONITOR

PNF should monitor the attitude and call out :

- PITCH PITCH when pitch reaches 9°
- BANK BANK when bank reaches 7°.

Note : *Do not flare too high or with too high pitch attitude. Tailstrike will occur at + 13° pitch.*
R *The pilot's objective, with respect to vertical*
R *navigation, is to maintain a constant flight path*
R *angle down to the runway threshold, using the*
R *vertical deviation indication of an ILS. However,*
R *when approaching flare height, the pilot's primary*
R *objective will shift from vertical flight path control*
R *to safe pitch attitude and vertical speed to start the*
R *flare in good conditions.*

THROTTLES . . . . Monitor idle

- Monitor throttles reduction to idle at 30 ft.
  If A/THR not engaged retard throttles to idle.

AT TOUCHDOWN

REVERSE LEVERS . . . . Pull

- Immediately after touch down of main landing gear, pull reverse levers to the idle reverse point, when REV (green) appears, apply max reverse.
- After reverse thrust is initiated, a full-stop landing must be performed.

Note 1 : *Maximum efficiency of the reverse is obtained at high speed.*

Note 2 : *Do not move reverse levers towards stow position while reversers are in transit ; such action may cause system damage.*

Note 3 : *If one or both REV UNLK lt remains on, apply reverse normally.*

Note 4 : *If the use of max reverse is restricted due to noise consideration, maintain reverse idle until taxi speed is reached.*

Note 5 : *If directional control problems are encountered, reduce thrust to reverse idle until directional control is satisfactory.*

- **MAX. REVERSE THRUST**. . . . . Apply
- **N1, EGT and IAS** . . . . Monitor

CAUTION

The use of high levels of reverse thrust at low airspeed should be avoided since the distortion of the air flow caused by gases re-entering the compressor can cause engine stalls which may result in excessive EGT.

GROUND SPOILERS . . . . check extension

- Check ground spoilers extension after touch down on ECAM system display.

Note : *If ground spoilers are not armed they will extend when reverse is selected.*

DIRECTIONAL CONTROL . . . . . . Rudder pedals

- Do not use NWS Control handle before taxi speed is reached

BRAKES . . . . As req

- Apply brakes as required or monitor autobrake
  When autobrake is used the PF should be ready to take over and apply manual braking as required.

CAUTION

If brakes are found inoperative, switch immediately BRK-A/SKID to ALTN/OFF and modulate brake pressure as required at or below 1000 PSI.
Brake pedals should be released when the A/SKID is switched OFF. Otherwise the pedal braking orders will be taken into account and the aircraft will react strongly.

AT 80 KTS or IAS FLUCTUATIONS . . . . . . Announce

REVERSE . . . . Idle

AT TAXI SPEED :

REVERSE . . . . STOW

- Stow the reverse when taxi speed is reached and before leaving the runway.

CAUTION

Do not recycle if reverse fails to stow. Engine shut down is recommended.

CAUTION

On taxiways, the use of reverse, even restricted to idle thrust, may have the following effects :

- Fine sand and debris may be ingested which might be detrimental to both the engine and airframe systems.
- On snow covered areas, snow will be recirculated into the air inlet, which may result in engine flame out or roll back.

Except in an emergency, reverse thrust should not be used to control aircraft speed while taxiing.

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To initiate Go Around, simultaneously :

R **Announce . . . . "GO AROUND-FLAPS"**

R Announce GO AROUND. When "GO-AROUND-FLAPS" is
R called, PNF retracts FLAPS one step and announce the
R new FLAP position when indicated.

GO LEVERS . . . . Trigger

Note : Triggering one GO LEVER is sufficient to initiate GO AROUND.

THROTTLE LEVERS . . . . GO AROUND thrust

Follow through on THROTTLE LEVERS if ATS is armed or manually set GO AROUND thrust if ATS is not armed.

> **CAUTION**
> PF should be ready to override or disconnect the autothrottle function in case of thrust asymmetry and to counteract aircraft yaw.

ROTATION . . . . Perform

Rotate the aircraft at a rate of typically 3 degrees per seconds.

Set a 18 degrees pitch attitude then follow the SRS orders if available (not exceeding 18 degrees) or maintain 18 degrees.

As thrust increases, be prepared to counteract the thrust pitch-up moment.

Trim the aircraft nose down as required. The pitch attitude should not be allowed to develop beyond 25 degrees, as such a pitch attitude would result in a significant speed loss.

An immediate and firm elevator nose down command (together with a nose down pitch trim order) would allow to recover the target pitch attitude.

FMA indication . . . . Announce
Check THR, GO AROUND

Note : FMS CDU automatically switches to GO AROUND page.

FLAPS . . . . Retract one step

Announce new FLAP positon when indicated.

THRUST . . . . Check/Adjust

Announce . . . . "Positive climb"

Order . . . . "GEAR UP"

L/G . . . . UP

FLIGHT PARAMETERS . . . . MONITOR

Monitor :
. the airspeed and speed trend,
. the pitch attitude and bank angle
. the thrust increase (GA thrust on the TRP and on N1/EPR indicators).

A call out must be made in case of excessive deviation :
. speed dropping below VLS – 5 KT
. speed trend negative
. pitch attitude in excess of 20 degrees
. bank angle in excess of 15 degrees (30 degrees if the missed approach procedure requires a turn)
. significant thrust loss.

NAV or HDG mode . . . . Select

Announce . . . . "GEAR UP"

L/G . . . . Neutral

At thrust reduction altitude

Set CL on TRP.

THROTTLES . . . Check symmetrical retard movement

Note : In case of asymmetrical throttle retard movement, A/THR should be disconnected and thrust manually set.

At GA acceleration altitude

SPD/MACH . . . . Select 250 Kt

LVL/CH . . . . Select

– Retract slats/flaps on schedule

MISSED APPROACH PROCEDURE . . . . . . Follow

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The following steps should be done once the aircraft has cleared the runway.

BRAKE FANS (if installed) . . . . **As req**

Brake fans selection should be delayed for a minimum of about 5 minutes or just before stopping at the gate (whichever occurs first), to allow for thermal equalization and stabilization and thus avoid oxidation of brake surface hot spots.
However, when turnaround times are short, or brake temperatures are likely to exceed 500°C, use the brake fans disregarding possible oxidation phenomenon.

Note : – *the arc displayed on the ECAM WHEEL page, suggesting the selection of brake fans at taxi out, should be ignored for taxi in.*
– *the ECAM BRAKE HOT warning after landing should not lead to the immediate selection of brake fans as long as 500°C is not likely to be reached (wait 5 minutes or gate arrival).*

LAND LTS . . . . **RETRACT**

Unless otherwise necessary.

STROBE LTS . . . . **AUTO**

Select the STROBE lights AUTO when leaving the runway.

ICE PROTECTION

ENG ANTI ICE . . . . **As req**

WING ANTI ICE SUPPLY . . . . **OFF**

IF ENG ANTI-ICE is used, take care to control taxi speed especially on wet or slippery surfaces (ground idle is increased)

IGNITION . . . . **OFF**

APU . . . . **Start**

APU start may be delayed until just prior to engine shutdown.

GROUND SPOILERS . . . . **Disarm**

ATC . . . . **STBY/OFF**

TCAS . . . . **STBY/OFF**

RADAR . . . . **OFF**

Turn off RADAR to prevent RADAR emissions

TEST (if installed) . . . . **Select**

Then in case of inadvertant switching of the RADAR to ON, no RADAR emission will occur.

PITCH TRIM . . . . **1° NOSE UP**

SLATS/FLAPS **0/0**

It is recommended to retract FLAPS step by step to minimise the possibility of jamming (mainly on bumpy taxiways).

If the approach was made in icing conditions, or, if the runway was contaminated with slush or snow, do not retract the slats/flaps until after engine shutdown once the ground crew has confirmed them clear of obstructing ice.

BRAKE TEMPERATURE . . . . **Check**

Check brake temperature on ECAM wheel page for discrepancy or high temperature.

A report for maintenance action must be made when :

1. temperature difference between two brakes on the same gear is greater than 150°C
   AND
   temperature of one brake is below 60°C (Loss of braking capability on this wheel) or temperature of one brake is above 600°C (brake binding on this wheel).

OR

2. difference between average temperature of LH and RH main landing gear brakes is greater or equal to 200°C (no significant crosswind, or differential braking).

AFTER LANDING

CHECK LIST . . . . **Completed**

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NOSE LIGHT . . . . **OFF/As req**

Turn nose light OFF before turning towards ground marshaller approaching stand.

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 engines shutdown.

PARKING BRAKE . . . . **ON**

CAUTION

R With Parking Brake ON, if the aircraft starts to move
R due to a parking brake failure, immediately release
R the Parking Brake and restore braking using the
R pedals.

Note : It is recommended not to leave PARKING BRAKE ON if "BRAKES HOT" ECAM message is displayed. Ensure chocks are in place as soon as possible so PARKING BRAKE can be released.

APU BLEED . . . . **ON**

- Check APU bleed established

  Note : Selection of APU BLEED before engine shut down avoids cycling of the packs.
  However delay as late as possible to avoid engine exhaust fumes entering the air cond.
  If APU is not available, set EXT PWR to ON before shutting down engines.

ENGINES FUEL LEVERS . . . . **OFF**

- Check engine parameters decrease

Note : 1) For thermal stabilization before shutdown the engines should be operated at idle or required taxi thrust until gate arrival. Refer to Single Engine Taxi procedure, as required.

2) If N2 does not decrease upon FUEL LEVER selection to OFF (HP VALVE light illuminated) select hydraulic pumps OFF and pull fire handle. Engine will shut down after 70 to 90 sec.

3) OIL LO PRESS warning may be spuriously triggered after fuel lever is selected off. If occurs, the warning may be disregarded.

ELAPSED TIME . . . . **Stop**

EXT LTS . . . . **As req**

- Set all lights as required. Switch off BEACON once all engines have spooled down.

SLIDE DISARMED . . . . **Check**

Check on ECAM DOOR page. Warn cabin crew if a slide is not disarmed.

CABIN PRESS . . . . **Check**

Check differential pressure is zero and inform cabin and ground crew that cabin and cargo doors can be opened.

SEAT BELTS . . . . **OFF**

GROUND CONTACT . . . . **Establish**

PARKING BRAKE . . . . **OFF/As req**

- Check chocks in place and release parking brake to improve cooling

It is recommended not to use the parking brake for prolonged periods when brake temperatures are above 200°C to avoid hydraulic fluid degradation.

RUD TRAVEL

Note : Do not select RUD TRAVEL pushbutton switches to OFF.

FUEL PUMPS **OFF**

- Set all fuel pumps to OFF except L INNER TANK Pump 2 if fuel remains in INNER TK and APU is used.
- TRIM TK MODE Pushbutton . . . . Check AUTO

WINDOW HEAT . . . . **OFF**

Note : Window Heat can be selected ON during the turn-around time to avoid ice build-up on the frontal windshield and the lateral windows.

PROBE HEAT . . . . **OFF**

- Select CAPT, STBY and F/O pushbutton switches to OFF

IRS . . . . **Check**

Record IRS 1, 2, 3 position, position error, Ground speed or drift rate as required for maintenance monitoring.

IRS MSU 1, 2, 3 . . . . **OFF/As req**

IRS ISDU . . . . **OFF/As req**

BRAKE TEMP . . . . **Check**

BRAKE FAN (If installed) . . . . **OFF/As req**

Select brake fans OFF when brake temperature is below 100°C

CRT's : (FMS, ECAM, EFIS) . . . . **Dim**

- Dim the CRTs to increase their life, do not switch OFF.
- If aircraft is not flying again within 2 hours, switch EFIS CRTs to OFF.

PARKING CHECK LIST . . . . **Completed**

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SECURING THE AIRCRAFT

R This procedure should be accomplished when required
R by airline policy.

IRS MSU 1, 2, 3 . . . . OFF

R – After switching the IRS OFF, wait at least 10
R seconds before switching off the electrical supply
R to ensure that the IRS memorize the last position
R data.

CREW OXYGEN . . . . OFF

EXTERIOR LTS . . . . OFF

CRT'S . . . . OFF

APU AIR BLEED . . . . OFF/R

EXT PWR . . . . AS REQUIRED

APU . . . . AS REQUIRED

R – Set master switch to OFF after the
passengers have disembarked.

R – Set L INR TK PUMP 2 to OFF.

CAUTION

R If APU is running when leaving the aircraft do not
R switch off the BATTERIES.

EMERG EXIT LT . . . . DISARM

BATTERIES . . . . OFF

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COMMUNICATIONS AND STANDARD TERMS

Standard phraseology is essential to ensure effective crew communication. The phraseology should be concise and exact. The following chapter lists calls that should be used as standard. They supplement the call outs identified in the SOP.

These Airbus standard calls are also designed to promote situational awareness, and to ensure crew understanding of systems and their use in line operation.

CHECKLIST CALLS

- "CHECK" : a command for the other pilot to check an item.
- "CHECKED" : a response that an item has been checked.
- "CROSS-CHECKED" : a call verifying information from both pilot stations.

If a checklist needs to be interrupted, announce "HOLD CHECKLIST AT ___" and "RESUME CHECKLIST AT ___" for continuation.

At the completion of a checklist announce "__CHECKLIST COMPLETED".

ACTIONS COMMANDED BY PF

The following commands do not necessarily initiate a change in a guidance mode. The intend is to ensure clear, consistent, standard communication between crew members.

All actions made on the FCU must be verified on the PFD/ND, ensure that the correct FCU knob is used, then verify indications on the PFD/ND.

SET

The command "SET" means to use a knob to set a value, but not to change a mode. SET is accomplished by only rotating the appropriate selection knob :

e.g. : "SET GO AROUND ALTITUDE__"

e.g. : "SET QNH __"

e.g. : "SET ALTITUDE __"

ENGAGE

The command "ENGAGE" means to PUSH the specified FCU button or set the specified lever or switch to "ON" that causes an immediate FMA change.

e.g. : "ENGAGE NAV"

e.g. : "ENGAGE PROFILE"

e.g. : "ENGAGE ALT HOLD"

ARM

The command "ARM __" means to arm a system, such as by pushing the specified FCU button.

e.g. : "ARM LAND"

e.g. : "ARM LOC."

PULL

The command "PULL" means to use a FCU knob to engage a mode.

e.g. : "ALTITUDE 8000 PULL"

e.g. : "VERTICAL SPEED SET - 1000$^{FT}/_{MN}$ AND PULL"

PUSH

The command "PUSH" means to use a FCU knob to synchronize or preset a value.

e.g. : "HEADING PUSH"

e.g. : "SPEED PUSH PRESET 250"

Note 1 : *Whenever there is no requirement for PULL/PUSH, and if a new setting is required, simply command SET the specific selector knob followed by the required value.*

e.g. : existing mode is lateral mode heading of 140 degrees and a new heading of 100 degrees is required ; command should be "SET HEADING 100".

Note 2 : *All actions made on the FCU and CDU must be verified on the PFD and ND as follows :*

a. First, ensure that the correct FCU knob is used, then verify indications on the PFD/ND.
b. Mode changes should be confirmed by calling the colour when appropriate - e.g. BLUE, GREEN.

FMA

Unless listed otherwise (e.g. CAT II & III task sharing), all FMA changes will be normally called by the PF and checked by the PNF :

- All armed modes are announced by calling their associated color e.g.: "G/S BLUE", "LOC BLUE".
- All active modes are announced without calling the color (green, white) e.g. : "NAV", "ALT".

ALTITUDE

The PNF calls "ONE THOUSAND TO GO" when passing 1000 feet before the cleared altitude or FL, and the PF calls "CHECKED".

SLATS/FLAPS CONFIGURATION

After selection of the Slats/Flaps lever position, the PNF replies when the correct selection is shown on SFPI.

EXTENSION

R PNF Checks the speed below V_{FE} next and decelerating (approach).

SLATS/FLAPS CONFIGURATION	PF	PNF
0/0 to 15/0	SLATS EXTEND	SPEED CHECKED SLATS EXTENDED
15/0 to 15/15	FLAPS 15	SPEED CHECKED FLAPS 15
15/15 to 20/20	FLAPS 20	SPEED CHECKED FLAPS 20
20/20 to 30/40	FLAPS 40	SPEED CHECKED FLAPS 40

RETRACTION

R PNF Checks the speed above the S or F speed and accelerating (takeoff).

SLATS/FLAPS CONFIGURATION	PF	PNF
SLATS/FLAPS 20/20 passing "F" speed 20/20 to 15/0	FLAPS 0	SPEED CHECKED FLAPS 0
SLATS 15 passing "S" speed 15/0 to 0/0	SLATS RETRACT	SPEED CHECKED SLATS RETRACTED

GEAR CONFIGURATION

EVENT	PF	PNF
To rectract the landing gear	GEAR UP	GEAR UP/NEUTRAL The PNF selects the gear lever position and replies when lights are extinguished and gear lever set to Neutral.
To extend the landing gear	GEAR DOWN	GEAR DOWN The PNF selects the gear lever position and replies after checking 3 green lights on the landing gear main indication panel.

FLIGHT PARAMETERS

PNF will make calls for the following conditions during final approach. Attitude callouts are also to be made through to landing.

CONDITIONS	PNF
When airspeed becomes less than Vapp – 5 or more than speed target + 10.	SPEED
When V/S is greater than – 1000 ft/min.	SINK RATE
When bank angle becomes greater than 7°.	BANK
When pitch attitude becomes lower than 0° or higher than + 10° nose up. For non precision approach, when pitch attitude becomes lower than –2.5° or higher than 10° nose up.	PITCH
When excessive LOC or GLIDE deviation occurs : – 1/4 dot LOC – 1 dot GS.	LOC or GLIDE
When greater than 0,5 dot (VOR) or 5 degrees (ADF).	COURSE
At altitude checks points.	__FT HIGH (LOW)

PF/PNF DUTIES TRANSFER

To tranfer control, flight crewmembers must use the following calls :

To give control : The pilot calls "YOU HAVE CONTROL". The other pilot accepts this transfer by calling "I HAVE CONTROL", before assuming PF duties.

To take control : The pilot calls "I HAVE CONTROL". The other pilot accepts this transfer by calling "YOU HAVE CONTROL", before assuming PNF duties.

ABNORMAL AND EMERGENCY CALLS

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, the call "REMOVE STATUS" is used.

4. "ECAM ACTIONS COMPLETED" is the announcement by the PNF that all APPLICABLE ACTIONS have been completed and system pages have been reviewed.

5. Should the PF requires an action from the PNF during ECAM procedures, the order "STOP ECAM" is used. When ready to resume the ECAM the order/statement "CONTINUE ECAM" is used.

MEMORY ITEMS

The following commands allow the crew to be aware of a situation that requires or will require actions to be done by memory. Crew will be prepared to properly react in terms of crew coordination, task sharing and communication.

CALLS	CONDITIONS
PULL UP TOGA	When GPWS warning require an avoidance maneuver.
WINDSHEAR TOGA	When windshear conditions required to select maximum takeoff power
UNRELIABLE SPEED	When an unreliable speed indication is detected
TCAS, I have control	"TRAFFIC" warning is triggered by TCAS
EMERGENCY DESCENT	When EMERGENCY DESCENT has to be initiated
LOSS OF BRAKING	In case of loss of braking at landing.

SUMMARY FOR EACH PHASE

EXTERNAL POWER DISCONNECTION		
EVENT	**PF**	**GND Mech**
Initial ground contact	GROUND (from) COCKPIT	COCKPIT (from) GROUND
External __ disconnection	REMOVE EXTERNAL __	EXTERNAL __ REMOVED

BEFORE ENGINE START		
EVENT	**PF**	**PNF**
Before start up clearance received	BEFORE START C/L DOWN TO THE LINE	BEFORE START C/L COMPLETED DOWN TO THE LINE
After start up clearance received	BEFORE START C/L BELOW THE LINE	BEFORE START C/L COMPLETED

PUSH BACK		
EVENT	**PF**	**GND Mech**
When ready for push back and push back clearance received from ATC	GROUND, (from) COCKPIT READY FOR PUSH	COCKPIT, (from) GROUND RELEASE PARKING BRAKE
Start of push	BRAKES RELEASED CLEARED TO PUSH	
When push back completed	BRAKES SET	SET PARKING BRAKES
When ready to disconnect (engine parameters are stabilized)	CLEAR TO DISCONNECT (hand signals on left/right)	DISCONNECTING (hand signals on left/right)

ENGINE START

EVENT	PF	PNF	GND
When start up clearance obtained	CLEAR TO START?		
			CLEAR TO START
	STARTING ENGINE(S) __		
			ROTATION
When fan starts to rotate			

AFTER ENGINE START

EVENT	PF	PNF
All engines started and stabilized and GND is disconnected	AFTER START C/L	
		AFTER START C/L COMPLETED

TAXI/BEFORE TAKEOFF

EVENT	PF	PNF
When taxi clearance obtained	CLEAR LEFT (RIGHT) SIDE	CLEAR RIGHT (LEFT) SIDE
Checking Brakes	BRAKE CHECK	PRESSURE ZERO
Flight controls 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
R 3. Rudder R *Note : the PNF should follow pedal* R *movement with feet*	RUDDER	FULL LEFT FULL RIGHT NEUTRAL
During taxi	BEFORE TAKEOFF C/L DOWN TO THE LINE	BEFORE TAKEOFF C/L DOWN TO THE LINE COMPLETED
Lining up on the runway	BEFORE TAKEOFF C/L BELOW THE LINE	BEFORE TAKEOFF C/L COMPLETED

TAKEOFF		
EVENT	**PF**	**PNF**
When triggering go levers	TAKEOFF ANNOUNCE FMA	CHECKED
R Before passing 80 kts		THRUST SET
At 100 kts	CHECKED	ONE HUNDRED
At V1		V1
At VR		ROTATE
When positively clear from the ground (+ V/S and RAD ALT increase)	GEAR UP	POSITIVE CLIMB
If AP is required	ENGAGE AP__ Followed by confirmation on FMA	AP__ENGAGED
When gear retracted		GEAR UP/NEUTRAL
When F Speed and accelerating	FLAPS 0	SPEED CHECKED FLAPS 0
When S Speed and accelerating	SLATS RETRACT	SPEED CHECKED SLATS RETRACTED
After TAKEOFF/CLIMB checklist	AFTER TAKEOFF C/L DOWN TO THE LINE	AFTER TAKEOFF C/L DOWN TO THE LINE COMPLETED
At transition altitude	AFTER TAKEOFF C/L BELOW THE LINE	AFTER TAKEOFF C/L COMPLETED

REJECTED TAKEOFF

EVENT	CAPTAIN	F/O
RTO decision	STOP	
Max reverse thrust selection		REVERSE GREEN (see note 1 below)
Deceleration		DECEL (see note 2 below)

Note 1 : If reverse deployment is not as expected, call "NO REVERSE ENGINE __" or "NO REVERSE", as appropriate.
Note 2 : "DECEL" call means that the deceleration is felt by the crew and confirmed by the speed trend on the PFD.

CLIMB, CRUISE, DESCENT PHASES

During climb, cruise and descent phases communication should be standardized as mentioned in paragraph COMMUNICATIONS AND STANDARD TERMS of this section 2.03.30 (page 1)

ALTIMETER SETTING CHANGES TO/FROM QNH/QFE-STD

EVENT	PF	PNF
Barometric setting change and subsequent altimeter cross-check	PULL STANDARD CHECKED	STANDARD CROSS-CHECKED PASSING FL__NOW
	SET QNH/QFE__ CHECKED	QNH/QFE __CROSS-CHECKED PASSING __ FT NOW

APPROACH AND LANDING
STABILIZED ILS APPROACH

EVENT	PF	PNF
When cleared below transition level or as appropriate.	APPROACH C/L	APPROACH C/L COMPLETED
Initial Approach	SET GREEN DOT SPEED (see note 3 below)	GREEN DOT SPEED SET
Beginning of Radio Altimeter indication	CHECKED	RADIO ALTIMETER ALIVE (see note 1 and 2 below)
At Green Dot Speed (or below VFE)	SLATS EXTEND SET ”S” SPEED (see note 3 below)	SPEED CHECKED SLATS EXTENDED
At ”S” speed (or below VFE)	FLAPS 20 SET ”F” SPEED (see note 3 below)	SPEED CHECKED FLAPS 20
INTERCEPTION HEADING	ARM LAND (see note 3 below)	LAND ARMED
LOCALIZER CAPTURE	LOC STAR SET RWY HEADING (see note 3 below)	__° SET
2 DOTS (1 DOT) SINGLE ENGINE	GEAR DOWN	GLIDE SLOPE ALIVE GEAR DOWN
When gear is down	FLAPS 40 SET VAPP (see note 3 below)	SPEED CHECKED FLAPS 40 VAPP SET
GS CAPTURE	GLIDE SLOPE STAR SET GO AROUND ALTITUDE (see note 3 below)	__^{FT} SET
FAF or OM if applicable	PASSING__(Fix name) or OM__^{FT}/TIMING	CHECKED (TIMING)
When FLAPS 40	LANDING CHECK LIST	LANDING C/L COMPLETED

R *Note 1 : Crew should now keep RA in scan to landing.*

R *Note 2 : PNF monitors auto callouts or announces if inoperative (as often as practical – CAT I and lower only).*

R *Note 3 : This call is recommended in manual flying.*

APPROACH AND LANDING
STABILIZED ILS APPROACH

EVENT	PF	PNF
1000^{FT} AGL	CHECKED	ONE THOUSAND (see note 2 below)
700^{FT} AGL Each pilot checks the ILS selected course on his ND.		COURSE SET
400^{FT}	LAND	CHECKED
100^{FT} above MDA	CHECKED	ONE HUNDRED ABOVE
MDA visual reference	CONTINUE	MINIMUM
MDA no visual reference	GO AROUND FLAPS	MINIMUM
		ONE HUNDRED FIFTY (see note 2 below)
After touch down		SPOILERS REVERSE GREEN (See the note 3 below)
When autobrake armed		DECEL (See note 4 and 5 below)
At 80kts groundspeed or IAS fluctuations		EIGHTY KNOTS

Note 1 : Crew should now keep RA in scan to landing.

Note 2 : PNF monitors auto callouts or announces if inoperative (as often as practical – CAT I and lower only).

Note 3 : If reverse deployment is not as expected, call NO REVERSE ENGINE__ or NO REVERSE, as appropriate.

Note 4 : "DECEL" call means that the deceleration is felt by the crew and confirmed by the speed trend on the PFD.

Note 5 : if Autobrake is armed and NO flow BAR green light observed, call NO AUTOBRAKE

GO AROUND

EVENT	PF	PNF
GO AROUND decision	GO AROUND – FLAPS	
Flaps retraction		FLAPS__
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
Checklist	AFTER TAKEOFF C/L DOWN TO THE LINE	AFTER TAKEOFF C/L DOWN TO THE LINE COMPLETED
At transition altitude	AFTER TAKEOFF C/L BELOW THE LINE	AFTER TAKEOFF C/L COMPLETED

AFTER LANDING

EVENT	PF	PNF
Checklist	AFTER LANDING C/L	AFTER LANDING C/L COMPLETED

PARKING

EVENT	PF	PNF
Checklist	PARKING C/L	PARKING C/L COMPLETED

SECURING THE AIRCRAFT

EVENT	PF	PNF
Checklist	SECURING THE AIRCRAFT C/L	SECURING THE AIRCRAFT C/L COMPLETED

CONTENTS

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GENERAL

- The emergency procedures provide the sequences of actions to be performed following :
  - A red warning,
  - An emergency condition not associated to a warning (e.g. both engine flame out, forced landing or ditching).
- The emergency procedures are to be applied following the READ-AND-DO principle.

COORDINATED USE OF ECAM AND QRH

- The ECAM and QRH (Quick Reference Handbook) must be used in a coordinated manner.
- The QRH is used :
  - When no ECAM procedure is available,

  or
  - When a QRH procedure is called by the prompt PROC in an ECAM warning page or in the ECAM STATUS page,

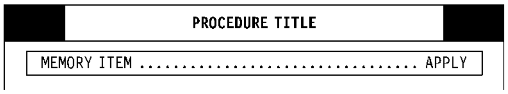
    and / or (in any case),

    before completing the ECAM STATUS page, in order to review the **originating procedure** for possible additional actions or information.
- Referring to the FCOM 1 and / or FCOM 2 is not required for the short term handling of any emergency procedure but may be considered when convenient, if so desired.

PROCEDURES LAYOUT

The FCOM / QRH procedures are presented using the following layout standards :

- Emergency procedures are identified by two black rectangles on each side of the title on top of the procedure
- ACTIONS : all actions are printed in capital letters. For enhanced clarity, actions are regrouped by action blocks (e.g. actions related to the same system or the same purpose) when there is space available. The abbreviations are used only when abbreviations are used on the ECAM or on the cockpit panels,
- MEMORY ITEMS : are identified by a thin solid line box. These actions have to be performed without referring to the QRH.



PROCEDURE TITLE

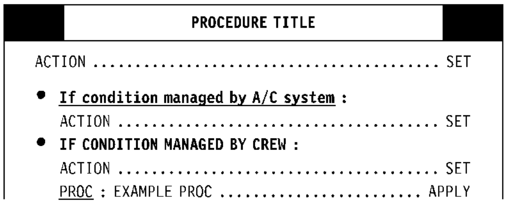
MEMORY ITEM .... APPLY

- ECAM ACTIONS : are identified by a bold solid vertical line,
- ECAM STATUS : items are identified by a bold dotted vertical line,
- Conditional actions :
  - ■ squares symbols are used whenever several conditions (**If**) are possible but **only one entry is to be used,**
  - • dots are used to identify a condition or a flight phase (e.g. **If, At, When**), all questions starting by a dot must be answered.

  Note : ■ and • are not displayed on ECAM.

  Small underlined letters in QRH mean that the condition is not displayed on the ECAM, but this condition is managed by the aircraft system.

  If the condition is displayed on the ECAM, it appears in the QRH in large letters and have to be managed by crew.



PROCEDURE TITLE

ACTION .... SET

• If condition managed by A/C system :

ACTION .... SET

• IF CONDITION MANAGED BY CREW :

ACTION .... SET

PROC : EXAMPLE PROC .... APPLY

Note : When action requests to set a system "OFF/R", the OFF position must be selected. It is not a request for reset.

- Cross-references :
  - when an other QRH procedure is cross-referenced, the procedure title is indicated after the prompt PROC :, and the associated QRH page is indicated between brackets,
- FLIGHT PHASE identifies the actions which must be delayed until indicated flight phase (e.g. FOR LANDING, FOR APPROACH...),
- Expanded information : for each procedure, an expanded information is provided in order to :
  - list the indications (warning light and audio warning) and / or clues associated with the prevailing emergency condition,
  - provide background information regarding the reason(s), result(s) and benefit(s) of actions (unless such reason, result and benefit are self evident).

PROCEDURES INITIATION

- No action shall be taken (apart from audio warning cancel) until :
  - – The appropriate flight path is stabilized,
  - – Normal procedures are applied,
  - – At least 400 ft above runway, in case of failure during takeoff, approach or go-around,
    - A height of 400 ft is recommended as a good compromise between :
      - * the time required for flight path stabilization,
      - * the initiation of the procedure without excessive delay.
    - In some emergency conditions, provided the appropriate flight path is established, the PF may initiate actions before reaching 400 ft AGL.
  - – Appropriate command by PF.

TASK SHARING

- The Pilot Flying (PF) remains PF throughout the entire procedure.
- However, when actions can only be performed from one side (e.g. landing gear gravity extension, minimum equipment bay sniffer fan), tasks must be redistributed accordingly.
  - – The PF (Pilot Flying) is responsible for :
    - Throttle levers,
    - Flight path and airspeed control,
    - Aircraft configuration (PF orders, PNF executes),
    - Navigation,
    - Communications.
  - – The PNF (Pilot Non Flying) is responsible for :
    - Reading the ECAM and QRH,
    - Execution of ECAM actions and paper check-list(s), upon PF command,
    - Actions on fuel levers, fire handles and guarded switches (with confirmation of PF).

    Note : During a rejected takeoff, an on-ground engine fire or an on-ground emergency / evacuation, a CAPT-F/O task sharing applies.

    Note : Memory Items may be carried out by either pilot, since response time may be important for success. However, initiation of Memory Items must be called out by the PF.

- Whenever a procedure calls for LAND ASAP, landing at the nearest suitable airport (considering the applicable LDG DIST factor, if any) must be considered.
- Following a fire or smoke condition, landing at the nearest suitable airport is recommended even if the fire (smoke) source has been successfully extinguished (stopped).
- **If the fire or smoke source cannot be extinguished (stopped) or if extinction cannot be positively confirmed, landing at the nearest suitable airport must be considered.**

LDG SPEED INCREMENT - LDG DISTANCE FACTOR

- Unless otherwise specified in the procedures, the minimum speed to be used for approach and landing is the VLS corresponding to the configuration requested by the procedure.

  Note : VLS, when mentioned in a procedure, is the one corresponding to the configuration requested by the procedure (e.g. if the procedure requests to use 15°/15° configuration, take VLS of 15°/15° configuration).

- When applicable, the LDG SPEED INCREMENT is to be added to the indicated V LS.
  - – A V LS increment is indicated on the ECAM STATUS page and in the FCOM / QRH procedure only when the indicated V LS does not account for the abnormal condition, this is the case only in the following three conditions : R
    - Kruger flaps not extended when selected,

      or
    - Loss of 4 or more roll spoilers per wing.

      or R
    - Spoiler(s) stuck in extended position. R

    In all other abnormal conditions, the indicated V LS accounts for the abnormal configuration. For abnormal slats or flaps configuration, the QRH increment applies to VREF only.

- The SPD INCREMENT is to be added to S and F speeds, only if specified in the QRH procedure :
  - Loss of krugers :
    - * SPD INCREMENT applicable to S, F and V LS for recovery of the stall margin.
  - Loss of 4 or more roll spoilers per wing :
    - * SPD INCREMENT applicable to V LS only for recovery of the maneuvering capability.
- The LDG DIST factor is to be applied on the LDG DIST 30 / 40 (QRH 15.02).
  - A LDG DIST factor is indicated on the ECAM STATUS page and in the FCOM / QRH procedure only in the following conditions :
    - When a LDG SPD INCREMENT is applicable,

    and / or
    - In case of loss of 3 or more ground spoilers per wing,

    and / or
    - In case of braking in ALTN / ON or ALTN / OFF.

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 performing an ECAM or non-ECAM procedure, both pilots must be fully aware of the status of the warning and system displays.
- After completing a warning page, CLEAR ... (title of the ECAM page) is proposed by the PNF but must be confirmed by the PF (after checking the status of the warning and system pages) before the PNF presses the CLR key.

AFFECTED EQUIPMENT REVIEW

- In case of Abnormal/Emergency procedure related to Electrical, Hydraulic, Auto flight systems or Servo Controls, the affected equipment have to be reviewed using the dedicated tables :
  - BUS EQPT LIST (QRH 3.08 - 3.09 - 3.10)
  - HYDRAULIC POWER DISTRIBUTION (QRH 8.01)
  - AUTO FLIGHT SYSTEM – DISTRIBUTION (QRH 11.03)
  - SERVO CONTROLS (QRH 6.12).

OPERATING ENGINEERING BULLETIN (OEB)

An 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. The information in the OEB should be followed immediately. R

The list of applicable OEBs is in the FCOM 2.19 and in QRH 19.00. R

In addition the OEB operational procedure(s) that the flight crew must apply are provided in the QRH (19.00). R

Example of Coordination and Cross-Confirmation

WARNING DISPLAY	PILOT FLYING	PILOT NOT FLYING
HYD BLUE RSVR OVHT – BLUE PUMP . . . . OFF	– READ FAILURE TITLE – TAKE ATC RADIO CTL – REQUEST «ECAM ACTION*»	– READ FAILURE TITLE – READ ACTION (full line) – PERFORM ECAM ACTION OR REQUEST EXECUTION BY THE PF
	– REQUEST «PAPER C/L» IF APPLICABLE	
HYD BLUE RSVR OVHT BLUE PUMP OFF BLUE SYS LO PR		– REQUEST « CLEAR HYDRAULIC »
	– CHECK ECAM ACTION COMPLETED – CONFIRM « CLEAR »	
* FLT CTL SLATS SYS 1 FAULT SPLR 7 FAULT . . . . OFF SPLR 3+2 FAULT . . . . OFF YAW DAMPER 1 OFF		– PERFORM ECAM ACTIONS FOR SECONDARY FAILURES – CHECK NO CYAN ON ECAM – REQUEST « CLEAR FLIGHT CONTROLS »
	– CHECK ECAM WARNING AND SYSTEM PAGES – CONFIRM « CLEAR »	
STATUS LAND 3 INOP LDG DIST : MULTIPLY BY 1.2 PROC : HYD SYS LO PR BLUE HYD SYS INOP SPLR PARTIALLY INOP SLATS SLOW		– READ STATUS LINE BY LINE
	– REQUEST « PAPER C/L » Note : STATUS will be called in APPROACH C/L	
		– PERFORM PAPER C/L – CONFIRM « PAPER C/L COMPLETED »
	– REQUEST « CONTINUE STATUS »	– READ STATUS LINE BY LINE – CONFIRM « STATUS COMPLETED »
	– REQUEST « PAPER C/L FOR (originating procedure) »	– REVIEW/PERFORM PAPER C/L FOR POSSIBLE ADDITIONAL ACTION/INFORMATION
		– REQUEST « CLEAR STATUS »
	– CONFIRM « CLEAR »	
		– CONFIRM « ECAM ACTIONS COMPLETED »

* Although the pilot flying requests ECAM actions, this does not preclude the CM1 from either taking control of the aircraft or ordering ECAM actions if he/she considers this necessary.

EMER DESCENT

CREW OXY MASKS . . . . ON
CREW COMMUNICATIONS (HEADSETS) . . ESTABLISH

TURN . . . . INITIATE
DESCENT . . . . INITIATE

- **<u>It is recommended to descend with AP engaged</u>** :
  FCU ALT . . . . DECREASE
  LVL/CH . . . . ENGAGE
  SPD/MACH . . . . SELECT SPD

THROTTLES . . . . IDLE
SPD BRK . . . . FULL
SPD . . . . ADJUST AS REQUIRED

CAUTION : ***Descend at maximum appropriate speed or reduce speed if structural damage is suspected.***

SEAT BELT . . . . ON

NO SMOKING . . . . ON

IGNITION . . . . CONT RELIGHT

ATC (VHF 1) . . . . NOTIFY
TRANSPONDER (ATC 1) . . . . 7700 OR 77..

FCU ALT . . . . MEA/MORA
LDG ELEVATION . . . . SET

- **<u>If CAB ALT above 14000 ft</u>** :
  OXYGEN PASSENGER . . . . MAN OVRD
  SYSTEM ACTUATED . . . . CHECK ON
  R CABIN CREW CONFIRMATION OF MASKS
  R RELEASED . . . . OBTAIN

- **<u>Below 20 000 ft and below 270 kt IAS</u>** :
  L/G LEVER DOWN . . . . CONSIDER

CREW OXY MASKS . . . . SET "N"

EMERGENCY DESCENT

– The descent is initiated in a turn, do not exceed a maximum bank angle of 30°. R R

– The following applies, in case of rapid decompression :

a) Ensure crew communication is established with oxygen masks. Set oxygen masks on normal (N) position.

b) Avoid the use of interphone position to minimize interference from oxygen mask breathing noise.

c) Passenger signs come on automatically when cabin altitude exceeds 11,300 ft except if MAN PRESS is selected.

d) Passenger oxygen masks drop automatically and OXYGEN SYS ACTUATED light illuminates green when cabin altitude exceeds 14,000 ft.

Confirm system activation by selecting the OXYGEN PASSENGER guarded switch to MAN OVRD.

e) Notify cabin crew to confirm that passenger masks are released. R R

– Maximum airspeed is MMO/VMO.
If structural damage is suspected use the flight controls with care and reduce speed as appropriate.

– In the event ATC cannot be contacted select ATC code 7700 or declare an emergency on one of the following frequencies :

(VHF) 121.5 MHz or (HF) 2182 KHz or 8364 KHz.

– Landing gear may be extended when below 20,000 ft at VLO/VLE 270 Kt to increase the rate of descent.

(Above 20000 ft, descending at MMO/VMO with landing gear retracted provides the highest rate of descent).

EXCESS CAB ALT

OXY MASK . . . . ON
DESCENT . . . . AS RQRD

- **IF RAPID DECOMPRESSION**
  EMER DESCENT . . . . PERFORM
  ATC . . . . INFORM
  IGNITION . . . . CONT RELIGHT
  TRANSPONDER . . . . AS RQRD
  <u>PROC</u> : EMER DESCENT (2.01) . . . . APPLY

- **<u>If no REG FAULT illuminated or no automatic change-over :</u>**
  CABIN PRESS REG (affected system) . . . . OFF
  - **<u>If CAB ALT control not recovered</u>** :
    DESCENT . . . . INITIATE

EXCESS CAB ALT

<u>Indications :</u>

Continuous repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : EXCESS CAB ALT procedure
Right ECAM CRT : CAB PRESS system page

– If decompression is rapid, apply EMER DESCENT procedure.

– Oxygen masks should be set to the normal (N) position.

Mod : 6269

LOSS OF BOTH ENG GENERATORS

IGNITION . . . . CONT RELIGHT

GEN 1 and 2 . . . . OFF/R then ON

- ● **<u>If GEN 1 and 2 not recovered (and APU GEN not available)</u>** :
  - ● **<u>If APU not required for air bleed</u>** :

    APU MASTER SWITCH . . . . CHECK OFF

  STBY GEN OPERATION . . . . CONFIRM BY :

  – DC ESS ON BAT . . . . . CHECK EXTINGUISHED
  – AC EMER ON INV . . . . CHECK EXTINGUISHED
  – FUEL X-FEED . . . . CHECK IN-LINE

  - ● **<u>If STBY GEN FAULT light illuminated</u>** :

    STBY GEN . . . . OVRD

    - ● **<u>If STBY GEN inoperative</u>** :

      <u>PROC</u> : FLIGHT ON BAT ONLY (3.05) . . APPLY

  - R ● **<u>If STBY GEN operative</u>** :

    PITCH TRIM 1 . . . . RESET

    YAW DAMPER 1 . . . . RESET

    TRIM TK MODE . . . . FWD

    COMMUNICATIONS VHF1/ATC1

    VENT EXTRACT . . . . OVBD

    PACK 1 . . . . MAN CTL

    LDG GEAR POSITION DET . . . . SYS 1

    RUDDER TRAVEL 1 . . . OFF, after 1 min . . . ON

    THROTTLE 1 + 2 . . . . REDUCE

    ENG 1 and 2 MODE N1

    N1 THRUST SETTING . . . . AS RQRD

    FUEL MANAGEMENT (3.07) . . . . APPLY

    BUS EQPT LIST-STBY GEN (3.08/3.09) . . REVIEW

    LDG DIST/VREF increments (15.02, 15.04) . DETERMINE

    LAND ASAP

(continued)

LOSS OF BOTH ENG GENERATORS

<u>Indications :</u>

Single chime

ECAM activation with appropriate warning light

The following lights illuminate on ELEC panel : GEN 1 and 2 FAULT, AC BUS 1 and 2, DC NORM BUS OFF.

– Generators reset may be successful if the origin of the fault was an electrical transient (lightning strike for instance).
– If the loss is caused by subsequent GEN or IDG failure, refer to GEN FAULT or IDG FAULT (use of APU if available. In case of unsuccessful APU start make sure that APU MASTER switch is reselected OFF).
– In case of GEN recovery, restore systems following ECAM INDICATIONS.
– Check of APU MASTER SWITCH to OFF is requested to confirm operation of stand-by generator (performed by checking that DC ESS BUS ON BAT and AC EMER ON INV ligths are extinguished). Indeed with APU MASTER SWITCH set to ON and APU N < 60 % during stand-by generator operation, DC ESS BUS is supplied by batteries and therefore DC ESS BUS ON BAT light is illuminated.
– If operation of stand-by generator is not confirmed, set STBY GEN p/b to OVRD position for manual start of stand-by generator. If manual start is unsuccessful, the aircraft is supplied by batteries only.
– APU start is possible below 20000 ft during operation of stand-by generator. During APU start sequence, DC ESS BUS is supplied by batteries to avoid auto shut down of stand-by generator (due to high DC loads). If APU start is unsuccessful, APU MASTER SWITCH must be re-selected OFF.
– EPR probes are not heated. FADEC automatically reverts to N1 mode. Confirmation should be performed by selecting both ENG MODE p/b switches to N1 position. Thrust managements should be performed using N1 parameter.
– If stand by generator is used in temperature conditions above ISA + 30, the green hydraulic fluid temperature may reach the warning level. In this case, the green hydraulic pumps must not be selected OFF.
– VENT EXTRACT is selected to OVBD to ensure ventilation of electronic bay with blower fans lost.
As both HP valves are not supplied, it may be necessary to re-select VENT EXTRACT to normal and/or to increase engine power during descent to avoid triggering of EXCESS CAB ALT warning due to high rate of cabin leakage.
– For equipment supplied by stand-by generator, refer to BUS EQPT LIST.

(continued)

LOSS OF BOTH ENG GENERATORS (cont'd)

FUEL MANAGEMENT

- **If CTR + TT FQI above 500 kg (1100 lb)** :
  L INR TK PUMP 2 and R INR TK PUMP 1 . . . OFF
- **When CTR + TT FQI below 500 kg (1100 lb)** :
  L INR TK PUMP 2 and R INR TK PUMP 1 . . NORM
  - **When L INR TK empty or fuel unbalance (max 4t/8800lb)** :
    L INR TK PUMP 2 . . . . OFF
  - **When R INR TK empty or fuel unbalance (max 4t/8800lb)** :
    L INR TK PUMP 2 . . . . NORM

  REPEAT CYCLE UNTIL BOTH INR TK'S ARE EMPTY.
- **When L and R INR TK empty** :
  IGNITION . . . . CONT RELIGHT
  MAX FL . . . . 250 (200 IF JP4/JET B USED)/MEA
  OUTR TK ISOL VALVES . . . . . . CHECK IN LINE
  INR TK ISOL VALVES . . . . OFF

  CAUTION : Avoid rapid throttle movement and negative load factors (fuel gravity feeding).
- **Before slats extension :**
  LAND RECOVERY . . . . ON

  CAUTION : DC power is now supplied from batteries, flight duration will be limited.
  - **If ENG 2 inoperative** :
    RAT . . . . ON

■ **If YELLOW HYD SYS LO PR** :

FLAPS INOP

- **If FLAPS less than 20°** :

  FOR APPROACH : ATS . . . . OFF

  PROC : ABNORMAL SLATS/FLAPS
  LANDING (6.14) . . . . APPLY

■ **If BLUE HYD SYS LO PR** :

SLATS INOP

- **If SLATS less than 20°** :

  PROC : ABNORMAL SLATS/FLAPS
  LANDING (6.14) . . . . APPLY

PROC : L/G GRAVITY EXTENSION (10.02) . . . . APPLY

NOTE 1 : In case of go around, do not retract landing gear
NOTE 2 : Nose wheel steering and reverse inoperative

LOSS OF BOTH ENG GENERATORS (continued)

- Only INR TK PUMPS 2L and 1R and CTR TK L PUMP remain supplied. They are supplied one at a time with the following priority order :
  INR TK 2L, INR TK 1R, CTR TK L
  Selection of TRIM TK MODE FWD allows gravity transfer from TRIM TK to CTR TK (if any fuel in TRIM TK).
- Fuel feed from CTR TK is ensured by selecting INR TK PUMPS 2L and 1R OFF.
- Fuel feed from INR TKs is accomplished alternatively from left or right tank. Switching from one tank to the other one is made when the tank is empty or in case of fuel unbalance (4 000 kg/8 800 lbs maximum).
- Switching LAND RECOVERY to ON restores SPLRS and SPD BRK 1, 4, 6, 7, FLAPS, SLATS and A/SKID. KRUGERS remain lost.
- Landing gear is extended by gravity to avoid disconnection of stand-by generator which may occur during normal landing gear extension due to temporary pressure drop in green hydraulic system.
  For the same reason, it is not recommended to retract landing gear in case of go around.
  Nose wheel steering is lost due to L/G gravity extension.

Note : In case of discrepancies between CM1 and STBY airspeed indications, disregard STBY indication (probe not de-iced).

- If BLUE HYD SYS is lost (In case of loss of engine 1), slats are lost.
- If YELLOW HYD SYS is lost (In case of loss of engine 2), and not recovered by RAT, flaps are lost. R

Mod : 3881 + 4801 + 5911

FLIGHT ON BAT ONLY

IGNITION . . . . CONT RELIGHT

CAUTION ***: Avoid rapid throttle movement and negative load factors.***

LAND ASAP

LDG GEAR POSITION DET . . . . SYS 1

COMMUNICATIONS VHF1/ATC1

MAX SPD 285/.78

USE ELEV AND RUD WITH CARE ABOVE SPD 170

MAX FL . . . . 250 (200 IF JP4/JET B USED)/MEA

TRIM TK MODE . . . . FWD

L and R OUTR TK ISOL VALVES . . . . . CHECK IN LINE

● **If any INR TK below 2000 kg/4400 lb** :

L and R INR TK ISOL VALVES . . . . OFF

BAT OVRD . . . . ON

BUS EQPT LIST - BAT ONLY (3.08/3.09) . . . . . REVIEW

R LDG DIST and VREF increments (15.02, 15.04) . DETERMINE

NOTES : 1) Beyond 30 min, total loss of electrical power may occur, leading to loss of slats/flaps extension.

2) Unsuccessful APU start attempts will decrease batteries operating time.

3) If landing is possible within 30 min, APU start is not recommended.

4) If landing is not possible within 30 min, APU may be started when below FL 200.

● **Before slats extension** :

LAND RECOVERY . . . . ON

● **If ENG 2 inoperative** :

RAT . . . . ON

R ■ **If YELLOW HYD SYS LO PR** :

R FLAPS INOP

R ● **If FLAPS less than 20°** :

R FOR APPROACH : ATS . . . . OFF

R PROC : ABNORMAL SLATS/FLAPS LANDING (6.14) . . . . APPLY

R ■ **If BLUE HYD SYS LO PR** :

R SLATS INOP

R ● **If SLATS less than 20°** :

R PROC : ABNORMAL SLATS/FLAPS LANDING (6.14) . . . . APPLY

NOTE : Reverse inoperative.

FLIGHT ON BAT ONLY

- STBY GEN FAULT light illuminates on ELEC panel
- CONT RELIGHT is selected to reduce the risk of engine malfunction with all tank pumps inoperative (gravity feeding).
- Keeping throttle movements slow and avoiding low load factors will prevent fuel supply surges.
- Airspeed must be limited due to loss of pitch feel.
- Descent to the specified flight level should provide sufficient static pressure to supply the engine driven fuel pumps.
- Fuel will be fed from all tanks containing fuel, but mainly from the OUTR TK due to their greater height above the engine.
- INR TK ISOL VALVES must be closed, when tank quantity is 2000 kg (4400 lbs).

  Below this level the non-return valves in the CTR TK feed line may not remain closed, resulting in fuel surges and possible air suction.
- It has been demonstrated that batteries with a capacity of 25 Ah charged at 70 % will last for 38 minutes or for 26 minutes if 2 APU start attempts are made.
- Switching LAND RECOVERY to ON restores SPLRS and SPD BRK 1, 4, 6, 7, FLAPS, SLATS and A/SKID. KRUGERS remain lost.
- If yellow hydraulic system is lost (in case of loss of engine 2) and not recovered by RAT, flaps are lost.
- If blue hydraulic system is lost (in case of loss of engine 1), slats are lost.

Mod : 3881 + 4801 + 5911

LEFT BLANK INTENTIONALLY

Mod : 5911

IN FLT ENG FIRE

THROTTLE . . . . IDLE

FUEL LEVER . . . . OFF

FIRE HANDLE . . . . PULL

1ST AGENT AFTER 10 S . . . . DISCH

● **IF FIRE AFTER FURTHER 30 S :**

  2ND AGENT . . . . DISCH

LAND ASAP

R PROC : SINGLE ENG OPERATION (12.08) . . . . . . APPLY

IN FLIGHT ENG FIRE

Indications :
Continuous Repetitive Chime
ENG 1 or ENG 2 FIRE handle illuminated.
ECAM activation with appropriate warning light
Left ECAM CRT : ENG FIRE procedure
Right ECAM CRT : ENG page
ENG 1 or 2 FUEL LEVER illuminated
LOOP A and LOOP B (ENG 1 or 2) lights

- The 10 sec delay allows N1 to decrease, this reduces the nacelle ventilation and increases the agent effect.
- CRC stops when pulling fire handle. CRC may be cancelled by use of AUDIO CANCEL switch.
- Fire handle remains illuminated as long as a fire is detected.

ON GND ENG FIRE

THROTTLE . . . . IDLE

● **WHEN A/C IS STOPPED :**

PARKING BRK . . . . SET
FUEL LEVER . . . . OFF
FIRE HANDLE . . . . PULL
1ST AGENT . . . . DISCH

PROC : ON GND ENG FIRE

2^{ND} FUEL LEVER . . . . OFF

● **If fire after 30 s :**

2^{ND} AGENT . . . . DISCH
FIRE HANDLES (ENG and APU) . . . . PULL
FUEL ISOL VALVES . . . . OFF

PROC : ON GROUND EMER/EVAC (20.01) . . . . APPLY

ON GROUND ENG FIRE

Indications :

Continuous Repetitive Chime
ENG 1 or ENG 2 FIRE handle illuminated.
ECAM activation with appropriate warning light
Left ECAM CRT : ENG FIRE procedure
Right ECAM CRT : ENG page
ENG 1 or 2 FUEL LEVER illuminated
LOOP A and LOOP B (ENG 1 or 2) lights

- The aircraft may be stopped using full reverse.
- Consider positioning the aircraft according to wind so that any possible fire is kept away from the fuselage.
- CRC stops when pulling fire handle. CRC may be cancelled by use of AUDIO CANCEL switch.
- Fire handle remains illuminated as long as a fire is detected.
- Do not attempt to restart the engine.
- The 10 sec delay before discharging agent is not required on ground.

APU FIRE

FIRE HANDLE . . . . PULL
AGENT AFTER 10 S . . . . DISCH
MASTER SW . . . . OFF

● **IF FIRE WARN PERSISTS :**

LAND ASAP

APU FIRE

Indications :

Continuous repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : APU FIRE procedure
Right ECAM CRT : APU page
Fire handle illuminated
LOOP A and LOOP B lights

- The 10 seconds delay allows the airflow from the APU cooling fan to reduce, which increases the agent effect.
- Do not attempt to restart APU.

STD or Mod : 12134

SMOKE/FUMES

LAND ASAP

● **If MIN EQPT BAY smoke or AVIONICS smoke** :

SNIFFER FAN . . . . OPERATE

● **If smoke confirmed or if perceptible smoke** :

OXY MASKS 100%/EMERG/ON
GOGGLES . . . . ON
CKPT/CABIN COM . . . . ESTABLISH
CABIN FANS . . . . OFF
VENT EXTRACT . . . . OVBD
GALLEY . . . . SHED
CABIN SIGNS . . . . ON

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

FAULTY EQPT . . . . ISOLATE

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

DIVERSION . . . . INITIATE
DESCENT (FL 100/MEA, min obstacle clearance altitude) . . . . INITIATE

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

PROC : SMOKE/FUMES REMOVAL . . . . CONSIDER

● **At ANY TIME of the procedure, if situation becomes UNMANAGEABLE** :

IMMEDIATE LANDING . . . . CONSIDER

R ■ **If AIR COND SMOKE suspected (visible smoke or odors**
R **and/or simultaneous warnings)** :

APU BLEED . . . . OFF/R
VENT EXTRACT . . . . AUTO
PACK 1 VALVE . . . . OFF

- ● **If AIR COND smoke continues** :

  PACK 1 VALVE . . . . AUTO
  PACK 2 VALVE . . . . OFF

  - ● **If AIR COND smoke still continues** :

    PACK 2 VALVE . . . . AUTO
    VENT EXTRACT . . . . OVBD

(Continued)

This procedure is applicable in case of suspected smoke from the avionics compartment, air conditioning, minimum equipment bay or if the cause is unknown. The flight crew must apply this paper procedure if smoke is detected with or without ECAM activation.
This paper procedure includes all the steps of the AVIONICS and MIN EQPT BAY SMOKE ECAM procedures. Therefore, if the ECAM procedure is displayed, it may be applied if smoke from the avionics or the minimum equipment bay is suspected. Associated additional steps must be performed after ECAM. However, if another smoke source is suspected, refer to the paper procedure.
The procedure layout is organized as follows :

- The first lines correspond to immediate actions which must be performed by the crew as soon as smoke is detected (with or without ECAM activation, whatever the smoke source). These immediate actions enable the crew to quickly refer to the steps most commonly adopted in smoke-related cases. In parallel, when smoke is detected, the crew must immediately be prepared to perform a diversion. This diversion may be avoided if the smoke source is obvious, extinguishable and accessible or confirmed isolated after completion of these immediate actions.
- The memory items indicate the immediate applicable procedure, if at any time of the procedure, the smoke/fumes becomes the greatest threat and smoke removal is required, before continuing the SMOKE/FUMES procedure.
- The last part of the procedure corresponds to specific actions to be applied by the crew once the smoke source has been identified.

In case of a CARGO SMOKE or BAT SMOKE (if applicable) ECAM warning, without any smoke detected in the cockpit/cabin, directly apply the related ECAM/QRH procedure. Note that these warnings may be caused by some other sources that should, ordinarily, be first detected by the flight crew/cabin crew or avionics smoke detectors.

AIR COND SMOKE

Indications :
Visible smoke or odor. R
Several SMOKE warnings may be triggered.

- As a result of contamination within the air conditioning system AVIONICS SMOKE, MIN EQT BAY SMOKE or BAT SMOKE (if applicable) warnings may be triggered simultaneously.
  Apply AIR COND SMOKE procedure only if visible smoke and/or strong odor is encountered. R
- Avoid the use of interphone position to minimize interference from oxygen mask breathing noise.
  Check oxygen masks at 100 %.
- When VENT EXTRACT is in the OVBD position, a single pack may not be able to maintain the cabin pressure.

(Continued)

R

SMOKE/FUMES (CONT'D)

R R ■ **<u>If AVIONICS SMOKE suspected and FAULTY EQPT not identified</u>** :

SNIFFER FAN . . . . OPERATE

● **IF SMOKE CONFIRMED :**

OXY MASKS/GOGGLES . . . . ON

R

VHF 1 / ATC 1 . . . . SELECT

PILOT FLYING CM1

TRIM TK MODE . . . . FWD

APU GEN . . . . OFF/R

R OVRD SUPPLY 1 AND 2 . . . . ON

<u>NOTE</u> : FUEL X FEED opens automatically.

PITCH TRIM 1 / YAW DAMPER 1 / AP-FD1 .. RESET

THROTTLE 1 + 2 . . . . REDUCE

ENG 1 AND 2 MODE N1

ENG PWR . . . . AS RQRD

LDG GEAR POSITION DET . . . . SYS 1

PACKS (if required) . . . . MAN CTL

● **<u>If WING ANTI ICE required</u>** :

WING ANTI ICE MODE SEL . . . . ALTN

BUS EQPT LIST (3.08/3.09) . . . . REVIEW

R <u>PROC</u> : FUEL MANAGEMENT (5.06)

● **<u>Before slats extension</u>** :

LAND RECOVERY . . . . ON

R SPEED INCREMENT ON S, F, V_{REF}, (14.01) . + 10 KT

LDG DIST . . . . MULTIPLY BY 1.4

R R ■ **<u>If MIN EQPT BAY SMOKE suspected and FAULTY EQPT not identified</u>** :

SNIFFER FAN . . . . OPERATE

● **IF SMOKE CONFIRMED :**

VHF 2 . . . . SELECT

VENT EXTRACT . . . . OVBD

MIN EQPT C/B's . . . . PULL

CAPT ADC INST . . . . SYS 2

ATC . . . . SYS 2

ATS . . . . RESET

AFFECTED EQUIPMENT . . . . OFF

<u>PROC</u> : FUEL FEED MANUAL CONTROL (7.04)

● **<u>If the SMOKE warning is still activated after 3 minutes</u>** :

● **<u>If IRS 1 or IRS 3 FAULT</u>** :

MSU (affected IRS) . . . . OFF

R ■ **<u>If CABIN SMOKE suspected</u>** :

R <u>PROC</u> : CABIN SMOKE

AVIONICS SMOKE

Indications :

Continuous repetitive chime
ECAM activation with appropriate warning light.
Left ECAM CRT : AVIONICS SMOKE proc.
Right ECAM CRT : Nil
AVIONICS SMOKE light.

- Avoid the use of interphone position to minimize the interference from oxygen mask breating noise.
- It is recommended to wait for a few seconds (typically 2 or 3 seconds) before sniffing in order to evacuate any possible dust accumulation in the duct.

R

- VHF 1, ATC 1 are selected due to loss of VHF 2, ATC 2 resulting from OVRD SUPPLY 1 and 2 at ON.
- Pressing both OVRD SUPPLY switches sheds the AC BUS 1, AC BUS 2 and DC NORM BUS.
- APU GEN must be selected OFF to open both AC BUS XFR contactors, if APU is operating.
- EPR probes are not heated. FADEC automatically reverts to N1 mode. Confirmation should be performed by selecting both ENG MODE pushbutton switches to N1 position. Thrust management should be performed using N1 parameter.
- Alternate wing anti ice valves remain supplied and must be selected if wing anti ice is required.

MIN EQPT BAY SMOKE

Indications :

Repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : MIN EQPT BAY SMOKE proc.
Right ECAM CRT : nil.
SMOKE light on C/B panel

- If MIN EQPT BAY SMOKE warning is activated together with AVIONICS SMOKE or other SMOKE warnings, suspect AIR COND SMOKE as probable cause of warnings.
- It is recommended to wait for a few seconds (typically 2 or 3 seconds) before sniffing in order to evacuate any possible dust accumulation in the duct.
- With MIN EQPT BAY SUPPLY C/B's pulled, the following are lost :
  a) VHF 1
  b) Public address (use megaphone if evacuation required)
  c) Fuel OUTR TK LO LVL warning
  d) Autofeed due to the loss of OUTR, CTR and INR TK low level detection.
  e) Engine 1 and 2 fire detection
  f) Engine 1 bleed air control
  g) Crew oxygen control
  h) ADC 1
  <u>Note</u> : AP1/FD1 is lost
  i) ADC 2 BARO SET
  <u>Note</u> : AP2/FD2 is lost
  j) Cab press sys 1
  k) Cargo smoke detection and warning

FUEL MANAGEMENT FOR AVIONICS SMOKE

- **If CTR + TT FQI above 500 kg (1100 lbs)** :
  INR TK PUMP 2 L and 1R . . . . OFF
- **If/when CTR + TT FQI below 500 kg (1100 lbs)** :
  INR TK PUMP 2 L and 1R . . . . NORM
  - **When L INR TK empty or fuel unbalance (max 4000 kg/8800 lbs)** :
    L INR TK PUMP 2 . . . . OFF
  - **When R INR TK empty or fuel unbalance (max 4000 kg/8800 lbs)** :
    L INR TK PUMP 2 . . . . NORM

  REPEAT CYCLE UNTIL BOTH INR TK EMPTY.
  - **When L and R INR TK empty** :
    CAUTION : Avoid rapid throttle movement and negative load factors (fuel gravity feeding).
    IGNITION . . . . CONT RELIGHT
    MAX FL . 250 (200 IF JP4/JET B USED)/MEA/MORA
    OUTR TK ISOL VALVES . . . . CHECK IN LINE
    INR TK ISOL VALVES . . . . OFF

RETURN TO AVIONICS SMOKE PROCEDURE (5.05)

FUEL MANAGEMENT FOR AVIONICS SMOKE

– This fuel management is the one to be used in case of avionics smoke.

– Only INR TK PUMPS 2L and 1R and CTR TK L PUMP remain supplied. They are supplied one at a time with the following priority order :
INR TK 2L, INR TK 1R, CTR TK L.
Selection of TRIM TK MODE FWD allows gravity transfer from TRIM TK to CTR TK (if any fuel in TRIM TK).

– Fuel feed from CTR TK is ensured by selecting INR TK PUMPS 2L and 1R OFF.

– Fuel feed from INR TKs is accomplished alternatively from left or right tank. Switching from one tank to the other one is made when the tank is emply or in case of fuel unbalance (4000 kg/8800 lb maximum).

Mod : 4801 + 6368 + 8648

BAT SMOKE

BAT (ALL) . . . . OFF/R

- **IF WARN PERSISTS** :

  LAND ASAP

- **<u>If other SMOKE warnings are activated</u>** :

  AIR COND SMOKE . . . . SUSPECT

  <u>PROC</u> : SMOKE/FUMES (5.04) FOR AIR COND SMOKE . . . . APPLY

BAT SMOKE

Indications :

Continuous repetitive chime

ECAM activation with appropriate warning light.

Left ECAM CRT : BATTERY SMOKE proc.

Right ECAM CRT : ELEC/DC page

BAT SMOKE light

– If BAT SMOKE warning is activated together with other SMOKE warnings, suspect AIR COND SMOKE as probable cause of warnings.

CARGO COMPT SMOKE

LAND ASAP

AGENT 1 . . . . DISCH

LDG ELEVATION 10 000FT

- **<u>One hour later or for approach, whichever is earlier</u> :**

  AGENT 2 . . . . DISCH

<u>NOTE 1</u> : CAB ALT warning will be activated.

<u>NOTE 2</u> : DISCH 2 light will illuminate approximately 30 minutes later due to the flow restrictor.

- **<u>If warning activated during climb (and air turn-back decided) or during approach</u>** :

  LANDING ELEVATION . . . SET AIRFIELD ELEVATION

- **<u>If transient warning (without crew action), if required (e.g. live stock transportation)</u> :**

  COMPT TEMP ISOL VALVE (affected) . OFF/R then ON

  Maintenance action is due

- **<u>When on ground</u>** :

  PASSENGERS . . . . DISEMBARK/EVACUATE

  - **<u>When fire brigade in position and evacuation completed</u>** :

    CARGO DOOR (affected compartment) . . ORDER OPEN

R **ON GROUND**

R ● **<u>If warning activated on ground with cargo door opened</u> :**

R AGENT . . . . DO NOT DISCHARGE

R GROUND CREW . . . . INFORM

CARGO COMPT SMOKE

Indications :

Continuous repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : COMPT SMOKE proc
Right ECAM CRT : nil.
SMOKE light.

– Smoke warning activation automatically closes the ISOL and TEMP CONTROL valves.

<u>Note</u> : Expect SMOKE warning to remain after AGENT discharge, even if smoke source is extinguished. Gases from smoke source are not evacuated and smoke detectors are sensitive to extinguishing agent as well.
Once the ISOL and TEMP CONTROL valves are closed, the cargo is not ventilated and cargo temperature is no longer reliable.

– Opening the access door to the forward cargo compartment from the main bay would result in a decrease of agent concentration.

– Maximum protection time is 260 minutes.

R Code : 0460

SMOKE/FUMES REMOVAL

OXY MASKS . . . . 100 %/EMERG/ON
GOGGLES . . . . ON
CREW COM headset . . . . ESTABLISH

SEAT BELT / NO SMOKING . . . . ON

CABIN FANS . . . . OFF
COMPT TEMP ISOL VALVES . . . . OFF / R
ECON FLOW . . . . OFF

ALL COCKPIT LOUVERS . . . . OPEN
COCKPIT DOOR . . . . CLOSE

LDG ELEVATION . . . . 10 000 FT / MEA / MORA
CAB PRESS RATE LIM . . . . MAX
NOTE : CAB ALT warning will be activated.

OUTFLOW AFT . . . . OFF

DESCENT (FL 100 or MEA or MORA) . . . . . . INITIATE

ATC . . . . NOTIFY

R PROC : SMOKE/FUMES . . . . CONTINUE

● **When △ P 1 PSI or below:**
  RAM AIR . . . . ON
  ● **If required to open sliding window :**
    COCKPIT DOOR . . . . OPEN
    MAX SPD . . . . 225 KT
    PACK VALVES 1 AND 2 . . . . OFF
    PNF SLIDING WINDOW . . . . OPEN
    PACK VALVES 1 AND 2 . . . . AS REQUIRED

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

R   PROC : SMOKE/FUMES . . . . CONTINUE

SMOKE/FUMES REMOVAL

Note : The efforts to extinguish the fire and to determine the smoke source must be the primary concern. If this is not possible, the captain must judge, whether survival depends on elimination of an extreme concentration of smoke or toxic fumes in the pax cabin. R
Therefore he can decide to increase the ventilation rate by applying the SMOKE/FUMES REMOVAL procedure regardless of the effect, which the increased airflow might have on the fire. R

- The smoke removal procedure must be applied if smoke becomes the greatest threat or in case of toxic fumes or if smoke generation cannot be stopped. R R
- In case of smoke in cabin it may be necessary to make a PA announcement to minimize apprehension.
- CABIN FANS are selected OFF to avoid recirculation of contaminated air.
- Putting the COMPT TEMP ISOL VALVES switches to OFF/R closes the CARGO ISOL VALVES and prevents a CARGO SMOKE warning triggered by smoke originating in the cabin.
- ECON FLOW is selected OFF to provide full airflow from packs.
- It is recommended to fully open all cockpit ventilation devices and to close the cockpit/cabin door.
- Since the most effective means for smoke removal is use of RAM AIR, descent is initiated to FL 100 or MEA or MORA while cabin altitude is increased to 10000 ft. The increase of cabin altitude also reduces, at least temporarily the smoke concentration.
- While descending, consider continuing the appropriate steps of the SMOKE/FUMES paper procedure depending on the suspected smoke source.
- At FL 100 or MEA or MORA opening of the RAM AIR valve is possible, when △P is 1 psi or below, without oxygen requirement for further flight (except when MEA above FL 140).
- If cockpit smoke removal required, one sliding window may be opened when at or below 225 kt. To facilitate opening, it is recommended to select both PACKS OFF before and reselect PACKS ON as required after opening. Headsets must be donned to ensure crew communication inspite of high noise level with one window open.
- Selecting CAB PRESS OUTFLOW AFT to OFF increases the air exchange in the cockpit.

Mod : 2989 + 3881

LEFT BLANK INTENTIONALLY

G + Y SERVO LO PR (BLUE REMAINING)

LAND ASAP

MAX SPD 285/.78

USE ELEV WITH CARE ABV SPD 170

PROC : G + Y SERVO LO PR (below) . . . . APPLY

AFFECTED EQUIPMENT . . . . OFF

■ **If GREEN HYD SYS lost (KRUGER inoperative)** :

  LDG SPD INCREMENT . . . . + 10 KT

  LDG DIST . . . . MULTIPLY BY 1.5

  PROC : L/G GRAVITY EXT (10.02) . . . . APPLY

■ **If GREEN SERVO only inoperative (KRUGER available)** :

  LDG DIST . . . . MULTIPLY BY 1.3

  PROC : L/G GRAVITY EXT (10.02) . . . . APPLY

MAX FL 350

● **If YELLOW PUMP LO PR** :

  RAT . . . . ON

  AFFECTED YELLOW EQUIPMENT . . . . . . RESTORE

  CAUTION : ***If YELLOW SYS powered by RAT, G + Y SERVO LO PR will apply for landing.***

FOR APPROACH

● **If one SERVO LO PR caused by** :

- **related HYD SYS RSVR OVHT (and if OVHT light is extinguished),**

or

- **related HYD SYS LO AIR PR** :

HYD PWR ENG PUMP(s) – related . . . . ON

AFFECTED EQUIPMENT . . . . RESTORE

● **If GREEN HYD SYS not recovered** :

  SPEED INCREMENT ON S, F, V LS . . . . + 10 KT

  LANDING SPEED . (VLS + 10 KT) or (VREF + 10 KT)

G + Y SERVO LO PR (BLUE REMAINING)

Indications :

Continuous repetitive chime
ECAM activation with appropriate warning light
Left ECAM : Procedure
Right ECAM : HYD page
LO PR lights on SERVO CTL panel
Local alert lights according to secondary failures.

- The procedure is applicable when two servo systems are lost or one servo and one hydraulic system are lost.

  If YELLOW system is recovered by use of RAT, be aware that YELLOW hydraulic pressure is not guaranteed below 140 Kt. It will not be available for landing.
- PITCH TRIM and PITCH FEEL systems are lost. Airspeed and altitude are limited respectively. PITCH FEEL system is in LO SPD mode.
- For approach the landing gear is extended by gravity, to maintain the GREEN system full capability and integrity.
- Approach with GREEN HYD SYS not recovered :

  VLS and maneuvering speeds are increased due to kruger fault.

B + Y SERVO LO PR (GREEN REMAINING)

LAND ASAP

PROC : B + Y SERVO LO PR (below) . . . . APPLY

AFFECTED EQUIPMENT . . . . OFF

LANDING CONFIG/GPWS 20/20

LDG SPD INCREMENT . . . . + 10 KT

LDG DIST . . . . MULTIPLY BY 1.8

PROC : L/G GRAVITY EXT (10.02) . . . . APPLY

AVOID USING PTU

● **If YELLOW PUMP LO PR** :

RAT . . . . ON

AFFECTED YELLOW EQUIPMENT . . . . . . RESTORE

CAUTION ***: If YELLOW SYS powered by RAT, B + Y SERVO LO PR will apply for landing.***

FOR APPROACH

● **If one SERVO LO PR caused by** :

- **related HYD SYS RSVR OVHT (and if OVHT light is extinguished),**

or

- **related HYD SYS LO AIR PR** :

HYD PWR ENG PUMP (related) . . . . ON

AFFECTED EQUIPMENT . . . . RESTORE

● **If GREEN SERVO CTL only remaining** :

GPWS . . . . FLAP 20

SPEED INCREMENT ON V LS . . . . + 10 KT

LANDING CONFIG . . . . FLAPS 20

LANDING SPEED . (V LS + 10 KT) or (V REF + 20 KT)

B + Y SERVO LO PR (GREEN REMAINING)

Indications :

Continuous repetitive chime

ECAM activation with appropriate warning light

Left ECAM : Procedure

Right ECAM : HYD page

LO PR lights on SERVO CTL panel

Local alert lights according to secondary failures.

- The procedure is applicable when two servo control systems are lost or when one servo control and one hydraulic system fail.
- If YELLOW system is recovered by use of RAT, be aware that YELLOW hydraulic pressure is not guaranteed below 140 Kt. It will not be available for landing.
- Approach with GREEN SERVO remaining :

  V_{LS} is augmented by 10 Kt and landing configuration is limited to 20/20 due to reduced lateral controllability caused by partial loss of roll spoilers.

  Landing distance is increased due to landing configuration, LDG SPD increment and partial loss of GND SPLRS.

  The landing gear is extended by gravity to maintain GREEN system full capability and integrity.

R Code : 0343

B+G SERVO LO PR (YELLOW REMAINING)

LAND ASAP

<u>PROC</u> : B + G SERVO LO PR (below) . . . . APPLY

AFFECTED EQUIPMENT . . . . OFF

■ **<u>If GREEN HYD SYS lost (KRUGER inoperative)</u>** :

LDG SPD INCREMENT . . . . + 10 KT

LDG DIST . . . . MULTIPLY BY 1.5

<u>PROC</u> : L/G GRAVITY EXT (10.02) . . . . APPLY

■ **<u>If GREEN SERVO only inoperative (KRUGER available)</u>** :

LDG DIST . . . . MULTIPLY BY 1.3

<u>PROC</u> : L/G GRAVITY EXT (10.02) . . . . APPLY

FOR APPROACH

● **<u>If one SERVO LO PR caused by</u>** :

- **<u>related HYD SYS RSVR OVHT (and if OVHT light is extinguished)</u>,**

or

- **<u>related HYD SYS LO AIR PR</u>** :

HYD PWR ENG PUMP(s) – related . . . . ON

AFFECTED EQUIPMENT . . . . RESTORE

● **<u>If GREEN HYD SYS not recovered</u>** :

SPEED INCREMENT ON S, F, V LS . . . . + 10 KT

LANDING SPEED . (VLS + 10 KT) or (VREF + 10 KT)

B + G SERVO LO PR (YELLOW REMAINING)

<u>Indications</u> :

Continuous repetitive chime

ECAM activation with appropriate warning light

Left ECAM : Procedure

Right ECAM : HYD page

LO PR lights on SERVO CTL panel

Local alert lights according to secondary failures.

- The procedure is applicable when two servo control systems are lost or when one servo control and one hydraulic system are lost.

  The different combinations of failure result in different landing distance increase or VLS increments.
- The landing gear is extended by gravity, to maintain the GREEN system full capability and integrity.
- Approach with GREEN HYD SYS not recovered :

  VLS and maneuvering speeds are increased due to kruger fault.

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EXCESS AFT CG

TRIM TK MODE . . . . FWD

TRIM TK PUMP 1 and 2 . . . . CHECK ON

- **IF FWD XFR UNSUCCESSFUL :**
  TRIM TK FUEL UNUSABLE PROC (7.08) . . . . APPLY

AUTO TRIM TK SYS INOP

FUEL MAN FWD XFR ONLY

- **<u>If/When TRIM TK empty</u>** :
  TRIM TK PUMP 1 and 2 . . . . OFF
  TRIM TK MODE . . . . AUTO
  - **<u>If EXCESS AFT CG warning persists</u>** :
    PASSENGER RELOCATION . . . . CONSIDER
    R 10 Pax from rear to front = – 2 % CG
    R 10 Pax from rear to mid = – 1 % CG
    <u>PROC</u> : TRIM TK FUEL UNUSABLE (7.08) . . APPLY

EXCESS AFT CG

<u>Indications :</u>

Continuous repetitive chime

ECAM activation with appropriate warning light.

Left ECAM CRT : EXCESS AFT CG procedure

Right ECAM CRT : Fuel page.

TRIM TK MODE FAULT light illuminated

– This warning is triggered when the THS position reaches a deflection limit (which represents a center of gravity of 43 %). This deflection limit is computed by the FWC and depends on Mach and N1 values.

– This warning should be preceded by the AFT CENTER OF GRAVITY warning which occurs when the center of gravity reaches 41 %.

– When TRIM TK is empty, select TRIM TK pumps OFF and TRIM TK MODE to AUTO to prevent further aft transfer and CTR TK overflow during next TRIM TK refueling.

Mod : 4801

LEFT BLANK INTENTIONALLY

Mod : 4801 or (4801 + 10806)

G+Y HYD SYS LO PR (BLUE REMAINING)

LAND ASAP

MAX SPD 285/.78

ELEV WITH CARE ABV SPD 170.

BRK/ANTI SKID . . . . ALTN / OFF

GPWS . . . . FLAP OVRD

- **<u>IF YELLOW PUMP FAIL (and no YELLOW HYD fluid loss suspected)</u>** :
  RAT . . . . ON

AFFECTED EQUIPMENT . . . . OFF

MAX BRK PRESS . . . . 1000 PSI

<u>PROC</u> : DUAL (G+Y) HYD SYS LO PR . . . . APPLY

<u>PROC</u> : L/G GRAVITY EXTENSION (10.02) . . . . APPLY

- **<u>If YELLOW SYS powered by RAT</u>** :
  AFFECTED YELLOW EQUIPMENT . . . . RESTORE
  <u>CAUTION</u> : G+Y HYD SYS LO PR will still apply for landing.
- **<u>If both GREEN ENG PUMP failed (and no GREEN HYD fluid loss suspected)</u>** :
  HYD PWR ELEC PUMPS . . . . ON

MAX FL 350

LDG DIST and V REF increments (15.02, 15.04) . . . DETERMINE

FOR APPROACH

- **<u>If SYS lost by RSVR OVHT (and if OVHT light is extinguished) or by LO AIR PR</u>** :
  HYD PWR ENG PUMP (related) . . . . ON
  AFFECTED EQUIPMENT . . . . RESTORE
- **<u>If YELLOW SYS lost by RSVR LO LEVEL, for flaps extension</u>** :
  RAT . . . . ON
  <u>CAUTION</u> : G+Y HYD SYS LO PR will still apply for landing.
- R **<u>If unable to restore by HYD PWR ENG PUMP</u>** :
  SYSTEM STATUS WITH ONE HYD SYS (8.05) . . . . REVIEW
  LDG DIST and V REF increments . . . . APPLY
  - **<u>If FLAPS less than 20°</u>** :
    ATS LEVER(s) . . . . OFF
    <u>PROC</u> : ABNORMAL SLATS/FLAPS LANDING (6.14) . APPLY

<u>DUAL (G + Y) HYD SYS LO PR</u>

<u>Indications :</u>

Repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : procedure
Right ECAM CRT : HYD page
Local alert lights according to the secondary failures

– Hydraulic system failure may be due to loss of system pressure or fluid.

– RAT should be extended if yellow circuit is lost.
If the yellow circuit is powered by the RAT, yellow hydraulic pressure cannot be guaranteed below 140 kt and therefore will not be available for landing.

– Altitude is limited to FL 350 due to loss of both PITCH TRIM.

– If YELLOW HYD pressure is recovered by RAT, leave BRK/A/SKID in OFF.

– Airspeed is limited due to loss of PITCH TRIM and PITCH FEEL systems.

– Selecting RAT to ON for approach may at least temporarily provide an opportunity for stabilizer trim and flap extension.

– Due to the low flow of the RAT, when flaps are extended using the RAT, the yellow pressure may drop below 130 bars leading to the closure of priority valves. DUAL HYD SYS LO PR may be triggered again. When pressure raises back to 130 bars, the priority valves re-open, and flaps extension continues.

– In case of turbulent approach, flight controls inputs greater than 20°/sec may also lead to priority valve temporary closure.

– When using the ELEC PUMPS, the slats, flaps and L/G must be extended in sequence in order to reduce loads on green system.

– If flaps are stuck at less than 20°, ATS must be disarmed to prevent operation of alpha floor.

– If the flaps were extended when the failure occurred, and remain, the landing distance increase is reduced respectively.

– BRK/A/SKID is switched OFF to avoid YELLOW brake accumulator pressure loss caused by antiskid operation. The yellow accumulator pressure should read 3,000 psi before landing. If below this value the PARKING BRAKE ACCU PRESS pushbutton may be operated to recharge the brake accumulator.

– As antiskid is not available, limit brake pressure to 1,000 psi and at low ground speed adjust brake pressure as required. Landing on an icy runway should be avoided.

B+Y HYD SYS LO PR (GREEN REMAINING)

LAND ASAP

AVOID USING PTU

● **<u>IF YELLOW PUMP FAIL (and no YELLOW HYD fluid loss suspected)</u>** :

RAT . . . . ON

AFFECTED EQUIPMENT . . . . OFF

LANDING CONFIG / GPWS 20/20
LDG SPD INCREMENT . . . . + 10KT
LDG DIST . . . . MULTIPLY BY 1.8

<u>PROC</u> : DUAL (B + Y) HYD SYS LO PR . . . . . . APPLY

<u>PROC</u> : L/G GRAVITY EXTENSION (10.02) . . . . APPLY

● **<u>If YELLOW SYS powered by RAT</u>** :

AFFECTED YELLOW EQUIPMENT . . . . . . RESTORE

<u>CAUTION</u> : B + Y HYD SYS LO PR will still apply for landing.

TRIM TK MODE . . . . FWD

DESCENT TO FL 310 . . . . CONSIDER

LDG DIST and V REF increments (15.02, 15.04) . DETERMINE

FOR APPROACH

● **<u>If SYS lost by RSVR OVHT (and if OVHT light is extinguished) or by LO AIR PR</u>** :

HYD PWR ENG PUMP (related) . . . . ON

AFFECTED EQUIPMENT . . . . RESTORE

● **<u>If YELLOW SYS lost by RSVR LO LEVEL for flaps extension</u>** :

RAT . . . . ON

<u>CAUTION</u> : B + Y HYD SYS LO PR will still apply for landing.

R ● **<u>If unable to restore by HYD PWR ENG PUMP</u>** :

SYSTEM STATUS WITH ONE HYD SYS (8.05) . REVIEW

LDG DIST and V REF increments . . . . APPLY

DUAL (B + Y) HYD SYS LO PR

<u>Indications :</u>

Continuous Repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : procedure
Right ECAM CRT : HYD page
Local alert lights according to the secondary failures

– It is recommended to avoid using PTU in order not to decrease the reliability of the remaining GREEN hydraulic system.

– Hydraulic system failure may be due to loss of system pressure or fluid.

– RAT should be extended if yellow circuit is lost.
If the yellow circuit is powered by the RAT, yellow hydraulic pressure cannot be guaranteed below 140 kt and therefore will not be available for landing.

– Due to the low flow of the RAT, when flaps are extended using the RAT, the yellow pressure may drop below 130 bars leading to the closure of priority valves. DUAL HYD SYS LO PR may be triggered again. When pressure raises back to 130 bars, the priority valves re-open, and flaps extension continues.

– In case of turbulent approach, flight controls inputs greater than 20°/sec may also lead to priority valve temporary closure.

– If the PTU was used to repressurize the first failing HYD system, it is recommended to select the PTU to OFF to maintain GREEN system full capability and integrity.

– VLS is augmented by 10 kt and landing configuration is limited to 20/20 due to reduced lateral controllability caused by partial loss of roll spoilers.

– Landing gear is extended by gravity to maintain GREEN system full capability and integrity.

– As both Yaw Dampers are lost, transferring fuel forward and descending to FL 310 will improve dutch roll characteristics.

B+G HYD SYS LO PR (YELLOW REMAINING)

LAND ASAP

AFFECTED EQUIPMENT . . . . OFF

PROC : DUAL (B+G) HYD SYS LO PR . . . . APPLY

PROC : L/G GRAVITY EXTENSION (10.02) . . . . APPLY

- **If both GREEN ENG PUMP failed (and no GREEN HYD fluid loss suspected)** :

  HYD PWR ELEC PUMPS . . . . ON

LDG DIST and V REF increments (15.02, 15.04) . DETERMINE

FOR APPROACH

- **If SYS lost by RSVR OVHT (and if OVHT light is extinguished) or by LO AIR PR** :

  HYD PWR ENG PUMP (related) . . . . ON

  AFFECTED EQUIPMENT . . . . RESTORE

R
- **If unable to restore by HYD PWR ENG PUMP** :

  BRK-A/SKID selector . . . . ALTN-ON

  SYSTEM STATUS WITH ONE HYD SYS (8.05) . REVIEW

  LDG DIST and V REF increments . . . . APPLY

  - **If SLATS less than 20°** :

    PROC : ABNORMAL SLATS/FLAPS LANDING (6.14) . . . . APPLY

DUAL B+G HYD SYS LO PR

Indications :

Continuous Repetitive chime

ECAM activation with appropriate warning light

Left ECAM CRT : procedure

Right ECAM CRT : HYD page

Local alert lights according to the secondary failures

– Hydraulic system failure may be due to loss of system pressure or fluid.

– VLS is augmented by 10 KT if slats are extended 15° or more but KRUGERS remain retracted.

– If slats were extended when the failure occured, and remain, the landing distance increase is reduced respectively. Braking is automatically transferred to YELLOW HYD system. However to obtain the RELEASE indication for YELLOW alternate braking, it is recommended to set the A/SKID-BRK selector to ALTN/ON.

– When using the ELEC PUMPS, the slats, flaps and L/G must be extended in sequence in order to reduce loads on green system.

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LOSS OF BRAKING AT LANDING

● **If AUTOBRAKE is selected** :

BRAKE PEDALS . . . . PRESS

● **If NO BRAKING available** :

MAX REVERSE . . . . APPLY
BRAKE PEDALS . . . . RELEASE
BRK/ANTI SKID . . . . ALTN/OFF
BRAKE PEDALS . . . . PRESS
MAX BRK PRESS . . . . 1000 PSI

● **If still NO BRAKING**

PARKING BRAKE . . . . USE

LOSS OF BRAKING AT LANDING

– Pressing simultaneously both brake pedals will override the autobrake avoiding unwanted differential braking.

– Max reverse thrust must not be used below 80 kt IAS or IAS fluctuations, whichever occurs first.

– Brake pedals must be released when the antiskid is switched OFF. Otherwise, the pedal braking orders will be taken into account and the aircraft will react strongly.

– If brakes are found inoperative, immediately switch BRK/ANTI SKID to ALTN/OFF and modulate brake pressure as required at or below 1000 psi.

– As antiskid is not available, limit brake pressure to 1000 psi and at low ground speed adjust brake pressure as required.

– In an extreme emergency and only if pedals are ineffective with the antiskid OFF the aircraft may be stopped with the parking brake (full pressure application will occur).

– Use short and successive parking brake applications to stop the aircraft. Brake onset asymmetry may be felt at each parking brake application.

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EGPWS ALERTS

CAUTION : ***During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.***
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert ceases or a safe trajectory is ensured.

■ **"PULL UP" – "TERRAIN TERRAIN PULL UP" – "TERRAIN AHEAD PULL UP"**

● **Simultaneously** :

AUTOPILOT . . . . DISCONNECT
PITCH ATTITUDE . . . . . INITIALLY 20° NOSE UP
– Use Stick Shaker boundary as upper limit of pitch

A/THR . . . . DISCONNECT
THROTTLES . . . . FULL FORWARD
SPEED BRAKES LEVER . . . . CHECK RETRACTED
BANK . . . . WINGS LEVEL OR ADJUST R

● **When flight path is safe and GPWS warning ceases :**

– Decrease pitch attitude and accelerate.

● **When speed above V_{LS} and V/S positive :**

– Clean up aircraft as required.

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN"**

– Adjust the flight path or initiate a go around.

■ **"TERRAIN AHEAD"**

– Adjust the flight path. Stop descent. Climb and/or turn as necessary based on analysis of all available instruments and information.

■ **"SINK RATE"**

– Adjust pitch attitude and thrust to silence the warning.

■ **"DON'T SINK"**

– Adjust pitch attitude and thrust to maintain level or climbing flight.

■ **"TOO LOW GEAR" – "TOO LOW FLAPS"**

– Perform a go-around.

■ **"GLIDE SLOPE"**

– Establish the airplane on the glide slope
or
– Switch off the G/S mode pushbutton switch if flight below glide slope is intentional (non precision approach).

EGPWS ALERTS

A nuisance EGPWS "TOO LOW GEAR" warning may be generated if the Nose Landing Gear downlock system 2 is inoperative.

Best climb performance is obtained when close to wings level. Then depending on the situation, a turn will be performed R R R

Code : 0423

LEFT BLANK INTENTIONALLY

BOTH ENG FLAME OUT – FUEL REMAINING

__CAUTION :__ ***This paper procedure is applicable in case of both engines flame out, when there is fuel remaining on board. It includes all the necessary information to manage the situation.***

LAND ASAP
IGNITION . . . . CONT RELIGHT
RAT . . . . ON

THROTTLES . . . . IDLE
OPTIMUM SPD . . . . 260 KT IAS or GREEN DOT whichever is higher

__NOTE__ : At optimum speed with both engines inop, it takes about 15 minutes to descend from FL 350 to the ground. The distance is about 90 NM.

GREEN DOT SPEED WITH BOTH ENGINES INOP (KNOTS)			
Weight (tons)	FL 200 and below	FL 300	FL 350
80	180	200	210
100	200	220	230
120	220	240	250
140	240	260	270
160	260	280	287

- **__If unreliable or lost airspeed indication (volcanic ash encounter) :__**

SET PITCH ATTITUDE	80t	100t	120t	140t	160t
FL 200 and below	–1.5	–1.5	–0.5	0.5	0.5
FL 300	–1.5	–1.5	–0.5	0.5	0.5
FL 350	–1.5	–1.5	–0.5	–0.5	–1

USE ELEVATOR AND RUDDER WITH CARE ABOVE SPD 170 KT IAS
COMMUNICATIONS VHF1/ATC1

- **__When time permits__** :
  ATC . . . . NOTIFY
  TRANSPONDER . . . . AS RQRD

LANDING STRATEGY . . . . DETERMINE
RELIGHT . . . . MONITOR

__NOTE__ : . The ground start EGT limit does not apply for airstarts.
. If EGT approaches the red line, cycle the FUEL LEVER (OFF, then ON as EGT decreases).
. The engine will accelerate very slowly at high altitudes, in heavy rain or in volcanic ash . If EGT is within limit and N1/N2 are increasing, continue the start attempt.

ENGINE RESPONSE . . . . CHECK

- **__If neither engine relights within 30s :__**
  FUEL LEVERS . . . . OFF then ON after 30s
- **__If unsuccessful :__**
  CREW OXY MASKS (above FL 100) . . . . ON
  - **__Below FL 200 :__**
    APU . . . . START
    APU BLEED . . . . ON
    STARTER ASSISTED RELIGHT . . . . ONE ENG AT A TIME

⇩

BOTH ENG FLAME OUT – FUEL REMAINING

– Before applying this procedure, a fuel supply check, must be done to confirm the correct fuel panel setting according to remaining fuel quantity, ISOL VALVES OPEN. If no fuel remains on board, the procedure "BOTH ENG FLAME OUT – NO FUEL REMAINING" must be applied.

– CONT RELIGHT selected during rundown ensures an immediate restart attempt. Above 30 000 ft (outside of engine relight envelope) a sub idle hung start condition may occur. Shut down the engine and relight within the relight envelope, with N2 stabilized.

– The optimum airspeed to achieve the best lift to drag ratio, and to allow simultaneously an effective windmilling start attempt is the highest speed between 260 kt and GREEN DOT speed. Green dot speed is read on the table.

– In case of unreliable or lost airspeed indication set aircraft pitch attitude according to aircraft estimated weight and Flight Level.

– Avoid abrupt rudder and elevator inputs because RUD TRAVEL and PITCH FEEL are in low speed configuration.

– Notify ATC of the nature of emergency encountered and state intentions.

CAUTION
Only VHF 1/ATC 1 are available on batteries only.

– If the nature of the emergency permits, allow cabin crew to make P/A announcement that will minimize apprehension. In the event of no ATC contact select ATC code 7700 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2182 KHZ or 8364 KHZ.

– Determine whether a runway can be reached, or the most appropriate place for a forced landing or ditching.

– During rapid relight attempt(s), the EGT may be allowed to rise above the ground starting EGT limit. If EGT approaches the EGT red line, the FUEL LEVER should be cycled (OFF then ON as EGT decreases) to clear a possible stall or hang-up engine condition. If unsuccessful, the start should be aborted and an other restart attempt considered.

– If no relight within 30 seconds, fuel lever must be left OFF for 30 seconds before new start attempt to allow ventilation of combustion chamber.

– If engine relights unsuccessful, it is recommended to don the oxygen masks to anticipate cabin depressurization.

– When one engine relights, the ECAM is reactivated and provides ENG FAIL/ENG SHUT DOWN message for the non operating engine. In addition, the systems which are to be restored with regard to the operating engine are displayed simultaneously.
Perform ECAM actions as soon as display reappears.

BOTH ENG FLAME OUT – FUEL REMAINING (cont'd)

- ● **When APU bleed is available or if engines restart is considered impossible :**

OPTIMUM SPD . . . . GREEN DOT

NOTE : . At green dot speed, the aircraft can fly up to approximately 3 NM per 1000 feet (with no wind).
. Average rate of descent is about 2200 feet/min.

HYD PWR ELEC PUMPS (if APU GEN operating) . . ON
GREEN HYDRAULIC EQUIPMENT . . . . . . RESTORE

APPROACH PREPARATION

LDG ELEV . . . . SET
ALTIMETERS . . . . SET
CREW OXY MASKS (below FL 100) . . . . OFF
CABIN CREW . . . . NOTIFY
SEAT BELTS/NO SMOKING . . . . ON
GPWS . . . . OFF
CABIN and COCKPIT . . . . PREPARE
. Loose equipment secured,
. Survival equipment secured,
. Belts and shoulder harness locked.

- ■ **If forced landing anticipated :**

APPROACH

- ● **Before slats extension :**

LAND RECOVERY . . . . ON
APPROACH CONFIG . . . . FLAPS 15°
APPROACH SPEED . . . . Determine below

Weight (tons)	≤100	110	120	130	140	160
App speed (kt)	150	155	165	170	175	183

NOTE : To reach the landing field/runway, the approach speed can be adjusted up to 210 (max speed with flaps 15).

L/G GRAVITY EXTENSION :
  GRAVITY EXTENSION HANDCRANK . . . . INSERT
  L/G LEVER . . . . CHECK NEUTRAL
  GRAVITY EXTENSION HANDCRANK . . . . ROTATE
  L/G LEVER . . . . DOWN
  GEAR DOWN INDICATIONS . . . . CHECK
GND SPLRS . . . . ARM

NOTE : Final descent slope at approach speed, F15 and LDG GEAR DOWN, will be approximately 1900 feet/min (with no wind).

TRIM TK ISOL VALVE . . . . OFF

AT 2000 FEET AGL

CABIN REPORT . . . . OBTAIN
EMER EXIT LT selector . . . . ON

BEFORE IMPACT

BRACE FOR IMPACT . . . . ORDER
RAM AIR . . . . ON
PITCH ATTITUDE . . . . APPROXIMATELY 11°
VERTICAL SPEED . . . . MINIMIZE

AT TOUCHDOWN

BOTH FUEL LEVERS . . . . OFF
APU MASTER SWITCH . . . . OFF
FIRE HANDLES (ALL) . . . . PULL

⇩

BOTH ENG FLAME OUT – FUEL REMAINING (cont'd)

The continuation of the procedure is linked to the fact that neither engine has been recovered :

- When APU bleed is available, GREEN DOT speed is the optimum speed for gliding as far as possible. Read green dot speed in the table at the beginning of the procedure (previous page).
- If APU GEN is available the ELEC PUMPS may be used to restore GREEN hydraulic pressure.
- The aircraft is then prepared for approach before referring to the forced landing or the ditching part of the procedure according to the situation.
- Notify the cabin crew of the nature of emergency encountered and the intentions.
- Specify the available time.

FORCED LANDING/DITCHING :

- LAND RECOVERY is selected ON to restore SLATS/FLAPS/SPLRS operation.
- SLATS/FLAPS operating times are noticeably increased due to the reduced hydraulic system capability.
- Flaps 15° configuration is considered as the optimum setting obtaining best controllability and optimum rate of descent (estimated approximately 1.900 ft/mn).
- In flaps 15° configuration, the recommended approach speed ensuring an adequate stall margin and an optimum rate of descent is determined according to the estimated aircraft weight.
- RAT operation is guaranteed above 140 kt.

Landing gear gravity extension (forced landing only)

- The landing gear gravity extension handcrank must be rotated clockwise 20 full turns until the mechanical stop is reached. Increasing loads are to be expected beyond 16 turns, then beyond 18 turns.
- When the landing gear is down, the amber door lights remain illuminated due to the door remaining open.
- Main gear : Positions for checking red pins on upper wing surface are marked by inverted T-symbols on cabin side walls.
- Nose gear : The mechanical indicator on the nose gear drag strut is checked from the avionics compartment through viewing windows in the nose landing gear well.

Mod : 4801

BOTH ENG FLAME OUT – FUEL REMAINING (cont'd)

AFTER LANDING

● **When aircraft stopped :**

CABIN CREW (PA) . . . . NOTIFY
FUEL ISOL VALVES . . . . OFF
AGENTS (ENG and APU) . . . . DISCH

● **If evacuation required** :

ΔP (DIFF PRESS) . . . . CHECK ZERO
EVACUATION . . . . INITIATE
BAT (before leaving the cockpit) . . . . . OFF/R

■ **If ditching anticipated** :

APPROACH

● **Before slats extension :**

LAND RECOVERY . . . . ON
APPROACH CONFIG . . . . FLAPS 15
APPROACH SPEED . . . . Determine below

Weight (tons)	≤100	110	120	130	140	160
App speed (kt)	150	155	165	170	175	183

NOTE : *To reach the landing field/runway, the approach speed can be adjusted up to 210 (max speed with flaps 15)*

L/G LEVER . . . . UP
TRIM TK ISOL VALVE . . . . OFF

AT 2000 FEET AGL

CABIN REPORT . . . . OBTAIN
EMER EXIT LT selector . . . . ON
OUTFLOW 1 and 2 (FWD and AFT) . . OFF/(CLOSED)
MAN PRESS . . . . CHECK OFF
RAM AIR . . . . OFF/CLOSED

BEFORE DITCHING

BRACE FOR IMPACT . . . . ORDER
PITCH ATTITUDE . . . . APPROXIMATELY 11°
VERTICAL SPEED . . . . MINIMIZE

AT TOUCHDOWN

BOTH FUEL LEVERS . . . . OFF
APU MASTER SWITCH . . . . OFF
FIRE HANDLES (ALL) . . . . PULL

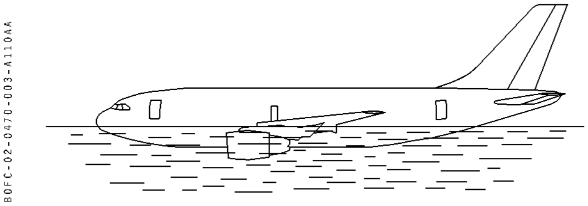
AFTER DITCHING

CABIN CREW (PA) . . . . NOTIFY
R FUEL ISOL VALVES . . . . OFF
ΔP (DIFF PRESS) . . . . CHECK ZERO
AGENTS (ENG and APU) . . . . DISCH
EVACUATION . . . . INITIATE
BAT (before leaving the cockpit) . . . . OFF/R

BOTH ENG FLAME OUT – FUEL REMAINING (cont'd)

DITCHING SPECIFICITIES :

– Reference aircraft attitude after ditching.



– Note : *The direction of ditching is mainly dependent on wind and state of sea and these factors may be assessed as follows :*

(1) Wind direction :

This may be assessed by observing the waves, wich move and break down wind, spray from wave tops is also a reliable indicator.

(2) Wind speed :

The following conditions can be used as a guide to wind speed :

A few white crest . . . . 8-17 Kt
Many white crests . . . . 17-26 Kt
Streaks of foam along water . . . 23-35 Kt
Spray from waves . . . . 35-43 Kt

(3) State of sea :

This is better assessed from a height of 500 to 1000 ft, particularly direction of swell which may not be as obvious as the less important wave direction when seen from a lower altitude.

– When there is no swell, align into the wind. In the presence of a swell, and provided that drift does not exceed 10 degrees, land parallel to the swell, and as nearly into wind as possible. If drift exceeds 10 degrees, land into wind. The presence of drift on touchdown is not dangerous, but every effort should be made to minimize roll.

BOTH ENG FLAME OUT – NO FUEL REMAINING

CAUTION : ***This paper procedure is applicable in case of both engines flame out, when there is no fuel remaining on board. It includes all the necessary information to manage the situation.***

LAND ASAP
RAT . . . . ON

THROTTLES . . . . IDLE
OPTIMUM SPD . . . . GREEN DOT

NOTE : At green dot speed with both engines inop, the aircraft can fly up to approximately 3.1 NM per 1000 feet (with no wind).
. Average rate of descent is about 1700 feet/min.
. It takes about 20 minutes to descend from FL 350 to the ground. The distance is about 105 NM.

GREEN DOT SPEED WITH BOTH ENGINES INOP (KNOTS)			
Weight (tons)	FL 200 and below	FL 300	FL 350
80	180	200	210
100	200	220	230
120	220	240	250

R R ● **If unreliable or lost airspeed indication (volcanic ash encounter)** :

PITCH ATTITUDE . . . . Determine below

FL 200 and below	FL 300	FL 350
1.5°	0.5°	0°

USE ELEVATOR AND RUDDER WITH CARE ABOVE SPD 170 KT IAS

COMMUNICATIONS VHF1/ATC1

● **When time permits** :

ATC . . . . NOTIFY
TRANSPONDER . . . . AS RQRD

LANDING STRATEGY . . . . DETERMINE
CREW OXY MASKS (above FL 100) . . . . ON
R EMER EXIT LT . . . . DISARM

BOTH ENG FLAME OUT – NO FUEL REMAINING

– Before applying this procedure, a fuel supply check, must be done to confirm the correct fuel panel setting according to remaining fuel quantity, ISOL VALVES OPEN. If fuel remains on board, the procedure "BOTH ENG FLAME OUT – FUEL REMAINING" must be applied.

– The optimum airspeed to achieve the best lift to drag ratio for gliding as far as posible, is GREEN DOT speed. Green dot speed is read on the table.

– In case of unreliable or lost airspeed indication set aircraft pitch attitude according to aircraft Flight Level.

– Avoid abrupt rudder and elevator inputs because RUD TRAVEL and PITCH FEEL are in low speed configuration.

– Notify ATC of the nature of emergency encountered and state intentions.

CAUTION

Only VHF 1/ATC 1 are available on batteries only.

– If the nature of the emergency permits, allow cabin crew to make P/A announcement that will minimize apprehension. In the event of no ATC contact select ATC code 7700 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2182 KHZ or 8364 KHZ.

– Determine whether a runway can be reached, or the most appropriate place for a forced landing or ditching.

– It is recommended to don the oxygen masks to anticipate cabin depressurization.

– The EMER EXIT LT selector should be set to disarm (and then back to ON at 2000 ft, just prior to landing/ditching). This allows to preserve aircraft batteries, as well as dedicated battery packs for the emergency lights and the FPEEPMS. R R R R R

BOTH ENG FLAME OUT – NO FUEL REMAINING (cont'd)

APPROACH PREPARATION

LDG ELEV . . . . SET
ALTIMETERS . . . . SET
CREW OXY MASKS (below FL 100) . . . . OFF
CABIN CREW . . . . NOTIFY
SEAT BELTS/NO SMOKING . . . . ON
GPWS . . . . OFF
CABIN and COCKPIT . . . . PREPARE
. Loose equipment secured,
. Survival equipment secured,
. Belts and shoulder harness locked.

■ **If forced landing anticipated** :

APPROACH

● **Before slats extension :**

LAND RECOVERY . . . . ON
APPROACH CONFIG . . . . FLAPS 15
APPROACH SPEED . . . . Determine below

Weight (tons)	≤100	110	120	130	140	160
App speed (kt)	150	155	165	170	175	183

NOTE : To reach the landing field/runway, the approach speed can be adjusted up to 210 (max speed with flaps 15).

L/G GRAVITY EXTENSION :
GRAVITY EXTENSION HANDCRANK . . . . INSERT
L/G LEVER . . . . CHECK NEUTRAL
GRAVITY EXTENSION HANDCRANK . . . ROTATE
L/G LEVER . . . . DOWN
GEAR DOWN INDICATIONS . . . . CHECK
GND SPLRS . . . . ARM

NOTE : Final descent slope at approach speed, F15 and LDG GEAR DOWN, will be approximately 1900 feet/min (with no wind).

AT 2000 FEET AGL

CABIN REPORT . . . . OBTAIN
EMER EXIT LT selector . . . . ON

BEFORE IMPACT

BRACE FOR IMPACT . . . . ORDER
RAM AIR . . . . ON
PITCH ATTITUDE . . . . APPROXIMATELY 11°
VERTICAL SPEED . . . . MINIMIZE

AT TOUCHDOWN

BOTH FUEL LEVERS . . . . OFF
FIRE HANDLES (ALL) . . . . PULL

BOTH ENG FLAME OUT – NO FUEL REMAINING (cont'd)

- The aircraft is then prepared for approach before referring to the forced landing or the ditching part of the procedure according to the situation.
- Notify the cabin crew of the nature of emergency encountered and the intentions.
- Specify the available time.

FORCED LANDING/DITCHING :

- LAND RECOVERY is selected ON to restore SLATS/FLAPS/SPLRS operation.
- SLATS/FLAPS operating times are noticeably increased due to the reduced hydraulic system capability.
- Flaps 15° configuration is considered as the optimum setting obtaining best controllability and optimum rate of descent (estimated approximately 1.900 ft/mn).
- In flaps 15° configuration, the recommended approach speed ensuring an adequate stall margin and an optimum rate of descent is determined according to the estimated aircraft weight.
- RAT operation is guaranteed above 140 kt.

Landing gear gravity extension (forced landing only)

- The landing gear gravity extension handcrank must be rotated clockwise 20 full turns until the mechanical stop is reached. Increasing loads are to be expected beyond 16 turns, then beyond 18 turns.
- When the landing gear is down, the amber door lights remain illuminated due to the door remaining open.
- Main gear : Positions for checking red pins on upper wing surface are marked by inverted T-symbols on cabin side walls.
- Nose gear : The mechanical indicator on the nose gear drag strut is checked from the avionics compartment through viewing windows in the nose landing gear well.

BOTH ENG FLAME OUT – NO FUEL REMAINING (cont'd)

AFTER LANDING

● **When aircraft stopped :**

CABIN CREW (PA) . . . . NOTIFY
FUEL ISOL VALVES . . . . OFF
AGENTS (ENG and APU) . . . . DISCH

● **If evacuation required** :

ΔP (DIFF PRESS) . . . . CHECK ZERO
EVACUATION . . . . INITIATE
BAT (before leaving the cockpit) . . . . . . OFF/R

■ **If ditching anticipated** :

APPROACH

● **Before slats extension :**

LAND RECOVERY . . . . ON
APPROACH CONFIG . . . . FLAPS 15
APPROACH SPEED . . . . Determine below

Weight (tons)	≤100	110	120	130	140	160
App speed (kt)	150	155	165	170	175	183

NOTE : To reach the landing field/runway, the approach speed can be adjusted up to 210 (max speed with flaps 15)

L/G LEVER . . . . UP

AT 2000 FEET AGL

CABIN REPORT . . . . OBTAIN
EMER EXIT LT selector . . . . ON
OUTFLOW 1 and 2 (FWD and AFT) . . OFF/(CLOSED)
MAN PRESS . . . . CHECK OFF
RAM AIR . . . . OFF/CLOSED

BEFORE DITCHING

BRACE FOR IMPACT . . . . ORDER
PITCH ATTITUDE . . . . APPROXIMATELY 11°
VERTICAL SPEED . . . . MINIMIZE

AT TOUCHDOWN

BOTH FUEL LEVERS . . . . OFF
FIRE HANDLES (ALL) . . . . PULL

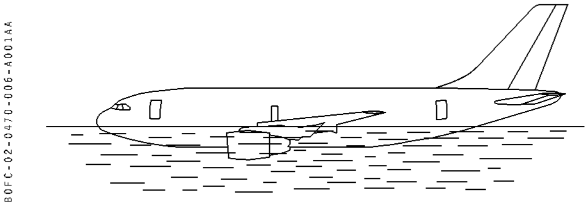
AFTER DITCHING

CABIN CREW (PA) . . . . NOTIFY
R FUEL ISOL VALVES . . . . OFF
ΔP (DIFF PRESS) . . . . CHECK ZERO
AGENTS (ENG and APU) . . . . DISCH
EVACUATION . . . . INITIATE
BAT (before leaving the cockpit) . . . . OFF/R

BOTH ENG FLAME OUT – NO FUEL REMAINING (cont'd)

DITCHING SPECIFICITIES :

– Reference aircraft attitude after ditching.



– *Note : The direction of ditching is mainly dependent on wind and state of sea and these factors may be assessed as follows :*

(1) Wind direction :

This may be assessed by observing the waves, wich move and break down wind, spray from wave tops is also a reliable indicator.

(2) Wind speed :

The following conditions can be used as a guide to wind speed :

A few white crest . . . . 8-17 Kt
Many white crests . . . . 17-26 Kt
Streaks of foam along water . . . 23-35 Kt
Spray from waves . . . . 35-43 Kt

(3) State of sea :

This is better assessed from a height of 500 to 1000 ft, particularly direction of swell which may not be as obvious as the less important wave direction when seen from a lower altitude.

– When there is no swell, align into the wind. In the presence of a swell, and provided that drift does not exceed 10 degrees, land parallel to the swell, and as nearly into wind as possible. If drift exceeds 10 degrees, land into wind. The presence of drift on touchdown is not dangerous, but every effort should be made to minimize roll.

ENG OIL LO PR

- **IF OIL PRESS BELOW 70 PSI :**

THROTTLE . . . . IDLE
FUEL LEVER . . . . OFF
PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

ENG OIL LO PRESS

Indications :

Continuous repetitive chime
ECAM activation with appropriate warning light
Left ECAM CRT : ENG OIL LO PR PROC
Right ECAM CRT : ENG page
OIL LO PRESS light

- Oil pressure drops below 5 psi prior to engine shutdown, and windmilling time without positive oil pressure indicated, must be recorded for maintenance purposes.
- If conditions do not permit engine shutdown, use the minimum thrust required to sustain safe flight.
- If the low oil pressure condition (OIL LO PRESS local warning and ENG OIL LO PR ECAM procedure) is not confirmed by the OIL PRESS reading on the RH ECAM ENGINE page, continue normal engine operation while monitoring the OIL PRESS reading and other engine primary and secondary parameters (a low oil pressure switch defect may be suspected).

PW Eng. : 4000

FORCED LANDING

PREPARATION **(time permitting)**

CABIN CREW . . . . NOTIFY
ATC . . . . NOTIFY
TRANSPONDER . . . . AS RQRD

SEAT BELTS/NO SMOKING . . . . ON
GPWS . . . . OFF

CABIN and COCKPIT . . . . PREPARE
. Loose equipment secured,
. Survival equipment secured,
. Belts and shoulder harness locked.

CAB PRESS-LDG ELEVATION . . . . SET

APPROACH

● **If green hydraulic system lost** :
PROC : L/G GRAVITY EXTENSION (10.02) . . APPLY

L/G LEVER . . . . DOWN
GND SPLRS . . . . ARM
SLATS and FLAPS (if engines running) . . MAX AVAIL
TRIM TK ISOL VALVE . . . . OFF

CABIN REPORT . . . . OBTAIN
EMER EXIT LT selector . . . . ON

BEFORE IMPACT

PACKS 1 and 2 . . . . OFF
RAM AIR . . . . ON

BRACE FOR IMPACT . . . . ORDER

PITCH ATTITUDE . . . . APPROXIMATELY 11°
VERTICAL SPEED . . . . MINIMIZE

IMPACT

BOTH FUEL LEVERS . . . . OFF

AFTER IMPACT

FIRE HANDLES (ALL) . . . . PULL

● **When aircraft stopped** :
CABIN CREW (PA) . . . . NOTIFY
FUEL ISOL VALVES . . . . OFF
AGENTS (ENG and APU) . . . . DISCH
R △P (DIFF PRESS) . . . . CHECK ZERO
EVACUATION . . . . INITIATE
BAT (before leaving the aircraft) . . . . OFF/R

FORCED LANDING

– Notify ATC of the nature of emergency encountered and state intentions.

In the event of no ATC contact select ATC code 7700 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2182 KHZ or 8364 KHZ.

CAUTION

Only VHF 1/ATC 1 are available on batteries only.

– Notify the cabin crew of the nature of emergency encountered and the intentions.
Specify the available time.

If the nature of the emergency permits, allow cabin crew to make P/A announcement that will minimize apprehension.

Mod. : 4801

DITCHING

PREPARATION (time permitting)

CABIN CREW	NOTIFY
ATC	NOTIFY
TRANSPONDER	AS RQRD
SEAT BELTS / NO SMOKING	ON
GPWS	OFF
CABIN and COCKPIT	PREPARE

. Loose equipment secured,
. Survival equipment prepared,
. Belts and shoulder harness locked.

CAB PRESS-LDG ELEVATION	SET

APPROACH

L/G LEVER	UP
SLATS and FLAPS (if engines running)	MAX AVAIL
TRIM TK ISOL VALVE	OFF
CABIN REPORT	OBTAINED
EMER EXIT LT selector	ON

BEFORE DITCHING

OUTFLOW FWD and AFT	OFF/CLOSED
MAN PRESS	CHECK OFF
BLEED VALVES (ENG and APU)	OFF/R
RAM AIR	OFF/CLOSED
BRACE FOR IMPACT	ORDER
PITCH ATTITUDE	APPROXIMATELY 11°
VERTICAL SPEED	MINIMIZE

DITCHING

BOTH FUEL LEVERS	OFF

AFTER DITCHING

FIRE HANDLES (ALL)	PULL
CABIN CREW (PA)	NOTIFY
FUEL ISOL VALVES	OFF
R △P (DIFF PRESS)	CHECK ZERO
EVACUATION	INITIATE
BAT (before leaving the aircraft)	OFF/R

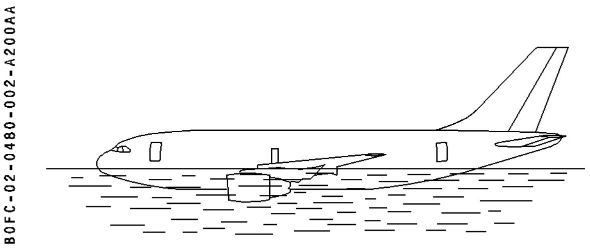
DITCHING

– Notify ATC of the nature of the emergency encountered and state intentions.
In the event of no ATC contact select ATC code 7700 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2182 KHZ or 8364 KHZ.

CAUTION
VHF1/ATC1 only are available on batteries only.

– Notify the cabin crew the nature of emergency encountered and intentions.
Specify the available time.

– Reference aircraft attitude after ditching.



– *Note : The direction of ditching is mainly dependent on wind and state of sea and these factors may be assessed as follows :*

(1) Wind direction :

This may be assessed by observing the waves, wich move and break down wind, spray from wave tops is also a reliable indicator.

(2) Wind speed :

The following conditions can be used as a guide to wind speed :

A few white crest	*8-17 Kt*
Many white crest	*17-26 Kt*
Streaks of foam along water	*23-35 Kt*
Spray from waves	*35-43 Kt*

(3) State of sea :

This is better assessed from a height of 500 to 1000 ft, particularly direction of swell which may not be as obvious as the less important wave direction when seen from a lower altitude.

– When there is no swell, align into the wind. In the presence of a swell, and provided that drift does not exceed 10 degrees, land parallel to the swell, and as nearly into wind as possible. If drift exceeds 10 degrees, land into wind. The presence of drift on touchdown is not dangerous, but every effort should be made to minimize roll.

ON GROUND EMER/EVACUATION

AIRCRAFT/PARKING BRK . . . . STOP/SET
ATC (VHF 1) . . . . NOTIFY
BOTH FUEL LEVERS . . . . OFF
CABIN CREW (PA) . . . . NOTIFY
EMER EXIT LT selector . . . . ON
FIRE handles (ENG and APU) . . . . PULL
FUEL ISOL VALVES . . . . OFF
AGENTS (ENG and APU) . . . . AS RQRD
RAM AIR . . . . ON

● **If CAB MAN PRESS selected** :
V/S CTL . . . . MAINTAIN UP
△P (DIFF PRESS) . . . . CHECK ZERO

R ■ **If Evacuation required** :
R EVACUATION (PA) . . . . INITIATE
R BAT (ALL) (before leaving the cockpit) . . . . . OFF/R

R ■ **If Evacuation not required** :
R CABIN CREW & PASSENGERS (PA) . . . . . . NOTIFY

ON GROUND EMERGENCY – EVACUATION

- Consider positioning the aircraft according to wind, so that any possible fire is kept away from the fuselage.
- Careful analysis is required to decide on passenger evacuation, however, useful time should not be wasted.
- Notify ATC of the nature of the emergency, and state intentions.

CAUTION

Only VHF 1 is available on batteries only.

- Notify the cabin crew about the emergency encountered and the intentions.
- To facilitate doors opening RAM AIR selected ON automatically opens all OUTFLOW valves when in CAB AUTO PRESS.
- Switching the batteries OFF stops the cockpit voice recorder (CVR) and prevents tape erasure.

CREW INCAPACITATION

In case of incapacitation of a cockpit crew member, the remaining crew member shall as soon as practicable call a cabin attendant.
The best way to request assistance from the cabin crew, is by P/A system :

« ATTENTION, PURSER TO COCKPIT PLEASE ».

The Purser or any other Cabin Attendant must proceed to the cockpit immediately.

The Cabin Attendant then must :

- 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 an unconscious body from a seat without endangering any controls and switches.

If it is not possible to remove the body, one cabin attendant shall 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.

GENERAL

- The successful conclusion of an emergency situation depends upon the perfect knowledge and execution of the duties assigned to each crew member.
- The captain must make sure that all crew members know exactly their assigned positions and their specific duties, as well as the duties of the other crew members.
- R Since it is not possible to cover all the situations which may occur, the captain is responsible for the adaptation of the following instructions, to obtain the best coordination. Should it be physically impossible for the captain to carry out his duties, he will be substituted according the prevailing chain of command.

COCKPIT CREW ASSIGNED AREAS FOR EVACUATION

- R If it is **not possible** to reach the passenger cabin :
  The crew shall evacuate the aircraft through the cockpit sliding windows by means of the escape ropes.

  On ground, each crew member shall give assistance to the passengers in order to direct them away from the aircraft.
- R If it is **possible** to reach the passenger cabin :

CPT	– He (she) is the last person to leave the cockpit, proceed to the cabin and assist in passenger evacuation, as situations dictate. – Check that all persons on board have been evacuated, – Leave the aircraft through the rear door (or any other suitable exit if rear door cannot be reached) – Take command on ground and gives assistance as required.
F/O	– Proceed to the cabin, assist passengers and take the emergency equipment. – Evacuate the aircraft through any suitable exit. – Assist on the ground as necessary.

CABIN CREW ASSIGNED AREAS FOR EVACUATION

C/ADESIGNATION	ASSIGNED JUMPSEAT and DOOR	ASSIGNED AREA
PURSER	DOOR 1 LH	FWD-ALLCABIN
ATTENDANT 1R	DOOR 1 RH	FWD/MID
ATTENDANT(*)	(*)	(*)
ATTENDANT3L/R	DOOR 3 LH/RH	AFT/MID

(*) Depending on overwing exists type (Type I or Type III)

If the cockpit crew does not participate in the cabin evacuation, the purser attendant is responsible to check the entire cabin, before leaving the aircraft. R R R

<u>Note</u> : The following procedures were established for the minimum required cabin attendant number.

COMMUNICATION BETWEEN FLIGHT CREW

1. EMERGENCY CALL

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	"ALL ATTND" push-button on CALLS panel : – press (at least 6 chimes) or P.A. SYSTEM : – "PURSER REPORT TO COCKPIT"	Purser must proceed to cockpit immediately
CABIN	COCKPIT	INTERPHONE : – "PRIO CAPT"	Any C/A can make such a call, cockpit crew must reply.

2. EMERGENCY ALERT

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM : – "ATTENTION! CREW AT STATIONS"	Short and precise announcement to warn an emergency evacuation might be required in very short time. C/A must proceed to their emergency stations and fasten seat belts.

3. NOTIFICATION TO PASSENGERS

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM NO SMOKING/SEAT BELT signs : – select ON	For psychological reasons the first information about an intended emergency landing should be made by the cockpit crew
PURSER	CABIN	P.A. SYSTEM CABIN LIGHTS : – select 100 %	Passengers must be informed that they have to pay special attention to the warnings : – FINISH PREPARATION – BRACE FOR IMPACT – PASSENGER EVACUATION

4. FINISH PREPARATION

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM : – "FINISH PREPARATION"	Order to be made short time before emergency landing.

5. BRACE FOR IMPACT

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM : – "BRACE FOR IMPACT"	Order to be made not later than 1mn before impact

6. INITIATION EVACUATION - (RESTRICTED EXITS)

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM : – "PASSENGER EVACUATION THROUGH LH (RH) EXITS" and EVAC SIGNAL/ COMMAND EVAC pushbutton : – Press to activate (ON)	This order means immediate evacuation through all usable exits
CABIN	COCKPIT AND CABIN	EVAC signal system at purser's station : – PUSH FOR ON, or P.A. SYSTEM, or Megaphone	When no signal or order from the cockpit and it is unmistakably apparent that an evacuation must be executed
CABIN	CABIN		STANDUP AND SHOUT – "SEAT BELTS OFF" – "SHOES OFF" – "LEAVE EVERYTHING" – "GET OUT"

7. EVACUATION NOT REQUIRED

FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. SYSTEM : – "CABIN CREW AND PASSENGERS KEEP YOUR SEATS"	Immediate announcement when CAPT decides that evacuation is not required

LAND EVACUATION PROCEDURE

CABIN ATTENDANTS RESPONSIBLE FOR FWD/MID/AFT PAX DOOR AND EMER EXITS

Each cabin attendant applies the following :

- Wait aircraft stop,
- Command to unfasten seat belts,
- Check outside conditions.

- **If outside condition is considered safe** :
  - Open door in ARMED configuration
  - Protect the exit and watch slide deployment
  - Command and assist passengers evacuation.
- **If outside condition is considered unsafe** :
  - Block the exit and direct the passengers to the nearest usable exit,
  - Evacuate the cabin after check of responsible area
  - Assist passengers on ground.

COCKPIT EVACUATION THROUGH SLIDING WINDOW, USING EMERGENCY DESCENT DEVICES

- Open sliding window,
- Remove the cover of the emergency descent devices (reels),
- Pull the reel, adjacent to the sliding window, from its stowage compartment,

  The handgrip will extend a few inches to allow grip with both hands while descending,
- Climb backwards into the cockpit window and stand on the window frame.
- Secure yourself with one hand, do not attempt to secure yourself at the handgrip due to the backlash in the cable,

  Secure yourself until your body is in a vertical position outside the cockpit, the feet under your body.
- Descend while holding the emergency descent device handgrip with both hands.
- Expect a high descent speed but attempt to reach the ground in an up-right position, practically standing.
- Walk away from the cockpit area to assist passengers and direct them away from the aircraft.

DITCHING EVACUATION PROCEDURE

CABIN ATTENDANT RESPONSIBLE FOR FWD/MID AND AFT DOORS

- Deploy the slide/raft in the same manner as for land deployment
- Pull manual inflation handle
  Do not wait for automatic inflation

- **If water level close to doors sill**
  - Slide/raft is inflated on water
  - Keep slide/raft attached to cabin floor
  - Board passengers
  - Last crew member separates slide/raft from door sill
  - Cut mooring line
- **If water level too far from door sill**
  - Disconnect slide/raft from door sill
    Slide/raft remains tied to the aircraft by a 20 feet mooring line.
  - Hold mooring line to approach the slide/raft close to the exit
  - Evacuate passengers into the slide/raft
  - Crew members board slide/raft last
  - Cut mooring line
  - Retrieve survival kit attached via the lanyard to the slide/raft.

<u>Note</u> : *As the capacity of the six slide/rafts is sufficiently large to accomodate all persons on board, priority of evacuation should be given to the doors equipped with slide/rafts.*

PW Eng : 4000

GENERAL

- The abnormal procedures provide the sequence of actions to be performed following :
  - An amber warning,
  - An abnormal condition not associated to a warning (e.g. elevator jam, unreliable airspeed),
  - An adverse weather condition (e.g. severe turbulence or volcanic ash encounter).
- The abnormal procedures are to be applied following the READ-AND-DO principle.

COORDINATED USE OF ECAM AND QRH

- The ECAM and QRH (Quick Reference Handbook) must be used in a coordinated manner.
- The QRH is used :
  - When no ECAM procedure is available,

  or
  - When a QRH procedure is called by the prompt PROC in an ECAM warning page or in the ECAM STATUS page,

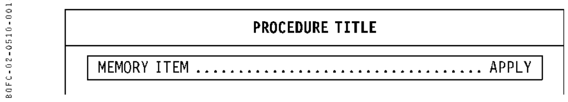
    and / or (in any case),

    before completing the ECAM STATUS page, in order to review the **originating procedure** for possible additional actions or information.
- Referring to the FCOM 1 and / or FCOM 2 is not required for the short term handling of any abnormal procedure but may be considered when convenient, if so desired.

PROCEDURES LAYOUT

The FCOM / QRH procedures are presented using the following layout standards :

- ACTIONS : all actions are printed in capital letters. For enhanced clarity, actions are regrouped by action blocks (e.g. actions related to the same system or the same purpose) when there is space available. The abbreviations are used only when abbreviations are used on the ECAM or on the cockpit panels,
- MEMORY ITEMS : are identified by a thin solid line box. These actions have to be performed without referring to the QRH.


PROCEDURE TITLE

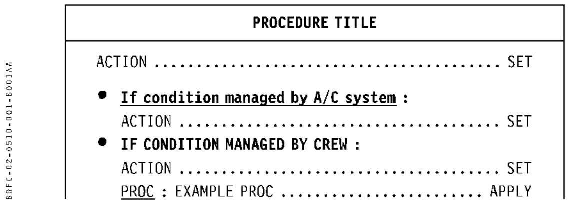
MEMORY ITEM .... APPLY

- ECAM ACTIONS : are identified by a bold solid vertical line,
- ECAM STATUS : items are identified by a bold dotted vertical line,
- Conditional actions :
  - ■ squares symbols are used whenever several conditions (**If**) are possible but **only one entry is to be used,**
  - • dots are used to identify a condition or a phase (e.g. **If, At, When**), all questions starting by a dot must be answered.

  Note : ■ and • are not displayed on ECAM.

  Small underlined letters in QRH mean that the condition is not displayed on the ECAM, but this condition is managed by the aircraft system.

  If the condition is displayed on the ECAM, it appears in the QRH in large letters and have to be managed by crew.


PROCEDURE TITLE

ACTION .... SET

- **If condition managed by A/C system :**

  ACTION .... SET
- **IF CONDITION MANAGED BY CREW :**

  ACTION .... SET

  PROC : EXAMPLE PROC .... APPLY

Note : When action requests to set a system "OFF/R", the OFF position must be selected. It is not a request for reset.

- Cross-references :
  - • when an other QRH procedure is cross-referenced, the procedure title is indicated after the prompt PROC :, and the associated QRH page is indicated between brackets,
- FLIGHT PHASE identifies the actions which must be delayed until indicated flight phase (e.g. FOR LANDING, FOR APPROACH...),
- Expanded information : for each procedure, an expanded information is provided in order to :
  - • list the indications (warning light and audio warning) and / or clues associated with the prevailing abnormal condition,
  - • provide background information regarding the reason(s), result(s) and benefit(s) of actions (unless such reason, result and benefit are self evident).

PROCEDURES INITIATION

- No action shall be taken (apart from audio warning cancel) until :
  - – The appropriate flight path is stabilized,
  - – Normal procedures are applied,
  - – At least 400 ft above runway, in case of failure during takeoff, approach or go-around,
    - • A height of 400 ft is recommended as a good compromise between :
      - * the time required for flight path stabilization,
      - * the initiation of the procedure without excessive delay.
    - • In some abnormal conditions, provided the appropriate flight path is established, the PF may initiate actions before reaching 400 ft AGL.
  - – Appropriate command by PF.

TASK SHARING

- The Pilot Flying (PF) remains PF throughout the entire procedure.
- However, when actions can only be performed from one side (e.g. landing gear gravity extension, minimum equipment bay sniffer fan activation), tasks must be redistributed accordingly.
  - – The PF (Pilot Flying) is responsible for :
    - • Throttle levers,
    - • Flight path and airspeed control,
    - • Aircraft configuration (PF orders, PNF executes),
    - • Navigation,
    - • Communications.
  - – The PNF (Pilot Non Flying) is responsible for :
    - • Reading the ECAM and QRH,
    - • Execution of ECAM actions and paper check-list(s), upon PF command,
    - • Actions on fuel levers, fire handles and guarded switches (with confirmation of PF).

Note : During a rejected takeoff, an on-ground engine fire or an on-ground emergency / evacuation, a CAPT-F/O task sharing applies.

Note : Memory Items may be carried out by either pilot, since response time may be important for success. However, initiation of Memory Items must be called out by the PF.

LDG SPEED INCREMENT - LDG DISTANCE FACTOR

- Unless otherwise specified in the procedures, the minimum speed to be used for approach and landing is the VLS corresponding to the configuration requested by the procedure.

  Note : VLS, when mentioned in a procedure, is the one corresponding to the configuration requested by the procedure (e.g. if the procedure requests to use 20°/20° configuration, take VLS of 20°/20° configuration).

- LDG SPEED INCREMENTS have to be added to the indicated V LS. R
  - – A V LS INCREMENT is indicated on the ECAM STATUS page and in the FCOM / QRH procedure only when the indicated V LS does not account for the abnormal condition, this is the case only in the following three conditions : R
    - • Kruger flaps not extended when selected,

    or

    - • Loss of 4 or more roll spoilers per wing,

    or R

    - • Spoiler(s) stuck in extended position. R

    In all other abnormal conditions, the indicated V LS accounts for the abnormal configuration.

- The SPD INCREMENT is to be added to S and F speeds, only if specified in the QRH procedure :
  - – Loss of krugers :
    - * SPD INCREMENT applicable to S, F and V LS for recovery of the stall margin.
  - – Loss of 4 or more roll spoilers per wing :
    - * SPD INCREMENT applicable to V LS only for recovery of the maneuvering capability.

- The LDG DIST factor is to be applied on the LDG DIST 30 / 40 (QRH 15.02).
  - A LDG DIST factor is indicated on the ECAM STATUS page and in the FCOM / QRH procedure only in the following conditions :
    - When a LDG SPD INCREMENT is applicable,

    and / or
    - In case of loss of 3 or more ground spoilers per wing,

    and / or
    - In case of braking in ALTN / ON or ALTN / OFF.

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.

Advisory Conditions

- In case of activation of the ADV mode on an ECAM system page, the only required action is the monitoring of the flashing parameter.

  Time and situation permitting, preventive action(s) may be considered (as indicated in section 2.05.80) in order to :
  - avoid the development of the prevailing condition into an abnormal condition,

  or
  - minimize the condition incurred by the affected equipment,

  or
  - ensure an optimum management of the affected system.

Crew coordination

- When performing an ECAM or non-ECAM procedure, both pilots must be fully aware of the status of the warning and system displays.
- After completing a warning page, CLEAR ... (title of the ECAM page) is proposed by the PNF but must be confirmed by the PF (after checking the status of the warning and system pages) before the PNF presses the CLR key.

AFFECTED EQUIPMENT REVIEW

- In case of Abnormal/Emergency procedure related to Electrical, Hydraulic, Auto flight systems or Servo Controls, the affected equipment have to be reviewed using the dedicated tables :
  - BUS EQPT LIST (QRH 3.08 - 3.09 - 3.10)
  - HYDRAULIC POWER DISTRIBUTION (QRH 8.01)
  - AUTO FLIGHT SYSTEM – DISTRIBUTION (QRH 11.03)
  - SERVO CONTROLS (QRH 6.12).

OPERATING ENGINEERING BULLETIN (OEB)

An OEB is issued to rapidly inform operators of any R
deviations from initial design objectives that have a R
significant operational impact. An OEB provides the R
operators with technical information and temporary R
operational procedures that address these deviations. R
The information in the OEB should be followed R
immediately. R

The list of applicable OEBs is in the FCOM 2.19 and R
in QRH 19.00. R

In addition the OEB operational procedure(s) that R
the flight crew must apply are provided in the QRH R
(19.00). R

Example of Crew Coordination and Cross-Confirmation

WARNING DISPLAY	PILOT FLYING	PILOT NOT FLYING
HYD BLUE RSVR OVHT – BLUE PUMP . . . . OFF	– READ FAILURE TITLE – TAKE ATC RADIO CTL – REQUEST « ECAM ACTION* »	– READ FAILURE TITLE – READ ACTION (full line) – PERFORM ECAM ACTION OR REQUEST EXECUTION BY THE PF
	– REQUEST « PAPER C/L » IF APPLICABLE	
HYD BLUE RSVR OVHT BLUE PUMP OFF BLUE SYS LO PR		– REQUEST « CLEAR HYDRAULIC »
	– CHECK ECAM ACTION COMPLETED – CONFIRM « CLEAR »	
* FLT CTL SLATS SYS 1 FAULT SPLR 7 FAULT . . . . OFF SPLR 1+4 FAULT . . . . OFF YAW DAMPER 1 OFF		– PERFORM ECAM ACTIONS FOR SECONDARY FAILURES – CHECK NO CYAN ON ECAM – REQUEST « CLEAR FLIGHT CONTROLS »
	– CHECK ECAM WARNING AND SYSTEM PAGES – CONFIRM « CLEAR »	
STATUS LAND 3 INOP LDG DIST : MULTIPLY BY 1.3 PROC HYD SYS LO PR BLUE HYD SYS INOP SPLR PARTIALLY INOP SLATS SLOW		– READ STATUS LINE BY LINE
	– REQUEST « PAPER C/L » Note : STATUS will be called in APPROACH C/L	
		– PERFORM PAPER C/L – CONFIRM « PAPER C/L COMPLETED »
	– REQUEST « CONTINUE STATUS »	– READ STATUS LINE BY LINE – CONFIRM « STATUS COMPLETED »
	– REQUEST « PAPER C/L FOR (originating procedure) »	– REVIEW/PERFORM PAPER C/L FOR POSSIBLE ADDITIONAL ACTION/INFORMATION
		– REQUEST « CLEAR STATUS »
	– CONFIRM « CLEAR »	
		– CONFIRM « ECAM ACTIONS COMPLETED »

* Although the pilot flying requests ECAM actions, this does not preclude the CM1 from either taking control of the aircraft or ordering ECAM actions if he/she considers this necessary.

BLEED LEAK

R
- ● **If WING ANTI ICE ON** :
  - AVOID ICING CONDITIONS
  - WING SUPPLY pushbutton . . . . OFF
- ● **If AIR X FEED in line** :
  - AIR X FEED . . . . MAN
  - AIR X FEED . . . . X LINE
- BLEED VALVE (affected) . . . . OFF/R
- ● **If left side affected** :
  - APU BLEED . . . . OFF/R
- PACK (affected side) . . . . OFF

BLEED LEAK

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : BLEED LEAK proc (if LH side affected)

Right ECAM CRT : AIR BLEED page

LEAK light on AIR BLEED panel.

- Following the detection of a leak the affected system valves will close automatically (Bleed valve, XFEED valve and APU bleed valve (if LH side affected)).

  The associated actions confirm automatic operation and extinguish related warnings, allowing flight to be continued with one pack supplied.
- WING ANTI ICE valve will close due to lack of bleed air supply. SUPPLY must be selected OFF to prevent wing anti ice asymmetry.
- PACK VALVE will close due to lack of air supply.

APU BLEED LEAK

APU BLEED . . . . OFF/R

APU BLEED LEAK

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : BLEED LEAK proc

Right ECAM CRT : AIR BLEED page

LEAK light on AIR BLEED panel.

- APU BLEED VALVE and X FEED valve (if AUTO) close automatically.

AIR X – FEED FAULT

AIR X FEED . . . . MAN

AIR X-FEED FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : AIR X FEED FAULT proc

Right ECAM CRT : AIR BLEED page

FAULT light on AIR BLEED panel.

BLEED HP VALVE FAULT

BLEED HP VALVE (affected) . . . . OFF

BLEED PRESS LO AT IDLE

- **<u>If FAULT light remains illuminated</u>** :

  BLEED HP VALVE STUCK OPEN
  AIR X FEED . . . . MAN
  AIR X FEED . . . . IN LINE

  - **<u>If WING ANTI-ICE ON</u>** :

    ONE PACK . . . . OFF

  BLEED VALVE (affected) . . . . OFF/R

BLEED HP VALVE FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : HP VALVE FAULT procedure
Right ECAM CRT : AIR BLEED page
FAULT light on AIR BLEED panel.

– If after having selected the BLEED HP VALVE to OFF the warning remains (BLEED HP VALVE jammed open) the BLEED VALVE must be closed.

– With the ENG BLEED VALVE closed, the flight can be continued with both packs supplied, however, one pack must be selected OFF, if wing anti-ice is used.
This will prevent the other bleed from failing due to precooler overheat.

ENG BLEED VALVE FAULT

AIR X FEED . . . . MAN
AIR X FEED . . . . IN LINE

- **<u>If WING ANTI-ICE ON</u>** :

  ONE PACK . . . . OFF

BLEED VALVE (affected) . . . . OFF/R

- **<u>If transient fault suspected, after 30 seconds</u>** :

  BLEED VALVE . . . . ON

  - **<u>If BLEED VALVE recovered</u>** :

    AIR X FEED . . . . AUTO

- **<u>If ENG FIRE HANDLE pulled or BLEED VALVE not recovered</u>** :

  - **<u>If remaining bleed system subsequently lost</u>** :

    R <u>PROC</u> : DUAL BLEED FAULT (01.02A) . . . . APPLY

ENG BLEED VALVE FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : BLEED VALVE FAULT procedure
Right ECAM CRT : AIR BLEED page
FAULT light on AIR BLEED panel.

– Following the detection of a fault the affected ENG BLEED VALVE closes automatically and the precooler overheat threshold of the other engine bleed system is increased automatically. The related WING ANTI-ICE VALVE and the PACK VALVE will close due to lack of air supply.

– The flight can be continued with both packs supplied, however, one pack must be selected OFF, if wing anti-ice is used.
This will prevent the other bleed failing due to precooler overheat.

– Should at high altitude and low speed the second
BLEED VALVE fail (precooler overheat), recovery of the R
second failed engine bleed system may be attempted R
by applying DUAL BLEED FAULT procedure. R

Mod : 6007 or (6007 + 6120)

DUAL BLEED FAULT

DESCENT TO FL100/MEA . . . . INITIATE

■ **<u>If ENG 1 BLEED was lost due to a</u>** :
LEAK on side 1 or,
ENG 1 FIRE or,
ENG START VALVE 1 failed OPEN

DESCENT TO FL100/MEA . . . . CONTINUE

AVOID ICING CONDITIONS

■ **<u>If ENG 2 BLEED was lost due to a</u>** :
LEAK on side 2 or,
ENG 2 FIRE or,
ENG START VALVE 2 failed OPEN

AIR X-FEED . . . . Check CROSS-LINE

APU . . . . START

● **<u>At or below FL200</u>** :

WING SUPPLY . . . . OFF

APU BLEED . . . . ON

MAX FL200

AVOID ICING CONDITIONS

■ **<u>In all other cases</u>** :

DESCENT TO FL100/MEA . . . . CONTINUE

● **<u>If both PACKS are available</u>** :

■ **<u>If ENG 1 BLEED was lost first</u>** :

PACK 1 . . . . OFF

BLEED VALVE 2 . . . . ON

■ **<u>If ENG 2 BLEED was lost first</u>** :

PACK 2 . . . . OFF

BLEED VALVE 1 . . . . ON

● **<u>If ENG BLEED is not recovered, or if one PACK is inoperative</u>** :

AIR X-FEED . . . . MAN/IN-LINE

APU . . . . START

● **<u>At or below FL200</u>** :

APU BLEED . . . . ON

MAX FL200

AVOID ICING CONDITIONS

● **<u>If WING ANTI-ICE required</u>** :

PACK (1 or 2) . . . . OFF

WING SUPPLY . . . . ON

DUAL BLEED FAULT

- If ENG 1 BLEED was lost due to a LEAK on side 1, an ENG 1 FIRE, or an ENG START VALVE 1 failed OPEN, descend to FL100/MEA to prevent excessive cabin altitude.
- If ENG 2 BLEED was lost due to a LEAK on side 2, an ENG 2 FIRE, or an ENG START VALVE 2 failed OPEN, descend to FL200 to recover the bleed supply from the APU.
  Start the APU during descent. Best starting capability is ensured up to 37000 ft.
  WING ANTI ICE SUPPLY must be selected OFF to prevent wing anti ice asymmetry.
- In other cases :
  - 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 system may be attempted.
  - If the attempt to recover the engine bleed system is not successful, descend to FL200 to recover the bleed supply from the APU. Start the APU during descent. Best starting capability is ensured up to 37000 ft.
  - If WING ANTI ICE is required, one PACK must be set to OFF to be in accordance with APU operating limitations. R R

Code : 0454

AIR PACK FAULT

- ■ **If pack not supplied** :
  - PACK . . . . OFF
- ■ **If pack overheat** :
  - PACK . . . . OFF
  - PACK MODE SEL . . . . MAN/COLD
  - ● **WHEN TURB TEMP BELOW LIMIT** :
    - PACK . . . . ON
    - PACK . . . . MAN CTL
- ■ **If both packs inoperative** :
  - MAX FL 100/MEA
  - ● **WHEN △P BELOW 1 PSI** :
    - RAM AIR . . . . ON

R ● **If PACK FAULT due to low bleed air supply and if BLEED LEAK not suspected and if WING ANTI ICE not required** :

- BLEED VALVE (affected side) . . . . OFF
- AIR X FEED . . . . MAN/IN LINE
- PACK (affected) . . . . ON

AIR PACK FAULT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : PACK FAULT procedure
Right ECAM CRT : AIR BLEED page
FAULT light

– The FAULT light may illuminate for one of the following reasons :

a) Pack valve is not in agreement with the selected (manual or automatic) position or pack is not supplied.

b) Overheat detection at the turbine inlet or compressor outlet.

– If a PACK FAULT occurs due to low bleed air supply pressure (less than 10 PSI), the ENG BLEED VALVE FAULT warning will be delayed for 60 sec (wing anti-ice ON), or inhibited (wing anti-ice OFF).

– Selecting the BLEED VALVE OFF increases the precooler overheat threshold of the remaining bleed, preventing the loss of the second bleed due to precooler overheat.

COMPT HOT AIR SUPPLY OVHT

- HOT AIR SUPPLY . . . . OFF/R
- COMPT TEMP (affected compartment) . . . MAN/COLD
- ● **WHEN OVHT DISAPPEARS** :
  - HOT AIR SUPPLY . . . . ON
  - COMPT TEMP (affected compartment) . . TEMP MAN CTL ONLY

● **If OVHT warning reoccurs when in COMPT TEMP MAN CTL** :

- HOT AIR SUPPLY . . . . OFF/R
- PACK TEMP . . . . MAN CTL

COMPT HOT AIR SUPPLY OVHT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : HOT AIR SUPPLY OVHT procedure
Right ECAM CRT : AIR COND page
OVHT light on COMPT TEMP panel.

– If the OVHT warning is caused by the trim air valve being jammed open, the warning will reoccur when using COMPT TEMP MAN CTL.

Mod : 7460

VENT BLOWERS LO FLOW

VENT BLOWERS . . . . ALTN

VENT BLOWERS LO FLOW

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : VENT BLOWERS LO FLOW proc
Right ECAM CRT : Nil
FLOW light on VENT panel.

VENT EXTRACT LO FLOW

VENT EXTRACT . . . . OVBD

VENT EXTRACT LO FLOW

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : VENT EXTRACT LO FLOW proc
Right ECAM CRT : Nil
FLOW light on VENT panel.

- VENT EXTRACT to OVBD position controls the overboard valve to partially open.

VENT OVBD VALVE FAULT

OVBD VALVE . . . . OFF

● **If valve not closed** :
CAB PRESS . . . . CHECK

VENT OVBD VALVE FAULT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : OVBD VALVE FAULT proc
Right ECAM CRT : CAB PRESS page
FAULT light on VENT panel.

- The VENT OVBD VALVE should automatically close after second engine start. If it remains open after OFF selection, maintenance action is due.

CARGO ISOL VALVES FAULT

FWD (BULK) ISOL VALVES . . . . OFF/R

● **If transient fault suspected, after 1 minute minimum** :
R COMPT TEMP ISOL VALVE (affected) . . . . ON

CARGO ISOL VALVE FAULT

Indications :

Left ECAM CRT : CARGO ISOL VALVE FAULT proc
Right ECAM CRT : AIR COND page
FAULT light on COMPT TEMP panel.

R Mod : 2989 or (2989 + 5119 + 5713)

LEFT INTENTIONALLY BLANK

CABIN PRESS REG FAULT

CAB PRESS REG (affected) . . . . OFF

● **If both REG affected** :

MAN PRESS . . . . ON

PROC : CAB PRESS MAN CTL (below) . . . . . APPLY

CABIN PRESS - REG FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : CAB PRESS REG FAULT proc

Right ECAM CRT : CAB PRESS page

FAULT light on CABIN PRESS panel.

- CAB PRESS REG selection to OFF confirms the automatic transfer to the non-affected system.

CABIN PRESS LO △P

EXPECT HI CABIN RATE.

A/C V/S . . . . REDUCE

CABIN PRESS - LO △P

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : CAB PRESS LO △P proc

Right ECAM CRT : CAB PRESS page

LO △P light on CAB PRESS panel.

CAB PRESS MAN CTL

R *CAUTION : When both CAB PRESS REGULATORS are selected OFF, the CAB ALT warning and the cabin pressure indications on ECAM are no longer provided nor valid.*

MAN PRESS . . . . ON

V/S CTL switch . . . . AS RQRD

CLIMB or CRUISE

FL	400	350	300	250	200 and BELOW
TARGET CAB ALT (ft)	8500	6800	5000	2500	0

CAB V/S (until target CAB ALT) . . . . 500 FT/MIN

BEFORE DESCENT

CAB V/S (until LDG ELEVATION) . . . . 350 FT/MIN

● **If high aircraft V/S :**

CAB V/S . . . . ADJUST ACCORDINGLY

R **BEFORE LANDING, WHEN CAB ALT = LDG ELEVATION**

V/S CTL switch . . . . UP (full open)

ON GROUND

PACKS 1 and 2 . . . . OFF

● **Before doors opening** :

△P (DIFF PRESS) . . . . CHECK ZERO

CABIN PRESS - MAN CTL

- The table of FL against CAB ALT gives the relationship required to obtain 8 psi.
- Monitor V/S and CAB ALT frequently and adjust as necessary.
- Maintain aircraft altitude above cabin altitude.
- To avoid cabin pressure oscillations it is recommended to maintain differential pressure in the green arc.
- For descent, set 350 ft/min cabin V/S. R
- On ground both packs are selected OFF to improve depressurization.

Mod : 3881

AC EMER BUS OFF

CRT AMBER CAUTIONS NOT AVAIL
– MONITOR OVHD PANEL

ATC . . . . SYS 2
CAB PRESS REG 1 . . . . OFF
CAPT ADC INST . . . . SYS 2
ATS 1 . . . . RESET
CAPT EFIS SGU . . . . SYS 3

R ● **If PFD information required** :

R PFD/ND XFR (CAPT side) . . . . ON

R R *NOTE 1 : If affected PFD is on the PF side, consider transferring PF responsibilities to PNF.*

R R R *NOTE 2 : Pressing the PFD/ND XFR pushbutton a second time will recover ND information on the lower CRT.*

BUS EQPT LIST (3.08/3.09) . . . . REVIEW

AC EMER BUS OFF

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : CRT AMBER CAUTIONS message
Right ECAM CRT : NIL
Local alert lights according to the secondary failures

- The ELEC/AC page on right ECAM CRT will not appear automatically.
- The AC EMER BUS failure can be identified by the illumination of CAB PRESS REG 1 FAULT light and SLATS SYS 1 FAULT light.
  If these two lights are not illuminated together, check if AC BUS 2 OFF light is illuminated (which indicates failure of AC BUS 2). If AC BUS 2 OFF light is not illuminated, the warning comes from the failure of one FWC.
- The AC EMER BUS OFF warning may be caused by a failure in a sub-BUS
- Out of the listed affected equipment switch off only those items, where secondary failure is indicated or obvious.

AC ESS BUS OFF

OVRD SUPPLY 1 (or 2, if GEN 1 lost) . . . . ON
PITCH TRIM 1 . . . . RESET
YAW DAMPER 1 . . . . RESET

● **If unsuccessful :**

VENT EXTRACT . . . . OVBD
FUEL X-FEED (if CTR TK feeding) . . . . IN LINE
AFFECTED EQUIPMENT . . . . OFF

. PITCH FEEL 1
. RUD TRAVEL 1
. L INR TK PUMP 2
. R INR TK PUMP 1
. CTR TK L PUMP

BUS EQPT LIST (3.08/3.09) . . . . REVIEW

AC ESS BUS OFF

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : AC ESS BUS OFF proc
Right ECAM CRT : ELEC/AC page
AC EMER BUS ON INV Light
AC ESS BUS OFF light

R Code : 0040

DC NORM BUS OFF

AVOID ICING CONDITIONS

LAND RECOVERY . . . . ON
FUEL X-FEED (if CTR TK in use) . . . . IN LINE

AFFECTED EQUIPMENT . . . . OFF
. RUD TRAVEL 2
. PITCH FEEL 2
. WING ANTI ICE (NORM MODE lost)
. SPLR 2, 3, 5
. CAB PRESS REG 2
. WINDOW HEAT
. FUEL PUMPS (except L INR 2, R INR 1 and CTR L)

LDG SPD INCREMENT . . . . + 10 KT
LDG DIST . . . . MULTIPLY BY 1.4

BUS EQPT LIST (3.08/3.09) . . . . REVIEW

- **If ENG ANTI ICE OFF :**
  THRUST LIM PENALTY

- **If WING ANTI ICE required** :
  MODE SEL . . . . ALTN

TRIM TK MODE . . . . FWD

AUTO FUEL FEED MODE IS LOST :

- **If fuel in CTR TK** :
  FUEL X-FEED . . . . IN-LINE
  L and R INR TK PUMPS (4) . . . . OFF
- **If/When CTR TK empty** :
  L INR 2 and R INR 1 TK PUMPS . . . . ON
  CTR TK PUMPS (2) . . . . OFF
  FUEL X-FEED . . . . CROSS-LINE

- **If / When INR TK's empty** :
  IGNITION . . . . CONT RELIGHT
  FUEL X-FEED . . . . CROSS-LINE

***CAUTION* : Avoid rapid throttle movement and low or negative g-load factors.**

MAX FL . . . . . . 250 (200 IF JP4/JETB USED)/MEA

OUTR TK ISOL VALVE (affected) . . . CHECK IN LINE
INR TK ISOL VALVE (affected) . . . . OFF

NOTE 1 : On the ECAM FUEL system page :
- *the fuel feed lines do not reflect the actual fuel feed configuration,*
- *the pump symbols correctly reflect the pump operation, for the three operative pumps (L INR 2, R INR 1 and CTR L).*

NOTE 2 : Spurious GPWS warning "TOO LOW GEAR" may occur during approach.

NOTE 3 : The Cockpit Door Locking System (if installed) is inoperative. Consequently, the reinforced cockpit door is unlocked and can be opened from the cabin.

DC NORM BUS OFF

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : DC NORM BUS OFF proc
Right ECAM CRT : ELEC/DC page
DC NORM BUS OFF light

Note : The DC NORM BUS OFF warning is triggered by the loss of one particular sub-bus of the DC NORM BUS. If this warning is displayed, it may be a sub BUS failure only. Switch OFF affected equipment only as indicated or obvious. The rest of DC NORM BUS remains supplied.

- Pushbutton lighting on OVHD panel is lost to a great extent. Consequently, if selecting affected equipment to OFF, be sure to identify the particular pushbutton. Action feedback is indicated on ECAM only.
- With ENG ANTI ICE OFF the nacelle anti ice valve opens due to lack of electrical supply (fail-safe position) ; this leads to a thrust limit decrease. For aircraft with two ATS, this thrust limit decrease is taken into account by the TCC. For aircraft with one ATS, the ATS is lost.
- Reverse is inoperative.
- Automatic fuel feed mode selection is lost. If fuel is remaining in CTR TK, fuel X feed should be opened to avoid fuel unbalance.
- Wipers are lost.
- The display of fuel feed lines on the ECAM Fuel System Page depends on pump pushbutton and contactor data which is partially lost with DC NORM BUS OFF.

DC ESS BUS ON BAT

STBY GEN . . . . OVRD

NOTE 1 : The L INR 2, R INR 1 and L CTR FUEL PUMPS are supplied, but one at a time and with this priority order.

With all three pump pushbuttons selected to NORM, the R INR 1 and L CTR PUMP FAULT lights are illuminated (pumps not supplied).

R *NOTE 2 : FCC1, FCU1 and TCC2 are lost.*

DC ESS BUS ON BAT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : DC ESS BUS ON BAT proc
Right ECAM CRT : ELEC/DC page
DC ESS ON BAT light

- Manual selection of STBY GEN allows the DC ESS BUS to be supplied by the standby generator. AC ESS BUS and AC EMER BUS will be also supplied by the standby generator.
- Manual selection of STBY GEN leads to loss of FCC 1, FCU 1, TCC 2
- All fuel pumps remain operational and run at the same R
time except the L INR 2, R INR 1 and L CTR fuel pumps, R
which run one at a time with this priority order. R

Mod : 5911

AC BUS 1 OFF (AC ESS BUS OFF)

NO ACTION FEEDBACK ON CRT

OVRD SUPPLY 1 (or 2, if GEN 1 lost) . . . . ON

PITCH TRIM 1 . . . . RESET

YAW DAMPER 1 . . . . RESET

AFFECTED EQUIPMENT . . . . OFF

- . SPLR 2, 3, 6, 7
- . L WINDOW HEAT
- . L OUTR TK PUMP 2
- . R OUTR TK PUMP 1
- . TRIM TK PUMP 1

LDG DIST . . . . MULTIPLY BY 1.3

BUS EQPT LIST (3.08, 3.09) . . . . REVIEW

AC BUS 1 OFF/AC ESS BUS OFF

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : NIL

Right ECAM CRT : AC BUS 1 OFF procedure

AC BUS 1 OFF + AC ESS BUS OFF lights on ELEC panel

Local alert lights according to the secondary failures.

Note : *The AC BUS 1 OFF warning is triggered by the loss of one particular sub-bus of the AC BUS 1. If this warning is displayed without AC ESS BUS warning and no other warning on ELEC panel, it is preferable only to switch OFF secondary failures as indicated or obvious.*

The rest of the AC BUS 1 remains supplied.

Depending on the kind of failure the left ECAM CRT may remain available.

– The action feedback is only partially available on warning display due to the loss of the SDAC.

– The ECAM procedure assumes the complete loss of the AC BUS 1 with the resultant loss of the AC ESS BUS, followed by the recovery of the AC ESS BUS when OVRD SUPPLY is selected to ON.

– FADEC may revert to N1 mode on engine 1 due to loss of EPR probe heat N° 1.

R CRT AMBER CAUTIONS NOT AVAIL R

– MONITOR OVERHEAD PANEL

■ **If no FAULT light illuminated** :

R PROC : FWS FAULT (13.13) . . . . APPLY

■ **If AC BUS 2 OFF light illuminated** :

PROC : AC BUS 2 OFF (3.02) . . . . APPLY

■ **If CAB PRESS REG 1 FAULT and SLATS SYS 1 FAULT lights illuminated** :

PROC : AC EMER BUS OFF (3.03) . . . . . APPLY

CRT AMBER CAUTIONS NOT AVAIL

Indications :

Single chime

ECAM activation with appropriate warning light

– The ECAM message CRT AMBER CAUTIONS NOT AVAIL – MONITOR OVERHEAD PANEL is displayed in case of : R R

- Loss of one FWC, for any reason,
- Loss of the FWC 2 due to the loss of the AC BUS 2,
- Loss of the FWC 1 due to the loss of the AC EMER BUS.

AC BUS 2 OFF

CRT AMBER CAUTIONS NOT AVAIL

– MONITOR OVERHEAD PANEL

R ● **If no fuel leak** :

R FUEL X-FEED (if CTR TK feeding) . . . . IN LINE

ATC . . . . SYS 1

AFFECTED EQUIPMENT . . . . OFF

- PITCH FEEL 2
- RUD TRAVEL 2
- SPLR 4 and 1, 5
- R WINDOW HEAT
- CAB PRESS REG 2
- L INR TK PUMP 1
- L OUTR TK PUMP 1
- R OUTR TK PUMP 2
- R INR TK PUMP 2
- CTR TK R PUMP
- TRIM TK PUMP 2

LDG DIST . . . . MULTIPLY BY 1.3

BUS EQPT LIST (3.08/3.09) . . . . CHECK

AC BUS 2 OFF

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : CRT AMBER CAUTIONS NOT AVAIL message

Right ECAM CRT : NIL

AC BUS 2 OFF light on ELEC panel

Local alert lights according to the secondary failures.

– The AC BUS 2 OFF warning is triggered by the loss of one particular sub-bus of the AC BUS 2. If this warning is displayed, it may be a sub-bus failure only.

Switch OFF affected equipment only as indicated or obvious.

The remainder of the AC BUS 2 remain supplied.

Depending on kind of failure the right ECAM CRT may remain available.

– In case of complete AC BUS 2 failure, CRT amber cautions are lost.

– FADEC may revert to N1 mode on engine 2 due to loss of EPR probe heat N° 2.

IDG FAULT

IDG . . . . DISC

GEN . . . . OFF/R

APU : START

IDG FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : IDG OIL (LO PR or OVHT) procedure

Right ECAM CRT : ELEC/AC

FAULT light on ELEC panel

– APU (if available) should be started to replace inoperative generator. Best starting capability is ensured up to 37,000 ft.

– The PUSH TO DISC IDG pushbutton switch must be released as soon as the GEN FAULT light illuminates.

Note : If the DISC position is maintained for more than 3 seconds, damage to the disconnect solenoid may occur.

GEN FAULT

GEN . . . . OFF/R

APU : START

- **<u>If transient fault suspected</u>** :
  GEN (affected) . . . . ON R

GEN FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : GEN FAULT procedure
Right ECAM CRT : ELEC AC page
FAULT light on ELEC panel

– APU (if available) should be started to replace inoperative generator.

Best starting capability is ensured up to 37 000 ft.

GEN LOAD HI

GALLEY . . . . SHED

GEN LOAD HI

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : GEN LOAD HI procedure
Right ECAM CRT : ELEC/AC page
GEN HI light on ELEC panel

– GEN LOAD HI activation indicates that the load is 10 % greater than the rated output of the generator, this will normally only occur when one generator only is operating.

BATTERY OVERHEAT

BAT affected . . . . OFF/R

- **<u>If ECAM inoperative :</u>**
  ALL BAT . . . . OFF/R
  BAT (one by one) . . . . ON
  - **<u>If warning reactivated</u>** :
    BAT (affected) . . . . OFF/R

BATTERY OVERHEAT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : BAT OVHT procedure
Right ECAM CRT : ELEC/DC page
BAT OVHT light on ELEC panel

– BAT OVHT activation is an indication that an excess charge rate has been detected by the battery charge limiter which, if not corrected, could lead to an increase in battery temperature.

The affected battery is automatically disconnected and the corresponding flow bar is extinguished.

R Code : 0142

BUS EQPT LIST

SYS		BUS FAILURES						STBY GEN	SMOKE DRILL	BAT ONLY
		AC BUS				DC BUS			OVRD Supply 1 + 2	
		1	2	ESS	EMER	NORM	ESS			
NAV FLT INST	**PFD**		CM2 lost		CM1 lost ★★			CM2 lost	CM2 lost	CM2 lost
	ND		CM2 lost	CM1 lost	Select SGU3 on CM1			CM2 lost	CM2 lost	LOST
	IRS							2 lost	2 lost	2 lost 3 lost if not selected
	ALT		CM2 lost		CM2 STD only			CM2 lost	CM2 lost	CM2 lost
	VOR/ILS		2 lost		1 lost			2 lost	2 lost	2 lost
	ADF-DME		2 lost	1 lost				DME 1 only	2 lost	LOST
	ATC		2 lost		1 lost			2 lost	2 lost	2 lost
	TCAS-GPWS	LOST						LOST	LOST	LOST
	ADC		2 lost		1 lost			2 lost	2 lost	2 lost
	TAT/SAT	SAT lost	SAT lost					LOST	LOST	LOST
	FMS		2 lost	1 lost				2 lost	2 lost	LOST
	RADAR	1 lost	2 lost					LOST	LOST	LOST
	ECAM CRT	L CRT lost	R CRT lost					LOST	LOST	LOST
FLT CTL	**ATS**	LOST	2 lost			1 lost	2 lost	LOST	LOST	LOST
	FD/AP		2 lost	1 lost	LOST ★★★	2 lost	1 lost	LOST	2 lost	LOST
	PITCH FEEL RUDD TRV		2 lost	1 lost		2 lost	1 lost	2 lost	2 lost	LOST
	PITCH TRIM YAW DAMP		2 lost	1 lost	1 lost	2 lost	1 lost	2 lost	2 lost	LOST
	GRND SPLR CTL					LOST ★ NORM	LOST	LOST ★ NORM	LOST ★ NORM	LOST ★ NORM
	SPLR and SPD BRK	2, 3, 6, 7 lost	1, 4, 5 lost			LOST ★ 1.4.6.7 only		LOST ★ 1.4.6.7 only	LOST ★ 1.4.6.7 only	LOST ★ 1.4.6.7 only
	FLAPS SLATS		SLOW	Flaps slow	Slats slow SFPI lost	LOST ★ SLOW		LOST ★ SLOW	LOST ★ SLOW	LOST ★ SLOW
	KRUGER					LOST		LOST	LOST	LOST
COM	**VHF**					2(3) lost	1 lost	2(3) lost	2(3) lost	2(3) lost
	HF		2 lost	1 lost				2 lost	2 lost	LOST

★ With LAND RECOVERY pushbutton selected ON
★★ Recovered when SGU 3 is selected and PFD/ND XFR (if installed) is used.
★★★ AP2 can be engaged in GS Track or LAND modes

Code : 0293

BUS EQPT LIST (Cont'd)

R

SYS			BUS FAILURES						STBY GEN	SMOKE DRILL	BAT ONLY
			AC BUS				DC BUS			OVRD Supply 1 + 2	
			1	2	ESS	EMER	NORM	ESS			
L/G and BRK	LDG GEAR	EXT						LOST	Not to be used		
		RET					SYS 1 ONLY	LOST	Not to be used	SYS 1 ONLY	SYS 1 ONLY
		IND					OVHD panel lost	MAIN panel lost	OVHD panel lost	OVHD panel lost	OVHD panel lost
	ANTI SKID						LOST ★ NORM		LOST ★ NORM	LOST ★ NORM	LOST ★ NORM
	NOSE WHEEL STEER							LOST	Not avail.		
POWER PLANT	FUEL HP VALVE							LOST			
	EPR				LOST						LOST
	N2		ENG 1 lost	ENG 2 lost					LOST	LOST	LOST
	OIL PRESS		ENG 1 lost	ENG 2 lost					LOST	LOST	LOST
	OIL QTY						LOST		LOST	LOST	LOST
	N1/EGT					LOST					
	START							LOST			
	FU/FF			ENG2 lost	ENG1 lost				LOST	ENG2 lost	LOST
	IGNITION		ENG 1A lost	ENG 2A lost		B lost		CONT REL. ONLY	A lost	A lost	A lost
	REVERSE						LOST		LOST	LOST	LOST
FUEL	QTY IND			L +CTR +TRIM lost							
	PUMPS CTR			R lost	L lost		R lost	L lost	R lost	R lost	LOST
	PUMPS INR			1L +2R lost	1R +2L lost		2R +1L lost	1R +2L lost	2R +1L lost	2R +1L lost	LOST
	PUMPS OUTR		1R +2L lost	1L+2R lost			LOST		LOST	LOST	LOST
	PUMPS TRIM		1 lost	2 lost			LOST		LOST	LOST	LOST
	ISOL VALVE							INR + OUTR lost			
CAB PRESS	SYS			SYS 2 lost		SYS 1 lost	SYS 2 lost	SYS 1 lost	SYS 2 lost	SYS 2 lost	SYS 2 lost
	MAN PRESS							LOST			
ICE	WING						ALTN only		ALTN only	ALTN only	ALTN only
	NAC						OPEN		OPEN	OPEN	OPEN
	WINDOW HEAT		L lost	R lost			LOST		LOST	LOST	LOST
	WIPERS						LOST		LOST	LOST	LOST

★ With LAND RECOVERY pushbutton selected ON

BUS EQPT LIST (Cont'd)

SYS		BUS FAILURES						STBY GEN	SMOKE DRILL	BAT ONLY
		AC BUS				DC BUS			OVRD Supply 1 + 2	
		1	2	ESS	EMER	NORM	ESS			
DOOR	CDLS					LOST		LOST	LOST	LOST

Mod : (5911 + 12557) or (5911 + 12715)

CABIN SMOKE

● **<u>In case of dense smoke</u>** :

LAND ASAP
CABIN CREW . . . ADVISE TO DON OXYGEN MASKS
COCKPIT DOOR . . . . CLOSE

● **<u>If cockpit smoke removal is required</u>** :

DESCENT . . . . INITIATE
R <u>PROC</u> : SMOKE/FUMES REMOVAL (5.02) . . APPLY

CABIN REPORT . . . . OBTAIN

■ **<u>If AIR CONDITIONING SMOKE suspected</u>** :

R <u>PROC</u> : SMOKE/FUMES (5.04) . . . . APPLY FOR
R AIR COND SMOKE

■ **<u>If GALLEYS SMOKE suspected</u>** :

GALLEY . . . . SHED

<u>NOTE</u> : *If the affected galley is well identified, advise the cabin crew to isolate the affected galley by pulling its C/B on the galley C/B panel. Then, the GALLEY pushbutton may be restored to normal.*

■ **<u>If SEATS SMOKE suspected, as applicable</u>** :

CABIN CREW . . . . . ADVISE TO PULL RELATED C/B
(affected zone) ON 800VU

<u>NOTE</u> : *If the smoke comes from the in-seat video or in-seat audio system, pull the C/B related to the Seat Electronic Box (SEB).*

● **<u>For approach</u>** :

SEATS . . . . CONFIGURE FOR LANDING

■ **<u>If READING LIGHTS SMOKE suspected</u>** :

CABIN CREW . . . . ADVISE TO PULL
READING LIGHT C/B (affected zone)
ON 800 VU

■ **<u>If PASSENGER ENTERTAINMENT SYSTEM SMOKE suspected, as applicable</u>** :

CABIN CREW . . . . . ADVISE TO PULL RELATED C/B
ON 800VU

<u>NOTE</u> : *Depending on the smoke origin, pull PES and/or PSS and/or VIDEO and/or TV and/or VCC C/B as appropriate.*

CABIN REPORT . . . . OBTAIN

Maintain contact with the cabin crew to follow up on the status of the smoke.

CABIN SMOKE

- This cabin smoke procedure covers the cases of smoke perceived in the cabin. It does not cover cases of cabin fire for which dedicated procedures must be developed by each operator as per company policy.
  Also adequate cabin crew procedures can be developed by each operator to enhance passengers quietness.
- A smoke in the cabin is reported by the cabin crew to the flight crew who decides which actions must be taken.
  Therefore a good coordination and communication is essential to deal with the smoke situation.
- If a dense smoke is present, close the cockpit door to prevent the smoke from entering the cockpit and consider to initiate a descent in order to apply the smoke removal procedure.
- If the cabin crew reports a smell in the cabin without any evident smoke, suspect an air conditioning smoke and apply the appropriate procedure.
- If the cabin crew reports a smoke coming from a specific equipment, advise the cabin crew to pull the appropriate circuit breaker.
- Electrically controlled seats and passenger entertainment system are an option and may not be fitted on the aircraft.
- Passenger entertainment system related C/B names depend on the aircraft configuration.
- The 800VU is located in the cockpit entrance area and the 811VU is located aft of the cabin.

ENG or APU LOOP FAULT

Affected LOOP . . . . OFF

ENG or APU LOOP FAULT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : LOOP FAULT procedure
Right ECAM CRT : Nil
LOOP light on overhead panel

CARGO LOOP FAULT

LOOP (illuminated) . . . . OFF
LOOP TEST . . . . PERFORM

■ **If SMOKE light does not illuminate for affected compartment :**

LOOP (which is OFF) . . . . RESELECT
Other LOOP . . . . OFF

PROC : CARGO COMPT SMOKE (5.07) . . . . . APPLY

■ **If SMOKE light illuminates for affected compartment :**

R COMPT TEMP ISOL VALVES . . . . . OFF/R then ON

CARGO LOOP FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : CARGO LOOP FAULT proc
Right ECAM CRT : Nil
Local LOOP warning

- Performing the LOOP TEST enables to determine whether the CARGO LOOP FAULT warning corresponds to a CARGO SMOKE detection or just to a CARGO LOOP FAULT detection.
- The following expanded information is based on the example of an illuminated LOOP A FAULT light. There are two possible cases :

● If the LOOP A is switched OFF and the LOOP test causes no SMOKE light illumination on the overhead panel, the LOOP B does not detect the smoke simulated by the LOOP test.

The LOOP B is faulty and the LOOP A is healthy.

The FAULT condition detected by LOOP A was therefore a real SMOKE condition.

Apply the CARGO COMPT SMOKE procedure.

● If the LOOP A is switched OFF and the LOOP test causes the SMOKE light illumination on the overhead panel, the LOOP B detects the smoke simulated by the LOOP test.

The LOOP B is healthy and the LOOP A is confirmed as faulty.

The CARGO ISOL VALVES, which close during the LOOP TEST must be reopened by cycling the related pushbutton OFF then ON.

Note : *When the LOOP test is performed in flight there will be no Continuous Repetive Chime or ECAM activation.*

Mod : 2254

LEFT BLANK INTENTIONALLY

Mod : 2254 or FDX

SLATS SYS 1 AND 2 FAULT/SLATS STUCK

SLATS/FLAPS lever . . . . CYCLE

■ **If SLATS less than 15°** :

TRIM TK AFT XFR NOT AVAIL

LDG DIST . . . . MULTIPLY BY 1.3

AFT CG WARNING INOP
AUTO FWD XFR ONLY
FUEL CONSUMPTION INCREASED

■ **If SLATS 15° or more** :

● **If TRIM TK not empty (and if above 1000 ft) :**

TRIM TK ISOL VALVE NOT OPEN

PROC : TRIM TK SYS FAULT (7.06) . . . . . APPLY

AUTO TRIM TK SYS INOP
FUEL MAN FWD XFR ONLY

● **If CTR TK not empty (and if above 1000 ft)** :

CTR TK AUTO FUEL FEED FAULT

L INR TK PUMP 1 . . . . OFF
L INR TK PUMP 2 . . . . OFF
R INR TK PUMP 1 . . . . OFF
R INR TK PUMP 2 . . . . OFF

PROC : FUEL FEED MAN CTL (7.04) . . . . APPLY

LDG DIST . . . . MULTIPLY BY 1.1

AFT CG WARNING INOP
FUEL CONSUMPTION INCREASED

NOTE : With slats extended, fuel consumption is multiplied by 1.7.

● **If FAULT/STUCK occured during retraction** :

Move the SLATS/FLAPS lever back to the notch selected before the jamming occured.

FOR APPROACH

LDG DIST and VREF increments (15.02, 15.04) . DETERMINE

● **If SLATS less than 20°** :

PROC : ABNORMAL SLATS/FLAPS LANDING (6.14) . . . . APPLY

SLATS SYS 1 AND 2 FAULT/SLATS STUCK

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : SLATS SYS 1 AND 2 FAULT proc
OR
SLATS STUCK proc
Right ECAM CRT : NIL or FUEL page
Both SLATS FAULT lights
If asymmetry : SFPI : SLATS lights

- Cycling the SLATS/FLAPS lever consists of moving back the lever to the notch selected before the jamming occured and then back to the desired position.
- Due to SFCC transitories, a SLATS light may be illuminated FAULT, at the overhead panel, after an engine start. In that case, check the SFPI :
  - If no SLATS light is illuminated AMBER at the SFPI, reset the SLATS system (SYS 1 or 2) by resetting the appropriate C/B (SYS1 : T63/133 VU – SYS2 : T64/133 VU).
  - If a SLATS light is illuminated AMBER at the SFPI, a maintenance action is due. The affected SFCC must be reset by pressing the RESET button on the SFCC frontpanel.
- If the jamming occured during retraction, the VFE displayed on the PFD is higher than the actual maximum speed (VFE displayed is based only on the SLATS/FLAPS lever position). Thus the SLATS/FLAPS lever has to be moved back to the notch selected before the jamming occured, in order to have VFE displayed on the PFD lower than the actual maximum speed (conservative limitation).

SLATS JAMMING

- In some cases, correct slats operation can be recovered by cycling the Slats/Flaps lever.
- SLATS SYS 1 AND 2 FAULT can be due to mechanical jamming.
- Without any input to the SLATS/FLAPS lever, uncommanded SLATS/FLAPS movement will not occur due to SFCC inhibition.
  When SLATS/FLAPS lever is moved, the system will move to the selected position provided the source of the jamming has cleared by itself.

SLATS ASYMMETRY

- Cycling Slats/Flaps lever has no effect, but the action is applied for commonality with SLATS JAMMING.
- SLATS STUCK results from an asymmetry movement during extension or retraction caused by a broken shaft.
- Further operation is inhibited by the wing tip brakes until the end of the flight.

FLAPS SYS 1 AND 2 FAULT/FLAPS STUCK

SLATS/FLAPS lever . . . . CYCLE

GPWS . . . . FLAP OVRD

■ **If FLAPS less than 20°** :

LDG DIST . . . . MULTIPLY BY 1.3
FOR APPR : ATS . . . . OFF
FUEL CONSUMPTION INCREASED

■ **If FLAPS 20° or more** :

LDG DIST . . . . MULTIPLY BY 1.1
FUEL CONSUMPTION INCREASED

NOTE : *With Flaps extended, fuel consumption is multiplied by 2.2.*

● **If FAULT/STUCK occured during retraction** :

Move the SLATS/FLAPS lever back to the notch selected before the jamming occured.

FOR APPROACH

LDG DIST and VREF increments (15.02, 15.04) . DETERMINE

● **If FLAPS less than 20°** :

PROC : ABNORMAL SLATS/FLAPS
LANDING (6.14) . . . . APPLY

FLAPS SYS 1 AND 2 FAULT/ FLAPS STUCK

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : FLAPS SYS 1 AND 2 FAULT proc
OR
FLAPS STUCK proc
Right ECAM CRT : NIL or FUEL page
Both FLAPS FAULT lights
If asymmetry : SFPI : FLAPS lights

- Cycling the SLATS/FLAPS lever consists of moving back the lever to the notch selected before the jamming occured and then back to the desired position.
- Due to SFCC transitories, a FLAPS light may be illuminated FAULT, at the overhead panel, after an engine start. In that case, check the SFPI :
  - ● If no FLAPS light is illuminated AMBER at the SFPI, reset the FLAPS system (SYS 1 or 2) by resetting the appropriate C/B (SYS1 : U61/133 VU – SYS2 : V61/133 VU).
  - ● If a FLAPS light is illuminated AMBER at the SFPI, a maintenance action is due. The affected SFCC must be reset by pressing the RESET button on the SFCC front panel.
- If flaps 40 cannot be obtained, set GPWS selector to FLAP OVRD to avoid nuisance warnings.
- If the jamming occured during retraction, the VFE displayed on the PFD is higher than the actual maximum speed (VFE displayed is based only on the SLATS/FLAPS lever position). Thus the SLATS/FLAPS lever has to be moved back to the notch selected before the jamming occured, in order to have VFE displayed on the PFD lower than the actual maximum speed (conservative limitation).

FLAPS JAMMING

- In some cases, correct flaps operation can be recovered by cycling the Slats/Flaps lever.
- FLAPS SYS 1 AND 2 FAULT can be due to mechanical jamming.
- Without any inputs to the SLATS/FLAPS lever, uncommanded SLATS/FLAPS movement will not occur due to SFCC inhibition.
  When SLATS/FLAPS lever is moved, the system will move to the selected position provided the source of the jamming has cleared by itself.
  If the source of the jamming is still present, the affected surface will not move.

FLAPS ASYMMETRY

- Cycling Flaps lever has no effect, but the action is applied for commonality with FLAPS JAMMING.
- FLAPS STUCK results from an asymmetry movement during extension or retraction caused by a broken shaft.
- Further operation is inhibited by the wing tip brakes until the end of the flight.

FLAP VANE JAM

R SLATS/FLAPS lever . . . . CYCLE

FLAPS EXTENSION (RETRACTION) LIMITED

■ **If FLAPS less than 20°** :

LDG DIST . . . . MULTIPLY BY 1.3

FOR APPR : ATS . . . . OFF

FUEL CONSUMPTION INCREASED

■ **If FLAPS 20° or more** :

LDG DIST . . . . MULTIPLY BY 1.1

FUEL CONSUMPTION INCREASED R

FOR APPROACH

■ **If FAULT during extension** :

GPWS . . . . FLAP OVRD

LDG DIST and VREF increments (15.02, 15.04)) . DETERMINE

PROC : ABNORMAL SLATS/FLAPS
LANDING (6.14) . . . . APPLY

■ **If FAULT during retraction** :

SLATS/FLAPS . . . . NORMAL EXTENSION

NOTE : With Flaps extended, fuel consumption is increased by 2.2.

FLAP VANE JAM

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : FLAP VANE JAM proc
Right ECAM CRT : NIL
Both FLAPS FAULT lights on

– Cycling the SLATS/FLAPS lever consists of moving back the lever to the notch selected before the jamming occured and then back to the desired position. R R R

– Flap vane correct operation can be recovered by Slats/Flaps lever cycling.

– If flaps vane jamming occurs during retraction, flaps system is stopped in retraction.

Further flaps extension remains possible.

Mod : 6865

NO FLAPS AND NO SLATS LANDING

- **If electrical failure suspected** :

  LAND RECOVERY . . . . ON

  - **If unsuccessful** :

    LAND RECOVERY . . . . OFF

- **If slats/flaps not recovered** :

  SLATS/FLAPS LEVER 0/0
  SPEED . . . . GREEN DOT

  MAXIMUM LANDING WEIGHT (below) . . DETERMINE

  LDG DIST . . . . MULTIPLY BY 1.8

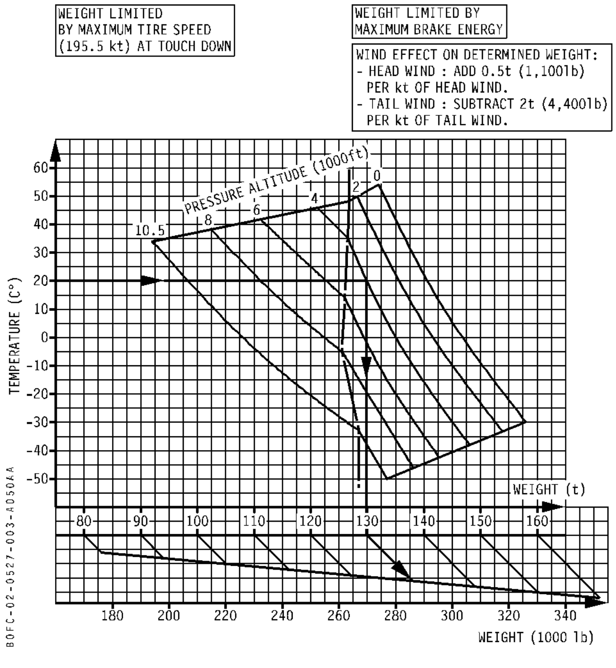
  R ATS LEVER(S) . . . . OFF
  TRP . . . . SELECT TOGA
  GPWS . . . . FLAP OVRD

  - **When V_{LS} or V_{APP} obtained** :

    SLATS/FLAPS lever 15/0

  SPEED . . . . V_{LS} (V_{REF} + 60) DOWN TO 300 FT
  THEN DECELERATE TO REACH V_{SS} AT TOUCHDOWN

  MAX REVERSE . . . . APPLY


WEIGHT LIMITED
BY MAXIMUM TIRE SPEED
(195.5 kt) AT TOUCH DOWN

WEIGHT LIMITED BY
MAXIMUM BRAKE ENERGY

WIND EFFECT ON DETERMINED WEIGHT:
- HEAD WIND : ADD 0.5t (1,100lb) PER kt OF HEAD WIND.
- TAIL WIND : SUBTRACT 2t (4,400lb) PER kt OF TAIL WIND.

NO FLAPS AND NO SLATS LANDING

Indications :

No slats/flaps response to slats/flaps lever movement.

- The ATS and GPWS must be disarmed, to prevent operation of the alpha floor, and nuisance GPWS warnings on final approach.
- With slats at 0, AFS-GA mode is lost. Select TOGA on TRP. GA thrust will be obtained at full forward throttle position.

  SLATS/FLAPS handle is extended one step to get GO-AROUND guidance on FD.
- Deceleration to stick shaker speed may cause stick shaker operation in the landing flare.
- Apply reverse thrust even before nosewheel touchdown. Lower nosewheel as soon as possible and select max reverse.
- Refer to following graph for maximum landing weight limited by tire speed or maximum brake energy.

- With a temperature of 20° C and a pressure altitude of 4000 ft the weight is limited by the maximum brake energy at 130 t or 285 lb. R R R

KRUGER FAULT CYCLE

■ **KRUGER NOT RETRACTED**

MAX SPD 300/.65

FUEL CONSUMPTION INCREASED

NOTE : Fuel consumption is increased by 12 %.

■ **KRUGER NOT EXTENDED**

R LDG SPD INCREMENT . . . . + 10 KT

LDG DIST . . . . MULTIPLY BY 1.1

● **If kruger not extended :**

SPEED INCREMENT ON S,F, V LS . . . . + 10 KT

KRUGER FAULT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT :
KRUGER NOT RETRACTED procedure
or
KRUGER NOT EXTENDED procedure
Right ECAM CRT : NIL
KRUGER light on SFPI.

Mod : 6041 or 6865

SPLR FAULT

SPLR (affected) . . . . OFF/R

■ **<u>If 4 or more roll spoilers per wing affected</u>** :

LDG CONFIG/GPWS . . . . FLAPS 20

LDG SPD INCREMENT . . . . + 10 KT

LDG DIST . . . . MULTIPLY BY 1.8

SPLR PARTIALLY INOP (or SPLRS INOP)

■ **<u>If 3 or more spoilers per wing affected</u>** :

LDG DIST . . . . MULTIPLY BY 1.3

SPLR PARTIALLY INOP

● **<u>If only one SPLR FAULT without any other warning activation</u>** :

SPLR (affected) . . . . ON

● **<u>If SPLR stuck in extended position, to attempt to retract the spoiler</u>** :

SERVO CTL (affected spoiler) . . . . OFF

- ● **<u>After about 10 seconds</u>** :

  SERVO CTL (affected spoiler) . . . . ON

- ● **<u>If SPLR cannot be retracted</u>** :

  SPEED INCREMENT ON V LS . . . . + 20 KT

  LANDING SPEED . (VLS + 20 KT) OR (VREF + 20 KT)

SPLR FAULT

<u>Indications :</u>

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : SPLR FAULT procedure
Right ECAM CRT : FLT CTL page
FAULT on spoiler panel.

– If more than three roll spoilers affected (more than three pairs selected OFF), landing configuration 20/20 must be selected and approach speed is increased due to reduced lateral control.

GPWS should be selected to FLAP OVRD to avoid nuisance warning.

– If a spoiler is stuck in extended position, selecting the SERVO CTL to OFF cuts off the hydraulic supply to the affected spoiler and may cause its retraction. In every case the SERVO CTL must be selected ON again to recover all the other connected systems.

– During engine start, SPLR FAULT light may illuminate on the overhead panel. The related pushbutton switch may be reset (OFF then ON) in order to reset the EFCU and to recover the affected spoiler(s).

<u>Note :</u> *For EFCU reset using C/B, refer to the SYSTEM* R
RESET TABLE in QRH 13.19 or in FCOM 2.02.06 R
p 2. R

INADVERTANT STICK SHAKER

● **<u>If spurious stall warning activation</u>** :

STICK SHAKER C/B (affected side) . . . . PULL

. WARN CAPT-STICK SHAKER (21VU-A9)

or

. WARN F/O-STICK SHAKER (21VU-A10)

INADVERTANT STICK SHAKER

<u>Indications :</u>

Stick shaker
Cricket audio warning.

INTENTIONALLY LEFT BLANK

PITCH FEEL FAULT

PITCH FEEL (affected) . . . . OFF/R

■ **<u>If both PITCH FEEL set OFF and both FAULT lights extinguished</u>** :

MAX SPD 285/.78
ELEV WITH CARE ABV SPD 170.

■ **<u>If both PITCH FEEL set OFF and both FAULT lights illuminated</u>** :

PITCH FEEL IN HIGH SPEED.

● **<u>If only one PITCH FEEL set OFF, without any other warning activation</u>,**

or

R **<u>If both PITCH FEEL set OFF and both FAULT lights extinguished and no STABILIZER JAM</u>** :

PITCH FEEL(s) . . . . ON

● **<u>If unsuccessful and if both PITCH FEEL affected</u>** :

MAX SPD 285/.78

USE ELEVATOR WITH CARE ABOVE SPD 170 KT.

● **<u>If PITCH FEEL in high speed configuration</u>** :

<u>PROC</u> : HIGH PITCH FORCE (6.09) . . . . APPLY

PITCH TRIM FAULT

PITCH TRIM . . . . RESET

● **<u>If both PITCH TRIM inoperative</u>** :

PITCH TRIM . . . . MANUAL
MAX SPD 285/.78
MAX FL 350

● **IF MAN CTL INOP** :

<u>PROC</u> : STAB JAM (6.09) . . . . APPLY

STABILIZER JAM

MAX SPD 285/.78
ELEV WITH CARE ABV SPD 170.

SPEED . . . . MAINTAIN

● **<u>Before reducing speed</u>** :

PITCH FEEL 1 and 2 . . . . OFF/R

USE ELEVATOR WITH CARE ABOVE SPD 170 KT

<u>PITCH FEEL FAULT</u>

<u>Indications :</u>

Single chime (only if both systems fail)
ECAM activation with appropriate warning light
Left ECAM CRT : PITCH FEEL FAULT procedure
Right ECAM CRT : NIL
FAULT (1 OR/AND 2) on pitch feel panel.

- If both systems are affected, and if selecting both systems to OFF/R extinguishes both FAULT lights, pitch feel is in low speed configuration. Limit speed to 285 kt/0.78 M and use pitch control with care due to reduced control forces.
- If both systems are affected and if selecting both systems to OFF/R does not extinguish either FAULT light, pitch feel is in high speed configuration. Expect higher control forces during approach and landing.
- PITCH FEEL IN HIGH SPEED message appears only when flaps are extended 20° or more.

<u>PITCH TRIM FAULT</u>

<u>Indications :</u>

Single chime (only if both systems fail)
ECAM activation with appropriate warning light
Left ECAM CRT : PITCH TRIM FAULT procedure
Right ECAM CRT : NIL
PITCH TRIM (1 OR/AND 2) levers tripped.

- If both pitch trim systems are affected, use manual pitch trim and limit speed to 285 kt/0.78 M. Altitude is limited to FL 350 to ensure acceptable longitudinal stability and sufficient margin to buffet onset.
- If manual pitch trim is not available, assume stabilizer jamming.

<u>STABILIZER JAM</u>

- Maintain speed at which the stabilizer jam was detected to delay onset of out of trim forces as long as possible.
- Before deceleration, select PITCH FEEL 1 + 2 OFF/R. PITCH FEEL FAULT will be displayed on ECAM CRT. Pitch control inputs should be made with care, not to overcontrol the aircraft.

ELEVATOR JAM or HIGH PITCH FORCE

● **If elevator jam** :

ELECTRICAL PITCH TRIM . . . . USE

MAX SPD 285/.78

FOR APPROACH

MANUAL PITCH TRIM . . . . USE

THROTTLES CONTROL BY PNF . . . . CONSIDER

● **If alpha-floor activation** :

ATS . . . . OFF

NOTE : *For approach, normal slats and flaps configuration applies. However, flaps should be selected 15 above 3000 ft, when Slats 15/S-speed is established.*

FOR GO AROUND

A/THR . . . . OFF

Apply GO AROUND thrust smoothly but gradually.

ELEVATOR JAM/HIGH PITCH FORCE

- If jamming occurs before V1, the takeoff must be rejected.
- If jamming occurs during takeoff above V1, both pilots may have to simultaneously operate the column control to achieve rotation.

  Trim should be used as required, but with caution, to help achieve and maintain a stabilized flight path.

  The two elevator surfaces can only be operated independently below 195 kt. Thus below 195 kt, one elevator is still available.
- During approach FLAPS 15 must be selected above 3000 ft, since this initial flap extension requires rapid trim adjustment and may lead to slight deviation from the flight path.

  The trim changes with further flap extension are much smaller.
- The PNF may control the throttles to relieve the PF for full concentration on flight path control. Autothrottle may be used during approach.
- Manual trim is used to avoid overcontrolling.
- The landing flare should be commenced earlier than normal, by use of the manual pitch trim, but the throttle retard action should be delayed because of the pitch change associated with engine power reduction.
- At all times rapid power changes must be avoided.

ABNORMAL PITCH BEHAVIOR or PITCH TRIM RUNAWAY

CONTROL WHEEL . . . . HOLD FIRMLY
TRIM WHEEL . . . . HOLD FIRMLY
AP (if engaged) . . . . DISCONNECT
PITCH TRIM LEVERS . . . . CHECK BOTH OFF
PITCH TRIM . . . . MANUAL

● **If STAB MAN CTL inop** :

PROC : STAB JAM (6.09)

● **If high pitch force** :

PROC : HIGH PITCH FORCE (6.09)

ABNORMAL PITCH BEHAVIOR
PITCH TRIM RUNAWAY

- An abnormal pitch behavior can be the result of :
  - a large out-of-trim condition,
  - a pitch trim runaway,
  - an AP pitch actuator hardover.
- The procedure for PITCH TRIM RUNAWAY / ABNORMAL PITCH BEHAVIOR covers all three scenarios.

RUDDER JAM

BANK ANGLE LIMIT . . . . 15°
MAX X-WIND FOR LDG . . . . 20 KT

RUDDER JAM

- Rudder jam is detected by an inhability to operate the rudder pedals and may lead to AP disconnection.

RUDDER TRAVEL FAULT

RUD TRAVEL (affected) . . . . OFF/R

- ■ **<u>If both RUD TRAVEL OFF and both FAULT lights extinguished</u>** :

  RUD WITH CARE ABV SPD 170.

- ■ **<u>If both RUD TRAVEL OFF and both FAULT light illuminated</u>** :

  RUD TRAVEL IN HIGH SPEED.

  MAX X WIND FOR LDG . . . . 20 KT

- ● **<u>If only one RUD TRAVEL set OFF, without any other warning activation</u>,**

  or

  <u>If both RUD TRAVEL set OFF and both FAULT lights extinguished</u> :

  - ● **<u>After 1 minute</u>** :

    RUD TRAVEL(s) . . . . ON

    - ● <u>If unsuccessful and if both RUD TRAVEL affected</u> :

      USE RUDDER WITH CARE ABOVE SPD 170 KT.

RUDDER TRIM RESET FAULT

TRIM RESET . . . . MANUAL

RUDDER TRIM RUNAWAY

AP (if engaged) . . . . KEEP IN CMD

RUDDER TRIM . . . . CHECK/RESET

YAW DAMPER FAULT

YAW DAMPER . . . . RESET

- ● **<u>If both YAW DAMPERS OFF</u>** :

  TRIM TK MODE . . . . FWD

  DESCENT TO FL 310 . . . . CONSIDER

<u>RUDDER TRAVEL FAULT</u>

Indications :

Single chime (only if both systems failed)
ECAM activation with appropriate warning light
Left ECAM CRT : RUDDER TRAVEL FAULT procedure
Right ECAM CRT : NIL
FAULT sys (1 OR/AND 2) on rudder travel panel.

- If both rudder travel systems are affected, the limitation of rudder movement at speeds in excess of 170 kt is lost. Use rudder with extreme caution.
- If both rudder travel systems are affected and if selecting both systems to OFF/R does not extinguish the FAULT lights, the rudder deflection is restricted in the high speed configuration.
- The maximum crosswind for landing is 20 kt.
  RUD TRAVEL IN HIGH SPEED, MAX X WIND FOR LDG ... 20KT ECAM message appear only when flaps are extended 20° or more.

<u>RUDDER TRIM RESET FAULT</u>

Indications :

FAULT on RUDDER TRIM panel.

- Rudder trim reset is only available through the trim knob.

<u>RUDDER TRIM RUNAWAY</u>

- With AP engaged in CMD, rudder trim runaway is only apparent from an increasing sideslip. Check the rudder trim and reset to zero if possible, keeping AP engaged.
- If AP is disengaged with a rudder trim runaway, there may be a large sideslip and roll induced. Use opposite aileron to level wings, centralize rudder and correct sideslip as appropriate. Then reset the rudder trim to zero.

<u>YAW DAMPER FAULT</u>

Indications :

Single chime (only if both systems failed)
ECAM activation with appropriate warning light
Left ECAM CRT : YAW DAMPER FAULT procedure
Right ECAM CRT : NIL
One or both YAW DAMPER levers tripped.

- In case of dutch roll keep controls at neutral and do not use rudder. R

  Natural damping will stop dutch roll.
  Transferring fuel forward will improve dutch roll characteristics.
- If both Yaw Dampers are inoperative, both AP are lost. Flying at or below FL 310 should improve aircraft stability. R

Mod : 4801

SERVO CTL JAM IN FLIGHT

R SERVO CTL (affected) . . . . OFF

AFFECTED EQUIPMENT . . . . OFF

- **BLUE** : SPLR 2, 3, 7
- **YELLOW** : PITCH FEEL 2
  SPLR 1, 4, 6
- **GREEN** : PITCH FEEL 1
  SPLR 5

● **If BLUE or YELLOW SERVO CTL affected** :

LDG DIST . . . . MULTIPLY BY 1.3

SYSTEMS AFFECTED (below) . . . . REVIEW

Affected system	Flight Controls	SPD BRK SPLRS	AP	YAW DAMPER	PITCH FEEL	PITCH TRIM
Blue	1 Actuator	2 + 3 + 7		N° 1		
Green	1 Actuator	5	N° 1		N° 1	1 Actuator
Yellow	1 Actuator	1 + 4 + 6	N° 2	N° 2	N° 2	1 Actuator

SERVO CTL JAM

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : (affected) SERVO JAM procedure R

Right ECAM CRT : FLT CTL page after SERVO CTL selected OFF

SERVO CTL JAM light on SERVO CTL panel.

- The warning is activated by detection of a jam of any of the servo control unit input valves.

SERVO CTL JAM ON GROUND

SERVO CTL (affected) . . . . CHECK ON
SERVO CTL (not affected) . . . . BOTH OFF

■ **If stabilizer not affected** :

AFFECTED FLIGHT CONTROLS . . . . MOVE RAPIDLY FULL TRAVEL
FLIGHT CONTROLS . CONFIRM DEFLECTION ON ECAM
or
LEFT ELEVATOR . . . . VISUALLY CHECK

■ **If deflection not confirmed on one (or more) affected surface(s)** :

Maintenance action is due.

■ **If deflection confirmed on all affected surfaces** :

SERVO CTL (all) . . . . ON
R AFFECTED FLIGHT CONTROLS . . . . MOVE FULL TRAVEL R
SERVO CTL (affected) . . . . OFF

● **When LO PR illuminated** :

SERVO CTL (affected) . . . . ON

■ **If JAM warning extinguished** :

Resume normal operation

■ **If JAM warning still illuminated** :

A jamming detection channel is inoperative. The aircraft can be dispatched, refer to MEL.

■ **If stabilizer affected** :

PITCH TRIM (manual or electrical) . . . . . . OPERATE
STABILIZER DEFLECTION (FLT CTL page) . . . CHECK

● **When releasing trim control** :

STAB TRIM . . . . CHECK MOTION STOPS
BLUE SERVO CTL . . . . ON
SERVO CTL (affected) . . . . OFF

● **When LO PR illuminated** :

SERVO CTL (affected) . . . . ON

■ **If deflection is confirmed and JAM warning extinguished** :

SERVO CTL (all) . . . . ON
Resume normal operation

■ **If deflection is not confirmed or JAM warning does not extinguished** :

Maintenance action is due.

SERVO CTL JAM

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : (affected) SERVO JAM procedure R
Right ECAM CRT : FLT CTL page after SERVO CTL selected OFF
SERVO CTL JAM light on SERVO CTL panel.

- The warning is activated by detection of a jam of any of the servo control unit input valves.
- On ground, if more than one Servo Control JAM lights are illuminated, contact maintenance.
- If the left elevator is affected, visually check that the left elevator moves symmetrically and simultaneously with the right elevator (in the same direction and same range).
- On ground during freezing conditions (typically OAT below -10°C/14°F) the warning may be due to micro switch stuck (frozen) in the engaged position. Operation of control with SERVO CTL switches ON may warm hydraulic fluid and restore micro switch to normal operation. R
  Normal operation can be resumed. R

Mod : 5904

AILERON JAM

RUDDER . . . . USE FOR ROLL CONTROL

■ **If CM1 control wheel jammed** :

SPLR 3 & 2, 6, 7 . . . . OFF
Use CM2 control wheel only

■ **If CM2 control wheel jammed**

SPLR 4 & 1, 5 . . . . OFF
Use CM1 control wheel only

FOR APPROACH

FLT CTL/KRUGER C/B (133VU-T61) . . . . PULL
PROC : KRUGER FAULT-NOT EXTENDED (6.04) . . APPLY

AILERON JAM

- Aileron jam can be evidenced by the jamming of one control wheel. The other control wheel remains fully operative and controls the other aileron, although control forces are increased.
- If aileron jam occurs out of the neutral position this may result in the extension of the roll spoilers controlled by the affected control.

  The initial action is to counteract the roll force by using opposite rudder. Then the affected spoilers must be selected OFF.
- For approach, the kruger circuit breaker must be pulled to disable the aileron droop function.

AILERON TRIM RUNAWAY

■ **If AP is not engaged in CMD** :

CONTROL WHEEL . . . . HOLD FIRMLY

■ **If AP engaged in CMD :**

AP . . . . KEEP ENGAGED IN CMD

FOR APPROACH

● **Below 200 kt and above 3000 ft AGL :**

AP . . . . DISCONNECT

AILERON TRIM RUNAWAY

- With AP engaged in CMD, an aileron trim runaway has no effect as it is countered by the AP.
- The AP must be maintained engaged in CMD as long as manual flying is not required.
- In approach, it is advisable to disconnect the AP below 200 kt and above 3000 ft.
- When the AP is disconnected after an aileron trim runaway, the result will be an abrupt movement of the control wheel, this will also result in spoilers deployment thus increasing the roll rate.

  The crew must firmly hold the control wheel and return it to the neutral position, or the position required for wings level.
- Similarly, if an aileron trim runaway occurs during manual flying, the crew must firmly hold the control wheel to keep wings level (or the required bank angle).

INTENTIONALLY LEFT BLANK

LANDING WITH ABNORMAL SLATS OR FLAPS

■ **If actual Landing Weight is at or below Max Landing Weight** :

- ● **Until SLATS/FLAPS lever in 30/40 position** :
  - SPEED . . . . VFE NEXT – 5
  - SLATS/FLAPS lever . EXTEND ONE STEP FURTHER
- ● **When SLATS/FLAPS lever in 30/40 position** :
  - SPEED . . . . VAPP

■ **If actual Landing Weight is above Max Landing Weight (overweight landing)** :

- ● **Until SLATS/FLAPS lever in 20/20 position** :
  - SPEED . . . . VFE NEXT
  - SLATS/FLAPS lever . EXTEND ONE STEP FURTHER
  - ● **When SLATS/FLAPS lever in 20/20** :
    - VFE 20/20 . . . . MAINTAIN
- ● **When aligned with the runway** :
  - SPEED . . . . VFE NEXT
  - SLATS/FLAPS lever 30/40
  - SPEED . . . . VAPP
  - PACK VALVE 1 and 2 . . . . OFF or on APU
  - VERTICAL SPEED AT TOUCHDOWN . . MINIMIZE
  - – Maximum vertical speed at touchdown : 360 ft/mn.

FOR GO AROUND

SLATS/FLAPS lever 20/20
SPEED . . . . VAPP + 10

■ **For immediate turn back** :

SLATS/FLAPS lever . . . . MAINTAIN 20/20
SPEED . . . . AS RQRD

■ **If diversion intended** :

Limit slats/flaps retraction to the position further extended than the jammed surface.

- ● **For slats or flaps retraction** :
  - SPEED . . . . ACCELERATE TO VFE
  - ● **When approaching VFE** :
    - SLATS/FLAPS lever . RETRACT ONE STEP FURTHER

LANDING WITH ABNORMAL SLATS OR FLAPS CONFIGURATION

- This procedure applies for approach only if slats are less than 20° or flaps are less than 20°. This procedure does not apply when landing with no slats and no flaps.
- Vfe Next is the placard Vfe corresponding to the next slats/flaps lever position.
  For example, if the slats/flaps lever is in 15/15 position, independently of actual slats or flaps position, Vfe Next is the placard Vfe corresponding to slats/flaps lever position 20/20, i.e. 195 kt.
- The technique consists basically in reducing the speed to Vfe Next – 5 (or Vfe Next) in order to extend the surfaces. When the speed is obtained, extend the surfaces.
- The target speed is Vfe Next – 5 to avoid exceeding Vfe in case of turbulence.
  Yet, in case of overweight landing, the target speed is Vfe Next to keep sufficient speed.
- When surfaces are extended, it is recommended to maintain speed.
- The landing speed is determined in accordance with the originating procedure.
- **In case of overweight landing** :
  - · If Vfe Next is lower than VLS, the slats/flaps lever can be set one notch further extended while the speed is decreased to follow VLS reduction as surfaces extend. The overspeed warning should not be triggered. In this case, disconnect the A/THR. A/THR can be re-engaged when the landing configuration is obtained.
  - · The S/F lever must not be placed in the 30/40 position before being aligned with the runway to avoid sharp movement in this configuration.
  - · Selecting packs off (or supplying packs from APU) will increase the maximum thrust available from the engines in case of a go-around.
- **For go around** :
  - · For immediate turn back, the speed can be increased up to Vfe – 5 kts (at pilot's discretion).
  - · For diversion, the slats/flaps lever must be maintained in the position further extended than the jammed surface (for example, 15/0 if slats are jammed at 13°) to limit the Max speed on the PFD to the corresponding Vfe. This is to remind pilots of the speed limit due to the jammed surface. R

INTENTIONALLY LEFT BLANK

FUEL LEAK

- ● **When a FUEL LEAK is suspected** :
  - – FQI CHAN SUPPLY 1&2 C/B . . . . PULL THEN PUSH (P60 & P61/132 VU)
- ● **If a FUEL LEAK is confirmed** :
  LAND ASAP
  - ■ **If LEAK FROM ENGINE/PYLON confirmed** :
    THROTTLE (affected side) . . . . IDLE
    FUEL LEVER (affected side) . . . . OFF
    FIRE HANDLE (affected side) . . . . PULL
    PROC : SINGLE ENG OPERATION (12.08) . . . . . . APPLY

    NOTE : – If the leak stops, the FUEL X FEED valve can now be selected OPEN.
    – Do not restart the engine.
  - ■ **If LEAK FROM WING TIP confirmed and CTR TK FEEDING** :
    (affected side OUTR TK indication may be 60-200 kg (132-440 lb) higher)

    NOTE : Check that no fuel forward transfer (ACT/TT) has been requested while the CTR TK is full.

    CTR TK PUMP (affected side) . . . . OFF
    INR TK PUMPS (affected side) . . . . OFF
    - ● **When both OUTR TK fuel quantities are equal** :
      CTR TK PUMP (affected side) . . . . NORM
      INR TK PUMPS (affected side) . . . . NORM
      Continue to monitor outer tanks fuel quantities and look for any increase.
    - ● **If leak is not prevented** :
      continue with LEAK FROM ENGINE/PYLON/WING TIP not confirmed or LEAK not located procedure (below).
  - ■ **If LEAK FROM ENGINE/PYLON/WING TIP not confirmed or LEAK not located** :
    FUEL X FEED . . . . MAINTAIN CROSS LINE
    CTR TK PUMPS . . . . OFF
    TRIM TK ISOL VALVE . . . . OFF
    INR TK FUEL QTY . . . . MONITOR
    - ■ **If one inner tank depletes faster than the other by at least 500 kg (1102 lb) in less than 30 min** :
      THROTTLE (affected side) . . . . IDLE
      FUEL LEVER (affected side) . . . . OFF
      FIRE HANDLE (affected side) . . . . PULL
      FUEL LEAK . . . . MONITOR
      - ■ **If the leak stops** :
        CTR TK PUMPS . . . . ON
        TRIM TK ISOL VALVE . . . . AUTO
        TRIM TK MODE . . . . AUTO
        PROC : SINGLE ENG OPERATION (12.08) . . APPLY

        NOTE : – The FUEL X FEED valve can now be selected OPEN.
        – Do not restart the engine.
      - ■ **If the leak continues after engine shutdown** :
        TRIM TK ISOL VALVE . . . . AUTO
        TRIM TK MODE . . . . AUTO
        FIRE HANDLE . . . . PUSH
        PROC : ENG RESTART IN FLIGHT (12.07) . . . . . . CONSIDER
        - ● **When INR TK empty** :
          CTR TK PUMPS . . . . ON

        CAUTION : Do not open the FUEL X FEED, even if requested by another procedure.
    - ■ **If both inner tanks deplete at a similar rate** :
      CTR TK PUMPS . . . . ON
      - ● **If fuel smell in the cabin** :
        APU (if running) . . . . OFF
        TRIM TK ISOL VALVE . . . . MAINTAIN OFF
      - ● **If no fuel smell in the cabin** :
        - ● **If trim tank not empty** :
          TRIM TK ISOL VALVE . . . . AUTO
          TRIM TK MODE . . . . FWD
        - ● **If/When trim tank empty** :
          TRIM TK MODE . . . . AUTO
          TRIM TK ISOL VALVE . . . . OFF

FOR LANDING

CAUTION : . Do not use reverse.
. Notify ATC

FUEL LEAK

A FUEL LEAK may be detected by :

- – the sum of the FOB and the F.USED is significantly less than the FOB at departure or decreases, or
- – visual check from the cabin if accessibility permits, (fuel spray from engine/pylon or from wing tip), or
- – total fuel quantity decreasing at an abnormal rate, or
- – fuel imbalance, or
- – tank emptying too fast (leak from engine/pylon or a hole in a tank), or
- – tank overflowing (due to pipe rupture in a tank), or
- – excessive fuel flow (leak from engine), or
- – fuel smell in the cabin.

- – The FUEL X FEED valve enables to re-balance the fuel quantity, or to use the fuel from both wings.
- – Although FQI malfunctions are generally indicated by blanking of digital readout, fluctuating readings, off scale readings, or indications that do not change, it is recommended to reset the FQI computers by action on FQI channels supply C/B's.
- – If leak from wing tip :
  - · Cycling the engine feed from center/inner tank to outer tank may allow correct closure of the non-return valve.
  - · On aircraft fitted with a trim tank or/and ACT, fuel forward transfer while the CTR TK is full leads to have fuel vented overboard at the LH wing tip.
- – If the leak from engine/pylon/wing tip is not confirmed or the leak is not located :
  - · Any fuel transfer has to be stopped.
  - · Each engine is fed via its associated inner tank.
  - · Fire Handle pulled closes the LP fuel valve. Any leak downstream the LP valve should stop.
  - · The depletion rate of each inner tank has to be monitored, to determine if the leak is from an engine or a wing, or from the trim tank or APU feeding line.
    - – If one inner tank depletes faster than the other by at least 500 kg (1102 lb) in less than 30 min, an engine leak may be suspected.
      - · If the leak stops after engine shutdown, the engine leak is confirmed.
      - · If the leak continues after engine shutdown, a leak from the wing may be suspected.
      - · Consider engine restart in flight. If engine restart in flight is attempted, push back fire handle.
    - – If both inner tanks deplete at a similar rate, a leak from the trim tank or the APU, or their respective fuel line may be suspected.
- – In case of unbalance, apply normal trim setting procedure, i.e. use rudder trim first. If rudder is not sufficient, use aileron trim.
- – There is no special procedure for approach and landing with any fuel imbalance.

Mod : 4801 + 4803

CTR/INR/OUTR TK PUMP FAULT / LO PR

CTR TK

- **If one FAULT light illuminated** :

  CTR TK PUMP (affected) . . . . OFF
  FUEL X-FEED . . . . IN-LINE

- **If both FAULT (or one FAULT/one OFF) lights illumintated** :

  CTR TK PUMPS . . . . OFF
  PROC : FUEL FEED MAN CTL (7.04) . . . . . . APPLY

INR TK

- **If one FAULT light illuminated** :

  INR TK PUMP (affected) . . . . OFF

- **If in one INR TK both FAULT (or one FAULT/one OFF) lights illuminated** :

  INR TK PUMPS (affected TK) . . . . OFF

  - ● **If INR TK not empty :**

    FUEL X-FEED . . . . IN LINE

    - ● **If INR TK above 2000 Kg (4400 lbs) :**

      PROC : FUEL GRAVITY FEEDING FOR INR TK (7.05) . . . . APPLY

- **If in both INR TK both FAULT (or one FAULT/one OFF) Lts on** :

  INR TK PUMPS (all) . . . . OFF
  PROC : FUEL FEED MAN CTL (7.04) . . . . . . APPLY

OUTR TK

- **If one PUMP LO PR :**

  OUTR TK PUMP (affected) . . . . OFF

- **If both PUMP LO PR in one OUTR TK, when other TK's empty :**

  PROC : FUEL GRAVITY FEEDING FOR OUTR TK (7.05) . . . . APPLY

AUTO FUEL FEED FAULT

- **If both L and R CTR TK PUMP FAULT (or one FAULT/ one OFF) lights illuminated :**

  L and R CTR TK PUMPs (2) . . . . OFF
  PROC : FUEL FEED MAN CTL (below) . . . . . APPLY

- **If all four INR TK PUMP FAULT (or FAULT/OFF) lights illuminated** :

  L and R INR TK PUMPs (4) . . . . OFF
  PROC : FUEL FEED MAN CTL (below) . . . . . APPLY

CTR/INR/OUTER TK PUMP FAULT/LO PR and or AUTO FUEL FEED FAULT

Indications :

Single chime (if two pumps fail in one tank)
ECAM activation with appropriate warning light
Left ECAM CRT : PUMP LO PR proc and/or
AUTO FUEL FEED FAULT proc
Right ECAM CRT : FUEL page
FAULT (LO PR) light(s) on FUEL panel

- If one CTR TK pump fails, FUEL X-FEED is selected open to avoid OUTR TK feeding on the concerned side and resultant fuel assymetry.
- If both CTR TK pump FAULT (or FAULT/OFF) lights illuminate, the reason is either :

  . Pump FAULT (low pressure) with CTR TK not empty,

  or

  . AUTO FEED FAULT with CTR TK empty, and any CTR TK PUMP running or INR TK PUMPS not started in either TK,

  or

  . CTR TK empty during FUEL FEED MAN CTL.

  In case of AUTO FEED FAULT the OFF selection of both CTR TK PUMPS deactivates the AUTO FEED logic and the INR TK PUMPS will start running. This action will engage FUEL FEED MAN CTL.
- If in one INR TK both PUMP FAULT (or FAULT/OFF) lights illuminate, the reason is either :

  . PUMP FAULT (LO pressure) with INR TK not empty,

  or

  . INR TK empty (LO) with pumps still running.
- If in both INR TK both PUMP FAULT (or FAULT/OFF) lights illuminate the reason is AUTO FUEL FEED FAULT.

  With CTR TK not empty, the CRT TK PUMPS do not run or any INR TK PUMP is running. The OFF selection of all INR TK PUMPS deactivates the AUTO FEED logic and CTR TK PUMPS will start. This action will engage FUEL FEED MAN CTL.

AUTO FUEL FEED FAULT R

The ECAM message AUTO FUEL FEED FAULT, when they R
occur at Inner tank low level in descent or during taxi are R
spurious warnings. R

FUEL X-FEED IN FLIGHT (FUEL IMBALANCE)

CAUTION* :** ***In case of fuel imbalance, consider first the possibility of a fuel leak.
For this purpose, 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 smaller than the fuel on board at departure, suspect a fuel leak.

■ **If fuel leak suspected or confirmed** :

FUEL X-FEED . . . . DO NOT USE

PROC : FUEL LEAK (7.02) . . . . APPLY

■ **If fuel leak not suspected** :

FUEL X-FEED . . . . IN LINE

● **On the wing from which fuel will be used** :

ISOL VALVES (2) . . . . CHECK IN LINE

INR TK PUMPS (2) . . . . CHECK NORM

● **On the opposite wing** :

INR TK PUMPS (2) . . . . OFF

● **When fuel balancing is completed** :

ALL INR TK PUMPS (4) . . . . NORM

R FUEL X-FEED . . . . CROSS-LINE

FUEL X-FEED IN FLIGHT

- This procedure is applied to correct or prevent fuel imbalance.
- When FUEL X-FEED valve is open (e.g in case of engine failure), a fuel imbalance may occur due to pump pressure difference. In this case select INR TK PUMPs OFF on the "light" side to restore the fuel balance.

FUEL FEED MANUAL CONTROL

● **If AUTO FUEL FEED FAULT is not displayed on ECAM**

  ● **If all INR TK, or both CTR TK FUEL PUMP FAULT lights have illuminated simultaneously**

  AUTO FEED C/B . . . . PULL THEN PUSH

  Affected PUMPS . . . . ON

    ● **If FAULT lights remain extinguished**

    Resume normal operation

OUTR TK PUMPs (4) . . . . CHECK ON

■ **For CTR TK feeding** :

CTR TK PUMPs (2) . . . . NORM

INR TK PUMPs (4) . . . . OFF

  ● **When approaching CTR TK depletion**

  OUTR TK's FUEL QTY . . . . MONITOR

    ● **When OUTR TK's start feeding**

    INR TK or OUTR TK FEEDING . . . . . . SELECT

  ● **When CTR TK empty** :

  TRIM TK MODE FWD . . . . CONSIDER

■ **For INR TK feeding** :

INR TK PUMPs (4) . . . . NORM

CTR TK PUMPs (2) . . . . OFF

■ **For OUTR TK feeding** :

INR TK PUMPs (4) . . . . OFF

CTR TK PUMPs (2) . . . . OFF

TANK FEEDING . . . . MONITOR ECAM/FQI

● **If tank feeding is not as desired** :

OUTR TK PUMPs (4) . . . . CHECK ON

CTR TK (2) and INR TK PUMPs (4) . . . . OFF

TK PUMPs (required INR TK or CTR TK) . . . . NORM

  ● **If unsuccessful** :

  AUTO FEED CTL C/B (132VU-M55) . . . . . . PULL

FUEL FEED MANUAL CONTROL

- This procedure should be used whenever the automatic fuel feed mode does not work correctly or when manual fuel feed is required.
- If all INR TK, or both CTR TK PUMP FAULT lights illuminate simultaneously, an AUTO FEED system fault should be considered. In this case, an AUTO FEED C/B reset is possible in order to recover the system.
- The manual feed sequence is to feed from the CTR TK until empty, then from INR TKs until empty, then from the OUTR TKs.
- In FUEL FEED MANUAL CONTROL, the CTR TK PUMP FAULT lights do not illuminate when reaching CTR TK depletion.

  When in CTR TK feeding, when approaching CTR TK depletion, monitor the OUTR TK's fuel quantity.

  When OUTR TK's start feeding, select INR TK's or OUTR TK's feeding, as desired.

OUTER TK LO LEVEL

FUEL MANAGEMENT . . . . CHECK

CAUTION *: If a fuel leak is suspected, do not apply this procedure and refer to FUEL LEAK procedure.*

■ **If CTR TK or INR TK is not empty** :

FUEL FEED MAN CTL (7.04) . . . . APPLY

■ **If CTR TK and INR TK are empty** :

FUEL X FEED . . . . IN LINE

OUTER TANK LO LEVEL

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : LO LEVEL proc

Right ECAM CRT : FUEL page

FUEL GRAVITY FEEDING

- ● **<u>If AUTO FUEL FEED FAULT is not displayed on ECAM</u>**
  - ● **<u>If both INR TK on same side FUEL PUMP FAULT lights have illuminated simultaneously</u>**

    AUTO FEED C/B . . . . PULL THEN PUSH

    Affected PUMPS . . . . ON

    - ● **<u>If FAULT lights remain extinguished</u>**

      Resume normal operation

IGNITION . . . . CONT RELIGHT

FUEL X-FEED . . . . CROSS-LINE

<u>CAUTION</u> : Avoid rapid throttle movement and low or negative g-load factors.

CTR TK

DO NOT CONSIDER FUEL GRAVITY FEEDING FROM CTR TK.

INR TK

- ■ **<u>If INR TK QTY above 2000 kg (4400 lbs) :</u>**

  MAX FL . 200 (150 IF JP4/JETB USED) / MEA / MORA

  INR TK ISOL VALVE (affected) . . . CHECK IN LINE

  OUTR TK ISOL VALVE (affected) . . . . OFF

  - ● **<u>When INR TK below 2000 kg (4400 lbs) :</u>**

    OUTR TK ISOL VALVE (affected) . . . . IN LINE

    INR TK ISOL VALVE (affected) . . . . OFF

- ■ **<u>If INR TK QTY below 2000 kg (4400 lbs) :</u>**

  DO NOT CONSIDER FUEL GRAVITY FEEDING FROM INR TK.

OUTR TK

- ● **<u>If fuel and pumps are available in CTR TK or INR TKs</u> :**

  ORIGINATING PROCEDURE . . . . REFER

  FUEL MANAGEMENT (originating procedure) . APPLY

- ● **<u>If/When CTR and INR TKs empty</u>** :

  MAX FL . 250 (200 IF JP4/JETB USED) / MEA / MORA

  OUTR TK ISOL VALVE (affected) . . CHECK IN LINE

  INR TK ISOL VALVE (affected) . . . . OFF

<u>FUEL GRAVITY FEEDING</u>

– If all INR TK, or both INR TK on same side, or both CTR TK PUMP FAULT lights illuminate simultaneously, an AUTO FEED system fault should be considered. In this case, an AUTO FEED C/B reset is possible in order to recover the system.

– Fuel gravity feeding with all tanks affected is not considered in this procedure. It is assumed to be required only in case of loss of all AC generation and flight on batteries only.

Refer to LOSS OF BOTH ENG GENERATORS.

– The selection of CONT RELIGHT protects the engine against flame-out caused by possible fuel supply surges.

– Descent to the specified flight level provides sufficient static pressure to supply the engine driven fuel pumps.

If fuel pressure fluctuations of 10 psi or more occur, descend to a lower altitude.

– Keeping throttle movements slow and avoiding low load factors will prevent fuel supply surges.
If JP4/JET B is used, avoid fuel flow below 1150 kg/h, (2530 lb/h)

– If the CTR TK only is affected, gravity feeding is not recommended. Due to the increased consumption at the required lower altitude the recovery of CTR TK fuel does not constitute a reasonable advantage.

– If an INR TK is affected, the respective OUTR TK must be isolated to prevent OUTR TK feeding.

INR TK feeding must be stopped, when the level reaches 2 000 kg/4400 lb.

Below this level the non-return valve in the CTR TK feed line may not remain closed, resulting in fuel surges and possible air suction. Consequently the OUTR TK must be used.

– If an OUTR TK is affected and pumps in the related INR TK operate in AUTO FEED MODE, monitor INR TK QTY and select INR TK ISOL VALVES to OFF, when pumps stop.

Should pumps operate in FUEL FEED MAN CTL, select INR TK ISOL VALVES and INR TK PUMPS to OFF at first indication of PUMP FAULT (low pressure).

TRIM TK SYS INIT

ZFW OR ZFCG DISAGREE
PROC : TRIM TK SYS INIT

ECAM and LOAD SHEET TOGW and TOCG .. COMPARE

- ■ **If ECAM values and load sheet data show a discrepancy of more than 1000 kg (2200 lbs) or 1.5 % CG :**

  ZFW and ZFWCG . . . . REENTER

  ECAM and LOAD SHEET TOGW and TOCG . COMPARE

  - ● **If ECAM values and load sheet data still show a discrepancy of more than 1000 kg (2200 lbs) or 1.5 % CG :**

    TRIM TK PUMPS . . . . OFF

- ■ **If ECAM TOGW and TOCG values and load sheet data are within 1000 kg (2200 lbs) or 1.5 % CG :**

  ECAM WARNING . . . . CLEAR

TRIM TK PUMP LO PR

TRIM TK PUMP (affected) . . . . OFF

- ■ **If both TRIM TK PUMPs OFF and TRIM TK not empty:**

  TRIM TK MODE . . . . FWD

  AUTO TRIM TK SYS INOP

  FUEL GRAVITY FWD XFR ONLY

- ■ **If TRIM TK empty and both TRIM TK PUMPs LO PR :**

  TRIM TK PUMP 1 and 2 . . . . OFF

  AUTO TRIM TK SYS INOP

TRIM TK MODE . . . . AUTO

TRIM TK AFT XFR NOT AVAIL

ON GROUND

TRIM TK PUMP 1 and 2 . . . . OFF

CAUTION : Do not select TRIM TK MODE pushbutton switch to FWD position even if instructed to do so by ECAM.

AFT CENTER OF GRAVITY

TRIM TK MODE . . . . FWD

- ● **AFTER 1 MINUTE :**

  TRIM TK MODE . . . . AUTO

  CG TARGET SHIFTED FWD

Mod : 4801 + 7259

TRIM TK SYS INIT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : TRIM TK SYS INIT procedure
Right ECAM CRT : FUEL page

- This warning is triggered on ground when the CGCC detects a discrepancy between the values received from the two FMS or when the crew performs a new initialization of ZFW or ZFCG in case of single FMS operation.
- In case of discrepancies between load sheet and ECAM values, trim tank system may be used manually (Refer to MMEL).

TRIM TK PUMP LO PR

Indications :
Single chime (if both pumps fail/off)
ECAM activation with appropriate warning light
Left ECAM CRT : PUMP LO PR procedure
Right ECAM CRT : FUEL page
LO PR light(s) on FUEL panel

- When TRIM TK pumps are selected OFF, and TRIM TK MODE pushbutton is selected to FWD, transfer from trim tank to center tank is by gravity only.
- When trim tank is empty select TRIM TK pumps OFF and TRIM TK MODE to AUTO to prevent CTR TK overflow during next trim tank refueling.

TRIM TK AFT XFR NOT AVAIL

Indications :
ECAM activation
Left ECAM CRT : TRIM TK AFT XFR NOT AVAIL
Right ECAM CRT : FUEL page

- On ground, this warning may indicate a failure that could lead to CTR TK overflow
- Select both TRIM TK pumps OFF to avoid this overflow risk. The AUTO TRIM TK SYS becomes inoperative.
- Do not select TRIM TK MODE to FWD, otherwise fuel overflow could occur due to gravity FWD transfer.

AFT CENTER OF GRAVITY

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : AFT CENTER OF GRAVITY procedure
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- This warning is triggered when the THS reaches a position corresponding to 41 % CG. This position is computed by the FWC and depends on Mach number and N1.
- Selection of TRIM TK MODE push-button to FWD position for at least 1 minute, shifts the CGCC target 1.5 % forward.
- This warning may be due to inaccuracy in load sheet computation which can be solved by the shift of CGCC target.
- If the CG reaches again 41 % after the shift of the CGCC target, this warning will not be triggered. Only the EXCESS AFT CG warning (CG reaching 43 %) remains available.

TRIM TK SYS FAULT

IN FLIGHT

TRIM TK MODE . . . . FWD
TRIM TK PUMP 1 and 2 . . . . CHECK ON

- **If no FWD XFR** :
  R PROC : TRIM TK FUEL UNUSABLE (7.08) . . . APPLY
- **If CTR TK above 14 T (31 000 lbs)** :
  TRIM TK PUMPS 1 and 2 . . . . OFF
  NOTE : TRIM TK fuel will be transferred FWD by gravity.
- **When TRIM TK empty** :
  TRIM TK PUMP 1 and 2 . . . . OFF
  TRIM TK MODE . . . . AUTO

ON GROUND

Do not select TRIM TK MODE pushbutton switch to FWD position.

TRIM TK SYS FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : TRIM TK SYS FAULT PROC
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- If CTR TK fuel quantity reaches 14 tons (31 000 lbs), TRIM TK pumps are selected OFF to decrease the rate of transfer (transfer only ensured by gravity) in order to avoid overfilling of center tank.
- Forward transfer can be confirmed by checking trim tank fuel quantity decrease or transfer indications (on FUEL page of ECAM system display).
- When trim tank is empty ensure TRIM TK pumps are selected OFF and TRIM TK MODE to AUTO to prevent CTR TK overflow during next trim tank refueling.

R Mod : 4801

TRIM TK FUEL UNUSABLE

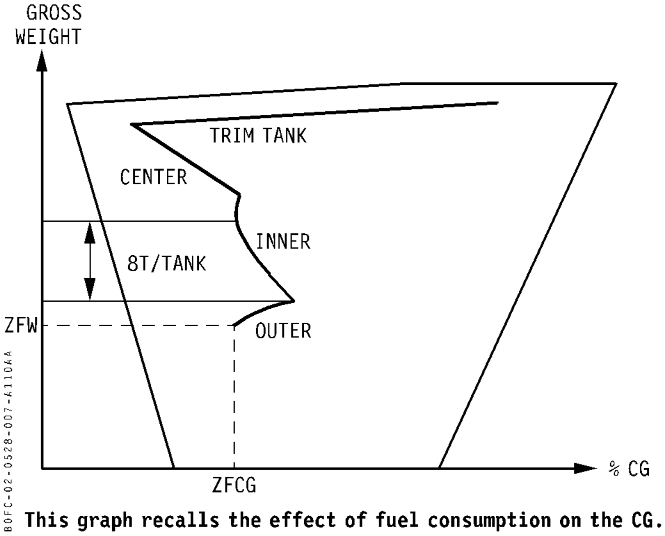
OUTR TK ISOL VALVES . . . . CHECK IN LINE

OUTR TK PUMPS . . . . CHECK ON
INR TK PUMPS (4) . . . . OFF
CTR TK PUMPS (2) . . . . OFF

- ● **When OUTR TK LO LVL** :
  INR TK PUMPS . . . . NORM
  - ● **If required** :
    CTR TK PUMPS . . . . NORM

CAUTION : ***Consider diversion since fuel consumption from CTR TK or from INR TKs (when below 8000 kg/17700 lbs in either INR TK) will move the CG aft and could lead to the exceedance of the aircraft aft CG limit for landing.***

LDG SPD INCREMENT . . . . + 5 KT
LDG DIST . . . . MULTIPLY BY 1.1



This graph recalls the effect of fuel consumption on the CG.

TRIM TK FUEL UNUSABLE

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : TRIM TK ISOL VALVE NOT OPEN
TRIM TK FUEL UNUSABLE PROC
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- To reduce the risk of center of gravity exceeding the aft limit, tanks must be emptied in the following sequence : OUTER tanks, INNER tanks and CENTER tank.
- Fuel consumption from INR TK (when either below 8000 kg/17700 lbs) or from CTR TK will move the CG rearward of the CG value at time of failure.

  Fuel consumption from the OUTER TKs and from the INR TKs when above 8000 kg/17700 lbs will move the CG forward, or maintain the current CG.

  Diversion should be considered to avoid exceedance of aft CG limit for landing.

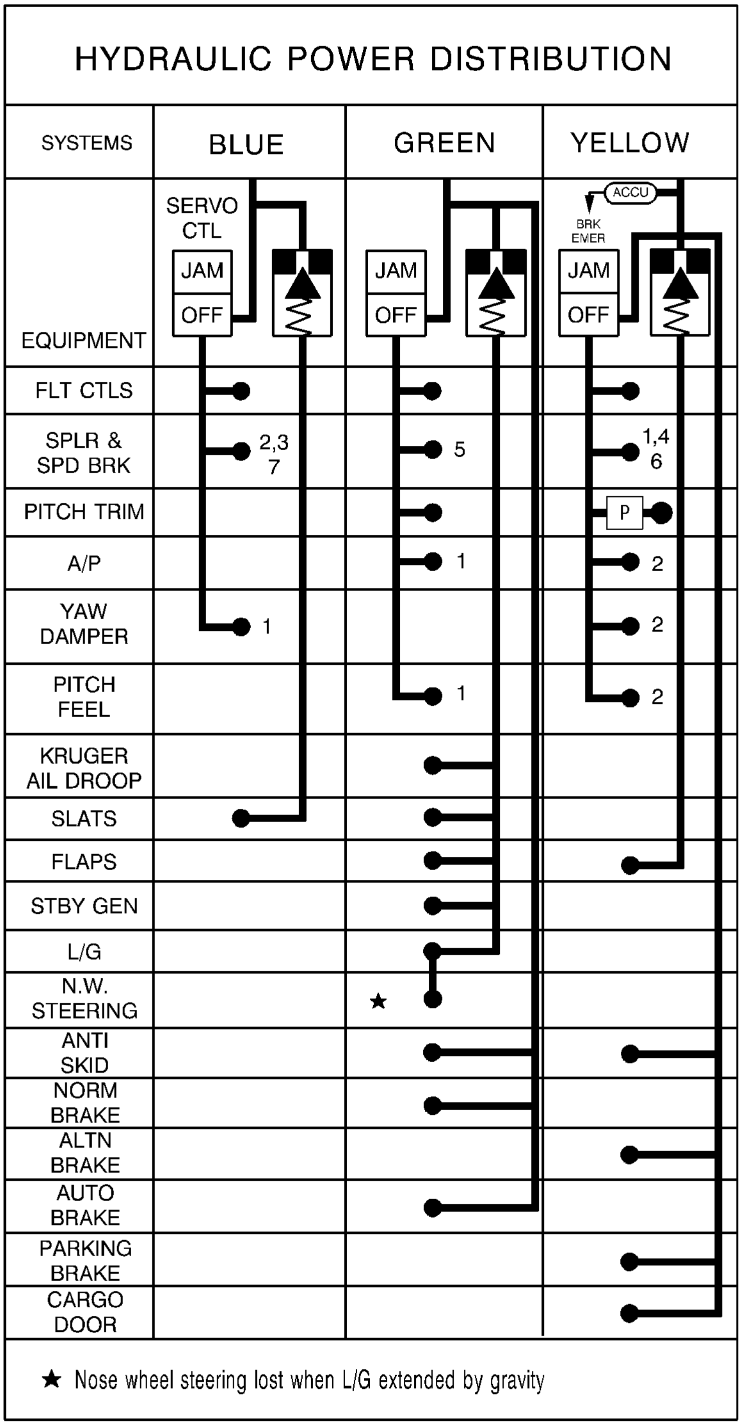
  The graph typically shows the effect of the fuel consumption on the CG and illustrates the caution note of the procedure. R R R
- Approach speed is increased for better manoeuvrability at aft CG.
- In case of both trim tank pumps failure and no gravity transfer, gravity transfer may be obtained by initiating a descent. Subsequently, flight may be resumed at normal cruise altitude (gravity transfer may have been prevented at high altitude by air trapped in the trim tank transfer line).

Mod : 4801 or (4801 + 7576)

LEFT BLANK INTENTIONALLY

Mod : 4801 or (4801 + 7576)

HYDRAULIC POWER DISTRIBUTION



SYSTEMS / EQUIPMENT	BLUE	GREEN	YELLOW
FLT CTLS	●	●	●
SPLR & SPD BRK	● 2,3 7	● 5	● 1,4 6
PITCH TRIM		●	P ●
A/P		● 1	● 2
YAW DAMPER	● 1		● 2
PITCH FEEL		● 1	● 2
KRUGER AIL DROOP		●	
SLATS	●	●	
FLAPS		●	●
STBY GEN		●	
L/G		●	
N.W. STEERING		★ ●	
ANTI SKID		●	●
NORM BRAKE		●	
ALTN BRAKE			●
AUTO BRAKE		●	
PARKING BRAKE			●
CARGO DOOR			●

★ Nose wheel steering lost when L/G extended by gravity

R
R

B0FC-02-0529-001-A100AC

Mod : 5911

HYD RSVR LO AIR PR / OVHT – PUMP LO PR

- **If HYD RSVR LO AIR PR and If PRESSURE FLUCTUATES**:

  or

  If HYD RSVR OVHT or HYD PUMP LO PR :

  PUMP(s) (affected system) . . . . OFF

  - **If GREEN SYS affected** :

    GREEN ELEC PUMPS . . . . OFF

  AFFECTED EQUIPMENT . . . . OFF

  BLUE : SPLRS 2, 3, 7

  YELLOW : PITCH FEEL 2
  SPLRS 1, 4, 6

  GREEN : PITCH FEEL 1
  SPLR 5

  PROC : HYD SYS LO PR (below) . . . . APPLY

  - **If GREEN HYD RSVR OVHT warning activated with STBY GEN operating and SAT above ISA + 30** :

    GREEN HYD PWR ENG PUMPS (2) . . . . ON

HYD RSVR LO AIR PR

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : RSVR LO AIR PR proc
Right ECAM CRT : HYD page
AIR light on HYD panel.

- This warning is activated if the tank air pressure is below 22 psi. The warning is cleared when the air pressure increases to 25 psi.
- If the warning is activated and all system pressures are normal without abnormal fluctuation, no action is required.
- The risk of pump cavitation increases with altitude.
  If GREEN system is affected, use of ELEC PUMPS may cause pump damage.

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

HYD RSVR OVHT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : RSVR OVHT proc
Right ECAM CRT : HYD page
OVHT light on HYD panel.

- If the GREEN system is affected each pump may be selected to ON in turn in an attempt to determine the affected pump.
- This warning may be triggered when using standby generator in temperature condition above ISA + 30.
  In this case, the green hydraulic pumps must not be selected OFF.

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

HYD PUMP LO PR

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : PUMP LO PR proc
Right ECAM CRT : HYD page
PUMP LO PR light on HYD panel.

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

Mod : 5911

HYD SYS LO PR

FOR APPROACH

- **If SYS lost by** :
  - **RSVR LO AIR PR** :
    PUMP(S) (affected system) . . . . ON
  - **RSVR OVHT** :
    - **If OVHT light extinguished**
      PUMP(S) (affected system) . . . . ON
  - **PUMP LO PR** :
    - **If GREEN SYS affected** :
      HYD PWR ELEC PUMPS . . . . ON
    - **If BLUE or YELLOW SYS affected** :
      PTU (affected SYS) . . . . ON
- **If affected SYS recovered :**
  AFFECTED EQUIPMENT . . . . RESTORE
- **If affected SYS not recovered** :
  HYDRAULIC POWER DISTRIBUTION (8.01) . . REVIEW
  - **If BLUE or YELLOW SYS affected** :
    LDG DIST . . . . MULTIPLY BY 1.3
  - **If GREEN SYS affected** :
    LDG SPD INCREMENT . . . . + 10 KT
    LDG DIST . . . . MULTIPLY BY 1.2
    PROC : L/G GRAVITY EXT (10.02) . . . . . . APPLY
  - **If GREEN SYS affected** :
    BRK-A/SKID . . . . ALTN-ON

HYD SYS LO PR

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : STATUS after basic failure
Right ECAM CRT : HYD page
Local alert light depending on the origine.

- If BLUE or YELLOW system remains unpressurized, the landing distance is increased due to the partial loss of GND SPLRS.
- If GREEN system remains unpressurized, S, F, VLS must be augmented by 10 Kt due to KRUGERS inoperative (the aileron droop loss has no effect). The landing distance is increased due to augmentation of VLS and due to alternate braking (YELLOW). R

  The AUTO BRAKE is inoperative.

  Braking is automatically transferred to YELLOW HYD system.

  However, to obtain the RELEASE indication for YELLOW alternate braking it is recommended to set the A/SKID-BRK selector to ALTN/ON.

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

- Due to the low flow of the ELEC PUMPS and PTU, the hydraulic pressure may drop below 130 bars leading to the closure of priority valve. HYD SYS LO PR may be triggered again. When pressure raises back to 130 bars, the priority valves re-open.
- When using the PTU, the slats, flaps and L/G must be extended in sequence in order to reduce loads on systems.
  - Blue system pressurized by PTU : sequence SLATS and L/G.
  - Yellow system pressurized by PTU : sequence FLAPS and L/G.

HYD RSVR LO LEVEL

PUMP(S) (affected system) . . . . OFF
AFFECTED EQUIPMENT . . . . OFF

BLUE : SPLRS 2, 3, 7
YELLOW : PITCH FEEL 2
SPLRS 1, 4, 6
GREEN : PITCH FEEL 1
SPLR 5

■ **If BLUE or YELLOW SYS affected** :
LDG DIST . . . . MULTIPLY BY 1.3

■ **If GREEN SYS affected** :
LDG SPD INCREMENT . . . . + 10 KT
LDG DIST . . . . MULTIPLY BY 1.2
PROC : L/G GRAVITY EXT (10.02) . . . . APPLY

● **If GREEN SYS affected** :
BRK-A/SKID . . . . ALTN-ON
HYDRAULIC POWER DISTRIBUTION (8.01) . . . REVIEW

HYD RSVR LO LEVEL

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : RSVR LO LEVEL proc
Right ECAM CRT : HYD page
QTY indication on HYD panel.

- The warning is triggered when tank fluid quantity is below 5 L.
- If the YELLOW tank is concerned, the respective HYD FIRE VALVE closes automatically. This does not prevent RAT operation.
- If BLUE or YELLOW system is affected, the landing distance is increased due to partial loss of GND SPLRS.
- If GREEN system is affected, S, F, V_{LS} must be augmented by 10 Kt due to KRUGERS inoperative (the aileron droop loss has no effect). The landing distance is increased due to augmentation of V_{LS} and due to alternate braking (YELLOW). R

  The AUTO BRAKE is inoperative.

  Braking is automatically transferred to YELLOW HYD system.

  However, to obtain the RELEASE indication for YELLOW alternate braking it is recommended to set the BRK-A/SKID selector to ALTN-ON.

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

ENG ANTI ICE FAULT

- ■ **<u>If ENG ANTI ICE selected ON (valve not open)</u>** :
  AVOID ICING CONDITIONS.
- R ■ **<u>If ENG ANTI ICE selected off (valve not closed)</u>** :
  THRUST LIM PENALTY.

ENG ANTI ICE FAULT

<u>Indications :</u>
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : ENG ANTI ICE FAULT procedure
Right ECAM CRT : NIL
Local FAULT light on ANTI ICE panel

- ENG ANTI ICE FAULT is indicated when there is a disagreement between the valve position and the selected position.
- If a valve does not close, when selected OFF, the thrust limit penalty for ANTI ICE ON remains valid. This is taken into consideration by the TCC.
- If ENG ANTI ICE FAULT occurs at idle with the valve not closed, a momentary thrust increase may lead to valve closure.

WING ANTI ICE VALVES FAULT

IN FLIGHT

- ■ **<u>If WING SUPPLY selected ON (valve not open)</u>** :
  WING MODE SEL . . . . ALTN
  - R ● **<u>If FAULT light remains illuminated</u>** :
    WING SUPPLY . . . . OFF
    AVOID ICING CONDITIONS.
- R ■ **<u>If WING SUPPLY selected off (valve not closed)</u>** :
  THRUST LIM PENALTY

ON GROUND

R BLEED VALVE (1 or 2) . . . . OFF/R
R APU BLEED . . . . OFF/R

WING ANTI ICE VALVES FAULT

<u>Indications :</u>
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : WING VALVE NOT OPEN/CLOSED procedure
Right ECAM CRT : NIL
FAULT light on ANTI ICE system panel

- WING ANTI-ICE FAULT is indicated when there is a disagreement between the valve position and the selected position.
- On ground, selecting BLEED VALVES OFF will prevent a slats overheat.
- The thrust limit penalty for ANTI ICE ON remains valid. This is taken into consideration by the TCC.

PW Eng. : All

PROBE HEAT FAULT

■ **CAPT PITOT/ALPHA/STAT/TAT HEAT FAULT**

ADC 1 IND . . . . MONITOR

■ **F/O PITOT/ALPHA/STAT/TAT HEAT FAULT**

ADC 2 IND . . . . MONITOR

■ **STBY PITOT/ALPHA/STAT HEAT FAULT**

STBY IND . . . . MONITOR

■ **ENG 1 (2) EPR HEAT FAULT**

ENG 1 (2) EPR IND . . . . MONITOR

PROBE HEAT PARTIALLY INOP

R ● **If CAPT or F/O PITOT HEAT FAULT** :

R AP/FD . . . . USE THE NON AFFECTED SIDE

R ● **If IAS disagree or before entering icing conditions** :

R ADC (affected) C/B . . . . PULL
R . ADC 1 115 VAC (22VU-B19)
R or
R . ADC 2 115 VAC (21VU-E10)

WINDOW HEAT FAULT

WINDOW HEAT (affected) . . . . OFF/R

● **If transient FAULT is suspected, after 3 seconds minimum:**

WINDOW HEAT (affected) . . . . ON

● **If FAULT light re-illuminates** :

WINDOW HEAT (affected) . . . . OFF/R

● **If FAULT warning is triggered on ground with OAT greater than 40°C (100°F) and with PACKS OFF** :

PACKS . . . . ON

● **After 5 minutes minimum** :

WINDOW HEAT (affected) . . . . ON

FOR APPROACH

● **If WINDOW HEAT not recovered** :

COCKPIT COMPT TEMP . . . . INCREASE

– Increasing the cockpit temperature will prevent window fogging during approach and landing.

PROBE HEAT FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : PROBE HEAT FAULT procedure

Right ECAM CRT : Nil

Corresponding local warning light on PROBE HEAT panel :

– In case of stand-by alpha probe heat fault, it is not necessary to monitor the stand-by air speed and altitude indications.

– PROBE HEAT FAILURE results in loss of FADEC EPR mode.

– Apply ENG EPR MODE and ENG ALT MODE procedures.

– The ADC indications monitoring must be done during R
the rest of the flight after a probe heat fault. R

WINDOW HEAT FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : WINDOW HEAT FAULT procedure

Right ECAM CRT : Nil

FAULT light on WINDOW HEAT panel.

– If WINDOW HEAT transient FAULT is suspected (e.g. during APU start), FAULT may be cleared by reset action on the affected WINDOW HEAT pushbutton.

R **ICE DETECTED**

IGNITION . . . . CONT RELIGHT
R ENG ANTI ICE (1 AND 2) . . . . ON
WING ANTI ICE . . . . AS RQRD

ICE DETECTION

Indications :
Single chime
ECAM activation with appropriate warning light R
Left ECAM CRT : ICE DETECTION procedure R
Right ECAM CRT : Nil
ICE light

- ICE light illuminates on the overhead panel for 1 min each time ice is detected. R
- Ignition may be set to OFF, after engine parameters have stabilized.

R **ICE DET OVHT**

ICE DET . . . . PTR

ICE DET OVHT

Indications :
Single chime
ECAM activation with appropriate warning light R
Left ECAM CRT : ICE DET OVHT procedure R
Right ECAM CRT : Nil
OVHT light

- OVHT light illuminates in case of overheat in the heating element for sensor de-icing. Heating element is automatically de-energized and the failure latched.
- Pressing the PTR switch reactivates the sensor heating and resets the OVHT protection circuit. R

Mod. : 2753

LEFT BLANK INTENTIONALLY

Mod : 2753 or 3588

LDG WITH NOSE L/G ABNORMAL

PREPARATION

CABIN CREW . . . . NOTIFY
ATC . . . . NOTIFY
TRANSPONDER . . . . AS RQRD
FUEL WEIGHT (if possible) . . . . REDUCE
CG LOCATION (if possible) . . . . MOVE AFT
  – 10 pax from front to rear = + 2 %
  – 10 pax from mid to rear = + 1 %
SEAT BELTS/NO SMOKING . . . . ON

APPROACH

R GRAVITY EXTENSION handcrank . . . . ROTATE BACK
R TO NORM
L/G LEVER . . . . DOWN
GPWS . . . . OFF
CABIN REPORT . . . . OBTAINED
EMER EXIT LT selector . . . . ON
TRIM TK ISOL VALVE . . . . OFF
BRK/A/SKID . . . . ALTN/OFF
MAX BRAKES PRESSURE . . . . 1000 PSI

BEFORE LANDING

PACKS 1 and 2 . . . . OFF
RAM AIR . . . . ON
BRACE FOR IMPACT . . . . ORDER
R ● **If the external light condition is poor at landing** :
R DOME LIGHT . . . . DIM

FLARE, TOUCH DOWN AND ROLL OUT

NOTE : Engines should be shut down sufficiently early to ensure fuel is shut off before the nacelles impact, but sufficiently late to ensure adequate supplies for the flight controls.

Engine pumps continue to supply adequate pressure for at least 15 seconds after first engine shutdown.

REVERSE . . . . DO NOT USE
NOSE . . . . MAINTAIN UP
– After touchdown keep the nose off the runway by use of elevator. Then, lower nose on to the runway before elevator control is lost.
BOTH FUEL LEVERS . . . . OFF
– Shutdown the engines before nose impact.

AT NOSE IMPACT

FIRE HANDLES (ALL) . . . . PULL

WHEN A/C STOPPED

CABIN CREW (PA) . . . . NOTIFY
FUEL ISOL VALVES . . . . OFF
AGENTS (ENG and APU) . . . . DISCH
△P (DIFF PRESS) . . . . CHECK ZERO
EVACUATION . . . . INITIATE
BAT (before leaving the aircraft) . . . . OFF/R

LANDING WITH NOSE L/G ABNORMAL

– The procedure is intended for use when one or more landing gear fail to extend or/and lockdown following the application of either normal or gravity gear extension procedure.

It is considered preferable to use all available gear locked down rather than carry out a belly landing. Under these circumstances, a hard surface runway landing is to be recommended.

Full advantage should be taken of foam spread on the runway.

– Notify ATC of the nature of emergency encountered and state intentions.
Specify the available time.

– Notify the cabin crew of the nature of emergency encountered and state intentions and the time available.

– GPWS is selected OFF to avoid nuisance warning.

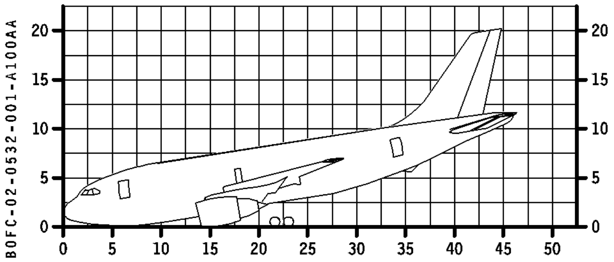
– Burn off fuel down to the minimum possible impact weight. This reduces the V REF and as a consequence the load factor for impact and the energy that must be dissipated.

– Rotating the GRAVITY EXT handcrank back to normal position may result in landing gear door(s) closure, and under certain failure conditions presssurize the landing gear actuators.

– Set the dome light to DIM in a poor external light condition to ensure that there is a light source after both engines are shut down. R R R

TOUCH DOWN TECHNIQUES

– Reference aircraft attitude after impact



– Trim the stabilizer to nose up upon touchdown.

– Use the brakes as compatible with the elevator efficiency.

– Be aware that forward passenger doors evacuation rates are considerably reduced, due to abnormal slide slope.

– Aft passenger/crew doors should preferably not be used for evacuation.

Mod : 4801

LDG WITH ONE MAIN L/G ABNORMAL

PREPARATION

CABIN CREW	NOTIFY
ATC/TRANSPONDER	NOTIFY/AS RQRD
FUEL WEIGHT (if possible)	REDUCE
FUEL IMBALANCE (if possible)	ESTABLISH
– Reduce fuel on side with affected L/G	
SEAT BELTS/NO SMOKING	ON

APPROACH

GRAVITY EXTENSION handcrank	ROTATE BACK TO NORM
L/G LEVER	DOWN
GPWS	OFF
CABIN REPORT	OBTAINED
EMER EXIT LT selector	ON
TRIM TK ISOL VALVE	OFF
GND SPLRS	DO NOT ARM

BEFORE LANDING

PACKS 1 and 2	OFF
RAM AIR	ON
BRACE FOR IMPACT	ORDER

FLARE, TOUCH DOWN AND ROLL OUT

NOTE : Engines should be shut down sufficiently early to ensure fuel is shut off before the nacelles impact, but sufficiently late to ensure adequate supplies for the flight controls.

Engine pumps continue to supply adequate pressure for at least 15 seconds after first engine shutdown.

REVERSE	DO NOT USE
FUEL LEVER (affected side)	OFF
– Shutdown the engine at touchdown before nacelle impact	
AFFECTED 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 to maintain runway center line as long as possible.	

AT NACELLE IMPACT

FIRE HANDLE (affected side)	PULL

WHEN A/C STOPPED

FUEL LEVER (opposite engine)	OFF
FIRE HANDLES (ALL)	PULL
CABIN CREW (PA)	NOTIFY
FUEL ISOL VALVES	OFF
AGENTS (ENG and APU)	DISCH
△P (DIFF PRESS)	CHECK ZERO
EVACUATION	INITIATE
BAT (before leaving the aircraft)	OFF/R

LANDING WITH ONE MAIN L/G ABNORMAL

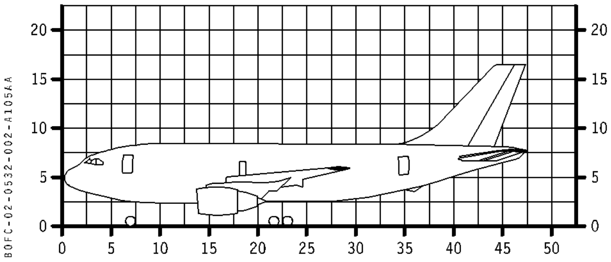
- The procedure is intended for use when one or more landing gear fail to extend or/and lockdown following the application of either normal or gravity gear extension procedure.

  It is considered preferable to use all available gear locked down rather than carry out a belly landing. Under these circumstances, a hard surface runway landing is to be recommended.

  Full advantage should be taken of foam spread on the runway.
- Notify ATC of the nature of emergency encountered and state intentions.
  Specify the available time.
- Notify the cabin crew of the nature of emergency encountered and state intentions and the time available.
- GPWS is selected OFF to avoid nuisance warning.
- Burn off fuel down to the minimum possible impact weight. This reduces the V REF and as a consequence the load factor for impact and the energy that must be dissipated.
- Rotating the GRAVITY EXT handcrank back to normal position may result in landing gear door(s) closure, and under certain failure conditions presssurize the landing gear actuators.

TOUCH DOWN TECHNIQUES

- Reference aircraft attitude after impact



- Use control wheel input as necessary to maintain the unsupported wing up as long as possible.
- Apply rudder and brakes upon nacelle impact for directional control.

LDG WITH BOTH MAIN L/G ABNORMAL

PREPARATION

CABIN CREW	NOTIFY
ATC	NOTIFY
TRANSPONDER	AS RQRD
FUEL WEIGHT (if possible)	REDUCE
SEAT BELTS/NO SMOKING	ON

APPROACH

R GRAVITY EXTENSION handcrank	ROTATE BACK R TO NORM
L/G LEVER	DOWN
GPWS	OFF
CABIN REPORT	OBTAINED
EMER EXIT LT selector	ON
TRIM TK ISOL VALVE	OFF
GND SPLRS	DO NOT ARM

BEFORE LANDING

PACKS 1 and 2	OFF
RAM AIR	ON
BRACE FOR IMPACT	ORDER

R ● **If the external light condition is poor at landing** :

R DOME LIGHT . . . . DIM

FLARE, TOUCH DOWN AND ROLL OUT

NOTE : Engines should be shut down sufficiently early to ensure fuel is shut off before the nacelles impact, but sufficiently late to ensure adequate supplies for the flight controls.

Engine pumps continue to supply adequate pressure for at least 15 seconds after first engine shutdown.

REVERSE	DO NOT USE
BOTH FUEL LEVERS	OFF

– Shutdown the engines before touchdown

PITCH ATTITUDE (at touchdown) . . . . . . NOT LESS THAN 6°

AT NACELLES IMPACT

FIRE HANDLES (ALL) . . . . PULL

WHEN A/C STOPPED

CABIN CREW (PA)	NOTIFY
FUEL ISOL VALVES	OFF
AGENTS (ENG and APU)	DISCH
△P (DIFF PRESS)	CHECK ZERO
EVACUATION	INITIATE
BAT (before leaving the aircraft)	OFF/R

LANDING WITH BOTH MAIN L/G ABNORMAL

– The procedure is intended for use when one or more landing gear fail to extend or/and lockdown following the application of either normal or gravity gear extension procedure.

It is considered preferable to use all available gear locked down rather than carry out a belly landing. Under these circumstances, a hard surface runway landing is to be recommended.

Full advantage should be taken of foam spread on the runway.

– Notify ATC of the nature of emergency encountered and state intentions.
Specify the available time.

– Notify the cabin crew of the nature of emergency encountered and state intentions and the time available.

– GPWS is selected OFF to avoid nuisance warning.

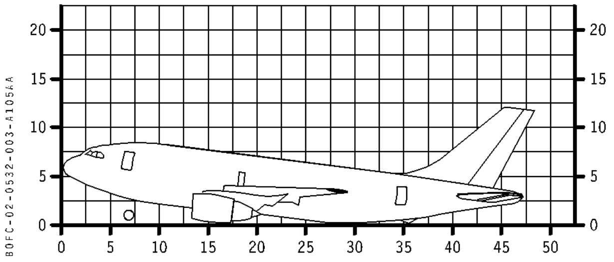
– Burn off fuel down to the minimum possible impact weight. This reduces the V REF and as a consequence the load factor for impact and the energy that must be dissipated.

– Rotating the GRAVITY EXT handcrank back to normal position may result in landing gear door(s) closure, and under certain failure conditions presssurize the landing gear actuators.

– Set the dome light to DIM in a poor external light condition to ensure that there is a light source after both engines are shut down. R R R

TOUCH DOWN TECHNIQUES

– Reference aircraft attitude after impact



– Touch down with approximately 6° of pitch attitude but not beyond to ensure the tail section impacts first.

– Be aware that aft passenger doors evacuation rates are considerably reduced, due to abnormal slide slope.

Mod : 4801

L/G LEVER INTERLOCKED

L/G POS DET SYS . . . . OTHER SYS
- **If second attempt unsuccessful** :
  L/G LEVER . . . . DOWN
  MAX SPD 270
  FUEL CONSUMPTION INCREASED

AUTOBRAKE . . . . DISARM

NOTE : With landing gear down, fuel consumption is multiplied by 2.4.
FMS fuel predictions must be disregarded.
Refer to FCOM 2.18.40 for any additional limitations and in-flight performance determination if no immediate turnback.

L/G DOOR NOT CLOSED

- **If amber light(s) illuminated on both panels** :
  MAX SPD 270
  FUEL CONSUMPTION INCREASED

CAUTION : Do not cycle landing gear.
- **If Go-around required** :
  L/G . . . . KEEP DOWN

NOTE : Fuel consumption increased by 30 %.

L/G GRAVITY EXTENSION

PREPARATION

GRAVITY EXTENSION HANDCRANK . . . . INSERT

EXTENSION

L/G LEVER . . . . CHECK NEUTRAL
GRAVITY EXTENSION HANDCRANK . . . . ROTATE
L/G LEVER . . . . DOWN

CAUTION : Nose wheel steering is inoperative.

GEAR DOWN INDICATIONS . . . . CHECK
- **If landing gear unsafe indication** :
  VISUAL DOWN LOCK INDICATORS . . . . . . CHECK
- ■ **If extension successful** :
  Do not reset the free fall system. This will avoid undesirable effects such as further loss of fluid in the event of a leak or possible landing gear unlocking in the event of a selector valve jammed in the UP position.
  NOTE : During training flights, the Flight Crew may reset the free fall system in flight.
  If the Green hydraulic system is available this will allow the landing gear doors to be closed and the nose wheel steering to operate. However, the Flight Crew must not reset the free fall system on ground after flight.
- ■ **If extension unsuccessful or down-lock position not confirmed** :
  - ■ **If Nose L/G affected** :
    PROC : LDG WITH NOSE L/G ABNORMAL (10.04) . . . . APPLY
  - ■ **If ONE MAIN L/G affected** :
    PROC : LDG WITH ONE MAIN L/G ABNORMAL (10.05) . . . . APPLY
  - ■ **If BOTH MAIN L/G affected** :
    PROC : LDG WITH BOTH MAIN L/G ABNORMAL (10.06) . . . . APPLY

RETURN TO ORIGINATING PROCEDURE, AS REQUIRED

L/G LEVER INTERLOCKED

Indications :

ECAM activation
Left ECAM CRT : Procedure
Right ECAM CRT : Nil

Note : Speed is limited to 270 kt or M 0.65 at or above 25000 ft.

L/G DOOR NOT CLOSED

Indications :
Single chime (nil if one L/G panel correct)
ECAM activation with appropriate warning light
Left ECAM CRT : Procedure
Right ECAM CRT : Nil
L/G panel

Note : Speed is limited to 270 kt or M 0.65 at or above 25000 ft.

L/G GRAVITY EXTENSION

– The landing gear gravity extension handcrank must be rotated clockwise 20 full turns until the mechanical stop is reached. Increasing loads are to be expected beyond 16 turns, then beyond 18 turns.

– When the landing gear is down, the amber door lights remain illuminated due to the doors remaining open.

– Main gear : Positions for checking red pins on upper wing surface are marked by inverted T-symbols on cabin side walls.

Nose gear : The mechanical indicator on the nose gear drag strut is checked from the avionics compartment through viewing windows in the nose landing gear well.

Code : 0275

L/G UNSAFE INDICATION

L/G selected DOWN

■ **Green light(s) extinguished on both panels** :
L/G NOT DOWN LOCKED
PROC : L/G GRAVITY EXTENSION (10.02) . . APPLY

● **If unsuccessful** :
PROC : LDG WITH ABNORMAL L/G (10.04/10.05/10.06) . . . . APPLY

■ **Green light(s) extinguished only on one panel** :
L/G POS DET SYS 1(2) FAULT
L/G POS DET SYS . . . . SYS 2(1)

● **If nose landing gear unsafe indication on overhead panel only :**
GPWS "TOO LOW GEAR" warning . . . . DISREGARD

L/G selected UP

■ **Red light(s) illuminated on both panels** :
L/G NOT UP LOCKED
MAX SPD 270
L/G . . . . DOWN
FUEL CONSUMPTION INCREASED

■ **Red light illuminated on only one panel** :
L/G POS DET SYS 1(2) FAULT
L/G POS DET SYS . . . . SYS 2(1)

NOTE : With landing gear down, fuel consumption is multiplied by 2.4.
FMS fuel predictions must be disregarded.
Refer to FCOM 2.18.40 for any additional limitations and in-flight performance determination if no immediate turnback.

L/G UNSAFE INDICATION

Indications :
Single chime (only if both panel indications are identical)
ECAM activation with appropriate warning light
Left ECAM CRT : Procedure
Right ECAM CRT : Nil
L/G panel(s)

LANDING GEAR SELECTED DOWN :

- If all green lights are illuminated on one panel, the unsafe indication on the other panel is spurious. Therefore, the L/G POSITION DET SYS switch must be set to the correct system.
- If the landing gear is extended at speeds near V LO it may be necessary to decelerate to obtain satisfactory uplock of the landing gear doors.
- If one gear remains unlocked, accelerate to Vmax, perform turns to increase the load factor and perform alternating side slips in an attempt to lock the gear.

  Generate steady state sideslip on one side. If the landing gear still does not lock, return the rudder to neutral and let the aircraft stabilize to equilibrium. R
  Then, repeat the same maneuver on the other side. R

LANDING GEAR SELECTED UP :

- If light(s) illuminated on one indicator panel but indications are normal on the other panel, the unsafe indication is spurious.
- Flight with landing gear extended has a significant effect on fuel consumption and climb gradient (refer to ch. 2.18.40 SPECIAL OPERATIONS).
- Landing gear down selection may be delayed if performance requires.

Note : When red light(s) illuminated on both panels, the speed is limited to 270 kt or M 0.65 at or above 25000 ft.

Code : 0326

BRAKES TEMP HI

- **Before T.O.** :
  - BRK FAN (if installed) . . . . ON
  - DELAY T.O.
- **In flight** :
  - ● **IF PERF PERMITS** :
    - LEAVE L/G DN FOR COOL.
    - BRK FAN (if installed) . . . . ON

BRAKES TEMP HI

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : BRK TEMP HI procedure
Right ECAM CRT : WHEEL page
BRK HOT light

- Delay takeoff until BRK HOT warning extinguishes if brake fans OFF or until brake temperature is below 150°C if brake fans ON. R
- If during taxi, the temperature difference between two brakes on the same gear is greater than 150°C and the temperature of one brake is above 600°C this may indicate a brake binding.

  In this case the aircraft must be stopped to avoid a possible fire and taxi back should not be done as long as the BRK HOT warning is illuminated.
- In all other cases, taxiing can be continued, this will improve the brake cooling and may prevent tyre deflation until the aircraft has stopped.
- It is recommended not to set parking brake handle while the BRK HOT warning is activated.

Note : Delay landing gear retraction after takeoff unless performance requires.

ANTI SKID FAULT

BRK/ANTI SKID . . . . ALTN/ON

- **If warning cleared** :
  - LDG DIST . . . . MULTIPLY BY 1.1
  - AUTO BRAKE INOP
- **If warning remains activated** :
  - RELEASE IND . . . . CHECK
  - MAX BRK PRESS . . . . 1000 PSI
  - LDG DIST . . . . MULTIPLY BY 1.5
  - AUTO BRAKE INOP.

ANTI SKID FAULT

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : ANTI SKID FAULT procedure
Right ECAM CRT : WHEEL page
BRK FAIL light

- If warning remains :
  - . Limit brake pressure to approximately 1000 psi, and at low ground speed adjust brake pressure as required.
  - . Avoid landing on icy runway.
- Landing distance is increased due to reduced braking efficiency.

Code : 0270

EFIS SGU FAULT

- ■ **EFIS SGU 3** :
  EFIS ON SYS 3 . . . . DO NOT USE
- ■ **EFIS SGU 1 or 2 (white diagonal line on affected PFD/ND)** :
  CAPT (F/O) EFIS . . . . SYS 3

LOSS OF PFD DISPLAY

CAUTION **:** ***In case of loss of PFD display, be alert to transition rapidly to stand-by instruments.***

NOTE : In case of excessive pitch or roll rate, both PFD and ND displays are blanked temporarily (white diagonal line on both CRT's).

- ● **If loss of CRT suspected (CRT is blank) or when PFD information required :**
  PFD brightness knob (affected side) . . . . OFF
  - ● **If ND information required**
    PFD/ND XFR (affected side) . . . . ON

NOTE 1 : If affected PFD is on the PF side, consider transferring PF responsibilities to PNF.

NOTE 2 : Pressing the PFD/ND XFR pushbutton a second time will recover ND information on the lower CRT.

LOSS OF ND DISPLAY

CAUTION **:** ***In case of loss of ND display, be alert to transition rapidly to stand-by instruments.***

NOTE : In case of excessive pitch or roll rate, both PFD and ND displays are blanked temporarily (white diagonal line on both CRT's).

- ● **If ND display saturation suspected (diagonal line on ND only)** :
  R ND mode selector . . . . PLAN
  - ● **If unsuccessful** :
    RANGE . . . . REDUCE
- ● **If loss of CRT suspected (CRT is blank) :**
  ND brightness knob (affected side) . . . . OFF
  - ● **If ND information required :**
    PFD/ND XFR (affected side) . . . . ON

NOTE 1 : If affected ND is on the PF side, consider transferring PF responsibilities to PNF.

NOTE 2 : Pressing the PFD/ND XFR pushbutton a second time will recover PFD information on the upper CRT.

EFIS SGU FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : EFIS SGU (3) FAULT proc
Right ECAM CRT : Nil

- If SGU 3 is used to replace SGU 2, the display selected for CAPT PFD (FD or FPV) is displayed on F/O PFD as well. Reselect as desired.
- EFIS SGU 3 FAULT is only displayed by ECAM, when not selected.

LOSS OF PFD

Indications :
PFD display blanking with white diagonal line or complete blanking.

- PFD information is recovered on lower CRT (replacing ND information) by switching the affected PFD OFF using the PFD brightness knob.
- ND information can be recovered on lower CRT by using PFD/ND XFR pusbutton.

LOSS OF ND

Indications :
ND display blanking with white diagonal line or complete blanking.

- ND information can be recovered on upper CRT (replacing PFD information).

STD or Mod : (5846 + 11123)

LOSS OF ECAM DISPLAY

- ● **<u>If white diagonal line on affected ECAM</u>** :
  - Affected SGU . . . . OFF
- ● **<u>If loss of CRT suspected (CRT is blank)</u>** :
  - ECAM brightness knob (affected side) . . . . . . OFF

ADC FAULT

R ■ **<u>If only one ADC FAULT</u>** :

R ADC INST SWITCHING . . . . SYS AVAILABLE

R ATC . . . . SYS AVAILABLE

R ATS . . . . RESET

R ■ **<u>If both ADC FAULT</u>** :

R STBY INST . . . . USE

R MAX SPD 285

MAX FL. 310

ELEV WITH CARE ABV SPD 170.

RUD WITH CARE ABV SPD 170.

PITCH TRIM . . . . MANUAL

AFFECTED EQUIPMENT . . . . OFF

. PITCH FEEL 1 and 2.

. RUD TRAVEL 1 and 2.

R . ATS

TRIM TK AFT XFR NOT AVAIL

● **<u>When Flaps are extended</u>** :

PITCH TRIM . . . . RESET

YAW DAMPER . . . . RESET

AFS DISTRIBUTION - ATS - TRP (11.03) . . . . . REVIEW

<u>LOSS OF ECAM DISPLAY</u>

Indications :

ECAM display blanking with white diagonal line or complete blanking.

– If SGU is affected, the remaining SGU supplies both CRTs.

– If loss of CRT is suspected, affected CRT must be switched off. The remaining CRT provides all normal functions.

<u>ADC FAULT</u>

<u>Indications :</u>

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : ADC 1 (2) FAULT procedure

Right ECAM CRT : Nil

Fail flags on Capt or F/O instruments

PITCH TRIM and YAW DAMPER 1 (2) levers tripped if flaps retracted

SINGLE ADC FAULT R

– The AP and FD on the side of the affected ADC is lost, except after GS capture (GS green or LAND green annunciated on FMA).

Select other AP if required.

To recover the FD, select the system available using the FD switching pushbutton switch.

– ATC switching is not necessary if the aircraft is equipped with an ATC mode S.

– The respective AUTO PILOT, PITCH TRIM, and YAW DAMPER will be inoperative.

DUAL ADC FAULT R

– In case of double ADC failure, the Mach indication is lost, each AUTO PILOT, each PITCH TRIM, each YAW DAMPER and ATS are inoperative.

Due to PITCH FEEL and PITCH TRIM FAULT, the speed is limited to 285/.78.

Since the Mach indication is lost, the FL has to be limited to 310, where 285 kt does not exceed M.78.

Perform descent with care.
(FL 400 – max 235 kt, FL 350 – max 265 kt).

Each YAW DAMPER and each PITCH TRIM may be reset when FLAPS are extended 15° or more.

Each AP can be re-engaged if the double failure occurs when already established on the glide slope (GS green for more than 10 sec and FD bars on).

Mod : 4801

IRS FAULT

- ■ **IRS 1 or 2** :

  CAPT (F/O) ATT/HDG . . . . SYS 3

- ■ **IRS 3** :

  ATT/HDG ON SYS 3 . . . . DO NOT USE

AFS DISTRIBUTION - ATS -TRP (11.03) . . . . . REVIEW

R ■ **If affected IRS ATT mode recovery is attempted** :

R *NOTE : Affected IRS may be available in ATT mode. The following procedure is not mandatory when only one IRS is affected. It has to be applied if a second IRS fails or at pilot's discretion.*

R IRS MODE (affected MSU) . . . . ATT

R ISDU SYS selector . . . . AFFECTED SYS

R ISDU DSPL selector . . . . HDG STS

R INDICATED HEADINGS ON ISDU and ND . . . CHECK

R ● **If heading indications disagree (more than 3 deg difference) and with wings level for 30 sec minimum :**

R Heading (4 digits) from the other IRS in NAV mode or from the stby compass . . . . ENTER

R ENT KEY . . . . PRESS

R *NOTE 1 : When HDG from another IRS in NAV mode is used, be sure to change it to magnetic HDG.*

R *NOTE 2 : Repeat HDG entry every 15 minutes or after a turn. Keep HDG accuracy between ± 3 deg.*

R ■ **If affected IRS ATT mode recovery is not attempted or if ATT mode selection unsuccessful** :

R IRS (affected) . . . . OFF

IRS FAULT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : IRS FAULT proc

Right ECAM CRT : Nil

IRS WARN on OVHD panel

– The respective AP, YAW DAMPER and ATS are inoperative.

MPS 5063 or Mod : 6523

AUTO FLIGHT SYSTEM – DISTRIBUTION

INOPERATIVE SYSTEM	FUNCTION LOST									
	FCC 1		FCC 2		FAC 1			FAC 2		
	AP 1	FD 1	AP 2	FD 2	YAW DAMP 1	PITCH TRIM 1	α FLOOR 1***	YAW DAMP 2	PITCH TRIM 2	α FLOOR 2***
HYD BLUE					INOP					
HYD GREEN	INOP									
HYD YELLOW			INOP					INOP		
IRS 1	INOP	INOP			INOP	INOP ****	INOP			
IRS 2			INOP	INOP				INOP	INOP ****	INOP
IRS 1 + 2	INOP	INOP	INOP	INOP	INOP	INOP	INOP	INOP	INOP	INOP
ADC 1	INOP **	INOP **			INOP if flaps <15°	INOP if slats retracted	INOP if slats extended			
ADC 2			INOP **	INOP **				INOP if flaps <15°	INOP if slats retracted	INOP if slats extended
* PITCH TRIM 1 + 2	INOP		INOP							
* YAW DAMPER 1 + 2	INOP		INOP							
* FAC 1 + 2	INOP	INOP	INOP	INOP						
FCU	INOP	INOP	INOP	INOP						

* No effect with single equipment failure.

** Except when GS green or LAND green is annunciated on the FMA.

*** α floor protection is lost when α floor 1 and α floor 2 are lost.

R **** Except if : – onside AP is in CMD, or
R – Slats are extended, or
R – Speedbrakes are extended.

INOPERATIVE SYSTEM	EFFECT ON TCC	
	ATS – A/THR	TRP
* ADC 1 + 2	Both ATS disarm – ATS rearming is not possible.	Inoperative
IRS 1 (or 2)	ATS 1 (or 2) disarms if SPD/MACH mode is engaged. Rearming is not possible	
* FAC 1 + 2	Both ATS disarm – ATS rearming is not possible	
ENG EPR MODE 1 (or 2) FAULT	ATS 1 and 2 are lost	
FCU	Both ATS disarm. ATS rearming is possible A/THR re-engagement is not possible THR L mode is available (by go-levers activation, in clean configuration).	
AP/FD 1 + 2	If A/THR is engaged, the active mode remains engaged. If A/THR is not engaged, A/THR engagement is possible but only in SPD/MACH mode.	

* No effect with single equipment failure.

Mod : MP S5063 or 6523

PW Eng. : 4000

FMC INDEPENDENT OPERATION

■ **<u>A/C STATUS MISMATCH (NAV data base difference)</u> :**

ON BOTH NDs . . . . SET IDENTICAL RANGE

ON BOTH CDUs . . . . ENTER SAME INPUTS

■ **<u>FMC POSITION MISMATCH (aircraft position difference):</u>**

FMC POSITION VERSUS RAW DATA .. CROSS-CHECK

AIRCRAFT POSITION OF THE INCORRECT FMC . UPDATE

FMC OPPOSITE TO ENGAGED AP . PULL/AFTER 10 SEC,
(C/B : FMC 1/J11, FMC 2/J14) PUSH

■ **<u>Resynchronization unsuccessful</u> :**

FMC OPPOSITE TO ENGAGED AP . PULL/AFTER 10 SEC,
(C/B : FMC 1/J11, FMC 2/J14) PUSH

● **<u>After 2 min following FMC reset by C/B</u> :**

■ **<u>If INDEPENDENT OPERATION still present</u> :**

ON BOTH NDs . . . . SET IDENTICAL RANGE

ON BOTH CDUs . . . . ENTER SAME INPUTS

■ **<u>If INDEPENDENT OPERATION has disappeared</u> :**

NORMAL DUAL FMC OPERATION . CHECK RECOVERED

<u>FMC INDEPENDENT OPERATION</u>

Indications : Refer to 2.02.28. R

LOSS OF ONE FMS

A/THR . . . . CHECK ENGAGED

PROFILE MODE . . . . . . DISENGAGE and RE-ENGAGE

AP OPPOSITE TO THE FAILED FMC . . . . ENGAGE

NAV MODE . . . . CHECK ENGAGED

NAVIGATION WITH ONE FMC . . CAREFULLY MONITOR

● **<u>If FMS navigation is not accurate</u> :**

LOSS OF BOTH FMS PROCEDURE (below) . . APPLY

<u>LOSS OF ONE FMS</u>

Indications : Refer to 2.02.28. R

LOSS OF BOTH FMS

AP . . . . CHECK ENGAGED

APPROPRIATE VERTICAL MODE . . . . ENGAGE

HDG SEL MODE . . . . ENGAGE

A/THR . . . . CHECK ENGAGED

ND MODE . . . . SET ARC OR ROSE

■ **<u>If aircraft is inside a NAVAID coverage area</u> :**

APPROPRIATE RADIO NAVAID . . . . TUNE

NAVAID RAW DATA . . . . USE

■ **<u>If aircraft is outside a NAVAID coverage area</u> :**

VOR-NAV-ILS switches . . . . SELECT VOR

FPV (on PF side) . . . . SELECT

FPA (in cruise) . . . . SET 0

VOR COURSE . . . . SET PRESENT ROUTE

TO MAINTAIN ”BIRD” IN THE ”CAGE”
(FPV/FPR) . . . . ADJUST HEADING

AIRCRAFT PRESENT POSITION . . CHECK USING ISDU

<u>LOSS OF BOTH FMS</u>

Indications : Refer to 2.02.28. R

LEFT BLANK INTENTIONALLY

STD or Mod : 11319 or 11702 or (11319 + 11702)

TCAS WARNINGS

■ **Traffic advisory – "TRAFFIC" messages** :

- Do not maneuver based on a TA alone.
- Attempt to see the reported traffic.

R ■ **Resolution Advisory – All "CLIMB" and "DESCEND" or**
R **"MAINTAIN VERTICAL SPEED" or "ADJUST VERTICAL**
R **SPEED" or "MONITOR VERTICAL SPEED" messages** :

R – AP (if engaged) . . . . DISCONNECT
R – A/THR (if engaged) . . . . DISCONNECT
R – Respond promptly and smoothly to an RA by adjusting
R or maintaining the thrust manually and the vertical
R speed, as required, to reach the green arc and/or avoid
R the red arc of the vertical speed scale.

R *NOTE : – The TCAS orders may require an incremental*
R *load factor that is greater than that achieved*
R *by the autopilot.*
R *– Avoid excessive maneuvers but, if necessary*
R *use the full speed range between Vss and*
R *Vmax.*

R – Respect stall, GPWS or windshear warning.

R – Notify ATC.

R – When "CLEAR OF CONFLICT" is announced :

R . Resume normal navigation in accordance with ATC
R clearance,

R . AP and A/THR can be reengaged as desired

● **If a RA "CLIMB" or "INCREASE CLIMB" warning is activated on final approach (after the FAF or under 1000 ft AGL), GO AROUND must be performed.**

Code : 0047

RADIO ALTIMETER(S) FAULT

	INOPERATIVE SYSTEM	FUNCTION LOST			
		SYSTEMS			LANDING CAPABILITY
R	**RA 1 FAULT**	AP 1* FD 1	GPWS		CAT 2 ONLY
R	**RA 2 FAULT**	AP 2* FD 2			CAT 2 ONLY
R	**RA 1+2 FAULT**	Both AP/FD*	GPWS	TCAS	CAT 1 ONLY

R * If in LAND mode only

RADIO ALTIMETER(S) FAULT

	INOPERATIVE SYSTEM ▼	SYSTEMS LOST				LANDING CAPABILITY
R	**RA 1 FAULT**	AP 1* FD 1	GPWS			CAT 2
R	**RA 2 FAULT**	AP 2* FD 2				CAT 2
R	**RA 1+2 FAULT**	Both AP/FD*	GPWS	TCAS	α-floor protection	CAT 1

R * If in LAND mode only

RADIO ALTIMETER(S) FAULT

INOPERATIVE SYSTEM	SYSTEMS LOST				LANDING CAPABILITY
RA 1 FAULT	AP 1* FD 1	GPWS			CAT 2
RA 2 FAULT	AP 2* FD 2				CAT 2
RA 1+2 FAULT	Both AP/FD*	GPWS	TCAS	α-floor protection	CAT 1

* If in LAND mode only

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APU AUTOMATIC SHUT DOWN

MASTER SWITCH . . . . OFF
APU INOP
R APU FUEL PUMP . . . . AUTO

APU AUTOMATIC SHUT DOWN

Indications :

Single chime
ECAM activation with appropriate warning light R
Left ECAM CRT : APU AUTO SHUT DOWN procedure R
Right ECAM CRT : APU page
FAULT light on APU panel

The APU automatically shuts down in case of :

- Overspeed,
- Abnormal EGT indication,
- Failure of the electronic control system,
- Air flow reversal,
- Incorrect automatic starting cycle,
- Abnormal oil pressure or temperature, R
- Oil filter clogging, R
- Overcurrent,
- Loss of DC ESS BUS,
- Loss of both EGT or SPEED sensors.

APU FUEL LO PR

APU FUEL PUMP . . . . OVRD
FUEL SUPPLY . . . . CHECK
R FUEL TK PUMPS (supplying tank) . . . . . . ON/NORM

APU FUEL LO PR

Indications :

Single Chime
ECAM activation with appropriate warning light
Left ECAM CRT : APU FUEL LO PR procedure R
Right ECAM CRT : APU page R
FUEL PUMP LO PR light on APU panel

APU FLAP FAULT

MASTER SWITCH . . . . OFF

APU FLAP FAULT

Indications :

Single Chime
ECAM activation with appropriate warning light R
Left ECAM CRT : APU FLAP FAULT procedure R
Right ECAM CRT : APU page
FAULT light on APU panel

LEFT BLANK INTENTIONALLY

SINGLE ENG OPERATION

LAND ASAP

● **If reverser UNLK :**
- MAX SPD 240

● **If WING ANTI ICE ON :**
- AIR X-FEED . . . . MAN/IN LINE
- PACK (1 or 2) . . . . OFF

● **If HYD PUMP LO PR :**
- ENG PUMPS (affected) . . . . OFF
- PITCH FEEL and SPLR (affected) . . . . OFF

GEN (affected) . . . . OFF
PACK (affected) . . . . OFF

AFT CG WARNING INOP

● **If SPLR not recovered** :
- LDG DIST . . . . MULTIPLY BY 1.3

BLEED VALVE (affected engine) . . . . OFF

● **If ENG FIRE handle not pulled and WING ANTI ICE off** :
- AIR X-FEED . . . . MAN/IN LINE
- PACK (affected) . . . . AUTO

IGNITION . . . . CONT RELIGHT
FUEL X-FEED (if fuel leak is not suspected) . . . IN LINE

CAUTION *: If a fuel leak from wing or not located is suspected, keep and check Fuel X-FEED cross-line.*

APU . . . . START

■ **If ENG 1 FIRE handle pulled** :
- APU BLEED . . . . Check OFF/R

■ **If ENG 1 FIRE handle not pulled, below FL 200** :
- APU BLEED . . . . ON
  - ● **In case of perceptible oil smell or smoke** :
    - APU BLEED . . . . OFF

TCAS (if installed) . . . . TA

FOR APPROACH

HYD PWR ELEC PUMPS . . . . ON
PTU (affected side, unless hydraulic fluid loss is suspected) . . . . ON
HYD PWR ENG PUMPS (affected side) . . . . OFF

PITCH FEEL and SPLR (if selected OFF) . . . . RESTORE
YAW DAMPER (if tripped OFF) . . . . RESET
APPROACH/CLIMB LIMITATION . . . . CHECK
R PROC : OVERWEIGHT LANDING (13.13) . . REVIEW AS RQRD

● **If reverser UNLK** :
- LANDING SPEED . . . . V_{LS} or (V_{REF} + 10 KT)
  - ■ **If SPLR recovered** :
    - LDG DIST . . . . MULTIPLY BY 1.1
  - ■ **If SPLR not recovered** :
    - LDG DIST . . . . MULTIPLY BY 1.4

SINGLE ENGINE OPERATION

Indications :

When FUEL LEVER is selected to OFF :
- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : ENG SHUT DOWN procedure
- Right ECAM CRT : ENG page.

- One PACK must be closed when using WING ANTI ICE to prevent loss of engine bleed due to precooler overheat.
- Before recovery of the affected PACK, the affected BLEED VALVE must be selected OFF in order to increase the precooler overheat threshold of the remaining bleed system.
- Fuel management may be required to keep fuel in balance. Use FUEL X-FEED IN FLIGHT procedure.
- Windmilling time without positive oil pressure should be recorded for maintenance purposes.
- APU (if available) should be started to replace inoperative generator. Best starting capability is ensured up to 37 000 ft.
- As N1 parameter is used in the computation of aft CG warning, this warning is inhibited in case of engine failure.
- If ENG 1 FIRE handle is pulled, to avoid possible contamination from related engine bleed, APU bleed air must bot be used and the AIR BLEED X-FEED valve must be closed.
  The AIR BLEED X-FEED valve is to be opened (with possible use of APU bleed) only if wing anti-ice is required because asymmetrical wing anti-ice must be avoided.
- If installed, TCAS must be set to TA as the aircraft performance does not enable to execute the TCAS RA orders in terms of V/S command.
- **For approach and landing** :
  a) Refer Flight Patterns section of FCOM.
  b) The flap configuration to be used is dependent upon the single engine approach climb gradient requirements.
  c) It is recommended that the operative engine air bleed be closed during final approach, to provide an increase in approach climb gradient. Use APU bleed air (if available).
  d) Affected hydraulic equipment may be recovered for approach and landing by selecting ELEC PUMPS and the affected side PTU to ON.
- When using the PTU, the slats, flaps and L/G must be extended in sequence in order to reduce loads on systems.
  - Blue system pressurized by PTU : sequence SLATS and L/G.
  - Yellow system pressurized by PTU : sequence FLAPS and L/G.
- If engine shutdown was caused by REV UNLK, the landing distance is increased due to the V_{REF} increment of 10 kt, which is taken into account by the PFD.

Mod : 4801 + 5336 + 5917 + 5918 PW Eng. : All

ENG FAIL

IGNITION . . . . CONT RELIGHT
THROTTLE (affected engine) . . . . IDLE

● **If no immediate relight :**
  FUEL LEVER (affected engine) . . . . OFF

  ■ **IF DAMAGE** :
    FIRE HANDLE . . . . PULL
    1ST AGENT (after 10 sec., if in flight) . . . . DISCH
R   PROC : SINGLE ENG OPERATION (12.08) . . APPLY

  ■ **If no damage** :
R   PROC : ENG RESTART IN FLIGHT (12.07) . . APPLY

ENGINE FAIL

Indications :

An engine flame-out may be recognized by :

- Rapid decrease in EGT, N2, FF and EPR

Engine damage may be accompanied by :

- Loud noise
- Significant increase in A/C vibrations and/or buffeting
- Repeated or uncontrollable engine stalls,
- Associated abnormal indications such as hydraulic fluid loss, no N2 indication.

When engine failure is detected by the FADEC :

- Single chime
- ECAM activation with appropriate warning light.
- Left ECAM CRT : ENG FAIL procedure.
- Right ECAM CRT : ENG page.

- The selection of CONT RELIGHT during rundown ensures an immediate restart attempt, and protects the non-affected engine.
- If no immediate relight or in case of a sub-idle hung condition (N2 below 55 %) shutdown the engine.
- The causes of engine flameout can generally be divided into two categories :
  - External causes such as icing, very severe turbulence, heavy rain/hail/sleet, fuel mismanagement, etc. These causes, which may affect both engines, can generally be easilydetermined and an immediate restart can be attempted.
  - Internal causes, such as engine stalls or failures, usually affect a single engine and are not so easily determined. In these cases the engine is shut down, then the cause of the flameout or sub-idle is investigated. If it cannot be positively determined what caused the flameout or sub-idle, the need for engine restart should be evaluated against the risk of further engine damage or fire, that may result from a restart attempt.
- If flame-out was due to an external cause (e.g. massive rain ingestion) or in case of sub-idle and if no damage is suspected, a normal windmilling or starter assisted relight should be considered, using the ENG RESTART IN FLIHT procedure.
- If damage is suspected the ENG FAIL procedure should be applied, even if ENG FAIL indications are not presented on ECAM. In this case the paper C/L must be used.

  As precautionary measure the FIRE handle is pulled and the extinguishing AGENT is discharged.

ENG RESTART IN FLIGHT

***CAUTION* : Do not attempt to restart an engine following an in-flight engine fire or a repetitive engine stall, or if damage is suspected.**

FUEL SUPPLY . . . . CHECK
THROTTLE . . . . IDLE
IGNITION . . . . CONT RELIGHT

■ **Above 230 Kt, below FL 300 (Windmilling Restart) :**

FUEL LEVER . . . . ON

■ **Below 230 Kt, below FL 200 (Starter Assisted Restart) :**

BLEED AIR (from ENG
or below FL 200 from APU) . . . . ESTABLISH
START PUSHBUTTON SWITCH . . . . PRESS (OPEN)
FUEL LEVER (above 15 % N2) . . . . ON

RELIGHT (within 30 seconds) . . . . MONITOR

NOTE : The engine acceleration may be very slow or the ENG FAIL ECAM warning may be activated, this should not be misinterpreted as a failure to restart. If EGT is within limit and N1/N2 are increasing, continue the start attempt.

NOTE : If EGT exceeds the ground start EGT limit, maximum EGT and duration must be recorded for maintenance action.

ENGINE RESPONSE . . . . CHECK

■ **If restart unsuccessful**

FUEL LEVER . . . . OFF

● **After any Starter Assisted Restart attempt** :

START PUSHBUTTON SWITCH . . . . . . RELEASE
START OPEN LIGHT . . . . CHECK EXTINGUISHED
PACK VALVES . . . . CHECK OPENED

R SECOND RESTART ATTEMPT . CONSIDER after 30 sec

■ **If restart successful** :

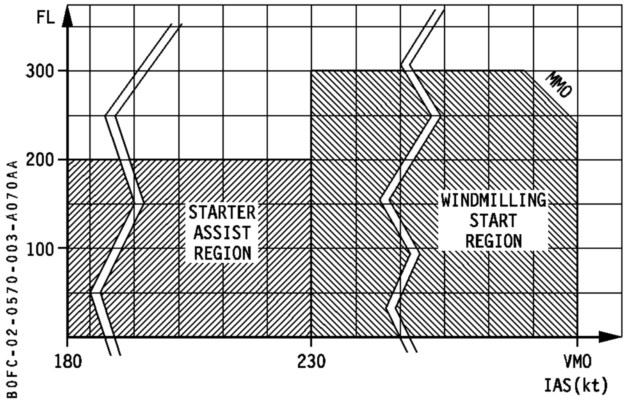
IGNITION . . . . AS RQRD
AFFECTED SYSTEMS . . . . RESTORE

IDLE (conditions permitting) . . MAINTAIN 2 MINUTES

ENGINE RESTART IN FLIGHT

– An airstart may be attempted above FL 300, however a successful engine restart is guaranteed (in the absence of system malfunction or engine damage) only when at FL 300 or below.

– Engine relighting in flight is only guaranteed when within this envelope :



– Monitor especially N2 and EGT to confirm successful relight within the time limit.

EGT may be extremely low during and after restart (≃ 150°C only). It will become normal after acceleration out of idle.

– Differentiation of successful start from hung start is best achieved by observation of :

- Stabilized idle N2 level,
- Response to throttle movement.

– If the initial windmilling start is not successful either repeat the windmilling start or continue with the starter assisted procedure.

– If restart is unsuccessful after a **Starter Assisted** attempt, allow pack valves re-opening (START pushbutton switch released-out), for maintaining aircraft pressurization, before proceeding with a new restart attempt.

– Bleed air is established from either :

- Opposite engine BLEED by selecting the AIR X FEED to MAN/OPEN and closing the ENG BLEED VALVE of the receiving engine

or

- APU, when below FL 200, by selecting the APU BLEED, switch to ON.

– If a second restart attempt is considered, fuel lever R
must be left OFF for 30 seconds before new restart R
attempt to allow ventilation of combustion chamber. R

PW Eng. : 4000

ENGINE STALL

■ **On ground :**

FUEL LEVER . . . . OFF

● **If an EGT limit exceedance is encountered** :

ENG START selector . . . . CRANK
Continue motoring the engine for 30 sec. to cool.

■ **In flight :**

THROTTLE . . . . IDLE
IGNITION . . . . CONT RELIGHT
ENG PARAMETERS . . . . CHECK

■ **If EGT approaching red line and increasing :**

FUEL LEVER . . . . OFF

● **If engine damage suspected :**

FIRE HANDLE . . . . PULL
1ST AGENT (after 10 sec, in flight) . . . . DISCH

R PROC : SINGLE ENG OPERATION (12.08) . . APPLY

■ **If EGT increasing but not approaching red line :**

ENG ANTI ICE (affected engine) . . . . ON
WING ANTI ICE SUPPLY . . . . ON
ENGINE PARAMETERS . . . . CHECK

● **If/when EGT stabilized or decreasing :**

THROTTLE . . . . SLOWLY ADVANCE
ENGINE RESPONSE . . . . CHECK NORMAL
ENGINE PARAMETERS . . . . CHECK

● **If stall recurs or parameters abnormal :**

THROTTLE . . . . RETARD

Operate the engine at reduced thrust below the stall threshold or at idle, at pilot's discretion.

● **If stall does not recur :**

Continue normal engine operation

ENGINE STALL

Indications :

- Varying degree of abnormal engine noise (loud bang, rumbling noise)
- Rapid EGT rise,
- Rapid N2 decrease,
- Slow or no throttle response,
- Vibrations.

- An EGT limit exceedance may encounter on ground, e.g. when applying reverse thrust.
- Selecting the ENG and WING ANTI ICE will increase the engine stall margin and enhance the stall recovery.
- High N1 fluctuations or the loss of N1 indication may be an indication of excessive fan tip rub and fan instability.
- In case of a non-recoverable surge and / or a sub-idle hung condition (N2 below 55 %) shutdown the engine. A restart attempt may be considered provided sufficient evidence exists that no engine damage has been incurred.
- The FADEC surge protection system, may detect and recover from multiple surges without pilot action.

  To enhance the engine stability the 2.5 bleed (low pressure compressor airflow control bleed) is opened and will remain open until the throttle is reduced to idle and then thrust is reset.

  The 2.5 bleed opening is characterised by approximately 30° C EGT rise.

CAUTION

The continued operation of an engine after a stall must be considered with extreme caution and close monitoring.

- If possible, the following engine and flight parameters (at the time of the stall) should be recorded for engineering analysis and maintenance purposes :
  - · FL, TAT, MN/IAS, weather conditions,
  - · EPR, EGT peak.

PW Eng. : 4000

ENG OVER LIMIT

THROTTLE . . . . BELOW LIMIT

■ **If engine within limits** :

- Normal engine operation may be resumed to next landing.
- Record level and duration of exceedance.

■ **If unable to maintain engine within limits** :

- **If conditions permit** :

  THROTTLE . . . . IDLE
  FUEL LEVER . . . . OFF
  R PROC SINGLE ENG OPERATION (12.08) . . APPLY

ENG OVER LIMIT

Indications :

- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : OVER LIMIT procedure
- Right ECAM CRT : ENG page.

CAUTION
Operating limits must not be deliberately exceeded.

Note : *These warnings are triggered by the N1, N2 or EGT indicators.*

- Before retarding the throttle lever, read and note the maximum N1/N2/EGT indication.
- Over limit conditions and primary engine parameters must be recorded for maintenance purposes.
- If conditions do not permit engine shutdown, land as soon as possible using the minimum thrust required to sustain safe flight.

Note : *If an EGT-Limit exceedance is encountered on ground, e.g. when applying reverse thrust, shut down the engine and motor the engine for 30 seconds.*

ENG OVERSPEED DETECTED

THROTTLE . . . . IDLE

- **If fuel flow valve controlled to min flow** :

  ENG THROTTLE INOP
  ENG BELOW IDLE ONLY

ENG OVERSPEED DETECTED

Indications :

- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : ENG OVERSPEED DETECTED procedure
- Right ECAM CRT : ENG page.

- If 117.0 % N1 or 110.3 % N2 is exceeded, the FADEC automatically drives the fuel flow valve of the affected engine to the minimum flow value (which corresponds to a thrust below idle).
- Over limit conditions and primary engine parameters must be recorded for maintenance purposes.
- If the engine primary parameters do not indicate that an overspeed has occurred, an engine restart may be attempted. The fuel lever must be selected OFF to reset the FADEC before performing the ENGINE RESTART procedure.

PW Eng. : 4000

ENG REV UNLK

THROTTLE (affected engine) . . . . IDLE
MAX SPEED 300

- **IF BUFFET OR BANK :**

  THROTTLE (affected engine) . . . . IDLE
  FUEL LEVER . . . . OFF
  MAX SPEED 240
  R PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

ENG AT IDLE
Displayed only if engine is automatically set at idle by FADEC.

- **If no buffet or bank** :

  THROTTLE (affected engine) . . . . . . KEEP AT IDLE
  DIVERSION . . . . CONSIDER

THROTTLE FAULT

IN FLIGHT

- **IF EXCESS POWER** :

  FUEL LEVER . . . . OFF
  R PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

ENG THROTTLE INOP
ENG IDLE ONLY AFTER RESTART

ON GROUND

ENG AT IDLE
ENG THROTTLE INOP
ENG AT IDLE ONLY

THROTTLE LEVER JAM

A/THR . . . . DISCONNECT

- **If aircraft handling affected :**

  FUEL LEVER . . . . OFF
  R PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

  - **If throttle becomes free :**

    R PROC : ENGINE RESTART IN FLIGHT (12.07) . . APPLY

- **For Descent/Approach** :

  - **If engine control not recovered and thrust above idle** :

    FUEL LEVER (affected engine) . . . . OFF
    R PROC : SINGLE ENG OPERATION (12.08) . . APPLY

    - **If throttle lever above idle position :**

      GROUND SPOILERS . . . . DO NOT ARM
      SPEED BRAKES . . . . . . EXTEND MANUALLY
      LDG DIST . . . . MULTIPLY BY 1.3
      AUTOBRAKE is inoperative.

ENG REV UNLK

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : REVERSE UNLK procedure
Right ECAM CRT : ENG page
REV UNLK light

- The activation of the REV UNLK local warning light and ENG REVERSE UNLK ECAM procedure alone, without abnormal aircraft behaviour, may be the result of :
  - either, a partial system malfunction (e.g. undue system pressurization),
  - or, a spurious warning activation.
- In readiness for a possible subsequent inadvertent in-flight deployment, retard the affected engine to idle and consider continued flight to destination or diversion, as appropriate, at LRC or 300 Kts IAS (whichever is the lower) – or at Green Dot speed in case of obstacle clearance strategy – so as to minimize buffeting and rolling, in the event of a thrust reverser deployment.

Note : *When the warning is triggered, the C/Bs REVERSE WARN and REVERSE CTL of the affected ENG 1(2) must not be pulled.*

THROTTLE FAULT

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : THROTTLE FAULT procedure
Right ECAM CRT : ENG page
A/THR disconnection

- The THROTTLE FAULT procedure is activated by the FADEC in the following cases :
  - In flight, in case of the loss of both throttle lever resolver signals. In this case the FADEC controls the engine thrust using the last valid throttle lever position.
  - On ground, in case of the loss of both throttle lever resolver signals or in case of disagreement between these two signals. In both cases the engine thrust is limited to idle.
- In flight, if excess power cannot be balanced by retarding the other engine, the affected engine should be shutdown and restarted. The FADEC will then control the engine at idle thrust, thus restoring electrical, hydraulic and bleed air services.
- In all cases of THROTTLE FAULT, the A/THR will disconnect and cannot be re-engaged.

THROTTLE LEVER JAM

Indications
Throttle lever positions asymmetry in excess of the normal throttle stagger.

- If undetected, throttle lever jam may result in significant thrust asymmetry and possible flight path deviation.
- In case of throttle lever jamming during thrust reduction, the A/THR may command retard action on the non-affected throttle lever down to the idle position.

PW Eng. : 4000

ENG OIL FILTER CLOG

THROTTLE . . . . BELOW WARN

■ **IF WARN AT IDLE AFTER 3 MN :**

FUEL LEVER . . . . OFF

R PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

ENG OIL FILTER CLOG

Indications :

Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : ENG OIL FILTER CLOG PROC
Right ECAM CRT : ENG page
OIL CLOG light

- During ground start and at ground idle, the activation of ENG OIL CLOG warning with OIL TEMP below 35° C can be disregarded if the OIL PRESS is normal and if the warning extinguishes as the oil temperature increases.
- If conditions do not permit engine shutdown, land as soon as possible using the minimum thrust required to sustain safe flight.

ENG OIL TEMP HI

■ **If OIL TEMP between 163 and 177° C for more than 20 minutes**

or

If OIL TEMP above 177° C :

THROTTLE . . . . IDLE

FUEL LEVER . . . . OFF

R PROC : SINGLE ENG OPERATION (12.08) . . . APPLY

■ **If OIL TEMP between 163 and 177° C**

OIL PRESS and QTY . . . . MONITOR

ENGINE PARAMETERS . . . . MONITOR

ENG OIL TEMP HI

Indications :

Right ECAM CRT : ENG page,

- from 163° C to 177° C : OIL TEMP flashing green,
- above 177° C : OIL TEMP steady amber

In addition to the previous indications, if OIL TEMP between 163° C and 177° C for more than 20 min or OIL TEMP above 177° C :

- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : ENG OIL TEMP HI PROC.

PW Eng. : 4000

ENG EPR MODE FAULT

THROTTLE (affected engine) . . . . REDUCE

ENG MODE (affected engine) . . . RESET (N1 then EPR)

- **IF UNSUCCESSFUL :**

  THROTTLE (non affected engine) . . . . . . REDUCE

  ENG 1 MODE N1

  ENG 2 MODE N1

  PROC : ENG ALTN MODE (below) . . . . APPLY

ENG EPR MODE FAULT

Indications :

- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : ENG EPR MODE FAULT procedure
- Right ECAM CRT : ENG page
- EPR MODE FAULT light

- In case of EPR MODE fault, the FADEC of the affected engine automatically reverts to the N1 mode.
- If the reset is unsuccessful, both engines should be controlled in N1 mode.

CAUTION

Before selection of N1 mode, throttles should be reduced to 1.1 EPR (or 70 % N1) in order to prevent an overspeed.

ENG ALTN MODE

N1 MANUAL THRUST SETTING . . . . AS REQUIRED

R N1 THRUST SETTING TABLES (14.07 to 14.10) . . APPLY

ENG ALTN MODE

Indications :

- N1 light illuminated on both ENG MODE pushbutton

- Autothrottle is lost.
- Set engine power manually, using cruise N1 thrust setting tables provided in FCOM THRUST SETTING chapter - ALTN MODE or in QRH chapter 14. R

FADEC OVHT

ENG PARAMETERS . . . . MONITOR

FADEC OVHT

Indications :

- Single chime
- ECAM activation with appropriate warning light
- Left ECAM CRT : FADEC OVHT procedure
- Right ECAM CRT : ENG page.

- Monitor engine parameters as an abnormal engine behaviour may occur following a FADEC OVHT.

PW Eng. : 4000

ENG OIL TEMP LO

THROTTLE . . . . IDLE
WARM UP BEFORE T.O.

ENG OIL TEMP LO

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : ENG OIL TEMP LO procedure
Right ECAM CRT : ENG page

– The ENG OIL TEMP LO warning is activated at T.O power application or by pressing the T.O CONFIG TEST pushbutton if the oil temperature is below 50° C. In this condition it is necessary to warm up the engine until the oil temperature reaches at least 50° C.

– Oil temperature above 50° C will prevent fuel icing under take off conditions.

ENG FUEL FILTER CLOG

ENG PARAMETERS . . . . MONITOR

ENG FUEL FILTER CLOG

Indications :
Single chime
ECAM activation with appropriate warning light
Left ECAM CRT : ENG FUEL FILTER CLOG procedure
Right ECAM CRT : ENG page
FUEL CLOG light

ENG START (VALVE) OPEN (IN FLIGHT)

AVOID ICING CONDITIONS
BLEED VALVE (affected side) . . . . OFF/R

● **If left side affected** :
APU BLEED . . . . OFF/R

PACK VALVE (affected side) . . . . OFF

■ **If WING ANTI-ICE off :**
R AIR X-FEED . . . . CHECK CROSS-LINE

■ **If WING ANTI ICE ON** :
AIR X-FEED . . . . MAN/IN-LINE

ENG START (VALVE) OPEN (IN FLIGHT)

Indication
START 1 or 2 OPEN light on ENG START panel

– This procedure applies only if wing anti-ice is not required.

– In case of engine start valve opening in flight, all bleed air sources should be removed from the starter.

– If wing anti-ice is required, starter may be damaged.

PW Eng. : 4000

ENGINE FAILURE ON TAKEOFF

Indications :

Engine fire or severe damage

Loss of thrust

Aborted takeoff. Engine failure before V1

- If an engine failure occurs before reaching V1, the takeoff should be aborted.
- Immediately when the engine failure is recognized, simultaneously select the throttles to idle and monitor autobrake system or apply full pedals braking.

Note : *1 If the takeoff is rejected above 100 kt it is recommended that maximum reverse thrust is selected on both engines.*
2 The autobrake system is initiated by the same logic which operates the ground spoilers.

Continued takeoff with engine failure between V1 and V2.

- If an engine failure occurs after passing V1 the takeoff must be continued.
- At VR rotate to the safe pitch attitude (or the attitude commanded by the Speed Reference System).
- At 50 ft and with positive rate of climb select the landing gear up.
- Maintain the airspeed at V2.

Note : *In the case where flexible takeoff thrust was used, the performance may be improved if required, by setting the operative engine to the go-around thrust.*

- Use sufficient rudder to hold a constant heading whilst maintaining the control wheel at about neutral.

Note : *If a change of heading is required, aileron application should be limited to avoid an increase in drag due to roll spoiler deployment.*

- **At acceleration height, level off and allow the speed to increase.**
  - ● At F speed retract the flaps
  - ● At S speed retract the slats.
- At 0 - speed (engine out operating speed in clean configuration - green dot) resume the climb using maximum continuous thrust and maintain 0 speed.

Note : *MAXIMUM TAKEOFF THRUST IS ONLY ALLOWED FOR 10 MINUTES.*

R – If a turn after takeoff is required, the same procedure
R applies except that the bank angle is limited to 15° up
R to green dot speed (or as published in RTOLW charts).

Engine failure after takeoff or at go around

- Speed must be closely monitored,
- If speed is decreasing, and before the speed trend reaches V_2 – 5 kt (take-off case) or V_{APP} – 5 kt (go around case) :
  - · disconnect the A.P, if engaged,
  - · set an initial pitch attitude of 12.5°. Then, adjust pitch attitude to fly at or above V_2 (take-off) or V_{APP} (go around),
  - · disregard the FD pitch bar order,
  - · maintain thrust of operative engine at Go Around thrust as long as required.

Immediate VMC landing following engine failure on takeoff R R

For an immediate VMC landing following an engine failure on takeoff : R R R

- At the acceleration height, maintain takeoff slats/flaps configuration and accelerate to F (if flaps 15°) or S (if flaps 0°) speed. R R R
- Maintain this configuration and speed until the preparation for the approach in the downwind leg. R R
- In the downwind leg, determine the landing slats/flaps configuration according to the approach/climb requirements. Prepare the aircraft and continue the approach as for a standard visual approach. R R R R

Code : 0034

CIRCLING APPROACH WITH ONE ENGINE INOPERATIVE

- Refer to Flight Pattern 2.03.20 p3.
- Landing weight : check.

● If the aircraft weight is above the maximum weight for circling in configuration Slats 20/Flaps 20 (given in the table below) :

The aircraft cannot maintain flight level with CONF 20/20 and landing gear down.

A diversion is recommended.

● If diversion is not possible :

- Consider delaying gear extension.
- Consider increasing altitude minima to 800 ft, to avoid triggering the warning "L/G NOT DOWN".

Note : 1) If the approach is flown at less than 750 ft RA, the warning "L/G NOT DOWN" will be triggered. This warning is to be disregarded. The aural signal is to be cancelled using the "EMERG CANCEL" pushbutton.
2) "TOO LOW GEAR" warning is to be expected, if the landing gear is not downlocked at 500 ft RA.

R

MAXIMUM WEIGHT FOR CIRCLING SLATS 20 FLAPS 20 (1000 KG)									
AIR CONDITIONING ON				ANTI-ICING OFF					
OAT (C°)	AIRPORT ELEVATION (feet)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
0	154	152	151	149	146	143	140	137	133
5	154	152	151	149	146	143	140	137	133
10	154	152	151	149	146	143	140	137	133
15	154	152	151	149	146	143	140	137	133
20	154	152	151	149	146	143	138	133	128
25	154	152	151	148	143	138	133	128	124
30	154	150	146	142	138	133	128	124	119
35	148	140	140	137	133	128	123	118	114
40	140	139	135	131	127	122	118	113	
45	136	132	129	125	121	117			
50	129	126	122						
55	123								

R WEIGHT CORRECTION FOR ANTI-ICING

R ENGINE ANTI-ICE ON -1%
R TOTAL ANTI-ICE ON -2%

R WEIGHT CORRECTION FOR ICE ACCRETION : -3%

R WEIGHT CORRECTION FOR FTDM (Fan Thrust Deterioration Mode) : -3000 kg

Mod : 4863

PW Eng. : 4000

START VALVE FAILS TO OPEN

ENG START selector . . . . OFF

● **Advise ground crew to prepare for manual start valve operation** :

GRND SERVICE INTPH . . . . ON

● **When ground crew member is ready, order « START 1 or 2 »** :

ENG START selector . . . . START A (or B)
ENG START button . . . . PRESS
START VALVE . . . . ORDER OPENING

– Continue the normal engine start procedure.

● **When N2 at 45 %** :

START VALVE . . . . ORDER CLOSURE

– Continue the normal procedure.

PREMATURE START VALVE CLOSURE

FUEL LEVER . . . . OFF

R ● **When N2 at/or below 30 %** :

ENG START button . . . . PRESS and HOLD

– Motor the engine for 30 seconds.

FUEL LEVER . . . . ON

● **When N2 at 45 %**

ENG START button . . . . RELEASE

– Continue the normal procedure.

START VALVE FAILS TO CLOSE (GROUND)

ENG START selector . . . . OFF
OPEN light . . . . CHECK EXTINGUISHED

■ **If OPEN light remains illuminated** :

- ■ **If APU supply** :

  ENG 1 and 2 BLEED VALVES . . . . OFF
  APU BLEED VALVE . . . . OFF

- ■ **If crossbleed supply** :

  BLEED VALVE (supplying engine) . . . . OFF

- ■ **If external pneumatic power supply** :

  External pneumatic power . . . ORDER SHUT OFF

- ● **When BLEED PRESS (affected side ECAM indication) at zero** :

  FUEL LEVER . . . . OFF

  – Maintenance action is due to verify START VALVE POSITION.

  - ● **If start valve confirmed closed** :

    – Apply appropriate MEL item (OPEN light inoperative)

  - ● **If start valve confirmed open** :

    – Apply appropriate MEL item (START VALVE inoperative)

■ **If OPEN light is extinguished** :

Continue normal operation.
Automatic closure of the start valve will not occur at 45% N2. The start valve will be closed when the ENG START selector is selected OFF.

ARM LIGHT OR START BUTTON FAILURE

NOTE : Start engine with affected ARM light first

ENG START pushbutton . . . . PRESS and HOLD
OPEN light . . . . CHECK ILLUMINATED

● **At 15 % N2 minimum :**

FUEL LEVER . . . . ON

● **When N2 at 45 % :**

ENG START pushbutton . . . . RELEASE
OPEN light . . . . CHECK EXTINGUISHED.

NOTE : After second engine start, both ARM lights will illuminate until ENG START selector is set to OFF.

NO « N2 » DURING ENGINE START (GROUND)

HYD ENG PUMP LO PR lights (affected side) . . . CHECK
ENG START Selector . . . . OFF

■ **If HYD ENG PUMP LO PR lights were extinguished** :

R ENGINE START WITH N2 INDICATION FAILED (12.17) . . . . APPLY

■ **If HYD ENG PUMP LO PR lights were illuminated** :

– Maintenance action is due.
(suspect starter motor failure)

ENGINE START WITH « N2 » INDICATION FAILED

NOTE : Be aware that the starter cut-out circuit may be inoperative.

GEN (affected side) . . . . CHECK ON

ENG START selector . . . . START A/B

ENG START pushbutton . . . . PRESS and HOLD

– Confirm starter motor operation by checking the extinguishing of the onside HYD LO PR lights.

CLOCK . . . . START

● **After 20 seconds (announce « 20 seconds »)** :

FUEL LEVER . . . . ON

***CAUTION* : be alert for a possible hot start**

● **When GEN FAULT light extinguishes** :

ENG START pushbutton . . . . RELEASE
START OPEN light . . . . . CHECK EXTINGUISHED

NORMAL ENGINE START PROCEDURE . . . CONTINUE

NO « N1 » DURING ENGINE START (GROUND)

Request ground crew to visually check for fan rotation.

● **Fan rotation** :

■ **If confirmed** :

– Continue the normal engine start procedure.

■ **If not confirmed** :

FUEL LEVER . . . . OFF

– Continue motoring the engine for at least 30 seconds, extend to 3 minutes if desired.

● **Fan rotation within the maximum 3-minute period** :

■ **If confirmed** :

FUEL LEVER . . . . ON

– Continue the normal engine start procedure

■ **If not confirmed** :

FUEL LEVER(s) . . . . OFF
ENG START selector . . . . OFF

– When the engine rotors have come to a complete stop, instruct ground crew to manually rotate the fan one or two turns in the reverse direction, after which another engine start can be attempted.

PW Eng. : All

NO LIGHT UP DURING ENGINE START (GROUND)

FUEL FLOW . . . . CHECK
FUEL LEVER . . . . OFF
ENGINE MOTORING . . . . 30 SECONDS

■ **If Fuel Flow (FF) satisfactory and for non-ETOPS flight** :

ENG START selector . SELECT OTHER « START » IGNITER

■ **If OPEN light extinguishes (start valve closure)** :

R

R ● **When N2 below 30 %** :

SECOND START ATTEMPT . . . . . . PERFORM

■ **If OPEN light remains illuminated (start valve open)** :

FUEL LEVER . . . . ON

SECOND START ATTEMPT . . . . MONITOR

● **If unsuccessful** :

FUEL LEVER(S) . . . . OFF
ENG START selector . . . . OFF
– Maintenance action is due

■ **If Fuel Flow (FF) satisfactory and for ETOPS flight** :

ENG START selector . . . . OFF

NOTE : Refer to MEL.

■ **If Fuel Flow (FF) low or zero** :

ENG START selector . . . . OFF

R

R ● **When N2 below 30 %** :

SECOND START ATTEMPT . . . . PERFORM

● **If unsuccessful** :

– Maintenance action is due

HUNG START (GROUND)

Indications :
- **Abnormally slow engine acceleration after light-up,**
- **N2 hanging below idle,**
- **FF normal or low,**
- **EGT within limit.**

NOTE : Record engine primary parameters for analysis.

FUEL LEVER . . . . OFF

● **If starter disengaged (valve closed), when N2 below 30 %** : R

ENG START pushbutton . . . . PRESS
ENGINE MOTORING . . . . 30 SECONDS
ENG START selector . . . . OFF

■ **If start pressure was low** :

PROC : CROSSBLEED ENGINE START (12.23) . CONSIDER

■ **When N2 below 5 %** :

ENG START selector . . . . CONT RELIGHT
– Manually select ECAM ENG page.
SECOND ENGINE START . . . . PERFORM

● **If unsuccessful** :

FUEL LEVER . . . . OFF
ENG START selector . . . . OFF
– Maintenance action is due.

HOT START

Indications :

- **Rapid EGT rise likely to exceed the starting EGT limit or starting EGT limit exceedance.**
- **N2 hanging at approximately 30 % N2.**
- **FF normal or high.**
- **Tailpipe burning may be reported by ground crew.**

NOTE : To prevent EGT from exceeding the starting limit of 535° C, observe N 1, N 2, and EGT closely during engine start.

If EGT reaches 400° C before N 2 has reached 30 %, anticipate a possible hot start and be prepared to select FUEL lever to OFF to prevent a hot start.

FUEL LEVER . . . . OFF

● **If starter disengaged (valve closed), when N2 below 30 % :** R

ENG START pushbutton . . . . PRESS

ENGINE MOTORING . . . . 30 SECONDS

● **Starting EGT limit (535° C) :**

■ **Exceeded :**

ENG START selector . . . . OFF

- Perform normal engine(s) shutdown procedure
- Maintenance action is due.

■ **Not exceeded :**

ENG START selector . . . . CONT RELIGHT

- Manually select ECAM ENG page.

● **When N2 below 5 % :**

- Perform second start attempt.
- Record hot start occurence in logbook.

ENG TAIL PIPE FIRE – ENG START

Indications :

- **EGT increases rapidly when FUEL lever is set to ON.**
- **Internal tailpipe fire reported by ground crew.**

CAUTION : Except as a last resort, do not use ground fire extinguisher, as serious engine damage may result.

FUEL LEVER . . . . OFF

AIR X FEED . . . . MAN/IN LINE

ENG FIRE handle . . . . PULL

● **If starter disengaged (valve closed), when N2 below 30 % :** R

ENG START pushbutton . . . . PRESS

- Continue motoring the engine for 30 seconds or until the evidence of burning has ceased.

IGNITION selector . . . . OFF

- Maintenance action is due.

ENG TAIL PIPE FIRE – ENG SHUTDOWN

Indications :

- **EGT fails to decrease when FUEL lever is set to OFF.**
- **Internal tailpipe fire reported by ground crew.**

CAUTION : Except as a last resort, do not use ground fire extinguisher, as serious engine damage may result.

FUEL LEVER . . . . CHECK OFF

AIR X FEED . . . . MAN/IN LINE

ENG FIRE handle . . . . PULL

IGNITION selector . . . . CRANK

AIR BLEED . . . . ESTABLISH

● **When below 30 % N2 :** R

NOTE : If N2 inoperative wait for 20 seconds after FUEL lever is set to OFF before re-engaging starter.

START pushbutton . . . . PRESS

- Continue motoring the engine for 30 seconds or until the evidence of burning has ceased.

IGNITION selector . . . . OFF

- Maintenance action is due.

PW Eng. : 4000

LACK OF THROTTLE RESPONSE (IN FLIGHT)

■ **If engine fails to accelerate upon throttle advance** :

■ **If no N1 response but N2 and EGT increasing** :

THROTTLE . . . . IDLE

■ **If engine operation/parameters normal** :

IDLE OPERATION . . . . MAINTAIN

END OF PROC

■ **If engine operation/parameters abnormal** :

FUEL LEVER (affected engine) . . . . OFF

R PROC : SINGLE ENG OPERATION (12.08) . APPLY

■ **If no N1, N2 and EGT response** :

ENG BLEED VALVE OFF . . . . CONSIDER

GALLEY SHED . . . . CONSIDER

REDUCING ALTITUDE . . . . CONSIDER

■ **If during idle descent** :

INCREASING AIRSPEED . . . . CONSIDER

ENGINE RESPONSE . . . . CHECK

● **If engine response not recovered** :

ENGINE OPERATION . AT PILOT DISCRETION

ENGINE PARAMETERS . . . . MONITOR

FOR APPROACH

● **If engine above idle** :

FUEL LEVER (affected engine) . . . . OFF

R PROC : SINGLE ENG OPERATION (12.08) . . . . APPLY

END OF PROC

■ **If during approach** :

CONFIGURATION CHANGES . . . . ANTICIPATE

END OF PROC

■ **If engine fails to decelerate upon throttle retard** :

ENGINE ANTI-ICE . . . . ON

WING ANTI-ICE . . . . ON

ECON FLOW . . . . OFF

ENGINE RESPONSE . . . . CHECK

● **If engine response not recovered** :

ENGINE OPERATION . . . . AT PILOT DISCRETION

ENGINE PARAMETERS . . . . MONITOR

FOR APPROACH

● **If engine above idle** :

FUEL LEVER (affected engine) . . . . OFF

R PROC : SINGLE ENG OPERATION (12.08) . APPLY

END OF PROC

LACK OF THROTTLE RESPONSE (IN FLIGHT)

■ **If engine fails to accelerate upon throttle advance** :

■ **If no N1 response but N2 and EGT increasing** :

- The most likely cause is the failure of the Variable Stator Vanes to open upon engine acceleration.
- Increasing the thrust above idle may result in overstress of the high pressure compressor and consequent severe engine damage.

■ **If no N1, N2 and EGT response** :

- The most likely cause is engine deterioration combined with high bleed air demand or a shift in the engine fuel control acceleration schedule.
- Such an engine behaviour may also be the result of massive water ingestion in heavy rain.
- Reducing the bleed air demand and electrical loads and, condition permitting, the altitude will increase the engine acceleration capability.

■ **If engine fails to decelerate upon throttle retard** :

- The most likely cause is a shift in the engine fuel control deceleration schedule.
- Increasing the bleed air demand will increase the engine deceleration capability.

● **If engine response not recovered** :

- In case of lack of throttle response in an idle or above idle condition, the engine can be kept operating (so as to take benefit of the available electrical, hydraulic and pneumatic power services), **unless certified operating limits are exceeded.**

FOR APPROACH

- Should the engine control be not recovered and the engine be in an out-of-idle condition, the engine should be shutdown for the approach and the SINGLE ENG OPERATION procedure applied.

LEFT BLANK INTENTIONALLY

BOMB ON BOARD

From experience, explosives brought on board of aircraft are fitted with time or altitude fuses.

For that reason a suspicious article considered to be an explosive, may be transported to a location in the aircraft where, in case of detonation, the least damage to aircraft structure and systems is expected.

This Least Risk Bomb Location (LRBL) is the right hand aft cabin door (DOOR 3R).

IF POSSIBLE, DESCEND, LAND, TAXI TO A REMOTE SITE AND EVACUATE THE AIRCRAFT IMMEDIATELY.
If it is not possible to land and evacuate the aircraft within 30 minutes, apply the following procedures :

COCKPIT PROCEDURES

Note : *As precautionary measure, the application of cockpit procedures is recommended, even if Bomb on Board is not confirmed, but a founded serious BOMB THREAT is received.*

CABIN CREW . . . . NOTIFY
ATC/COMPANY OPERATIONS . . . . NOTIFY
– To obtain expert advice from explosive specialists.

LANDING ELEVATION . . . . . . SET INDICATED CABIN ALTITUDE

FUEL RESERVES . . . . DETERMINE

– With L/G and slats extended, fuel consumption (kg/NM) is multiplied by 3.

NEXT SUITABLE AIRPORT . . . . DETERMINE

SPD/MACH SELECTION KNOB . . . . PULL
– 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″ exploded.

DESCENT TO CAB ALT + 2500 FT OR MEA/MORA . INITIATE

– Avoid any increase of cabin altitude and g-loads. Avoid any sharp maneuvers which might result in a displacement of the suspicious article.

– By descending to 2500 ft above the cabin altitude and respective setting of LANDING ELEVATION selector, a cabin △P of approximately 1 PSI is obtained. This reduces the structural load on the fuselage, as far as possible, but maintains a small positive differential pressure in the cabin to ensure that any explosion and subsequent debris will be directed out of the cabin.

- **When at CAB ALT + 2500 FT OR MEA/MORA** :

  GALLEY . . . . SHED

  – Electrical power in the vicinity of the least risk bomb location is considerably reduced by selecting GALLEY SHED to reduce the risks of an electrical fire in case of damage.

- **Fuel permitting** :

  SLATS . . . . EXTEND

  – Slats are extended as a precautionary measure, should any damage occur. The associated speed reduction reduces aerodynamic loads and allows the extension of the landing gear. For approach and landing, use normal flap configuration.

  L/G (except for overwater operation) . . . . . DOWN
  Note : *With gear down, fuel consumption is multiplied by 3.*

- **When cleared to lower FL or altitude :**

  DESCENT TO CLEARED FL (ALTITUDE) . . . INITIATE

- **Before landing** :

  MAN PRESS . . . . ON
  V/S CTL . . . . FULL UP R
  OUTFLOW VALVES . . . . CHECK FULL OPEN

- **When aircraft on ground and stopped in a remote area (if possible) :**

  △ P (DIFF PRESS). . . . . CHECK ZERO

  EVACUATION/DISEMBARKATION . . . INITIATE ASAP

CABIN PROCEDURES

EOD PERSONNEL ON BOARD . . . . CHECK
– Announce ″Are there any EOD personnel on board ?″. By using the initials, only persons familiar with EOD will be made aware of the problem.

SUSPICIOUS ARTICLE . . . . DO NOT OPEN, DO NOT CUT WIRES, SECURE, AVOID SHOCKS

– Secure in the attitude found and do not lift before having checked for an anti-lift ignition device.

PASSENGERS . . . . . LEAD AWAY FROM SUSPICIOUS ARTICLE

– Move passengers at least 4 seat rows away from the ″bomb″. The passengers must be seated with their seat belts fastened and seat backs and tray tables in their full upright position.

SUSPICIOUS ARTICLE . . . . CHECK FOR 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″.

BOMB ON BOARD CONT'D

If it is indicated that an anti-lift device is present, it may be possible to move the ″bomb″ together with the surface on which the ″bomb″ is located, such as a shelf or seat cushion.

If it is not possible to move the ″bomb″ then it should be surrounded with a single thin sheet of plastic and with wetted materials and other blast attenuation material such as seat cushions and soft carry-on baggage.

Move passengers as far from the ″bomb″ location as possible.

- **If suspicious article can be moved** :

PASSENGERS . . . . MOVE/ADVISE

Move passengers at least 4 seat rows away from the least risk bomb location (RH aft cabin door). If other seats are full these passengers should sit on the floor in protected areas towards the front of the aircraft.

Passengers seated the nearest to the ″bomb″ should protect their heads with pillows, blankets, etc... or sit in the brace position.

All passengers must remain seated with seat belts fastened and, if possible, with the head below the top of the head rest.

The seat backs and tray tables throughout the cabin should be placed in their full, upright positions.

R RH AFT CABIN DOOR SLIDE . . . . DISARM

LEAST RISK BOMB LOCATION . . . . 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.

SUSPICIOUS ARTICLE . . . . MOVE TO LRBL

- Carefully carry the suspicious article in the attitude found and place on top of the wetted material in the same attitude and as close to the door structure as possible.

LEAST RISK BOMB LOCATION SET UP. . COMPLETE

- Place an additional single thin sheet of plastic over the ″bomb″.
- Build up at least 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 objective is to build up a protective surrounding of the ″bomb″ so that the explosive force is directed in the only non protected area i.e. into the door structure.
- Fill the area around the ″bomb″ with seat cushions and other soft material such as hand baggage (saturated with water or any other non flammable liquid) up to the cabin ceiling, compressing as much as possible.

  Secure the LRBL stack in place using belts, ties, or other appropriate materials. The more material stacked around the ″bomb″, the less the damage can be.
- **Use only soft material. Avoid using materials containing any flammable liquid and any metal objects which could become dangerous projectiles.**

- **When aircraft on ground and stopped, and when cabin evacuation/disembarkation signal is received from the cockpit :**

EVACUATION/DISEMBARKATION . . . . . . EXECUTE

- Use available airport facilities to disembark without delay.
- Evacuate passengers through normal and emergency exits on the opposite side of the ″bomb″ location. Do not use the door just in front of the ″bomb″.

DOOR NOT CLOSED IN FLIGHT

- **IF ABNORM CAB RATE OR CONFIRMED UNLOCKED :**
  - LDG ELEVATION . . . . 10 000 FT
  - MAX FL 100/MEA

FWD or AFT or BULK CARGO

- **IF ABNORM CAB RATE :**
  - LDG ELEVATION . . . . 10 000 FT
  - MAX FL 100/MEA

AVIONIC or FWD COMPT

– No Action

CABIN

DOOR CONTROL HANDLE . . . . PUSH

LOCKING INDICATOR . . . . CHECK

DOOR NOT CLOSED IN FLIGHT

Indications :

Single chime

ECAM activation with appropriate warning light

Left ECAM CRT : DOOR warning procedure

Right ECAM CRT : DOOR page with DOOR and identification in amber

– If a door is confirmed unlocked or if the DOOR warning is accompanied by abnormal increase of cabin altitude, the △P cabin must be reduced by increasing the landing elevation selection and initiating a descent.

OVERWEIGHT LANDING

APPROACH/CLIMB LIMITATION (TGA) . . . . . . CHECK

LANDING CONFIGURATION . . . . DETERMINE

LANDING DIST . . . . CHECK

PACK VALVE 1 and 2 . . . . OFF or on APU

VERTICAL SPEED AT TOUCHDOWN . . . . . . MINIMIZE

– Maximum vertical speed at touchdown : 360 ft/mn.

OVERWEIGHT LANDING

– When an overweight landing has to be performed following an operational turnback, refer to corresponding RTLOW chart, or to FCOM, to determine the approach and landing configuration as a function of the approach-climb limiting weight.

– Selecting packs off (or supplying packs from APU) will increase the maximum thrust available from the engines in case of a go-around.

Mod. : 5779 + 7172

COCKPIT WINDOW CRACKED

WINDOW HEAT (if arcing) . . . . OFF
Max FL 250
LDG ELEVATION . . . . SET ACCORDING TO TABLE

MAX △P = 5 PSI	FL	100	120	150	180	200	230	250
	LDG ELEV SETTING	0	1000	3000	5000	6000	8000	9200

- **When starting the descent** :
  LDG ELEVATION . . . SET DESTINATION ELEVATION

COCKPIT WINDOW CRACKED

- Max. flight level is restricted to FL 250 in order to obtain △P 5 PSI without excessive cabin altitude and resultant CAB ALT warning.
- In case of a one ply failure, whichever the one may be, the windshield is still able to sustain the maximum differential pressure. Nevertheless, because the pilot is unable to accurately determine how many plies have failed, the differential pressure must be reduced to 5 PSI. R

COCKPIT WINDOW ARCING

WINDOW HEAT . . . . OFF

COCKPIT WINDOW ARCING

- Arcing may be identified by brown marks on the window.
- Arcing occurs when a powered heating element is defective.
- Continuous arcing in a windshield can result in cracking of the adjacent glass plies.

FWS FAULT

■ **SINGLE FWS FAULT**

FWS

CRT AMBER CAUTIONS NOT AVAIL

– MONITOR OVERHEAD PANEL

NOTE : . Red warnings are not affected.

. Amber cautions processed by the affected FWS are lost, but local warnings are available.

. For the following faults and systems, no local warning is available :

- *A/SKID selected OFF*
- *L/G Lever interlocked*
- *Radio altimeter fault*
- *EFIS SGU 3 FAULT*
- *Automatic call out*
- *DOOR (DOOR page on CRT available)*
- *AC EMER BUS OFF*
- *Ground spoilers not extended*

■ **DUAL FWS FAULT**

FWS FAULT . . . . MONITOR SYS

NOTE : . All red warnings and amber cautions are lost, but local warnings are available.

. For the following faults and systems and in addition to the systems affected by the loss of one FWS (see list above), no local warning is available :

- *O/SPEED (Vmax strip available on PFD)*
- *STALL (Vss strip available on PFD)*
- *LDG GEAR (3 green lights available on L/G panels)*
- *EXCESS CAB ALT (CAB ALT indicator available)*
- *HYD TANK LO LEVEL (QTY indicators available)*
- *ALTITUDE ALERT*
- *DOOR (DOOR page on CRT available)*
- *AP OFF*
- *AFS capacity change (tripple click lost)*

FWS FAULT

Indications :

Single chime (if single FWS FAULT only)

ECAM activation with appropriate warning light

Left ECAM CRT :

– CRT AMBER CAUTIONS NOT AVAIL or

– FWS FAULT (on MEMO page)

SPEED CONTROL WITH UNRELIABLE AIRSPEED INDICATION

GENERAL

- The following section provides background information and operational recommendations regarding the speed control with an unreliable airspeed indication or in case of the total loss of all airspeed indications.

- An unreliable airspeed indication or the loss of all airspeed indications may be the result of :
  - a radome burst,
  - heavy rain,
  - severe icing,
  - the loss of probe heating,
  - volcanic ash, dust, insect or contamination by other types of debris.

- The purpose of the procedure is to provide the flight crews with three levels of information and guidance :
  - **clues** for the **recognition** of an unreliable airspeed condition,
  - **memory items** for the **short term control** of the flight path,
  - additional **read-and-do items** and **pitch / N1 data** for the **long term control of the flight path down to landing.**

- The procedure for flight with unreliable airspeed is split into two parts, as follows :
  - **FCOM 2.05.80 Page 6 thru 10** :
    - · Background information and expanded procedural information,
  - R R **QRH Page 13.01, 13.02 and 13.03 and FCOM 2.05.80 Page 10 thru 11** :
    - · Memory items, read-and-do items and Pitch / N1 data for climb, level flight, descent, approach and landing.

BACKGROUND INFORMATION

- An unreliable airspeed condition or the loss of airspeed indication is usually the result of the partial or total obstruction of the pitot probe(s) or static ports.

- Whatever the nature of the contamination, two possibilities have to be considered :
  - the blockage of the pitot tubes, with or without blockage of the drain holes,
  - the blockage of the static ports.

- Blockage resulting from contamination by dust, insects or leaf clips usually affects only one pitot tube or static port,

- Blockage resulting from the failure to remove the maintenance protective covers or from severe weather conditions usually affects all three pitot- static systems.

UNDERSTANDING THE IAS RESPONSE TO PITOT PROBE OR STATIC PORT OBSTRUCTION

- The Indicated Air Speed (IAS) is a direct function of the difference between the Total Pressure (Pt) measured by the pitot probe and the Ambient / Static Pressure (Ps) measured by the static ports.

$$\boxed{IAS = f (Pt - Ps)}$$

- Whenever a pitot probe is blocked, two scenarios can be considered :
  - the pitot probe drain holes are free and the trapped Pt drops progressively or quickly towards the ambient pressure (P s),

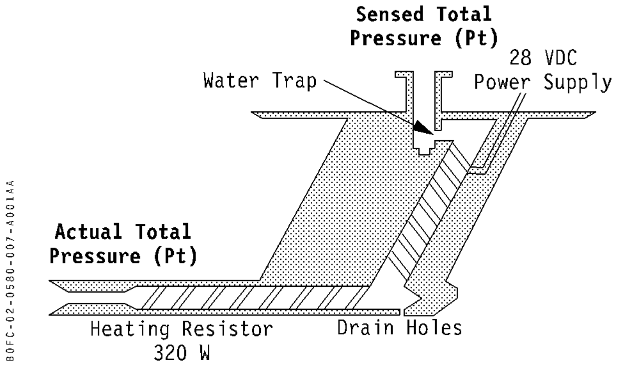
  or
  - the pitot drain holes are also blocked and the trapped Pt remains constant.

- In the same manner, should the static ports be blocked, the ambient pressure is trapped and Ps remains constant.

- A good understanding of the above basic facts is of a paramount importance for the recognition and understanding of an unreliable airspeed condition.

PITOT PROBE DESIGN

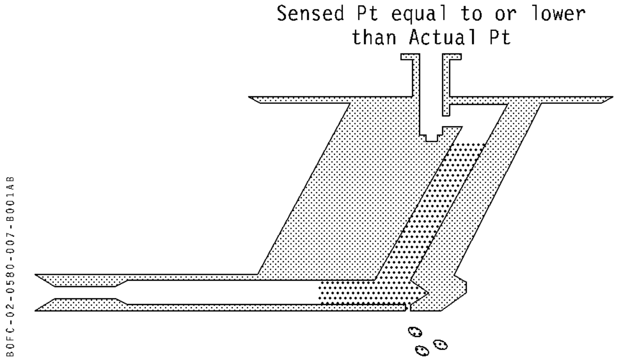
- The illustration hereafter provides a cutaway view of the pitot probe :



IAS RESPONSE TO PITOT PROBE OR STATIC PORTS OBSTRUCTION

- The following paragraph provides a review of the main modes of pitot probe or static ports obstruction.

Heavy rain :



In heavy rain, the amount of water to be drained may temporarily exceed the draining capability of the drain holes.

Such heavy rain conditions are usually being encountered during climb, descent and approach.

The IAS may fluctuates or exhibit a gradual or step decrease to very low values.

As water drains, the IAS returns to a normal reading.

If drain holes are obstructed, the IAS remains affected.

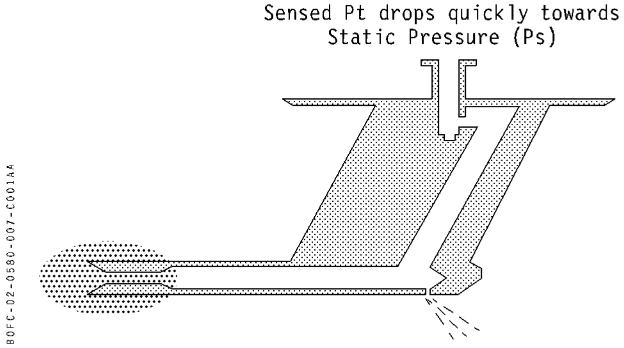
Severe icing :

In severe icing, the ice build-up rate may temporarily exceed the anti-icing / de-icing capability of the pitot heater.

Such severe icing conditions are usually being encountered in ice crystal areas (e.g. cirrus clouds or on the downwind side of a Cb) or in severe storms.

The IAS behavior depends on the conditions of the pitot probe drain holes.

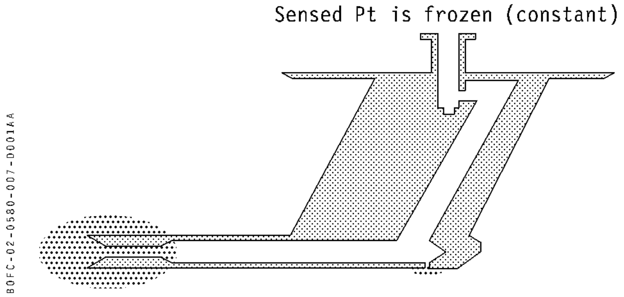
Drain holes free :



The IAS may fluctuate or drop quickly towards the stick shaker speed.

The IAS remains affected for a few seconds, until the pitot heater overcomes the ice build-up but this phenomenon may repeat itself over several minutes until exiting the severe icing area.

Drain holes blocked :



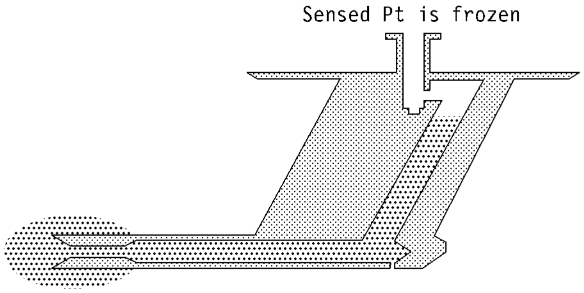
If the drains holes are blocked, the sensed Pt is trapped and remains constant, whatever the changes in airspeed or altitude.

In **level flight** (constant Ps), the IAS is constant and the pitot condition may go undetected.

In **climb**, the IAS increases (with decreasing Ps), possibly resulting in the activation of the overspeed warning.

In **descent**, the IAS decreases (with increasing Ps).

Loss of pitot probe heating :



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In case of loss of pitot probe heating, the IAS upset is identical to the IAS behavior in severe icing conditions (with drain holes free or blocked) but, in this case, the upset lasts as long as icing conditions exist.

Volcanic ash, insects, leaf clips, dust..... :

In case of pitot probe obstruction by volcanic ash, dust, insects or leaf clips, the Pt may be trapped (i.e. remains constant) or may drop towards the ambient static pressure Ps.

The IAS upset depends upon the behavior of the sensed Pt and on the flight phase.

STATIC PORTS OBSTRUCTION

- Static ports enroute icing is very unlikely.
- Static ports obstruction is usually present on the ground (as the result of contamination) or because of protective covers being left in place.
- During the takeoff roll, the IAS indication is normal.
- After lift-off, the static pressure is trapped and remains frozen at the airfield elevation :
  - The indicated altitude remains also equal to the airfield elevation,
  - The IAS decreases as the Pt decreases with increasing altitude (at constant actual air speed).
- In case of accumulated water in static ports tubbing, the water freezes when reaching freezing level, resulting in an altitude and IAS behavior similar to that described hereabove.

COCKPIT INDICATIONS

- Only the following cockpit information and their correlation are available for the recognition of an unreliable airspeed indication :
  - Main and standby IAS,
  - Main and standby altimeters,
  - Overspeed warning,
  - Stall warning and stick-shaker activation.
- The **stall warning** and the **stick-shaker** activation are solely **based on defined angle-of-attack thresholds**.

  The activation of these warning is therefore not linked in any manner to the pitot-static system.

  The activation of the Stall Warning and Stick Shaker shall be trusted at all times.

  Conversely, the overspeed warning may be untimely activated in case of unreliable airspeed indication.

RECOGNITION OF AN UNRELIABLE AIRSPEED

- Detecting an unreliable airspeed indication presents two main difficulties :
  - All airspeed indications may be consistent but equally unreliable,
  - Indications may differ but attempting to assess the correct indication may be hazardous.
- The following aspects are important contributors to the timely detection of an unreliable airspeed condition :
  - Instrument scanning (as adapted as a function of the flight phase),
  - Awareness of the IAS / pitch attitude / thrust / climb rate relationships.
- Any one of the following observations can be considered as an indication of an unreliable airspeed :
  - Abnormally large IAS fluctuations,
  - CAPT-to-F/O IAS discrepancy,
  - IAS-to-target speed discrepancy,
  - Abnormal A/THR or AP/FD behavior, when respectively in SPD mode,
  - IAS increasing with large nose-up pitch attitude,
  - IAS decreasing with large nose down pitch attitude,
  - Constant indicated altitude while climbing or descending,
  - Positive or negative vertical speed indication while in level flight,
  - Unanticipated stall warning and stick shaker activation
  - Unexpected and undue overspeed warning (e.g. in climb with high nose-up pitch attitude,
  - Simultaneous activation of overspeed warning and stall warning / stick shaker.

PROCEDURE – EXPANDED INFORMATION

- The procedure for flight with UNRELIABLE AIRSPEED, as provided in the QRH 13.01, 13.02 and 13.03, consists of three successive phases as follows :
  - **Memory Items** :

    The Memory Items enables the PF to ensure the short-term control of the flight path while the PNF is reaching over for the QRH and for the UNRELIABLE AIRSPEED procedure.

    The Memory Items have been developed based on extensive simulator testing in order to provide a, typically, 20 seconds period without accelerating beyond VMAX or decelerating below VLS.

    The Memory Items are only concerned with maintaining or acquiring a given flight path (climb, level flight or descent).

  - **Read-and-do Items** : R

    The read-and-do items complement the initial memory actions and provide data for the adjustment of the pitch attitude and thrust.

    The following aircraft systems may also be affected by the airspeed indication upset, should any abnormal behavior be observed or suspected, the affected system must be selected OFF and the associated ECAM or QRH procedure must be applied :

    · Pitch Feel,
    · Rudder Travel,
    · Yaw Damper,
    · Pitch Trim,
    · AP/FD and A/THR, when engaged in SPD mode.

The TRP thrust limit computation may also be affected.

Setting 100 % N1 (GE engines) / 90 % N1 (PW engines) provides a thrust setting close to the maximum CL rating, for all climb phases.

Note 1 : *If the baro altitude indication is unreliable, the following alternate altitude indications can be used :*

- *Radio altitude (when below 2500 ft RA).*

  The use of RA reading implies an awareness of the elevation and profile of the terrain being overflown.

- *CAB ALT, after selecting the CABIN PRESS MAN mode and selecting the V/S CTL switch to UP (for opening the outflow valves).*

Note 2 : *If the landing runway is ILS equipped, a coupled ILS approach can be performed but with manual thrust setting.*

- **Pitch / N1 data** :

  The QRH provides **pitch attitude** and **N1** data for :

  · level flight (cruise, holding, approach),
  · slats / flaps configuration setup and landing.

- During the slats / flaps configuration setup (which should be anticipated and performed in **level flight**), in order to transition from one configuration to the next one, the following **deceleration technique** must be applied.

  Starting from a stabilized configuration (given configuration, pitch attitude and N1) :

  – **select the next configuration,**

  – **maintain the altitude** (initially the pitch attitude will be lower than the initial pitch attitude prior to changing the configuration),

  increase progressively the pitch attitude to the next tabulated target (in order to maintain the altitude while the aircraft decelerates),

  – when the pitch attitude is close to reach the next target, **set the next tabulated N1 target.**

- Repeat the above sequence for each slats / flaps configuration change.

- Extend the landing gear only when intercepting the Glide Slope or when reaching the Visual Descent Point, as applicable.

- Select flaps 40 as soon as the landing gear is down locked.

- Set the target N1 for the final approach and maintain the desired flight path angle (or follow the FD bars, if an ILS approach is available).

ADDITIONAL INFORMATION

- If the loss of airspeed indication is the result of a radome burst, the target N1 must be increased by 10 % N1.

- Due to the increased N1, the fuel consumption is increased by approximately 30 % .

- **In case of engine-out condition, the tabulated N1 must be increased by 20 % N1** (this increment is valid for all flight phases and configurations).

UNRELIABLE AIRSPEED

ALL AIRSPEED INDICATIONS . . . . DISREGARD
AP/FD (except in level flight), A/THR . . . DISCONNECT

■ **To climb :**
SET PITCH . . . . SLATS EXT. : **12.5**° NOSE UP
SLATS RET. – BELOW FL 100 : **7.5**° NOSE UP
– ABOVE FL 100 : **5**° NOSE UP

SET THRUST . . . . **90** % N1

■ **To level-off/maintain level flight (at safe altitude) :**
SET PITCH . . . . **2**° NOSE UP

SET THRUST . . . . BELOW FL 100 : **62** % N1
FL 100 – FL 250 : **72** % N1
ABOVE FL 250 : **82** % N1

■ **To descend :**
SET PITCH . . . . **1.5**° NOSE DOWN

SET THRUST . . . . IDLE

● **If Stall Warning/Stick Shaker activated :**
STALL RECOVERY procedure . . . . APPLY
– Stall Warning and Stick Shaker are based on the Angle-of-Attack and must be trusted.

● **If AP disconnection :**
DESCENT TO LOWER FL (FL 310) . . . . . CONSIDER

PROBE HEAT . . . . CHECK ON

CONFIGURATION . . . . CHECK/AS REQD
(GEAR, SLATS/FLAPS, SPEEDBRAKES)

PITCH ATTITUDE (13.02) . . . . . CHECK TABLE/ADJUST
N1 (13.02) . . . . CHECK TABLE/ADJUST

USE OF FPV (only if altitude information is reliable) . CONSIDER
– Check actual angle of attack versus target :
. Angle of Attack = Pitch attitude (aircraft symbol) – Flight Path Angle (FPV).

GROUND SPEED . . . . MONITOR

AIRSPEED INDICATIONS . CHECK FOR MOST RELIABLE INDICATION
ADC INST SWITCHING . . . . CONSIDER

Continued on Page 13.02 and 13.03

UNRELIABLE AIRSPEED

Continued from Page 13.01

PITCH TARGET/N1 TARGET

TO OBTAIN/MAINTAIN	SET PITCH	SET N1	ANGLE OF ATTACK
Takeoff :			
– V2 + 10 kt (2 engine)	+ 15	TOGA	8
– V2 (1 engine out)	+ 12.5	TOGA	8
Acceleration/clean-up :			
– F speed	+ 10 (Start chrono)	90 % N1	5
– S speed (30 seconds after flaps retraction)	+ 10	90 % N1	5
Climb :			
– Turbulence speed :			
Below FL100	+ 10	90 % N1	2
Above FL100	+ 5	90 % N1	2
Cruise :			
– Turbulence speed	+ 2	**Refer to Page 13.03**	2
Descent :			
– Turbulence speed	– 1.5	Idle	2
Approach and **Landing**	**Refer to Page 13.03**	**Refer to Page 13.03**	**Refer to Page 13.03**

UNRELIABLE AIRSPEED

TARGET N1 TO MAINTAIN TURBULENCE SPEED IN LEVEL FLIGHT

Weight (1000 kg) → FL ↓	90	100	110	120	130	140	150	160	164
390	81	83	85						
350	79	80	81	83	84	87			
310	78	79	80	81	82	83	85	86	
270	75	77	78	78	79	80	82	82	83
250	73	75	76	77	78	79	80	81	82
200	70	72	73	74	75	76	77	78	78
150	66	68	69	70	71	72	73	74	74
100	63	65	66	67	67	68	69	70	70
50	59	61	62	63	64	65	66	66	67

TARGET PITCH/N1 TO MAINTAIN MANEUVERING/FINAL APPROACH SPEEDS

					Weight (1000 kg)			
IN CONFIG	TO MAINTAIN	SET PITCH	FPA	AOA	100	120	140	160
Clean	G. Dot	+ 5	0	5	50	54	58	62
S15	S speed	+ 7	0	7	53	58	61	65
F15	F + 20	+ 7	0	7	54	58	62	66
F20	F speed	+ 7	0	7	59	64	68	72
Gear Down F40	V REF + 10	+ 4	– 3°	7	54	59	62	66

CORRECTIONS ON TARGET N1 :

– Single engine operation	: + 20 % N1
– Radome burst	: + 10 % N1
– Airfield elevation	: + 0.7 % N1 per 1000 ft above sea level,
– Temperature	: +/– 1 % N1 per 10°C above/below ISA,
– Wind component	: + 1 % N1 per 10 kt head wind, – 1 % N1 per 10 kt tail wind,
– Glide slope angle	: + 0.5 % N1 per 0.1° below 3°, – 0.5 % N1 per 0.1° above 3°.

PW Eng. : 4000

COCKPIT DOOR FAULT

CKPT DOOR CONT PANEL . . . . CHECK

- **<u>If at least one STRIKE status light is illuminated</u>** :
  - Select and maintain the toggle switch to UNLOCK position on the COCKPIT DOOR control panel ;
  - Fully open the door ;
  - Release the toggle switch to NORM position ;
  - Close the door ;
  - **<u>If two or more STRIKE status lights are illuminated</u>** :

    The cockpit door is no more intrusion-proof.
- **<u>If the two CHAN status lights are illuminated</u>** :

  Automatic latch release is unavailable in case of rapid cockpit decompression.
- **<u>If no status light on the CKPT DOOR CONT panel is illuminated</u>** :

  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.

<u>NOTE</u> : In case of a DC NORM BUS fault, no FAULT indication appears on the overhead COCKPIT DOOR panel. The Cockpit Door Locking System is no more electrically-supplied, and is inoperative. Then the reinforced cockpit door is unlocked and can be opened from the cabin.

COCKPIT DOOR FAULT

<u>Indications</u> :
COCKPIT DOOR FAULT light

The CKPT DOOR CONT panel is used to identify the faulty CDLS item, and to verify the status of the pressure sensors and the three electrical latches (referred too as strikes).

If the COCKPIT DOOR FAULT light, and one or more of the associated status lights come on, then, one or more of the cockpit door's electric-locking latches (those corresponding to the status light(s) that are on) may be jammed. If this situation lasts longer than 5 to 15 minutes, the internal thermal fuse of the electric-locking latches will trigger due to the overheating of the unit.

If only one STRIKE status light is on, the cockpit door is still intrusion-proof.
If two STRIKE status lights are on (i.e. one electric-locking latch remains operational), the cockpit door may still be locked, but will no longer meet intrusion requirements.

Mod : 12557 or 12715

SUSPECTED STUCK PTT IN TRANSMIT POSITION

PTT selector (affected) . . . . RELEASE

● **If unsuccessful**

ACP affected channel . . . . DESELECT

ACP (affected side) . . . . . USE IN RECEPTION ONLY

If any Push To Talk (PTT) transmission selector (control Wheels INT/RAD switch, hand mike selector, or ACP PTT switch) is jammed in the transmit position, try to release it in order to stop the transmit mode (communication can be received on the selected channel).

If unsuccessful, deselect the identified failed VHF/HF transmission keys on the associated Audio Control Panel (ACP) to neutralize the onside ACP. This ACP should only be used in reception mode, the associated PTT transmission selector must not be used.

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

AFTER TAILSTRIKE

LAND ASAP
MAN PRESS . . . . ON
V/S CTL . . . . FULL UP

● **If immediate return is not possible**

MAX FL . . . . 100 or MSA
Refer to FLIGHT WITHOUT CABIN PRESSURIZATION (FCOM 2.18.20)

Note : For the comfort of the people on board, consider :

- *Climb at a rate of about 500 feet/minute*
- *descent at a rate of about 300 feet/minute, except for the final approach, which must be performed normally.*

Notify ATC of the aircraft rate of climb.

AFTER TAILSTRIKE

- Observation/confirmation of tailstrike may be obtained from the cabin crew, ATC or any other source available.

SYSTEM	CONDITION	RECOMMENDED ACTION
AIR BLEED	Pack LO flow indication	Compare pack 1 and 2 Turbine Inlet Temperatures and Pack Discharge Temperatures : if respective temperatures do not differ by more than 10° C, ignore LO flow indication.
	TURBINE INLET TEMP ≥ 95° C to ≤ 120° C	PACK VALVE. . . . . .OFF (for a cooling period)
APU	EGT ≥ 540° C	
CAB PRESS	CAB DIFF PRESS ≥ 8.6PSI	. **In level flight :** Other CABIN PRESS SYS. . . .SELECT . **In Climb :** RATE LIM SEL. . . . . .MAX . **If required** : AIRCRAFT V/S . . . . REDUCE
	CAB VERTICAL SPEED V/S ≥ V/S selected + 50 %	Other CABIN PRESS SYS. . . . .SELECT
	FWD and AFT OUTFLOW VALVE position difference > 40 %	Other CABIN PRESS SYS. . . . .SELECT
ELEC – AC	IDG Outlet Oil Temp ≥ 142° C	Reduce electrical load, if possible (GALLEY OFF or GEN OFF) Observe OIL TEMP evolution. If required, restore load when temperature has dropped. Restrict use of generator to short duration, if temperature rises again excessively. *Note : – If IDG is connected, reduced power setting may increase the OIL TEMP due to the decreased fuel flow and corresponding heat exchange across the fuel/oil heat exchanger :* *– If IDG DISC, this advisory may be activated due to :* *– low cooling effect* *– high nacelle temperature affecting IDG temperature bulb*
ELEC – DC	TR Current ≤ 6A	No crew action required.
FUEL	Fuel imbalance in wing tanks: (INR + OUTR TK) > 3000 kg (6700 lb)	FUEL management. . . . . .CHECK . **If FUEL LEAK suspected** : PROC : FUEL LEAK (7.02) . . . APPLY
FLT CTL	SPLRS Extended at WHEEL SPD > 70KT	

SYSTEM	CONDITION	RECOMMENDED ACTION
ENGINE	OIL TEMP ⩾ 163° C	• Refer to ENG OIL TEMP HI procedure. • Monitor OIL PRESS, OIL QTY and other engine parameters for associated abnormal indication (s), such as shift, fluctuation, mismatch.
	OIL TEMP ⩽ 50° C	• Refer to ENG OIL TEMP LO procedure
	OIL PRESS ⩽ 75 PSI	• If the OIL LO PRESS local warning light and associated ENG OIL LO PR ECAM procedure are not activated, continue normal engine operation (an oil pressure transmitter defect may be suspected). • Monitor the OIL PRESS and other engine parameters, particularly the OIL TEMP, OIL QTY and OIL FILTER CLOG light. R • Reduce power setting, as practical, if OIL TEMP is not in normal range.
	OIL QTY ⩽ 4 qt	• Monitor OIL PRESS, OIL TEMP and other engine parameters. • If OIL QTY is low at high power setting, expect oil level to increase after power reduction (oil gulping effect). • Only if the low OIL QTY is associated with a fluctuating or decreasing OIL PRESS, a precautionary engine shutdown may be considered.
	OIL DELTA TEMP ⩾ 44° C	• Record maximum differential oil temperature for maintenance purposes
	NAC TEMP ⩾ 230° C	• Monitor engine parameters and cross-check with other engine parameters. • Bleed air leakage has usually a short term effect on EGT, N2 and F/F (bleed air extraction effect) and a longer term effect on EGT and OIL TEMP (increased temperature exposure). • Conditions permitting, the following may be considered : – Checking NAC TEMP response to BLEED VALVE closure, – Checking NAC TEMP response to thrust level reduction, • If NAC TEMP drop confirms the bleed air leakage condition and all engine parameters are normal, engine operation can be continued, as follows (at pilot's discretion) : – In normal configuration, while monitoring NAC TEMP and other engine parameters, – With BLEED VALVE closed (refer to ENG BLEED VALVE FAULT procedure), – At reduced thrust level. • Only if NAC TEMP remains high in conjunction with abnormal engine indication, a precautionary engine shutdown may be considered, conditions permitting.

SYSTEM	CONDITION	RECOMMENDED ACTION
ENGINE	VIBRATION (N1) ≥ 3 units (N2) ≥ 5 units	● Check engine parameters and cross-check with other engine. ● Validate VIB level by checking for : – VIB level response to throttle lever movement, – engine rumbling noise (N1 VIB), – aircraft structure vibration (N1 VIB), – engine parameters shift or mismatch (N2 VIB). ● If engine parameters normal, continue engine operation at normal or reduced thrust level, at pilot's discretion. ● Only if engine parameters and/or behaviour is abnormal, a precautionary engine shutdown may be considered, conditions permitting. ● If icing conditions exist, N1 vibrations may be due to fan blades and/or spinner icing. Select IGNITION on CONT RELIGHT and increase thrust on affected engine with power setting compatible with flight phase (70 % N1 minimum). Resume normal operation when VIB level normal.

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CONTENTS

1. BASIC WEIGHT

It is the aircraft weight without any load. This means a weight not including crew members, pantry load, fuel load and traffic load but including the commercial arrangement of the corresponding version and the not expendable fuel.

2. DRY OPERATING WEIGHT

It is the weight of the aircraft in operating configuration. It is obtained by addition of the BASIC WEIGHT, crew members and pantry load.

3. TAKE-OFF FUEL

It is the weight of the inboard fuel at take-off.

4. OPERATING WEIGHT

It is the weight obtained by addition of the DRY OPERATING WEIGHT and the TAKE-OFF FUEL.

5. TOTAL TRAFFIC LOAD

It is the weight of the payload including cargo loads, passengers and passengers bags.

6. ZERO FUEL WEIGHT

It is the weight obtained by addition of the TOTAL TRAFFIC LOAD and the DRY OPERATING WEIGHT.

7. TAKE-OFF WEIGHT

It is the weight at take-off. It is equal to the addition of the ZERO FUEL WEIGHT and TAKE-OFF FUEL.

8. TRIP FUEL

It is the weight of the fuel necessary to cover the normal leg without reserves.

9. LANDING WEIGHT

It is the weight at landing. It is equal to TAKE-OFF WEIGHT minus TRIP FUEL.

10. REFERENCE DATA :

Datum line	STA 0 (26.67 m (87.50 ft) forward of 25 % MAC)
Leading edge of MAC	STA 25.2132 m (82.72 ft)
Length of MAC	5.8287 m (19.124 ft)

1. GENERAL

The cargo is loaded in three underfloor cargo holds designated FWD, AFT and BULK, and designed category C as defined by FAR.
Doors for the forward and aft cargo hold are hydraulically powered. The bulk cargo door is manually operated from outside or inside the aircraft.

2. FWD CARGO COMPARTMENT

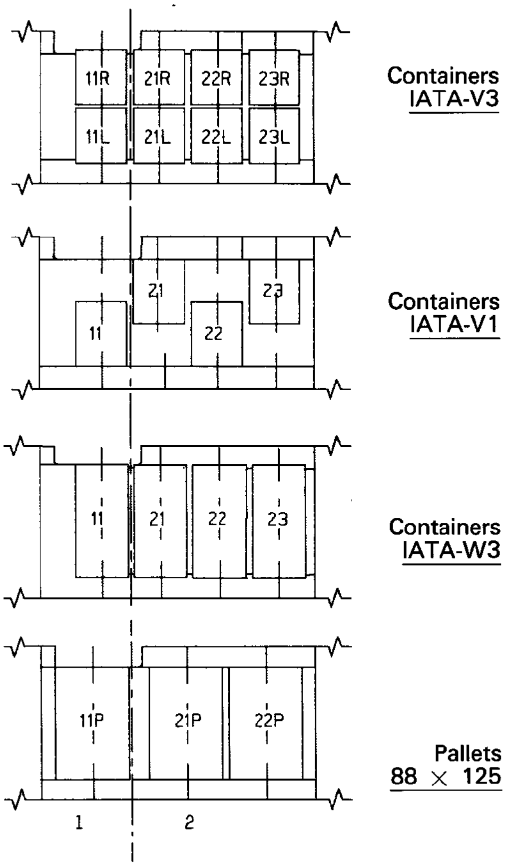
The FWD cargo is provided with a semi automatic loading system as is designed to carry containers and pallets. It is prohibited to carry bulk freight in this cargo. FWD cargo is divided in 2 zones (1 and 2).

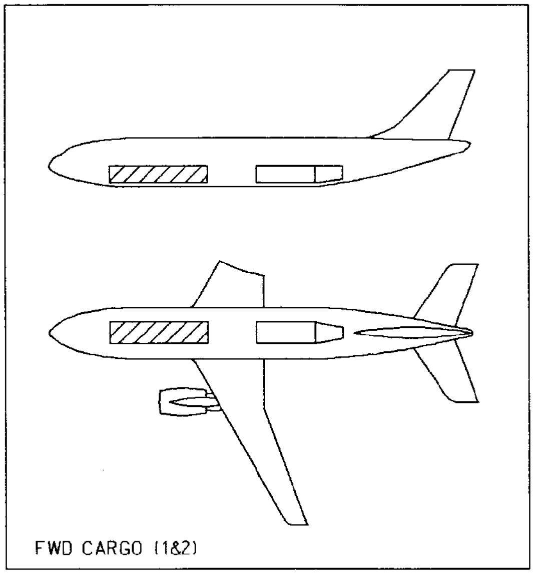
MAX CONTAINER WEIGHT		
IATA V3	IATA V1	IATA W3
1 587 kg (3 500 lb)	1 587 kg (3 500 lb)	3 175 kg (7 000 lb)

MAX PALLET WEIGHT	
IATA A2 (88 × 125 in)	IATA W2 (60.4 × 125 in)
4 627 kg (10 200 lb)	3 175 kg (7 000 lb)

R MAXIMUM CUMULATIVE LOAD (1 + 2) : 12 700 kg
R (28 000 lbs)

Non certified containers are limited to 1284 kg (2830 lb) for half size containers and to 2568 kg (5660 lb) for full size containers.





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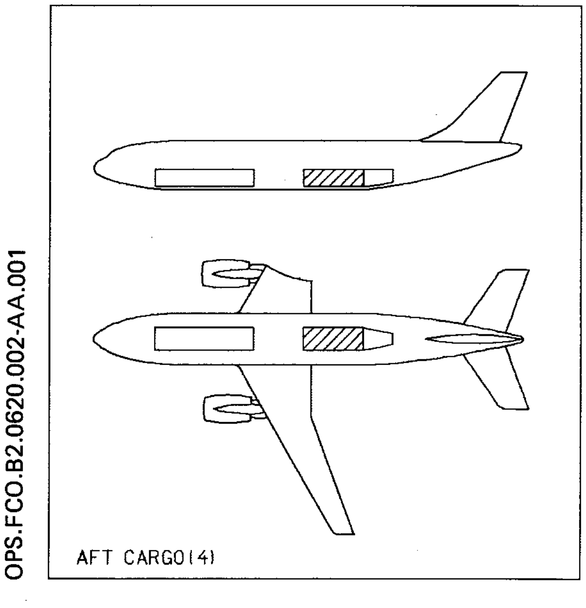
3. AFT CARGO COMPARTMENT

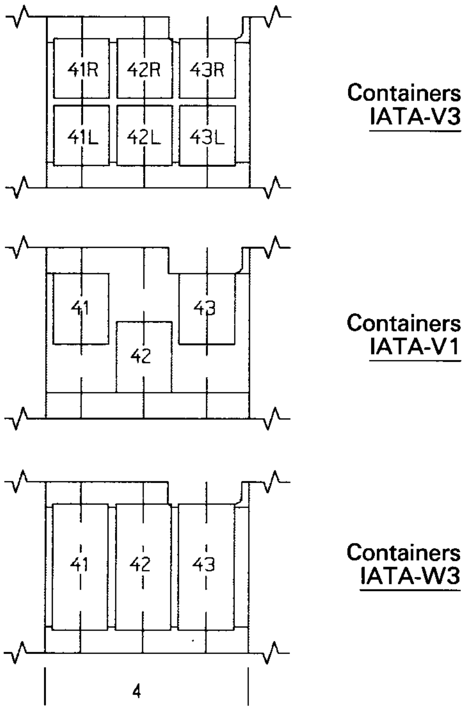
The AFT cargo is provided with a semi automatic loading system and is designed to carry containers. It is prohibited to carry bulk freight in this cargo.

R	MAX CONTAINER WEIGHT		
R	IATA V3	IATA V1	IATA W3
R R	1 587 kg (3 500 lb)	1 587 kg (3 500 lb)	3 175 kg (7 000 lb)

R MAXIMUM OVERALL LOAD WEIGHT : 9 525 kg (21 000 lb)

Non certified containers have the same limitations.





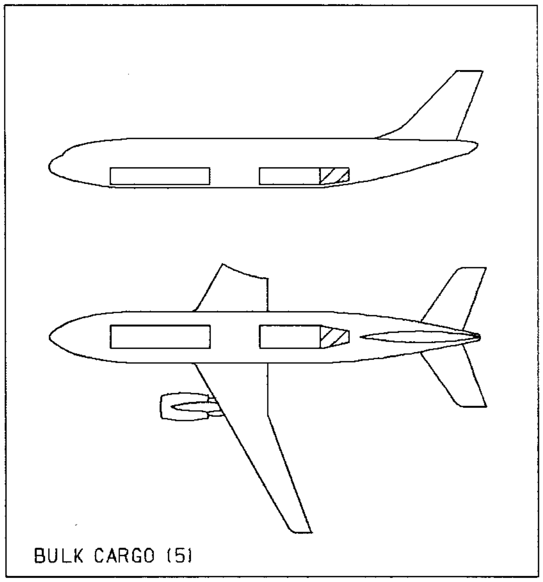
Vers. : All

Eng. : All

4. BULK CARGO COMPARTMENT

This compartment is provided for bulk freight loading and the transportation of livestock.

	Zone	A	B1	B2	C	TOTAL
BULK CARGO	MAX WEIGHT	1 840 kg (4 055 lb)	656 kg (1 445 lb)	274 kg (600 lb)	door area	2 770 kg (6 100 lb)
	Max distributed unit load on the floor : 732 kg/m2 (150 lb/ft2) Max local load on the floor : 272 kg/ft2 (600 lb)					



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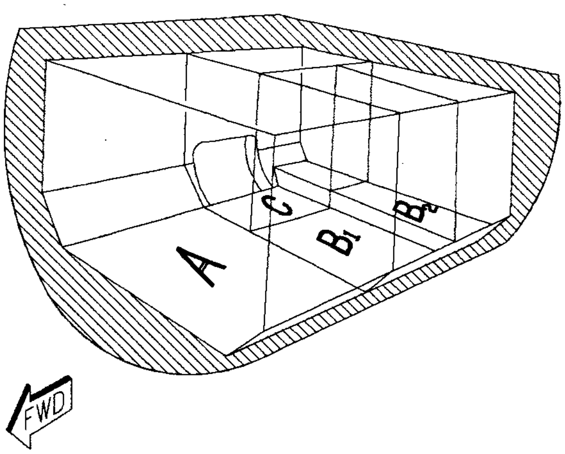

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STD or Mod : (4010/FDX)

1 – GENERAL INFORMATION

A – MAXIMUM TOTAL FUEL CAPACITY :

	LITERS	US GAL
OUTER TANKS	7 400	1 955
INNER TANKS	27 900	7 371
CENTER TANK	19 640	5 189
TRIM TANK	6 150	1 625
TOTAL	61 090	16 140

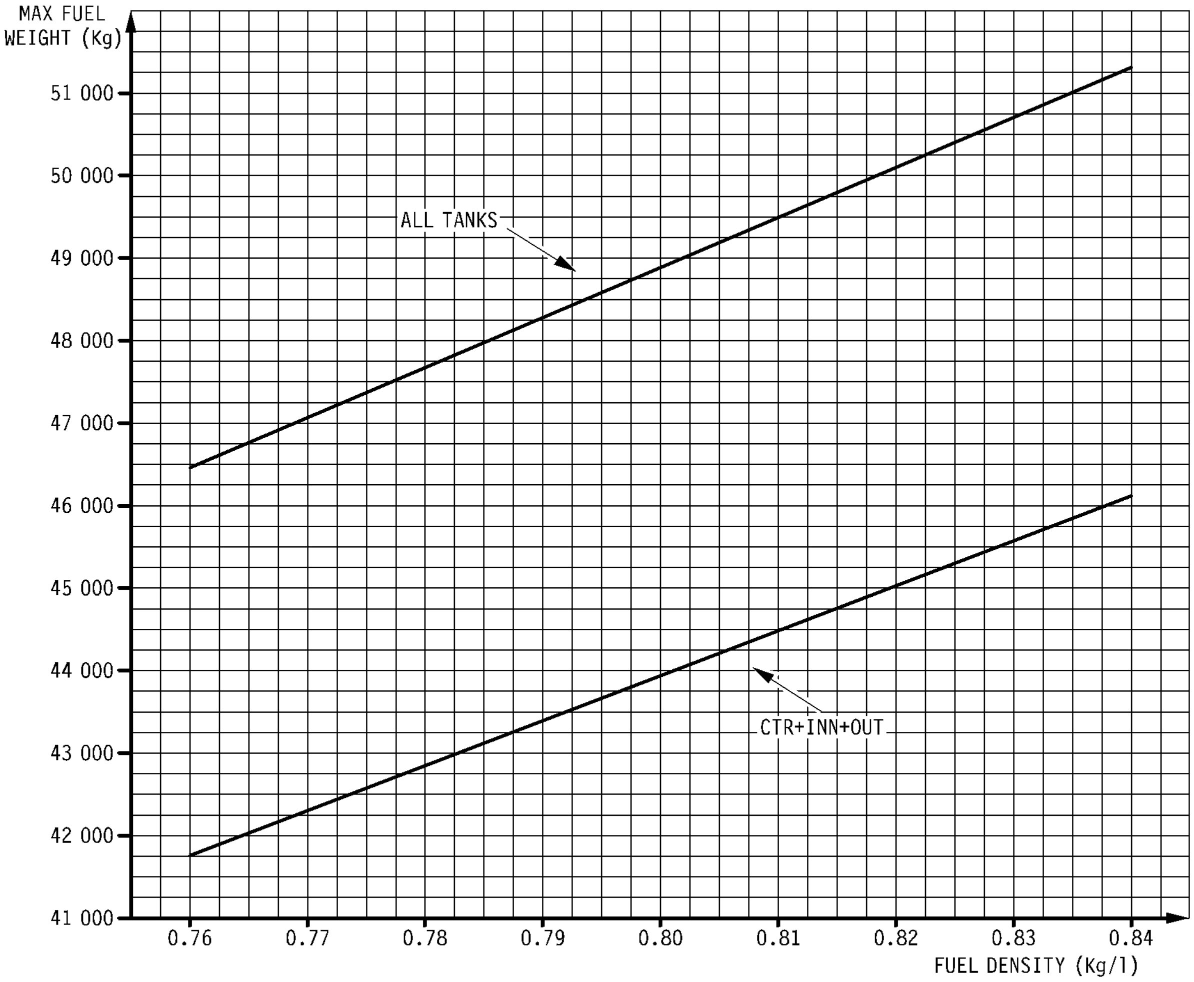
CUMULATIVE FUEL CAPACITY

	LITERS	US GAL
INN + OUT	35 300	9 326
CTR + INN + OUT	54 940	14 515
ALL TANKS	61 090	16 140

R

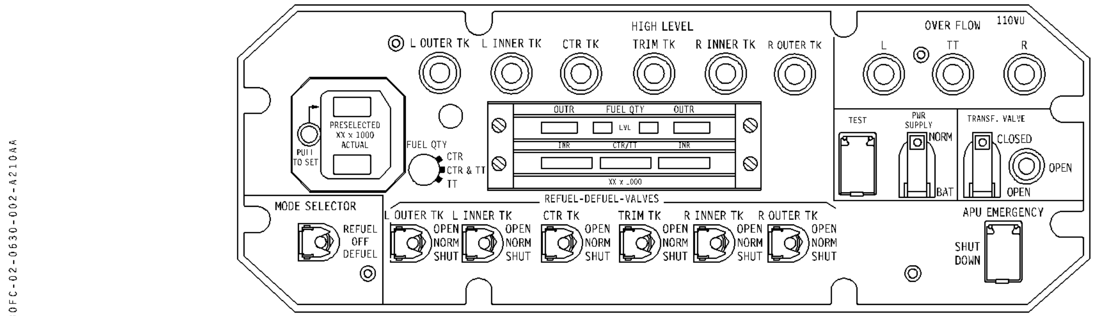
B – MAXIMUM FUEL WEIGHT :

R



Mod. : 4801

C – REFUEL/DEFUEL CONTROL PANEL



- During automatic refueling all tanks receive fuel simultaneously.
  Tanks become full in the order outers, inners center and trim. For manual refueling the tanks must be filled : outers, inners, center and trim.
- With the tanks filled to the maximum nominal total fuel capacity, there is sufficient space in each tank to allow a 2 % thermal expansion of fuel without spillage through the vent system.
- The vent tank in each wing has a volume of 190 liters (50 US GAL). The vent tank in trim tank has a volume of 120 liters. (32 US GAL).
- If necessary during refueling procedures, close relevant refuel/defuel valves(s) to isolate associated tank(s) as required.

2 – REFUELING PROCEDURE

- Position access platform for access to refuel/defuel couplings. Observe the safety precautions and make certain that tanker and aircraft are properly grounded. Connect tanker-to-aircraft grounding cable to grounding point on main landing gear.

CAUTION

Do not use fuel pump 1 of left inner tank or/and fuel pump 2 of right inner tank, because of the risk of overfueling the inner tank through the refueling drain valve. If a pump is required use pump 2 of left inner tank or pump 1 of right inner tank.

On overhead panel, check TRIM TK MODE p/b is in AUTO position. Selection of TRIM TK MODE p/b in FWD position prevents refueling of TRIM TK and may lead to fuel spillage.

FUELING PANEL

- Set PWR SUPPLY switch to BAT if aircraft electrical network is to be powered by aircraft on-board batteries, otherwise check that NORM position is selected.
- Press TEST pb and check :
  - · six HIGH LEVEL plus three OVERFLOW lights come on,
  - · within 2 seconds all 8's are displayed on FUEL QTY, PRESELECTED and ACTUAL indicators.
  - R · The display changes to 7's for 30 seconds, if the
    R system is operational, or becomes blank, for fault
    R condition.

- Check TRANSF VALVE switch is at CLOSED position and guarded. OPEN light is off.

AUTOMATIC REFUELING	MANUAL REFUELING
– Check REFUEL/DEFUEL VALVE switch are at NORMAL position and guarded	– Raise REFUEL/DEFUEL VALVE switch guards and place all switches in SHUT position
– Pull preselector knob and rotate to set required fuel quantity	– Place MODE SELECTOR switch in REFUEL position
– Push preselector knob	– Place appropriate tank REFUEL/DEFUEL VALVES switch(es) in OPEN position.
Note : *When preselector knob is pulled ACTUAL contents display goes off*	– Start refueling
– Place MODE SELECTOR switch in REFUEL position.	– Monitor individual tank contents on FUEL QTY indicator and select appropriate tank REFUEL/DEFUEL VALVE switch(es) to SHUT as tank contents reach required fuel.
– Start refueling.	
Note : *No further action is necessary until refueling is completed.*	

Notes :
1. *Total time to fill wing tanks is approximately 19 minutes.*
2. *Total time to fill all the tanks is approximately 27 minutes.*
3. *As tanks become full, refuel valves will be automatically closed by high level sensors, and appropriate tank HIGH LEVEL light will illuminate.*
4. *CGCC goes to alternate mode at the end of refueling if aircraft is only electrically powered by batteries or maintenance buses (due to fuel tank calibration sensors not powered during refueling).*
5. *If any REFUEL/DEFUEL VALVE switch is selected out of NORMAL position during AUTOMATIC refueling, the preselected fuel quantity may not be reached.*
6. *During manual refueling the TRIM TANK can only be refueled if either 1) both inner tanks are at high level or 2) the CTR TK REFUEL/DEFUEL VALVE switch is also selected OPEN.*

Mod. : 4801 + 6874

- After refueling, check that ACTUAL quantity is within 100 kg (or 220 lbs) of PRESELECTED quantity.
- Place FUEL QTY switch in CTR position and then in TT position and check that disposition of fuel in center and trim tanks is correct.
- Place MODE SELECTOR switch in OFF position and guarded.
- Check/set all REFUEL/DEFUEL VALVE sw in NORM position and guarded.
- If applicable, place PWR SUPPLY sw in NORM position and guarded.

Note : *APU Starts or shutdowns are permitted during refuel procedures. If it is necessary to operate the APU, the following limits apply :*
1. An APU start is not permitted during a refuel procedure if the APU has failed to start or an automatic shutdown has occurred.
R *2. An APU shutdown must be completed if a fuel spill has occurred during the refuel procedure.*

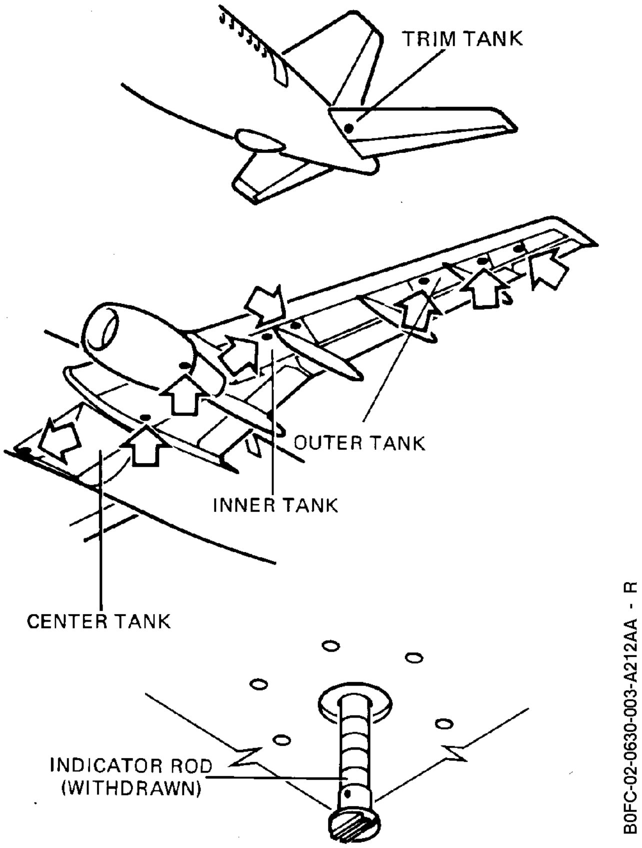
3 – OVERWING (GRAVITY) FILLING

Note : *The inner and outer tanks may be gravity filled. The center and trim tanks are replenished by transferring fuel from the wing tanks using the aircraft transfer system.*

- Position access platform for access to overwing refueling caps and attach refueling hose grounding cable to grounding connection at overwing refueling cap. Remove overwing refueling cap.
- Commence filling, monitor quantity of fuel delivered on FQI, and observe the HIGH LEVEL indicator lights on refuelling panel.
  Stop filling when required fuel level is reached or when HIGH LEVEL indicator light(s) come on.
- Replenish center and trim tanks by transferring fuel from inner tanks. Complete replenishment of inner tanks.

4 – USE OF MANUAL (MAGNETIC) INDICATORS

Note : *Indicators are disposed as follows :*
- Three in each outer tank.
- four in each inner tank.
- one in center tank.
- one in trim tank (used only to check trim tank empty).



- Read and note attitude of aircraft pitch and roll axes on clinometers in main landing gear bay
- Position access platform
- Unlock indicator rod with screwdriver and slowly withdraw rod until magnetic attraction between rodand float magnets is felt.

Note : *Do not use force when withdrawing indicator rod as this will disengage float magnet from rod magnet and bring rod down on to mechanical stop.*

- Note the graduation on rod which aligns with wing bottom surface.
- Compare reading with fuel Quantity Chart, using fuel specific gravity and aircraft attitude readings noted previously.
- Replace indicator rod and lock with screwdriver.

Mod : 4801 + 6605

II. Increase in loading flexibility by manual refuelling

The manual refuelling procedures given hereafter are applicable when the following conditions are met all together :

- Fuel planning does not require total fuel capacity (full trim tank capacity not necessary).
- Fuel planning requires more than 28 tons (both inner tanks full).
- TOCG is outside the TO limit and therefore dispatch is not allowed.

In these conditions, the dispatch can become possible by filling partially the trim tank (even if the center tank is not full). First of all, using trim tank CG correction, determine how much fuel must be filled in trim tank to get the TOCG inside the TO limit.

Then apply one of the two procedures described hereafter :

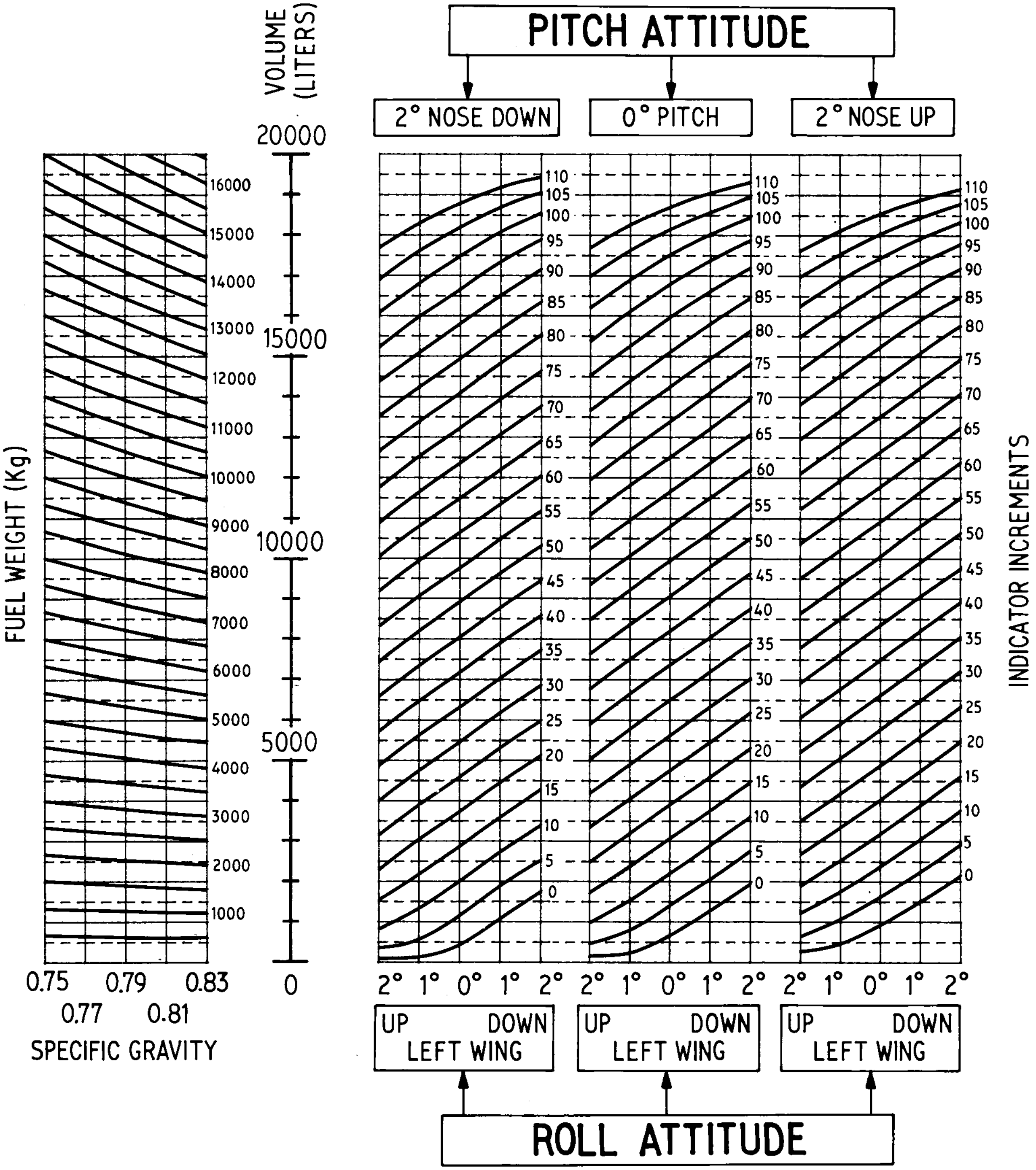
a) First procedure
   - Lift REFUEL/DEFUEL VALVE switch guards and place all switches in SHUT position.
   - Place MODE SELECTOR switch in REFUEL position.
   - Refuel OUTER and INNER TANKS by selecting corresponding REFUEL/DEFUEL VALVE switches in OPEN position and then in SHUT position when reaching HIGH LEVEL. (HIGH LEVEL light illuminated for both INNER TKs). R R
   - Place CTR and TRIM TK REFUEL/DEFUEL VALVE switches in OPEN position.
   - Refuel CTR and TRIM TANKS. When reaching required fuel quantity, set corresponding REFUEL/DEFUEL VALVE switches in SHUT position.

   Note : *Make sure that at least 500 kg of fuel goes through the cadensicon (Right Inner tank).*

b) Second procedure
   - Perform the refuelling as usually by selecting the required fuel quantity on the preselector.
   - Transfer the required fuel quantity from center tank to trim tank as follow :
     - On overhead panel select both CTR TK PUMPS ON and select FUEL X-FEED valve IN LINE.
     - On refuel/defuel panel :
       - ● keep MODE selector on REFUEL position
       - ● set TRANSFER VALVE to OPEN position
       - ● raise TRIM TK REFUEL/DEFUEL VALVE switch guard
       - ● set TRIM TK REFUEL/DEFUEL VALVE switch to OPEN
       - ● when reaching required fuel quantity in trim tank, set REFUEL/DEFUEL VALVE switch to SHUT
       - ● set TRANSFER VALVE to CLOSED position
       - ● set MODE selector on OFF position
       - ● set TRIM TK REFUEL/DEFUEL VALVE switch to NORM
   - On overhead panel select both CTR TK PUMPS OFF and select FUEL X-FEED valve CROSS-LINE.

Mod. : 4801

SECONDARY FUEL GAUGING SYSTEM
– MANUAL (MAGNETIC) LEVEL INDICATORS CTR TANK



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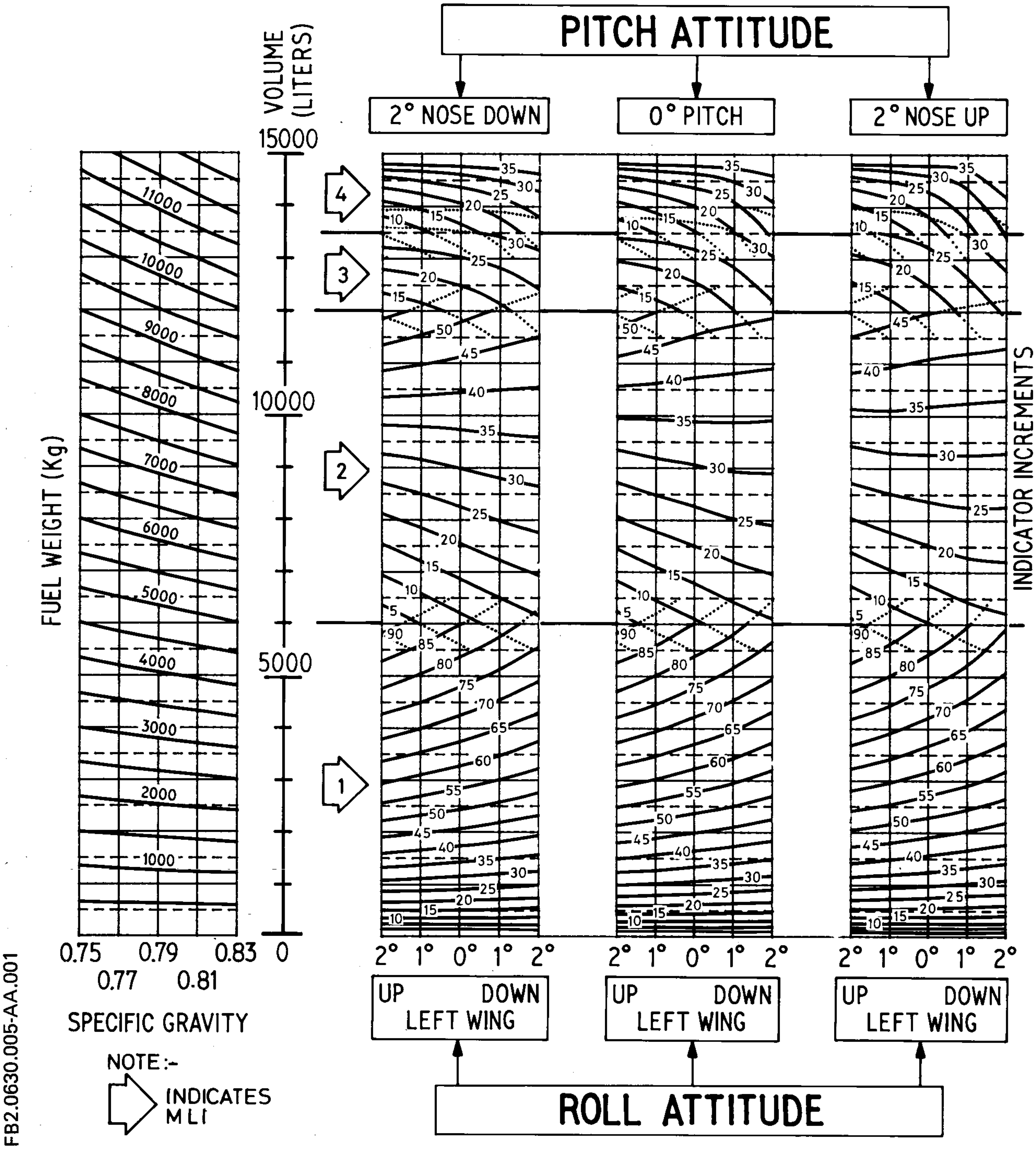
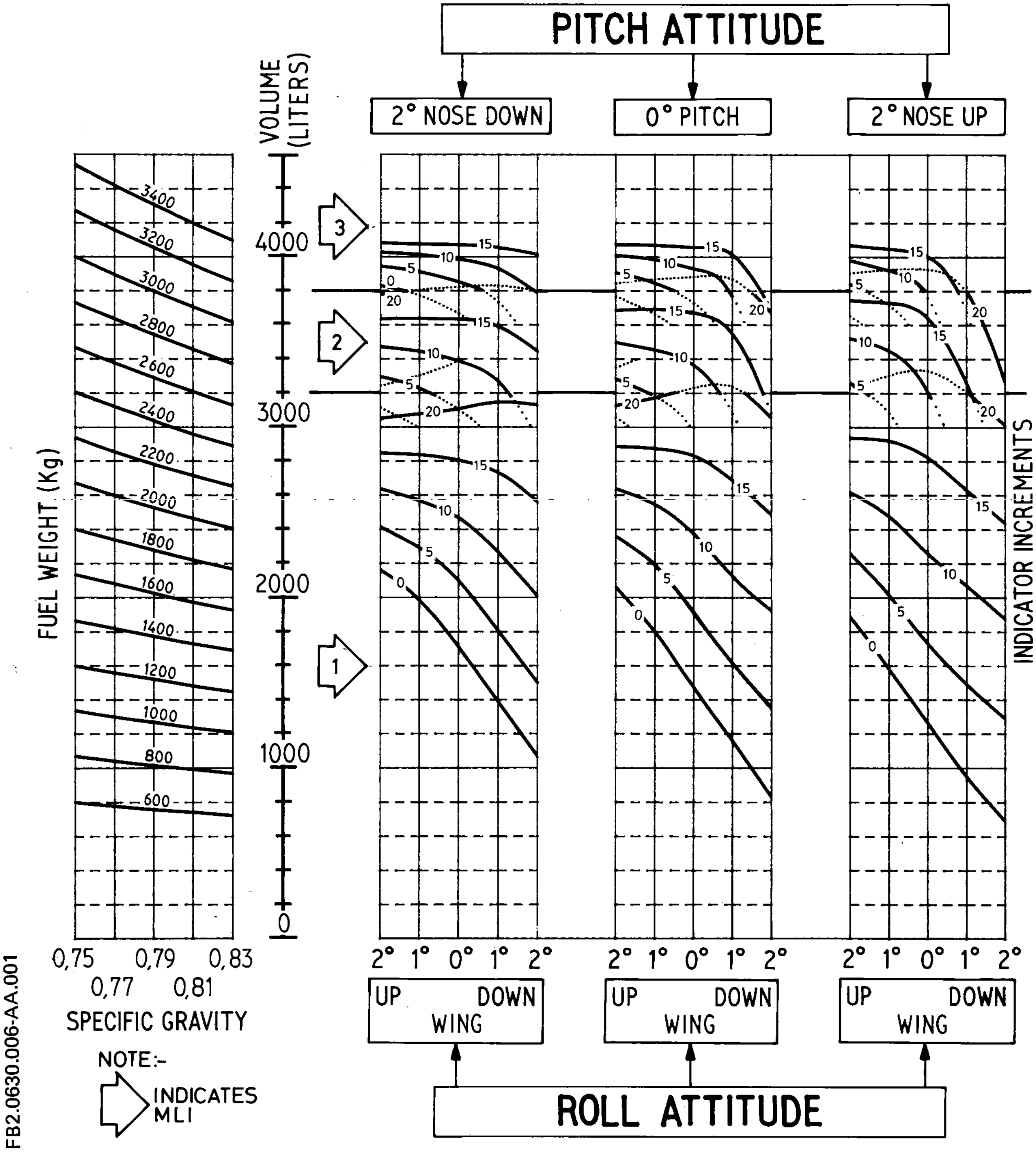
Vers. : All

Eng. : All

SECONDARY FUEL GAUGING SYSTEM
– MANUAL (MAGNETIC) LEVEL INDICATORS INNER TANKS



SECONDARY FUEL GAUGING SYSTEM
– MANUAL (MAGNETIC) LEVEL INDICATORS OUTER TANKS



5 – DEFUELLING PROCEDURE

- Position platform for access to refuel/defuel couplings. Observe the safety precautions and make certain that tanker and aircraft are properly grounded. Connect tanker-to-aircraft grounding cable to grounding point on main landing gear.
- For suction defuelling set PWR SUPPLY switch to BAT if aircraft electrical network is to be powered by aircraft on board batteries, otherwise check that NORM position is selected.
  For defuelling by means of tank pumps, electrical supply by EXT PWR or APU is required.

DEFUELLING BY MEANS OF SUCTION

- Check TRANS VALVE is closed, the switch is guarded, OPEN light is off.
- Set the MODE SELECTOR switch to DEFUEL position.
- Set the REFUEL/DEFUEL VALVE switch of the tank to be defuelled to OPEN position.
- Start defuelling by applying suction.

DEFUELLING BY MEANS OF TANK PUMPS

CAUTION : TRIM TANK MUST BE DEFUELLED BEFORE DEFUELLING OTHER TANKS

a) Trim tank

- Set the MODE SELECTOR switch to DEFUEL position.
- Set the TRIM TK REFUEL/DEFUEL VALVE sw to OPEN.

On the overhead panel :

- Set one or two TRIM TK PUMP to NORM.
- Check the pumps of the other tanks are OFF.
- Reset the REFUEL/DEFUEL panel to normal configuration.

b) Outer, inner and center tanks.

- Check REFUEL/DEFUEL VALVE switches are in NORMAL position.
- Check the MODE SELECTOR switch is in the OFF position.
- Set the TRANSFER VALVE sw to OPEN position.
  Check OPEN light is on.

On the overhead panel :

- Set the X-FEED switch to OPEN position (pressed-in, flowbar in line).
- In each tank to be defuelled set one or two PUMPS to NORM.
- Checks the pumps of the tanks not to be defuelled are OFF.

Note : For INR tanks use only PUMP 2 of left tank and PUMP 1 of right tank.

Note : Switch OFF PUMPS when corresponding tank becomes empty (Fuel qty indications, PUMP FAULT lights, ECAM LO PRESS indication).

- After defuelling, reset overhead FUEL panel and REFUEL/DEFUEL panel to NORMAL configuration.

Mod. : 4801

Note : APU Starts or shutdowns are permitted during defuel procedures. If it is necessary to operate the APU, the following limits apply :
1. *An APU start is not permitted during a defuel procedure if the APU has failed to start or an automatic shutdown has occurred.*
2. *An APU shutdown must be completed if a fuel spill has occurred during the defuel procedure.* R

6 – FUEL TRANSFER PROCEDURE

. **On the REFUEL/DEFUEL panel** :

a) Transfer from outer, inner or center tanks.
- Set the MODE SELECTOR switch to REFUEL position.
- Set the REFUEL/DEFUEL VALVE switches of the tanks to be filled to OPEN position.
- Set the REFUEL/DEFUEL VALVE switches of the tanks not to be filled to SHUT.
- Set the TRANSF VALVE switch to OPEN.
  Check the OPEN light is on.

. **On the overhead FUEL panel** :
- Set the X-FEED pb switch to OPEN (pressed in flowbar in line).
- Check the PUMPS of the tanks not to be defuelled are OFF.
- Set one or two PUMPS for each tank to be defuelled ON.

Note : For inner tank defuelling, use only pump 2 of left tank or/and pump 1 of right tank.

b) Transfer from trim tank to center tank.
- Check sufficient space is available in the center tank.

. On the overhead FUEL panel :
- Set trim tk Mode pushbutton to Fwd.
  - Set one or two TRIM TK PUMPS ON.
- Monitor the center Tank Fuel quantity to ensure it is not overfilled.

c) Transfer from trim tank to inner or outer tanks
- Check sufficient space is available in the tank to receive fuel

On the REFUEL/DEFUEL panel
- Set MODE SELECTOR switch to DEFUEL position
- Set the REFUEL/DEFUEL VALVE switches of the tanks to be filled to OPEN.
- Set the REFUEL/DEFUEL VALVE switches of the tanks not to be filled to SHUT.
- Set the TRIM TK REFUEL/DEFUEL VALVE switch to OPEN

On the overhead FUEL Panel :
- Set one or two TRIM TK PUMPS ON.

After fuel transfer, reset overhead FUEL panel and REFUEL/DEFUEL panel to NORMAL configuration, as follows :

- ALL FUEL PUMPS . . . . OFF unless required
- TRIM TK MODE . . . . AUTO
- All REFUEL/DEFUEL VALVES . . . Set/Check NORM
- TRANSF. VALVE . . . . Set CLOSED and check amber OPEN light off
- FUEL quantity/distribution . . . . .Check
- REFUEL PANEL . . . check NORMAL configuration and close door.

7 – REFUELLING WITH ONE ENGINE RUNNING

A. Particular requirements

- Obtain airport authorization.
- Refuelling with one engine running is only permitted at such airports where no external ground pneumatic power is available while APU is unserviceable.
- The refuelling system must be fully operational.
- The overwing fuelling is not permitted.

B. Procedure

- Keep the left hand engine (n° 1) running.
- The aircraft shall be positioned into the wind and at a position where the slope is negligible.
- Parking brakes must be set and pressure checked.
- Passengers must be disembarked. Disembarkation must be done on the right side of the aircraft.
- The airport Fire Department must be alerted to standby at the aircraft during the entire refuelling procedure.
- Position the fuel truck under the extremity of the right hand wing. Its pressure will be limited to 30 psi. The monitoring of the fuel truck shut off valve is performed during all the refuelling.
- Engines may not be started (n° 2) or shutdown (n° 1) and no attempt to start the inoperative APU should be made before the refuelling operation has been terminated and all fuelling operation has been performed by the fuelling company.
- Refuelling operation should only be commenced after having ensured that permanent control of the emergency fuel shut off device during the entire fuelling operation is performed by the fuelling company.
- A flight crew member has to monitor from the cockpit all systems and the running engine, for the entire duration of the operation.
- A qualified ground crew member has to be present at the fuelling station to operate the refuel valve switches.
- Filling of fuel tanks shall be discontinued before the HIGH LEVEL DETECTORS are operative, to ensure that spillage does not occur from the vent outlets.

- The following fuel quantities must not be exceeded. Therefore it is necessary to monitor the refuelling and be prepared to close the REFUEL DEFUEL VALVES.

DENSITY (KG/L)

	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84
L OUTR (KG)	2700	2740	2775	2810	2845	2880	2915	2950	2985
L INR (KG)	10090	10220	10355	10485	10620	10750	10885	11020	11150
CTR (KG)	14195	14380	14565	14755	14940	15125	15315	15500	15685
R INR (KG)	10090	10220	10355	10485	10620	10750	10885	11020	11150
R OUTR (KG)	2700	2740	2775	2810	2845	2880	2915	2950	2985
TRIM TK (KG)	4370	4425	4485	4540	4600	4655	4715	4770	4830
ACT 1 or 2 (IF INSTALLED)	5035	5100	5165	5230	5300	5365	5430	5495	5565

Mod : 4801

LOAD and TRIM SHEET

This chart allows the determination of the CG location (MAC) of the aircraft function of dry operating weight, pantry adjustments, cargo load, passengers and fuel on board.

To allow dispatch of the aircraft, it must be checked that ZFCG and TOCG are within corresponding limits.

The operational limits shown on the load and trim sheet are more restrictive than the certified limits because error margins have been taken into account.

The load and trim sheet needs to be updated when :

– a modification which changes the aircraft certified limit is included.
  or
– a modification (cabin layout, cargo arrangement) which influences the operational limist is made.

It is the airline responsibility to define a load and trim sheet and to keep it to date.

UTILIZATION

1) Example 1 (see 2.06.40, page 3).

DRY OPERATING WEIGHT 83 000 kg and H-ARM = 26.7
DEVIATION OR ADJUSTMENTS :
  + 200 kg in the FWD galley (zone D)
  +100 kg in the AFT galley (zone F)
CARGO
  8000 kg (2000 kg in CARGO 1, 2000 kg in CARGO 2
  2000 kg in CARGO 4, 2000 kg in CARGO 5)
PASSENGERS
  160 PAX (75 kg)
ZERO FUEL WEIGHT
  103 300 kg
FUEL
  38 000 kg
TOTAL WEIGHT
  141 300 kg

a) Carry forward the master data in **1**

b) Compute the DRY OPER. WT INDEX using the corresponding formulae and carry forward it in **2**.

c) Apply index corrections according to weight deviations entered in **3** and write index correction in **5**.

  200 kg in zone D : – 0.8 × 2 = – 1.6
  100 kg in zone F : +0.7 × 1 = +0.7
  TOTAL = – 0.9

d) Compute corrected index : 51.23 – 0.9 = 50.33 and enter corresponding figure in **6**.

e) Enter index scale with corrected index in **7** and apply corresponding index variations according to CARGO and passenger loading through **8** scales and draw from the final point (cabin C) a vertical line down to the zero fuel weight determined on table **9**.

f) Check that the intersection is within the corresponding ZFW limit. If not it is necessary to rearrange cargo loading.

g) With table 10 determine fuel index correction : – 9 and apply corresponding correction on scale 11 to determine intersection of TAKE OFF weight line and take off weight index.

Check that the intersection is within the corresponding T.O limit. Read corresponding CG → 22.0 %.

h) On scale **12** enter with take off CG and determine corresponding T/O TRIM SETTING = 2 UP.

Notes : 1. The ZFW and T.O limits take into account :
. seating variations
. in flight movements
. asymmetric loading on pallets/containers
. Unit Load Device (ULD) variations
. fuel consumption
. landing gear and flap movement
2. For fuel economy it is recommended to distribute the loads in order to obtain a CG position as rear as possible. 2) Example 2 (see 2.06.40 pages 5 and 6).

2) Example 2 (see 2.06.40 pages 5 and 6)

Same conditions as for example 1 except :
  Cargo 4 empty   Cargo 5 : 1000 kg
  Fuel : 42 000 kg
  Total weight : 142 300 kg

Proceed as described in example 1 up to take off weight determination.

In this example, the take off weight is out of the T.O limit. It is possible to get the TOCG inside the T.O limit (and therefore to allow the dispatch) by filling partially the trim tank.

a) Refuelling already performed (see 2.06.40 page 5)

Determine the minimum fuel quantity in trim tank to get the TOCG inside the operational limit : 600 kg.

Apply a manual refuelling procedure to transfer 600 kg from center tank to trim tank.

Read corresponding CG → 20.5 %.

b) Refuelling not performed (see 2.06.40 page 6)

Apply a manual refuelling procedure to fill the trim tank with 1000 kg of fuel.

Note : *Whatever the take off CG is, filling 1000 kg of fuel in the trim tank ensures that the take off CG moves enough rearward to be inside the T.O limit.*

Read corresponding CG → 21.5 %

3) Example 3 (see 2.06.40 page 2B)

Determination of Fuel Correction Index with Trim Tank Fuel.

a) Required Fuel Weight is 43 000 kg
  Fuel Density = 0.79

Read from FUEL INDEX TABLE (TRIM TANK ASSUMED EMPTY) Index = – 15.4, no fuel inTrim Tank.

But after refuelling, due to systems inaccuracy, wings are full and 300 kg are in fact in Trim Tank.

Read from FUEL INDEX CORRECTION (TRIM TANK NOT EMPTY) Index = – 12.9

So T.O. C.G. should be corrected using this value in the FUEL CORRECTION.

b) Required Fuel Weight is 45 000 kg, density =0.8

Read ASSUMED FUEL WEIGHT IN TRIM TANK = 1048 kg.

For 1048 kg, FUEL INDEX CORRECTION = – 5.2.

But after refuelling, due to systems inaccuracy, wings are full and 1500 kg are in fact in trim tank.

Read from FUEL INDEX CORRECTION, for 1500 kg Index = – 0.5

So T.O. C.G. should be corrected using this value in the FUEL CORRECTION.

CAUTION

If the trim sheet on 2.06.40 page 2 is not customized to your airline you must not use it for day to day operation as margins and load C.G. vary with cabin and cargo layout.

R Code : 0364

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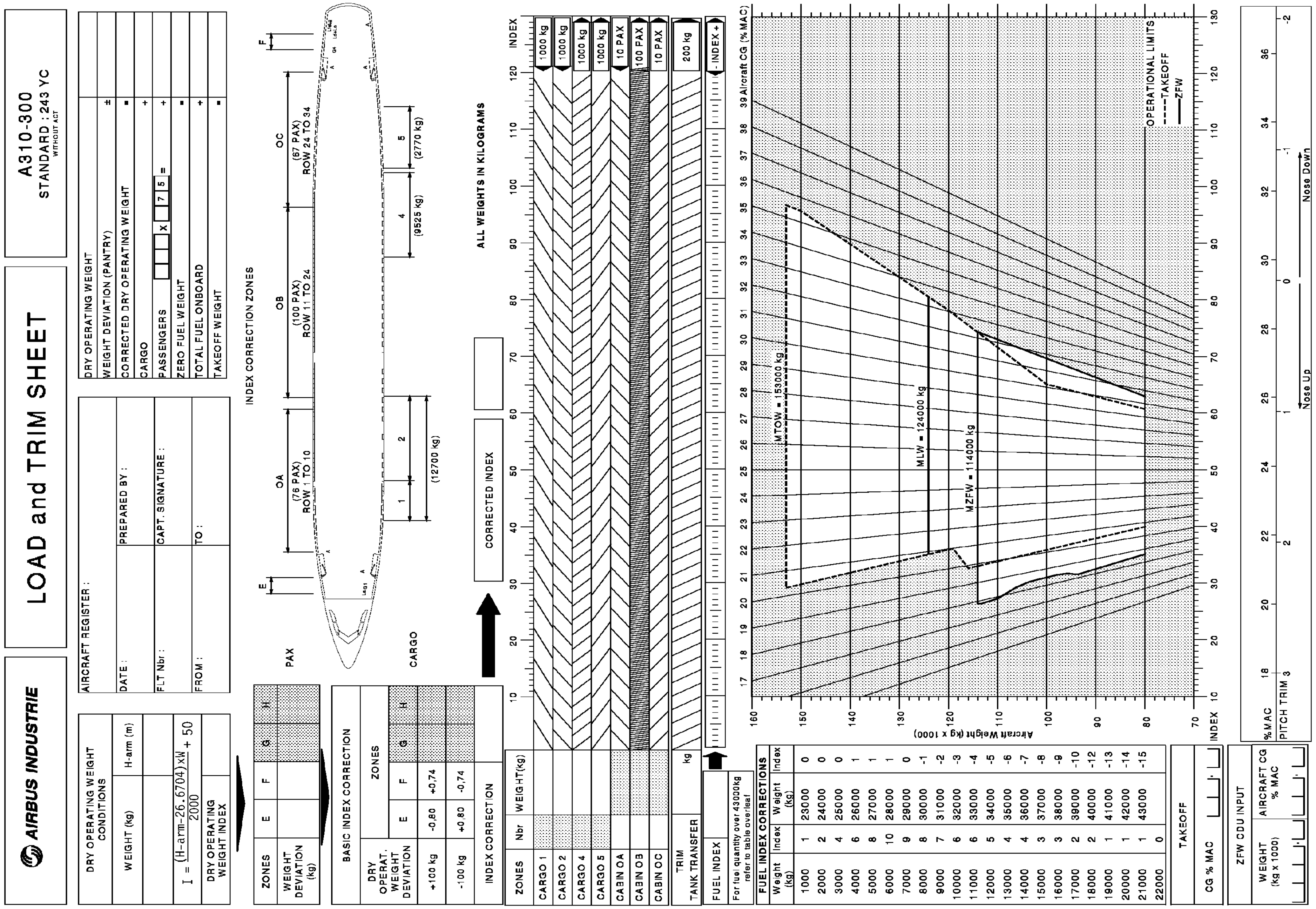


For fuel quantity over 43000kg refer to table overleaf

FUEL INDEX CORRECTIONS

Weight (kg)	Index	Weight (kg)	Index
1000	1	23000	0
2000	2	24000	0
3000	4	25000	0
4000	6	26000	1
5000	8	27000	1
6000	10	28000	1
7000	9	29000	0
8000	8	30000	-1
9000	7	31000	-2
10000	6	32000	-3
11000	6	33000	-4
12000	5	34000	-5
13000	4	35000	-6
14000	4	36000	-7
15000	3	37000	-8
16000	3	38000	-9
17000	2	39000	-10
18000	2	40000	-12
19000	1	41000	-13
20000	1	42000	-14
21000	1	43000	-15
22000	0		

CAUTION

BEFORE USING THIS LOAD AND TRIM SHEET, CHECK THAT IT CORRESPONDS TO THE ACTUAL CONFIGURATION OF THE AIRCRAFT.

R Code : 0364

FUEL INDEX CORRECTION (FOR FUEL WEIGHT GREATER THAN 41000 KG)

Note : This table is valid only when used with the following formulae for the index :

$I = [(H\text{-}ARM - 26.6704) \times W/2000] + K$

or

$I = [(CG - 25) \times W \times 0.029]/1000 + K$

W in kg H-ARM in meters.

FUEL INDEX TABLE (TRIM TANK ASSUMED EMPTY)

WEIGHT (KG)	FUEL DENSITY (KG/L)										
	0.760	0.765	0.770	0.775	0.780	0.785	0.790	0.795	0.800	0.805	0.810
41200	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3	-13.0	-12.8	-12.6	-12.4	-12.2
41400	-14.9	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3	-13.0	-12.8	-12.6	-12.4
41600	-15.2	-14.9	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3	-13.1	-12.8	-12.6
41800		-15.2	-14.9	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3	-13.1	-12.9
42000		-15.5	-15.2	-14.9	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3	-13.1
42200			-15.5	-15.2	-14.9	-14.6	-14.3	-14.0	-13.8	-13.5	-13.3
42400				-15.5	-15.2	-14.8	-14.6	-14.3	-14.0	-13.8	-13.6
42600					-15.5	-15.1	-14.8	-14.6	-14.3	-14.0	-13.8
42800					-15.8	-15.4	-15.1	-14.8	-14.6	-14.3	-14.0
43000						-15.8	-15.4	-15.1	-14.8	-14.6	-14.3
43200							-15.7	-15.4	-15.1	-14.8	-14.6
43400							-16.1	-15.7	-15.4	-15.1	-14.8
43600								-16.0	-15.7	-15.4	-15.1
43800									-16.0	-15.7	-15.4
44000										-16.0	-15.7
44200										-16.3	-16.0
44400											-16.3

FOR THIS QUANTITY AND DENSITY IN THE SHADED AREA THERE IS FUEL IN TRIM TANK.
FOR INDEX CHECK FUEL WEIGHT IN TRIM TANK ONTABLE BELOW AND READ INDEX DEVIATION ON TABLE ON THE RIGHT.

ASSUMED FUEL WEIGHT IN TRIM TANK

WEIGHT (KG)	FUEL DENSITY (KG/L)										
	0.760	0.765	0.770	0.775	0.780	0.785	0.790	0.795	0.800	0.805	0.810
41200											
41400											
41600											
41800	46										
42000	246										
42200	446	171									
42400	646	371	96								
42600	846	571	296	22							
42800	1046	771	496	221							
43000	1246	971	696	421	147						
43200	1446	1171	896	622	347	72					
43400	1646	1371	1096	822	547	272					
43600	1846	1571	1296	1022	747	472	197				
43800	2046	1771	1496	1222	947	672	397	123			
44000	2246	1971	1696	1422	1147	872	597	323	48		
44200	2446	2171	1896	1622	1347	1072	797	523	248		
44400	2646	2371	2096	1822	1547	1272	997	723	448	173	
44600	2846	2571	2296	2022	1747	1472	1197	923	648	373	99
44800	3046	2771	2496	2222	1947	1672	1397	1123	848	573	299
45000	3246	2971	2696	2422	2147	1872	1597	1323	1048	773	499
45200	3446	3171	2896	2622	2347	2072	1797	1523	1248	973	699
45400	3646	3371	3096	2822	2547	2272	1997	1723	1448	1173	899
45600	3846	3571	3296	3022	2747	2472	2197	1923	1648	1373	1099
45800	4046	3771	3496	3222	2947	2672	2397	2123	1848	1573	1299
46000	4246	3971	3696	3422	3147	2872	2597	2323	2048	1773	1499
46200	4446	4171	3896	3622	3347	3072	2797	2523	2248	1973	1699
46400	4646	4371	4096	3822	3547	3272	2997	2723	2448	2173	1899
46600		4571	4296	4022	3747	3472	3197	2923	2648	2373	2099
46800			4496	4222	3947	3672	3397	3123	2848	2573	2299
47000			4696	4422	4147	3872	3597	3323	3048	2773	2499
47200				4622	4347	4072	3797	3523	3248	2973	2699
47400					4547	4272	3997	3723	3448	3173	2899
47600					4747	4472	4197	3923	3648	3373	3099
47800						4672	4397	4123	3848	3573	3299
48000							4597	4323	4048	3773	3499
48200							4797	4523	4248	3973	3699
48400								4723	4448	4173	3899
48600									4648	4373	4099
48800									4848	4573	4299
49000										4773	4499
49200											4699
49400											4899

FUEL WEIGHT IN TRIM TANK IS ZERO.
FOR INDEX DEVIATION SEE TABLE ABOVE.

FUEL INDEX CORRECTION (TRIM TANK NOT EMPTY)

TRIM TANK WEIGHT (KG)	INDEX
100	-15.0
200	-14.0
300	-12.9
400	-11.9
500	-10.9
600	-9.8
700	-8.8
800	-7.8
900	-6.7
1000	-5.7
1100	-4.6
1200	-3.6
1300	-2.6
1400	-1.5
1500	-0.5
1600	+0.6
1700	+1.6
1800	+2.7
1900	+3.7
2000	+4.8
2100	+5.8
2200	+6.9
2300	+7.9
2400	+9.0
2500	+10.1
2600	+11.1
2700	+12.2
2800	+13.2
2900	+14.3
3000	+15.4
3100	+16.4
3200	+17.5
3300	+18.6
3400	+19.6
3500	+20.7
3600	+21.8
3700	+22.9
3800	+24.0
3900	+25.1
4000	+26.2
4100	+27.3
4200	+28.4
4300	+29.5
4400	+30.6
4500	+31.8
4600	+32.9
4700	+34.0
4800	+35.2
4900	+36.3

FOR TOTAL FUEL WEIGHT REQUIRED AND KNOWN OR ASSUMED DENSITY, FIND FUEL INDEX (TRIM TANK EMPTY) OR ASSUMED FUEL WEIGHT IN TRIM TANK. FROM THE ASSUMED FUEL WEIGHT IN TRIM TANK FIND THE AIRCRAFT FUEL INDEX CORRECTION. AFTER REFUELING, CHECK THE ACTUAL TRIM TANK WEIGHT AND COMPARE WITH THE ASSUMED FUEL WEIGHT IN TRIM TANK. IF THE DIFFERENCE IS GREATER THAN 50 KG, THE ACTUAL TRIM TANK WEIGHT MUST BE USED TO CALCULATE THE INDEX.

NOTE:
THESE TABLES ASSUME A NORMAL AUTOMATIC REFUEL WITH WINGS FULL IF THERE IS FUEL IN THE TRIM TANK.
FOR GROUND TRANSFERS TO TRIM TANK, USE THE "TRANSFER TRIM TANK" INDEX.

B0FC-02-0640-002B-A100AA - R

R Code : 0364

B0FC-02-0640-003-A100AA - R

AIRBUS INDUSTRIE

LOAD and TRIM SHEET

A310-300
STANDARD : 243 YC
WITHOUT ACT

DRY OPERATING WEIGHT CONDITIONS	
WEIGHT (kg) ①	H-arm (m)
83 000	26.7

$$I = \frac{(H\text{-}arm-26.6704)xW}{2000} + 50$$

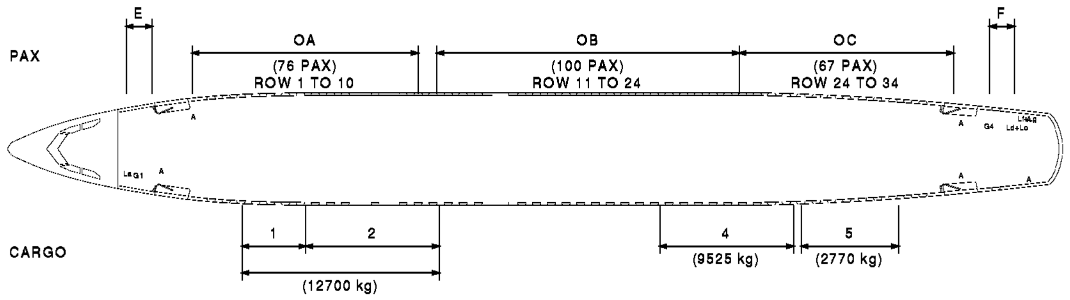
DRY OPERATING WEIGHT INDEX ② 51.23

AIRCRAFT REGISTER :	
DATE :	PREPARED BY :
FLT Nbr :	CAPT. SIGNATURE :
FROM :	TO :

DRY OPERATING WEIGHT		83 000
WEIGHT DEVIATION (PANTRY)	±	300
CORRECTED DRY OPERATING WEIGHT	=	83 300
CARGO	+	8 000 ⑨
PASSENGERS 160 x 75 =	+	12 000
ZERO FUEL WEIGHT	=	103 300
TOTAL FUEL ONBOARD	+	38 000
TAKEOFF WEIGHT	=	141 300

ZONES	E	F ③	G	H
WEIGHT DEVIATION (kg)	200	100		

INDEX CORRECTION ZONES



BASIC INDEX CORRECTION

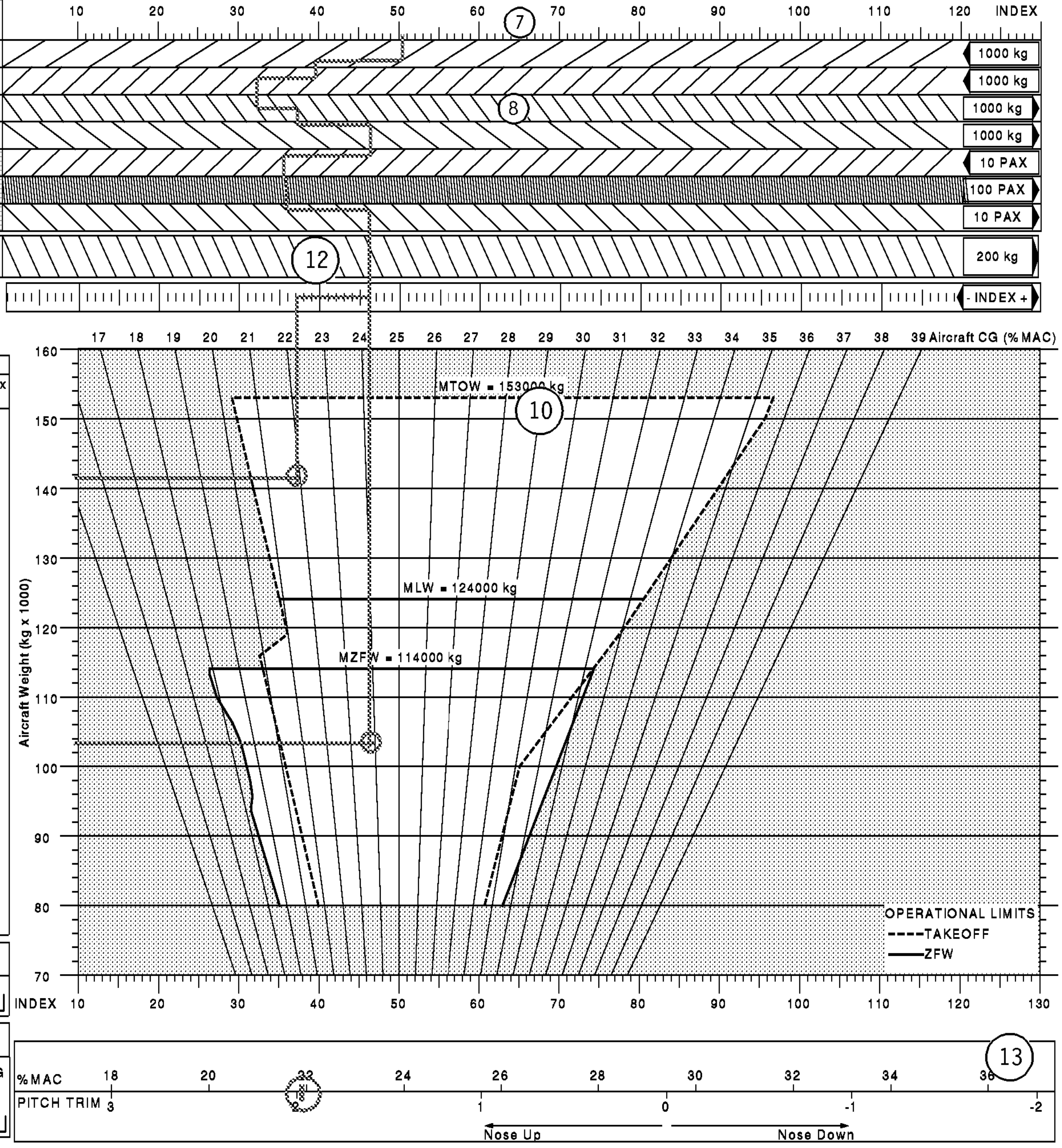
DRY OPERAT. WEIGHT DEVIATION	ZONES			
	E	F	G	H
+100 kg	-0,80	+0,74		
-100 kg	+0,80	-0,74		⑤
INDEX CORRECTION		-0.9		

CORRECTED INDEX ⑥ 50.33

ALL WEIGHTS IN KILOGRAMS

ZONES	Nbr	WEIGHT(kg)
CARGO 1		2000
CARGO 2		2000
CARGO 4		2000
CARGO 5		2000
CABIN OA	30	
CABIN OB	100	
CABIN OC	30	
TRIM TANK TRANSFER		kg
FUEL INDEX	-9	

For fuel quantity over 43000kg refer to table overleaf



FUEL INDEX CORRECTIONS

Weight (kg)	Index	Weight (kg)	Index
1000	1	23000	0
2000	2	24000	0
3000	4	25000	0
4000	6	26000	1
5000	8	27000	1
6000	10	28000	1
7000	⑪	9000	0
8000	8	30000	-1
9000	7	31000	-2
10000	6	32000	-3
11000	6	33000	-4
12000	5	34000	-5
13000	4	35000	-6
14000	4	36000	-7
15000	3	37000	-8
16000	3	38000	-9
17000	2	39000	-10
18000	2	40000	-12
19000	1	41000	-13
20000	1	42000	-14
21000	1	43000	-15
22000	0		

TAKEOFF
CG % MAC ☐☐☐.☐

ZFW CDU INPUT

WEIGHT (kg x 1000)	AIRCRAFT CG % MAC
☐☐☐☐.☐	☐☐☐.☐

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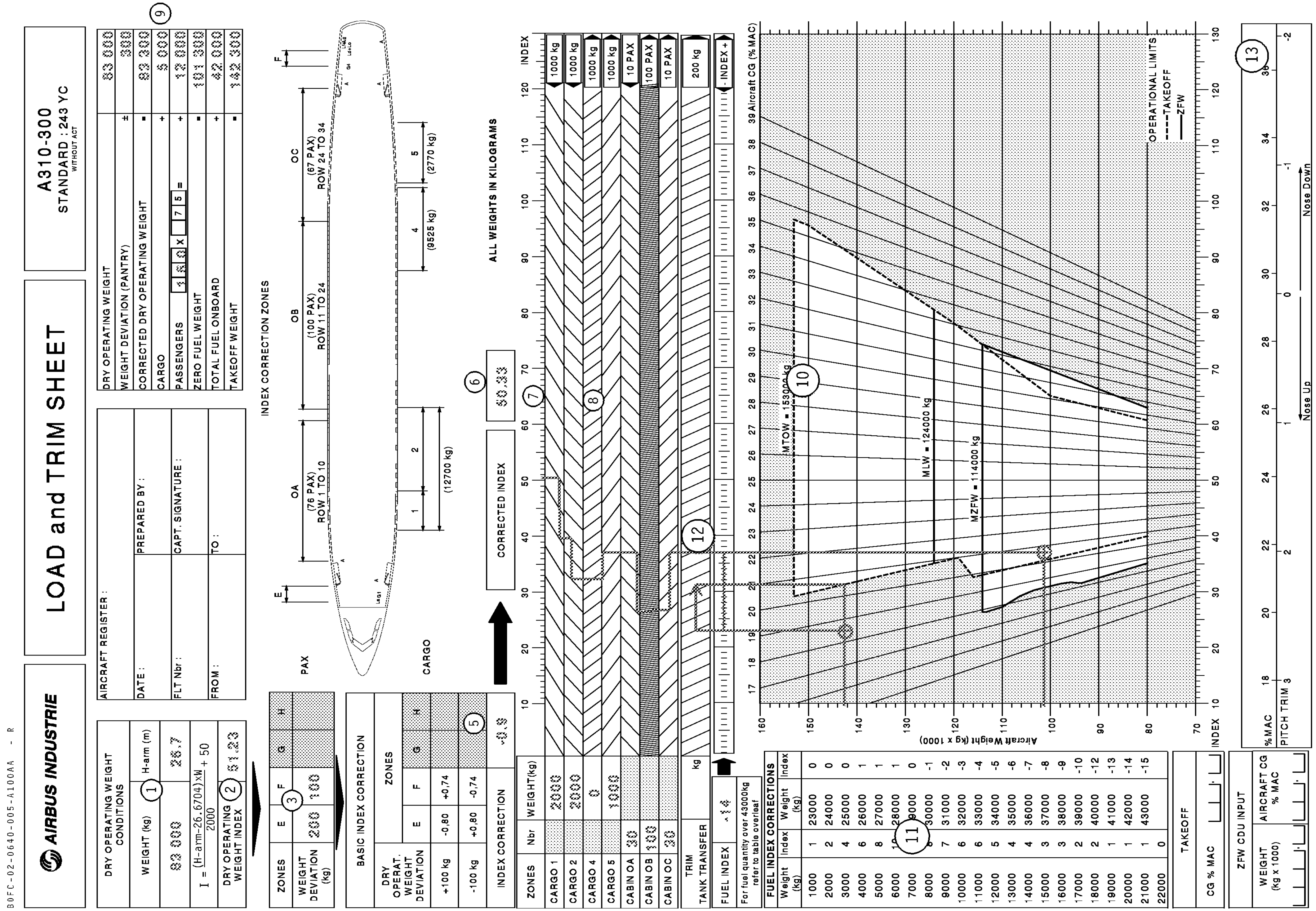
STD or Mod : 4801 or RJA



Weight (kg)	Index	Weight (kg)	Index
1000	1	23000	0
2000	2	24000	0
3000	4	25000	0
4000	6	26000	1
5000	8	27000	1
6000	10	28000	1
7000	11	29000	0
8000	9	30000	-1
9000	7	31000	-2
10000	6	32000	-3
11000	6	33000	-4
12000	5	34000	-5
13000	4	35000	-6
14000	4	36000	-7
15000	3	37000	-8
16000	3	38000	-9
17000	2	39000	-10
18000	2	40000	-12
19000	1	41000	-13
20000	1	42000	-14
21000	1	43000	-15
22000	0		

EXAMPLE : DO NOT USE FOR OPERATIONAL PURPOSE

R Code : 0364

B0FC-02-0640-006-A100AA - R

AIRBUS INDUSTRIE

LOAD and TRIM SHEET

A310-300
STANDARD : 243 YC
WITHOUT ACT

DRY OPERATING WEIGHT CONDITIONS	
WEIGHT (kg) ①	H-arm (m)
83 000	26.7

$$I = \frac{(\text{H-arm}-26.6704)\times W}{2000} + 50$$

DRY OPERATING WEIGHT INDEX ② 51.23

AIRCRAFT REGISTER :

DATE :

PREPARED BY :

FLT Nbr :

CAPT. SIGNATURE :

FROM :

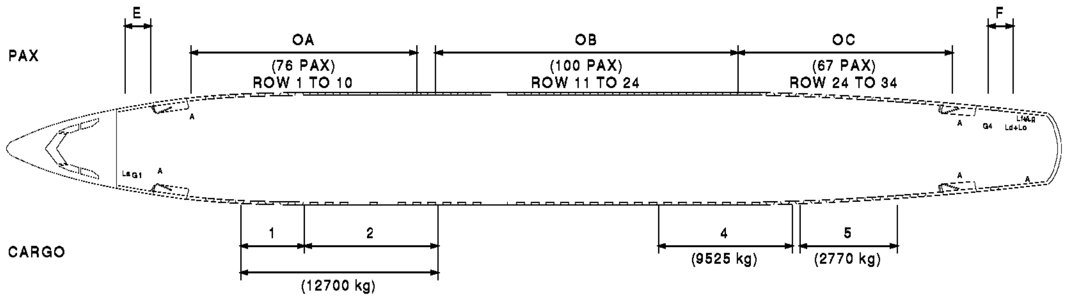
TO :

DRY OPERATING WEIGHT		83 000
WEIGHT DEVIATION (PANTRY)	±	300
CORRECTED DRY OPERATING WEIGHT	=	83 300
CARGO	+	5 000 ⑨
PASSENGERS 160 X 75 =	+	12 000
ZERO FUEL WEIGHT	=	101 300
TOTAL FUEL ONBOARD	+	42 000
TAKEOFF WEIGHT	=	142 300

ZONES	E ③	F	G	H
WEIGHT DEVIATION (kg)	200	100		

BASIC INDEX CORRECTION				
DRY OPERAT. WEIGHT DEVIATION	ZONES			
	E	F	G	H
+100 kg	-0,80	+0,74		
-100 kg	+0,80	-0,74	⑤	
INDEX CORRECTION			-0.9	

INDEX CORRECTION ZONES



CORRECTED INDEX ⑥ 50.33

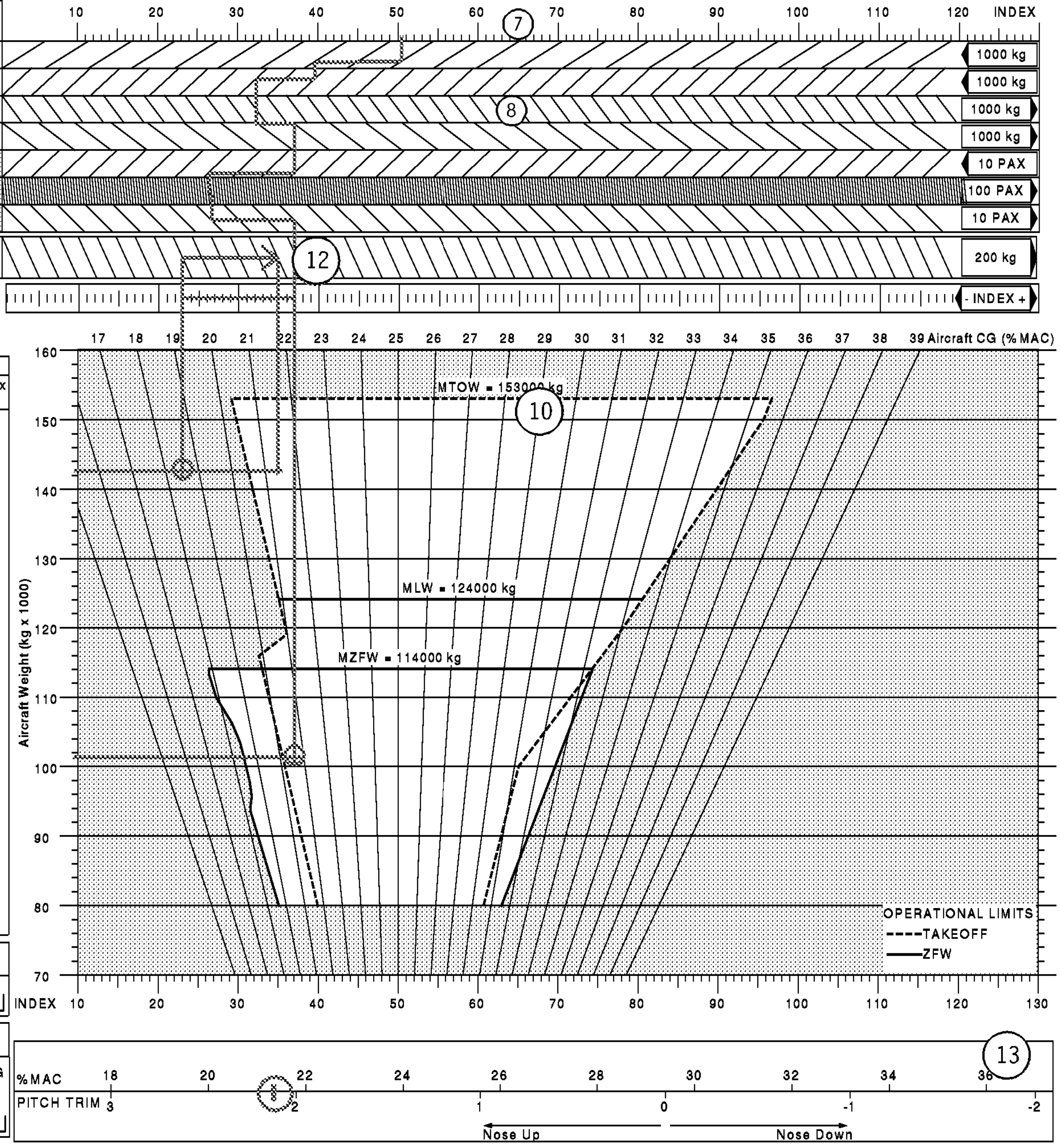
ALL WEIGHTS IN KILOGRAMS

ZONES	Nbr	WEIGHT(kg)
CARGO 1		2000
CARGO 2		2000
CARGO 4		0
CARGO 5		1000
CABIN OA	30	
CABIN OB	100	
CABIN OC	30	

TRIM TANK TRANSFER 1000 kg

FUEL INDEX -14

For fuel quantity over 43000kg refer to table overleaf



FUEL INDEX CORRECTIONS			
Weight (kg)	Index	Weight (kg)	Index
1000	1	23000	0
2000	2	24000	0
3000	4	25000	0
4000	6	26000	1
5000	8	27000	1
6000	10	28000	1
7000	⑪	[illegible]9000	0
8000	8	30000	-1
9000	7	31000	-2
10000	6	32000	-3
11000	6	33000	-4
12000	5	34000	-5
13000	4	35000	-6
14000	4	36000	-7
15000	3	37000	-8
16000	3	38000	-9
17000	2	39000	-10
18000	2	40000	-12
19000	1	41000	-13
20000	1	42000	-14
21000	1	43000	-15
22000	0		

TAKEOFF

CG % MAC ☐☐.☐

ZFW CDU INPUT	
WEIGHT (kg x 1000)	AIRCRAFT CG % MAC
☐☐☐.☐	☐☐.☐

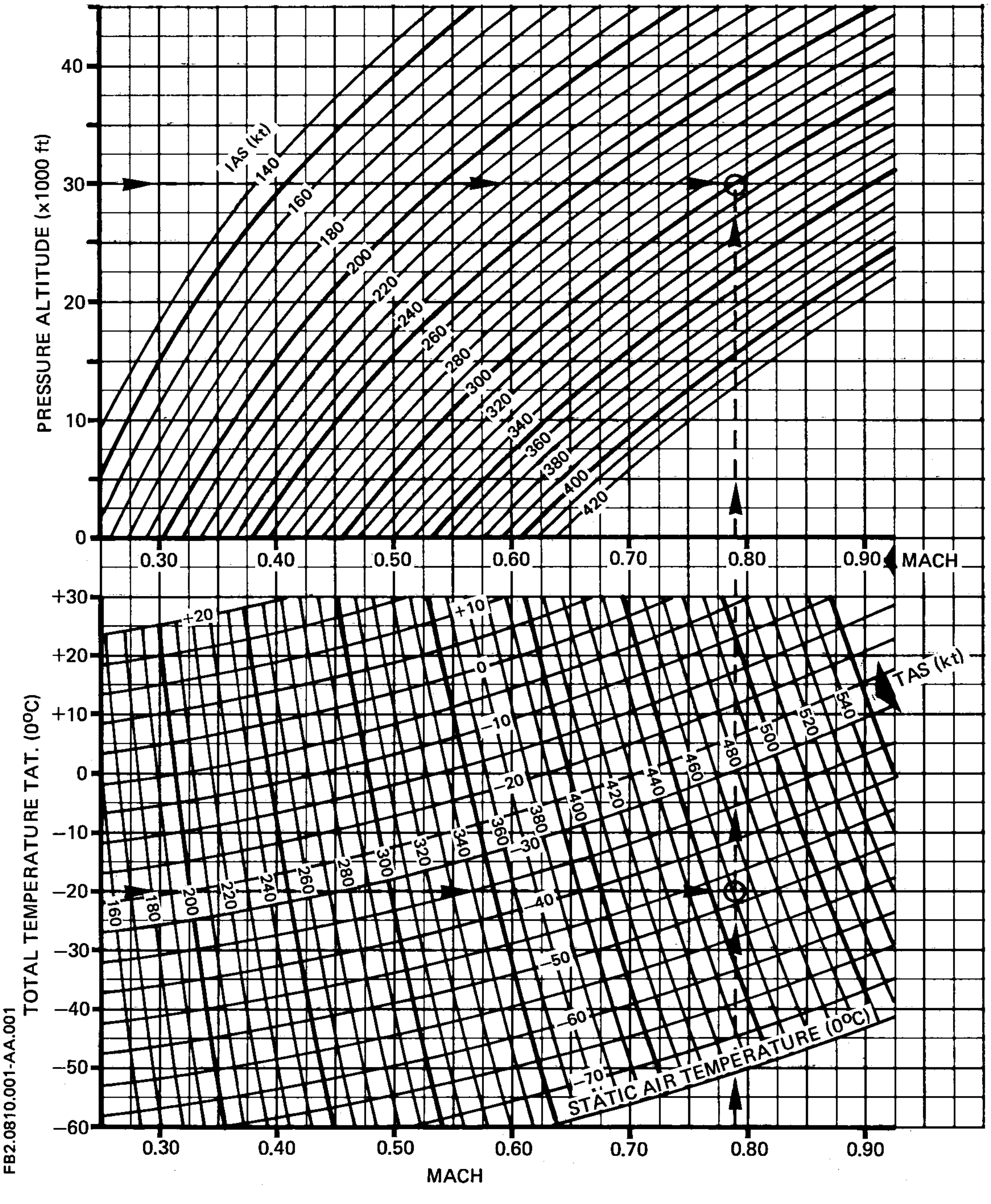
EXAMPLE : DO NOT USE FOR OPERATIONAL PURPOSE

R Code : 0364

2.08.10 OPERATING DATA

MACH – Z – IAS – TAS – SAT – TAT

DATA		RESULTS	
PRESSURE ALTITUDE	30,000 ft	IAS	300 kt
MACH	.790	STATIC AIR TEMPERATURE (SAT).	- 48 °C
Total temperature	- 20 °C	TRUE AIRSPEED (TAS)	462 kt



ALTITUDE Feet	TEMP. 0° C	PRESSURE			PRESSURE RATIO $\delta = P/Po$	DENSITY $\sigma = \rho/\rho o$	$\sqrt{\text{DENSITY}}$	SPEED of SOUND (a) kt	ALTITUDE METRES
		Mb	P.S.I.	In Hg.					
45,000	- 56.5	147	2.14	4.36	0.1455	0.1936	0.440	573	13,716
44,000	- 56.5	155	2.24	4.57	0.1527	0.2031	0.451	573	13,411
43,000	- 56.5	162	2.35	4.79	0.1602	0.2131	0.462	573	13.106
42,000	- 56.5	170	2.47	5.03	0.1681	0.2236	0.473	573	12.802
41,000	- 56.5	179	2.59	5.28	0.1764	0.2346	0.484	573	12.497
40,000	- 56.5	188	2.72	5.54	0.1851	0.2462	0.496	573	12.192
39,000	- 56.5	197	2.85	5.81	0.1942	0.2583	0.508	573	11.887
38,000	- 56.5	206	2.99	6.10	0.2038	0.2710	0.521	573	11.582
37,000	- 56.5	217	3.14	6.40	0.2138	0.2844	0.533	573	11.278
36,000	- 56.3	227	3.30	6.71	0.2243	0.2981	0.546	573	10.973
35,000	- 54.3	238	3.46	7.04	0.2353	0.3099	0.557	576	10.668
34,000	- 52.4	250	3.63	7.38	0.2467	0.3220	0.567	579	10.363
33,000	- 50.4	262	3.80	7.74	0.2586	0.3345	0.578	581	10.058
32,000	- 48.4	274	3.98	8.11	0.2709	0.3473	0.589	584	9.754
31,000	- 46.4	287	4.17	8.49	0.2837	0.3605	0.600	586	9.449
30,000	- 44.4	301	4.36	8.89	0.2970	0.3741	0.611	589	9.144
29,000	- 42.5	315	4.57	9.30	0.3107	0.3881	0.623	591	8.839
28,000	- 40.5	329	4.78	9.73	0.3250	0.4025	0.634	594	8.534
27,000	- 38.5	344	4.99	10.17	0.3398	0.4173	0.646	597	8.230
26,000	- 36.5	360	5.22	10.63	0.3552	0.4325	0.658	599	7.925
25,000	- 34.5	376	5.45	11.10	0.3711	0.4481	0.669	602	7.620
24,000	- 32.5	393	5.70	11.60	0.3876	0.4642	0.681	604	7.315
23,000	- 30.6	410	5.95	12.11	0.4046	0.4806	0.693	607	7.010
22,000	- 28.6	428	6.21	12.64	0.4223	0.4976	0.705	609	6.706
21,000	- 26.6	446	6.47	13.18	0.4406	0.5150	0.718	611	6.401
20,000	- 24.6	466	6.75	13.75	0.4595	0.5328	0.730	614	6.096
19,000	- 22.6	485	7.04	14.34	0.4791	0.5511	0.742	616	5.791
18,000	- 20.7	506	7.34	14.94	0.4994	0.5699	0.755	619	5.406
17,000	- 18.7	527	7.65	15.57	0.5203	0.5892	0.768	621	5.182
16,000	- 16.7	549	7.97	16.22	0.5420	0.6090	0.780	624	4.877
15,000	- 14.7	572	8.29	16.89	0.5643	0.6292	0.793	626	4.572
14,000	- 12.7	595	8.63	17.58	0.5875	0.6500	0.806	628	4.267
13,000	- 10.8	619	8.99	18.29	0.6113	0.6713	0.819	631	3.962
12,000	- 8.8	644	9.35	19.03	0.6360	0.6932	0.833	633	3.658
11,000	- 6.8	670	9.72	19.79	0.6614	0.7156	0.846	636	3.353
10,000	- 4.8	697	10.10	20.58	0.6877	0.7385	0.859	638	3.048
9,000	- 2.8	724	10.51	21.39	0.7148	0.7620	0.873	640	2.743
8,000	- 0.8	753	10.92	22.22	0.7428	0.7860	0.887	643	2.438
7,000	+ 1.1	782	11.34	23.09	0.7716	0.8106	0.900	645	2.134
6,000	+ 3.1	812	11.78	23.98	0.8014	0.8359	0.914	647	1.829
5,000	+ 5.1	843	12.23	24.90	0.8320	0.8617	0.928	650	1.524
4,000	+ 7.1	875	12.69	25.84	0.8637	0.8881	0.942	652	1.219
3,000	+ 9.1	908	13.17	26.82	0.8962	0.9151	0.957	654	914
2,000	+ 11.0	942	13.67	27.82	0.9298	0.9428	0.971	656	610
1,000	+ 13,0	977	14.17	28.86	0.9644	0.9711	0.985	659	305
0	+ 15.0	1013	14.70	29.92	1.0000	1.0000	1.000	661	0
- 1.000	+ 17.0	1050	15.23	31.02	1.0366	1.0295	1.015	664	-305

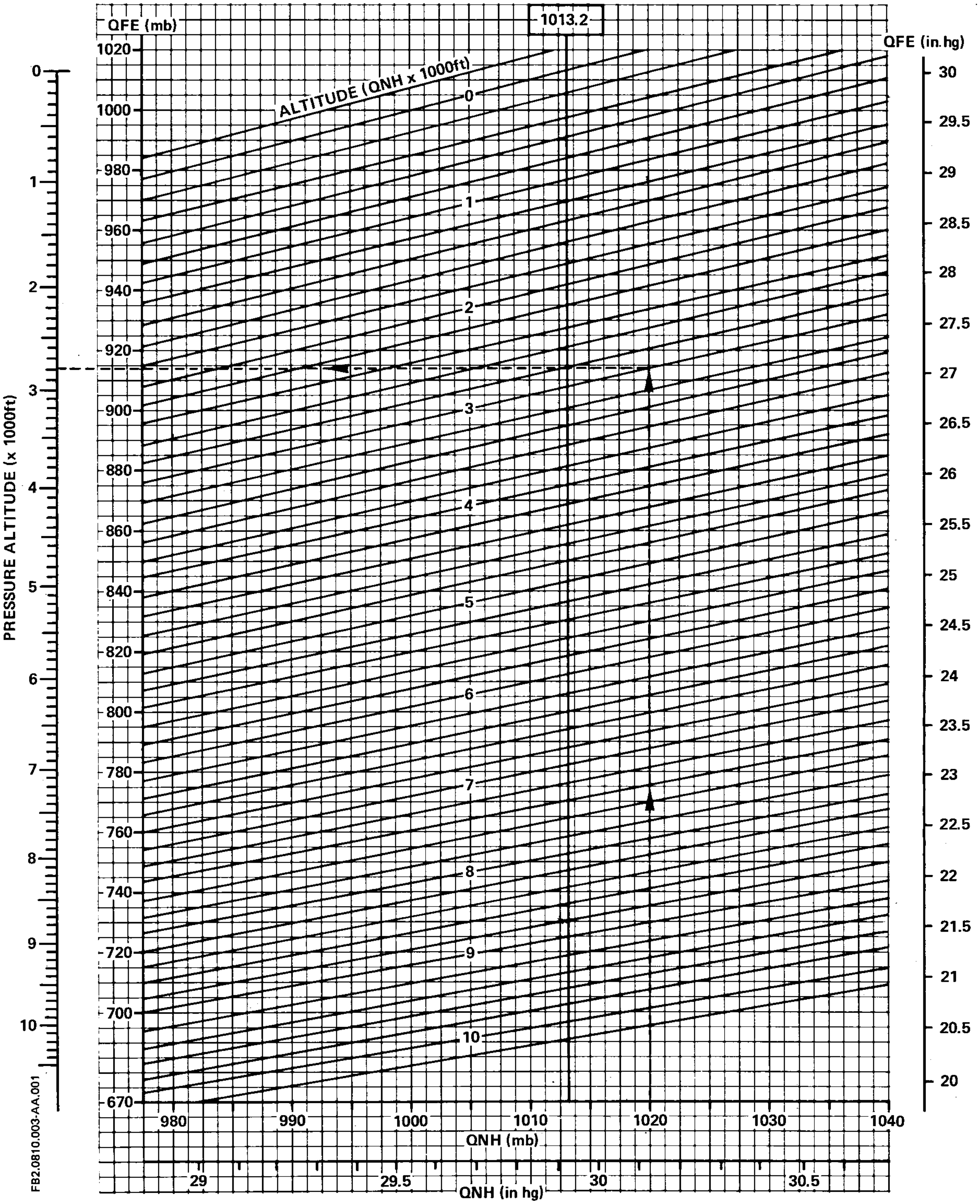
FB2.0810.002-AA.001

Vers. : All

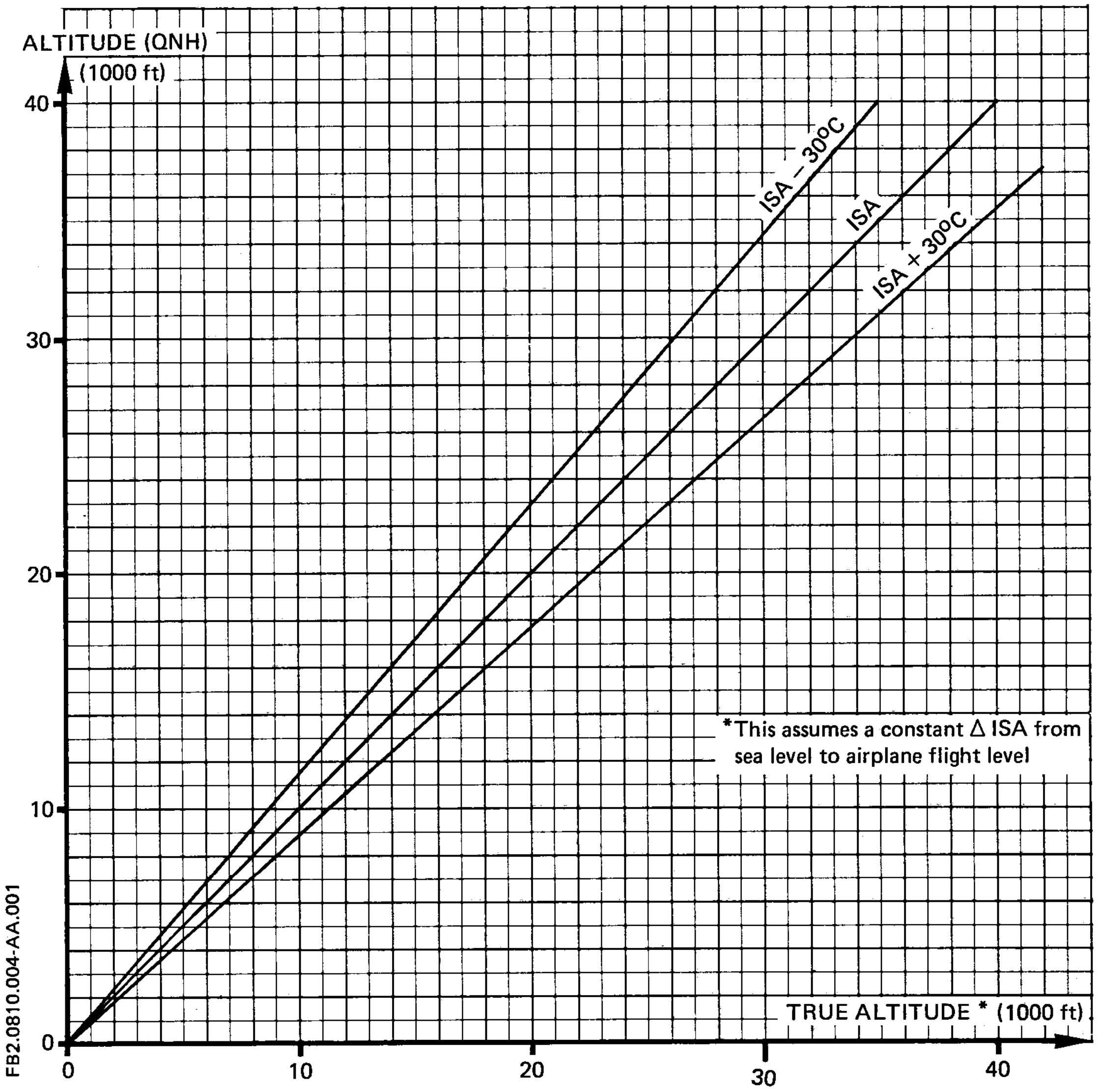
Eng. : All

EXAMPLE :	QNH	1020 mb	→	QFE	914 mb.
	Z	3000 ft		ZP	2820 ft

R



FOR HIGH ALTITUDE USE



FOR LOW ALTITUDE USE

R Values to be added by the pilot to minimum promulgated heights/altitude (ft)

Aerodrome 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

DATA	RESULT
2,211 m	2,200 m : 7217.8 ft 11 m : + 36.09 ft
	2,211 m : 7253.89 ft

Multiply	by	to get
m	3.281	ft

m	0	1	2	3	4	5	6	7	8	9
0	0.	3.28	6.56	9.84	13.12	16.40	19.68	22.97	26.25	29.53
10	32.81	36.09	39.37	42.65	45.93	49.21	52.49	55.77	59.05	62.34
20	65.62	68.90	72.18	75.46	78.74	82.02	85.30	88.58	91.86	95.14
30	98.42	101.70	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.79	141.07	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.16	180.44	183.72	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.53	219.81	223.09	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.18
80	262.46	265.74	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.27	298.55	301.83	305.11	308.40	311.96	314.96	318.24	321.52	324.80
	0	10	20	30	40	50	60	70	80	90
100	328.08	360.89	393.70	426.50	459.31	492.12	524.93	557.74	590.54	623.35
200	656.16	688.97	721.78	754.58	787.39	820.20	853.01	885.52	918.62	951.43
300	984.24	1017.0	1049.9	1082.7	1115.5	1148.3	1181.1	1213.9	1246.7	1279.5
400	1312.3	1345.1	1377.9	1410.7	1443.6	1476.4	1509.2	1542.0	1574.8	1607.6
500	1640.4	1673.2	1706.0	1738.8	1771.6	1804.4	1837.2	1870.1	1902.9	1935.7
600	1968.5	2001.3	2034.1	2066.9	2099.7	2132.5	2165.3	2198.1	2230.9	2263.8
700	2296.6	2329.4	2362.2	2395.0	2427.8	2460.6	2493.4	2526.2	2559.0	2591.8
800	2624.6	2657.4	2690.3	2723.1	2755.9	2788.7	2821.5	2854.3	2887.1	2919.9
900	2952.7	2985.5	3018.3	3051.1	3084.0	3116.8	3149.6	3182.4	3215.2	3248.0
	0	100	200	300	400	500	600	700	800	900
1000	3280.0	3608.9	3937.0	4265.0	4593.1	4921.2	5249.3	5577.4	5905.4	6233.5
2000	6561.6	6889.7	7217.8	7545.8	7873.9	8202.0	8530.1	8858.2	9186.2	9514.3
3000	9842.4	10170	10499	10827	11155	11483	11811	12139	12467	12795
4000	13123	13451	13779	14107	14436	14764	15092	15420	15748	16076
5000	16404	16732	17060	17388	17716	18044	18372	18701	19029	19357
6000	19685	20013	20341	20669	20997	21325	21653	21981	22309	22638
7000	22966	23294	23622	23950	24278	24606	24934	25262	25590	25918
8000	26246	26574	26903	27231	27559	27887	28215	28543	28871	29199
9000	29527	29855	30183	30511	30840	31168	31496	31824	32152	32480

FB2.0810.005-AA.001

CONVERSION FEET → METERS

DATA	RESULT
403 ft	400 ft : 121.92 m 3 ft : + 0.91 m
	403 ft : 122.83 m

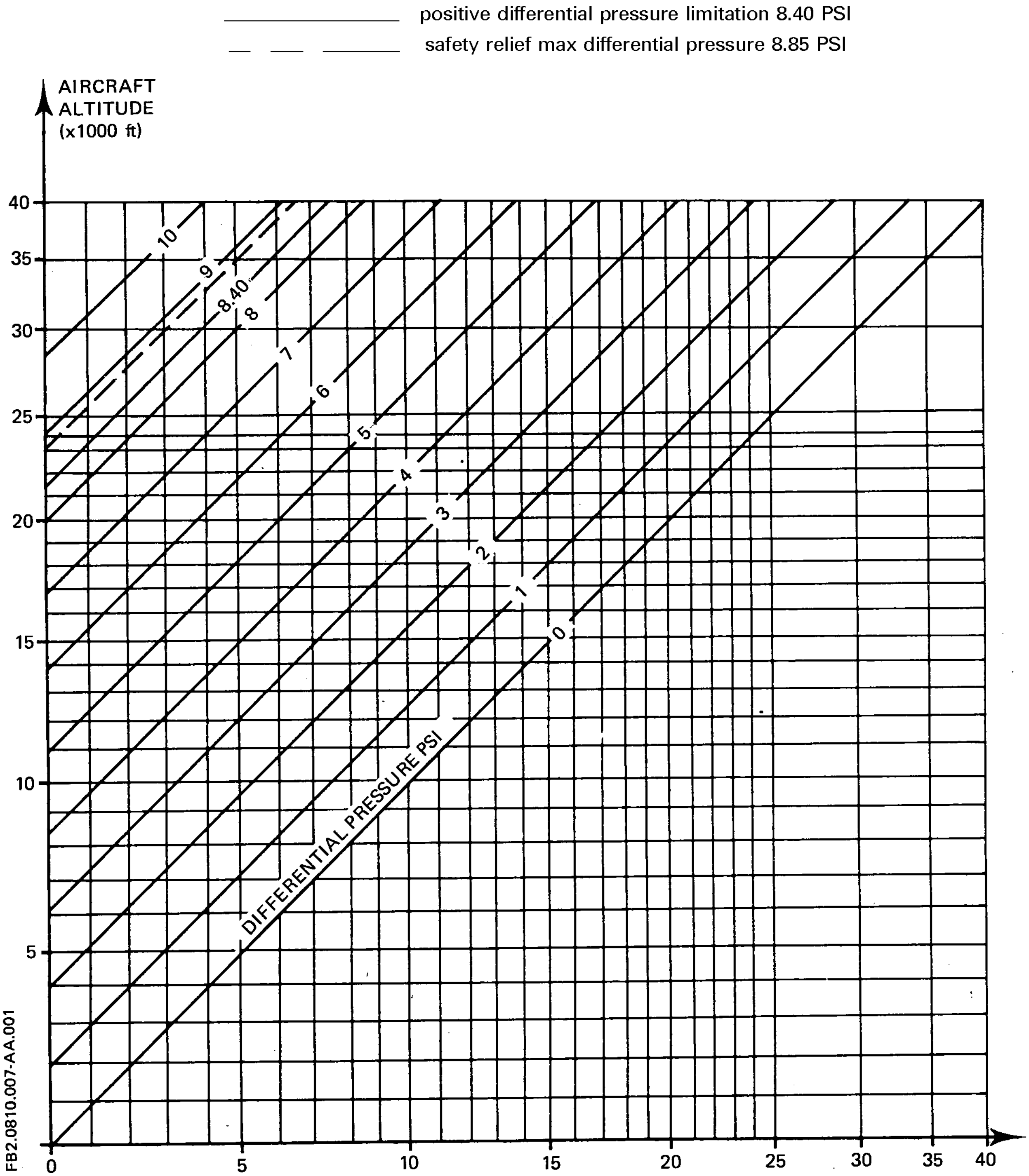
Multiply	by	to get
ft	0.3048	m

ft	0	1	2	3	4	5	6	7	8	9
0	0	0.30	0.61	0.91	1.22	1.52	1.83	2.13	2.44	2.74
10	3.05	3.35	3.66	3.96	4.27	4.57	4.88	5.18	5.49	5.79
20	6.10	6.40	6.71	7.01	7.32	7.62	7.92	8.23	8.53	8.84
30	9.14	9.45	9.75	10.06	10.36	10.67	10.97	11.28	11.58	11.89
40	12.19	12.50	12.80	13.11	13.41	13.72	14.02	14.33	14.63	14.94
50	15.24	15.54	15.85	16.15	16.46	16.76	17.07	17.37	17.68	17.98
60	18.29	18.59	18.90	19.20	19.51	19.81	20.12	20.42	20.73	21.03
70	21.34	21.64	21.95	22.25	22.56	22.86	23.16	23.47	23.77	24.08
80	24.38	24.69	24.99	25.30	25.60	25.91	26.21	26.52	26.82	27.13
90	27.43	27.74	28.04	28.35	28.65	28.96	29.26	29.57	29.87	30.18
	0	10	20	30	40	50	60	70	80	90
100	30.48	33.53	36.58	39.62	42.67	45.72	48.77	51.82	54.86	57.91
200	60.96	64.01	67.06	70.10	73.15	76.20	79.25	82.30	85.34	88.39
300	91.44	94.49	97.54	100.53	103.63	106.68	109.73	112.78	115.82	118.87
400	121.92	124.97	128.02	131.06	134.11	137.16	140.21	143.26	146.30	149.35
500	152.40	155.45	158.50	161.54	164.59	167.64	170.69	173.74	176.78	179.83
600	182.88	185.93	188.98	192.02	195.07	198.12	201.17	204.22	207.26	210.31
700	213.36	216.41	219.46	222.50	222.55	228.60	231.65	234.70	237.74	240.79
800	243.84	246.89	249.94	252.98	256.03	259.08	262.13	265.18	268.22	271.27
900	274.32	277.37	280.42	283.46	286.51	289.56	292.61	295.66	298.70	301.75
	0	100	200	300	400	500	600	700	800	900
1000	304.80	335.28	365.76	396.24	426.72	457.20	487.68	518.16	548.64	579.12
2000	609.60	640.08	670.56	701.04	731.52	762.00	792.48	822.96	853.44	883.92
3000	914.40	944.88	975.36	1005.8	1036.3	1066.8	1097.3	1127.8	1158.2	1188.7
4000	1219.2	1249.7	1280.2	1310.6	1341.1	1371.6	1402.1	1432.6	1463.0	1493.5
5000	1524.0	1554.5	1585.0	1615.4	1645.9	1676.4	1706.9	1737.4	1767.8	1798.3
6000	1828.8	1859.3	1889.8	1902.2	1950.7	1981.2	2011.7	2042.2	2072.6	2103.1
7000	2133.6	2164.1	2194.6	2225.0	2255.5	2286.0	2316.5	2347.0	2377.6	2407.9
8000	2438.4	2468.9	2499.4	2529.8	2560.3	2590.8	2621.3	2651.8	2682.2	2712.7
9000	2743.2	2773.7	2804.2	2834.6	2865.1	2895.6	2926.1	2956.6	2987.0	3017.5
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	3048.0	3352.8	3657.6	3962.4	4267.2	4572.0	4876.8	5181.6	5486.4	5791.2
20000	6096.0	6400.8	6705.6	7010.4	7315.2	7620.0	7924.8	8229.6	8534.4	8839.2
30000	9144.0	9448.8	9753.6	10058	10363	10668	10973	11278	11582	11887
40000	12192	12497	12802	13106	13411	13716	14021	14326	14630	14935
50000	15240	15545	15850	16154	16459	16764	17069	17374	17678	17983

Vers. : All Eng. : All

OPERATING DATA

DIFFENTIAL PRESSURE VERSUS AIRCRAFT ALTITUDE AND CABIN ALTITUDE



Vers. : All

Eng. : All

CONVERSION

QFEMB – IN HG – PRESS. ALT. FT.

QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft
1050	31.01	-989									
1048	30.95	-936	958	28.29	1543	868	25.63	4219	778	22.97	7131
1046	30.89	-883	956	28.23	1601	866	25.57	4281	776	22.92	7199
1044	30.83	-830	954	28.17	1658	864	25.51	4343	774	22.86	7267
1042	30.77	-776	952	28.11	1715	862	25.45	4405	772	22.80	7335
1040	30.71	-723	950	28.05	1773	860	25.40	4468	770	22.74	7402
1038	30.65	-669	948	27.99	1831	858	25.34	4531	768	22.68	7470
1036	30.59	-615	946	27.94	1889	856	25.28	4593	766	22.62	7538
1034	30.53	-562	944	27.88	1947	854	25.22	4656	764	22.56	7607
1032	30.47	-508	942	27.82	2005	852	25.16	4718	762	22.50	7676
1030	30.42	-454	940	27.76	2062	850	25.10	4781	760	22.44	7745
1028	30.36	-400	938	27.70	2120	848	25.04	4844	758	22.38	7815
1026	30.30	-346	936	27.64	2178	846	24.98	4907	756	22.32	7885
1024	30.24	-292	934	27.58	2236	844	24.92	4970	754	22.27	7955
1022	30.18	-238	932	27.52	2294	842	24.86	5033	772	22.21	8025
1020	30.12	-184	930	27.46	2353	840	24.81	5097	770	22.15	8095
1018	30.06	-129	928	27.40	2412	838	24.75	5161	748	22.09	8161
1016	30.00	-74	926	27.34	2471	836	24.69	5225	746	22.03	8231
1014	29.94	-20	924	27.29	2530	834	24.63	5289	744	21.97	8301
1012	29.88	34	922	27.23	2589	832	24.57	5353	742	21.91	8371
1010	29.83	89	920	27.17	2647	830	24.51	5417	740	21.85	8442
1008	29.77	144	918	27.11	2707	828	24.45	5481	738	21.79	8512
1006	29.71	199	916	27.05	2767	826	24.39	5545	736	21.73	8583
1004	29.65	254	914	26.99	2826	824	24.33	5610	734	21.68	8654
1002	29.59	309	912	26.93	2885	822	24.27	5675	732	21.62	8725
1000	29.53	364	910	26.87	2944	820	24.21	5740	730	21.56	8796
998	29.47	419	908	26.81	3004	818	24.16	5805	728	21.50	8867
996	29.41	475	906	26.75	3064	816	24.10	5870	726	21.44	8939
994	29.35	530	904	26.70	3124	814	24.04	5935	724	21.38	9010
922	29.29	586	902	26.64	3183	812	23.98	6000	722	21.32	9082
990	29.23	641	900	26.58	3243	810	23.92	6065	720	21.26	9154
988	29.18	697	898	26.52	3303	808	23.86	6131	718	21.20	9226
986	29.12	753	896	26.46	3363	806	23.80	6197	716	21.14	9298
984	29.06	809	894	26.40	3424	804	23.74	6263	714	21.08	9371
982	29.00	865	892	26.34	3484	802	23.68	6329	712	21.03	9443
980	28.94	921	890	26.28	3545	800	23.62	6394	710	20.97	9516
978	28.88	977	888	26.22	3606	798	23.56	6461	708	20.91	9589
976	28.82	1033	886	26.16	3667	796	23.51	6528	706	20.85	9662
974	28.76	1089	884	26.10	3728	794	23.45	6595	704	20.79	9735
972	28.70	1145	882	26.05	3789	792	23.39	6661	702	20.73	9809
970	28.64	1202	880	25.99	3850	790	23.33	6727	700	20.67	9882
968	28.59	1259	878	25.93	3911	788	23.27	6794	698	20.61	9956
966	28.53	1316	876	25.87	3973	786	23.21	6861	696	20.55	10030
964	28.47	1373	874	25.81	4034	784	23.15	6928	694	20.49	10104
962	28.41	1430	872	25.75	4096	782	23.09	6995	692	20.43	10179
960	28.35	1486	870	25.69	4157	780	23.03	7063	690	20.38	10253

Vers. : All Eng. : All

TAT VERSUS SAT AND MACH NUMBER

FB2.0810.009-AA.001

M \ SAT	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55
.20	-53	-48	-43	-38	-33	-28	-23	-18	-13	-8	-3	2	7	12	17	22	27	32	37	43	48	53	58
.25	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	14	19	24	29	34	39	44	49	54	59
.30	-51	-46	-41	-36	-31	-26	-21	-15	-10	-5	0	5	10	15	20	25	30	35	41	46	51	56	61
.35	-50	-45	-39	-34	-29	-24	-19	-14	-9	-4	2	7	12	17	22	27	32	37	43	48	53	58	63
.40	-48	-43	-38	-33	-27	-22	-17	-12	-7	-2	4	9	14	19	24	29	35	40	45	50	55	60	66
.45	-46	-41	-36	-31	-25	-20	-15	-10	-5	1	6	11	16	21	27	32	37	42	47	53	58	63	68
.50	-44	-39	-34	-28	-23	-18	-13	-7	-2	3	8	14	19	24	29	35	40	45	50	56	61	66	71
.53	-43	-38	-33	-27	-22	-17	-12	-6	-1	4	10	15	20	25	31	36	41	46	52	57	62	67	73
.54	-42	-37	-32	-26	-21	-16	-11	-5	0	5	11	16	21	27	32	37	42	48	53	58	64	69	74
.56	-41	-36	-31	-25	-20	-15	-9	-4	1	7	12	17	22	28	33	38	44	49	54	60	65	70	76
.58	-40	-35	-30	-24	-19	-14	-8	-3	2	8	13	18	24	29	34	40	45	50	56	61	66	72	77
.60	-39	-34	-29	-23	-18	-12	-7	-2	4	9	14	20	25	30	36	41	46	52	57	63	68	73	79
.62	-38	-33	-27	-22	-17	-11	-6	-1	5	10	16	21	26	32	37	43	48	53	59	64	69	75	80
.64	-37	-32	-26	-21	-15	-10	-5	1	6	12	17	22	28	33	39	44	49	55	60	66	71	76	82
.66	-36	-31	-25	-20	-14	-9	-3	2	7	13	18	24	29	35	40	46	51	56	62	67	73	78	84
.68	-35	-29	-24	-18	-13	-8	-2	3	9	14	20	25	31	36	42	47	53	58	63	69	74	80	85
.70	-34	-28	-23	-17	-12	-6	-1	5	10	16	21	27	32	38	43	49	54	60	65	71	76	82	87
.72	-32	-27	-21	-16	-10	-5	1	6	12	17	23	28	34	39	45	50	56	61	67	72	78	84	89
.74	-31	-26	-20	-14	-9	-3	2	8	13	19	24	30	35	41	47	52	58	63	69	74	80	85	91
.76	-30	-24	-19	-13	-7	-2	4	9	15	20	26	32	37	43	48	54	59	65	71	76	82	87	93
.78	-28	-23	-17	-12	-6	0	5	11	16	22	28	33	39	44	50	56	61	67	72	78	84	89	95
.80	-27	-21	-16	-10	-5	1	7	12	18	24	29	35	41	46	52	58	63	69	74	80	86	91	97
.82	-26	-20	-14	-9	-3	3	8	14	20	25	31	37	42	48	54	59	65	71	76	82	88	93	99
.84	-24	-19	-13	-7	-1	4	10	16	21	27	33	39	44	50	56	61	67	73	78	84	90	96	101
.86	-23	-17	-11	-6	0	6	12	17	23	29	35	40	45	52	58	63	69	75	81	86	92	98	104

CONVERSION °C / °F and °F / °C

	ENTER	
°C	←°F or °C→	°F
– 60	– 76	– 104.8
– 59.44	– 75	– 103
– 58.59	– 74	– 101.2
– 58.33	– 73	– 99.4
– 57.78	– 72	– 97.6
– 57.22	– 71	– 95.8
– 56.67	– 70	– 94
– 56.11	– 69	– 92.2
– 55.55	– 68	– 90.4
– 55	– 67	– 88.6
– 54.44	– 66	– 86.8
– 53.89	– 65	– 85
– 53.33	– 64	– 83.2
– 52.78	– 63	– 81.4
– 52.22	– 62	– 79.6
– 51.67	– 61	– 77.8
– 51.11	– 60	– 76
– 50.55	– 59	– 74.2
– 50	– 58	– 72.4
– 49.44	– 57	– 70.6
– 48.89	– 56	– 68.8
– 48.33	– 55	– 67
– 47.78	– 54	– 65.2
– 47.22	– 53	– 63.4
– 46.67	– 52	– 61.6
– 46.11	– 51	– 59.8
– 45.55	– 50	– 58
– 45	– 49	– 56.2
– 44.44	– 48	– 54.4
– 43.89	– 47	– 52.6
– 43.33	– 46	– 50.8
– 42.78	– 45	– 49
– 42.22	– 44	– 47.2
– 41.66	– 43	– 45.4
– 41.11	– 42	– 43.6
– 40.55	– 41	– 41.8
– 40	– 40	– 40
– 39.44	– 39	– 38.2
– 38.89	– 38	– 36.4
– 38.33	– 37	– 34.6
– 37.78	– 36	– 32.8
– 37.22	– 35	– 31
– 36.67	– 34	– 29.2
– 36.11	– 33	– 27.4
– 35.55	– 32	– 25.6
– 35	– 31	– 23.8
– 34.44	– 30	– 22
– 33.89	– 29	– 20.2
– 33.33	– 28	– 18.4
– 32.78	– 27	– 16.6
– 32.22	– 26	– 14.8
– 31.67	– 25	– 13
– 31.11	– 24	– 11.2
– 30.55	– 23	– 9.4
– 30	– 22	– 7.6
– 29.44	– 21	– 5.8
– 28.89	– 20	– 4
– 28.33	– 19	– 2.2
– 27.78	– 18	– 0.4
– 27.22	– 17	+ 1.4
– 26.67	– 16	+ 3.2

	ENTER	
°C	←°F or °C→	°F
– 26.11	– 15	+ 5
– 25.55	– 14	+ 6.8
– 25	– 13	+ 8.6
– 24.44	– 12	+10.4
– 23.89	– 11	+12.2
– 23.33	– 10	+14
– 22.78	– 9	+15.8
– 22.22	– 8	+17.6
– 21.67	– 7	+19.4
– 21.11	– 6	+21.2
– 20.55	– 5	+23
– 20	– 4	+24.8
– 19.44	– 3	+26.6
– 18.89	– 2	+28.4
– 18.33	– 1	+30.2
– 17.78	0	+32
– 17.22	+ 1	+33.8
– 16.67	2	35.6
– 16.11	3	37.4
– 15.55	4	39.2
– 15	5	41
– 14.44	6	42.8
– 13.89	7	44.6
– 13.33	8	46.4
– 12.78	9	48.2
– 12.22	10	50
– 11.67	11	51.8
– 11.11	12	53.6
– 10.55	13	55.4
– 10	14	57.2
– 9.44	15	59
– 8.89	16	60.8
– 8.33	17	62.6
– 7.78	18	64.4
– 7.22	19	66.2
– 6.67	20	68
– 6.11	21	69.8
– 5.55	22	71.6
– 5	23	73.4
– 4.44	24	75.2
– 3.89	25	77
– 3.33	26	78.8
– 2.78	27	80.6
– 2.22	28	82.4
– 1.67	29	84.2
– 1.11	30	86
– 0.55	31	87.8
0	32	89.6
+ 0.55	33	91.4
1.11	34	93.2
1.67	35	95
2.22	36	96.8
2.78	37	98.6
3.33	38	100.4
3.89	39	102.2
4.44	40	104
5.0	41	105.8
5.55	42	107.6
6.11	43	109.4
6.67	44	111.2
7.22	45	113

	ENTER	
°C	←°F or °C→	°F
7.78	46	114.8
8.33	47	116.6
8.89	48	118.4
9.44	49	120.2
10.0	50	122
10.55	51	123.8
11.11	52	125.6
11.67	53	127.4
12.22	54	129.2
12.78	55	131
13.33	56	132.8
13.89	57	134.6
14.44	58	136.4
15.0	59	138.2
15.55	60	140
16.11	61	141.8
16.67	62	143.6
17.22	63	145.4
17.78	64	147.2
18.33	65	149
18.89	66	150.8
19.44	67	152.6
20.0	68	154.4
20.55	69	156.2
21.11	70	158
21.67	71	159.8
22.22	72	161.6
22.78	73	163.4
23.33	74	165.2
23.89	75	167
24.44	76	168.8
25	77	170.6
25.55	78	172.4
26.11	79	174.2
26.67	80	176
27.22	81	177.8
27.78	82	179.6
28.33	83	181.4
28.89	84	183.2
29.44	85	185
30	86	186.8
30.55	87	188.6
31.11	88	190.4
31.67	89	192.2
32.22	90	194
32.78	91	195.8
33.33	92	197.6
33.89	93	199.4
34.44	94	201.2
35	95	203
35.55	96	204.8
36.11	97	206.6
36.67	98	208.4
37.22	99	210.2
37.78	100	212
40.55	105	221
43.33	110	230
46.11	115	239
48.89	120	248
51.67	125	257
54.33	130	266
57.22	135	275
60	140	284

<u>Examples</u> :

. 15°C = 59°F,
. 32°F = 0°C

PW Eng. : 4000

1. GENERAL

- The PW 4000 Thrust Management is based on a Full Authority Digital Engine Control (FADEC) concept.
- The FADEC concept involves several engine components such as the Electronic Engine Control (EEC) and the Fuel Metering Unit (FMU). The airframe interface involves the throttle lever angle (TLA), the Thrust Control Computer (TCC) and discrete signals.

2. ENGINE RATINGS

A – Max Take off

This is the maximum thrust certified for take off and is normally time limited to five minutes.

This time limit is extended to 10 minutes for engine out contingency as authorized by the approved AFM.

B – Flex Take off

It is a derated take off thrust as compared to the max permissible. The calculation of the related EPR is a function of the flex temperature set on the thrust rating panel. The flex temperature is a function of the aircraft weight and environmental conditions and guarantees that the regulatory performances requirements are met.

C – Maximum Continuous

The Maximum Continuous rating is the maximum thrust certified for continuous use. To prolong engine life, this rating should not be used under normal operating conditions to increase aircraft speed or rate of climb. This rating should be used at the pilot's discretion and is intended for use in an engine out situation and will allow the airplane to continue operating, but at a lower altitude and fly to an alternate airfield, if necessary.

D – Maximum Climb

The Maximum climb rating is the maximum thrust approved for normal climb operation.

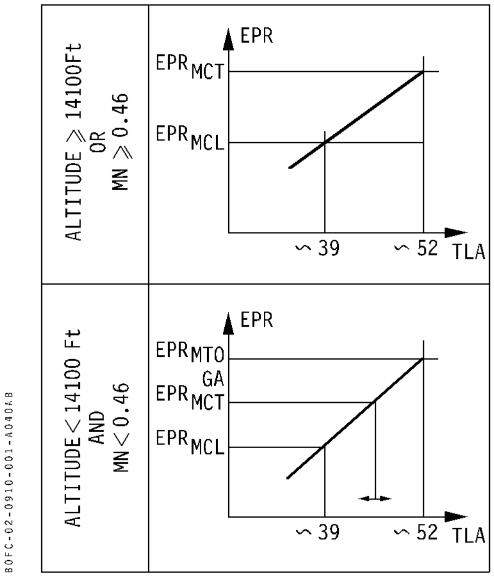
E – Maximum Cruise

The maximum cruise rating is the maximum thrust approved for normal cruise operation.

F – Maximum Go Around

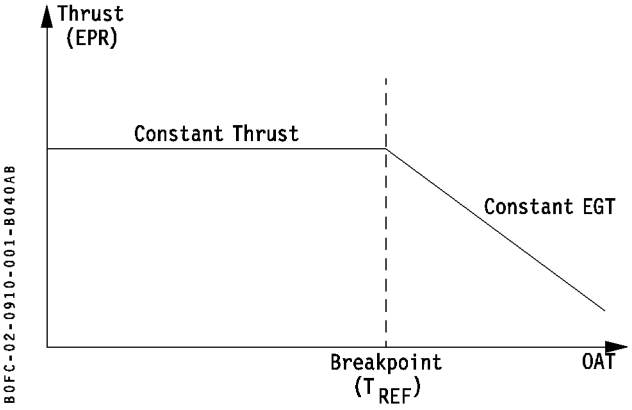
It is the maximum permissible thrust during go-around. Selection on thrust rating panel is identical to the selection of maximum take off rating.

TLA-RATINGS RELATION (EPR MODE-NO BLEED)



3. FADEC OPERATING MODES OVERVIEW

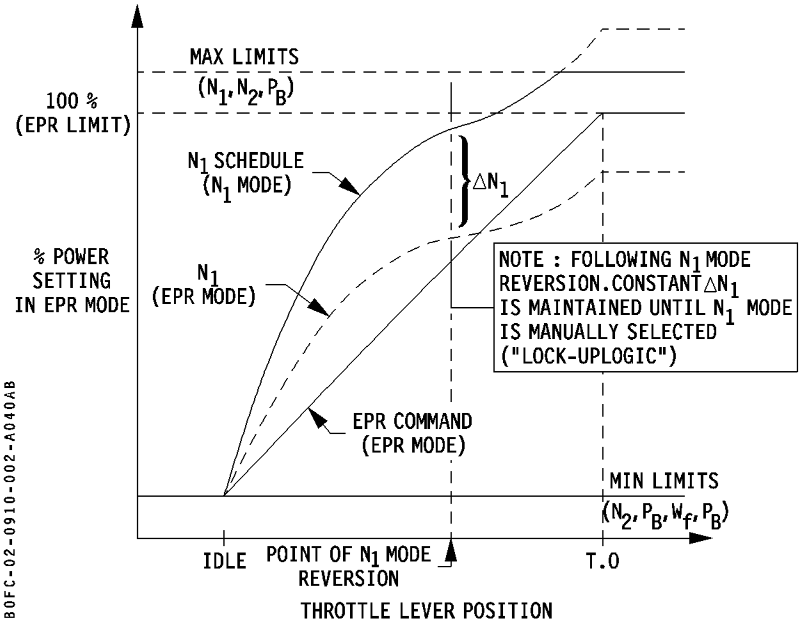
- The FADEC is able to operate under two possible control modes :
  - EPR mode :
    - * The EPR mode is the FADEC primary control mode.
    - * This is a "rated" mode, which translates into :
      - · EPR (thrust) is proportional to throttle lever position (linear relationship),
      - · Flat ratings concept :



- * Ratings (TO, GA, MCT, CL) are computed, based on Total Temperature, Pressure Altitude, MN and Bleeds status, by both EEC and TTC.
- * Operational aspects :
  - · Same rating is always obtained at same throttle lever position,
  - · No overboost potential,
  - · Throttles stagger potential is minimized,
  - · ATS can be used,
  - · EPR is the thrust setting parameter : EPR CMD (EPR Command) can be used for manual thrust setting.

– N1 mode :

- * The N1 mode is the FADEC alternate control mode.
- * Automatic reversion to N1 mode will occur in case of unability to close the loop on EPR or in case of loss of input data necessary for power management in EPR mode :
  - · N1 mode reversion will occur only if both channels are unable to close the loop on EPR (channel switch-over will occur if other channel is capable of control in EPR mode).
- * This is a ″non-rated″ mode, which translates into :
  - · Thrust is not proportional to throttle lever position (non linear relationship).
  - · Flat rating concept is not applicable.
- * Required N1 is computed by EEC only as a function of throttle lever position (TT2 considered only for N1 reverse schedule).
- * Operational aspects :
  - · The automatic reversion to N1 mode is ″bumpless″ : thrust is maintained and parameters are unchanged, this bumpless transfer is known as the ″lock-up″ logic.
  - · Upon manual selection of N1 mode, the ″lock-up″ logic is removed and the N1 schedule is followed.
  - · EPR CMD (EPR Command) is not available for thrust setting.
  - · EPR actual may be still available and valid.
  - · N1 becomes the thrust setting parameter.
  - · ATS cannot be used.
  - · Overboost is possible, as shown on figure below.
  - · Throttles stagger is possible.



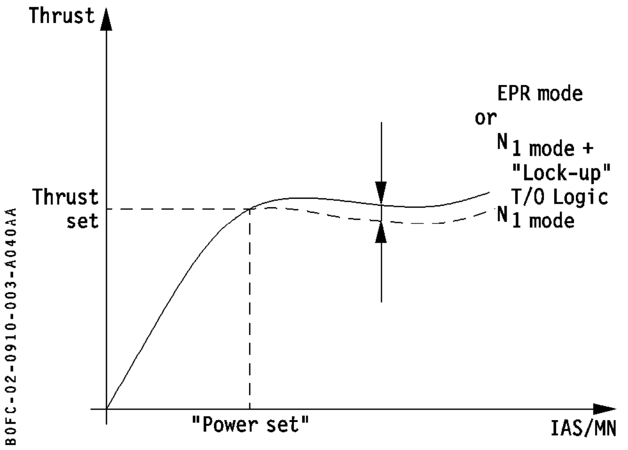
MODE SWITCHING – STEADY STATE CONTROL

PW Eng. : 4000

4. THRUST SETTING FOR TAKE-OFF

Four cases have to be considered, as follows :

- Thrust setting in EPR mode, without EPR MODE FAULT before or after power set :
  - * This configuration corresponds to the normal system operation and is covered by normal procedures and performance data.
- Thrust setting in EPR mode, with EPR MODE FAULT occurring prior to power set :
  - * The take-off phase should be abandonned, as no reference is available for thrust setting : EPR CMD lost, ATS lost and EPR actual not to be used – even if available – (reference § "Thrust setting in N1 mode").
- Thrust setting in EPR mode, with EPR MODE FAULT occuring after power set :
  - * The take-off phase can be continued, the "lock-up" logic (T / O mode) will assure a bumpless transfer to the N1 mode and, by design, will provide a thrust at least equivalent to that achieved in EPR mode at the time of reversion.
  - * ENG EPR MODE FAULT procedure can be delayed until flight conditions permit.
- Thrust setting in N1 mode :
  - * The aircraft dispatch, under MMEL, with both FADEC in N1 mode implies the following :
    - · Usage of N1 power management tables,
    - · Max take-off, Final take-off and Go-around weight limitations.
  - * Eventhough the EPR actual parameter may be still available and valid, it should not be used for thrust setting as thrust evolution – in N1 mode – (as a function of MN and TT2) after power set would not guarantee the certified AFM performances.



THRUST EVOLUTION AFTER POWER SET (LAPSE RATE)

5. THRUST SETTING IN FLIGHT

- · In case of automatic reversion to the N1 mode during steady state flight, the lock-up logic maintains the thrust and parameters constant until the crew applies the ENG EPR MODE FAULT procedure.
- · Should the reset / recovery of EPR mode be unsuccessful, both FADEC's should be manually reverted to the N1 mode, and the ENG ALTN MODE procedure applied.
- · Manual engine thrust setting is to be performed, using the N1 power management tables provided in section 2.09.30.

TAKE OFF EPR

R

PW4152	TAKE OFF EPR NO AIR BLEED MACH=.100	
EPR CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	SAT<8 (C)	SAT>8 (C)
AIR CONDITIONING ON	-.017	-.017
ENGINE ANTI-ICE ON	.000	-.006
ENGINE ANTI-ICE AND WING ANTI -ICE ON	-.008	-.014

SAT (C)	ALTITUDE (FT) -1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
10.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
12.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
14.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
16.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
18.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.631	1.634	1.636	1.638
20.0	1.449	1.476	1.505	1.536	1.567	1.598	1.628	1.629	1.629	1.629	1.629
22.0	1.449	1.476	1.505	1.536	1.567	1.598	1.615	1.615	1.615	1.615	1.615
24.0	1.449	1.476	1.505	1.536	1.567	1.598	1.602	1.602	1.602	1.602	1.602
26.0	1.449	1.476	1.505	1.536	1.567	1.588	1.588	1.588	1.588	1.588	1.588
28.0	1.449	1.476	1.505	1.536	1.567	1.574	1.574	1.574	1.574	1.574	1.574
30.0	1.449	1.476	1.505	1.536	1.559	1.559	1.559	1.559	1.559	1.559	1.559
32.0	1.449	1.476	1.505	1.536	1.545	1.545	1.545	1.545	1.545	1.545	1.545
34.0	1.449	1.476	1.505	1.531	1.531	1.531	1.531	1.531	1.530	1.531	1.531
36.0	1.449	1.476	1.505	1.517	1.517	1.517	1.516	1.516	1.516	1.517	1.517
38.0	1.449	1.476	1.504	1.504	1.504	1.502	1.501	1.501	1.502	1.504	1.504
40.0	1.449	1.476	1.490	1.490	1.489	1.487	1.487	1.487	1.488	1.490	1.490
42.0	1.449	1.476	1.477	1.475	1.474	1.473	1.473	1.473	1.475	1.477	1.477
44.0	1.449	1.465	1.462	1.460	1.459	1.459	1.459	1.461	1.462	1.465	1.465
46.0	1.449	1.450	1.447	1.446	1.445	1.445	1.446	1.448	1.450	1.453	1.453
48.0	1.437	1.435	1.433	1.432	1.432	1.432	1.435	1.437	1.439	1.441	1.441
50.0	1.422	1.420	1.419	1.419	1.418	1.420	1.424	1.426	1.428	1.430	1.428
52.0	1.407	1.406	1.406	1.406	1.406	1.408	1.413	1.415	1.417	1.415	1.414
54.0	1.393	1.393	1.392	1.392	1.394	1.398	1.404	1.405	1.402	1.401	
55.0	1.386	1.387	1.386	1.386	1.388	1.393	1.399	1.397	1.394		
60.0	1.353	1.355	1.356	1.359	1.363	1.362	1.363				
65.0	1.327	1.330	1.329	1.328							
70.0	1.301	1.300									
75.0			DATA GIVEN ABOVE ISA+40 (C) ARE TO BE USED FOR FLEX-TAKEOFF ONLY								

B0FC-02-0920-001-A040AA - R

PW Eng. : 4152

PW4152 TAKE OFF EPR NO AIR BLEED MACH=.100

EPR CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	SAT< 8 (C)	SAT> 8 (C)
AIR CONDITIONING ON	-.017	-.017
NACELLE ANTI-ICE ON	0.000	-.006
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.008	-.014

SAT (C)	ALTITUDE (FT)										
	8500.	9000.	9500.	10000.	10500.	11000.	11500.	12000.	12500.	13000.	14100.
-60.0	1.638	1.639	1.640	1.642	1.651						
-50.0	1.638	1.639	1.640	1.642	1.651						
-40.0	1.638	1.639	1.640	1.642	1.651						
-30.0	1.638	1.639	1.640	1.642	1.651						
-20.0	1.638	1.639	1.640	1.642	1.651						
-10.0	1.638	1.639	1.640	1.642	1.651						
0.0	1.638	1.639	1.640	1.642	1.651						
2.0	1.638	1.639	1.640	1.642	1.651						
4.0	1.638	1.639	1.640	1.642	1.651						
6.0	1.638	1.639	1.640	1.642	1.651						
8.0	1.638	1.639	1.640	1.642	1.651						
10.0	1.638	1.639	1.640	1.642	1.651						
12.0	1.638	1.639	1.640	1.642	1.651						
14.0	1.638	1.639	1.640	1.642	1.651						
16.0	1.638	1.639	1.640	1.642	1.651						
18.0	1.638	1.639	1.640	1.642	1.642						
20.0	1.629	1.629	1.629	1.629	1.629						
22.0	1.615	1.615	1.615	1.615	1.615						
24.0	1.602	1.602	1.602	1.602	1.602						
26.0	1.588	1.588	1.588	1.588	1.588						
28.0	1.574	1.574	1.574	1.574	1.574						
30.0	1.559	1.559	1.559	1.559	1.559						
32.0	1.545	1.545	1.545	1.545	1.545						
34.0	1.531	1.531	1.531	1.531	1.531						
36.0	1.517	1.517	1.517	1.517	1.517						
38.0	1.504	1.504	1.504	1.504	1.504						
40.0	1.490	1.490	1.490	1.490	1.490						
45.0	1.459	1.459	1.459	1.459	1.458						
50.0	1.428	1.427	1.427	1.427							
52.0	1.414	1.414									
54.0			DATA GIVEN ABOVE ISA+40 (C) ARE TO BE USED FOR FLEX-TAKEOFF ONLY								

BOFC-02-0920-002-A040AA -R

R

PW4152	GO AROUND EPR AIR COND ON	MACH=.225

EPR CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	SAT<8 (C)	SAT>8 (C)
AIR CONDITIONING OFF	.017	.017
ENGINE ANTI-ICE ON	.000	-.006
ENGINE ANTI-ICE AND WING ANTI -ICE ON	-.008	-.014

SAT (C)	ALTITUDE (FT)										
	-1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
-30.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
-20.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
-10.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
-5.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
2.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
4.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
6.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
8.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
10.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
12.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
14.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
16.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
18.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.633	1.636	1.639	1.640
20.0	1.445	1.472	1.500	1.531	1.563	1.597	1.630	1.631	1.630	1.630	1.630
22.0	1.445	1.472	1.500	1.531	1.563	1.597	1.616	1.615	1.615	1.615	1.615
24.0	1.445	1.472	1.500	1.531	1.563	1.597	1.600	1.600	1.600	1.599	1.599
26.0	1.445	1.472	1.500	1.531	1.563	1.585	1.585	1.585	1.584	1.584	1.584
28.0	1.445	1.472	1.500	1.531	1.563	1.570	1.570	1.570	1.569	1.569	1.569
30.0	1.445	1.472	1.500	1.531	1.555	1.555	1.555	1.555	1.554	1.554	1.554
32.0	1.445	1.472	1.500	1.531	1.541	1.540	1.540	1.540	1.539	1.539	1.539
34.0	1.445	1.472	1.500	1.526	1.526	1.526	1.526	1.525	1.524	1.525	
36.0	1.445	1.472	1.500	1.512	1.512	1.512	1.511	1.510	1.510		
38.0	1.445	1.472	1.499	1.498	1.498	1.497	1.496	1.495			
40.0	1.445	1.472	1.485	1.485	1.483	1.482	1.481				
42.0	1.445	1.472	1.473	1.471	1.469	1.468					
45.0	1.445	1.453	1.450	1.449							
50.0	1.419	1.417									
55.0											

B0FC-02-0920-003-A040AA - R

PW Eng. : 4152

PW4152 GO AROUND EPR AIR COND ON MACH=.225

EPR CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	SAT< 8 (C)	SAT> 8 (C)
AIR CONDITIONING OFF	.017	.017
NACELLE ANTI-ICE ON	0.000	-.006
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.008	-.014

SAT (C)	ALTITUDE (FT) 8500.	9000.	9500.	10000.	10500.	11000.	11500.	12000.	12500.	13000.	14100.
-60.0	1.640	1.641	1.643	1.644	1.655						
-50.0	1.640	1.641	1.643	1.644	1.655						
-40.0	1.640	1.641	1.643	1.644	1.655						
-30.0	1.640	1.641	1.643	1.644	1.655						
-20.0	1.640	1.641	1.643	1.644	1.655						
-15.0	1.640	1.641	1.643	1.644	1.655						
-10.0	1.640	1.641	1.643	1.644	1.655						
-8.0	1.640	1.641	1.643	1.644	1.655						
-6.0	1.640	1.641	1.643	1.644	1.655						
-4.0	1.640	1.641	1.643	1.644	1.655						
-2.0	1.640	1.641	1.643	1.644	1.655						
0.0	1.640	1.641	1.643	1.644	1.655						
2.0	1.640	1.641	1.643	1.644	1.655						
4.0	1.640	1.641	1.643	1.644	1.655						
6.0	1.640	1.641	1.643	1.644	1.655						
8.0	1.640	1.641	1.643	1.644	1.655						
10.0	1.640	1.641	1.643	1.644	1.655						
12.0	1.640	1.641	1.643	1.644	1.655						
14.0	1.640	1.641	1.643	1.644	1.655						
16.0	1.640	1.641	1.643	1.644	1.655						
18.0	1.640	1.641	1.643	1.644	1.644						
20.0	1.630	1.630	1.630	1.629	1.629						
22.0	1.615	1.614	1.614	1.614	1.614						
24.0	1.599	1.599	1.599	1.599	1.598						
26.0	1.584	1.584	1.584	1.583	1.583						
28.0	1.569	1.569	1.568	1.568	1.568						
30.0	1.554	1.554	1.553	1.553							
32.0	1.539	1.539									
34.0											

BOFC-02-0920-004-A040AA -R

PW Eng. : 4152

PW4000	MAXIMUM CONTINUOUS EPR AIR COND ON VC =230KT

R

EPR CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)

AIR CONDITIONING OFF	.019
ENGINE ANTI-ICE ON	-.008
ENGINE ANTI-ICE AND WING ANTI -ICE ON	-.030

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.675	1.652
-35.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.675	1.652
-30.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.675	1.652
-25.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.675	1.652
-20.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.675	1.652
-15.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.652	1.661	1.652
-10.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.643	1.635	1.638	1.637
-8.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.642	1.625	1.621	1.630
-6.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.631	1.615	1.603	1.621
-4.0	1.361	1.422	1.471	1.519	1.570	1.626	1.634	1.620	1.601	1.585	1.605
-2.0	1.361	1.422	1.471	1.519	1.570	1.626	1.632	1.609	1.582	1.567	1.588
.0	1.361	1.422	1.471	1.519	1.570	1.626	1.620	1.598	1.563	1.549	1.571
2.0	1.361	1.422	1.471	1.519	1.570	1.626	1.607	1.580	1.545	1.530	1.554
4.0	1.361	1.422	1.471	1.519	1.570	1.625	1.595	1.562	1.527		1.536
6.0	1.361	1.422	1.471	1.519	1.570	1.611	1.582	1.544	1.508		1.518
8.0	1.361	1.422	1.471	1.519	1.570	1.597	1.565	1.527	1.490		
10.0	1.361	1.422	1.471	1.519	1.570	1.583	1.548	1.508			
12.0	1.361	1.422	1.471	1.519	1.555	1.569	1.531	1.490			
14.0	1.361	1.422	1.471	1.519	1.541	1.554	1.514				
16.0	1.361	1.422	1.471	1.519	1.526	1.538	1.497				
18.0	1.361	1.422	1.471	1.510	1.512	1.522	1.479				
20.0	1.361	1.422	1.471	1.496	1.498	1.505					
22.0	1.361	1.422	1.471	1.482	1.484	1.488					
24.0	1.361	1.422	1.467	1.468	1.469	1.471					
26.0	1.361	1.422	1.454	1.456	1.454						
28.0	1.361	1.422	1.442	1.443	1.438						
30.0	1.361	1.422	1.429	1.431	1.422						
32.0	1.361	1.412	1.417	1.418							
34.0	1.361	1.400	1.407	1.405							
36.0	1.361	1.389	1.397	1.392							
38.0	1.358	1.379	1.386								
40.0	1.348	1.369	1.374								
45.0	1.324	1.347									
50.0	1.306	1.321									
55.0	1.284										

B0FC-02-0920-005-A060AA - R

PW Eng. : 4000

PW4000 MAXIMUM CLIMB EPR AIR COND ON 250/300/.80

EPR CORRECTIONS FOR AIR BLEED

AIR CONDITIONING OFF	.030
ENGINE ANTI-ICE ON	-.010
ENGINE ANTI-ICE AND WING ANTI -ICE ON	-.023

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.483	1.520	1.560	1.556
-30.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.483	1.520	1.560	1.556
-20.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.483	1.520	1.560	1.556
-10.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.483	1.520	1.534	1.529
-5.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.483	1.504	1.510	1.505
.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.468	1.476	1.482	1.478
2.0	1.330	1.357	1.387	1.363	1.387	1.417	1.451	1.456	1.464	1.470	1.466
4.0	1.330	1.357	1.387	1.363	1.387	1.417	1.440	1.443	1.452	1.458	1.453
6.0	1.330	1.357	1.387	1.363	1.387	1.417	1.426	1.430	1.439	1.445	1.440
8.0	1.330	1.357	1.387	1.363	1.387	1.413	1.413	1.416	1.426	1.432	1.427
10.0	1.330	1.357	1.387	1.363	1.387	1.399	1.400	1.403	1.412	1.418	1.413
12.0	1.330	1.357	1.387	1.363	1.387	1.386	1.386	1.389	1.398		
14.0	1.330	1.357	1.387	1.363	1.379	1.373	1.373	1.375	1.384		
16.0	1.330	1.357	1.387	1.363	1.366	1.360	1.360	1.362	1.370		
18.0	1.330	1.357	1.387	1.363	1.354	1.347	1.346	1.348	1.355		
20.0	1.330	1.357	1.387	1.353	1.341	1.334	1.333	1.334			
22.0	1.330	1.357	1.375	1.341	1.329	1.321	1.320	1.320			
24.0	1.330	1.357	1.364	1.329	1.317	1.309	1.308	1.306			
26.0	1.330	1.357	1.352	1.318	1.305	1.296	1.295				
28.0	1.330	1.350	1.342	1.306	1.293	1.284	1.282				
30.0	1.330	1.340	1.331	1.295	1.281	1.272					
32.0	1.330	1.329	1.321	1.284	1.270	1.261					
34.0	1.328	1.319	1.310	1.273	1.259	1.249					
36.0	1.318	1.310	1.301	1.262	1.248						
38.0	1.309	1.300	1.291	1.252	1.237						
40.0	1.300	1.291	1.282	1.242							
42.0	1.291	1.282	1.273	1.233							
45.0	1.279	1.270	1.260	1.219							
50.0	1.259	1.250									
55.0	1.241										

B0FC-02-0920-006-A050AA - R

PW Eng. : 4000

PW4000 MAXIMUM CRUISE EPR AIR COND ON 250/300/.80

EPR CORRECTIONS FOR AIR BLEED

AIR CONDITIONING OFF	.030
ENGINE ANTI-ICE ON	-.010
ENGINE ANTI-ICE AND WING ANTI -ICE ON	-.023

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.393	1.436	1.504	1.502
-30.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.393	1.436	1.504	1.502
-20.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.393	1.436	1.504	1.502
-10.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.393	1.436	1.446	1.443
-5.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.393	1.410	1.407	1.404
.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.375	1.372	1.369	1.365
2.0	1.234	1.267	1.302	1.305	1.327	1.348	1.366	1.360	1.357	1.354	1.350
4.0	1.234	1.267	1.302	1.305	1.327	1.348	1.354	1.346	1.342	1.339	1.335
6.0	1.234	1.267	1.302	1.305	1.327	1.348	1.340	1.332	1.327	1.324	1.321
8.0	1.234	1.267	1.302	1.305	1.327	1.343	1.327	1.318	1.313	1.310	1.306
10.0	1.234	1.267	1.302	1.305	1.327	1.330	1.314	1.305	1.299	1.296	1.293
12.0	1.234	1.267	1.302	1.305	1.327	1.318	1.302	1.291	1.285		
14.0	1.234	1.267	1.302	1.305	1.319	1.306	1.289	1.279	1.272		
16.0	1.234	1.267	1.302	1.305	1.307	1.294	1.277	1.266	1.259		
18.0	1.234	1.267	1.302	1.305	1.296	1.282	1.266	1.254	1.247		
20.0	1.234	1.267	1.301	1.297	1.284	1.271	1.254	1.242			
22.0	1.234	1.267	1.290	1.286	1.273	1.260	1.244	1.231			
24.0	1.234	1.267	1.279	1.275	1.263	1.249	1.233	1.220			
26.0	1.234	1.267	1.269	1.264	1.252	1.239	1.223				
28.0	1.234	1.259	1.258	1.254	1.243	1.229	1.213				
30.0	1.234	1.250	1.248	1.244	1.233	1.220					
32.0	1.234	1.240	1.239	1.235	1.224	1.212					
34.0	1.232	1.231	1.230	1.226	1.215	1.204					
36.0	1.223	1.222	1.221	1.217	1.207						
38.0	1.215	1.214	1.212	1.209	1.200						
40.0	1.207	1.206	1.205	1.201							
42.0	1.199	1.198	1.197	1.194							
45.0	1.189	1.188	1.187	1.184							
50.0	1.175	1.174									
55.0	1.165										

B0FC-02-0920-007-A060AA - R

PW Eng. : 4000

PW4152 | TAKE OFF N1 NO AIR BLEED MACH=.100

N1 CORRECTIONS FOR AIR BLEED	SAT< 8 (C)	SAT> 8 (C)
AIR CONDITIONING ON	-.450	-.450
NACELLE ANTI-ICE ON	0.000	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.350	-.650

SAT (C)	ALTITUDE (FT)										
	-1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	80.5	81.9	83.4	84.9	86.3	87.6	87.4	87.9	88.3	88.8	89.0
-30.0	82.1	83.5	85.0	86.6	88.0	89.4	90.0	90.3	90.6	90.9	91.0
-20.0	83.7	85.2	86.7	88.2	89.7	91.2	92.6	92.7	92.8	93.0	93.0
-10.0	85.4	86.8	88.4	89.9	91.4	92.9	94.4	94.5	94.7	94.8	94.8
-5.0	86.2	87.7	89.2	90.8	92.3	93.8	95.3	95.5	95.6	95.7	95.8
0.0	87.1	88.5	90.1	91.6	93.2	94.7	96.3	96.4	96.5	96.6	96.7
2.0	87.4	88.8	90.4	92.0	93.5	95.0	96.4	96.6	96.7	96.9	97.0
4.0	87.7	89.2	90.7	92.3	93.9	95.4	96.6	96.8	97.0	97.2	97.2
6.0	88.0	89.5	91.1	92.7	94.2	95.7	96.7	97.0	97.2	97.4	97.5
8.0	88.4	89.9	91.4	93.0	94.6	96.1	96.9	97.2	97.4	97.7	97.8
10.0	88.7	90.2	91.8	93.4	94.9	96.4	97.1	97.4	97.7	98.0	98.1
12.0	89.0	90.5	92.1	93.7	95.2	96.7	97.3	97.6	98.0	98.3	98.4
14.0	89.3	90.8	92.4	93.9	95.5	97.0	97.9	98.2	98.4	98.7	98.8
16.0	89.7	91.2	92.7	94.3	95.8	97.4	98.6	98.8	99.0	99.2	99.2
18.0	90.0	91.5	93.1	94.6	96.2	97.7	99.3	99.4	99.5	99.6	99.7
20.0	90.3	91.8	93.4	95.0	96.5	98.1	99.6	99.6	99.6	99.6	99.6
22.0	90.6	92.2	93.7	95.3	96.8	98.4	99.2	99.2	99.2	99.2	99.2
24.0	90.8	92.5	94.0	95.5	97.1	98.7	98.8	98.8	98.8	98.8	98.8
26.0	91.1	92.8	94.3	95.8	97.1	98.4	98.4	98.4	98.4	98.4	98.4
28.0	91.4	93.0	94.6	96.1	97.1	98.0	98.0	98.0	98.0	98.0	98.0
30.0	91.7	93.3	94.9	96.4	97.0	97.6	97.6	97.6	97.6	97.6	97.6
32.0	92.0	93.6	95.2	96.7	97.0	97.2	97.2	97.2	97.2	97.2	97.2
34.0	92.3	93.9	95.3	96.8	96.8	96.8	96.8	96.8	96.8	96.8	96.8
36.0	92.6	94.0	95.1	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2
38.0	92.9	94.2	94.9	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6
40.0	93.3	94.3	94.7	95.1	95.1	95.1	95.1	95.1	95.1		
42.0	93.6	94.5	94.5	94.5	94.5	94.5	94.5	94.5			
45.0	94.0	94.3	94.3	94.3	94.3	94.3	94.3				
50.0	93.2	93.2	93.2	93.2							
55.0	91.9	91.9									

FB2.0930.001-AA.025

PW Eng. : 4152

PW4152 TAKE OFF N1 NO AIR BLEED MACH=. 100

N1 CORRECTIONS FOR AIR BLEED	SAT< 8 (C)	SAT> 8 (C)
AIR CONDITIONING ON	-. 450	-. 450
NACELLE ANTI-ICE ON	0. 000	-. 300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-. 350	-. 650

SAT (C)	ALTITUDE (FT)										
	8500.	9000.	9500.	10000.	10500.	11000.	11500.	12000.	12500.	13000.	14100.
-60. 0	85. 7	85. 8	85. 8	85. 9	86. 3						
-50. 0	87. 4	87. 5	87. 6	87. 8	88. 2						
-40. 0	89. 0	89. 2	89. 4	89. 7	90. 1						
-30. 0	91. 0	91. 1	91. 3	91. 4	91. 8						
-20. 0	93. 0	93. 1	93. 1	93. 2	93. 6						
-15. 0	93. 9	94. 0	94. 1	94. 1	94. 5						
-10. 0	94. 8	94. 9	95. 0	95. 0	95. 5						
-8. 0	95. 2	95. 3	95. 3	95. 4	95. 8						
-6. 0	95. 6	95. 6	95. 7	95. 8	96. 2						
-4. 0	95. 9	96. 0	96. 1	96. 1	96. 6						
-2. 0	96. 3	96. 4	96. 4	96. 5	96. 9						
0. 0	96. 7	96. 7	96. 8	96. 9	97. 3						
2. 0	97. 0	97. 0	97. 1	97. 2	97. 6						
4. 0	97. 2	97. 3	97. 4	97. 5	98. 0						
6. 0	97. 5	97. 6	97. 8	97. 9	98. 3						
8. 0	97. 8	98. 0	98. 1	98. 2	98. 7						
10. 0	98. 1	98. 3	98. 4	98. 6	99. 0						
12. 0	98. 4	98. 6	98. 7	98. 9	99. 3						
14. 0	98. 8	99. 0	99. 1	99. 2	99. 5						
16. 0	99. 2	99. 3	99. 4	99. 5	99. 7						
18. 0	99. 7	99. 7	99. 8	99. 8	99. 9						
20. 0	99. 6	99. 6	99. 6	99. 6	99. 6						
22. 0	99. 2	99. 2	99. 2	99. 2	99. 2						
24. 0	98. 8	98. 8	98. 8	98. 8	98. 8						
26. 0	98. 4	98. 4	98. 4	98. 4	98. 4						
28. 0	98. 0	98. 0	98. 0	98. 0	98. 0						
30. 0	97. 6	97. 6	97. 6	97. 6	97. 6						
32. 0	97. 2	97. 2	97. 2	97. 2	97. 2						
34. 0	96. 8	96. 8	96. 8	96. 8	96. 8						
36. 0	96. 2	96. 2	96. 2								
38. 0	95. 6										

PW Eng. : 4152

GO AROUND N1 – M.225

PW4152	GO AROUND N1 AIR COND ON	MACH=.225

N1 CORRECTIONS FOR AIR BLEED	SAT< 8 (C)	SAT≥ 8 (C)
AIR CONDITIONING OFF	.450	.450
NACELLE ANTI-ICE ON	0.000	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.350	-.650

SAT (C)	ALTITUDE (FT) -1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	83.2	83.3	85.3	87.4	88.4	89.4	91.9	92.0	92.1	92.1	92.2
-30.0	84.9	85.6	87.4	89.2	90.4	91.7	93.7	93.8	93.9	94.0	94.0
-20.0	86.6	87.9	89.5	91.0	92.5	94.0	95.4	95.5	95.7	95.8	95.9
-10.0	88.3	89.6	91.2	92.7	94.2	95.8	97.3	97.4	97.5	97.7	97.7
-5.0	89.1	90.5	92.0	93.5	95.1	96.7	98.2	98.3	98.5	98.6	98.7
0.0	90.0	91.4	92.9	94.4	95.9	97.6	99.1	99.2	99.4	99.5	99.6
2.0	90.3	91.7	93.2	94.7	96.3	97.9	99.5	99.6	99.7	99.9	100.0
4.0	90.7	92.0	93.5	95.1	96.6	98.2	99.8	100.0	100.1	100.2	100.3
6.0	91.0	92.4	93.9	95.4	97.0	98.6	100.2	100.3	100.5	100.6	100.7
8.0	91.3	92.7	94.2	95.8	97.3	98.9	100.5	100.7	100.8	101.0	101.1
10.0	91.7	93.1	94.6	96.1	97.7	99.3	100.9	101.0	101.2	101.3	101.4
12.0	92.0	93.4	94.9	96.5	98.1	99.7	101.2	101.4	101.5	101.6	101.7
14.0	92.3	93.7	95.2	96.8	98.4	100.0	101.5	101.7	101.8	101.9	102.0
16.0	92.6	94.0	95.6	97.1	98.7	100.3	101.9	102.0	102.1	102.3	102.3
18.0	92.9	94.3	95.9	97.4	99.0	100.6	102.2	102.3	102.5	102.6	102.6
20.0	93.2	94.6	96.2	97.7	99.4	101.0	102.5	102.5	102.5	102.5	102.5
22.0	93.5	95.0	96.5	98.1	99.7	101.3	102.2	102.2	102.2	102.2	102.2
24.0	93.9	95.3	96.8	98.4	100.0	101.6	101.8	101.8	101.8	101.8	101.8
26.0	94.2	95.6	97.2	98.7	100.0	101.4	101.4	101.4	101.4	101.4	101.4
28.0	94.5	95.9	97.5	99.0	100.0	101.0	101.0	101.0	101.0	101.0	101.0
30.0	94.8	96.2	97.8	99.4	100.0	100.6	100.6	100.6	100.6	100.6	100.6
32.0	95.1	96.5	98.1	99.7	99.9	100.2	100.2	100.2	100.2	100.2	100.2
34.0	95.4	96.9	98.3	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8
36.0	95.7	97.2	98.3	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4
38.0	96.0	97.5	98.2	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
40.0	96.4	97.8	98.2	98.5	98.5	98.5	98.5	98.5	98.5		
42.0	96.7	98.1	98.1	98.1	98.1	98.1	98.1	98.1			
45.0	97.1	97.6	97.6	97.6	97.6	97.6	97.6				
50.0	96.4	96.4	96.4	96.4							
55.0	95.0	95.0									

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PW Eng. : 4152

PW4152 GO AROUND N1 AIR COND ON MACH=.225

N1 CORRECTIONS FOR AIR BLEED	SAT< 8 (C)	SAT> 8 (C)
AIR CONDITIONING OFF	.450	.450
NACELLE ANTI-ICE ON	0.000	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.350	-.650

SAT (C)	ALTITUDE (FT)										
	8500.	9000.	9500.	10000.	10500.	11000.	11500.	12000.	12500.	13000.	14100.
-60.0	88.4	88.4	88.5	88.5	88.9						
-50.0	90.3	90.3	90.4	90.4	90.8						
-40.0	92.2	92.2	92.3	92.3	92.8						
-30.0	94.0	94.1	94.1	94.2	94.7						
-20.0	95.9	96.0	96.0	96.1	96.6						
-15.0	96.8	96.9	97.0	97.0	97.5						
-10.0	97.7	97.8	97.9	98.0	98.4						
-8.0	98.1	98.2	98.3	98.3	98.8						
-6.0	98.5	98.6	98.6	98.7	99.2						
-4.0	98.9	98.9	99.0	99.1	99.5						
-2.0	99.2	99.3	99.4	99.4	99.9						
0.0	99.6	99.7	99.7	99.8	100.3						
2.0	100.0	100.0	100.1	100.2	100.6						
4.0	100.3	100.4	100.5	100.5	101.0						
6.0	100.7	100.8	100.8	100.9	101.4						
8.0	101.1	101.1	101.2	101.3	101.7						
10.0	101.4	101.5	101.6	101.6	102.1						
12.0	101.7	101.8	101.9	101.9	102.4						
14.0	102.0	102.1	102.1	102.2	102.5						
16.0	102.3	102.4	102.4	102.5	102.7						
18.0	102.6	102.7	102.7	102.8	102.8						
20.0	102.5	102.5	102.5	102.5	102.5						
22.0	102.2	102.2	102.2	102.2	102.2						
24.0	101.8	101.8	101.8	101.8	101.8						
26.0	101.4	101.4	101.4	101.4	101.4						
28.0	101.0	101.0	101.0	101.0	101.0						
30.0	100.6	100.6	100.6	100.6	100.6						
32.0	100.2	100.2	100.2	100.2	100.2						
34.0	99.8	99.8	99.8	99.8	99.8						
36.0	99.4	99.4	99.4								
38.0	99.0										

PW Eng. : 4152

MAXIMUM CONTINUOUS N1 – IAS = 230 KT

PW4000 MAXIMUM CONTINUOUS N1 AIR COND ON VC=230 KT

N1 CORRECTIONS FOR AIR BLEED

AIR CONDITIONING OFF	.700
NACELLE ANTI-ICE ON	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-1.000

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	79.5	82.7	85.4	87.6	89.7	92.1	92.6	93.2	93.6	93.8	93.9
-30.0	81.1	84.4	87.1	89.4	91.6	93.9	94.5	95.0	95.4	95.6	95.7
-20.0	82.7	86.0	88.7	91.2	93.6	95.8	96.4	96.9	97.2	97.4	97.6
-10.0	84.5	87.8	90.8	93.1	95.3	97.7	98.1	98.7	99.0	99.0	99.0
-5.0	85.3	88.7	91.5	94.0	96.3	98.7	99.1	99.2	99.3	99.3	99.3
0.0	86.1	89.4	92.2	94.8	97.1	99.4	99.6	99.7	99.7	99.7	99.7
2.0	86.4	89.7	92.5	95.1	97.4	99.7	99.8	99.9	99.9	99.9	99.9
4.0	86.7	90.0	92.8	95.4	97.6	100.0	100.0	100.0	100.0		100.0
6.0	87.0	90.4	93.2	95.7	98.0	99.7	99.7	99.7	99.7		99.7
8.0	87.3	90.7	93.6	96.1	98.3	99.5	99.5	99.5	99.5		
10.0	87.6	91.1	93.9	96.4	98.6	99.3	99.3	99.3			
12.0	88.0	91.5	94.3	96.8	99.0	99.0	99.0	99.0			
14.0	88.3	91.8	94.5	97.0	98.8	98.8	98.8				
16.0	88.6	92.0	94.8	97.3	98.5	98.5	98.5				
18.0	88.9	92.3	95.1	97.3	98.2	98.2	98.2				
20.0	89.2	92.6	95.4	97.2	97.8	97.8					
22.0	89.5	92.9	95.8	97.2	97.4	97.4					
24.0	89.8	93.3	95.8	97.0	97.0	97.0					
26.0	90.1	93.6	95.7	96.6	96.6						
28.0	90.4	93.9	95.6	96.2	96.2						
30.0	90.7	94.2	95.5	95.8	95.8						
32.0	91.0	94.5	95.4	95.4							
34.0	91.3	94.3	95.0	95.0							
36.0	91.6	94.1	94.6	94.6							
38.0	91.8	93.9	94.1								
40.0	92.1	93.7	93.7								
42.0	92.4	93.3	93.3								
45.0	92.8	92.8									
50.0	92.2	92.2									
55.0	91.6										

B0FC-02-0930-005-A025AA - R

PW Eng. : 4000

PW4000 | **MAXIMUM CLIMB N1** AIR COND ON **300/.78**

N1 CORRECTIONS FOR AIR BLEED

AIR CONDITIONING OFF	.700
NACELLE ANTI-ICE ON	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.650

TAT (C)	ALTITUDE (FT) 0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	78.4	79.9	81.3	82.6	83.9	85.2	86.9	88.3	89.8	90.7	91.6
-30.0	80.0	81.4	82.8	84.2	85.6	86.9	88.6	89.4	91.6	92.5	93.5
-20.0	81.5	83.0	84.4	85.8	87.3	88.7	90.4	90.5	93.4	94.4	95.4
-10.0	83.1	84.6	86.0	87.5	89.0	90.4	92.2	93.2	95.2	95.2	95.2
-5.0	84.0	85.4	86.9	88.5	90.0	91.3	93.1	94.3	95.1	95.1	95.1
0.0	84.8	86.3	87.8	89.4	90.9	92.3	94.0	95.0	95.0	95.0	95.0
2.0	85.2	86.6	88.1	89.7	91.2	92.6	94.3	94.9	94.9	94.9	94.9
4.0	85.5	86.9	88.5	90.0	91.5	92.9	94.6	94.7	94.7	94.7	94.7
6.0	85.8	87.2	88.8	90.3	91.8	93.2	94.6	94.6	94.6	94.6	94.6
8.0	86.0	87.5	89.1	90.6	92.1	93.5	94.4	94.4	94.4	94.4	94.4
10.0	86.3	87.8	89.4	90.9	92.4	93.8	94.2	94.2	94.2		
12.0	86.6	88.1	89.6	91.1	92.7	94.0	94.0	94.0	94.0		
14.0	86.9	88.4	90.0	91.5	93.1	93.8	93.8	93.8	93.8		
16.0	87.3	88.8	90.5	91.8	93.5	93.5	93.5	93.5	93.5		
18.0	87.6	89.1	90.7	92.1	93.3	93.3	93.3	93.3	93.3		
20.0	87.8	89.4	91.0	92.5	93.0	93.0	93.0	93.0			
22.0	88.1	89.7	91.3	92.8	92.8	92.8	92.8	92.8			
24.0	88.5	90.0	91.5	92.5	92.5	92.5	92.5	92.5			
26.0	88.8	90.3	91.8	92.2	92.2	92.2	92.2				
28.0	89.1	90.6	91.9	91.9	91.9	91.9	91.9				
30.0	89.4	90.9	91.6	91.6	91.6	91.6					
32.0	89.7	91.1	91.3	91.3	91.3	91.3					
34.0	90.0	91.0	91.0	91.0	91.0	91.0					
36.0	90.2	90.6	90.6	90.6	90.6						
38.0	90.3	90.3	90.3	90.3	90.3						
40.0	90.1	90.1	90.1	90.1							
42.0	89.9	89.9	89.9	89.9							
45.0	89.5	89.5	89.5	89.5							
50.0	88.9	88.9	88.9								
55.0	88.4	88.4									

B0FC-02-0930-006-A025AA - R

R *Note : Values to be applied for IAS = 250 kt below 10000 ft pressure altitude.*

PW Eng. : 4000

MAXIMUM CRUISE N1 – IAS 250 / 340 KT / M.80

PW4000	MAXIMUM CRUISE N1 AIR COND ON 250/340/.80
N1 CORRECTIONS FOR AIR BLEED	
AIR CONDITIONING OFF	.700
NACELLE ANTI-ICE ON	-.300
NACELLE ANTI-ICE AND WING ANTI-ICE ON	-.650

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	72.9	75.7	78.1	80.6	80.6	81.6	82.6	84.5	86.6	89.0	91.4
-30.0	74.5	77.2	79.7	81.8	82.3	83.3	84.3	86.2	88.4	90.8	93.1
-20.0	76.1	78.8	81.3	83.0	83.9	85.1	86.0	87.9	90.2	92.5	94.8
-10.0	77.5	80.3	82.8	84.3	85.6	86.7	87.7	89.6	91.9	92.4	92.8
-5.0	78.2	81.1	83.7	85.2	86.5	87.2	88.6	90.5	91.9	91.9	91.9
0.0	79.0	81.8	84.5	86.0	87.3	87.5	89.4	91.2	91.5	91.5	91.5
2.0	79.3	82.2	84.8	86.4	87.7	87.9	89.8	91.3	91.3	91.3	91.3
4.0	79.5	82.5	85.2	86.7	88.0	88.4	90.0	91.2	91.2	91.2	91.2
6.0	79.8	82.8	85.5	87.0	88.3	88.9	90.3	91.0	91.0	91.0	91.0
8.0	80.1	83.1	85.8	87.3	88.5	89.4	90.6	90.9	90.9	90.9	90.9
10.0	80.4	83.3	86.0	87.6	88.9	89.8	90.7	90.7	90.7	90.7	90.7
12.0	80.7	83.6	86.3	87.9	89.2	90.1	90.5	90.5	90.5		
14.0	81.0	84.0	86.7	88.2	89.5	90.4	90.4	90.4	90.4		
16.0	81.3	84.3	87.0	88.5	89.8	90.2	90.2	90.2	90.2		
18.0	81.6	84.6	87.4	88.8	90.1	90.1	90.1	90.1	90.1		
20.0	81.9	84.9	87.5	89.1	90.0	90.0	90.0	90.0			
22.0	82.2	85.2	87.2	89.4	89.9	89.9	89.9	89.9			
24.0	82.5	85.4	86.9	89.7	89.7	89.7	89.7	89.7			
26.0	82.8	85.8	86.5	89.6	89.6	89.6	89.6	89.6			
28.0	83.1	86.1	86.1	89.6	89.6	89.6	89.6	89.6			
30.0	83.4	85.8	85.8	89.5	89.5	89.5	89.5				
32.0	83.6	85.5	85.5	89.4	89.4	89.4	89.4				
34.0	83.9	85.2	85.2	89.3	89.3	89.3	89.3				
36.0	84.2	84.8	84.8	89.2	89.2	89.2	89.2				
38.0	84.5	84.5	84.5	89.1	89.1	89.1					
40.0	84.2	84.2	84.2	89.1	89.1	89.1					
42.0	83.9	83.9	83.9	89.0	89.0						
45.0	83.4	83.4	83.4	89.0	89.0						
50.0	82.7	82.7		88.9							
55.0	81.9										

B0FC-02-0930-007-A025AA - R

PW Eng. : 4000

PW 4000	**CRUISE N1 M.80**
Air Conditioning : ECON – Typical CG – ISA	

	Flight Level							
WEIGHT (1000 kg)	270	290	310	330	350	370	390	410
95	80.4	80.3	80.1	80.0	80.1	80.6	81.9	83.5
100	80.7	80.4	80.4	80.4	80.5	81.3	82.6	86.4
105	80.9	80.7	80.7	80.8	81.0	81.8	83.4	84.8
110	81.1	81.0	81.0	81.2	81.5	82.4	84.7	83.5
115	81.3	81.2	81.3	81.5	82.1	83.2	86.1	
120	81.6	81.6	81.8	82.1	82.6	84.3	88.0	
125	81.8	81.9	82.1	82.6	83.3	85.5		
130	82.1	82.3	82.6	83.1	84.1	87.1		
135	82.4	82.7	83.0	83.7	85.2	88.8		
140	82.7	83.0	83.5	84.4	86.5			
145	83.0	83.4	84.0	85.2	88.0			
150	83.4	83.8	84.5	86.2				
155	83.8	84.3	85.2	87.5				
160	84.2	84.8	86.0	88.9				
165	84.6	85.3	87.0	89.8				

TEMPORARY REVISION N° 218

This Temporary Revision has been issued after REV 20.
Do not remove this Temporary Revision until instructed to do so by the "Temporary Revision Filing Instructions".

VALIDITY : A310 with PW Eng. 4152 with modification 5443 (in kilogrammes).

SUBJECT : SHORTFALL IN MAXIMUM TORQUE CAPABILITY OF THE MHB CARBON BRAKES.

Insert the following pages in volume 2 and update the list of Temporary Revisions.

TR N° 218 page 1 of 10 at the beginning of chapter 2.10
TR N° 218 page 2 of 10 facing 2.10.40 page 3
TR N° 218 page 3 of 10 facing 2.10.40 page 4
TR N° 218 page 4 of 10 facing 2.10.40 page 5
TR N° 218 page 5 of 10 facing 2.10.40 page 6
TR N° 218 page 6 of 10 facing 2.10.40 page 7
TR N° 218 page 7 of 10 facing 2.10.40 page 8
TR N° 218 page 8 of 10 facing 2.10.40 page 9
TR N° 218 page 9 of 10 facing 2.10.40 page 10
TR N° 218 page 10 of 10 facing 2.10.40 page 11

TEMPORARY REVISION N° 248

This TR has been issued after REV 24.
Do not remove this Temporary Revision until instructed to do so by the "Temporary Revision Filing Instructions".

VALIDITY : A310 without modification 10848 or without modification 10849.

SUBJECT : SHORTFALL IN MAXIMUM TORQUE CAPABILITY OF THE MHB CARBON BRAKES.

Bulletin Services has been issued to cure the above mentioned problem.

As soon as B.S. 32-2084 (modification 10848)
or B.S. 32-2082 (modification 10849)
has been installed and Flight Manual updated, you can disregard the temporary revisions 213 to 221 if incorporated in FCOM volume 2 chapter 10.

Insert this page in volume 2 at beginning of chapter 2.10 and update the list of Temporary Revisions.

TR N° 535-2 Page 4 of 6

R Code : 0376

V_2 VERSUS WEIGHT AND V_2/V_S RATIO – SLATS 15/FLAPS 0
V_2 (KT IAS)

WEIGHT (1000kg)	V2/VS														
	1.21	**1.22**	**1.23**	**1.24**	**1.25**	**1.26**	**1.27**	**1.28**	**1.29**	**1.30**	**1.31**	**1.32**	**1.33**	**1.34**	**1.35**
164	175	176	178	179	181	182	183	185	186	188	189	191	192	193	195
162	174	175	177	178	179	181	182	184	185	187	188	189	191	192	194
160	173	174	175	177	178	180	181	183	184	185	187	188	190	191	192
158	172	173	174	176	177	179	180	181	183	184	186	187	188	190	191
156	171	172	173	175	176	177	179	180	182	183	184	186	187	189	190
154	169	171	172	174	175	176	178	179	181	182	183	185	186	187	189
152	168	170	171	172	174	175	177	178	179	181	182	183	185	186	188
150	167	169	170	171	173	174	175	177	178	180	181	182	184	185	186
148	166	168	169	170	172	173	174	176	177	178	180	181	182	184	185
146	165	166	168	169	170	172	173	174	176	177	179	180	181	183	184
144	164	165	167	168	169	171	172	173	175	176	177	179	180	181	183
142	163	164	165	167	168	169	171	172	173	175	176	177	179	180	181
140	161	162	164	165	166	168	169	170	172	173	174	175	177	178	179
138	160	161	162	164	165	166	168	169	170	172	173	174	176	177	178
136	159	160	161	163	164	165	166	168	169	170	172	173	174	176	177
134	158	159	160	161	163	164	165	167	168	169	170	172	173	174	176
132	156	158	159	160	162	163	164	165	167	168	169	170	172	173	174
130	155	156	158	159	160	162	163	164	165	167	168	169	170	172	173
128	154	155	157	158	159	160	162	163	164	165	167	168	169	170	172
126	153	154	155	157	158	159	160	162	163	164	165	167	168	169	170
124	152	153	154	155	157	158	159	160	162	163	164	165	166	168	169
122	150	152	153	154	155	157	158	159	160	161	163	164	165	166	168
120	149	150	152	153	154	155	157	158	159	160	161	163	164	165	166
118	148	149	150	152	153	154	155	156	158	159	160	161	162	164	165
116	147	148	149	150	152	153	154	155	156	158	159	160	161	162	163
114	145	147	148	149	150	151	153	154	155	156	157	158	160	161	162
112	144	145	147	148	149	150	151	152	154	155	156	157	158	160	161
110	143	144	145	146	148	149	150	151	152	153	155	156	157	158	159
108	142	143	144	145	146	147	149	150	151	152	153	154	156	157	158
106	140	142	143	144	145	146	147	148	150	151	152	153	154	155	156
104	139	140	141	142	144	145	146	147	148	149	150	152	153	154	155
102	138	139	140	141	142	143	144	146	147	148	149	150	151	152	153
100	136	137	139	140	141	142	143	144	145	146	147	149	150	151	152
98	135	136	137	138	139	141	142	143	144	145	146	147	148	149	150
96	134	135	136	137	138	139	140	141	142	143	145	146	147	148	149
94	132	133	134	136	137	138	139	140	141	142	143	144	145	146	147
92	131	132	133	134	135	136	137	138	139	140	142	143	144	145	146
90	129	131	132	133	134	135	136	137	138	139	140	141	142	143	144
88	128	129	130	131	132	133	134	135	136	137	138	140	141	142	143
86	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141
84	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
82	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
80	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136

CAUTION

R THE ABOVE V_2 VALUES DO NOT TAKE INTO ACCOUNT VMU AND VMCA LIMITATIONS

Code : 0030

V_2 VERSUS WEIGHT AND V_2/V_s RATIO – SLATS 15/FLAPS 15
V_2 (KT IAS)

WEIGHT (1000kg)	V2/VS														
	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
164	163	164	166	167	168	170	171	172	174	175	176	177	179	180	181
162	162	163	165	166	167	169	170	171	173	174	175	176	178	179	180
160	161	162	164	165	166	167	169	170	171	173	174	175	177	178	179
158	160	161	163	164	165	166	168	169	170	172	173	174	176	177	178
156	159	160	161	163	164	165	167	168	169	171	172	173	174	176	177
154	158	159	160	162	163	164	166	167	168	169	171	172	173	175	176
152	157	158	159	161	162	163	165	166	167	168	170	171	172	173	175
150	156	157	158	160	161	162	163	165	166	167	169	170	171	172	174
148	155	156	157	159	160	161	162	164	165	166	167	169	170	171	172
146	154	155	156	158	159	160	161	163	164	165	166	168	169	170	171
144	153	154	155	157	158	159	160	162	163	164	165	166	168	169	170
142	152	153	154	155	157	158	159	160	162	163	164	165	167	168	169
140	151	152	153	154	156	157	158	159	161	162	163	164	166	167	168
138	150	151	152	153	155	156	157	158	159	161	162	163	164	166	167
136	149	150	151	152	153	155	156	157	158	160	161	162	163	164	166
134	147	149	150	151	152	154	155	156	157	158	160	161	162	163	164
132	146	148	149	150	151	152	154	155	156	157	158	160	161	162	163
130	145	146	148	149	150	151	152	154	155	156	157	158	160	161	162
128	144	145	147	148	149	150	151	152	154	155	156	157	158	160	161
126	143	144	145	147	148	149	150	151	152	154	155	156	157	158	159
124	142	143	144	145	147	148	149	150	151	152	154	155	156	157	158
122	141	142	143	144	145	147	148	149	150	151	152	153	155	156	157
120	140	141	142	143	144	145	146	148	149	150	151	152	153	155	156
118	138	140	141	142	143	144	145	146	148	149	150	151	152	153	154
116	137	138	140	141	142	143	144	145	146	147	149	150	151	152	153
114	136	137	138	139	141	142	143	144	145	146	147	148	150	151	152
112	135	136	137	138	139	140	142	143	144	145	146	147	148	149	150
110	134	135	136	137	138	139	140	141	142	144	145	146	147	148	149
108	132	134	135	136	137	138	139	140	141	142	143	144	146	147	148
106	131	132	133	134	136	137	138	139	140	141	142	143	144	145	146
104	130	131	132	133	134	135	136	137	139	140	141	142	143	144	145
102	129	130	131	132	133	134	135	136	137	138	139	140	141	143	144
100	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142
98	126	127	128	129	130	131	132	133	135	136	137	138	139	140	141
96	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
94	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
92	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
90	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
88	120	121	122	123	124	125	126	127	128	129	129	130	131	132	133
86	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
84	117	118	119	120	121	122	123	124	125	126	127	127	128	129	130
82	116	116	117	118	119	120	121	122	123	124	125	126	127	128	129
80	114	115	116	117	118	119	120	121	122	123	123	124	125	126	127

R CAUTION : THE ABOVE V_2 VALUES DO NOT TAKE INTO ACCOUNT VMU AND VMCA LIMITATIONS

Code : 1010B

V_2 VERSUS WEIGHT AND V_2/V_S RATIO – SLATS 20/FLAPS 20
V_2 (KT IAS)

WEIGHT (1000kg)	V2/VS															
	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
164	158	159	160	162	163	164	165	167	168	169	171	172	173	175	176	177
162	157	158	159	161	162	163	164	166	167	168	170	171	172	173	175	176
160	156	157	158	160	161	162	163	165	166	167	169	170	171	172	174	175
158	155	156	157	159	160	161	162	164	165	166	167	169	170	171	172	174
156	154	155	156	158	159	160	161	163	164	165	166	168	169	170	171	173
154	153	154	156	157	158	160	161	162	163	165	166	167	168	169	170	172
152	152	153	155	156	157	159	160	161	162	164	165	166	167	168	169	170
150	151	152	154	155	156	158	159	160	161	163	164	164	166	167	168	169
148	150	151	153	154	155	157	158	159	160	162	163	163	165	166	167	168
146	149	150	152	153	154	156	157	158	159	161	162	162	164	165	166	167
144	148	149	151	152	153	154	156	157	158	159	161	161	162	164	165	166
142	147	148	150	151	152	153	155	156	157	158	160	160	161	162	164	165
140	146	147	149	150	151	152	154	155	156	157	158	159	160	161	163	164
138	145	146	148	149	150	151	152	154	155	156	157	158	159	160	161	163
136	144	145	147	148	149	150	151	153	154	155	156	157	158	159	160	161
134	143	144	146	147	148	149	150	152	153	154	155	156	157	158	159	160
132	142	143	144	146	147	148	149	150	152	153	154	154	156	157	158	159
130	141	142	143	145	146	147	148	149	150	152	153	153	154	156	157	158
128	140	141	142	143	145	146	147	148	149	150	152	152	153	154	156	157
126	139	140	141	142	144	145	146	147	148	149	150	151	152	153	154	156
124	137	139	140	141	142	144	145	146	147	148	149	150	151	152	153	154
122	136	138	139	140	141	142	144	145	146	147	148	149	150	151	152	153
120	135	136	138	139	140	141	142	144	145	146	147	147	149	150	151	152
118	134	135	137	138	139	140	141	142	143	145	146	146	147	148	150	151
116	133	134	136	137	138	139	140	141	142	143	144	145	146	147	148	149
114	132	133	135	136	137	138	139	140	141	142	143	144	145	146	147	148
112	131	132	133	134	135	137	138	139	140	141	142	143	144	145	146	147
110	130	131	132	133	134	135	136	137	139	140	141	141	142	143	144	146
108	128	129	131	132	133	134	135	136	137	138	140	140	141	142	143	144
106	127	128	130	131	132	133	134	135	136	137	138	139	140	141	142	143
104	126	127	128	130	131	132	133	134	135	136	137	137	138	140	141	142
102	125	126	127	128	129	130	131	133	134	135	136	136	137	138	139	140
100	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
98	122	123	125	126	127	128	129	130	131	132	133	133	134	135	136	138
96	121	122	124	125	126	127	128	129	130	131	132	132	133	134	135	136
94	120	121	122	123	124	125	126	128	128	129	130	131	132	133	134	135
92	119	120	121	122	123	124	125	126	127	128	129	129	130	131	132	133
90	117	118	120	121	122	123	124	125	126	127	128	128	129	130	131	132
88	116	117	118	120	120	121	122	123	124	125	126	127	128	128	129	130
86	115	116	117	118	119	120	121	122	123	124	125	125	126	127	128	129
84	114	114	116	117	118	119	120	121	121	122	123	124	125	126	127	127
82	112	113	114	115	116	117	118	119	120	121	122	122	123	124	125	126
80	111	112	113	114	115	116	117	118	119	120	120	121	122	123	124	124

R CAUTION : THE ABOVE V_2 VALUES DO NOT TAKE INTO ACCOUNT VMU AND VMCA LIMITATIONS

Mod. : 4863

OPERATING SPEEDS : (KT IAS)

F – S – « GREEN DOT » – VREF

SPEED WEIGHT (1000 KG)	F (1.25 Vs 15/0)	S (1.25 Vs 0/0)	« GREEN DOT » SPEED below 20000 FT	VREF (1.3 Vs 30/40)
164	180	226	264	160
162	179	224	262	159
160	178	223	260	158
158	177	222	258	157
156	175	220	256	156
154	174	219	254	155
152	173	217	252	154
150	172	216	250	153
148	171	215	248	152
146	170	213	246	151
144	169	212	244	150
142	167	210	242	149
140	167	209	240	147
138	166	207	238	146
136	164	206	236	145
134	163	204	234	144
132	162	203	232	143
130	161	201	230	142
128	159	200	228	141
126	158	198	226	140
124	157	197	224	139
122	156	195	222	138
120	154	193	220	137
118	153	192	218	135
116	152	190	216	134
114	151	189	214	133
112	149	187	212	132
110	148	185	210	131
108	147	184	208	129
106	145	182	206	128
104	144	180	204	127
102	142	178	202	126
100	141	177	200	125
98	140	175	198	123
96	138	173	196	122
94	137	171	194	121
92	135	170	192	120
90	134	168	190	118

Mod. : 4863

1. DEFINITION OF FLEXIBLE TAKEOFF

In many cases, the aircraft takes off at a weight lower than the maximum permissible weight. In consequence, it is possible to continue to meet the performance requirements (Runway, 2nd segment, obstacle) with a decreased thrust that is adapted to the weight : this is called FLEXIBLE TAKEOFF and the thrust is called FLEXIBLE THRUST.

2. UTILIZATION OF FLEXIBLE TAKEOFF

Flexible takeoff can be used when the actual takeoff weight is lower than the maximum permissible takeoff weight for the actual temperature. As this weight decreases when temperature increases, it is possible to assume a temperature at which the actual takeoff weight would be the limiting one. This temperature is called FLEXIBLE TEMPERATURE.

3. AIRWORTHINESS REQUIREMENTS

(A) **Thrust reduction** :

Thrust reduction must not exceed 25 % of the full rated takeoff thrust. To meet this requirement the flexible temperature must not be higher than ISA + 57 °C.

(B) Flexible takeoff is not recommended on contaminated runways.

(C) The operator should check the maximum thrust at regular intervals in order to detect any possible engine deterioration, or maintain an adequate engine performance monitoring program to follow up the engine parameters.

4. DETERMINATION OF FLEXIBLE TEMPERATURE AND CORRESPONDING EPR

(A) **Flexible temperature**

See in section 2.10.30 how to determine flexible temperature.
Flexible temperature must not be higher than ISA + 57 °C.

(B) **Corresponding EPR**

This can be determined :

- either by inserting flexible temperature on Thrust Rating Panel then selecting FLX TO
- or with chart TO EPR of chapter 2.09 THRUST SETTING.

5. DETERMINATION OF ASSOCIATED SPEEDS

See how to determine these speeds in section 2.10.30.

6. CLIMB FOLLOWING A FLX TO

- Without profile mode :
  Before takeoff, compare FLX TO EPR and CL EPR. If FLX TO EPR is lower than CL EPR, select CR at thrust reduction altitude. When rate of climb becomes lower than 1 000 ft/mn, select CL.
- With profile mode :
  At thrust reduction altitude, CL is automatically selected. If FLX TO EPR is lower than CL, the FMS will gradually increase the thrust from FLX TO to reach CL before 20 000 ft.

7. RECOMMENDATION WHEN PERFORMING FLEXIBLE TAKEOFF R R

In order to extend engine life and save maintenance costs our recommendation is to use flexible thrust reduction. R R

However, to improve the takeoff performance, the thrust can be increased by selecting a lower flex temperature. R R

Using the same takeoff chart, it is possible for a given weight :

1) To select a temperature lower than the maximum one and keep the speeds defined at maximum temperature.

or

2) To move towards the left side of the takeoff chart. This introduces a lower maximum temperature and in general lower takeoff speeds V_1, V_R and V_2.

or

3) To select a temperature lower than the maximum one and to decrease the V_1 decision speed by 1 kt per 1.5° C decremented from maximum temperature.
The V_1 decrement should be limited to a maximum of 5 kt.

Using one of the three above possibilities, do not forget to check that the selected temperature is greater than the actual temperature and greater than flat rating temperature.

PW Eng : All

8. CONCLUSION

Depending on environmental takeoff conditions, we recommend the following procedure :

CONDITIONS	PROCEDURE	REASON
Dry, well paved runway	– Use flaps configuration giving the highest flexible temperature. – When flexible temperature difference between two flaps configurations is low (less than 5 degrees), use the configuration giving the lowest speeds.	Extend engine life and save maintenance costs.
High altitude takeoff	– Use flaps 15°	Add comfort
Badly paved runway or Accelerate stop distance limited runway and warm brakes	– Use flaps 15° or – Move towards left side of takeoff chart or – Select a flex temperature lower than the maximum one and decrease V1 by 1 kt per 1.5° C decremented from flexible temperature with a maximum of 5 kt reduction.	Add comfort Improve stopping distance
Wet runway	– Use flaps configuration giving the lowest speeds	Improve stopping distance
Contaminated runway	– Use maximum thrust	Improve stopping distance Decrease time on runway
Windshear expected along takeoff path	– Use maximum thrust	Maintain acceleration capability

1. INTRODUCTION

These charts enable the crew to determine for the corresponding runway :

- the maximum permissible take-off weight for the ambient pressure, temperature and surface wind conditions, or :
- for a **given** aircraft weight, the maximum temperature at which a take-off would be permitted. This temperature (corrected for QNH and airbleeds) is called the flexible Temperature.

The flexible temperature may be selected on the Thrust Rating Panel or used in the T/O EPR Chart to obtain the corresponding flexible EPR (Refer to chapter 09). This reduced power setting provides performance in compliance with regulations in the event of engine failure at V1.

A specific chart is established for each runway. It is based on standard atmospheric pressure and takes account of the significant obstacles along the specified flight path.

What does the crew know ?

- runway
- reference pressures
- actual temperature and / or T/O weight
- wind

What does the crew need to know ?

- maximum take-off weight for the actual temperature, wind and QNH
- maximum temperature corresponding to the actual weight, wind and QNH, becoming the flexible temperature when reduced thrust take-off is possible.

What are the entries into the chart ?

For the given runway, enter the corresponding chart with :

- wind and actual temperature to determine maximum take-off weight
- wind and weight to determine maximum temperature.

What are the outputs ?

After making corrections due to QNH variations and bleeds, the outputs are :

- maximum take-off weight or maximum temperature
- nature of the performance limitation
- V1, VR and V2

In addition, maximum go-around temperature for both approach configurations is indicated.
Single engine climb out procedure may be indicated.

2. EXPLANATION OF THE OUTPUTS OF THE CHART

A. Flap setting

The flap setting is indicated on top of the chart in the right corner.

B. Maximum take-off weight

For each line an entry weight is given. For each Box a weight increment/decrement is given. The weight corresponding to any box is the sum of entry weight and weight increment or decrement. A decrement is shown in the upper boxes of the chart when the take-off weight at the lowest computed temperature is lower than the highest entry weight. It is the maximum permissible T/O weight corresponding to the temperature shown in the box.

C. Maximum temperature (° C)

The temperature shown in the box is the maximum temperature at which the maximum weight determined as above can be lifted.

D. Limitation

This indicates the nature of the limitation or the balance between two limitations as resulting from the optimization. Limitation codes are as follows :

1 – Maximum structural weight
2 – Second segment
3 – Runway
4 – Obstacle
5 – Tire speed
6 – Brake energy
7 – Runway 2 engines operative (if applicable)
8 – Final take-off. R

E. V1 : decision speed (IAS)

F. VR : rotation speed (IAS)

G. V2 : safety speed (IAS)

This speed is to be maintained up to the acceleration height (or altitude) in case of engine failure to obtain the expected performance associated with the given configuration and data.

Note : *The SRS provides automatically the correct pitch guidance. In the absence of SRS indication, it is recommended to initially set a safe pitch attitude of 12.5°.*

3. CORRECTIONS. Refer to page 2.10.30 page 6

In order to get the most out of the chart, there are two kinds of corrections :

- either on weight when determining maximum take-off weight
- or on maximum temperature when determining the flexible or limiting temperature.

Any QNH variation from the standard, for which the chart is calculated, will affect either the maximum temperature or the weight. The air bleeds will affect the maximum temperature or the weight in the same manner.

PW Eng. : All

A. Corrections on weight

The effect of QNH variations or bleed compensation consists of an addition or substraction to the weight as specified on each chart.

1st step

In order to avoid a weight penalty when the actual temperature does not appear in the chart, the weight gradients on both sides of the flat rating temperature are given on top of the chart (Grad 1/Grad 2). Flat rating temperature is given as Tref. Using the data, weight and temperature given in the upper box of the wind column, add the weight increment determined by multiplying the weight gradient by the difference of temperature between actual temperature and that given in the box.

When these two temperatures (actual and max.) are on either side of flat rating temperature, two steps are necessary. First multiply the weight gradient given above Tref by the difference between max. temp. and flat rating temperature. Then multiply the weight gradient given below Tref by the difference between flat rating temperature and actual temperature. Add these two values to the max. weight of the first box.

Note : *Weight gradients must only be used to extrapolate above the maximum weight shown in the RTOLW chart (upper box of the chart). They do not allow to interpolate between two boxes, neither between two filled boxes, nor between one filled and one blank box.*

2nd step

From this maximum weight, subtract or add the weight increment equivalent to the QNH variation from standard as indicated on the chart. Subtract bleed effect if any. The final weight is the max. permissible TOW for the actual environmental conditions.

B. Corrections on temperature

Variations in QNH and bleeds affect the maximum temperature corresponding to a given weight. The resulting temperature called flexible temperature must be checked on the chart as shown in order to avoid :

- either a take-off at a higher weight than allowed by the maximum available level of thrust when the flexible temperature is lower than Tref or actual temperature.
- or setting a thrust derated by more than allowed : maximum derated thrust : **maximum thrust at ISA + 57° C for the actual conditions**.

  This maximum derating corresponds to a maximum flexible temperature of ISA + 57° C.

  This final temperature (called corrected temperature (CT)) will be set on the THRUST RATING PANEL (TRP).
  Any temperature below Tref should not be set on the TRP.
  The maximum value of CT which may be set is ISA + 57° C.
  The setting of a temperature lower than actual will result in dashes being displayed on the TRP.

Note : *Take-off charts for wet runways, when based on the use of reverse thrust, may show for some conditions a weight higher than on dry runway. It is then necessary to compare both charts (dry and wet) and to retain the lowest weight and the associated speeds determined on wet runway*

4. ADDITIONAL INFORMATION

A. Single engine climb out procedure

The performance given in the chart is consistent with the specified flight path in case of engine failure, and takes account of significant obstacles.

When the procedure to follow is not the standard instrument departure, a specific procedure is described.

When the specified procedure requires a turn, except if otherwise stated on the RTOLW chart, the turn will be performed with a 15° bank angle maximum until 1500 ft or green dot speed is reached.

The acceleration height (or altitude) ensures that the highest obstacle will be cleared by the net flight path by at least 35 ft when accelerating in level flight to green dot speed after an engine failure, in the most adverse conditions.

B. Speeds (IAS)

F – Flaps retraction speed, one engine out (1.25 Vs slats out)

S – Slats retraction speed, one engine out (1.25 Vs clean)

Green dot – Optimum climb out speed, one engine out (1.45 Vs clean).

C. Supplementary operating instructions for take-off

(1) Contaminated runway

Refer to 2.18

(2) Wet runway

Refer to 2.18.

(3) Antiskid failure

Refer to MMEL

(4) Spoilers inoperative

Refer to MMEL

R

D. Landing information

TGA is the maximum temperature at which the approach climb gradient condition is satisfied as a function of weight. Two TGA and flap settings are presented in order to choose the most appropriate as a function of the scheduled landing weight and temperature. The configurations 15/15 and 20/20, specified under TGA, are the configurations in which the required gradient of 2.1 % is satisfied, with one engine failed. The single engine approach is normally performed with one step of flaps further down until overshoot is decided, while the 2 engines approach is performed with up to two steps (if applicable) beyond the indicated flaps position. In both cases, one step of flaps is retracted when the Go-Around is decided.

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 1.3 Vs of the specified flap setting.

The temperature TGA is also published for weight higher than the maximum landing weight in order to cover the overweight landing condition.
If the OAT is greater than the temperature TGA, follow the overweight landing procedure requiring to land in configuration 20/20.
Again, the indicated setting is one step of flaps below the approach configuration.
Note : If no bleed for air conditioning is extracted from the engines, the minimum gain to be expected is :
– 2° C on the temperature
R *– or 1,5 ton (3 300 lb) on the weight.*

5. INTERPOLATION

It is allowed to interpolate weight, temperature and speeds between two consecutive boxes of a column, or of a line.

6. METHOD OF APPLICATION

A. Maximum take-off weight determination

(1.)

Enter with actual wind and actual temperature

(2.)

Read or interpolate total weight or determine total weight by adding the effect of weight gradient to the weight of the first box.

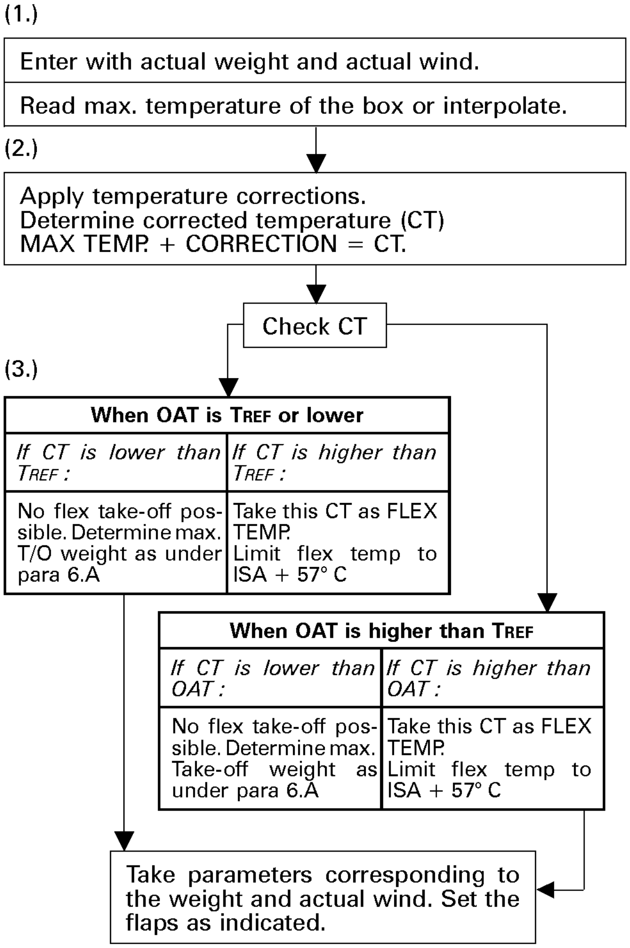
(3.)

Apply weight corrections and determine maximum T/0 weight.

(4.)

Take parameters and flaps setting corresponding to this weight and actual wind.

B. Flexible temperature determination



(1.)

Enter with actual weight and actual wind.

Read max. temperature of the box or interpolate.

(2.)

Apply temperature corrections.
Determine corrected temperature (CT)
MAX TEMP. + CORRECTION = CT.

Check CT

(3.)

When OAT is TREF or lower	
If CT is lower than TREF :	*If CT is higher than TREF :*
No flex take-off possible. Determine max. T/O weight as under para 6.A	Take this CT as FLEX TEMP. Limit flex temp to ISA + 57° C

When OAT is higher than TREF	
If CT is lower than OAT :	*If CT is higher than OAT :*
No flex take-off possible. Determine max. Take-off weight as under para 6.A	Take this CT as FLEX TEMP. Limit flex temp to ISA + 57° C

Take parameters corresponding to the weight and actual wind. Set the flaps as indicated.

7. RESEARCH OF OPTIMUM USE OF THE CHART (valid only when flexible take-off is possible) :

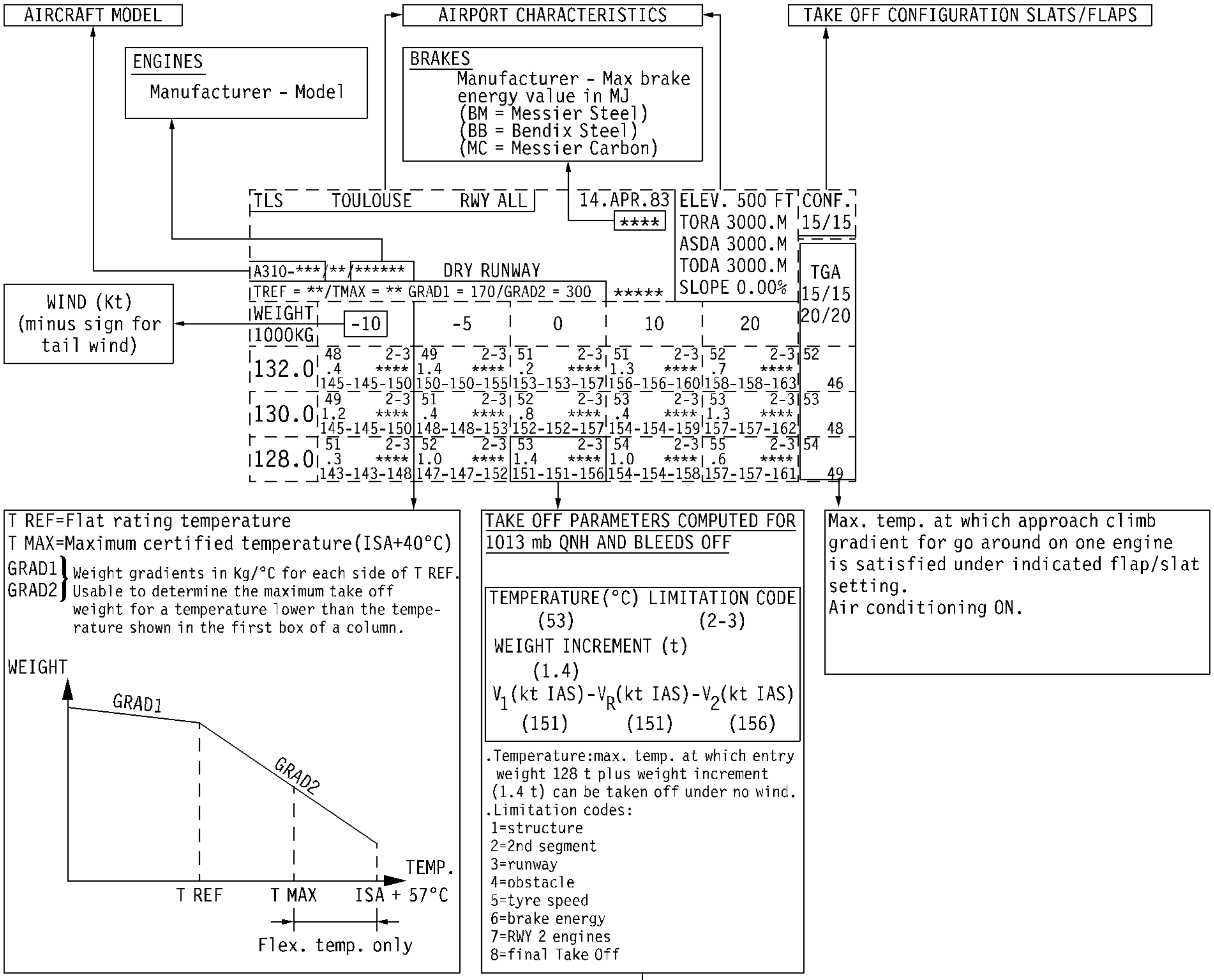
On some airports, the runway structure is not perfect and it may be advisable to take-off as soon as possible. On some others, particularly in altitude, maximum performance is often limited by tire speed. In this case, actual T/0 weight or temperature permitting, it may be interesting to take-off with a lower speed.

The chart offers the possibility of trading a lower take-off speed against the unnecessary temperature margin (which is the temperature above max. permissible CT) or even against some thrust reduction.

For this purpose, move to the left of the actual wind until :

- either the maximum for flexible temperature is met (ISA + 57° C) to take the full advantage of the unused temperature above that figure.
- or a temperature, which, as a compromise, represents less than the maximum permissible thrust reduction.

8. RTOLW CHARTS – COMPLEMENTARY INFORMATION : EFFECT OF QNH OR/AND BLEEDS



T REF=Flat rating temperature
T MAX=Maximum certified temperature(ISA+40°C)
GRAD1, GRAD2: Weight gradients in Kg/°C for each side of T REF. Usable to determine the maximum take off weight for a temperature lower than the temperature shown in the first box of a column.

TAKE OFF PARAMETERS COMPUTED FOR 1013 mb QNH AND BLEEDS OFF

TEMPERATURE(°C) LIMITATION CODE
(53) (2-3)
WEIGHT INCREMENT (t)
(1.4)
V_1(kt IAS)-V_R(kt IAS)-V_2(kt IAS)
(151) (151) (156)

.Temperature:max. temp. at which entry weight 128 t plus weight increment (1.4 t) can be taken off under no wind.
.Limitation codes:
1=structure
2=2nd segment
3=runway
4=obstacle
5=tyre speed
6=brake energy
7=RWY 2 engines
8=final Take Off

Max. temp. at which approach climb gradient for go around on one engine is satisfied under indicated flap/slat setting.
Air conditioning ON.

R
R

To take into account QNH deviation and/or bleeds ON apply:

CORRECTIONS ON TEMPERATURE IF FLEX. TAKE OFF PERFORMED		CORRECTIONS ON WEIGHT IF TAKE OFF WITH FULL THRUST PERFORMED
Add 1°C per 12 mb	QNH above 1013 mb*	Add 50 kg/mb
Sub 1°C per 8 mb	QNH below 1013 mb	Sub 190 kg/mb
Sub 2°C	Engine A/ICE ON	Sub 600 kg
Sub 3°C	Total A/ICE ON	Sub 2500 kg
Sub 3°C	Air conditioning ON	Sub 2500 kg

COMPARE CORRECTED TEMP. (CT), FLAT RATING TEMP.(T REF) AND OAT

CT Higher than OAT and CT Higher than T REF	Take CT as flex. Temp. limited to ISA + 57°C
Both conditions above not fulfilled	NO FLEX. Determine MAX TOW

* No correction when airport pressure altitude 0 ft or below

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XXXX AIRPORT **RWY **** FAR 30/03/92 ELEV. 79.FT
**** TORA 3658.M
ASDA 3658.M
A310-*/AA/*** TODA 3658.M
TREF= 43/TMAX= ** GRAD1=110/GRAD2= 700 ***** SLOPE -.02 %

CONF. 15/15

WEIGHT 1000KG	**-10**	**-5**	**0**	**10**	**20**	TGA 15/15 20/20
157.0		6 4-4 .1 165-165-169	32 2-4 .0 164-165-169	44 2-4 .0 166-167-171	45 2-4 .6 170-171-174	45
155.0	- 2 4-4 -1. 161-161-165	23 2-4 .1 160-161-165	43 2-4 .7 162-163-167	45 2-4 1.0 166-167-171	47 2-4 .4 172-172-175	46
152.5	16 4-4 .0 156-156-160	43 2-4 .0 155-157-161	46 2-4 .7 162-163-167	48 2-4 .1 167-167-171	49 2-4 .3 171-171-174	48 43
150.0	35 4-4 .0 151-153-157	46 2-4 .2 156-157-161	48 2-4 1.0 163-164-167	50 2-4 .1 167-167-170	51 2-4 .2 170-170-173	50 45
147.5	43 4-4 1.4 149-152-156	48 2-4 .7 157-157-161	50 2-4 1.1 163-163-166	52 2-4 .1 166-166-169	53 2-4 .0 169-169-172	51 47
145.0	47 4-4 .8 151-151-156	50 4-4 1.0 158-158-162	52 4-4 1.1 162-162-166	53 2-4 1.3 166-166-169	54 2-2 1.1 168-168-171	53 49
142.5	50 4-4 .4 152-152-156	52 4-4 1.2 160-160-163	54 4-4 1.0 162-162-166	55 2-4 1.2 165-165-168	56 2-2 .8 166-167-170	55 51
140.0	52 4-4 .9 153-153-157	54 4-4 1.2 159-159-162	56 4-4 1.0 162-162-165	57 2-4 1.1 164-164-167	58 2-2 .5 164-165-168	55 53
137.5	55 4-4 .1 155-155-159	56 4-4 1.2 158-158-161	58 4-4 1.0 160-160-164	59 2-4 1.1 163-163-166	60 2-2 .3 162-163-166	55 54
135.0	57 4-4 .2 155-155-159	58 4-4 1.2 157-157-160	60 4-4 1.0 159-159-162	61 2-4 1.0 161-161-164	62 2-2 .1 160-162-165	55 55
132.5	59 4-4 .2 154-154-157	61 4-4 .0 156-156-159	62 4-4 1.0 158-158-161	63 2-4 1.0 160-160-163	63 2-2 1.2 159-161-164	55 55
130.0	61 4-4 .3 152-152-156	63 4-4 .1 155-155-158	64 2-4 1.0 156-156-159	65 2-2 .9 159-159-162	65 2-2 .9 157-159-162	55 55
127.5	63 4-4 .4 151-151-155	65 4-4 .1 154-154-157	66 2-4 1.0 155-155-158	67 2-2 .7 157-158-161	67 2-2 .7 155-158-161	55 55
125.0	65 4-4 .5 151-151-154	67 4-4 .2 153-153-156	68 2-4 .9 154-154-157	69 2-2 .5 155-156-159	69 2-2 .5 153-156-159	55 55

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9. EXAMPLES

See chart on previous page to follow examples.

A. Determination of maximum take-off weight.

DATA
OAT = 10 °
QNH = 1003 mb
20 kt head wind
Air conditioning on

(1) Enter in 20 kt head wind column and read temperature and weight, in first line at 45 ° . . . . 157 600 kg

(2) Use weight gradients for increase in weight capability between 45 ° and 10 ° :
between 45 ° and TREF = 43 ° . 2 × 700 1 400 kg
between 43 ° and 10 ° . . . . . 33 × 110 3 630 kg
Total weight . . . . 162 630 kg

(3) Effect of QNH . . . . 10 × 190 – 1 900 kg
160 730 kg

(4) Effect of air conditioning . . . . – 2 500 kg
Maximum capability . . . . 158 230 kg
Maximum permissible take off weight depending on version, for example : 157 000 kg

(5) Read Take-off parameters in 157 000 kg line for 20 kt head wind Flaps 15 °
V1 = 170 kt
VR = 171 kt Limitation : obstacles
V2 = 174 kt and second segment

B. Determination of flexible temperature.

DATA
OAT = 15 °
Take-off weight : 130 000 kg
QNH = 1026 mb
No wind
Air conditioning OFF

(1) Enter with 130 000 kg and no wind and read temperature . . . . 64 °

(2) Effect of QNH . . . . + 1 °
Corrected temperature . . . . . . = 65 °

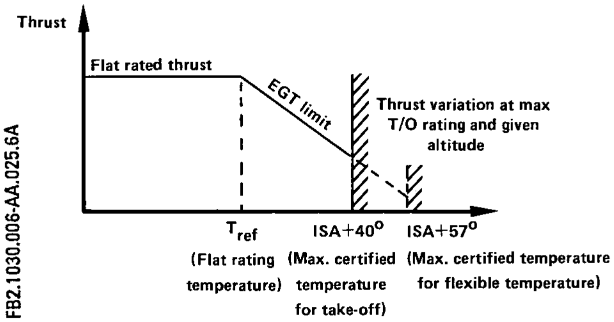
(3) Check CT is lower than 72 ° (ISA + 57 °).
Flex temperature to be set on THRUST CONTROL COMPUTER : . . . . 65 °

(4) Read take-off parameters in 130 000 kg line for no wind
V1 = 156 kt
VR = 156 kt
V2 = 159 kt

10. EXPLANATION OF TAKE-OFF PERFORMANCE CALCULATION

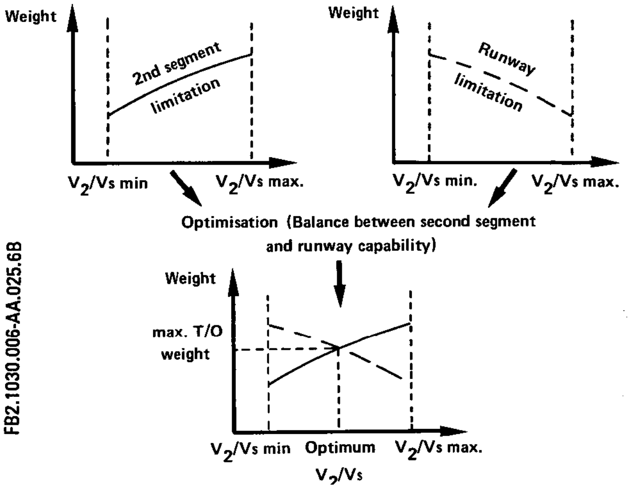
The performance calculation is optimized. This means that
considering the runway, the obstacles (if any) and the environmental conditions, the maximum take-off weight, associated to the optimum flap setting is the resulting parameter. Conversely, a max. TO temperature will result if the chart is entered with the actual TO weight.

A. Engine thrust

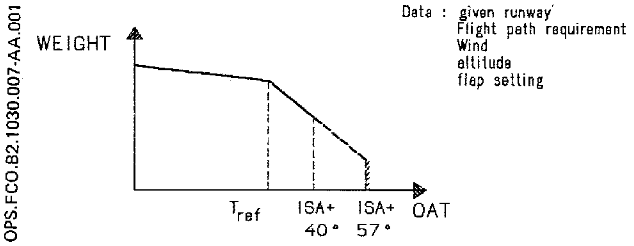


B. Airplane performance

Considering a given runway and wind, given temperature and pressure conditions, given flap setting, the max. weight that can be lifted varies with the V2/Vs ratio.

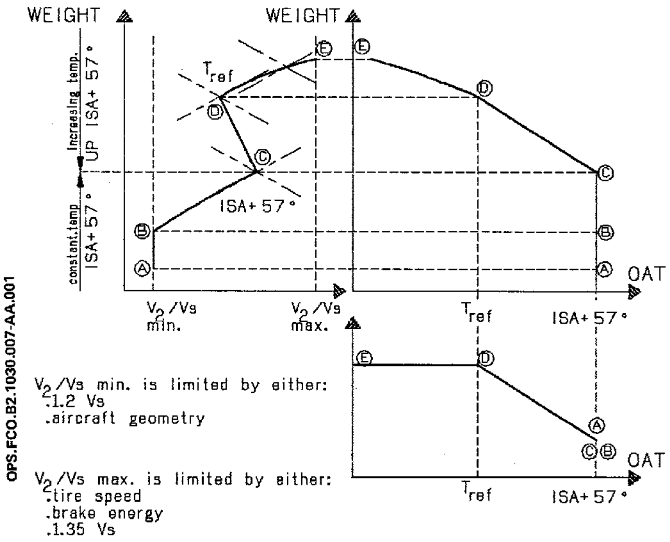


If the same calculation is done for all temperature at the same pressure altitude and on same runway, the resulting graph is :



This graph is converted into a tabular form in one column of the take-off chart.

If we enter more deeply in details, the column of a chart represents the optimization line as presented below.



V2/Vs min. is limited by either:
.1.2 Vs
.aircraft geometry

V2/Vs max. is limited by either:
.tire speed
.brake energy
.1.35 Vs

Between (D) and (E), i.e. below Tref, the thrust remains constant. However the weight which can be lifted increases when the temperature decreases. This is due to the TAS decreasing along with the temperature for the same IAS, which in turn allows an acceleration to a higher IAS on the same runway length and consequently leads to a higher weight being lifted.

Between (D) and (C), the thrust decreases, and, consequently, the weight, when the temperature increases.

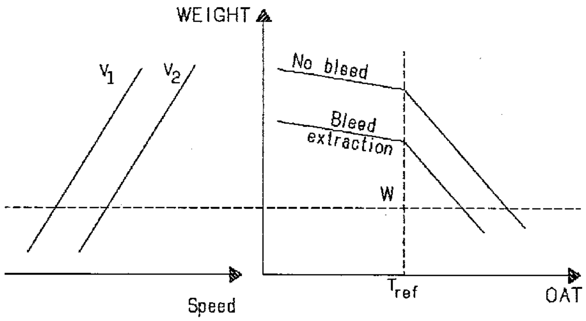
Between (C) and (B), the thrust remains constant at the level delivered at ISA + 57°. The optimization line follows the climb limiting weight, until the minimum V2/Vs value is reached. Then, towards (A), the V2/Vs ratio remains constant.

C. Effect of wind, runway length and bleeds

As a general rule, the optimization leads to balance ASD and TOD, which means having a single V1. However, on very long runway, the airplane being limited by the second segment climb gradient, it is possible to have a wide range of V1, V1 min. being limited by TOD and V1 max. by ASD.

Concerning the wind effect, it must be noted that a tail wind makes the runway « shorter » and a head wind makes the runway « longer », which in the last case leads to a lower V1 min.

In case of air bleed, it is interesting to note that the available max. thrust decreases, and, consequently, the weight for a given temperature.



In addition, for a given weight W, with or without bleed, the take-off speeds are the same.

Crosswind component greater than 20 knots :

Referring to procedure presented in 2.03.12 page 1, the associated takeoff performance can be determined with one of both following methods.

BASIC METHOD, DRY and WET RUNWAY : TAKEOFF DISTANCE PENALTY

Use a dedicated RTOW chart, computed with PEP/TLO or equivalent software, which takes into account a takeoff distance penalty by either :

- reducing the available runway distances (ASDA, TORA, TODA), or
- increasing the ASD, TOR, TOD.

Distance Penalty : 30 m

Flexible takeoff is permitted.

ALTERNATE METHOD, DRY and WET RUNWAY : MAXIMUM TAKEOFF WEIGHT PENALTY

When the above method cannot be used, decrease the Maximum Takeoff Weight, deduced from the current available data, by the following value :

	Weight Penalty
RWY LGTH > 3000 m	700 kg/1600 lb
2500 m < RWY LGTH < 3000 m	900 kg/2000 lb
2000 m < RWY LGTH < 2500 m	1100 kg/2500 lb

Use the associated speeds corresponding to the decreased weight.

Flexible takeoff is possible : no change in weight and Takeoff speeds, decrease the flexible temperature by :

	Delta TFlex
RWY LGTH > 3000 m	– 1°C
2500 m < RWY LGTH < 3000 m	– 1.5°C
2000 m < RWY LGTH < 2500 m	– 2°C

CONTAMINATED RUNWAY

The takeoff is performed with full thrust.
Consider the crosswind limitations recommendations presented in 2.02.13 page 18.

If the performance computation software is used for direct determination of takeoff performance on contaminated runway, the basic method can be applied with the same distance penalty for a dedicated computation.

If the FCOM method for contaminated runway, described in 2.18.50, is used, determine firstly the MTOW on dry runway with crosswind, with one of both above methods ; apply to this crosswind corrected MTOW the FCOM method 2.18.50.

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NO CHANGE

NO CHANGE

D. CORRECTIONS FOR WIND AND RUNWAY SLOPE

NO CHANGE

Note : For crosswind component greater than 20 knots, refer to 2.10.35. R R

TR N° 535-2 Page 6 of 6

INTRODUCTION :

These tables enable the crew to quickly determine take off performance out of an airport, for which no take off chart has been established. They are obviously conservative.

USE OF TABLES :

A first table gives the corrections to be applied to the runway length versus wind and runway slope. For each flap setting three other tables give, for three different pressure altitudes (0, 1000 and 2000 ft) function of temperature and corrected runway length, maximum take off weight, limitation codes and associated speeds. At the top of the table TREF and TMAX are given. For pressure altitude above 2000 ft the flight manual has to be used. Two graphs give for each configuration the penalty to apply in case of obstacles on the flight path.
NOMINAL THRUST. The Quick reference tables are on pages 3 to 11/12.
FAN THRUST DETERIORATION MODE (FTDM). The FTDM phenomenon, which occurs after 500 to 1250 flight cycles since the last fan blade overhaul, produces a thrust decrease of approximately 2.5%.

The French DGAC Airworthiness Directive AD 2001-086(B) R2 stipulates that a restoration of the leading edge contour of fan blades must be achieved every 450 engine cycles, in order to recover the nominal thrust.
The quick reference tables for the FTDM affected aircraft are in pages 19 to 27/28.

HOW TO PROCEED ?

Enter the first table with runway length, slope and wind data. Determine the corrected runway length by applying the corrections due to slope and wind data. Select then the configuration as a function of this corrected runway length and enter the table(s) corresponding to the proper configuration and airport pressure altitude. As far as airport pressure altitude is concerned, two methods may be applied :

- either interpolate the take off performance by using the two tables enclosing the airport pressure altitude,
- or, if one only need a conservative figure, use the table corresponding to the pressure altitude immediately above the one of the considered airport.

  Enter then the proper column of the table(s) with the corrected runway length as criteria. Once again, two methods may be applied :
- either interpolate the take off performance between the two columns enclosing the corrected runway length
- or, if one only need a conservative figure, use the column corresponding to the foregoing value of the corrected runway length.

A. DETERMINATION OF MAXIMUM TAKE OFF WEIGHT

Enter the proper table(s) and column(s) as explained above with the actual OAT and read maximum take off weight, limitation codes, V1, VR and V2. If necessary interpolate weight and speeds.
In case of obstacles refer to pages 13 to 18 and apply the corresponding weight and speed decrements.

B. DETERMINATION OF FLEXIBLE TEMPERATURE

Determination of flexible temperature is only possible without any obstacle on the flight path.
Enter the proper table(s) and column(s) with the actual take off weight and determine flexible temperature.

C. LIMITATION CODES :

2 : second segment
3 : runway
5 : tirespeed
6 : brake energy

Note : Limitation codes 1 (structural weight) and 4 (obstacles) do not appear in quick reference tables.

D. CORRECTIONS FOR WIND AND RUNWAY SLOPE

Runway length (m)		1 500	2 000	2 500	3 000	3 500	4 000
Effect of wind	per kt of tail* wind subtract (meters)	30	40	50	60	75	85
	per kt of head wind add (meters)	7	9	11	12	14	16
Effect of runway slope	per percent uphill slope subtract (meters)	85	165	215	310	360	450
	per percent downhill slope add (meters)	30	40	60	75	110	135

* For runway length above 2750 m
. reduce Max. Take-off weight by 2.5 tons (5500 lb)/kt tail wind
. reduce V_1 by 2 kt/kt tail wind

E. PENALTIES IN CASE OF OBSTACLES

Use the proper graph as explained below.

- Position the obstacle by entering its distance from end of runway and its height above the end of runway (No 35 ft margin is required as this is already included).

  In case of ascending runway, increase the obstacle height by an additional value as indicated below each graph.

- Read the associated weight correction. Interpolate if necessary. The second segment gradient is given for information only.
- Decrease the takeoff speeds by 0.5 knot per 1000 kg weight decrement. Limit the final speeds to the minimum values as given in 2.10.10.

F. EXAMPLE

Pressure altitude : 1400 FT
Temperature : 36° C
Runway length : 3500 m
Wind : 10 kt head
Slope : 1 % up

1. Determination of corrected runway length :

   Runway length 3500
   Correction due to wind . . . . 10 × 15 = + 150
   Correction due to slope . . . . — 365

   Corrected runway length . . . . = 3285 m

   Take-off configuration : 15/0

2. Determination of a conservative figure as maximum take-off weight :

   Pressure altitude : 1400 FT ; Use the table corresponding to 2000 FT (2.10.40 page 5)
   Corrected runway length : 3285 m ; enter the column corresponding to 3250 m
   Read the maximum take-off weight on the line corresponding to the temperature 35° C : 150 000 kg
   V_1 = 151 kt, Vr = 165 kt, V_2 = 169 kt.

3. Determination of a precise figure as flexible temperature for the actual take-off weight of 125 000 kg

   - Interpolate the temperature corresponding to 125 tons for the corrected runway length of 3285 m at 1000 and 2000 ft pressure altitude.
     Results :
     1000 FT : 68° C, V_1 = 160 kt, Vr = 162 kt, V_2 = 164 kt
     2000 FT : 65° C, V_1 = 158 kt, Vr = 160 kt, V_2 = 163 kt

   - Interpolate between these two values to get the flexible temperature at 1400 FT pressure altitude :
     66° C, V_1 = 159 kt, V_R = 161 kt, V_2 = 163 kt

4. Determination of a conservative figure as maximum take-off weight in case of a 930 ft height obstacle located at 15 km from runway end. From 2.10.40 page 5, as in paragraph 2, find TOW and associated speeds without obstacle :
   150 000 kg V_1 = 151 kt, Vr = 165 kt, V_2 = 169 kt
   2.10.40 page 14 :
   Corrected obstacle height for uphill runway :
   930 + 70 = 1000 ft
   Weight decrement : 10 000 kg.
   Maximum takeoff weight
   150 000 – 10 000 = 140 000 kg
   V_1 = 151 – 6 = 145 kt
   Vr = 165 – 6 = 159 kt
   V_2 = 169 – 6 = 163 kt

CONFIGURATION 15/ 0 **PRESSURE ALTITUDE = 0 FT**

TREF = 42 °C DRY RUNWAY **MAX T.O. WEIGHT(1000KG)** **CODES**
TMAX = 55 °C SLOPE = 0.0 % **IAS(KT) V1 - VR - V2**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-18	165.6 2-6 165-174-179	167.0 2-6 164-177-182	168.3 2-6 163-180-184	169.5 2-6 162-183-187	170.7 2-6 162-185-190
-8	164.2 2-6 163-172-177	165.6 2-6 162-175-179	167.0 2-6 161-177-182	168.2 2-6 160-180-184	169.5 2-6 159-183-187
2	161.9 6-6 161-170-175	164.3 2-6 159-172-177	165.6 2-6 158-175-179	167.0 2-6 158-177-182	168.2 2-6 157-180-184
12	159.3 6-6 159-169-174	162.0 6-6 157-170-175	164.3 2-6 156-172-177	165.6 2-6 155-175-179	167.0 2-6 154-178-182
22	156.8 6-6 158-167-172	159.6 6-6 156-169-174	162.2 6-6 154-171-175	164.4 2-6 153-172-177	165.7 2-6 152-175-179
32	154.4 6-6 156-166-171	157.1 6-6 154-168-172	159.8 6-6 153-169-174	162.4 6-6 151-171-175	164.5 2-6 150-173-177
42	151.9 6-6 154-165-170	154.7 6-6 153-166-171	157.4 6-6 151-168-173	160.1 6-6 149-169-174	162.6 6-6 148-171-175
44	150.8 6-6 155-164-169	153.6 6-6 153-166-170	156.3 6-6 151-168-172	158.9 6-6 150-169-173	161.3 2-6 148-171-175
46	149.6 6-6 155-164-168	152.3 6-6 153-166-170	155.0 6-6 152-167-171	157.6 6-6 150-168-173	159.1 2-6 149-171-175
48	148.4 6-6 155-164-168	151.1 6-6 154-165-169	153.7 6-6 152-166-171	155.6 2-6 151-168-172	156.9 2-6 150-171-175
50	147.3 6-6 156-163-167	149.9 6-6 154-165-168	152.2 2-6 153-166-170	153.4 2-6 152-168-173	154.6 2-6 151-171-175
52	146.1 6-6 156-163-166	148.6 6-6 154-164-168	149.9 2-6 154-166-170	151.1 2-6 153-168-173	152.3 2-6 152-171-175
54	144.9 6-6 156-162-166	146.5 2-6 155-164-168	147.7 2-6 155-166-170	148.8 2-6 154-168-172	149.9 2-6 153-171-175
56	143.0 2-3 157-162-165	144.3 2-6 156-164-168	145.4 2-6 156-166-170	146.5 2-6 155-168-172	147.5 2-6 155-171-175
58	140.4 2-3 156-161-164	142.1 2-6 158-164-168	143.1 2-6 157-166-170	144.1 2-6 156-168-172	145.0 2-6 156-170-174
60	137.8 2-3 156-160-163	139.8 2-6 159-164-168	140.8 2-6 158-166-170	141.7 2-6 158-168-172	142.6 2-6 157-170-174
62	135.3 2-3 156-160-163	137.5 2-3 160-164-168	138.5 2-6 160-166-170	139.3 2-6 159-168-172	140.2 2-6 158-170-174
64	132.8 2-3 155-159-162	134.9 2-3 160-164-167	136.2 2-6 161-167-170	137.0 2-6 160-169-172	137.7 2-6 160-171-174
66	130.2 2-3 155-158-161	132.2 2-3 159-163-166	133.8 2-6 162-167-170	134.6 2-6 162-169-172	135.3 2-6 161-171-174
68	127.7 2-3 155-158-161	129.6 2-3 159-163-165	131.3 2-3 163-167-170	132.1 2-6 163-169-172	132.8 2-6 163-171-174
70	125.2 2-3 154-157-160	127.0 2-3 159-162-165	128.7 2-3 163-166-169	129.7 2-6 165-169-172	130.2 . 2-2 163-171-174
72	122.6 2-3 154-157-159	124.4 2-3 159-162-164	126.0 2-3 163-166-169	126.9 2-2 165-169-171	126.9 2-2 163-169-171

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NOMINAL THRUST

CONFIGURATION 15/ 0			PRESSURE ALTITUDE 0 FT		
TREF = 42 °C TMAX = 55 °C		DRY RUNWAY SLOPE = 0 %	MAX T.O. WEIGHT(1000KG) CODES IAS(KT) : V1 - VR - V2		
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-18	165.6 2-6 165-174-179	167.0 2-6 164-177-182	168.3 2-6 163-180-184	169.5 2-6 162-183-187	170.7 2-6 162-185-190
-8	164.2 2-6 163-172-177	165.6 2-6 162-175-179	167.0 2-6 161-177-182	168.2 2-6 160-180-184	169.5 2-6 159-183-187
2	161.9 6-6 161-170-175	164.3 2-6 159-172-177	165.6 2-6 158-175-179	167.0 2-6 158-177-182	168.2 2-6 157-180-184
12	159.3 6-6 159-169-174	162.0 6-6 157-170-175	164.3 2-6 156-172-177	165.6 2-6 155-175-179	167.0 2-6 154-178-182
22	156.8 6-6 158-167-172	159.6 6-6 156-169-174	162.2 6-6 154-171-175	164.4 2-6 153-172-177	165.7 2-6 152-175-179
32	154.4 6-6 156-166-171	157.1 6-6 154-168-172	159.8 6-6 153-169-174	162.4 6-6 151-171-175	164.5 2-6 150-173-177
42	151.9 6-6 154-165-170	154.7 6-6 153-166-171	157.4 6-6 151-168-173	160.1 6-6 149-169-174	162.6 6-6 148-171-175
44	150.8 6-6 155-164-169	153.6 6-6 153-166-170	156.3 6-6 151-168-172	158.9 6-6 150-169-173	161.3 2-6 148-171-175
46	149.6 6-6 155-164-168	152.3 6-6 153-166-170	155.0 6-6 152-167-171	157.6 6-6 150-168-173	159.1 2-6 149-171-175
48	148.4 6-6 155-164-168	151.1 6-6 154-165-169	153.7 6-6 152-166-171	155.6 2-6 151-168-172	156.9 2-6 150-171-175
50	147.3 6-6 156-163-167	149.9 6-6 154-165-168	152.2 2-6 153-166-170	153.4 2-6 152-168-173	154.6 2-6 151-171-175
52	146.1 6-6 156-163-166	148.6 6-6 154-164-168	149.9 2-6 154-166-170	151.1 2-6 153-168-173	152.3 2-6 152-171-175
54	144.9 6-6 156-162-166	146.5 2-6 155-164-168	147.7 2-6 155-166-170	148.8 2-6 154-168-172	149.9 2-6 153-171-175
56	143.2 2-6 157-162-165	144.3 2-6 156-164-168	145.4 2-6 156-166-170	146.5 2-6 155-168-172	147.5 2-6 155-171-175
58	140.9 2-6 158-162-165	142.1 2-6 158-164-168	143.1 2-6 157-166-170	144.1 2-6 156-168-172	145.0 2-6 156-170-174
60	138.4 2-3 158-161-165	139.8 2-6 159-164-168	140.8 2-6 158-166-170	141.7 2-6 158-168-172	142.6 2-6 157-170-174
62	135.9 2-3 158-161-164	137.6 2-6 160-164-168	138.5 2-6 160-166-170	139.3 2-6 159-168-172	140.2 2-6 158-170-174
64	133.4 2-3 158-160-163	135.3 2-6 161-165-168	136.2 2-6 161-167-170	137.0 2-6 160-169-172	137.7 2-6 160-171-174
66	130.8 2-3 157-160-163	132.8 2-3 162-164-168	133.8 2-6 162-167-170	134.6 2-6 162-169-172	135.3 2-6 161-171-174
68	128.2 2-3 157-159-162	130.2 2-3 162-164-167	131.4 2-6 164-167-170	132.1 2-6 163-169-172	132.8 2-6 163-171-174
70	125.7 2-3 157-159-161	127.6 2-3 162-164-166	129.1 2-6 165-168-170	129.7 2-6 165-169-172	130.2 2-2 163-171-174
72	123.1 2-3 157-158-161	125.0 2-3 162-163-166	126.6 2-3 166-168-170	126.9 2-2 165-169-171	126.9 2-2 163-169-171

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R Code : 0378 PW Eng. : 4152

NOMINAL THRUST

CONFIGURATION 15/ 0		PRESSURE ALTITUDE 1000 FT			
TREF = 37 °C TMAX = 53 °C	DRY RUNWAY SLOPE = 0 %	MAX T.O. WEIGHT(1000KG) CODES IAS(KT) : V1 - VR - V2			
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-23	164.6 2-6 164-174-178	166.0 2-6 163-176-181	167.3 2-6 162-179-183	168.5 2-6 162-182-186	169.7 2-6 161-184-189
-13	163.2 6-6 162-171-176	164.6 2-6 161-174-178	166.0 2-6 160-176-181	167.3 2-6 159-179-183	168.5 2-6 158-182-186
-3	160.6 6-6 160-169-174	163.2 6-6 159-171-176	164.6 2-6 158-174-178	165.9 2-6 157-176-181	167.2 2-6 156-179-183
7	157.9 6-6 159-168-173	160.6 6-6 157-170-174	163.3 2-6 155-171-176	164.6 2-6 154-174-178	165.9 2-6 153-176-181
17	155.3 6-6 157-167-171	158.1 6-6 155-168-173	160.8 6-6 154-170-174	163.3 2-6 152-171-176	164.6 2-6 151-174-178
27	152.9 6-6 155-165-170	155.7 6-6 154-167-172	158.4 6-6 152-169-173	161.0 6-6 150-170-174	163.4 2-6 149-172-176
37	150.2 6-6 154-164-169	153.0 6-6 152-166-170	155.7 6-6 151-167-172	158.3 6-6 149-169-173	160.8 6-6 148-170-174
39	149.4 6-6 154-164-168	152.1 6-6 152-165-170	154.8 6-6 151-167-171	157.4 6-6 149-168-173	160.0 6-6 148-170-174
41	148.4 6-6 154-163-168	151.2 6-6 152-165-169	153.9 6-6 151-166-171	156.5 6-6 149-168-172	159.0 6-6 148-169-173
43	147.4 6-6 154-163-167	150.0 6-6 153-164-169	152.7 6-6 151-166-170	155.2 6-6 150-167-171	157.0 2-6 149-169-173
45	146.2 6-6 154-162-166	148.9 6-6 153-164-168	151.5 6-6 151-165-169	153.7 2-6 150-167-171	154.9 2-6 149-169-173
47	145.1 6-6 155-162-166	147.7 6-6 153-163-167	150.3 6-6 152-165-169	151.6 2-6 151-167-171	152.8 2-6 150-169-173
49	144.0 6-6 155-161-165	146.5 6-6 154-163-167	148.4 2-6 153-165-169	149.5 2-6 152-167-171	150.7 2-6 151-169-173
51	142.9 6-6 155-161-164	145.0 2-6 154-163-166	146.2 2-6 153-165-168	147.4 2-6 153-167-171	148.4 2-6 152-169-173
53	141.8 6-6 156-161-164	143.0 2-6 155-163-166	144.1 2-6 154-165-168	145.2 2-6 154-167-171	146.2 2-6 153-169-173
55	139.7 2-6 157-160-164	140.8 2-6 156-163-166	141.9 2-6 156-165-168	142.9 2-6 155-167-171	143.9 2-6 154-169-173
57	137.3 2-3 157-160-163	138.7 2-6 157-163-166	139.6 2-6 157-165-168	140.6 2-6 156-167-170	141.5 2-6 156-169-172
59	134.8 2-3 156-159-162	136.5 2-6 159-163-166	137.4 2-6 158-165-168	138.3 2-6 157-167-170	139.2 2-6 157-169-172
61	132.4 2-3 156-159-162	134.4 2-6 160-163-166	135.2 2-6 159-165-168	136.0 2-6 159-167-170	136.8 2-6 158-169-172
63	129.9 2-3 156-158-161	132.0 2-3 160-163-166	132.9 2-6 160-165-168	133.7 2-6 160-167-170	134.4 2-6 159-169-172
65	127.4 2-3 155-158-160	129.4 2-3 160-162-165	130.7 2-6 162-165-168	131.4 2-6 161-167-170	132.1 2-6 161-169-172
67	124.9 2-3 155-157-160	126.9 2-3 160-162-164	128.4 2-6 163-166-168	129.1 2-6 163-168-170	129.7 2-6 162-169-172
69	122.5 2-3 155-157-159	124.4 2-3 160-162-164	126.0 2-3 164-166-168	126.7 2-6 164-168-171	127.0 2-2 163-169-171
70	121.3 2-3 155-156-159	123.1 2-3 160-161-164	124.7 2-3 164-166-168	125.5 2-2 164-168-170	125.5 2-2 162-168-170

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R Code : 0378 PW Eng. : 4152

CONFIGURATION 15/ 0 **PRESSURE ALTITUDE = 1000 FT**

TREF = 37 °C	DRY RUNWAY	MAX T.O. WEIGHT(1000KG)	CODES
TMAX = 53 °C	SLOPE = 0.0 %	IAS(KT) V1 - VR - V2	

TEMP.	CORRECTED RUNWAY LENGTH (M)				
(°C)	3000	3250	3500	3750	4000
-23	164.6 2-6 164-174-178	166.0 2-6 163-176-181	167.3 2-6 162-179-183	168.5 2-6 162-182-186	169.7 2-6 161-184-189
-13	163.2 6-6 162-171-176	164.6 2-6 161-174-178	166.0 2-6 160-176-181	167.3 2-6 159-179-183	168.5 2-6 158-182-186
-3	160.6 6-6 160-169-174	163.2 6-6 159-171-176	164.6 2-6 158-174-178	165.9 2-6 157-176-181	167.2 2-6 156-179-183
7	157.9 6-6 159-168-173	160.6 6-6 157-170-174	163.3 2-6 155-171-176	164.6 2-6 154-174-178	165.9 2-6 153-176-181
17	155.3 6-6 157-167-171	158.1 6-6 155-168-173	160.8 6-6 154-170-174	163.3 2-6 152-171-176	164.6 2-6 151-174-178
27	152.9 6-6 155-165-170	155.7 6-6 154-167-172	158.4 6-6 152-169-173	161.0 6-6 150-170-174	163.4 2-6 149-172-176
37	150.2 6-6 154-164-169	153.0 6-6 152-166-170	155.7 6-6 151-167-172	158.3 6-6 149-169-173	160.8 6-6 148-170-174
39	149.4 6-6 154-164-168	152.1 6-6 152-165-170	154.8 6-6 151-167-171	157.4 6-6 149-168-173	160.0 6-6 148-170-174
41	148.4 6-6 154-163-168	151.2 6-6 152-165-169	153.9 6-6 151-166-171	156.5 6-6 149-168-172	159.0 6-6 148-169-173
43	147.4 6-6 154-163-167	150.0 6-6 153-164-169	152.7 6-6 151-166-170	155.2 6-6 150-167-171	157.0 2-6 149-169-173
45	146.2 6-6 154-162-166	148.9 6-6 153-164-168	151.5 6-6 151-165-169	153.7 2-6 150-167-171	154.9 2-6 149-169-173
47	145.1 6-6 155-162-166	147.7 6-6 153-163-167	150.3 6-6 152-165-169	151.6 2-6 151-167-171	152.8 2-6 150-169-173
49	144.0 6-6 155-161-165	146.5 6-6 154-163-167	148.4 2-6 153-165-169	149.5 2-6 152-167-171	150.7 2-6 151-169-173
51	142.9 6-6 155-161-164	145.0 2-6 154-163-166	146.2 2-6 153-165-168	147.4 2-6 153-167-171	148.4 2-6 152-169-173
53	141.4 3-3 155-160-164	143.0 2-6 155-163-166	144.1 2-6 154-165-168	145.2 2-6 154-167-171	146.2 2-6 153-169-173
55	139.2 2-3 155-159-163	140.8 2-6 156-163-166	141.9 2-6 156-165-168	142.9 2-6 155-167-171	143.9 2-6 154-169-173
57	136.7 2-3 154-159-162	138.7 2-6 157-163-166	139.6 2-6 157-165-168	140.6 2-6 156-167-170	141.5 2-6 156-169-172
59	134.3 2-3 154-158-161	136.4 2-3 158-163-166	137.4 2-6 158-165-168	138.3 2-6 157-167-170	139.2 2-6 157-169-172
61	131.8 2-3 154-157-160	133.9 2-3 158-162-165	135.2 2-6 159-165-168	136.0 2-6 159-167-170	136.8 2-6 158-169-172
63	129.3 2-3 153-157-160	131.4 2-3 158-162-164	132.9 2-6 160-165-168	133.7 2-6 160-167-170	134.4 2-6 159-169-172
65	126.9 2-3 153-156-159	128.9 2-3 157-161-164	130.6 2-3 161-165-168	131.4 2-6 161-167-170	132.1 2-6 161-169-172
67	124.4 2-3 153-156-158	126.3 2-3 157-160-163	128.0 2-3 161-165-167	129.1 2-6 163-168-170	129.7 2-6 162-169-172
69	122.0 2-3 153-155-158	123.8 2-3 157-160-162	125.4 2-3 161-164-167	126.7 2-6 164-168-171	127.0 2-2 163-169-171
70	120.8 2-3 152-155-157	122.6 2-3 157-160-162	124.1 2-3 161-164-166	125.5 2-2 164-168-170	125.5 2-2 162-168-170

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CONFIGURATION 15/ 0 **PRESSURE ALTITUDE = 2000 FT**

TREF = 33 °C TMAX = 51 °C	DRY RUNWAY SLOPE = 0.0 %	MAX T.O. WEIGHT(1000KG) CODES IAS(KT) V1 - VR - V2			
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-27	163.5 2-6 163-172-177	164.8 2-6 162-175-179	166.2 2-6 161-178-182	167.4 2-6 160-180-185	168.6 2-6 160-183-187
-17	161.6 6-6 161-170-175	163.5 2-6 160-172-177	164.8 2-6 159-175-179	166.1 2-6 158-178-182	167.3 2-6 157-180-185
-7	159.0 6-6 160-169-173	161.6 6-6 158-170-175	163.5 2-6 157-173-177	164.8 2-6 156-175-179	166.1 2-6 155-178-182
3	156.3 6-6 158-167-172	159.0 6-6 156-169-173	161.7 6-6 154-170-175	163.5 2-6 153-173-177	164.7 2-6 152-175-179
13	153.6 6-6 156-166-171	156.4 6-6 154-167-172	159.1 6-6 153-169-173	161.7 6-6 151-170-175	163.5 2-6 150-173-177
23	151.2 6-6 154-165-169	154.0 6-6 153-166-171	156.7 6-6 151-168-172	159.3 6-6 150-169-174	161.8 6-6 148-171-175
33	148.7 6-6 153-163-168	151.5 6-6 151-165-169	154.2 6-6 149-166-171	156.9 6-6 148-168-172	159.5 6-6 146-169-174
35	147.7 6-6 153-163-167	150.5 6-6 151-164-169	153.2 6-6 150-166-170	155.8 6-6 148-167-172	158.4 6-6 147-169-173
37	146.7 6-6 153-162-167	149.4 6-6 151-164-168	152.0 6-6 150-165-170	154.6 6-6 148-167-171	157.2 6-6 147-168-172
39	145.6 6-6 153-162-166	148.3 6-6 152-164-168	150.9 6-6 150-165-169	153.5 6-6 149-166-170	155.7 2-6 147-168-172
41	144.6 6-6 154-162-165	147.2 6-6 152-163-167	149.8 6-6 150-165-168	152.3 6-6 149-166-170	153.9 2-6 148-168-172
43	143.5 6-6 154-161-165	146.1 6-6 152-163-166	148.7 6-6 151-164-168	150.7 2-6 150-166-170	151.9 2-6 149-168-172
45	142.5 6-6 154-161-164	145.0 6-6 153-162-166	147.5 6-6 151-164-167	148.8 2-6 150-166-169	149.9 2-6 150-168-172
47	141.5 6-6 154-160-164	143.9 6-6 153-162-165	145.7 2-6 152-163-167	146.8 2-6 151-166-169	147.9 2-6 150-168-172
49	140.2 3-3 154-160-163	142.5 2-6 153-161-165	143.7 2-6 153-163-167	144.8 2-6 152-166-169	145.8 2-6 151-168-172
51	138.6 3-3 154-159-162	140.6 2-6 154-161-165	141.7 2-6 154-164-167	142.8 2-6 153-166-169	143.8 2-6 152-168-171
53	136.6 3-3 153-158-161	138.5 2-6 155-161-165	139.6 2-6 155-163-167	140.5 2-6 154-165-169	141.5 2-6 153-167-171
55	134.3 2-3 153-157-160	136.4 2-6 156-161-164	137.4 2-6 156-163-167	138.3 2-6 155-165-169	139.2 2-6 155-167-171
57	132.0 2-3 152-156-159	134.1 2-3 157-161-164	135.3 2-6 157-163-167	136.1 2-6 156-165-169	136.9 2-6 156-167-171
59	129.6 2-3 152-156-159	131.7 2-3 156-160-163	133.1 2-6 158-164-167	133.9 2-6 157-166-169	134.7 2-6 157-167-171
61	127.2 2-3 152-155-158	129.3 2-3 156-160-163	130.9 2-6 159-164-167	131.7 2-6 159-166-169	132.4 2-6 158-167-170
63	124.9 2-3 151-154-157	126.8 2-3 156-159-162	128.6 2-3 160-164-166	129.4 2-6 160-166-168	130.1 2-6 160-168-170
65	122.5 2-3 151-154-157	124.4 2-3 155-159-161	126.0 2-3 159-163-165	127.2 2-6 162-166-169	127.8 2-6 161-168-170
67	120.1 2-3 151-154-156	122.0 2-3 155-158-160	123.5 2-3 159-163-165	125.0 2-3 163-167-169	125.5 2-2 162-168-170
68	119.0 2-3 151-153-156	120.8 2-3 155-158-160	122.3 2-3 159-162-164	123.7 2-3 163-166-169	123.9 2-2 162-167-169

A310-324/AA/PW-4152 T15/00-EE-CM72-1—A FCOM-B0-02-10-40-005-000

NOMINAL THRUST

CONFIGURATION 15/ 0 **PRESSURE ALTITUDE 2000 FT**

TREF = 33 °C DRY RUNWAY **MAX T.O. WEIGHT(1000KG)** **CODES**
TMAX = 51 °C SLOPE = 0 % **IAS(KT) : V1 - VR - V2**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-27	163.5 2-6 163-172-177	164.8 2-6 162-175-179	166.2 2-6 161-178-182	167.4 2-6 160-180-185	168.6 2-6 160-183-187
-17	161.6 6-6 161-170-175	163.5 2-6 160-172-177	164.8 2-6 159-175-179	166.1 2-6 158-178-182	167.3 2-6 157-180-185
-7	159.0 6-6 160-169-173	161.6 6-6 158-170-175	163.5 2-6 157-173-177	164.8 2-6 156-175-179	166.1 2-6 155-178-182
3	156.3 6-6 158-167-172	159.0 6-6 156-169-173	161.7 6-6 154-170-175	163.5 2-6 153-173-177	164.7 2-6 152-175-179
13	153.6 6-6 156-166-171	156.4 6-6 154-167-172	159.1 6-6 153-169-173	161.7 6-6 151-170-175	163.5 2-6 150-173-177
23	151.2 6-6 154-165-169	154.0 6-6 153-166-171	156.7 6-6 151-168-172	159.3 6-6 150-169-174	161.8 6-6 148-171-175
33	148.7 6-6 153-163-168	151.5 6-6 151-165-169	154.2 6-6 149-166-171	156.9 6-6 148-168-172	159.5 6-6 146-169-174
35	147.7 6-6 153-163-167	150.5 6-6 151-164-169	153.2 6-6 150-166-170	155.8 6-6 148-167-172	158.4 6-6 147-169-173
37	146.7 6-6 153-162-167	149.4 6-6 151-164-168	152.0 6-6 150-165-170	154.6 6-6 148-167-171	157.2 6-6 147-168-172
39	145.6 6-6 153-162-166	148.3 6-6 152-164-168	150.9 6-6 150-165-169	153.5 6-6 149-166-170	155.7 2-6 147-168-172
41	144.6 6-6 154-162-165	147.2 6-6 152-163-167	149.8 6-6 150-165-168	152.3 6-6 149-166-170	153.9 2-6 148-168-172
43	143.5 6-6 154-161-165	146.1 6-6 152-163-166	148.7 6-6 151-164-168	150.7 2-6 150-166-170	151.9 2-6 149-168-172
45	142.5 6-6 154-161-164	145.0 6-6 153-162-166	147.5 6-6 151-164-167	148.8 2-6 150-166-169	149.9 2-6 150-168-172
47	141.5 6-6 154-160-164	143.9 6-6 153-162-165	145.7 2-6 152-163-167	146.8 2-6 151-166-169	147.9 2-6 150-168-172
49	140.4 6-6 155-160-163	142.5 2-6 153-161-165	143.7 2-6 153-163-167	144.8 2-6 152-166-169	145.8 2-6 151-168-172
51	139.3 6-6 155-159-162	140.6 2-6 154-161-165	141.7 2-6 154-164-167	142.8 2-6 153-166-169	143.8 2-6 152-168-171
53	137.4 2-3 156-159-162	138.5 2-6 155-161-165	139.6 2-6 155-163-167	140.5 2-6 154-165-169	141.5 2-6 153-167-171
55	134.9 2-3 155-158-161	136.4 2-6 156-161-164	137.4 2-6 156-163-167	138.3 2-6 155-165-169	139.2 2-6 155-167-171
57	132.6 2-3 155-157-161	134.4 2-6 157-162-164	135.3 2-6 157-163-167	136.1 2-6 156-165-169	136.9 2-6 156-167-171
59	130.2 2-3 154-157-160	132.3 2-6 159-162-165	133.1 2-6 158-164-167	133.9 2-6 157-166-169	134.7 2-6 157-167-171
61	127.8 2-3 154-156-159	129.9 2-3 159-161-164	130.9 2-6 159-164-167	131.7 2-6 159-166-169	132.4 2-6 158-167-170
63	125.4 2-3 154-156-158	127.4 2-3 158-161-163	128.8 2-6 161-164-167	129.4 2-6 160-166-168	130.1 2-6 160-168-170
65	123.0 2-3 153-155-158	125.0 2-3 158-160-163	126.5 2-6 162-164-167	127.2 2-6 162-166-169	127.8 2-6 161-168-170
67	120.7 2-3 153-155-157	122.5 2-3 158-160-162	124.1 2-3 162-164-167	125.0 2-6 163-167-169	125.5 2-2 162-168-170
68	119.5 2-3 153-155-157	121.3 2-3 158-160-162	122.9 2-3 162-164-166	123.8 2-6 164-167-169	123.9 2-2 162-167-169

A310-324/AA/PW-4152 T15/00-EE-CM72-1---A FCOM-B0-02-10-40-005-090

R Code : 0378 PW Eng. : 4152

NOMINAL THRUST

CONFIGURATION 15/15 **PRESSURE ALTITUDE 0 FT**

TREF = 42 °C
TMAX = 55 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) : V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-18	158.1 2-3 154-158-163	161.6 2-3 160-165-170	164.5 2-3 166-171-175	166.0 2-6 166-175-179	167.1 2-6 164-177-181
-8	156.8 2-3 152-156-161	160.4 2-3 158-163-167	163.4 2-3 163-169-173	164.9 2-6 163-172-176	166.1 2-6 162-175-179
2	155.5 2-3 150-154-159	159.2 2-3 155-161-165	162.3 2-3 161-167-171	163.8 2-6 161-170-174	165.0 2-6 160-173-177
12	153.2 3-3 148-153-158	158.0 2-3 153-159-163	161.1 2-3 158-165-169	162.7 2-6 158-168-172	163.9 2-6 157-170-174
22	150.9 3-3 147-151-156	156.8 2-3 151-156-161	160.0 2-3 156-163-167	161.5 2-6 156-165-170	162.8 2-6 155-168-172
32	148.7 3-3 146-150-155	155.6 2-3 149-155-159	158.9 2-6 154-160-165	160.3 2-6 153-163-167	161.7 2-6 152-166-170
42	146.5 3-3 144-149-154	153.7 3-3 148-153-158	157.6 2-6 152-158-163	159.1 2-6 150-161-165	160.5 2-6 149-164-168
44	145.0 3-3 144-148-153	152.2 3-3 148-152-157	155.8 2-3 152-158-163	157.2 2-6 151-161-165	158.6 2-6 150-164-168
46	143.3 3-3 143-147-153	150.1 2-3 147-152-157	153.4 2-3 152-158-162	155.1 2-6 152-161-165	156.4 2-6 151-164-168
48	141.7 3-3 143-147-152	147.9 2-3 147-151-156	151.1 2-3 152-157-162	153.0 2-6 153-161-166	154.2 2-6 152-164-168
50	140.0 3-3 142-146-151	145.6 2-3 147-151-156	148.7 2-3 152-157-161	150.8 2-6 154-162-166	152.0 2-6 154-164-168
52	138.2 3-3 142-145-150	143.2 2-3 146-150-155	146.2 2-3 151-157-161	148.6 2-6 155-162-166	149.7 2-6 155-164-168
54	136.5 3-3 141-144-149	140.8 2-3 146-150-155	143.7 2-3 151-156-160	146.2 2-3 156-162-165	147.3 2-6 156-164-168
56	134.5 3-3 141-143-148	138.3 2-3 146-149-154	141.2 2-3 151-155-160	143.6 2-3 156-161-165	145.0 2-6 157-164-168
58	132.5 2-3 140-142-147	135.8 2-3 145-149-153	138.6 2-3 151-155-159	140.9 2-3 156-160-164	142.6 2-6 158-165-168
60	130.1 2-3 140-142-146	133.3 2-3 145-148-152	136.0 2-3 150-154-158	138.3 2-3 155-160-163	140.2 2-2 160-165-168
62	127.8 2-3 139-141-146	130.9 2-3 145-147-152	133.5 2-3 150-153-157	135.7 2-3 155-159-162	137.1 2-2 158-163-166
64	125.4 2-3 139-141-145	128.4 2-3 144-147-151	130.9 2-3 150-153-157	133.1 2-3 155-158-162	134.0 2-2 157-161-164
66	122.9 2-3 138-140-144	125.9 2-3 144-146-150	128.3 2-3 149-152-156	130.4 2-3 154-158-161	130.8 2-2 155-159-162
68	120.5 2-3 138-140-144	123.4 2-3 144-146-150	125.7 2-3 149-151-155	127.7 3-3 154-157-160	127.7 2-2 153-157-160
70	118.2 2-3 138-139-143	120.9 2-3 143-145-149	123.2 2-3 149-151-154	124.6 2-2 152-155-158	124.6 2-2 150-155-158
72	115.8 2-3 137-139-142	118.4 2-3 143-145-148	120.6 2-3 148-151-154	121.5 2-2 150-153-156	121.5 2-2 148-153-156

A310-324/AA/PW-4152 T15/15-EE-CM72-1---A FCOM-B0-02-10-40-006-090

R Code : 0378 PW Eng. : 4152

CONFIGURATION 15/15		PRESSURE ALTITUDE = 0 FT			
TREF = 42 °C TMAX = 55 °C	DRY RUNWAY SLOPE = 0.0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) V1 - VR - V2			CODES
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	2500	2750	3000	3250
-18	157.9 2-3 154-158-163	161.3 2-3 159-165-169	164.2 2-3 164-171-175	166.0 2-6 166-175-179	167.1 2-6 164-177-181
-8	156.6 2-3 151-156-161	160.1 2-3 156-162-167	163.0 2-3 161-168-172	164.9 2-6 163-172-176	166.1 2-6 162-175-179
2	155.3 3-3 149-154-159	158.9 2-3 154-160-165	161.9 2-3 159-166-170	163.8 2-6 161-170-174	165.0 2-6 160-173-177
12	152.9 3-3 148-152-157	157.6 2-3 152-158-163	160.7 2-3 157-164-168	162.7 2-6 158-168-172	163.9 2-6 157-170-174
22	150.6 3-3 146-151-156	156.5 2-3 150-156-161	159.6 2-3 155-162-166	161.5 2-6 156-165-170	162.8 2-6 155-168-172
32	148.3 3-3 145-150-155	155.3 3-3 148-154-159	158.5 2-3 153-160-164	160.3 2-6 153-163-167	161.7 2-6 152-166-170
42	146.2 3-3 144-149-154	153.1 3-3 147-153-158	157.5 2-3 151-158-162	159.1 2-6 150-161-165	160.5 2-6 149-164-168
44	144.6 3-3 143-148-153	151.5 3-3 147-152-157	155.4 2-3 151-157-162	157.2 2-6 151-161-165	158.6 2-6 150-164-168
46	143.0 3-3 143-147-152	149.8 2-3 146-151-156	153.0 2-3 150-157-162	155.1 2-6 152-161-165	156.4 2-6 151-164-168
48	141.3 3-3 142-146-152	147.5 2-3 146-151-156	150.7 2-3 150-157-161	153.0 2-6 153-161-166	154.2 2-6 152-164-168
50	139.7 3-3 142-146-151	145.3 2-3 146-150-155	148.3 2-3 150-156-161	150.8 2-6 154-162-166	152.0 2-6 154-164-168
52	137.9 3-3 141-145-150	142.9 2-3 145-150-155	145.8 2-3 150-156-160	148.3 2-3 154-161-165	149.7 2-6 155-164-168
54	136.1 3-3 141-144-149	140.5 2-3 145-149-154	143.3 2-3 150-155-160	145.8 2-3 154-161-165	147.3 2-6 156-164-168
56	134.2 3-3 140-143-148	138.0 2-3 145-149-153	140.8 2-3 149-155-159	143.2 2-3 154-160-164	145.0 2-6 157-164-168
58	132.2 3-3 140-142-147	135.5 2-3 144-148-153	138.2 2-3 149-154-158	140.5 2-3 154-159-163	142.5 2-3 158-164-168
60	130.0 2-3 139-141-146	133.1 2-3 144-147-152	135.7 2-3 149-153-157	137.9 2-3 153-159-162	139.8 2-3 158-164-167
62	127.6 2-3 139-141-145	130.6 2-3 144-147-151	133.1 2-3 148-153-157	135.3 2-3 153-158-162	137.1 2-2 157-163-166
64	125.2 2-3 138-140-145	128.1 2-3 143-146-151	130.6 2-3 148-152-156	132.7 2-3 153-157-161	134.0 2-2 156-161-164
66	122.8 2-3 138-140-144	125.6 2-3 143-146-150	128.0 2-3 148-151-155	130.0 2-3 152-157-160	130.8 2-2 154-159-162
68	120.4 2-3 138-139-143	123.1 2-3 143-145-149	125.4 2-3 147-151-154	127.4 2-3 152-156-159	127.7 2-2 153-157-160
70	118.0 2-3 137-139-143	120.6 2-3 142-145-148	122.8 2-3 147-150-154	124.6 2-2 151-155-158	124.6 2-2 150-155-158
72	115.7 2-3 137-139-142	118.2 2-3 142-144-148	120.3 2-3 147-150-153	121.5 2-2 150-153-156	121.5 2-2 148-153-156

A310-324/AA/PW-4152 T15/15-EE-CM72-1—A FCOM-B0-02-10-40-006-000

CONFIGURATION 15/15 PRESSURE ALTITUDE = 1000 FT

TREF = 37 °C DRY RUNWAY **MAX T.O. WEIGHT(1000KG)** **CODES**

TMAX = 53 °C SLOPE = 0.0 % **IAS(KT) V1 - VR - V2**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-23	157.0 2-3 153-157-162	160.3 2-3 158-164-168	163.2 2-3 163-170-174	164.9 2-6 164-174-177	166.1 2-6 163-176-180
-13	155.6 2-3 150-155-160	159.1 2-3 156-161-166	162.0 2-3 160-167-172	163.9 2-6 162-171-175	165.0 2-6 161-174-178
-3	153.9 3-3 148-153-158	157.9 2-3 153-159-164	160.9 2-3 158-165-169	162.8 2-6 159-169-173	164.0 2-6 158-172-176
7	151.5 3-3 147-152-157	156.6 2-3 151-157-162	159.7 2-3 156-163-167	161.6 2-6 157-167-171	162.9 2-6 156-169-173
17	149.1 3-3 146-150-156	155.4 2-3 149-155-160	158.6 2-3 154-161-165	160.4 2-6 154-164-169	161.8 2-6 153-167-171
27	146.8 3-3 144-149-154	153.7 3-3 148-153-158	157.4 2-3 152-159-163	159.2 2-6 152-162-166	160.6 2-6 151-165-169
37	144.2 3-3 143-148-153	151.1 3-3 146-152-157	155.6 2-3 150-157-161	157.4 2-6 150-160-164	158.8 2-6 149-163-167
39	143.2 3-3 143-147-153	150.1 3-3 146-151-156	154.5 2-3 150-156-161	156.4 2-6 150-160-164	157.7 2-6 149-162-167
41	142.0 3-3 142-147-152	148.9 3-3 145-151-155	153.0 2-3 149-156-160	155.0 2-6 150-160-164	156.4 2-6 149-162-166
43	140.5 3-3 142-146-151	147.4 3-3 145-150-155	150.9 2-3 149-155-160	153.1 2-6 151-160-164	154.4 2-6 150-162-167
45	138.9 3-3 141-145-150	145.6 2-3 145-149-154	148.7 2-3 149-155-159	151.1 2-6 152-160-164	152.3 2-6 151-163-166
47	137.3 3-3 141-144-149	143.5 2-3 144-149-154	146.5 2-3 149-155-159	149.1 2-3 153-160-164	150.3 2-6 152-163-167
49	135.7 3-3 140-144-149	141.3 2-3 144-148-153	144.2 2-3 148-154-159	146.7 2-3 153-160-164	148.2 2-6 153-163-167
51	134.0 3-3 140-143-148	139.0 2-3 144-148-153	141.9 2-3 148-154-158	144.3 2-3 153-159-163	146.0 2-6 154-163-166
53	132.3 3-3 139-142-147	136.8 2-3 143-147-152	139.6 2-3 148-153-157	142.0 2-3 152-159-162	143.8 2-6 156-163-167
55	130.3 3-3 138-141-146	134.3 2-3 143-147-151	137.1 2-3 148-152-157	139.4 2-3 152-158-161	141.4 2-3 156-163-166
57	128.4 3-3 138-140-145	131.9 2-3 143-146-150	134.6 2-3 147-152-156	136.8 2-3 152-157-161	138.8 2-3 156-162-165
59	126.5 2-3 137-139-144	129.6 2-3 142-145-150	132.1 2-3 147-151-155	134.3 2-3 151-156-160	136.2 2-3 156-161-165
61	124.2 2-3 137-139-143	127.2 2-3 142-145-149	129.7 2-3 147-150-154	131.8 2-3 151-156-159	133.6 2-2 156-161-164
63	121.9 2-3 136-138-143	124.8 2-3 142-144-148	127.2 2-3 146-150-153	129.2 2-3 151-155-158	130.6 2-2 154-159-162
65	119.6 2-3 136-138-142	122.3 2-3 141-144-147	124.7 2-3 146-149-153	126.7 2-3 150-154-158	127.6 2-2 152-157-160
67	117.3 2-3 136-137-141	119.9 2-3 141-143-147	122.2 2-3 146-149-152	124.1 2-3 150-154-157	124.6 2-2 151-155-158
69	115.0 2-3 135-137-141	117.6 2-3 141-143-146	119.7 2-3 145-148-151	121.6 3-3 150-153-156	121.6 2-2 149-153-156
70	113.9 2-3 135-137-140	116.4 2-3 140-143-146	118.5 2-3 145-148-151	120.1 2-2 149-153-155	120.1 2-2 148-153-155

A310-324/AA/PW-4152 T15/15-EE-CM72-1—A

FCOM-B0-02-10-40-007-000

NOMINAL THRUST

CONFIGURATION 15/15			PRESSURE ALTITUDE 1000 FT		
TREF = 37 °C TMAX = 53 °C	DRY RUNWAY SLOPE = 0 %	**MAX T.O. WEIGHT(1000KG)** **IAS(KT) : V1 - VR - V2**			**CODES**
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-23	157.1 2-3 153-158-163	160.7 2-3 159-164-169	163.6 2-3 165-171-175	164.9 2-6 164-174-177	166.1 2-6 163-176-180
-13	155.8 2-3 151-155-160	159.4 2-3 157-162-167	162.4 2-3 162-168-172	163.9 2-6 162-171-175	165.0 2-6 161-174-178
-3	154.2 3-3 149-153-158	158.1 2-3 154-160-164	161.3 2-3 160-166-170	162.8 2-6 159-169-173	164.0 2-6 158-172-176
7	151.8 3-3 148-152-157	156.9 2-3 152-158-162	160.1 2-3 157-164-168	161.6 2-6 157-167-171	162.9 2-6 156-169-173
17	149.4 3-3 146-150-156	155.7 2-3 150-155-160	159.0 2-3 155-162-166	160.4 2-6 154-164-169	161.8 2-6 153-167-171
27	147.2 3-3 145-149-155	154.4 3-3 148-154-158	157.8 2-6 153-159-164	159.2 2-6 152-162-166	160.6 2-6 151-165-169
37	144.5 3-3 143-148-153	151.7 3-3 147-152-157	155.9 2-6 151-157-162	157.4 2-6 150-160-164	158.8 2-6 149-163-167
39	143.6 3-3 143-147-153	150.7 3-3 147-152-156	154.9 2-6 151-157-161	156.4 2-6 150-160-164	157.7 2-6 149-162-167
41	142.4 3-3 143-147-152	149.5 3-3 146-151-156	153.4 2-3 151-157-161	155.0 2-6 150-160-164	156.4 2-6 149-162-166
43	140.8 3-3 142-146-151	148.0 3-3 146-150-155	151.3 2-3 151-156-161	153.1 2-6 151-160-164	154.4 2-6 150-162-167
45	139.3 3-3 142-145-150	145.9 2-3 146-150-154	149.1 2-3 150-156-160	151.1 2-6 152-160-164	152.3 2-6 151-163-166
47	137.7 3-3 141-145-150	143.8 2-3 145-149-154	146.9 2-3 150-155-160	149.1 2-6 153-160-164	150.3 2-6 152-163-167
49	136.0 3-3 141-144-149	141.6 2-3 145-149-154	144.6 2-3 150-155-159	147.0 2-6 154-160-164	148.2 2-6 153-163-167
51	134.3 3-3 140-143-148	139.3 2-3 145-148-153	142.3 2-3 150-154-159	144.8 2-3 155-160-164	146.0 2-6 154-163-166
53	132.6 3-3 140-142-147	137.1 2-3 144-148-152	139.9 2-3 149-154-158	142.4 2-3 154-160-163	143.8 2-6 156-163-167
55	130.6 3-3 139-141-146	134.6 2-3 144-147-152	137.4 2-3 149-153-157	139.8 2-3 154-159-162	141.5 2-6 157-163-166
57	128.7 3-3 138-141-145	132.2 2-3 144-147-151	134.9 2-3 149-152-156	137.2 2-3 154-158-162	139.2 2-6 158-163-166
59	126.7 2-3 138-140-144	129.8 2-3 143-146-150	132.5 2-3 148-152-156	134.7 2-3 153-157-161	136.6 2-2 158-163-166
61	124.4 2-3 137-139-144	127.4 2-3 143-145-150	130.0 2-3 148-151-155	132.2 2-3 153-157-160	133.6 2-2 157-161-164
63	122.1 2-3 137-139-143	125.0 2-3 143-145-149	127.5 2-3 148-151-154	129.6 2-3 153-156-159	130.6 2-2 155-159-162
65	119.7 2-3 137-138-142	122.6 2-3 142-144-148	125.0 2-3 147-150-153	127.0 2-3 152-155-159	127.6 2-2 153-157-160
67	117.4 2-3 136-138-141	120.2 2-3 142-144-147	122.5 2-3 147-149-153	124.4 2-3 152-155-158	124.6 2-2 151-155-158
69	115.1 2-3 136-137-141	117.8 2-3 142-143-147	120.0 2-3 147-149-152	121.6 2-2 151-153-156	121.6 2-2 149-153-156
70	114.0 2-3 136-137-141	116.6 2-3 141-143-146	118.8 2-3 147-149-152	120.1 2-2 150-153-155	120.1 2-2 148-153-155

A310-324/AA/PW-4152 T15/15-EE-CM72-1---A FCOM-B0-02-10-40-007-090

R Code : 0378 PW Eng. : 4152

NOMINAL THRUST

CONFIGURATION 15/15			PRESSURE ALTITUDE 2000 FT		
TREF = 33 °C TMAX = 51 °C		DRY RUNWAY SLOPE = 0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) : V1 - VR - V2		CODES
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-27	156.1 2-3 152-157-161	159.6 2-3 158-163-168	162.5 2-3 164-169-174	163.8 2-6 163-172-176	165.0 2-6 162-175-179
-17	154.7 2-3 150-154-159	158.3 2-3 156-161-165	161.3 2-3 161-167-171	162.7 2-6 160-170-174	163.9 2-6 159-173-176
-7	152.7 3-3 148-152-157	157.1 2-3 153-159-163	160.2 2-3 159-165-169	161.6 2-6 158-168-172	162.8 2-6 157-170-174
3	150.2 3-3 147-151-156	155.8 2-3 151-156-161	159.0 2-3 156-162-167	160.4 2-6 155-165-169	161.7 2-6 154-168-172
13	147.8 3-3 145-150-155	154.6 2-3 149-154-159	157.8 2-6 154-160-165	159.2 2-6 153-163-167	160.6 2-6 152-166-170
23	145.5 3-3 144-148-154	152.7 3-3 148-153-157	156.5 2-6 151-158-162	158.0 2-6 150-161-165	159.4 2-6 149-163-167
33	143.3 3-3 143-147-153	150.5 3-3 146-151-156	155.1 2-6 149-156-160	156.7 2-6 148-158-163	158.2 2-6 147-161-165
35	142.0 3-3 142-147-152	149.2 3-3 146-151-156	153.8 2-6 149-155-160	155.3 2-6 148-158-163	156.7 2-6 147-161-165
37	140.6 3-3 142-146-151	147.7 3-3 145-150-155	152.0 2-3 150-155-160	153.6 2-6 149-158-163	154.9 2-6 148-161-165
39	139.1 3-3 141-145-150	146.3 3-3 145-149-154	150.1 2-3 149-155-159	151.8 2-6 150-158-163	153.1 2-6 149-161-165
41	137.7 3-3 141-145-150	144.8 3-3 145-149-153	148.1 2-3 149-155-159	150.0 2-6 151-159-163	151.3 2-6 150-161-165
43	136.2 3-3 140-144-149	142.9 2-3 144-148-153	146.0 2-3 149-154-159	148.2 2-6 152-159-163	149.4 2-6 151-161-165
45	134.7 3-3 140-143-148	140.9 2-3 144-148-152	143.9 2-3 149-154-158	146.3 2-6 152-159-163	147.5 2-6 152-161-165
47	133.1 3-3 139-143-147	138.8 2-3 144-147-152	141.8 2-3 148-153-158	144.4 2-3 153-159-163	145.5 2-6 153-161-165
49	131.5 3-3 139-142-146	136.7 2-3 143-147-151	139.6 2-3 148-153-157	142.1 2-3 153-158-162	143.5 2-6 154-161-165
51	129.9 3-3 138-141-146	134.6 2-3 143-146-151	137.5 2-3 148-152-156	139.9 2-3 153-158-161	141.5 2-6 155-162-165
53	127.9 3-3 138-140-145	132.2 2-3 143-146-150	135.1 2-3 148-151-155	137.4 2-3 152-157-161	139.2 2-6 156-162-165
55	126.1 3-3 137-139-144	129.9 2-3 142-145-149	132.6 2-3 147-151-155	134.9 2-3 152-156-160	136.9 2-3 157-161-165
57	124.3 3-3 136-138-143	127.6 2-3 142-144-148	130.2 2-3 147-150-154	132.5 2-3 152-156-159	134.4 2-3 157-161-164
59	122.3 2-3 136-138-142	125.3 2-3 141-144-148	127.9 2-3 147-149-153	130.0 2-3 151-155-158	131.8 2-2 155-160-163
61	120.0 2-3 135-137-141	123.0 2-3 141-143-147	125.4 2-3 146-149-152	127.5 2-3 151-154-158	128.9 2-2 154-158-161
63	117.8 2-3 135-136-140	120.6 2-3 141-143-146	123.0 2-3 146-148-152	125.0 2-3 151-154-157	126.0 2-2 153-156-159
65	115.5 2-3 135-136-140	118.3 2-3 140-142-146	120.6 2-3 145-148-151	122.6 2-3 150-153-156	123.1 2-2 151-154-157
67	113.3 2-3 134-136-139	116.0 2-3 140-142-145	118.2 2-3 145-147-150	120.1 2-3 150-153-155	120.2 2-2 149-153-155
68	112.2 2-3 134-135-139	114.9 2-3 140-142-145	117.0 2-3 145-147-150	118.7 2-2 149-152-155	118.7 2-2 148-152-155

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R Code : 0378 PW Eng. : 4152

CONFIGURATION 15/15 **PRESSURE ALTITUDE = 2000 FT**

TREF = 33 °C
TMAX = 51 °C

DRY RUNWAY
SLOPE = 0.0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-27	155.9 2-3 152-156-161	159.3 2-3 157-163-167	162.2 2-3 162-169-173	163.8 2-6 163-172-176	165.0 2-6 162-175-179
-17	154.5 2-3 149-154-159	158.0 2-3 154-160-165	161.0 2-3 159-166-170	162.7 2-6 160-170-174	163.9 2-6 159-173-176
-7	152.3 3-3 148-152-157	156.7 2-3 152-158-163	159.8 2-3 157-164-168	161.6 2-6 158-168-172	162.8 2-6 157-170-174
3	149.9 3-3 146-151-156	155.5 2-3 150-156-161	158.6 2-3 155-162-166	160.4 2-6 155-165-169	161.7 2-6 154-168-172
13	147.5 3-3 145-149-155	154.2 2-3 148-154-158	157.4 2-3 153-159-164	159.2 2-6 153-163-167	160.6 2-6 152-166-170
23	145.2 3-3 143-148-154	152.1 3-3 147-152-157	156.3 2-3 151-157-162	158.0 2-6 150-161-165	159.4 2-6 149-163-167
33	143.0 3-3 142-147-152	149.8 3-3 145-151-156	155.1 2-3 149-156-160	156.7 2-6 148-158-163	158.2 2-6 147-161-165
35	141.7 3-3 142-146-152	148.6 3-3 145-150-155	153.5 2-3 149-155-160	155.3 2-6 148-158-163	156.7 2-6 147-161-165
37	140.2 3-3 141-146-151	147.1 3-3 145-150-155	151.6 2-3 148-155-159	153.6 2-6 149-158-163	154.9 2-6 148-161-165
39	138.8 3-3 141-145-150	145.6 3-3 144-149-154	149.6 2-3 148-154-159	151.8 2-6 150-158-163	153.1 2-6 149-161-165
41	137.3 3-3 140-144-149	144.2 3-3 144-148-153	147.7 2-3 148-154-158	150.0 2-6 151-159-163	151.3 2-6 150-161-165
43	135.8 3-3 140-144-149	142.5 2-3 143-148-152	145.6 2-3 148-153-158	148.2 2-6 152-159-163	149.4 2-6 151-161-165
45	134.3 3-3 139-143-148	140.6 2-3 143-147-152	143.6 2-3 147-153-157	146.1 2-3 152-158-162	147.5 2-6 152-161-165
47	132.8 3-3 139-142-147	138.5 2-3 143-147-151	141.4 2-3 147-153-157	143.9 2-3 151-158-162	145.5 2-6 153-161-165
49	131.1 3-3 138-142-146	136.4 2-3 142-146-151	139.3 2-3 147-152-156	141.7 2-3 151-157-161	143.5 2-6 154-161-165
51	129.5 3-3 138-141-145	134.3 2-3 142-146-150	137.1 2-3 146-151-156	139.5 2-3 151-157-161	141.5 2-6 155-162-165
53	127.6 3-3 137-140-144	132.0 2-3 142-145-149	134.7 2-3 146-151-155	137.0 2-3 150-156-160	139.0 2-3 155-161-164
55	125.7 3-3 136-139-143	129.6 2-3 141-144-149	132.3 2-3 146-150-154	134.5 2-3 150-155-159	136.5 2-3 155-160-163
57	123.9 3-3 136-138-142	127.3 2-3 141-144-148	129.9 2-3 145-149-153	132.1 2-3 150-155-158	134.0 2-3 154-160-163
59	122.1 2-3 135-137-142	125.1 2-3 140-143-147	127.5 2-3 145-149-153	129.7 2-3 149-154-157	131.5 2-3 154-159-162
61	119.9 2-3 135-137-141	122.7 2-3 140-143-147	125.1 2-3 145-148-152	127.2 2-3 149-153-157	128.9 2-2 153-158-161
63	117.6 2-3 134-136-140	120.4 2-3 140-142-146	122.7 2-3 144-147-151	124.7 2-3 149-153-156	126.0 2-2 152-156-159
65	115.4 2-3 134-136-139	118.1 2-3 139-142-145	120.3 2-3 144-147-150	122.2 2-3 148-152-155	123.1 2-2 150-154-157
67	113.2 2-3 134-135-139	115.8 2-3 139-141-144	117.9 2-3 144-146-150	119.8 2-3 148-151-154	120.2 2-2 149-153-155
68	112.1 2-3 133-135-139	114.6 2-3 139-141-144	116.7 2-3 144-146-149	118.6 2-3 148-151-154	118.7 2-2 148-152-155

A310-324/AA/PW-4152 T15/15-EE-CM72-1---A

FCOM-B0-02-10-40-008-000

Mod : 5443

PW Eng. : 4152

CONFIGURATION 20/20		PRESSURE ALTITUDE = 0 FT			
TREF = 42 °C TMAX = 55 °C	DRY RUNWAY SLOPE = 0.0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) V1 - VR - V2			CODES
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	1750	2000	2250	2500
-18	138.0 3-3 137-138-145	148.3 2-3 143-145-151	152.8 2-3 149-153-158	156.2 2-3 155-160-165	157.1 2-2 156-162-167
-8	135.3 3-3 135-137-144	146.1 3-3 141-143-149	151.6 2-3 147-150-156	155.1 2-3 153-158-163	157.1 2-2 156-162-167
2	132.8 3-3 133-136-143	143.6 3-3 139-142-148	150.4 2-3 145-148-154	154.0 2-3 151-155-161	157.0 2-3 156-162-167
12	130.4 3-3 132-135-141	141.2 3-3 138-141-147	149.2 2-3 143-146-152	153.0 2-3 148-153-159	156.0 2-3 154-160-165
22	128.1 3-3 130-133-140	138.9 3-3 136-139-146	148.0 2-2 141-144-150	151.8 2-3 146-151-157	155.1 2-3 152-158-163
32	126.0 3-3 129-132-139	136.7 3-3 135-138-144	145.9 3-3 140-143-149	150.8 2-3 145-149-155	154.0 2-3 150-156-161
42	124.0 3-3 128-131-138	134.5 3-3 134-137-143	143.7 3-3 139-142-148	149.7 2-3 143-148-153	153.1 2-3 148-154-159
44	122.5 3-3 127-130-137	133.0 3-3 133-136-143	142.2 3-3 138-142-147	147.7 2-3 143-147-153	151.0 2-3 148-154-159
46	120.9 3-3 127-130-137	131.3 3-3 133-136-142	140.6 3-3 138-141-146	145.5 2-3 142-147-152	148.6 2-3 147-153-158
48	119.4 3-3 126-129-136	129.6 3-3 132-135-141	138.9 3-3 137-140-146	143.2 2-3 142-146-152	146.3 2-3 147-153-158
50	117.8 3-3 126-128-135	128.1 3-3 132-134-140	137.2 3-3 137-139-145	140.9 2-3 142-146-151	143.9 2-3 147-152-157
52	116.1 3-3 125-127-134	126.3 3-3 131-134-139	134.9 2-3 136-139-144	138.5 2-3 142-145-151	141.5 2-3 147-152-157
54	114.5 3-3 124-127-133	124.6 3-3 131-133-138	132.7 2-3 136-138-144	136.2 2-3 142-145-150	139.0 2-3 147-151-156
56	112.7 3-3 124-126-132	122.8 3-3 130-132-138	130.3 2-3 136-138-143	133.7 2-3 141-144-149	136.5 2-3 146-151-155
58	110.8 3-3 123-125-131	120.9 3-3 129-131-137	128.0 2-3 135-137-142	131.2 2-3 141-144-149	133.9 2-2 146-150-154
60	109.1 3-3 122-124-130	119.0 3-3 129-130-136	125.6 2-3 135-136-141	128.8 2-3 140-143-148	131.0 2-2 144-148-153
62	107.3 3-3 122-123-129	117.2 3-3 128-129-135	123.3 2-3 134-136-141	126.4 2-3 140-143-147	128.0 2-2 143-146-151
64	105.6 3-3 121-123-129	115.5 3-3 127-128-134	120.9 2-3 134-135-140	123.9 2-3 140-142-147	125.1 2-2 142-145-149
66	101.6 3-3 121-123-129	113.6 3-3 127-128-133	118.5 2-3 133-135-139	121.4 2-3 139-141-146	122.2 2-2 140-143-148
68	98.3 3-3 121-123-129	111.8 3-3 126-127-132	116.2 2-3 133-134-139	118.9 2-3 139-141-145	119.3 2-2 138-142-146
70	95.1 3-3 121-124-129	110.1 3-3 125-126-131	113.8 2-3 133-134-138	116.4 2-2 138-140-144	116.4 2-2 135-140-144
72	92.1 3-3 121-124-129	108.0 2-3 125-125-130	111.5 2-3 132-133-138	113.5 2-2 136-139-142	113.5 2-2 133-139-142

A310-324/AA/PW-4152 T20/20-EE-CM72-1—A

FCOM-B0-02-10-40-009-000

NOMINAL THRUST

CONFIGURATION 20/20 **PRESSURE ALTITUDE 0 FT**

TREF = 42 °C TMAX = 55 °C	DRY RUNWAY SLOPE = 0 %	**MAX T.O. WEIGHT(1000KG)** **CODES** **IAS(KT) : V1 - VR - V2**		

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-18	138.0 3-3 137-138-145	148.3 2-3 143-145-151	152.8 2-3 149-153-158	156.3 2-3 156-160-165	157.1 2-2 156-162-167
-8	135.3 3-3 135-137-144	146.1 3-3 141-143-149	151.6 2-3 147-150-156	155.2 2-3 153-158-163	157.1 2-2 157-162-167
2	132.8 3-3 133-136-143	143.6 3-3 139-142-148	150.4 2-3 145-148-154	154.1 2-3 151-156-161	157.1 2-2 156-162-167
12	130.4 3-3 132-135-141	141.2 3-3 138-141-147	149.2 2-3 143-146-152	153.1 2-3 149-154-159	156.2 2-3 155-160-165
22	128.1 3-3 130-133-140	138.9 3-3 136-139-146	148.0 2-2 141-144-150	152.0 2-3 147-152-157	155.3 2-3 153-158-163
32	126.0 3-3 129-132-139	136.7 3-3 135-138-144	145.9 3-3 140-143-149	150.9 2-3 145-150-155	154.3 2-3 151-156-161
42	124.0 3-3 128-131-138	134.5 3-3 134-137-143	143.7 3-3 138-142-148	149.9 2-3 143-148-153	153.3 2-3 149-154-159
44	122.5 3-3 127-130-137	133.0 3-3 133-136-143	142.2 3-3 138-142-147	147.8 2-3 143-147-153	151.2 2-3 148-154-159
46	120.9 3-3 127-130-137	131.3 3-3 133-136-142	140.6 3-3 138-141-146	145.6 2-3 143-147-152	148.8 2-3 148-154-158
48	119.4 3-3 126-129-136	129.6 3-3 132-135-141	138.9 3-3 137-140-146	143.3 2-3 143-147-152	146.5 2-3 148-153-158
50	117.8 3-3 126-128-135	128.1 3-3 132-134-140	137.2 3-3 137-139-145	141.0 2-3 142-146-152	144.1 2-3 148-153-158
52	116.1 3-3 125-127-134	126.3 3-3 131-134-139	134.9 2-3 136-139-144	138.7 2-3 142-146-151	141.6 2-3 148-152-157
54	114.5 3-3 124-127-133	124.6 3-3 131-133-138	132.7 2-3 136-138-144	136.3 2-3 142-145-150	139.2 2-3 147-152-156
56	112.7 3-3 124-126-132	122.8 3-3 130-132-138	130.3 2-3 136-138-143	133.8 2-3 142-145-150	136.7 2-3 147-151-156
58	110.8 3-3 123-125-131	120.9 3-3 129-131-137	128.0 2-3 135-137-142	131.3 2-3 141-144-149	133.9 2-2 146-150-154
60	109.1 3-3 122-124-130	119.0 3-3 129-130-136	125.6 2-3 135-136-141	128.9 2-3 141-143-148	131.0 2-2 145-148-153
62	107.3 3-3 122-123-129	117.2 3-3 128-129-135	123.3 2-3 134-136-141	126.5 2-3 141-143-147	128.0 2-2 143-146-151
64	105.6 3-3 121-123-129	115.5 3-3 127-128-134	120.9 2-3 134-135-140	124.0 2-3 140-142-147	125.1 2-2 142-145-149
66	101.6 3-3 121-123-129	113.6 3-3 127-128-133	118.5 2-3 133-135-139	121.5 2-3 140-142-146	122.2 2-2 140-143-148
68	98.3 3-3 121-123-129	111.8 3-3 126-127-132	116.2 2-3 133-134-139	119.0 2-3 139-141-145	119.3 2-2 138-142-146
70	95.1 3-3 121-124-129	110.1 3-3 125-126-131	113.8 2-3 133-134-138	116.4 2-2 138-140-144	116.4 2-2 135-140-144
72	92.1 3-3 121-124-129	108.0 2-3 125-125-130	111.5 2-3 132-133-138	113.5 2-2 137-139-142	113.5 2-2 133-139-142

A310-324/AA/PW-4152 T20/20-EE-CM72-1---A FCOM-B0-02-10-40-009-090

R Code : 0378 PW Eng. : 4152

NOMINAL THRUST

CONFIGURATION 20/20 **PRESSURE ALTITUDE 1000 FT**

TREF = 37 °C DRY RUNWAY **MAX T.O. WEIGHT(1000KG)** **CODES**
TMAX = 53 °C SLOPE = 0 % **IAS(KT) : V1 - VR - V2**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-23	136.7 3-3 136-138-144	147.4 2-3 142-144-150	151.8 2-3 148-152-157	155.4 2-3 155-159-164	156.4 2-2 157-162-167
-13	134.0 3-3 134-136-143	144.8 3-3 140-142-148	150.6 2-3 146-150-155	154.3 2-3 152-157-162	156.4 2-2 156-162-167
-3	131.4 3-3 133-135-142	142.3 3-3 138-141-147	149.4 2-3 144-147-153	153.2 2-3 150-155-160	156.2 2-3 156-161-166
7	129.0 3-3 131-134-141	139.8 3-3 137-140-146	148.1 2-3 142-145-151	152.1 2-3 148-153-158	155.2 2-3 154-159-164
17	126.7 3-3 130-133-140	137.4 3-3 136-139-145	146.6 3-3 140-144-149	150.9 2-3 146-151-156	154.2 2-3 152-157-162
27	124.6 3-3 128-131-138	135.2 3-3 134-137-144	144.4 3-3 139-143-148	149.9 2-3 144-149-154	153.2 2-3 150-155-160
37	122.1 3-3 127-130-137	132.5 3-3 133-136-143	141.8 3-3 138-141-147	148.1 2-3 142-147-152	151.5 2-3 148-153-158
39	121.2 3-3 126-130-137	131.6 3-3 132-136-142	140.8 3-3 137-141-146	147.0 2-3 142-146-152	150.4 2-3 147-153-158
41	120.1 3-3 126-129-136	130.4 3-3 132-135-141	139.6 3-3 137-140-146	145.6 2-3 142-146-151	148.9 2-3 147-152-157
43	118.6 3-3 125-128-135	128.9 3-3 132-135-141	138.1 3-3 136-140-145	143.6 2-3 142-145-151	146.8 2-3 147-152-157
45	117.1 3-3 125-128-135	127.3 3-3 131-134-140	136.4 3-3 136-139-144	141.4 2-3 141-145-150	144.6 2-3 147-152-157
47	115.6 3-3 124-127-134	125.8 3-3 131-133-139	134.9 3-3 135-138-144	139.3 2-3 141-145-150	142.4 2-3 146-151-156
49	114.1 3-3 124-126-133	124.3 3-3 130-132-138	133.2 3-3 135-138-143	137.1 2-3 141-144-149	140.1 2-3 146-151-156
51	112.5 3-3 123-126-132	122.6 3-3 129-132-137	131.3 2-3 135-137-142	134.9 2-3 141-144-149	137.8 2-3 146-150-155
53	111.0 3-3 123-125-131	121.0 3-3 129-131-137	129.1 2-3 134-136-142	132.7 2-3 140-143-148	135.5 2-3 146-150-154
55	109.1 3-3 122-124-130	119.1 3-3 128-130-136	126.8 2-3 134-136-141	130.2 2-3 140-143-147	133.0 2-3 145-149-154
57	107.4 3-3 121-123-129	117.2 3-3 128-129-135	124.5 2-3 133-135-140	127.9 2-3 139-142-147	130.5 2-2 144-148-152
59	105.7 3-3 121-122-129	115.5 3-3 127-128-134	122.3 2-3 133-134-139	125.5 2-3 139-141-146	127.6 2-2 143-146-151
61	102.0 3-3 121-123-129	113.8 3-3 126-127-133	120.0 2-3 132-134-139	123.2 2-3 139-141-145	124.8 2-2 142-145-149
63	98.6 3-3 121-123-129	111.9 3-3 126-127-132	117.7 2-3 132-133-138	120.8 2-3 138-140-145	122.0 2-2 140-143-147
65	95.3 3-3 121-123-129	110.2 3-3 125-126-131	115.4 2-3 132-133-137	118.3 2-3 138-140-144	119.2 2-2 139-142-146
67	92.2 3-3 121-124-129	108.4 3-3 124-125-130	113.1 2-3 131-132-137	115.9 2-3 137-139-143	116.4 2-2 136-140-144
69		106.7 3-3 124-124-129	110.8 2-3 131-132-136	113.6 2-2 137-139-142	113.6 2-2 134-139-142
70		105.9 3-3 123-124-129	109.7 2-3 131-132-136	112.2 2-2 136-138-142	112.2 2-2 133-138-142

A310-324/AA/PW-4152 T20/20-EE-CM72-1---A FCOM-B0-02-10-40-010-090

R Code : 0378 PW Eng. : 4152

CONFIGURATION 20/20 **PRESSURE ALTITUDE = 1000 FT**

TREF = 37 °C TMAX = 53 °C	DRY RUNWAY SLOPE = 0.0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) V1 - VR - V2	CODES

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-23	136.7 3-3 136-138-144	147.4 2-3 142-144-150	151.8 2-3 148-152-157	155.3 2-3 155-159-164	156.4 2-2 156-162-167
-13	134.0 3-3 134-136-143	144.8 3-3 140-142-148	150.6 2-3 146-150-155	154.2 2-3 152-157-162	156.4 2-2 156-162-167
-3	131.4 3-3 133-135-142	142.3 3-3 138-141-147	149.4 2-3 144-147-153	153.0 2-3 150-154-160	156.0 2-3 155-161-166
7	129.0 3-3 131-134-141	139.8 3-3 137-140-146	148.1 2-3 142-145-151	151.9 2-3 147-152-158	155.0 2-3 153-159-164
17	126.7 3-3 130-133-140	137.4 3-3 136-139-145	146.6 3-3 140-144-149	150.8 2-3 145-150-156	154.0 2-3 151-157-162
27	124.6 3-3 128-131-138	135.2 3-3 134-137-144	144.4 3-3 139-143-148	149.7 2-3 144-148-154	153.0 2-3 149-155-160
37	122.1 3-3 127-130-137	132.5 3-3 133-136-143	141.8 3-3 138-141-147	148.0 2-3 142-146-152	151.3 2-3 147-153-158
39	121.2 3-3 126-130-137	131.6 3-3 132-136-142	140.8 3-3 137-141-146	146.9 2-3 142-146-151	150.3 2-3 146-152-157
41	120.1 3-3 126-129-136	130.4 3-3 132-135-141	139.6 3-3 137-140-146	145.5 2-3 141-146-151	148.7 2-3 146-152-157
43	118.6 3-3 125-128-135	128.9 3-3 132-135-141	138.1 3-3 136-140-145	143.4 2-3 141-145-151	146.6 2-3 146-152-157
45	117.1 3-3 125-128-135	127.3 3-3 131-134-140	136.4 3-3 136-139-144	141.3 2-3 141-145-150	144.4 2-3 146-151-156
47	115.6 3-3 124-127-134	125.8 3-3 131-133-139	134.9 3-3 135-138-144	139.2 2-3 141-145-150	142.2 2-3 146-151-156
49	114.1 3-3 124-126-133	124.3 3-3 130-132-138	133.2 3-3 135-138-143	137.0 2-3 140-144-149	139.9 2-3 145-150-155
51	112.5 3-3 123-126-132	122.6 3-3 129-132-137	131.3 2-3 135-137-142	134.8 2-3 140-144-149	137.6 2-3 145-150-155
53	111.0 3-3 123-125-131	121.0 3-3 129-131-137	129.1 2-3 134-136-142	132.6 2-3 140-143-148	135.3 2-3 145-149-154
55	109.1 3-3 122-124-130	119.1 3-3 128-130-136	126.8 2-3 134-136-141	130.1 2-3 139-142-147	132.8 2-3 145-148-153
57	107.4 3-3 121-123-129	117.2 3-3 128-129-135	124.5 2-3 133-135-140	127.7 2-3 139-142-146	130.4 2-3 144-148-152
59	105.7 3-3 121-122-129	115.5 3-3 127-128-134	122.3 2-3 133-134-139	125.4 2-3 139-141-146	127.6 2-2 143-146-151
61	102.0 3-3 121-123-129	113.8 3-3 126-127-133	120.0 2-3 132-134-139	123.1 2-3 138-141-145	124.8 2-2 142-145-149
63	98.6 3-3 121-123-129	111.9 3-3 126-127-132	117.7 2-3 132-133-138	120.7 2-3 138-140-144	122.0 2-2 140-143-147
65	95.3 3-3 121-123-129	110.2 3-3 125-126-131	115.4 2-3 132-133-137	118.2 2-3 137-139-144	119.2 2-2 139-142-146
67	92.2 3-3 121-124-129	108.4 3-3 124-125-130	113.1 2-3 131-132-137	115.9 2-3 137-139-143	116.4 2-2 136-140-144
69		106.7 3-3 124-124-129	110.8 2-3 131-132-136	113.5 2-3 137-138-142	113.6 2-2 134-139-142
70		105.9 3-3 123-124-129	109.7 2-3 131-132-136	112.2 2-2 136-138-142	112.2 2-2 133-138-142

A310-324/AA/PW-4152 T20/20-EE-CM72-1—A

FCOM-B0-02-10-40-010-000

CONFIGURATION 20/20 **PRESSURE ALTITUDE = 2000 FT**

TREF = 33 °C DRY RUNWAY **MAX T.O. WEIGHT(1000KG)** **CODES**
TMAX = 51 °C SLOPE = 0.0 % **IAS(KT) V1 - VR - V2**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-27	135.1 3-3 135-137-144	145.9 3-3 141-143-149	150.8 2-3 147-151-156	154.3 2-3 153-158-163	155.7 2-2 156-161-166
-17	132.4 3-3 133-136-142	143.3 3-3 139-142-148	149.5 2-3 145-149-154	153.1 2-3 151-156-161	155.7 2-2 156-161-166
-7	129.9 3-3 132-134-141	140.7 3-3 138-140-146	148.2 2-3 143-146-152	152.0 2-3 149-153-159	155.0 2-3 154-160-165
3	127.5 3-3 130-133-140	138.2 3-3 136-139-145	147.0 2-3 141-144-150	150.8 2-3 146-151-157	154.0 2-3 152-158-163
13	125.2 3-3 129-132-139	135.8 3-3 135-138-144	145.0 3-3 140-143-149	149.7 2-3 144-149-155	152.9 2-3 150-156-161
23	123.0 3-3 127-131-138	133.5 3-3 133-137-143	142.8 3-3 138-142-147	148.6 2-3 143-147-153	151.9 2-3 148-154-159
33	121.0 3-3 126-129-137	131.3 3-3 132-136-142	140.6 3-3 137-141-146	147.5 2-3 141-145-151	150.9 2-3 146-152-157
35	119.8 3-3 125-129-136	130.1 3-3 132-135-141	139.3 3-3 136-140-146	145.9 2-3 141-145-150	149.3 2-3 145-151-156
37	118.4 3-3 125-128-135	128.6 3-3 131-134-141	137.8 3-3 136-139-145	144.1 2-3 140-145-150	147.4 2-3 145-151-156
39	117.0 3-3 124-128-135	127.2 3-3 131-134-140	136.3 3-3 136-139-144	142.2 2-3 140-144-149	145.4 2-3 145-150-155
41	115.7 3-3 124-127-134	125.8 3-3 130-133-139	134.9 3-3 135-138-144	140.3 2-3 140-144-149	143.5 2-3 145-150-155
43	114.2 3-3 123-126-133	124.4 3-3 130-132-138	133.3 3-3 135-138-143	138.3 2-3 140-143-149	141.4 2-3 144-150-154
45	112.9 3-3 123-126-132	123.0 3-3 129-132-138	131.9 3-3 134-137-142	136.4 2-3 139-143-148	139.4 2-3 144-149-154
47	111.4 3-3 122-125-132	121.5 3-3 129-131-137	130.3 3-3 134-136-141	134.3 2-3 139-143-148	137.3 2-3 144-149-153
49	109.9 3-3 122-124-131	119.9 3-3 128-130-136	128.6 3-3 133-135-141	132.3 2-3 139-142-147	135.1 2-3 144-148-153
51	108.5 3-3 121-124-130	118.4 3-3 127-130-135	126.8 2-3 133-135-140	130.2 2-3 138-142-146	133.0 2-3 144-148-152
53	106.7 3-3 121-123-129	116.5 3-3 127-129-134	124.5 2-3 132-134-139	127.9 2-3 138-141-146	130.6 2-3 143-147-151
55	103.8 3-3 120-123-129	114.7 3-3 126-128-133	122.3 2-3 132-133-138	125.5 2-3 138-140-145	128.2 2-3 143-146-151
57	100.6 3-3 120-123-129	113.0 3-3 126-127-132	120.1 2-3 131-133-138	123.3 2-3 137-140-144	125.8 2-2 142-145-150
59	97.5 3-3 120-123-129	111.3 3-3 125-126-132	118.0 2-3 131-132-137	121.0 2-3 137-139-143	123.1 2-2 141-144-148
61	94.2 3-3 120-123-129	109.5 3-3 124-125-131	115.8 2-3 130-132-136	118.7 2-3 136-138-143	120.4 2-2 140-142-147
63		107.8 3-3 124-125-130	113.5 2-3 130-131-136	116.4 2-3 136-138-142	117.6 2-2 138-141-145
65		106.1 3-3 123-124-129	111.3 2-3 129-131-135	114.1 2-3 135-137-141	114.9 2-2 136-139-143
67		102.9 3-3 123-124-129	109.1 2-3 129-130-134	111.8 2-3 135-137-141	112.2 2-2 134-138-142
68		101.4 3-3 123-124-129	108.0 2-3 129-130-134	110.6 2-3 135-137-140	110.9 2-2 133-137-141

A310-324/AA/PW-4152 T20/20-EE-CM72-1—A FCOM-80-02-10-40-011-000

NOMINAL THRUST

CONFIGURATION 20/20			PRESSURE ALTITUDE 2000 FT		
TREF = 33 °C TMAX = 51 °C		DRY RUNWAY SLOPE = 0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) : V1 - VR - V2		CODES
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-27	135.1 3-3 135-137-144	145.9 3-3 141-143-149	150.8 2-3 147-151-156	154.4 2-3 154-158-163	155.7 2-2 156-161-166
-17	132.4 3-3 133-136-142	143.3 3-3 139-142-148	149.5 2-3 145-149-154	153.2 2-3 151-156-161	155.7 2-2 156-161-166
-7	129.9 3-3 132-134-141	140.7 3-3 138-140-146	148.2 2-3 143-146-152	152.1 2-3 149-154-159	155.2 2-3 155-160-165
3	127.5 3-3 130-133-140	138.2 3-3 136-139-145	147.0 2-3 141-144-150	151.0 2-3 147-151-157	154.2 2-3 153-158-163
13	125.2 3-3 129-132-139	135.8 3-3 135-138-144	145.0 3-3 140-143-149	149.8 2-3 145-149-155	153.1 2-3 150-156-161
23	123.0 3-3 127-131-138	133.5 3-3 133-137-143	142.8 3-3 138-142-147	148.7 2-3 143-147-153	152.1 2-3 148-154-159
33	121.0 3-3 126-129-137	131.3 3-3 132-136-142	140.6 3-3 137-141-146	147.6 2-3 141-146-151	151.1 2-3 146-152-157
35	119.8 3-3 125-129-136	130.1 3-3 132-135-141	139.3 3-3 136-140-146	146.0 2-3 141-145-151	149.5 2-3 146-152-157
37	118.4 3-3 125-128-135	128.6 3-3 131-134-141	137.8 3-3 136-139-145	144.2 2-3 141-145-150	147.6 2-3 146-151-156
39	117.0 3-3 124-128-135	127.2 3-3 131-134-140	136.3 3-3 136-139-144	142.3 2-3 141-144-150	145.6 2-3 146-151-156
41	115.7 3-3 124-127-134	125.8 3-3 130-133-139	134.9 3-3 135-138-144	140.5 2-3 140-144-149	143.7 2-3 146-150-155
43	114.2 3-3 123-126-133	124.4 3-3 130-132-138	133.3 3-3 135-138-143	138.5 2-3 140-144-149	141.6 2-3 145-150-155
45	112.9 3-3 123-126-132	123.0 3-3 129-132-138	131.9 3-3 134-137-142	136.5 2-3 140-143-148	139.6 2-3 145-150-154
47	111.4 3-3 122-125-132	121.5 3-3 129-131-137	130.3 3-3 134-136-141	134.5 2-3 140-143-148	137.5 2-3 145-149-154
49	109.9 3-3 122-124-131	119.9 3-3 128-130-136	128.6 3-3 133-135-141	132.4 2-3 139-142-147	135.3 2-3 145-149-153
51	108.5 3-3 121-124-130	118.4 3-3 127-130-135	126.8 2-3 133-135-140	130.3 2-3 139-142-147	133.1 2-3 144-148-153
53	106.7 3-3 121-123-129	116.5 3-3 127-129-134	124.5 2-3 132-134-139	128.0 2-3 138-141-146	130.7 2-3 144-147-152
55	103.8 3-3 120-123-129	114.7 3-3 126-128-133	122.3 2-3 132-133-138	125.7 2-3 138-140-145	128.4 2-3 144-146-151
57	100.6 3-3 120-123-129	113.0 3-3 126-127-132	120.1 2-3 131-133-138	123.4 2-3 138-140-144	125.8 2-2 142-145-150
59	97.5 3-3 120-123-129	111.3 3-3 125-126-132	118.0 2-3 131-132-137	121.1 2-3 137-139-144	123.1 2-2 141-144-148
61	94.2 3-3 120-123-129	109.5 3-3 124-125-131	115.8 2-3 130-132-136	118.8 2-3 137-139-143	120.4 2-2 140-142-147
63		107.8 3-3 124-125-130	113.5 2-3 130-131-136	116.5 2-3 136-138-142	117.6 2-2 138-141-145
65		106.1 3-3 123-124-129	111.3 2-3 129-131-135	114.2 2-3 136-137-141	114.9 2-2 136-139-143
67		102.9 3-3 123-124-129	109.1 2-3 129-130-134	111.9 2-3 135-137-141	112.2 2-2 134-138-142
68		101.4 3-3 123-124-129	108.0 2-3 129-130-134	110.7 2-3 135-137-140	110.9 2-2 133-137-141

A310-324/AA/PW-4152 T20/20-EE-CM72-1---A FCOM-B0-02-10-40-011-090

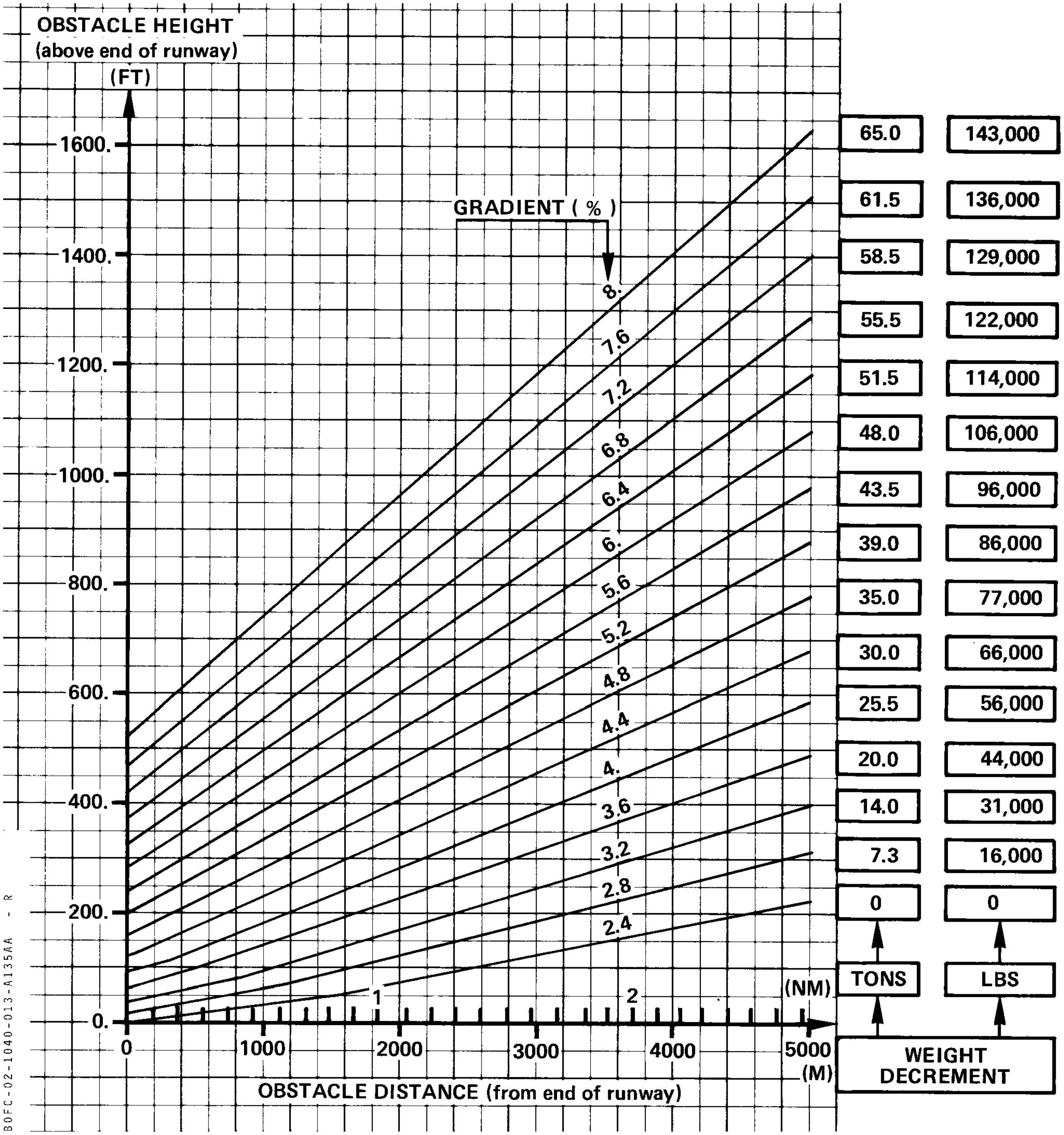
R Code : 0378 PW Eng. : 4152

LEFT BLANK INTENTIONALLY

R Code : 0381

NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

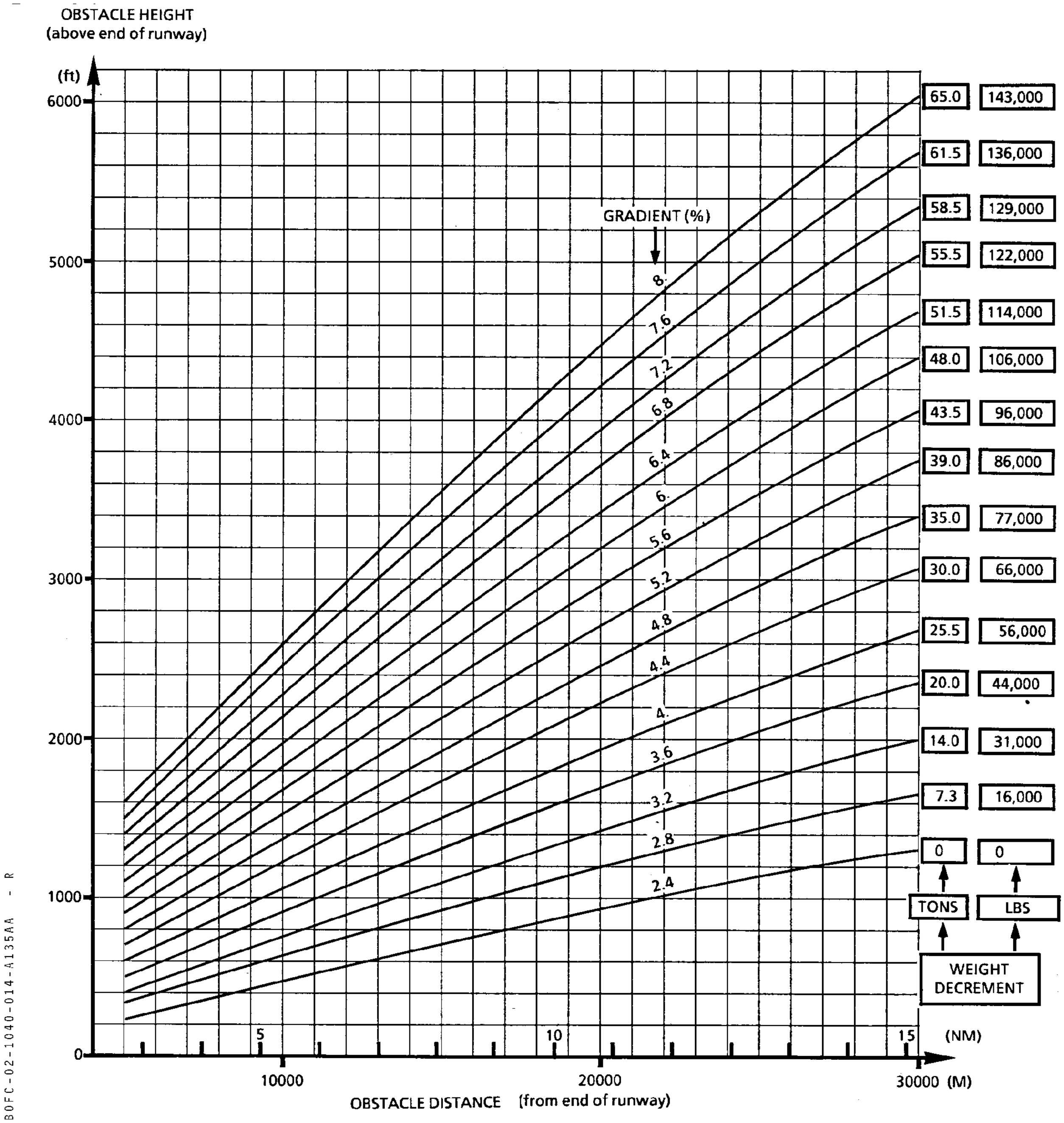
SLATS 15 – FLAPS 0



Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 77 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 0

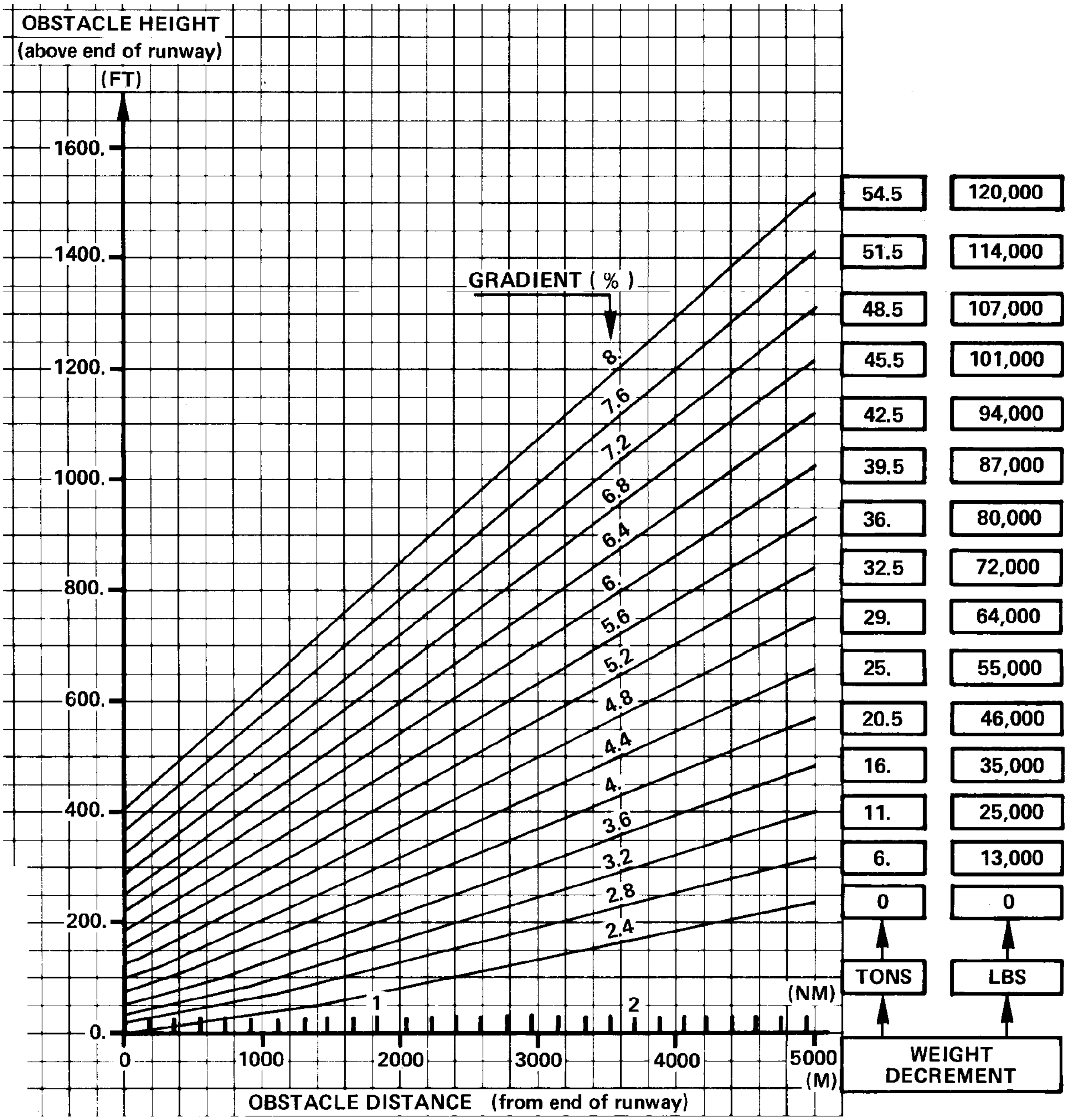


Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 77 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

Mod : 4863 PW Eng. : 4152

NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 15



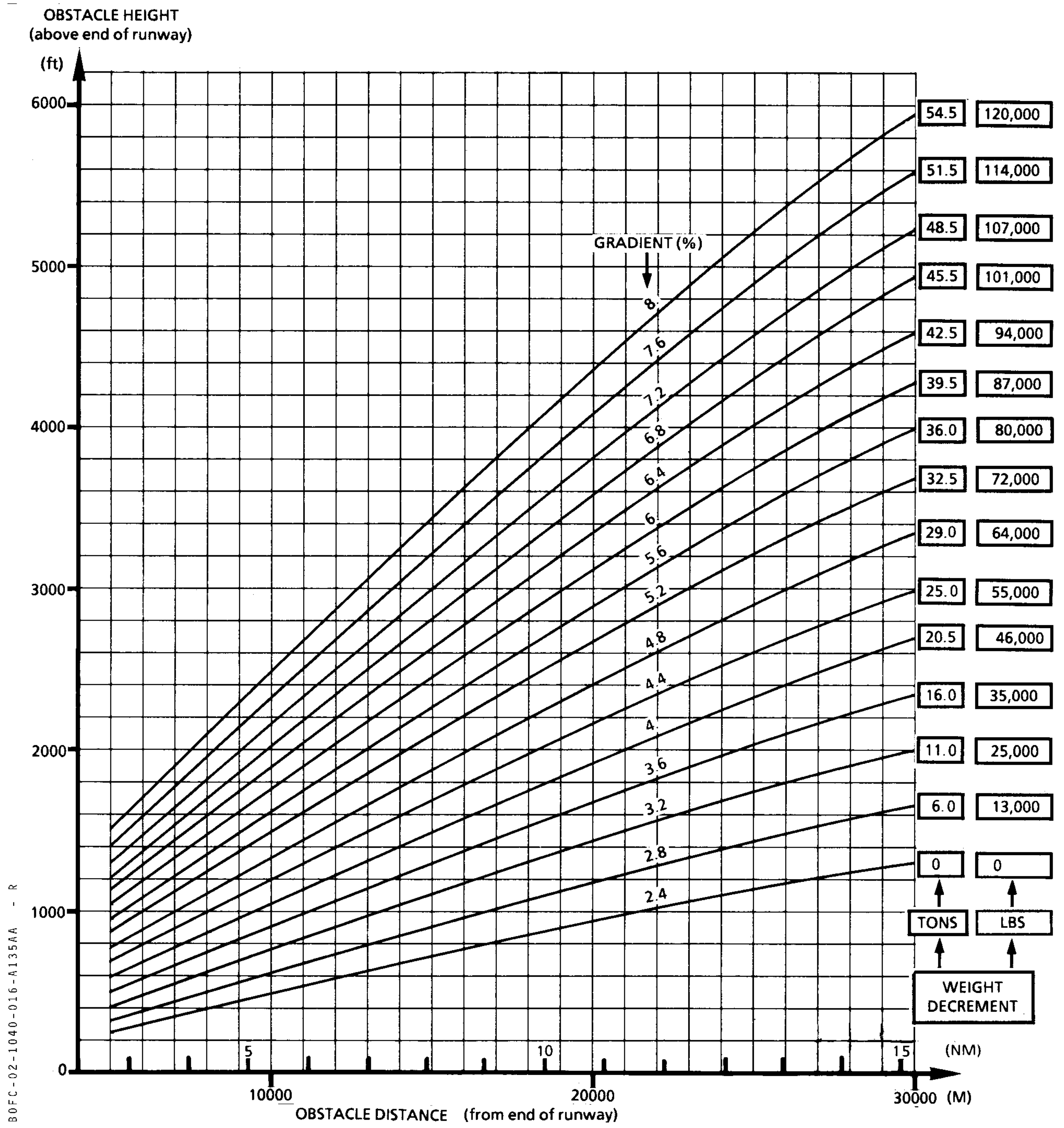
B0FC-02-1040-015-A135AA - R

Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 61 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

Mod : 4863

PW Eng. : 4152

NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE
SLATS 15 – FLAPS 15

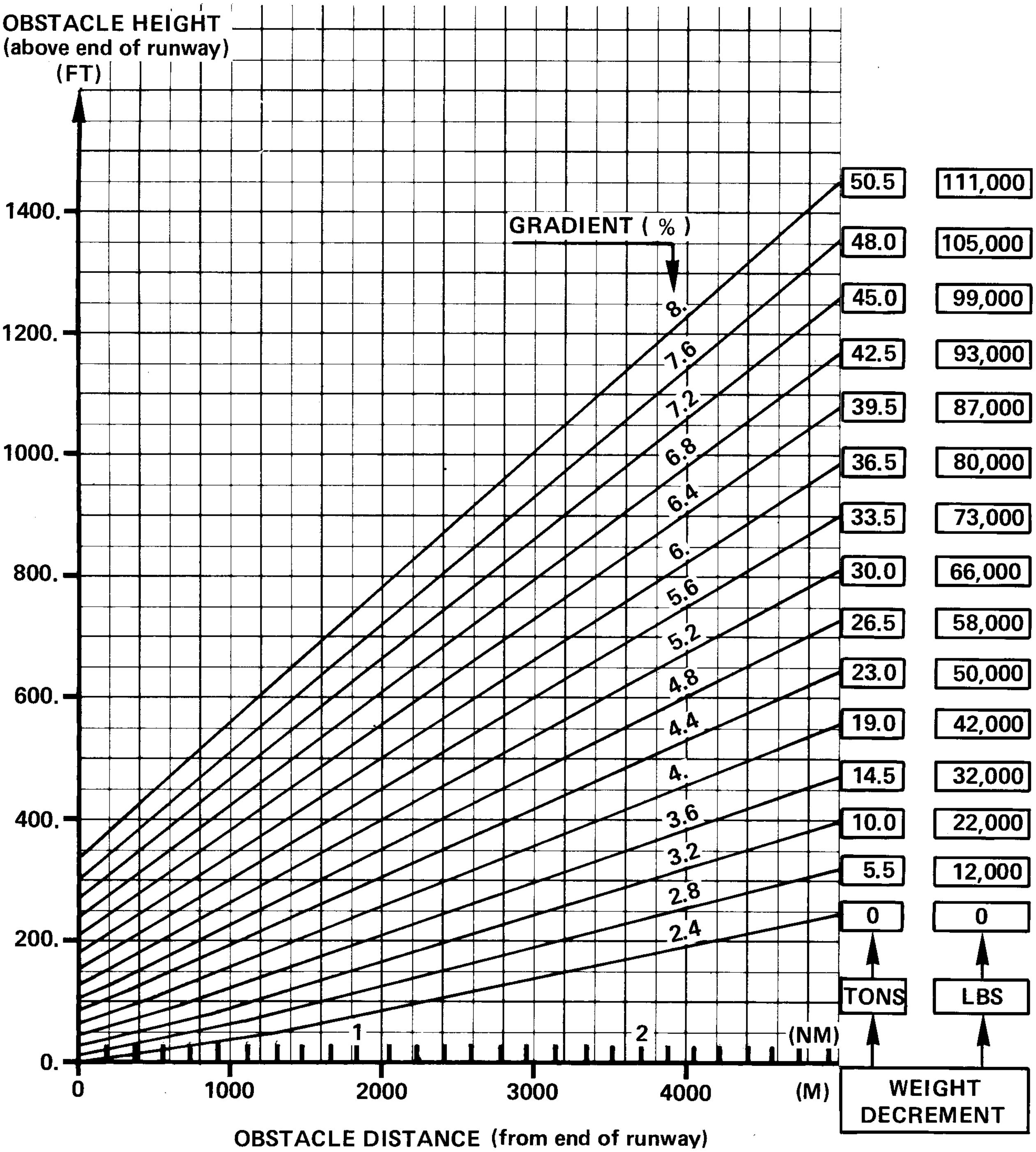


Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 61 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

Mod : 4863 PW Eng. : 4152

NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

SLATS 20 – FLAPS 20

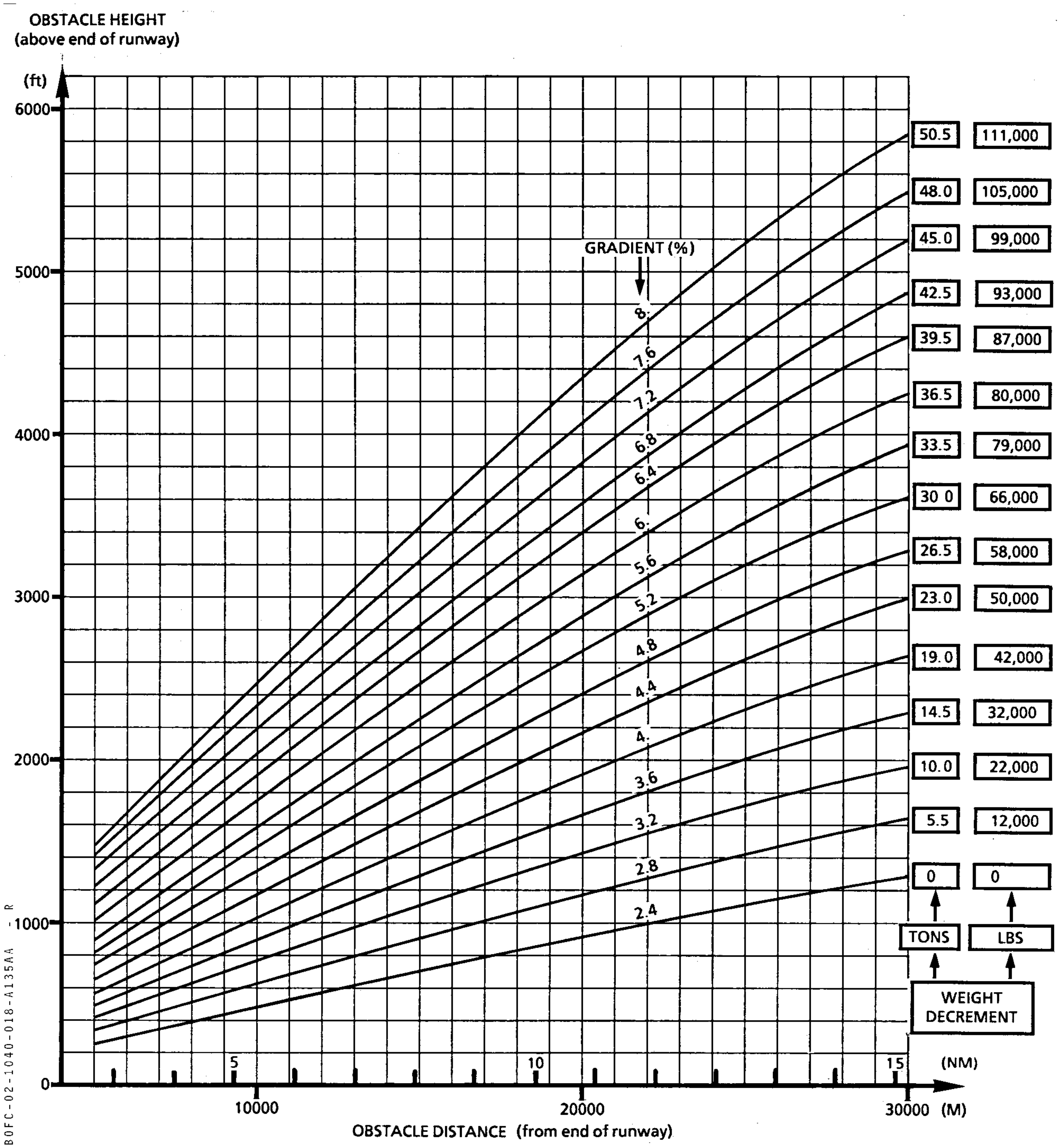


BOFC-02-1040-017-A135AA - R

Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 46 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

Mod : 4863 PW Eng. : 4152

NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE
SLATS 20 – FLAPS 20



Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 46 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

Mod : 4863

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/ 0 ELEVATION = 0 FT

TREF = 42 °C
TMAX = 55 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-18	163.0 2-6 167-175-179	164.2 2-6 166-177-182	165.4 2-6 165-180-184	166.6 2-6 164-183-187	167.6 2-6 164-185-189
-8	161.7 2-6 165-172-177	163.0 2-6 164-175-179	164.2 2-6 163-177-182	165.4 2-6 162-180-184	166.5 2-6 161-183-187
2	160.3 2-6 162-170-174	161.7 2-6 161-172-177	163.0 2-6 160-175-179	164.2 2-6 160-177-182	165.3 2-6 159-180-184
12	157.8 6-6 160-168-173	160.3 2-6 159-170-174	161.7 2-6 158-172-177	162.9 2-6 157-175-179	164.1 2-6 156-178-182
22	155.4 6-6 158-167-171	158.0 6-6 157-168-173	160.5 2-6 155-170-174	161.7 2-6 154-173-177	163.0 2-6 154-175-179
32	153.0 6-6 157-166-170	155.7 6-6 155-167-172	158.3 6-6 154-169-173	160.5 2-6 152-170-175	161.8 2-6 151-173-177
42	150.6 6-6 155-164-169	153.3 6-6 153-166-170	155.9 6-6 152-167-172	158.5 6-6 150-169-173	160.6 2-6 149-171-175
44	149.5 6-6 155-164-168	152.2 6-6 154-166-170	154.8 6-6 152-167-171	157.4 6-6 151-168-173	158.7 2-6 150-171-175
46	148.3 6-6 156-164-168	151.0 6-6 154-165-169	153.6 6-6 153-166-170	155.3 2-6 152-168-173	156.5 2-6 151-171-175
48	147.2 6-6 156-163-167	149.8 6-6 154-165-168	151.9 2-6 153-166-170	153.1 2-6 152-168-173	154.3 2-6 152-171-175
50	146.0 6-6 156-163-166	148.5 2-6 155-164-168	149.8 2-6 154-166-170	151.0 2-6 153-169-173	152.1 2-6 153-171-175
52	144.9 6-6 157-162-166	146.4 2-6 156-164-168	147.6 2-6 155-166-170	148.7 2-6 154-169-173	149.8 2-6 154-171-175
54	143.1 2-6 158-162-166	144.3 2-6 157-164-168	145.4 2-6 156-167-170	146.4 2-6 155-169-173	147.5 2-6 155-171-175
56	140.9 2-6 159-162-166	142.1 2-6 158-164-168	143.1 2-6 157-167-170	144.1 2-6 157-169-173	145.0 2-6 156-171-175
58	138.6 2-3 159-162-165	139.8 2-6 159-164-168	140.8 2-6 158-166-170	141.8 2-6 158-169-172	142.7 2-6 157-171-174
60	136.1 2-3 159-161-164	137.6 2-6 160-165-168	138.5 2-6 160-167-170	139.4 2-6 159-169-172	140.2 2-6 159-171-174
62	133.6 2-3 158-161-164	135.4 2-6 162-165-168	136.3 2-6 161-167-170	137.1 2-6 160-169-172	137.9 2-6 160-171-174
64	131.0 2-3 158-160-163	133.1 2-3 163-165-168	134.0 2-6 162-167-170	134.7 2-6 162-169-172	135.5 2-6 161-171-174
66	128.5 2-3 158-159-162	130.5 2-3 162-164-167	131.6 2-6 164-167-170	132.4 2-6 163-169-172	133.0 2-6 163-171-174
68	125.9 2-3 157-159-161	127.8 2-3 162-164-166	129.3 2-6 165-167-170	130.0 2-6 165-169-172	130.5 2-2 163-171-174
70	123.4 2-3 157-158-161	125.3 2-3 162-163-166	126.8 2-3 166-168-170	127.3 2-2 165-169-172	127.3 2-2 163-169-172
72	120.9 2-3 157-158-160	122.7 2-3 162-163-165	124.2 2-2 166-167-170	124.2 2-2 164-167-170	124.2 2-2 162-167-170

A310-324/AA/4152FTDMT15/00-EF-CM72-1---A #BK0 FCOM-B0-02-10-40-019-090

Code : 0182 PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/ 0			ELEVATION = 1000 FT		
TREF = 37 °C TMAX = 53 °C		DRY RUNWAY SLOPE = 0 %	MAX T.O. WEIGHT(1000KG) IAS(KT) V1 - VR - V2		CODES
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-23	162.0 2-6 166-174-178	163.3 2-6 165-176-181	164.5 2-6 164-179-183	165.6 2-6 164-182-186	166.7 2-6 163-184-188
-13	160.7 2-6 164-171-176	162.0 2-6 163-174-178	163.2 2-6 162-177-181	164.4 2-6 161-179-183	165.5 2-6 160-182-186
-3	159.1 6-6 161-169-173	160.7 2-6 160-171-176	162.0 2-6 160-174-178	163.2 2-6 159-177-181	164.3 2-6 158-179-183
7	156.5 6-6 160-168-172	159.1 6-6 158-169-173	160.7 2-6 157-171-176	162.0 2-6 156-174-178	163.1 2-6 155-177-181
17	153.9 6-6 158-166-171	156.6 6-6 156-168-172	159.2 6-6 154-169-174	160.7 2-6 154-172-176	161.9 2-6 153-174-178
27	151.5 6-6 156-165-169	154.2 6-6 154-167-171	156.9 6-6 153-168-172	159.4 6-6 151-169-174	160.8 2-6 150-172-176
37	148.9 6-6 155-164-168	151.6 6-6 153-165-169	154.2 6-6 151-167-171	156.8 6-6 150-168-172	158.9 2-6 149-170-174
39	148.1 6-6 154-163-167	150.8 6-6 153-165-169	153.4 6-6 151-166-170	156.0 6-6 150-168-172	157.9 2-6 149-169-174
41	147.2 6-6 155-163-167	149.9 6-6 153-164-168	152.5 6-6 151-166-170	155.0 6-6 150-167-171	156.5 2-6 149-169-174
43	146.1 6-6 155-162-166	148.8 6-6 153-164-168	151.3 6-6 152-165-169	153.3 2-6 151-167-171	154.5 2-6 150-169-173
45	145.0 6-6 155-162-166	147.6 6-6 154-163-167	150.1 2-6 152-165-169	151.3 2-6 151-167-171	152.5 2-6 151-169-173
47	144.0 6-6 155-162-165	146.5 6-6 154-163-167	148.1 2-6 153-165-169	149.3 2-6 152-167-171	150.4 2-6 152-169-173
49	142.9 6-6 156-161-165	144.9 2-6 155-163-166	146.1 2-6 154-165-169	147.2 2-6 153-167-171	148.3 2-6 153-169-173
51	141.7 2-6 156-161-164	142.8 2-6 156-163-166	144.0 2-6 155-165-169	145.0 2-6 154-167-171	146.1 2-6 154-169-173
53	139.7 2-6 157-161-164	140.8 2-6 156-163-166	141.9 2-6 156-165-169	142.9 2-6 155-167-171	143.8 2-6 155-169-173
55	137.4 2-3 158-160-164	138.6 2-6 158-163-166	139.6 2-6 157-165-168	140.6 2-6 156-167-171	141.5 2-6 156-169-173
57	134.9 2-3 157-160-163	136.5 2-6 159-163-166	137.5 2-6 158-165-168	138.3 2-6 158-167-171	139.2 2-6 157-169-173
59	132.5 2-3 157-159-162	134.4 2-6 160-163-166	135.2 2-6 159-165-168	136.1 2-6 159-167-170	136.8 2-6 158-169-172
61	130.1 2-3 156-159-161	132.2 2-3 161-163-166	133.1 2-6 161-165-168	133.8 2-6 160-167-170	134.6 2-6 160-169-172
63	127.6 2-3 156-158-161	129.6 2-3 161-163-166	130.8 2-6 162-165-168	131.5 2-6 161-167-170	132.2 2-6 161-169-172
65	125.2 2-3 156-157-160	127.1 2-3 160-162-165	128.6 2-6 163-166-169	129.2 2-6 163-168-170	129.9 2-6 162-169-172
67	122.7 2-3 155-157-159	124.6 2-3 160-162-164	126.2 2-3 164-166-169	127.0 2-6 164-168-171	127.3 2-2 163-169-172
69	120.3 2-3 155-156-159	122.1 2-3 160-161-163	123.7 2-3 164-165-168	124.3 2-2 165-167-170	124.3 2-2 163-167-170
70	119.1 2-3 155-156-158	120.8 2-3 160-161-163	122.4 2-3 164-165-168	122.8 2-2 164-166-169	122.8 2-2 162-166-169

A310-324/AA/4152FTDMT15/00-EF-CM72-1---A #BK0 FCOM-B0-02-10-40-020-090

Code : 0182 PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/ 0 ELEVATION = 2000 FT

TREF = 33 °C
TMAX = 51 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) CODES
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	3000	**3250**	**3500**	**3750**	**4000**
-27	160.9 2-6 165-173-177	162.2 2-6 164-175-180	163.4 2-6 163-178-182	164.6 2-6 162-180-185	165.6 2-6 162-183-187
-17	159.6 2-6 163-170-175	160.9 2-6 162-173-177	162.2 2-6 161-175-180	163.3 2-6 160-178-182	164.5 2-6 159-180-185
-7	157.5 6-6 161-168-173	159.6 2-6 159-170-175	160.9 2-6 158-173-177	162.1 2-6 158-175-180	163.3 2-6 157-178-182
3	154.9 6-6 159-167-171	157.5 6-6 157-168-173	159.6 2-6 156-170-175	160.8 2-6 155-173-177	162.1 2-6 154-175-179
13	152.2 6-6 157-165-170	154.9 6-6 155-167-171	157.6 6-6 154-168-173	159.6 2-6 152-170-175	160.8 2-6 152-173-177
23	149.8 6-6 155-164-168	152.5 6-6 153-166-170	155.2 6-6 152-167-171	157.7 6-6 150-169-173	159.6 2-6 149-171-175
33	147.4 6-6 153-163-167	150.1 6-6 152-164-169	152.8 6-6 150-166-170	155.4 6-6 149-167-171	157.9 6-6 147-169-173
35	146.5 6-6 153-162-167	149.2 6-6 152-164-168	151.8 6-6 150-165-169	154.4 6-6 149-167-171	156.9 2-6 147-168-172
37	145.5 6-6 154-162-166	148.1 6-6 152-164-167	150.7 6-6 151-165-169	153.2 6-6 149-166-170	155.1 2-6 148-168-172
39	144.5 6-6 154-162-165	147.1 6-6 152-163-167	149.6 6-6 151-165-168	152.0 2-6 150-166-170	153.3 2-6 149-168-172
41	143.4 6-6 154-161-165	146.0 6-6 153-163-166	148.5 6-6 151-164-168	150.2 2-6 150-166-170	151.4 2-6 150-168-172
43	142.4 6-6 154-161-164	144.9 6-6 153-162-166	147.2 2-6 152-164-167	148.4 2-6 151-166-170	149.5 2-6 150-168-172
45	141.4 6-6 155-160-164	143.9 6-6 153-162-165	145.4 2-6 152-164-167	146.6 2-6 152-166-170	147.7 2-6 151-168-172
47	140.4 6-6 155-160-163	142.4 2-6 154-162-165	143.5 2-6 153-164-167	144.6 2-6 152-166-169	145.7 2-6 152-168-172
49	139.3 2-6 155-159-163	140.4 2-6 155-162-165	141.5 2-6 154-164-167	142.6 2-6 153-166-169	143.6 2-6 153-168-172
51	137.4 2-3 156-160-163	138.5 2-6 156-162-165	139.5 2-6 155-164-167	140.5 2-6 154-166-169	141.4 2-6 154-168-172
53	135.0 2-3 156-159-162	136.4 2-6 157-162-165	137.4 2-6 156-164-167	138.3 2-6 155-166-169	139.2 2-6 155-168-171
55	132.6 2-3 155-158-161	134.3 2-6 158-162-165	135.2 2-6 157-164-167	136.1 2-6 157-166-169	136.9 2-6 156-168-171
57	130.3 2-3 155-157-160	132.3 2-6 159-162-165	133.1 2-6 158-164-167	133.9 2-6 158-166-169	134.7 2-6 157-168-171
59	128.0 2-3 155-157-160	130.0 2-3 159-162-164	131.0 2-6 160-164-167	131.7 2-6 159-166-169	132.5 2-6 159-168-171
61	125.5 2-3 154-156-159	127.5 2-3 159-161-164	128.8 2-6 161-164-167	129.5 2-6 160-166-169	130.2 2-6 160-168-171
63	123.1 2-3 154-155-158	125.1 2-3 159-160-163	126.7 2-6 162-164-167	127.4 2-6 162-166-169	128.0 2-6 161-168-171
65	120.8 2-3 154-155-157	122.7 2-3 158-160-162	124.3 2-3 163-164-167	125.1 2-6 163-166-169	125.7 2-2 163-168-171
67	118.5 2-3 153-154-157	120.3 2-3 158-159-161	121.9 2-3 162-164-166	122.8 2-2 164-166-169	122.8 2-2 162-166-169
68	117.3 2-3 153-154-156	119.1 2-3 158-159-161	120.6 2-3 162-163-166	121.3 2-2 163-165-168	121.3 2-2 161-165-168

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#BK0 FCOM-B0-02-10-40-021-090

Code : 0182

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/15			ELEVATION = 0 FT		
TREF = 42 °C TMAX = 55 °C		DRY RUNWAY SLOPE = 0 %	**MAX T.O. WEIGHT(1000KG)** **IAS(KT) V1 - VR - V2**		**CODES**
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-18	155.3 2-3 155-158-163	158.7 2-3 161-165-169	161.5 2-3 167-171-175	163.1 2-6 168-175-179	164.2 2-6 167-178-181
-8	154.1 2-3 153-156-161	157.6 2-3 158-163-167	160.4 2-3 164-169-173	162.2 2-6 166-173-177	163.3 2-6 165-176-179
2	152.9 2-3 151-154-159	156.4 2-3 156-161-165	159.4 2-3 162-167-171	161.1 2-6 163-171-174	162.3 2-6 162-173-177
12	151.6 3-3 149-152-157	155.3 2-3 154-158-163	158.4 2-3 159-165-169	160.1 2-6 160-168-172	161.3 2-6 159-171-175
22	149.3 3-3 147-151-156	154.2 2-3 152-157-161	157.3 2-3 157-162-167	159.0 2-6 158-166-170	160.2 2-6 157-169-172
32	147.1 3-3 146-149-155	153.1 2-3 150-155-159	156.3 2-3 155-161-165	157.9 2-6 155-164-168	159.1 2-6 154-166-170
42	145.0 3-3 145-148-153	152.0 2-3 148-153-157	155.3 2-6 153-159-163	156.7 2-6 152-161-166	158.0 2-6 151-164-168
44	143.5 3-3 144-148-153	150.0 2-3 148-152-157	153.2 2-3 153-158-163	154.8 2-6 153-162-166	156.1 2-6 152-164-168
46	141.9 3-3 144-147-152	147.8 2-3 148-152-157	150.9 2-3 153-158-162	152.8 2-6 154-162-166	153.9 2-6 153-164-168
48	140.2 3-3 143-146-151	145.5 2-3 148-151-156	148.6 2-3 153-157-162	150.6 2-6 155-162-166	151.8 2-6 154-164-168
50	138.6 3-3 143-145-150	143.2 2-3 147-151-156	146.2 2-3 152-157-161	148.5 2-6 156-162-166	149.6 2-6 155-165-168
52	136.8 3-3 142-145-149	140.8 2-3 147-150-155	143.8 2-3 152-157-161	146.2 2-3 157-162-166	147.3 2-6 156-165-168
54	135.1 3-3 141-144-148	138.5 2-3 147-150-155	141.3 2-3 152-156-160	143.7 2-3 157-162-165	145.0 2-6 158-165-168
56	132.7 2-3 141-143-148	136.0 2-3 146-149-154	138.8 2-3 151-155-159	141.1 2-3 156-161-165	142.7 2-6 159-165-168
58	130.3 2-3 140-142-147	133.5 2-3 146-149-153	136.2 2-3 151-155-159	138.5 2-3 156-160-164	140.1 2-2 159-164-168
60	127.9 2-3 140-142-146	131.0 2-3 145-148-152	133.6 2-3 151-154-158	135.8 2-3 156-159-163	137.0 2-2 158-163-166
62	125.6 2-3 140-141-145	128.6 2-3 145-147-151	131.1 2-3 150-153-157	133.2 2-3 155-159-162	134.0 2-2 157-161-164
64	123.2 2-3 139-141-145	126.1 2-3 145-147-151	128.6 2-3 150-153-156	130.6 2-3 155-158-161	131.0 2-2 155-159-162
66	120.7 2-3 139-140-144	123.6 2-3 144-146-150	126.0 2-3 149-152-155	127.9 2-2 154-157-160	127.9 2-2 153-157-160
68	118.4 2-3 138-139-143	121.1 2-3 144-145-149	123.4 2-3 149-151-155	124.9 2-2 153-155-158	124.9 2-2 150-155-158
70	116.0 2-3 138-139-142	118.6 2-3 143-145-148	120.8 2-3 149-150-154	121.9 2-2 151-153-157	121.9 2-2 148-153-157
72	113.6 2-3 137-138-142	116.2 2-3 143-144-148	118.3 2-3 148-150-153	118.8 2-2 149-152-155	118.8 2-2 146-152-155

A310-324/AA/4152FTDMT15/15-EF-CM72-1---A #BK0 FCOM-B0-02-10-40-022-090

Code : 0182 PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/15 **ELEVATION = 1000 FT**

TREF = 37 °C
TMAX = 53 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-23	154.4 2-3 154-157-162	157.8 2-3 160-164-168	160.6 2-3 166-170-174	162.2 2-6 167-174-178	163.2 2-6 166-177-180
-13	153.2 2-3 152-155-160	156.6 2-3 157-162-166	159.5 2-3 163-168-172	161.2 2-6 164-172-175	162.3 2-6 163-174-178
-3	151.9 2-3 150-153-158	155.5 2-3 155-160-164	158.4 2-3 161-166-170	160.1 2-6 162-170-173	161.3 2-6 161-172-176
7	150.2 3-3 148-151-156	154.3 2-3 153-158-162	157.4 2-3 158-164-168	159.0 2-6 159-167-171	160.2 2-6 158-170-174
17	147.9 3-3 146-150-155	153.2 2-3 151-156-160	156.3 2-3 156-162-166	157.9 2-6 156-165-169	159.2 2-6 155-167-171
27	145.7 3-3 145-149-154	152.0 2-3 149-154-158	155.3 2-3 154-160-164	156.8 2-6 154-162-167	158.1 2-6 153-165-169
37	143.1 3-3 144-147-152	150.2 2-3 147-152-156	153.5 2-3 152-158-162	155.0 2-6 152-160-165	156.3 2-6 151-163-167
39	142.1 3-3 143-147-152	149.2 2-3 147-151-156	152.5 2-3 152-157-162	154.0 2-6 152-160-164	155.3 2-6 151-163-167
41	141.0 3-3 143-146-151	147.7 2-3 147-151-155	151.0 2-3 152-157-161	152.7 2-6 152-160-164	153.9 2-6 151-163-167
43	139.4 3-3 142-146-151	145.7 2-3 146-150-155	148.9 2-3 151-156-161	150.8 2-6 153-160-164	152.0 2-6 152-163-167
45	137.9 3-3 142-145-150	143.6 2-3 146-150-154	146.7 2-3 151-156-160	148.8 2-6 154-160-164	150.0 2-6 153-163-167
47	136.3 3-3 141-144-149	141.5 2-3 146-149-154	144.5 2-3 151-155-160	146.9 2-6 155-161-164	148.0 2-6 154-163-167
49	134.6 3-3 141-143-148	139.3 2-3 146-149-153	142.3 2-3 150-155-159	144.7 2-3 155-160-164	145.9 2-6 155-163-167
51	132.9 3-3 140-143-147	137.0 2-3 145-148-153	139.9 2-3 150-154-159	142.3 2-3 155-160-164	143.7 2-6 156-163-167
53	131.3 3-3 140-142-146	134.8 2-3 145-148-152	137.6 2-3 150-154-158	139.9 2-3 155-159-163	141.5 2-6 157-164-167
55	129.1 2-3 139-141-145	132.4 2-3 144-147-151	135.0 2-3 149-153-157	137.3 2-3 154-159-162	139.2 2-6 159-164-167
57	126.8 2-3 139-140-145	129.9 2-3 144-146-151	132.6 2-3 149-152-156	134.8 2-3 154-158-161	136.5 2-2 158-162-166
59	124.5 2-3 138-140-144	127.5 2-3 144-146-150	130.1 2-3 149-152-155	132.3 2-3 154-157-160	133.6 2-2 157-161-164
61	122.2 2-3 138-139-143	125.2 2-3 143-145-149	127.7 2-3 148-151-155	129.8 2-3 153-156-160	130.7 2-2 156-159-162
63	119.9 2-3 137-138-142	122.8 2-3 143-145-148	125.2 2-3 148-150-154	127.2 2-3 153-156-159	127.7 2-2 153-157-160
65	117.6 2-3 137-138-142	120.3 2-3 142-144-148	122.7 2-3 147-149-153	124.7 2-3 152-155-158	124.8 2-2 151-155-158
67	115.2 2-3 136-137-141	117.9 2-3 142-143-147	120.2 2-3 147-149-152	121.9 2-2 151-154-157	121.9 2-2 149-154-157
69	113.0 2-3 136-137-140	115.6 2-3 141-143-146	117.8 2-3 147-148-152	118.9 2-2 150-152-155	118.9 2-2 147-152-155
70	111.8 2-3 136-137-140	114.4 2-3 141-143-146	116.5 2-3 146-148-151	117.5 2-2 148-151-154	117.5 2-2 146-151-154

A310-324/AA/4152FTDMT15/15-EF-CM72-1---A #BK0 FCOM-B0-02-10-40-023-090

Code : 0182 PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 15/15			ELEVATION = 2000 FT		
TREF = 33 °C TMAX = 51 °C		DRY RUNWAY SLOPE = 0 %	**MAX T.O. WEIGHT(1000KG)** **IAS(KT) V1 - VR - V2**		**CODES**
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	**2500**	**2750**	**3000**	**3250**
-27	153.4 2-3 153-156-161	156.8 2-3 159-163-168	159.6 2-3 164-169-173	161.1 2-6 165-173-176	162.2 2-6 164-176-179
-17	152.1 2-3 151-154-159	155.6 2-3 156-161-165	158.5 2-3 162-167-171	160.1 2-6 163-170-174	161.2 2-6 162-173-177
-7	150.8 2-3 149-152-157	154.4 2-3 154-158-163	157.4 2-3 159-165-169	159.0 2-6 160-168-172	160.2 2-6 159-171-174
3	148.6 3-3 147-150-155	153.2 2-3 152-156-161	156.3 2-3 157-162-167	157.9 2-6 157-166-170	159.1 2-6 156-168-172
13	146.3 3-3 146-149-154	152.1 2-3 150-154-159	155.2 2-3 155-160-165	156.8 2-6 155-163-167	158.0 2-6 154-166-170
23	144.0 3-3 144-148-153	150.9 2-3 148-152-157	154.2 2-3 153-158-163	155.5 2-6 152-161-165	156.9 2-6 151-164-168
33	141.9 3-3 143-147-152	149.0 3-3 147-151-156	152.8 2-6 150-156-160	154.3 2-6 149-159-163	155.7 2-6 148-161-166
35	140.6 3-3 142-146-151	147.8 3-3 146-150-155	151.5 2-3 151-156-160	152.9 2-6 150-159-163	154.2 2-6 149-161-165
37	139.2 3-3 142-145-150	146.3 2-3 146-150-154	149.6 2-3 150-156-160	151.2 2-6 151-159-163	152.5 2-6 150-161-165
39	137.8 3-3 141-145-150	144.5 2-3 145-149-154	147.7 2-3 150-155-159	149.5 2-6 151-159-163	150.7 2-6 151-161-165
41	136.3 3-3 141-144-149	142.6 2-3 145-149-153	145.7 2-3 150-155-159	147.8 2-6 152-159-163	148.9 2-6 151-162-165
43	134.8 3-3 140-143-148	140.7 2-3 145-148-153	143.7 2-3 149-154-158	146.0 2-6 153-159-163	147.1 2-6 152-162-165
45	133.3 3-3 140-143-147	138.7 2-3 144-148-152	141.7 2-3 149-154-158	144.2 2-3 154-159-163	145.3 2-6 153-162-165
47	131.8 3-3 139-142-147	136.7 2-3 144-147-152	139.6 2-3 149-153-157	142.1 2-3 154-159-163	143.4 2-6 154-162-165
49	130.1 3-3 139-141-146	134.5 2-3 144-147-151	137.4 2-3 149-153-157	139.8 2-3 153-158-162	141.3 2-6 155-162-165
51	128.5 3-3 138-141-145	132.3 2-3 143-146-151	135.1 2-3 148-152-156	137.5 2-3 153-158-161	139.2 2-6 157-162-165
53	126.5 3-3 138-140-144	130.0 2-3 143-146-150	132.7 2-3 148-151-155	135.0 2-3 153-157-160	136.9 2-3 158-162-165
55	124.5 2-3 137-139-143	127.7 2-3 142-145-149	130.3 2-3 147-150-154	132.5 2-3 152-156-159	134.4 2-3 157-161-164
57	122.3 2-3 136-138-142	125.4 2-3 142-144-148	127.9 2-3 147-150-154	130.1 2-3 152-155-159	131.7 2-2 156-160-163
59	120.1 2-3 136-138-141	123.1 2-3 142-144-147	125.6 2-3 147-149-153	127.7 2-3 152-155-158	128.8 2-2 155-158-161
61	117.9 2-3 135-137-141	120.8 2-3 141-143-147	123.1 2-3 146-148-152	125.2 2-3 151-154-157	126.0 2-2 153-156-159
63	115.6 2-3 135-136-140	118.4 2-3 141-142-146	120.7 2-3 146-148-151	122.7 2-3 151-153-156	123.2 2-2 151-154-157
65	113.4 2-3 134-136-139	116.1 2-3 140-142-145	118.4 2-3 145-147-150	120.3 2-3 150-152-155	120.4 2-2 149-153-156
67	111.2 2-3 134-135-139	113.8 2-3 140-141-144	116.0 2-3 145-147-150	117.5 2-2 149-151-154	117.5 2-2 147-151-154
68	110.1 2-3 134-135-138	112.7 2-3 140-141-144	114.8 2-3 145-146-149	116.1 2-2 148-150-153	116.1 2-2 146-150-153

A310-324/AA/4152FTDMT15/15-EF-CM72-1---A

#BK0 FCOM-B0-02-10-40-024-090

Code : 0182

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 20/20 **ELEVATION = 0 FT**

TREF = 42 °C TMAX = 55 °C	DRY RUNWAY SLOPE = 0 %	**MAX T.O. WEIGHT(1000KG)** **IAS(KT) V1 - VR - V2**	**CODES**

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-18	135.9 3-3 136-138-144	145.6 2-3 143-145-150	150.0 2-3 150-153-158	153.5 2-3 157-160-165	153.6 2-2 155-161-165
-8	133.4 3-3 135-136-143	144.2 3-3 141-143-148	148.9 2-3 148-151-156	152.5 2-3 155-158-163	153.5 2-2 156-161-165
2	130.9 3-3 133-135-142	141.9 3-3 139-141-147	147.8 2-3 146-149-154	151.5 2-3 152-156-161	153.5 2-2 156-161-165
12	128.6 3-3 132-134-141	139.6 3-3 138-140-146	146.7 2-3 144-147-152	150.5 2-3 150-154-159	153.5 2-2 156-161-165
22	126.4 3-3 130-133-139	137.3 3-3 137-139-145	145.6 2-3 142-145-150	149.6 2-3 148-152-157	152.7 2-3 154-159-163
32	124.4 3-3 129-132-138	135.1 3-3 135-138-144	144.6 2-2 141-143-148	148.6 2-3 147-150-155	151.8 2-3 153-157-162
42	122.4 3-3 127-130-137	133.0 3-3 134-137-143	142.5 3-3 139-142-147	147.6 2-3 145-149-154	151.0 2-3 151-155-160
44	120.9 3-3 127-130-137	131.5 3-3 133-136-142	141.0 3-3 139-141-147	145.6 2-3 144-148-153	148.9 2-3 150-155-159
46	119.3 3-3 126-129-136	129.8 3-3 133-135-141	139.3 3-3 138-141-146	143.3 2-3 144-148-153	146.5 2-3 150-154-159
48	117.7 3-3 126-128-135	128.2 3-3 132-135-140	137.2 2-3 138-140-145	141.1 2-3 144-147-152	144.1 2-3 150-154-158
50	116.2 3-3 125-128-134	126.6 3-3 132-134-140	135.0 2-3 137-140-145	138.8 2-3 143-147-152	141.8 2-3 149-153-158
52	114.5 3-3 125-127-133	124.9 3-3 131-133-139	132.8 2-3 137-139-144	136.4 2-3 143-146-151	139.3 2-3 149-153-157
54	112.9 3-3 124-126-132	123.2 3-3 130-132-138	130.5 2-3 136-139-144	134.0 2-3 143-145-150	136.5 2-2 148-151-156
56	111.2 3-3 123-125-131	121.4 3-3 130-131-137	128.2 2-3 136-138-143	131.6 2-3 142-145-150	133.7 2-2 146-150-154
58	109.3 3-3 123-124-130	119.4 3-3 129-130-136	125.8 2-3 135-137-142	129.1 2-3 142-144-149	130.8 2-2 145-148-153
60	107.5 3-3 122-124-130	117.5 3-3 128-130-135	123.4 2-3 135-136-141	126.6 2-3 141-143-148	128.0 2-2 143-146-151
62	105.8 3-3 121-123-129	115.7 3-3 128-129-134	121.1 2-3 134-136-141	124.2 2-3 141-143-147	125.1 2-2 141-145-149
64	102.3 3-3 121-123-129	113.9 3-3 127-128-133	118.7 2-3 134-135-140	121.8 2-3 140-142-146	122.3 2-2 139-143-148
66	98.9 3-3 121-123-129	112.0 3-3 126-127-132	116.3 2-3 133-134-139	119.3 2-3 140-141-146	119.4 2-2 138-142-146
68	95.7 3-3 121-124-129	110.2 3-3 126-126-131	114.0 2-3 133-134-138	116.6 2-2 138-140-144	116.6 2-2 135-140-144
70	92.7 3-3 121-124-129	108.2 2-3 125-125-130	111.6 2-3 132-133-138	113.7 2-2 137-139-143	113.7 2-2 134-139-143
72		106.0 2-3 125-125-130	109.3 2-3 132-133-137	110.9 2-2 135-137-141	110.9 2-2 131-137-141

A310-324/AA/4152FTDMT20/20-EF-CM72-1---A

#BK0 FCOM-B0-02-10-40-025-090

Code : 0183

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 20/20 **ELEVATION = 1000 FT**

TREF = 37 °C
TMAX = 53 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-23	134.6 3-3 136-137-144	144.7 2-3 142-144-149	149.1 2-3 149-152-157	152.6 2-3 156-160-164	152.9 2-2 154-160-165
-13	132.1 3-3 134-136-142	143.0 3-3 140-142-148	148.0 2-3 147-150-155	151.6 2-3 154-157-162	152.9 2-2 156-160-165
-3	129.6 3-3 132-135-141	140.6 3-3 139-141-146	146.9 2-3 145-148-153	150.6 2-3 151-155-160	152.9 2-2 156-160-165
7	127.3 3-3 131-133-140	138.2 3-3 137-140-145	145.7 2-3 143-146-151	149.6 2-3 149-153-158	152.7 2-3 156-160-164
17	125.1 3-3 129-132-139	135.9 3-3 136-138-144	144.6 2-3 141-144-149	148.6 2-3 147-151-156	151.7 2-3 153-158-162
27	123.0 3-3 128-131-138	133.6 3-3 134-137-143	143.1 3-3 140-143-148	147.5 2-3 146-149-154	150.9 2-3 151-156-161
37	120.5 3-3 126-129-136	131.1 3-3 133-136-142	140.6 3-3 138-141-146	145.9 2-3 144-147-152	149.2 2-3 150-154-159
39	119.6 3-3 126-129-136	130.1 3-3 133-135-141	139.6 3-3 138-141-146	144.8 2-3 143-147-152	148.2 2-3 149-154-158
41	118.5 3-3 126-128-135	128.9 3-3 132-135-141	138.4 3-3 137-140-145	143.4 2-3 143-146-152	146.7 2-3 149-153-158
43	117.0 3-3 125-128-135	127.4 3-3 132-134-140	136.8 3-3 137-139-145	141.3 2-3 143-146-151	144.6 2-3 148-153-157
45	115.5 3-3 125-127-134	125.9 3-3 131-133-139	135.2 3-3 136-139-144	139.2 2-3 142-145-151	142.4 2-3 148-152-157
47	114.1 3-3 124-126-133	124.4 3-3 130-133-138	133.4 2-3 136-138-143	137.2 2-3 142-145-150	140.2 2-3 148-152-156
49	112.6 3-3 123-126-132	122.8 3-3 130-132-138	131.3 2-3 135-138-143	135.0 2-3 142-144-150	137.9 2-3 147-151-156
51	111.0 3-3 123-125-131	121.2 3-3 129-131-137	129.1 2-3 135-137-142	132.7 2-3 141-144-149	135.6 2-3 147-150-155
53	109.5 3-3 122-124-131	119.6 3-3 129-130-136	127.0 2-3 135-137-141	130.4 2-3 141-143-148	133.0 2-2 146-149-154
55	107.6 3-3 122-123-130	117.6 3-3 128-129-135	124.7 2-3 134-136-141	128.0 2-3 140-143-147	130.2 2-2 144-148-152
57	105.9 3-3 121-123-129	115.7 3-3 127-129-134	122.4 2-3 133-135-140	125.6 2-3 140-142-147	127.5 2-2 144-146-151
59	102.4 3-3 121-123-129	113.9 3-3 127-128-133	120.1 2-3 133-134-139	123.3 2-3 139-141-146	124.7 2-2 142-145-149
61	99.4 3-3 121-123-129	112.2 3-3 126-127-132	117.8 2-3 133-134-138	120.9 2-3 139-141-145	122.0 2-2 140-143-147
63	96.1 3-3 121-123-129	110.4 3-3 125-126-131	115.5 2-3 132-133-138	118.5 2-3 138-140-144	119.2 2-2 138-142-146
65	92.9 3-3 121-124-129	108.6 3-3 125-125-130	113.3 2-3 131-132-137	116.1 2-3 138-139-143	116.5 2-2 136-140-144
67		106.8 3-3 124-124-129	111.0 2-3 131-132-136	113.7 2-2 137-139-143	113.7 2-2 135-139-143
69		105.1 3-3 123-124-128	108.7 2-3 131-131-135	111.0 2-2 136-137-141	111.0 2-2 132-137-141
70		102.8 3-3 124-124-129	107.6 2-3 130-131-135	109.6 2-2 135-136-140	109.6 2-2 131-136-140

A310-324/AA/4152FTDMT20/20-EF-CM72-1---A

#BK0 FCOM-B0-02-10-40-026-090

Code : 0183

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

CONFIGURATION 20/20 **ELEVATION = 2000 FT**

TREF = 33 °C
TMAX = 51 °C

DRY RUNWAY
SLOPE = 0 %

MAX T.O. WEIGHT(1000KG) **CODES**
IAS(KT) V1 - VR - V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	**1750**	**2000**	**2250**	**2500**
-27	133.2 3-3 135-136-143	143.7 2-3 141-143-148	148.1 2-3 148-151-156	151.6 2-3 155-159-163	152.2 2-2 154-160-164
-17	130.6 3-3 133-135-142	141.5 3-3 139-141-147	146.9 2-3 146-149-154	150.6 2-3 153-156-161	152.2 2-2 156-160-164
-7	128.1 3-3 132-134-140	139.1 3-3 138-140-146	145.8 2-3 144-147-152	149.5 2-3 150-154-159	152.2 2-2 155-160-164
3	125.8 3-3 130-132-139	136.6 3-3 136-139-144	144.7 2-3 142-145-150	148.5 2-3 148-152-157	151.6 2-3 154-159-163
13	123.5 3-3 129-131-138	134.3 3-3 135-138-143	143.5 2-3 140-143-148	147.5 2-3 146-150-155	150.7 2-3 152-157-161
23	121.4 3-3 127-130-137	132.0 3-3 133-136-142	141.5 3-3 139-142-147	146.5 2-3 144-148-153	149.8 2-3 150-155-159
33	119.4 3-3 126-129-136	129.8 3-3 132-135-141	139.3 3-3 137-141-146	145.4 2-3 143-146-151	148.8 2-3 148-153-158
35	118.2 3-3 125-128-135	128.6 3-3 132-135-141	138.1 3-3 137-140-145	143.9 2-3 142-146-151	147.2 2-3 148-152-157
37	116.8 3-3 125-128-134	127.2 3-3 131-134-140	136.6 3-3 137-139-144	142.0 2-3 142-145-150	145.3 2-3 148-152-157
39	115.5 3-3 124-127-134	125.8 3-3 131-133-139	135.2 3-3 136-139-144	140.2 2-3 142-145-150	143.4 2-3 147-151-156
41	114.1 3-3 124-126-133	124.4 3-3 130-133-138	133.7 3-3 135-138-143	138.3 2-3 141-144-150	141.5 2-3 147-151-156
43	112.7 3-3 123-126-132	123.0 3-3 130-132-138	132.1 3-3 135-137-142	136.4 2-3 141-144-149	139.5 2-3 146-150-155
45	111.4 3-3 123-125-132	121.6 3-3 129-131-137	130.6 3-3 134-137-142	134.5 2-3 141-143-148	137.5 2-3 146-150-155
47	110.0 3-3 122-124-131	120.1 3-3 128-131-136	128.8 2-3 134-136-141	132.4 2-3 140-143-148	135.4 2-3 146-149-154
49	108.5 3-3 121-124-130	118.5 3-3 128-130-135	126.7 2-3 133-135-140	130.3 2-3 140-142-147	133.1 2-3 145-149-153
51	107.0 3-3 121-123-129	116.9 3-3 127-129-134	124.7 2-3 133-135-140	128.1 2-3 139-142-147	130.9 2-2 145-148-153
53	104.4 3-3 120-123-129	115.0 3-3 127-128-133	122.4 2-3 132-134-139	125.8 2-3 139-141-146	128.2 2-2 144-147-151
55	101.1 3-3 120-123-129	113.2 3-3 126-127-133	120.2 2-3 132-133-138	123.5 2-3 138-140-145	125.6 2-2 142-145-150
57	98.0 3-3 120-123-129	111.4 3-3 125-126-132	118.0 2-3 131-133-137	121.2 2-3 138-140-144	122.9 2-2 141-144-148
59	95.0 3-3 120-123-129	109.8 3-3 124-126-131	115.8 2-3 131-132-137	118.9 2-3 137-139-143	120.3 2-2 139-142-146
61	91.9 3-3 120-123-129	108.0 3-3 124-125-130	113.6 2-3 130-132-136	116.6 2-3 137-138-142	117.6 2-2 138-141-145
63		106.2 3-3 123-124-129	111.4 2-3 130-131-135	114.3 2-3 136-138-142	115.0 2-2 136-139-143
65		103.0 3-3 123-124-129	109.2 2-3 129-130-134	112.0 2-3 136-137-141	112.3 2-2 134-138-142
67		99.9 3-3 123-124-129	107.0 2-3 129-130-134	109.7 2-2 135-136-140	109.7 2-2 132-136-140
68		98.4 3-3 123-125-129	105.9 2-3 129-129-133	108.3 2-2 134-136-139	108.3 2-2 131-136-139

A310-324/AA/4152FTDMT20/20-EF-CM72-1---A #BK0 FCOM-B0-02-10-40-027-090

Code : 0183 PW Eng. : 4152

INTRODUCTION

Climb Charts are established at MAX CLIMB THRUST with air conditioning in economic mode.
When using normal air conditioning, increase fuel
R consumption by 0.8 %.

All tables are established with a center of gravity location corresponding to 27 %

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN) FUEL (KG)** **DIST.(NM) TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	85	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**
410	13 1877 82 385	14 2011 89 388	15 2155 96 390	16 2313 104 392	17 2493 115 395	19 2710 128 398			
390	12 1781 73 378	12 1902 78 380	13 2031 84 382	14 2168 91 384	15 2315 98 385	16 2476 106 387	18 2656 115 389	19 2868 126 391	22 3140 142 395
370	11 1693 65 370	11 1805 70 372	12 1923 75 374	13 2047 80 376	14 2179 86 377	15 2319 92 378	16 2469 99 379	17 2632 106 380	18 2813 114 382
350	10 1614 59 363	10 1719 63 365	11 1829 68 367	12 1944 72 368	13 2065 77 370	13 2194 82 370	14 2329 88 371	15 2474 94 372	16 2629 100 372
330	9 1541 54 355	10 1640 58 358	10 1743 62 360	11 1852 66 361	12 1965 70 362	12 2084 74 363	13 2210 79 363	14 2343 84 364	15 2485 90 364
310	8 1469 49 347	9 1562 52 350	10 1660 56 351	10 1761 60 353	11 1868 63 354	11 1979 67 355	12 2097 72 355	13 2221 76 355	14 2353 81 356
290	8 1376 43 336	8 1462 46 338	9 1552 49 340	9 1646 52 342	10 1744 56 343	10 1847 59 343	11 1956 63 344	12 2070 67 344	12 2190 71 344
270	7 1285 38 324	7 1364 40 327	8 1446 43 329	8 1533 46 330	9 1623 49 331	9 1718 52 332	10 1817 55 332	10 1922 58 332	11 2032 61 332
250	6 1197 33 313	7 1270 35 315	7 1346 38 317	8 1425 40 319	8 1508 43 320	8 1595 45 321	9 1686 48 321	9 1782 51 321	10 1883 53 321
240	6 1154 31 307	6 1224 33 310	7 1297 35 312	7 1373 38 313	8 1452 40 314	8 1536 42 315	8 1623 45 315	9 1715 47 315	9 1811 50 315
220	5 1069 27 295	6 1133 29 298	6 1199 31 300	6 1269 33 302	7 1342 35 303	7 1418 37 304	8 1498 39 304	8 1582 41 304	9 1671 43 303
200	5 985 23 283	5 1043 25 286	6 1104 26 289	6 1167 28 290	6 1233 30 291	6 1303 32 292	7 1376 33 292	7 1453 35 292	8 1534 37 291
180	4 903 20 270	5 955 21 274	5 1010 23 276	5 1067 24 278	5 1128 26 279	6 1191 27 280	6 1258 29 280	6 1327 30 280	7 1401 32 279
160	4 823 17 257	4 870 18 261	4 919 19 263	5 971 20 265	5 1026 22 266	5 1083 23 267	5 1143 24 267	6 1207 26 267	6 1273 27 266
140	3 746 14 243	4 787 15 247	4 831 16 250	4 878 17 252	4 926 18 253	5 978 19 253	5 1033 20 254	5 1090 21 253	5 1150 23 252
120	3 670 12 228	3 706 13 232	3 745 13 235	4 787 14 237	4 830 15 238	4 876 16 239	4 925 17 239	4 977 18 238	5 1031 19 238
100	2 545 8 199	3 574 9 204	3 604 9 207	3 637 10 209	3 672 10 211	3 710 11 212	3 749 12 212	3 791 12 211	4 836 13 211
50	2 368 4 159	2 385 4 165	2 404 5 169	2 424 5 172	2 446 5 174	2 471 6 174	2 497 6 174	2 525 6 174	2 556 7 172
15	1 243 2 108	1 251 2 114	1 262 2 118	1 273 2 121	1 287 2 123	1 302 3 124	1 319 3 124	1 338 3 123	1 359 3 121

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 0

FCOM-B0-02-11-10-002-050

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

FROM BRAKES RELEASE PT.
TIME (MIN) FUEL (KG)
DIST.(NM) TAS (KT)

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	125	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**
410									
390	22 3140 142 395								
370	18 2813 114 382	19 3018 124 384	21 3264 137 387						
350	16 2629 100 372	17 2796 107 374	18 2979 115 375	20 3182 124 378	21 3417 134 381	23 3699 149 384			
330	15 2485 90 364	16 2635 95 365	17 2796 101 366	18 2969 108 368	19 3158 116 370	20 3365 124 372	22 3597 135 374	23 3867 147 376	26 4200 164 380
310	14 2353 81 356	14 2492 86 356	15 2639 91 357	16 2796 97 359	17 2965 103 361	18 3145 110 362	19 3340 117 363	21 3554 126 364	22 3793 136 366
290	12 2190 71 344	13 2316 75 344	14 2450 79 345	14 2592 84 347	15 2743 89 348	16 2902 95 349	17 3071 101 350	18 3254 108 351	20 3453 115 352
270	11 2032 61 332	12 2147 65 332	12 2269 69 333	13 2397 73 335	14 2533 77 336	14 2675 81 337	15 2825 86 338	16 2984 92 338	17 3154 98 339
250	10 1883 53 321	11 1989 56 321	11 2100 60 322	12 2217 63 323	12 2341 66 325	13 2469 70 325	14 2603 75 326	15 2744 79 326	15 2893 84 327
240	9 1811 50 315	10 1912 53 315	11 2019 56 316	11 2131 59 317	12 2249 62 319	12 2371 65 320	13 2498 69 320	14 2631 73 320	15 2772 78 321
220	9 1671 43 303	9 1763 46 304	9 1861 48 305	10 1963 51 306	10 2070 53 307	11 2180 56 308	12 2296 60 308	12 2415 63 309	13 2541 67 309
200	8 1534 37 291	8 1618 39 292	8 1707 41 293	9 1800 43 294	9 1898 46 295	10 1997 48 296	10 2101 51 296	11 2208 54 297	12 2320 57 297
180	7 1401 32 279	7 1478 33 279	8 1559 35 280	8 1644 37 282	8 1732 39 283	9 1822 41 284	9 1916 44 284	10 2012 46 284	10 2112 49 284
160	6 1273 27 266	6 1343 28 266	7 1417 30 267	7 1494 31 269	7 1575 33 270	8 1656 35 271	8 1740 37 272	9 1827 39 272	9 1917 41 272
140	5 1150 23 252	6 1214 24 253	6 1281 25 254	6 1351 26 255	6 1424 28 257	7 1497 29 258	7 1573 31 258	8 1651 33 259	8 1732 35 259
120	5 1031 19 238	5 1089 20 238	5 1149 21 239	5 1212 22 241	6 1279 23 243	6 1344 24 244	6 1413 26 244	7 1483 27 245	7 1555 29 245
100	4 836 13 211	4 884 14 211	4 933 14 212	4 986 15 214	4 1041 16 217	5 1096 17 218	5 1152 18 219	5 1209 19 220	6 1268 21 221
50	2 556 7 172	2 588 7 173	3 623 7 175	3 659 8 177	3 698 8 181	3 735 9 183	3 772 10 185	3 811 10 187	4 849 11 188
15	1 359 3 121	2 381 3 121	2 405 3 124	2 431 4 127	2 459 4 132	2 484 4 136	2 509 5 140	2 535 5 144	2 560 6 147

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 0

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA+10 CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN) FUEL (KG)** **DIST.(NM) TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	85	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**
410	13 1962	14 2104	15 2257	16 2424	18 2613	20 2841			
	86 393	93 396	101 398	109 400	120 403	134 406			
390	12 1860	13 1989	14 2125	15 2270	16 2425	17 2594	18 2784	20 3006	22 3291
	76 386	82 388	88 390	95 391	102 393	111 394	120 396	132 399	149 403
370	11 1767	12 1886	12 2011	13 2143	14 2281	15 2428	16 2586	17 2757	18 2945
	68 378	73 380	78 382	84 383	90 384	96 385	103 387	111 388	120 389
350	10 1684	11 1795	11 1912	12 2034	13 2161	14 2296	15 2438	16 2589	17 2751
	62 370	66 372	71 374	76 375	81 376	86 377	92 378	98 379	104 380
330	9 1606	10 1711	11 1821	11 1936	12 2055	13 2180	13 2311	14 2451	15 2598
	56 362	60 365	64 366	69 368	73 369	78 369	83 370	88 371	94 371
310	9 1530	9 1629	10 1733	10 1840	11 1952	12 2069	12 2192	13 2322	14 2458
	51 354	55 356	58 358	62 359	66 360	70 361	75 361	79 362	84 362
290	8 1432	8 1524	9 1619	9 1719	10 1822	11 1930	11 2043	12 2161	13 2286
	45 342	48 344	51 346	55 348	58 348	62 349	65 350	69 350	73 350
270	7 1335	8 1420	8 1508	9 1599	9 1694	10 1793	10 1897	11 2005	11 2119
	39 330	42 332	45 334	48 336	51 337	54 337	57 337	60 338	64 338
250	6 1243	7 1321	7 1402	8 1486	8 1573	9 1664	9 1759	10 1859	10 1963
	34 318	37 321	39 323	42 324	44 325	47 325	50 326	53 326	56 326
240	6 1198	7 1273	7 1350	7 1431	8 1514	8 1602	9 1692	9 1788	10 1887
	32 312	34 315	37 317	39 318	41 319	44 320	46 320	49 320	52 320
220	6 1109	6 1177	6 1248	7 1322	7 1398	7 1478	8 1562	8 1649	9 1740
	28 300	30 303	32 305	34 306	36 307	38 308	40 308	42 308	45 308
200	5 1021	5 1083	6 1147	6 1215	6 1285	7 1357	7 1433	7 1513	8 1596
	24 288	26 291	27 293	29 294	31 295	33 296	35 296	37 296	39 295
180	5 935	5 991	5 1049	5 1110	6 1174	6 1240	6 1309	7 1381	7 1457
	21 275	22 278	23 280	25 282	26 282	28 283	30 283	31 283	33 282
160	4 851	4 902	4 954	5 1009	5 1067	5 1127	6 1189	6 1255	6 1323
	17 261	19 264	20 267	21 268	22 269	24 270	25 270	26 270	28 269
140	4 770	4 815	4 862	4 911	4 963	5 1017	5 1073	5 1132	5 1194
	15 247	16 250	17 252	18 254	19 255	20 256	21 256	22 256	23 255
120	3 691	3 730	3 772	4 816	4 862	4 911	4 961	5 1014	5 1070
	12 231	13 234	14 237	15 239	16 240	16 240	17 241	18 240	19 240
100	2 561	3 592	3 625	3 660	3 697	3 736	3 777	4 821	4 866
	8 201	9 205	10 208	10 210	11 212	11 212	12 212	13 212	13 211
50	2 376	2 395	2 416	2 438	2 462	2 487	2 514	2 543	2 573
	4 160	5 165	5 168	5 171	6 172	6 173	6 173	7 172	7 171
15	1 245	1 256	1 268	1 281	1 296	1 312	1 329	1 348	2 368
	2 106	2 111	2 115	2 117	2 119	3 119	3 119	3 118	3 117

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 10

FCOM-B0-02-11-10-004-050

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

FROM BRAKES RELEASE PT.
TIME (MIN) FUEL (KG)
DIST.(NM) TAS (KT)

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	125	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**
410									
390	22 3291 149 403								
370	18 2945 120 389	20 3160 130 391	22 3418 143 394						
350	17 2751 104 380	18 2925 112 381	19 3116 120 382	20 3330 129 385	22 3576 141 388	24 3873 155 391			
330	15 2598 94 371	16 2755 100 372	17 2923 106 373	18 3104 113 375	19 3302 121 376	21 3519 130 378	22 3764 141 380	24 4048 154 383	27 4400 171 386
310	14 2458 84 362	15 2603 89 363	16 2757 95 364	17 2921 101 365	18 3097 107 367	19 3286 115 368	20 3491 123 369	21 3717 132 370	23 3970 142 372
290	13 2286 73 350	13 2418 78 350	14 2557 82 351	15 2705 87 352	16 2863 93 354	17 3029 99 355	18 3208 105 355	19 3400 112 356	20 3610 120 357
270	11 2119 64 338	12 2239 68 338	13 2366 71 339	13 2500 76 340	14 2642 80 341	15 2790 85 342	16 2948 90 342	17 3115 96 343	18 3295 102 343
250	10 1963 56 326	11 2073 59 326	11 2188 62 327	12 2310 65 328	13 2439 69 329	13 2573 73 330	14 2714 78 330	15 2862 82 330	16 3020 87 330
240	10 1887 52 320	10 1992 55 320	11 2103 58 321	11 2219 61 322	12 2343 64 323	13 2470 68 324	13 2604 72 324	14 2744 76 324	15 2893 81 324
220	9 1740 45 308	9 1835 47 308	10 1937 50 309	10 2043 53 310	11 2155 55 311	11 2270 59 311	12 2391 62 312	13 2517 66 312	13 2649 69 312
200	8 1596 39 295	8 1683 41 295	9 1775 43 296	9 1872 45 297	10 1974 48 298	10 2078 50 299	11 2187 53 299	11 2300 56 299	12 2418 59 299
180	7 1457 33 282	7 1536 35 283	8 1620 36 283	8 1708 38 284	8 1800 40 286	9 1894 43 286	9 1992 45 286	10 2094 48 286	11 2200 50 286
160	6 1323 28 269	7 1395 29 269	7 1471 31 270	7 1551 33 271	8 1635 34 272	8 1720 36 273	8 1808 38 273	9 1900 40 273	9 1995 43 273
140	5 1194 23 255	6 1260 25 255	6 1329 26 256	6 1401 27 257	7 1477 29 258	7 1554 30 259	7 1633 32 259	8 1716 34 259	8 1801 36 259
120	5 1070 19 240	5 1129 20 240	5 1191 21 241	6 1256 23 242	6 1325 24 243	6 1394 25 244	7 1466 27 245	7 1540 28 245	7 1617 30 245
100	4 866 13 211	4 914 14 212	4 966 15 213	4 1020 16 214	5 1077 17 216	5 1134 18 217	5 1193 19 218	5 1254 20 219	6 1317 21 219
50	2 573 7 171	3 606 7 171	3 642 8 173	3 679 8 175	3 719 9 177	3 758 9 179	3 798 10 181	3 838 11 182	4 880 11 184
15	2 368 3 117	2 391 3 117	2 415 3 119	2 441 4 122	2 470 4 126	2 496 4 129	2 524 5 133	2 551 5 136	2 579 6 139

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 10

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+15
CG=27.0%

FROM BRAKES RELEASE PT.
TIME (MIN) **FUEL (KG)**
DIST.(NM) **TAS (KT)**

	WEIGHT AT BRAKES RELEASE (1000KG)								
FL	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**
410	14 2046 93 398	15 2200 101 401	16 2365 109 403	18 2545 119 405	19 2750 131 407	21 3001 147 411			
390	13 1939 83 391	14 2078 89 393	15 2225 96 394	16 2381 104 396	17 2547 112 397	18 2729 121 399	20 2934 132 401	22 3176 146 404	
370	12 1842 74 383	12 1970 80 385	13 2105 86 386	14 2247 92 388	15 2395 98 389	16 2553 106 390	17 2721 113 391	19 2905 122 392	20 3108 132 394
350	11 1754 67 376	11 1875 72 377	12 2001 77 379	13 2132 83 380	14 2269 88 381	15 2413 94 382	16 2565 101 383	17 2726 108 384	18 2899 115 385
330	10 1673 61 368	11 1787 66 370	11 1905 70 371	12 2028 75 372	13 2156 80 373	14 2290 85 374	15 2430 91 375	15 2579 97 375	16 2736 103 376
310	9 1592 56 360	10 1700 60 361	11 1811 64 363	11 1927 68 364	12 2047 73 365	13 2172 77 366	13 2303 82 366	14 2441 87 367	15 2586 93 367
290	8 1489 49 348	9 1588 53 350	10 1691 56 351	10 1798 60 352	11 1908 64 353	12 2023 68 354	12 2143 72 354	13 2269 76 354	14 2401 81 355
270	8 1386 43 336	8 1478 46 338	9 1573 49 339	9 1671 52 340	10 1772 56 341	10 1878 59 342	11 1988 63 342	12 2103 66 342	12 2223 70 342
250	7 1289 38 324	7 1374 40 326	8 1461 43 327	8 1551 46 329	9 1644 49 329	9 1741 52 330	10 1842 55 330	11 1947 58 330	11 2057 61 330
240	7 1242 35 318	7 1323 38 320	7 1407 40 322	8 1493 43 323	8 1582 45 323	9 1675 48 324	9 1771 51 324	10 1871 54 324	11 1976 57 324
220	6 1148 31 306	6 1222 33 308	7 1299 35 310	7 1378 37 311	8 1460 39 312	8 1545 42 312	8 1633 44 312	9 1724 47 312	9 1820 49 312
200	5 1055 26 293	6 1123 28 295	6 1193 30 297	6 1265 32 298	7 1340 34 299	7 1417 36 300	8 1497 38 300	8 1580 40 300	8 1667 42 299
180	5 965 22 280	5 1026 24 282	5 1090 26 284	6 1155 27 285	6 1223 29 286	6 1293 31 287	7 1366 32 287	7 1441 34 287	8 1520 36 286
160	4 877 19 266	5 933 20 269	5 990 22 271	5 1049 23 272	5 1110 24 273	6 1174 26 273	6 1239 27 273	6 1308 29 273	7 1379 30 273
140	4 792 16 251	4 842 17 254	4 894 18 256	4 947 19 258	5 1002 20 258	5 1059 22 259	5 1118 23 259	6 1179 24 259	6 1243 25 258
120	3 710 13 235	4 754 14 238	4 800 15 240	4 847 16 242	4 896 17 243	4 947 18 243	5 1000 19 243	5 1055 20 243	5 1112 21 242
100	3 574 9 205	3 610 10 208	3 646 10 211	3 684 11 212	3 724 11 214	3 765 12 214	4 808 13 214	4 852 14 214	4 899 14 213
50	2 384 5 162	2 406 5 166	2 430 5 169	2 455 5 171	2 480 6 172	2 507 6 173	2 536 7 173	2 565 7 172	3 595 7 171
15	1 249 2 105	1 262 2 109	1 277 2 112	1 292 2 114	1 308 2 115	1 326 3 115	1 344 3 115	1 363 3 114	2 382 3 113

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 15

FCOM-B0-02-11-10-006-050

Mod. : 4863

PW Eng. : 4000

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA+15 CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN) FUEL (KG)** **DIST.(NM) TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	125	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**
410									
390									
370	20 3108 132 394	22 3342 144 396	24 3629 159 400						
350	18 2899 115 385	19 3088 123 386	21 3296 133 387	22 3531 144 390	24 3805 157 393	26 4146 175 396			
330	16 2736 103 376	18 2905 110 377	19 3086 117 378	20 3284 126 380	21 3501 135 381	23 3743 145 383	25 4020 158 385	27 4349 174 388	
310	15 2586 93 367	16 2741 99 368	17 2907 105 369	18 3085 112 370	19 3278 119 371	21 3486 128 372	22 3716 137 374	24 3970 148 375	26 4260 161 377
290	14 2401 81 355	15 2542 86 355	15 2691 91 356	16 2851 97 357	17 3022 103 358	18 3205 110 359	20 3403 117 360	21 3618 125 361	22 3855 135 362
270	12 2223 70 342	13 2350 74 343	14 2486 79 343	15 2630 84 344	15 2783 89 345	16 2945 94 346	17 3119 100 347	18 3304 107 347	20 3506 114 348
250	11 2057 61 330	12 2172 65 330	12 2296 68 331	13 2427 72 332	14 2565 76 333	15 2711 81 333	15 2866 86 334	16 3029 91 334	17 3205 97 334
240	11 1976 57 324	11 2087 60 324	12 2205 64 325	12 2329 67 326	13 2461 71 327	14 2600 75 327	15 2747 80 328	15 2901 85 328	16 3066 90 328
220	9 1820 49 312	10 1920 52 312	11 2028 55 313	11 2141 58 314	12 2261 61 315	12 2385 65 315	13 2517 68 315	14 2656 73 315	15 2803 77 315
200	8 1667 42 299	9 1758 45 300	9 1856 47 300	10 1959 50 301	10 2067 52 302	11 2180 55 302	12 2298 58 302	12 2422 62 302	13 2553 65 302
180	8 1520 36 286	8 1602 38 286	8 1691 40 287	9 1784 42 288	9 1882 44 289	10 1983 47 289	10 2090 50 289	11 2201 52 289	12 2318 55 289
160	7 1379 30 273	7 1454 32 273	7 1534 34 273	8 1618 36 274	8 1707 37 275	9 1798 40 275	9 1894 42 275	10 1994 44 275	10 2099 47 275
140	6 1243 25 258	6 1311 27 258	7 1383 28 259	7 1460 30 260	7 1540 31 261	8 1622 33 261	8 1708 35 261	8 1799 37 261	9 1892 39 261
120	5 1112 21 242	5 1173 22 243	6 1238 23 243	6 1307 24 244	6 1380 26 245	7 1453 27 246	7 1531 29 246	7 1612 31 246	8 1696 32 246
100	4 899 14 213	4 949 15 213	4 1002 16 214	5 1059 17 216	5 1119 18 217	5 1180 19 218	6 1244 20 218	6 1311 21 219	6 1380 23 219
50	3 595 7 171	3 629 8 171	3 665 8 173	3 704 9 174	3 746 9 176	3 788 10 177	3 831 10 179	4 876 11 180	4 922 12 181
15	2 382 3 113	2 405 3 113	2 430 3 115	2 457 4 117	2 486 4 120	2 515 4 123	2 545 5 126	2 575 5 129	3 607 6 132

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 15

FCOM-B0-02-11-10-007-050

Mod. : 4863

PW Eng. : 4000

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN)** **FUEL (KG)** **DIST.(NM)** **TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	85	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**
410	15 2150 102 404	16 2318 111 406	18 2499 121 408	19 2697 132 410	21 2923 146 413	24 3206 164 416			
390	14 2036 91 396	15 2188 98 398	16 2349 106 400	17 2519 114 401	18 2700 124 403	20 2899 134 404	22 3124 147 406	24 3395 163 410	
370	13 1932 82 389	14 2074 88 390	14 2221 95 392	16 2375 102 393	17 2536 109 394	18 2707 117 395	19 2891 126 397	20 3091 136 398	22 3314 147 400
350	12 1840 74 381	12 1972 80 383	13 2110 86 384	14 2253 92 385	15 2401 98 386	16 2557 105 387	17 2722 112 388	19 2898 120 389	20 3086 129 390
330	11 1754 68 374	12 1879 73 375	12 2008 78 377	13 2142 83 378	14 2280 89 379	15 2425 95 380	16 2577 101 380	17 2738 108 381	18 2909 115 382
310	10 1668 62 365	11 1786 66 367	12 1908 71 368	12 2034 76 369	13 2163 81 370	14 2299 86 371	15 2440 91 371	16 2589 97 372	17 2745 104 373
290	9 1557 54 354	10 1666 58 355	10 1779 62 356	11 1895 66 357	12 2014 71 358	13 2138 75 359	13 2267 80 359	14 2402 85 360	15 2544 90 360
270	8 1448 47 341	9 1549 51 343	9 1652 54 344	10 1759 58 345	11 1868 62 346	11 1982 65 347	12 2100 69 347	13 2223 74 347	14 2351 78 347
250	8 1345 41 330	8 1438 44 331	9 1533 47 333	9 1631 50 333	10 1732 54 334	10 1836 57 335	11 1943 60 335	11 2055 64 335	12 2172 68 335
240	7 1294 39 324	8 1384 41 325	8 1475 44 327	9 1569 47 328	9 1665 50 328	10 1765 53 329	10 1867 56 329	11 1974 60 329	12 2085 63 329
220	6 1195 34 311	7 1277 36 313	7 1361 38 315	8 1447 41 315	8 1535 43 316	9 1626 46 317	9 1719 49 317	10 1816 51 317	10 1917 54 317
200	6 1097 29 299	6 1172 31 301	7 1249 33 302	7 1327 35 303	7 1407 37 304	8 1490 39 304	8 1575 42 304	9 1663 44 304	9 1754 47 304
180	5 1001 25 285	5 1069 26 287	6 1139 28 289	6 1210 30 290	7 1283 32 290	7 1358 34 291	7 1435 35 291	8 1514 37 291	8 1596 40 291
160	5 909 21 271	5 971 22 273	5 1034 24 275	5 1098 25 276	6 1164 27 277	6 1232 28 277	6 1301 30 277	7 1372 32 277	7 1446 33 277
140	4 819 17 256	4 875 18 258	5 932 20 260	5 990 21 261	5 1049 22 262	5 1110 24 262	6 1172 25 262	6 1236 26 262	6 1302 28 262
120	4 732 14 240	4 782 15 242	4 833 16 244	4 885 17 245	4 937 18 246	5 992 19 246	5 1047 20 246	5 1105 21 246	6 1163 23 246
100	3 590 10 209	3 631 10 211	3 672 11 213	3 714 12 215	3 757 12 216	4 801 13 216	4 846 14 216	4 892 15 216	4 939 15 216
50	2 393 5 165	2 420 5 168	2 447 5 170	2 476 6 172	2 504 6 173	2 533 6 173	2 562 7 173	3 592 7 173	3 623 8 172
15	1 253 2 103	1 271 2 106	1 289 2 109	1 307 2 110	1 326 2 111	1 344 3 112	1 363 3 111	2 382 3 111	2 401 3 110

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 20

FCOM-B0-02-11-10-008-050

CLIMB 250 KT / 300 KT / M.80

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN) FUEL (KG)** **DIST.(NM) TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	125	**130**	**135**	**140**	**145**	**150**	**155**	**160**	**165**
410									
390									
370	22 3314 147 400	24 3575 161 402							
350	20 3086 129 390	21 3293 138 391	23 3524 149 393	25 3788 162 396	27 4104 179 399				
330	18 2909 115 382	19 3092 123 383	21 3293 132 384	22 3512 141 385	24 3756 152 387	26 4033 165 389	28 4356 181 392	31 4752 202 395	
310	17 2745 104 373	18 2914 111 373	19 3095 118 374	20 3292 126 375	21 3506 135 377	23 3742 145 378	25 4004 156 380	27 4300 170 381	29 4644 186 384
290	15 2544 90 360	16 2695 96 361	17 2858 102 361	18 3033 108 362	19 3222 116 364	20 3427 124 364	22 3651 132 365	23 3897 142 366	25 4172 154 368
270	14 2351 78 347	14 2488 83 348	15 2635 88 349	16 2791 93 349	17 2959 99 350	18 3139 106 351	19 3334 113 351	21 3544 120 352	22 3775 129 353
250	12 2172 68 335	13 2295 72 336	14 2429 76 336	14 2570 81 337	15 2722 85 338	16 2883 91 338	17 3055 97 338	18 3239 103 339	19 3439 110 339
240	12 2085 63 329	12 2203 67 329	13 2330 71 330	14 2465 75 331	14 2609 79 331	15 2762 84 332	16 2925 89 332	17 3098 95 332	18 3285 101 333
220	10 1917 54 317	11 2024 58 317	11 2139 61 317	12 2261 64 318	13 2391 68 319	14 2528 72 319	14 2674 76 319	15 2829 81 319	16 2994 86 319
200	9 1754 47 304	10 1851 49 304	10 1955 52 305	11 2065 55 305	11 2182 58 306	12 2305 61 306	13 2436 65 306	13 2574 69 306	14 2720 73 306
180	8 1596 40 291	9 1684 42 291	9 1778 44 291	10 1878 46 292	10 1983 49 292	11 2093 52 292	11 2211 55 293	12 2334 58 292	13 2464 62 292
160	7 1446 33 277	8 1525 35 277	8 1610 37 277	8 1700 39 278	9 1795 41 278	9 1894 44 279	10 1999 46 279	11 2110 49 278	11 2227 52 278
140	6 1302 28 262	7 1373 29 262	7 1450 31 262	7 1531 32 263	8 1616 34 264	8 1705 36 264	9 1800 38 264	9 1900 41 264	10 2004 43 263
120	6 1163 23 246	6 1227 24 246	6 1295 25 246	6 1368 27 247	7 1445 28 248	7 1525 30 248	8 1610 31 248	8 1700 33 248	9 1794 35 248
100	4 939 15 216	5 990 16 216	5 1046 17 216	5 1106 18 217	5 1170 19 218	6 1236 20 219	6 1306 22 219	6 1380 23 219	7 1457 25 220
50	3 623 8 172	3 657 8 172	3 695 8 173	3 736 9 174	3 779 10 175	3 825 10 176	4 872 11 177	4 922 12 178	4 975 13 179
15	2 401 3 110	2 423 3 110	2 449 3 111	2 478 4 113	2 508 4 115	2 540 4 117	2 573 5 120	2 608 5 123	3 644 6 126

04 P-05 A310-324-01 PW4152 21100000E5KG270 0 018590 0 0 2 1.3 300.0 300.0 1 03250.000300.000 .800 20

R Mod : 4801 or (4801 + CSA) PW Eng. : All

INTRODUCTION

Cruise tables are established from FL 270 to FL 410 at ISA, ISA + 10, ISA + 15 and ISA + 20 for different Mach number, with air conditioning in economic mode.

These tables are established with a center of gravity location of 37.5 %.

In addition LONG RANGE tables are given at ISA, ISA + 10, ISA + 15, ISA + 20 from FL 100 to FL 410.

The LONG RANGE tables are established with a center of gravity of 37.5 % for a flight level above 20 000 ft.

For a flight level below 20 000 ft, the LONG RANGE tables are established with a center of gravity location of 27 %.

CORRECTION

	FUEL CONSUMPTION	
	Constant Mach Number	Long Range Mach Number
Normal air conditioning	+ 0.8 %	+ 0.8 %
Engine anti-ice ON	+ 0.8 %	+ 0.9 %
Total anti-ice ON	+ 1.5 %	+ 5 %

Mod : 4801

PW Eng. : 4000

CRUISE - FL 270

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-38°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	319 1.086 2401 99.5	347 1.088 2472 98.6	360 1.088 2507 98.2	374 1.089 2542 97.8	323 1.093 2483 97.4	350 1.094 2556 96.6	364 1.095 2593 96.2	378 1.096 2629 95.8
90	320 1.090 2424 98.5	348 1.092 2495 97.7	361 1.092 2531 97.3	375 1.093 2566 96.9	324 1.096 2504 96.5	351 1.098 2578 95.7	365 1.099 2615 95.4	379 1.100 2652 95.0
95	322 1.094 2448 97.5	349 1.096 2520 96.7	362 1.097 2556 96.4	376 1.098 2592 96.0	325 1.101 2528 95.6	352 1.102 2600 94.9	366 1.103 2637 94.6	380 1.104 2673 94.2
100	323 1.099 2474 96.5	350 1.100 2546 95.8	364 1.101 2582 95.4	378 1.102 2617 95.1	326 1.105 2550 94.8	354 1.107 2624 94.1	368 1.108 2660 93.7	382 1.109 2696 93.4
105	324 1.104 2498 95.6	352 1.105 2569 94.9	365 1.106 2605 94.5	379 1.107 2641 94.2	328 1.110 2574 93.9	355 1.112 2648 93.2	369 1.113 2685 92.9	383 1.114 2721 92.6
110	326 1.109 2522 94.7	353 1.110 2594 94.0	367 1.111 2630 93.6	381 1.112 2666 93.3	329 1.115 2598 93.1	357 1.117 2672 92.4	371 1.118 2709 92.0	385 1.119 2746 91.7
115	327 1.114 2547 93.7	355 1.116 2621 93.0	369 1.117 2657 92.7	382 1.117 2693 92.4	331 1.121 2623 92.2	358 1.123 2698 91.5	372 1.123 2735 91.2	386 1.124 2772 90.8
120	329 1.120 2575 92.7	356 1.121 2649 92.1	370 1.122 2685 91.7	384 1.123 2722 91.4	332 1.126 2649 91.3	360 1.128 2725 90.6	374 1.129 2763 90.3	388 1.130 2800 89.9
125	331 1.126 2603 91.7	358 1.127 2678 91.1	372 1.128 2715 90.7	386 1.129 2751 90.4	334 1.132 2677 90.3	362 1.134 2754 89.6	376 1.135 2792 89.3	390 1.136 2830 89.0
130	332 1.132 2633 90.7	360 1.134 2708 90.0	374 1.135 2746 89.7	388 1.135 2783 89.4	336 1.139 2709 89.2	364 1.141 2787 88.6	378 1.142 2825 88.3	392 1.143 2864 87.9
135	334 1.139 2666 89.6	362 1.141 2742 88.9	376 1.141 2780 88.6	390 1.142 2817 88.3	338 1.146 2743 88.1	366 1.148 2821 87.5	380 1.149 2860 87.2	394 1.150 2899 86.9
140	337 1.146 2701 88.4	365 1.148 2778 87.8	379 1.149 2817 87.4	393 1.150 2855 87.1	340 1.154 2779 87.0	368 1.155 2859 86.3	382 1.156 2899 86.0	397 1.157 2939 85.7
145	339 1.154 2741 87.1	367 1.156 2820 86.4	381 1.157 2860 86.1	395 1.158 2899 85.8	342 1.161 2818 85.8	370 1.163 2899 85.2	385 1.164 2939 84.8	399 1.165 2979 84.5
150	341 1.163 2785 85.7	369 1.164 2865 85.1	383 1.165 2905 84.8	398 1.166 2944 84.5	344 1.169 2860 84.5	373 1.171 2942 83.9	387 1.172 2983 83.6	401 1.173 3024 83.3
155	344 1.172 2833 84.3	372 1.174 2914 83.7	386 1.175 2955 83.4	400 1.175 2995 83.1	347 1.178 2905 83.2	375 1.180 2988 82.6	389 1.181 3030 82.3	404 1.181 3071 82.0
IAS(kts) **TAS(kts)** **TAT(° C)**	324 478 -8.5	324 488 2.8	324 493 8.5	324 497 14.1	328 484 -7.7	328 494 3.6	328 499 9.3	328 504 14.9

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 02700 20.000 .000 .000 0 FCOM-B0-02-12-10-002-104

R Code : 0398 PW Eng. : 4000

CRUISE - FL 290

MAX. CRUISE THRUST LIMITS ECON. AIR CONDITIONING ANTI-ICING OFF	ISA=-42°C CG=37.5%	**EGT °C** **EPR** **KG/H/ENG** **NM/1000KG**

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	313 1.094 2220 106.6	341 1.096 2287 105.7	354 1.097 2320 105.3	368 1.098 2352 104.9	317 1.101 2293 104.6	344 1.103 2360 103.7	358 1.104 2393 103.4	372 1.105 2426 103.0
90	315 1.099 2245 105.4	342 1.101 2312 104.6	356 1.102 2344 104.2	370 1.103 2376 103.9	318 1.106 2314 103.6	346 1.108 2382 102.8	360 1.109 2415 102.4	374 1.110 2449 102.1
95	316 1.105 2268 104.4	344 1.106 2334 103.6	357 1.107 2367 103.2	371 1.108 2400 102.8	320 1.111 2337 102.6	347 1.113 2406 101.8	361 1.114 2440 101.4	375 1.115 2473 101.0
100	318 1.110 2292 103.3	345 1.112 2359 102.5	359 1.113 2392 102.2	373 1.113 2425 101.8	321 1.117 2360 101.6	349 1.119 2430 100.8	363 1.120 2464 100.4	377 1.120 2498 100.1
105	319 1.116 2317 102.2	347 1.118 2385 101.4	361 1.118 2418 101.0	375 1.119 2451 100.7	323 1.123 2385 100.5	351 1.125 2455 99.7	365 1.125 2490 99.4	379 1.126 2524 99.0
110	321 1.122 2344 101.0	349 1.124 2412 100.2	363 1.125 2446 99.9	377 1.126 2480 99.5	325 1.129 2411 99.4	353 1.131 2482 98.6	367 1.132 2517 98.3	381 1.132 2551 97.9
115	323 1.129 2372 99.8	351 1.130 2441 99.0	365 1.131 2476 98.7	379 1.132 2509 98.3	327 1.136 2440 98.3	355 1.137 2511 97.5	369 1.138 2546 97.2	383 1.139 2581 96.8
120	325 1.136 2403 98.5	353 1.137 2473 97.8	367 1.138 2507 97.5	381 1.139 2541 97.1	329 1.143 2472 97.0	357 1.145 2544 96.2	371 1.146 2580 95.9	385 1.147 2615 95.6
125	327 1.143 2435 97.2	355 1.145 2506 96.5	369 1.146 2541 96.1	383 1.147 2576 95.8	331 1.151 2506 95.7	359 1.153 2580 94.9	373 1.154 2616 94.6	387 1.155 2652 94.2
130	330 1.152 2473 95.7	358 1.154 2546 95.0	372 1.154 2581 94.6	386 1.155 2617 94.3	333 1.159 2544 94.2	361 1.161 2619 93.5	376 1.162 2656 93.2	390 1.163 2692 92.8
135	332 1.161 2515 94.1	360 1.163 2589 93.4	374 1.163 2625 93.1	389 1.164 2661 92.7	335 1.167 2583 92.8	364 1.169 2659 92.1	378 1.170 2697 91.7	392 1.171 2734 91.4
140	335 1.170 2561 92.5	363 1.172 2636 91.8	377 1.173 2673 91.4	391 1.174 2709 91.1	338 1.177 2627 91.2	366 1.179 2705 90.5	381 1.179 2743 90.2	395 1.180 2780 89.9
145	337 1.181 2610 90.7	366 1.183 2687 90.0	380 1.184 2724 89.7	395 1.184 2761 89.4	341 1.187 2674 89.6	369 1.188 2753 88.9	384 1.189 2791 88.6	398 1.190 2829 88.3
150	340 1.192 2662 89.0	369 1.194 2739 88.3	383 1.195 2777 88.0	398 1.195 2815 87.7	343 1.197 2725 88.0	372 1.199 2805 87.3	387 1.200 2844 87.0	401 1.201 2883 86.7
155	343 1.204 2716 87.2	372 1.206 2795 86.5	387 1.207 2834 86.2	401 1.208 2872 85.9	347 1.210 2781 86.2	376 1.212 2862 85.6	390 1.213 2902 85.3	405 1.214 2941 85.0
IAS(kts) **TAS(kts)** **TAT(°C)**	311 473 -12.9	311 484 -1.6	311 489 4.0	311 494 9.6	315 479 -12.2	315 490 -.9	315 495 4.8	315 500 10.4

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 02900 20.000 .000 .000 0 FCOM-B0-02-12-10-003-104

CRUISE - FL 310

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-46°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	308 1.105 2053 114.3	335 1.106 2114 113.5	349 1.107 2144 113.0	363 1.108 2174 112.6	311 1.112 2115 112.3	339 1.113 2178 111.5	353 1.114 2209 111.1	367 1.115 2241 110.6
90	309 1.110 2075 113.1	337 1.112 2137 112.2	351 1.113 2168 111.8	365 1.114 2198 111.4	313 1.118 2138 111.1	341 1.119 2202 110.3	355 1.120 2233 109.9	369 1.121 2265 109.5
95	311 1.117 2100 111.8	339 1.119 2163 110.9	353 1.120 2194 110.5	367 1.120 2224 110.1	315 1.124 2162 109.9	343 1.126 2227 109.1	357 1.127 2259 108.6	371 1.128 2290 108.2
100	313 1.124 2127 110.4	341 1.125 2190 109.5	355 1.126 2221 109.1	369 1.127 2252 108.7	317 1.131 2188 108.6	345 1.132 2253 107.8	359 1.133 2285 107.4	373 1.134 2317 107.0
105	315 1.131 2155 108.9	343 1.133 2219 108.1	357 1.134 2250 107.7	371 1.134 2282 107.3	319 1.138 2216 107.2	347 1.140 2282 106.4	361 1.141 2314 106.0	375 1.141 2347 105.6
110	317 1.139 2185 107.4	345 1.140 2250 106.6	360 1.141 2282 106.2	374 1.142 2313 105.8	321 1.146 2248 105.7	349 1.148 2315 104.9	363 1.149 2348 104.5	378 1.150 2381 104.1
115	320 1.147 2218 105.8	348 1.149 2284 105.0	362 1.150 2316 104.6	376 1.151 2349 104.2	323 1.155 2283 104.1	352 1.157 2352 103.3	366 1.158 2386 102.9	380 1.158 2419 102.5
120	322 1.157 2258 104.0	351 1.158 2325 103.2	365 1.159 2358 102.8	379 1.160 2392 102.4	326 1.164 2321 102.4	354 1.165 2390 101.6	368 1.166 2425 101.2	383 1.167 2459 100.8
125	325 1.166 2300 102.0	353 1.168 2368 101.3	368 1.169 2403 100.9	382 1.170 2436 100.5	328 1.173 2362 100.6	357 1.175 2432 99.8	371 1.176 2467 99.4	386 1.177 2502 99.1
130	328 1.178 2347 100.0	356 1.179 2417 99.2	371 1.180 2452 98.8	385 1.181 2486 98.5	331 1.184 2407 98.7	360 1.185 2478 98.0	374 1.186 2514 97.6	389 1.187 2549 97.2
135	331 1.189 2397 97.9	360 1.191 2468 97.2	374 1.192 2504 96.8	388 1.193 2539 96.4	334 1.195 2454 96.8	363 1.197 2527 96.1	377 1.198 2563 95.7	392 1.198 2599 95.4
140	334 1.202 2450 95.8	363 1.204 2522 95.1	378 1.205 2558 94.7	392 1.206 2594 94.4	337 1.208 2509 94.7	367 1.210 2583 94.0	381 1.211 2620 93.7	396 1.212 2656 93.3
145	338 1.216 2507 93.6	367 1.218 2581 92.9	382 1.219 2617 92.6	396 1.220 2653 92.3	341 1.223 2569 92.5	371 1.225 2644 91.8	385 1.226 2682 91.5	400 1.227 2719 91.2
150	342 1.233 2572 91.3	372 1.235 2647 90.6	386 1.236 2685 90.3	401 1.237 2722 89.9	346 1.241 2637 90.1	375 1.243 2714 89.5	390 1.244 2753 89.1	405 1.245 2791 88.8
155	348 1.253 2650 88.6	377 1.255 2728 87.9	392 1.256 2767 87.6	407 1.257 2805 87.3	351 1.261 2717 87.5	381 1.263 2797 86.8	396 1.264 2837 86.5	411 1.265 2876 86.2
IAS(kts) **TAS(kts)** **TAT(°C)**	297 469 -17.4	297 480 -6.1	297 485 -.5	297 490 5.2	301 475 -16.7	301 486 -5.4	301 491 .3	301 496 6.0

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 03100 20.000 .000 .000 0 FCOM-B0-02-12-10-004-104

CRUISE - FL 330

MAX. CRUISE THRUST LIMITS ECON. AIR CONDITIONING ANTI-ICING OFF	ISA=-50°C CG=37.5%	**EGT °C** **EPR** **KG/H/ENG** **NM/1000KG**

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	303 1.117 1896 122.7	331 1.119 1954 121.7	345 1.119 1982 121.3	359 1.120 2010 120.8	306 1.124 1953 120.6	334 1.126 2012 119.7	348 1.127 2041 119.2	362 1.128 2070 118.8
90	305 1.124 1922 121.0	333 1.126 1980 120.1	347 1.127 2009 119.6	361 1.128 2037 119.2	308 1.131 1978 119.1	336 1.133 2038 118.2	351 1.134 2067 117.7	365 1.135 2097 117.3
95	307 1.132 1950 119.3	335 1.134 2009 118.4	349 1.135 2038 118.0	363 1.135 2066 117.5	310 1.139 2005 117.5	339 1.141 2066 116.6	353 1.142 2096 116.1	367 1.143 2125 115.7
100	309 1.140 1979 117.5	337 1.142 2039 116.6	352 1.143 2068 116.2	366 1.144 2097 115.8	313 1.148 2037 115.7	341 1.150 2098 114.8	356 1.151 2129 114.3	370 1.152 2159 113.9
105	312 1.150 2012 115.6	340 1.151 2073 114.7	354 1.152 2104 114.3	369 1.153 2133 113.8	315 1.157 2072 113.7	344 1.159 2136 112.7	358 1.160 2167 112.3	372 1.161 2198 111.9
110	315 1.160 2053 113.3	343 1.162 2115 112.4	357 1.163 2146 112.0	372 1.164 2176 111.6	318 1.167 2110 111.6	347 1.169 2174 110.7	361 1.170 2206 110.3	375 1.171 2237 109.9
115	317 1.171 2095 111.0	346 1.173 2159 110.2	360 1.174 2190 109.8	375 1.175 2221 109.4	321 1.178 2151 109.5	349 1.180 2217 108.6	364 1.181 2249 108.2	378 1.182 2281 107.8
120	321 1.184 2143 108.5	349 1.186 2208 107.7	364 1.186 2240 107.3	378 1.187 2272 106.9	324 1.189 2197 107.2	353 1.191 2263 106.4	367 1.192 2296 106.0	382 1.193 2328 105.6
125	324 1.197 2194 106.1	353 1.199 2260 105.2	367 1.199 2292 104.8	382 1.200 2325 104.5	327 1.202 2246 104.9	356 1.205 2314 104.1	371 1.206 2347 103.7	385 1.207 2380 103.3
130	328 1.212 2247 103.5	357 1.214 2315 102.7	372 1.215 2348 102.4	386 1.215 2381 102.0	331 1.218 2302 102.3	361 1.220 2371 101.5	375 1.221 2405 101.2	390 1.222 2439 100.8
135	332 1.229 2309 100.8	362 1.231 2378 100.0	376 1.232 2412 99.7	391 1.233 2446 99.3	336 1.236 2365 99.6	365 1.238 2436 98.8	380 1.239 2471 98.5	395 1.240 2506 98.1
140	338 1.250 2381 97.7	367 1.252 2452 97.0	382 1.253 2488 96.6	397 1.254 2522 96.3	341 1.257 2441 96.5	371 1.259 2514 95.8	386 1.260 2550 95.4	401 1.261 2586 95.1
145	344 1.275 2471 94.1	374 1.277 2545 93.4	389 1.278 2582 93.1	404 1.279 2618 92.8	347 1.283 2531 93.1	378 1.285 2607 92.4	393 1.286 2645 92.0	408 1.287 2682 91.7
150	351 1.305 2576 90.3	382 1.307 2653 89.6	397 1.308 2691 89.3	412 1.309 2729 89.0	355 1.313 2638 89.3	385 1.315 2718 88.6	401 1.316 2757 88.3	416 1.318 2795 88.0
155	360 1.341 2702 86.1	391 1.343 2782 85.5	406 1.345 2822 85.2	422 1.346 2861 84.9	364 1.349 2764 85.2	395 1.351 2846 84.6	410 1.353 2887 84.3	426 1.354 2928 84.0
IAS(kts) **TAS(kts)** **TAT(°C)**	284 465 -21.9	284 476 -10.6	284 481 -4.9	284 486 .7	288 471 -21.1	288 482 -9.8	288 487 -4.2	288 492 1.5

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 03300 20.000 .000 .000 0 FCOM-B0-02-12-10-005-104

CRUISE - FL 350

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-54°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	298 1.132 1757 131.3	326 1.133 1810 130.2	341 1.134 1837 129.7	355 1.135 1864 129.2	302 1.139 1807 129.2	330 1.140 1862 128.2	344 1.142 1890 127.7	359 1.143 1917 127.2
90	301 1.140 1785 129.2	329 1.142 1840 128.2	343 1.143 1867 127.7	357 1.144 1894 127.2	304 1.148 1837 127.1	333 1.150 1893 126.1	347 1.151 1922 125.6	361 1.152 1950 125.1
95	303 1.151 1817 126.9	332 1.152 1874 125.8	346 1.154 1902 125.3	360 1.155 1930 124.8	307 1.158 1872 124.7	336 1.160 1930 123.7	350 1.161 1959 123.2	364 1.163 1988 122.7
100	306 1.162 1857 124.1	335 1.164 1915 123.1	349 1.165 1943 122.6	364 1.166 1972 122.1	310 1.169 1910 122.2	338 1.171 1968 121.3	353 1.172 1998 120.8	367 1.173 2027 120.3
105	310 1.174 1900 121.4	338 1.176 1958 120.4	353 1.177 1988 119.9	367 1.178 2017 119.4	313 1.181 1951 119.7	342 1.183 2010 118.7	356 1.184 2041 118.3	371 1.185 2071 117.8
110	313 1.188 1948 118.4	342 1.190 2008 117.4	356 1.191 2038 117.0	371 1.192 2067 116.5	316 1.194 1996 117.0	345 1.196 2057 116.1	360 1.197 2088 115.6	374 1.198 2118 115.1
115	317 1.203 1998 115.4	346 1.205 2059 114.5	360 1.206 2090 114.1	375 1.207 2120 113.6	320 1.209 2046 114.1	349 1.211 2109 113.2	364 1.212 2140 112.8	379 1.213 2171 112.3
120	321 1.220 2053 112.3	350 1.222 2115 111.5	365 1.223 2147 111.0	380 1.224 2178 110.6	325 1.227 2104 111.0	354 1.229 2168 110.1	369 1.230 2200 109.7	384 1.231 2232 109.3
125	326 1.241 2118 108.9	356 1.243 2182 108.1	371 1.244 2214 107.6	386 1.245 2246 107.2	330 1.248 2171 107.5	360 1.250 2237 106.7	375 1.251 2270 106.3	389 1.253 2303 105.9
130	333 1.266 2199 104.9	362 1.268 2266 104.1	377 1.269 2299 103.7	393 1.271 2332 103.3	336 1.274 2255 103.5	366 1.276 2323 102.7	381 1.278 2358 102.3	396 1.279 2392 102.0
135	340 1.297 2297 100.4	370 1.299 2366 99.6	385 1.300 2401 99.3	401 1.301 2436 98.9	344 1.305 2354 99.2	374 1.307 2425 98.4	389 1.309 2461 98.1	405 1.310 2497 97.7
140	349 1.335 2416 95.4	380 1.337 2489 94.7	396 1.338 2526 94.4	411 1.340 2562 94.0	353 1.343 2474 94.4	384 1.345 2548 93.7	400 1.347 2586 93.3	415 1.348 2623 93.0
145	360 1.381 2554 90.3	392 1.383 2630 89.6	407 1.385 2669 89.3	423 1.386 2707 89.0	364 1.389 2611 89.4	395 1.391 2689 88.8	411 1.393 2729 88.4	
150	376 1.437 2722 84.7	408 1.439 2804 84.1	424 1.441 2845 83.8		380 1.447 2789 83.7	413 1.450 2873 83.1		
155								
IAS(kts) **TAS(kts)** **TAT(°C)**	272 461 -26.3	272 472 -15.1	272 477 -9.4	272 482 -3.8	276 467 -25.6	276 477 -14.3	276 483 -8.7	276 488 -3.0

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 03500 20.000 .000 .000 0 FCOM-B0-02-12-10-006-104

CRUISE - FL 370

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-57°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	300 1.150 1642 139.7	328 1.152 1694 138.5	342 1.153 1720 137.9	357 1.154 1745 137.4	303 1.158 1693 137.2	332 1.160 1746 136.1	346 1.161 1772 135.5	361 1.162 1799 135.0
90	303 1.163 1681 136.4	331 1.165 1734 135.3	346 1.166 1761 134.8	360 1.167 1786 134.2	306 1.170 1729 134.3	335 1.172 1784 133.2	349 1.173 1811 132.7	364 1.174 1837 132.1
95	306 1.176 1723 133.2	335 1.178 1777 132.0	349 1.179 1804 131.5	364 1.180 1830 131.0	309 1.183 1769 131.3	338 1.185 1825 130.2	353 1.186 1853 129.7	368 1.187 1880 129.2
100	310 1.191 1771 129.6	339 1.193 1826 128.5	354 1.194 1854 128.0	368 1.195 1881 127.5	313 1.197 1814 128.0	342 1.199 1871 127.0	357 1.200 1899 126.5	372 1.201 1927 126.0
105	314 1.208 1821 126.0	343 1.210 1878 125.0	358 1.211 1906 124.5	373 1.212 1933 124.0	317 1.214 1865 124.6	347 1.216 1923 123.6	362 1.217 1951 123.1	376 1.218 1980 122.6
110	319 1.227 1877 122.2	349 1.230 1935 121.2	363 1.231 1964 120.8	378 1.232 1992 120.4	322 1.234 1923 120.8	352 1.237 1983 119.8	367 1.238 2012 119.4	382 1.239 2042 118.9
115	325 1.251 1945 117.9	355 1.253 2006 117.0	370 1.255 2036 116.5	385 1.256 2065 116.1	329 1.259 1995 116.4	359 1.261 2057 115.5	374 1.263 2088 115.1	389 1.264 2118 114.6
120	332 1.282 2034 112.8	363 1.284 2097 111.9	378 1.285 2128 111.5	393 1.286 2158 111.1	336 1.289 2083 111.5	366 1.292 2148 110.6	381 1.293 2179 110.2	397 1.294 2211 109.8
125	342 1.319 2141 107.2	372 1.322 2207 106.3	388 1.323 2240 105.9	403 1.324 2272 105.5	345 1.327 2192 106.0	376 1.330 2260 105.1	392 1.331 2293 104.7	407 1.332 2326 104.4
130	353 1.366 2270 101.1	384 1.369 2340 100.3	400 1.370 2374 99.9	415 1.371 2408 99.6	356 1.373 2319 100.2	388 1.376 2390 99.4	403 1.377 2426 99.0	419 1.378 2460 98.7
135	368 1.424 2427 94.5	400 1.427 2502 93.8	416 1.428 2539 93.5		372 1.432 2480 93.7	404 1.435 2557 92.9	420 1.436 2595 92.6	
140	384 1.491 2614 87.8	416 1.494 2695 87.1						
145								
IAS(kts) **TAS(kts)** **TAT(°C)**	260 459 -28.8	260 469 -17.5	260 474 -11.8	260 480 -6.2	263 465 -28.1	263 475 -16.8	263 480 -11.1	263 486 -5.4

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 03700 20.000 .000 .000 0 FCOM-B0-02-12-10-007-104

CRUISE - FL 390

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-57°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	308 1.175 1566 146.5	337 1.177 1614 145.3	352 1.178 1639 144.7	366 1.179 1663 144.1	312 1.182 1608 144.4	341 1.184 1658 143.3	355 1.185 1683 142.7	370 1.186 1709 142.1
90	312 1.191 1612 142.3	342 1.193 1662 141.2	356 1.195 1687 140.6	371 1.196 1712 140.0	316 1.198 1652 140.6	345 1.200 1703 139.5	360 1.201 1729 138.9	374 1.202 1755 138.3
95	317 1.210 1662 138.1	346 1.212 1713 137.0	361 1.213 1739 136.4	376 1.214 1764 135.9	320 1.216 1702 136.5	350 1.218 1754 135.5	365 1.219 1780 134.9	380 1.221 1807 134.4
100	322 1.231 1718 133.6	352 1.233 1771 132.5	367 1.234 1797 132.0	382 1.236 1823 131.5	326 1.238 1760 132.0	356 1.240 1814 131.0	371 1.242 1841 130.5	386 1.243 1868 129.9
105	329 1.258 1788 128.3	359 1.260 1843 127.3	374 1.262 1871 126.8	389 1.263 1899 126.3	333 1.266 1833 126.7	363 1.268 1890 125.7	378 1.270 1918 125.2	393 1.271 1947 124.7
110	338 1.293 1879 122.1	368 1.295 1937 121.2	383 1.296 1966 120.7	399 1.298 1994 120.2	341 1.300 1924 120.7	372 1.303 1984 119.8	387 1.304 2013 119.3	403 1.305 2043 118.8
115	348 1.337 1992 115.2	379 1.339 2054 114.3	395 1.341 2084 113.8	411 1.342 2115 113.4	352 1.345 2041 113.8	383 1.348 2103 113.0	399 1.349 2135 112.5	415 1.350 2166 112.1
120	362 1.393 2130 107.7	393 1.396 2195 106.9	409 1.397 2227 106.5	425 1.398 2260 106.1	365 1.401 2178 106.7	397 1.404 2245 105.9	413 1.405 2278 105.4	
125	380 1.463 2306 99.5	413 1.466 2376 98.8			385 1.477 2371 98.0	418 1.479 2443 97.3		
130								
IAS(kts) **TAS(kts)** **TAT(°C)**	248 459 -28.8	248 469 -17.5	248 474 -11.8	248 480 -6.2	251 465 -28.1	251 475 -16.8	251 480 -11.1	251 486 -5.4

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 03900 20.000 .000 .000 0 FCOM-B0-02-12-10-008-104

CRUISE - FL 410

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA=-57°C
CG=37.5%

EGT °C
EPR
KG/H/ENG
NM/1000KG

	.80				.81			
WEIGHT (1000KG)	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20
85	319 1.208 1507 152.3	348 1.210 1554 151.0	363 1.211 1577 150.4	378 1.212 1600 149.9	322 1.214 1543 150.6	352 1.216 1591 149.3	367 1.217 1615 148.8	382 1.219 1638 148.2
90	325 1.230 1560 147.0	354 1.233 1609 145.8	369 1.234 1633 145.3	384 1.235 1657 144.7	328 1.237 1599 145.3	358 1.240 1649 144.1	373 1.241 1674 143.5	388 1.242 1698 143.0
95	332 1.259 1630 140.8	362 1.262 1680 139.6	377 1.263 1706 139.1	392 1.264 1730 138.6	335 1.267 1671 139.0	366 1.270 1723 137.9	381 1.271 1749 137.3	396 1.272 1775 136.8
100	341 1.297 1720 133.4	372 1.300 1773 132.3	387 1.301 1800 131.8	403 1.302 1826 131.3	345 1.305 1762 131.9	376 1.308 1817 130.8	391 1.309 1844 130.2	407 1.311 1871 129.7
105	353 1.347 1836 125.0	385 1.350 1893 124.0	400 1.351 1921 123.5	416 1.352 1949 123.1	357 1.356 1880 123.6	389 1.359 1938 122.6	404 1.360 1967 122.1	420 1.361 1996 121.7
110	369 1.412 1980 115.8	402 1.415 2042 114.9	418 1.417 2072 114.5		373 1.420 2025 114.7	406 1.423 2088 113.8	422 1.425 2119 113.4	
115	389 1.492 2165 106.0	422 1.495 2232 105.1						
120								
IAS(kts) **TAS(kts)** **TAT(°C)**	237 459 -28.8	237 469 -17.5	237 474 -11.8	237 480 -6.2	240 465 -28.1	240 475 -16.8	240 480 -11.1	240 486 -5.4

04 P-05 A310-324-01 PW4152 12400000E5KG375 0 018590 0 0 1 1.0 .0 .0 04100 20.000 .000 .000 0 FCOM-B0-02-12-10-009-104

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	322 .424 1.002 257 1852 275 74.3	305 .458 1.008 253 1756 292 83.3	290 .502 1.016 253 1694 315 92.9	289 .508 1.019 251 1671 317 94.9	288 .514 1.022 249 1647 320 97.0	287 .520 1.025 247 1624 322 99.1	286 .526 1.028 245 1601 324 101.3	285 .534 1.031 244 1585 328 103.4
95	322 .429 1.004 260 1912 279 73.0	305 .471 1.010 260 1844 300 81.4	293 .511 1.019 257 1763 320 90.7	292 .516 1.022 255 1737 322 92.7	291 .522 1.025 253 1712 324 94.7	290 .528 1.028 251 1690 327 96.8	289 .536 1.032 250 1675 331 98.8	289 .547 1.035 250 1669 336 100.7
100	322 .440 1.005 266 1997 286 71.6	305 .483 1.011 267 1933 308 79.7	296 .518 1.022 261 1829 325 88.7	295 .523 1.026 259 1802 327 90.6	294 .530 1.029 257 1782 330 92.5	293 .539 1.032 256 1766 334 94.4	293 .550 1.035 257 1762 339 96.2	293 .560 1.039 256 1753 344 98.1
105	321 .451 1.006 273 2089 293 70.2	305 .494 1.013 274 2020 316 78.1	299 .525 1.026 265 1894 329 86.8	298 .532 1.029 263 1875 332 88.6	297 .541 1.032 262 1860 336 90.4	297 .552 1.035 263 1855 342 92.1	297 .562 1.039 262 1845 346 93.9	296 .572 1.043 262 1836 351 95.7
110	321 .462 1.007 280 2179 300 68.9	307 .504 1.015 279 2100 322 76.6	302 .534 1.029 269 1969 334 84.9	302 .543 1.032 269 1956 339 86.6	301 .554 1.035 269 1949 344 88.3	301 .564 1.039 268 1939 349 90.0	300 .574 1.043 268 1929 354 91.7	300 .584 1.047 268 1921 359 93.4
115	321 .472 1.008 286 2268 307 67.6	310 .511 1.017 283 2170 326 75.1	305 .544 1.032 275 2050 341 83.1	305 .555 1.035 275 2044 346 84.7	305 .565 1.039 274 2034 351 86.3	304 .575 1.043 274 2023 356 87.9	304 .585 1.047 274 2015 361 89.6	304 .598 1.052 274 2014 367 91.2
120	321 .482 1.009 292 2357 313 66.5	312 .517 1.020 286 2237 330 73.7	309 .555 1.035 280 2138 348 81.3	308 .565 1.039 280 2128 353 82.9	308 .575 1.043 280 2118 358 84.4	307 .586 1.047 280 2109 363 86.0	307 .599 1.051 280 2110 369 87.5	309 .629 1.052 289 2173 387 89.0
125	321 .492 1.011 298 2448 320 65.3	314 .522 1.022 289 2301 333 72.4	312 .565 1.038 286 2223 354 79.7	311 .575 1.042 285 2212 359 81.2	311 .586 1.046 285 2202 364 82.7	311 .599 1.050 286 2205 371 84.1	313 .630 1.051 296 2273 389 85.5	314 .651 1.055 300 2304 400 86.9
130	322 .501 1.012 304 2535 326 64.3	317 .528 1.025 293 2369 337 71.2	315 .575 1.042 291 2307 360 78.1	314 .585 1.046 290 2296 365 79.6	314 .599 1.050 291 2299 372 80.9	316 .630 1.051 302 2373 390 82.2	317 .652 1.054 306 2405 402 83.6	317 .664 1.061 306 2403 408 84.9
135	324 .507 1.014 307 2604 329 63.2	319 .536 1.028 297 2447 342 69.9	318 .585 1.045 296 2392 366 76.6	318 .598 1.049 297 2393 373 77.9	320 .629 1.050 307 2469 391 79.2	321 .651 1.053 312 2506 403 80.5	320 .663 1.059 312 2504 409 81.7	320 .674 1.067 311 2491 414 83.1
140	326 .512 1.016 311 2674 333 62.3	322 .545 1.030 302 2533 348 68.7	321 .596 1.048 302 2487 374 75.1	323 .626 1.049 311 2560 391 76.3	324 .651 1.051 318 2609 405 77.5	323 .662 1.058 318 2605 410 78.7	323 .673 1.065 317 2590 415 80.1	323 .685 1.073 316 2586 421 81.3
145	328 .517 1.018 314 2741 336 61.3	325 .554 1.032 307 2622 354 67.4	326 .622 1.049 315 2648 390 73.6	327 .650 1.050 323 2710 405 74.8	327 .661 1.056 323 2707 411 75.9	326 .671 1.063 322 2689 415 77.2	326 .683 1.071 321 2682 421 78.5	326 .697 1.079 322 2686 428 79.7
150	330 .521 1.020 316 2806 339 60.4	328 .563 1.035 312 2709 359 66.3	330 .646 1.049 328 2803 405 72.2	330 .660 1.055 329 2809 412 73.3	329 .669 1.062 327 2790 416 74.5	329 .680 1.069 326 2779 421 75.8	329 .694 1.077 327 2782 428 76.9	330 .708 1.084 328 2785 435 78.1
155	332 .526 1.023 319 2872 342 59.5	331 .571 1.038 317 2795 364 65.2	333 .658 1.053 334 2912 412 70.8	332 .668 1.060 333 2894 417 72.0	332 .677 1.067 332 2877 421 73.2	332 .691 1.074 332 2878 428 74.3	332 .705 1.082 333 2881 435 75.5	333 .719 1.090 333 2882 442 76.7
160	334 .532 1.025 323 2949 346 58.6	333 .579 1.040 321 2880 369 64.1	335 .666 1.058 338 2999 417 69.6	334 .675 1.065 337 2979 421 70.7	334 .688 1.072 337 2976 428 71.8	335 .702 1.080 337 2979 434 72.9	336 .716 1.088 338 2981 442 74.1	336 .724 1.097 336 2955 445 75.3

04 P-05 A310-324-01 PW4152 12200000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 0 FCOM-B0-02-12-10-010-104

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=37.5%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	**FL250**	**FL270**	**FL290**	**FL310**	**FL330**	**FL350**	**FL370**	**FL390**	**FL410**
90	283 .589 1.050 244 1553 355 114.2	284 .630 1.058 251 1587 376 118.5	285 .664 1.070 254 1604 393 122.6	285 .696 1.087 256 1610 408 126.8	286 .724 1.106 255 1601 421 131.5	286 .732 1.128 247 1545 422 136.6	292 .750 1.154 242 1525 430 141.0	310 .791 1.189 245 1583 454 143.3	327 .806 1.235 239 1585 462 145.9
95	288 .611 1.055 253 1658 368 110.9	289 .654 1.063 261 1701 390 114.8	289 .682 1.079 261 1699 404 118.8	290 .715 1.096 263 1706 420 123.0	290 .729 1.117 257 1661 424 127.6	290 .736 1.142 248 1603 424 132.4	301 .776 1.171 251 1644 445 135.3	318 .802 1.211 249 1671 460 137.7	334 .807 1.265 239 1658 463 139.6
100	294 .643 1.057 267 1796 387 107.7	293 .671 1.071 268 1797 400 111.4	294 .701 1.088 269 1801 415 115.3	295 .725 1.107 267 1782 426 119.4	294 .733 1.129 259 1720 426 124.0	296 .753 1.155 254 1698 434 127.9	309 .795 1.190 258 1753 456 130.1	325 .807 1.236 250 1747 463 132.5	343 .806 1.302 239 1744 462 132.5
105	298 .661 1.063 275 1902 398 104.6	298 .687 1.079 275 1894 410 108.3	299 .719 1.096 276 1898 425 112.1	299 .730 1.117 269 1842 428 116.2	298 .736 1.141 260 1777 428 120.5	305 .780 1.170 264 1825 450 123.1	315 .803 1.210 261 1836 461 125.5	332 .807 1.264 250 1820 463 127.2	354 .803 1.349 238 1849 461 124.6
110	301 .673 1.070 280 1985 405 102.0	302 .703 1.087 282 1991 420 105.4	303 .726 1.106 280 1969 430 109.2	302 .734 1.128 271 1901 431 113.2	304 .753 1.153 266 1876 438 116.7	312 .795 1.187 270 1929 458 118.8	321 .807 1.232 262 1910 463 121.2	340 .806 1.297 250 1906 462 121.3	368 .796 1.409 235 1961 456 116.3
115	305 .688 1.078 287 2083 414 99.4	307 .719 1.095 289 2088 429 102.8	306 .730 1.115 281 2029 432 106.5	306 .736 1.139 272 1959 432 110.3	312 .777 1.167 276 2005 452 112.8	318 .803 1.205 273 2011 463 115.0	328 .807 1.257 262 1980 463 116.9	350 .803 1.340 249 2008 461 114.7	385 .787 1.472 232 2086 451 108.2
120	310 .703 1.085 294 2184 423 96.9	310 .726 1.104 292 2160 433 100.3	310 .733 1.125 283 2087 434 104.0	312 .752 1.149 278 2057 441 107.2	319 .794 1.182 282 2115 462 109.1	323 .806 1.225 274 2087 465 111.4	335 .807 1.287 262 2067 463 112.0	362 .800 1.393 248 2130 459 107.7	
125	314 .718 1.092 300 2282 432 94.7	314 .730 1.112 293 2222 436 98.0	313 .736 1.136 284 2146 436 101.5	319 .773 1.162 286 2183 454 103.9	325 .802 1.198 285 2202 466 105.9	329 .807 1.246 275 2158 465 107.8	343 .804 1.322 261 2160 461 106.7	377 .791 1.449 245 2243 453 101.1	
130	317 .725 1.100 304 2358 437 92.6	317 .733 1.121 295 2281 438 95.9	318 .743 1.145 287 2223 440 99.0	326 .791 1.175 294 2305 464 100.7	330 .806 1.216 287 2279 469 102.8	335 .807 1.272 275 2238 465 103.9	353 .801 1.367 260 2277 460 100.9	391 .785 1.511 243 2386 450 94.3	
135	320 .729 1.108 306 2422 439 90.6	320 .736 1.131 296 2340 439 93.8	324 .761 1.156 294 2342 451 96.2	331 .799 1.189 297 2393 469 98.0	335 .807 1.234 287 2352 470 99.9	342 .805 1.301 274 2326 464 99.8	365 .793 1.417 257 2386 455 95.4		
140	323 .732 1.116 307 2480 441 88.8	323 .738 1.140 297 2400 441 91.8	331 .787 1.167 305 2493 466 93.4	336 .804 1.205 299 2475 472 95.3	340 .807 1.255 287 2424 470 96.8	351 .803 1.337 273 2433 463 95.1	379 .786 1.470 255 2513 451 89.7		
145	326 .735 1.125 308 2539 442 87.1	329 .754 1.148 304 2515 450 89.5	336 .796 1.180 309 2588 471 91.0	340 .807 1.221 300 2550 473 92.8	346 .807 1.280 287 2513 469 93.4	361 .801 1.381 272 2557 461 90.2			
150	329 .737 1.133 309 2598 443 85.3	335 .775 1.159 313 2655 463 87.2	341 .802 1.193 311 2673 475 88.8	345 .808 1.239 300 2622 474 90.4	353 .804 1.308 286 2601 468 89.9	372 .792 1.426 269 2662 456 85.7			
155	333 .748 1.141 314 2696 450 83.5	341 .791 1.170 320 2781 472 84.9	345 .805 1.207 313 2752 477 86.6	350 .807 1.259 300 2701 474 87.7	361 .802 1.343 285 2716 467 85.9	385 .786 1.476 267 2795 453 81.0			
160	338 .758 1.150 318 2795 456 81.6	346 .798 1.181 323 2869 476 83.0	350 .807 1.223 314 2825 478 84.6	356 .807 1.282 300 2788 473 84.9	371 .800 1.384 284 2843 465 81.8				

04 P-05 A310-324-01 PW4152 12200000E5KG375 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 0

FCOM-B0-02-12-10-011-104

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	345 .423 1.002 256 1897 280 73.8	328 .457 1.009 253 1797 297 82.7	313 .502 1.017 253 1737 321 92.3	312 .508 1.019 251 1714 323 94.3	311 .514 1.022 249 1690 326 96.4	310 .520 1.025 247 1666 328 98.5	309 .526 1.029 245 1643 331 100.6	309 .533 1.032 244 1625 334 102.8
95	345 .429 1.004 260 1958 284 72.5	328 .470 1.010 260 1889 306 80.9	316 .510 1.020 257 1807 326 90.2	315 .516 1.023 255 1781 328 92.1	315 .522 1.026 253 1757 331 94.1	314 .528 1.029 251 1735 333 96.1	313 .536 1.032 250 1719 337 98.1	313 .547 1.036 250 1712 342 100.0
100	344 .439 1.005 266 2044 291 71.1	328 .482 1.012 267 1980 314 79.2	319 .518 1.023 261 1874 330 88.2	318 .523 1.026 259 1847 333 90.0	318 .530 1.029 257 1828 336 91.9	317 .539 1.033 256 1813 340 93.8	317 .550 1.036 256 1808 346 95.6	317 .560 1.040 256 1799 351 97.5
105	344 .450 1.006 273 2137 298 69.7	328 .494 1.013 274 2070 321 77.6	322 .525 1.026 264 1941 335 86.3	322 .532 1.030 263 1921 338 88.0	321 .541 1.033 262 1907 343 89.8	321 .552 1.036 263 1903 348 91.5	321 .562 1.040 262 1894 353 93.3	321 .572 1.044 262 1885 358 95.1
110	344 .461 1.007 280 2231 305 68.4	330 .503 1.015 279 2151 327 76.1	326 .533 1.030 269 2018 341 84.4	325 .542 1.033 268 2003 345 86.1	325 .553 1.036 268 1997 350 87.7	325 .563 1.040 268 1989 355 89.4	325 .573 1.044 268 1979 361 91.1	324 .584 1.048 268 1973 366 92.8
115	344 .472 1.009 286 2323 312 67.2	333 .510 1.018 283 2223 332 74.6	329 .544 1.033 274 2102 347 82.6	329 .554 1.036 274 2095 353 84.2	329 .564 1.040 274 2085 357 85.7	328 .574 1.044 274 2074 362 87.4	328 .585 1.048 274 2067 368 89.0	328 .597 1.053 274 2065 374 90.6
120	344 .482 1.010 292 2415 319 66.0	335 .516 1.020 286 2291 336 73.3	333 .555 1.036 280 2193 354 80.8	332 .565 1.039 280 2182 359 82.3	332 .575 1.043 280 2171 364 83.9	332 .586 1.048 279 2163 370 85.5	332 .598 1.052 280 2161 376 87.0	334 .626 1.054 288 2220 392 88.4
125	344 .492 1.011 298 2506 325 64.9	338 .522 1.023 289 2358 339 72.0	336 .565 1.039 286 2280 361 79.2	336 .575 1.043 285 2269 366 80.6	335 .586 1.047 285 2260 371 82.1	335 .598 1.051 286 2260 378 83.6	338 .628 1.053 294 2325 395 84.9	339 .650 1.056 299 2360 407 86.3
130	344 .501 1.012 304 2594 331 63.8	340 .528 1.026 293 2428 343 70.7	339 .575 1.042 291 2366 367 77.6	339 .585 1.046 290 2356 372 79.0	339 .598 1.051 291 2358 379 80.4	341 .628 1.052 300 2426 396 81.7	342 .650 1.055 305 2463 409 83.0	342 .663 1.062 306 2463 415 84.3
135	347 .506 1.014 307 2667 335 62.8	343 .536 1.028 297 2509 348 69.4	342 .585 1.046 296 2452 373 76.1	342 .597 1.050 297 2454 380 77.4	344 .627 1.051 306 2525 397 78.7	346 .650 1.054 311 2567 410 79.9	345 .662 1.061 311 2565 416 81.1	345 .673 1.068 311 2557 422 82.5
140	349 .512 1.016 311 2739 339 61.8	346 .545 1.031 302 2596 354 68.2	345 .596 1.049 302 2549 380 74.6	347 .625 1.050 311 2622 398 75.8	349 .649 1.053 317 2669 411 77.0	349 .661 1.059 317 2669 417 78.2	348 .672 1.066 316 2658 423 79.5	349 .685 1.074 316 2655 429 80.8
145	351 .517 1.018 314 2809 342 60.9	349 .554 1.033 307 2688 360 67.0	350 .622 1.049 315 2713 397 73.1	352 .647 1.051 322 2770 412 74.3	352 .660 1.058 323 2773 418 75.4	351 .671 1.065 322 2762 423 76.7	352 .683 1.072 321 2755 429 77.9	352 .696 1.080 322 2758 436 79.1
150	353 .522 1.021 316 2876 345 60.0	352 .562 1.036 312 2776 366 65.9	355 .645 1.050 327 2872 412 71.7	355 .659 1.056 328 2876 419 72.8	354 .669 1.063 327 2865 424 74.0	354 .680 1.070 327 2856 430 75.2	355 .694 1.078 327 2858 437 76.4	356 .708 1.086 328 2861 444 77.6
155	355 .526 1.023 319 2943 348 59.1	354 .570 1.038 317 2863 371 64.8	358 .657 1.054 334 2982 420 70.3	357 .667 1.061 333 2969 424 71.5	357 .678 1.068 332 2955 429 72.7	358 .691 1.076 332 2958 436 73.8	358 .706 1.083 333 2962 444 74.9	359 .720 1.091 333 2961 451 76.1
160	358 .532 1.025 323 3021 352 58.3	357 .578 1.041 321 2950 376 63.7	360 .665 1.059 338 3075 425 69.1	360 .675 1.066 337 3056 429 70.2	360 .688 1.073 337 3056 436 71.3	361 .702 1.081 338 3060 443 72.4	362 .717 1.089 338 3064 451 73.6	362 .725 1.098 336 3037 454 74.8

04 P-05 A310-324-01 PW4152 12200000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 10

FCOM-B0-02-12-10-012-074

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=37.5%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
90	308 .589 1.051 244 1596 362 113.4	309 .629 1.059 250 1629 383 117.6	310 .664 1.071 254 1652 402 121.6	311 .697 1.088 256 1661 418 125.8	313 .724 1.107 255 1650 430 130.4	313 .732 1.130 247 1592 432 135.5	320 .750 1.155 242 1572 440 139.9	339 .791 1.191 245 1633 464 142.1	357 .806 1.237 239 1634 473 144.7
95	313 .609 1.056 252 1698 374 110.2	315 .653 1.064 260 1746 398 114.0	315 .682 1.080 261 1749 412 117.9	317 .716 1.098 263 1758 429 122.0	317 .729 1.119 257 1712 433 126.6	318 .736 1.144 248 1651 434 131.3	329 .775 1.173 251 1693 455 134.3	347 .803 1.213 249 1724 471 136.6	365 .807 1.267 239 1710 473 138.4
100	319 .639 1.059 265 1835 393 107.0	319 .669 1.072 267 1843 408 110.6	320 .701 1.089 269 1852 424 114.4	322 .725 1.108 267 1834 435 118.5	322 .733 1.131 259 1772 436 123.0	324 .753 1.156 254 1749 444 126.9	338 .794 1.192 258 1805 466 129.1	355 .807 1.238 250 1801 473 131.4	374 .805 1.305 238 1798 472 131.4
105	324 .661 1.064 275 1954 406 103.9	324 .687 1.080 275 1947 419 107.5	326 .718 1.097 276 1952 434 111.2	326 .730 1.119 269 1896 437 115.4	326 .736 1.143 260 1831 438 119.5	333 .779 1.172 264 1880 459 122.2	345 .803 1.212 261 1892 471 124.5	362 .807 1.266 250 1876 473 126.2	386 .803 1.352 238 1906 471 123.6
110	327 .673 1.072 280 2042 413 101.2	328 .704 1.088 282 2050 429 104.6	330 .726 1.107 279 2025 439 108.3	330 .734 1.130 270 1957 440 112.4	332 .754 1.155 266 1934 448 115.8	341 .795 1.189 270 1988 469 117.9	351 .807 1.234 262 1968 473 120.3	370 .806 1.300 250 1965 473 120.3	400 .795 1.411 235 2022 467 115.4
115	331 .688 1.079 287 2143 423 98.6	333 .719 1.096 289 2150 439 102.0	333 .730 1.117 281 2088 441 105.7	334 .736 1.141 272 2016 441 109.5	341 .777 1.169 276 2065 462 111.9	347 .803 1.207 273 2073 473 114.1	357 .807 1.259 262 2041 473 116.0	381 .803 1.342 249 2070 471 113.8	418 .787 1.475 232 2151 462 107.3
120	336 .703 1.086 294 2244 432 96.2	337 .726 1.105 292 2222 442 99.6	337 .733 1.127 283 2149 443 103.2	339 .751 1.151 278 2116 450 106.4	348 .793 1.184 282 2176 471 108.3	353 .807 1.227 274 2150 475 110.5	365 .807 1.289 262 2130 473 111.1	393 .800 1.396 248 2195 469 106.9	
125	340 .717 1.093 300 2345 441 94.0	341 .730 1.114 293 2285 445 97.3	341 .736 1.137 284 2208 445 100.8	347 .772 1.164 286 2244 463 103.1	353 .801 1.199 285 2266 476 105.1	359 .807 1.248 275 2223 476 107.0	374 .803 1.325 261 2226 471 105.9	410 .791 1.451 245 2312 464 100.3	
130	344 .725 1.102 304 2424 446 91.9	344 .733 1.123 295 2345 447 95.2	345 .743 1.147 287 2287 449 98.2	354 .791 1.177 294 2372 474 100.0	359 .806 1.218 287 2347 479 102.0	365 .807 1.274 275 2306 476 103.1	385 .801 1.370 260 2347 470 100.1		
135	347 .729 1.110 306 2490 448 90.0	347 .735 1.132 296 2406 448 93.2	352 .762 1.158 294 2412 461 95.5	359 .799 1.191 297 2463 479 97.2	364 .807 1.236 287 2421 480 99.1	372 .805 1.303 274 2396 474 99.0	397 .793 1.419 257 2459 465 94.6		
140	350 .732 1.118 307 2550 450 88.2	351 .738 1.142 297 2467 450 91.1	360 .787 1.169 305 2564 475 92.7	365 .804 1.207 299 2548 482 94.6	370 .807 1.257 287 2497 480 96.1	381 .803 1.340 273 2507 473 94.4	412 .786 1.473 255 2590 461 89.0		
145	353 .735 1.126 308 2611 451 86.4	356 .754 1.150 304 2585 460 88.9	365 .796 1.182 309 2662 481 90.3	370 .807 1.223 300 2625 484 92.2	376 .807 1.282 287 2587 480 92.7	392 .801 1.384 272 2634 472 89.6			
150	356 .737 1.135 309 2672 453 84.7	363 .774 1.160 313 2726 472 86.5	369 .801 1.195 311 2749 485 88.1	375 .808 1.241 300 2698 484 89.7	383 .804 1.310 286 2679 478 89.2	404 .792 1.429 269 2743 467 85.1			
155	361 .748 1.142 314 2772 460 82.9	369 .791 1.171 320 2859 482 84.3	374 .805 1.209 313 2831 487 86.0	380 .807 1.261 300 2778 484 87.1	392 .802 1.345 285 2796 477 85.3	417 .786 1.479 267 2880 463 80.4			
160	366 .758 1.151 319 2875 466 81.0	374 .797 1.183 323 2951 486 82.4	379 .807 1.224 314 2907 488 83.9	386 .807 1.284 300 2870 484 84.2	402 .800 1.387 284 2926 475 81.2				

04 P-05 A310-324-01 PW4152 12200000E5KG375 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 10

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+15
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	356 .424 1.002 256 1920 283 73.6	340 .457 1.009 253 1818 300 82.5	325 .502 1.017 253 1759 324 92.0	324 .508 1.019 251 1736 326 94.0	323 .514 1.022 249 1711 329 96.1	322 .519 1.026 247 1686 331 98.2	321 .525 1.029 245 1663 334 100.3	320 .533 1.032 243 1645 337 102.4
95	356 .429 1.004 260 1982 286 72.3	340 .470 1.010 260 1910 308 80.7	328 .510 1.020 257 1829 329 89.9	327 .516 1.023 255 1804 331 91.8	326 .522 1.026 253 1779 334 93.8	325 .528 1.029 251 1756 336 95.8	325 .536 1.033 250 1739 340 97.8	325 .546 1.036 250 1732 346 99.7
100	356 .439 1.005 266 2069 293 70.8	340 .482 1.012 267 2003 316 79.0	331 .517 1.023 261 1898 333 87.9	330 .523 1.026 259 1871 336 89.7	330 .530 1.030 257 1851 339 91.6	329 .539 1.033 256 1836 343 93.5	329 .549 1.036 256 1830 349 95.3	329 .559 1.040 256 1821 354 97.2
105	356 .450 1.007 273 2163 300 69.5	340 .494 1.013 274 2096 324 77.3	334 .524 1.027 264 1965 338 86.0	334 .532 1.030 263 1946 341 87.8	333 .540 1.033 262 1931 346 89.5	333 .552 1.036 263 1927 352 91.2	333 .562 1.040 262 1918 357 93.0	333 .572 1.044 262 1908 362 94.8
110	355 .461 1.008 279 2256 308 68.2	341 .503 1.015 279 2177 330 75.8	337 .533 1.030 269 2042 344 84.1	337 .542 1.033 268 2028 348 85.8	337 .553 1.036 268 2023 354 87.4	337 .563 1.040 268 2014 359 89.1	337 .573 1.044 268 2005 364 90.8	337 .584 1.049 268 1998 370 92.5
115	355 .472 1.009 286 2350 315 67.0	344 .510 1.018 283 2250 335 74.4	341 .543 1.033 274 2126 350 82.3	341 .554 1.036 274 2120 356 83.9	341 .564 1.040 274 2110 361 85.5	341 .574 1.044 274 2100 366 87.1	340 .585 1.048 274 2094 371 88.7	341 .597 1.053 274 2092 378 90.3
120	355 .482 1.010 292 2443 321 65.8	347 .516 1.020 286 2318 339 73.0	345 .555 1.036 280 2219 358 80.6	344 .565 1.040 280 2208 363 82.1	344 .575 1.044 279 2197 368 83.6	344 .585 1.048 279 2189 373 85.2	344 .598 1.053 280 2189 379 86.7	346 .625 1.055 287 2245 395 88.1
125	355 .492 1.011 298 2536 328 64.7	349 .522 1.023 289 2386 342 71.7	348 .565 1.039 286 2308 364 78.9	348 .575 1.043 285 2296 369 80.4	347 .586 1.047 285 2287 375 81.9	348 .598 1.052 285 2286 381 83.3	350 .626 1.054 294 2347 397 84.7	351 .648 1.057 299 2384 410 86.0
130	356 .501 1.013 304 2626 334 63.6	352 .528 1.026 293 2457 346 70.5	351 .575 1.043 291 2395 371 77.3	351 .585 1.047 290 2386 376 78.8	351 .598 1.051 291 2387 383 80.1	353 .627 1.053 300 2453 399 81.4	355 .649 1.056 305 2490 412 82.7	355 .662 1.062 305 2492 419 84.0
135	358 .506 1.015 307 2698 338 62.6	355 .536 1.028 297 2538 351 69.2	354 .585 1.046 296 2483 377 75.9	354 .597 1.050 297 2485 384 77.2	357 .626 1.052 305 2553 400 78.4	358 .649 1.054 311 2595 413 79.7	358 .661 1.061 311 2596 420 80.9	358 .673 1.069 311 2590 426 82.2
140	361 .512 1.017 310 2771 342 61.6	358 .545 1.031 302 2627 357 68.0	357 .596 1.049 302 2581 384 74.4	360 .624 1.051 310 2650 400 75.6	361 .648 1.053 316 2699 414 76.8	361 .661 1.060 317 2701 421 78.0	361 .672 1.067 316 2692 427 79.2	361 .685 1.075 316 2691 433 80.5
145	363 .517 1.019 313 2841 345 60.7	361 .554 1.033 307 2720 363 66.8	362 .621 1.050 315 2746 400 72.9	364 .646 1.052 322 2802 415 74.0	364 .660 1.058 322 2806 422 75.2	364 .670 1.065 322 2795 427 76.4	364 .682 1.073 321 2790 433 77.6	365 .697 1.081 322 2795 441 78.8
150	365 .521 1.021 316 2909 348 59.8	364 .562 1.036 312 2810 369 65.6	367 .644 1.051 327 2904 415 71.5	367 .658 1.056 328 2911 423 72.6	367 .669 1.063 327 2902 428 73.7	367 .680 1.071 327 2892 433 74.9	368 .694 1.078 327 2895 441 76.1	369 .708 1.086 328 2897 448 77.3
155	367 .526 1.023 319 2979 351 58.9	366 .570 1.039 317 2898 374 64.6	370 .657 1.055 333 3017 423 70.1	370 .667 1.061 333 3007 428 71.2	370 .678 1.069 332 2995 434 72.4	370 .691 1.076 332 2996 440 73.5	371 .705 1.084 333 3000 448 74.7	372 .719 1.092 333 2999 455 75.9
160	369 .532 1.025 323 3058 355 58.0	369 .578 1.041 321 2986 379 63.5	373 .665 1.059 338 3114 429 68.8	373 .675 1.066 337 3097 433 70.0	373 .688 1.074 337 3097 440 71.1	374 .702 1.082 338 3101 448 72.2	375 .717 1.089 338 3104 455 73.3	375 .725 1.099 336 3076 458 74.5

04 P-05 A310-324-01 PW4152 12200000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 15

Mod. : 4863

PW Eng. : 4000

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+15
CG=37.5%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	**FL250**	**FL270**	**FL290**	**FL310**	**FL330**	**FL350**	**FL370**	**FL390**	**FL410**
90	320 .589 1.052 244 1617 366 113.1	322 .628 1.059 250 1650 387 117.2	323 .664 1.072 254 1674 406 121.2	325 .697 1.089 256 1683 422 125.3	327 .724 1.108 255 1673 435 129.9	327 .732 1.131 247 1615 436 135.0	334 .751 1.156 242 1597 445 139.3	354 .791 1.192 245 1656 469 141.6	372 .806 1.238 239 1658 478 144.2
95	325 .609 1.056 252 1720 378 109.8	328 .653 1.065 260 1769 402 113.6	328 .682 1.081 261 1774 417 117.4	330 .716 1.098 264 1785 434 121.5	331 .729 1.120 257 1736 438 126.1	332 .736 1.144 248 1675 438 130.8	344 .776 1.174 251 1720 460 133.7	362 .802 1.215 249 1749 476 136.1	380 .807 1.269 239 1735 479 137.9
100	331 .639 1.059 265 1859 396 106.6	332 .669 1.073 267 1868 412 110.2	334 .701 1.090 269 1879 428 114.0	335 .725 1.109 267 1861 440 118.1	336 .733 1.131 259 1798 441 122.5	338 .753 1.157 254 1774 449 126.4	352 .794 1.192 257 1830 471 128.6	370 .807 1.239 250 1828 479 130.9	389 .805 1.306 238 1824 478 130.9
105	336 .660 1.065 275 1978 410 103.5	337 .686 1.081 274 1972 422 107.1	339 .718 1.098 276 1979 439 110.8	339 .730 1.119 269 1924 442 114.9	340 .736 1.144 260 1858 442 119.1	347 .779 1.173 264 1906 464 121.7	359 .803 1.213 261 1919 476 124.1	377 .807 1.267 250 1904 479 125.7	401 .803 1.353 238 1934 476 123.1
110	340 .672 1.072 280 2069 417 100.9	342 .704 1.089 282 2078 433 104.2	343 .726 1.108 279 2053 443 108.0	343 .734 1.130 270 1985 444 112.0	346 .754 1.155 266 1962 453 115.4	355 .795 1.190 270 2017 474 117.4	366 .807 1.235 262 1997 479 119.8	386 .806 1.301 250 1994 478 119.8	416 .795 1.413 235 2051 472 115.0
115	344 .688 1.080 287 2173 427 98.3	347 .719 1.097 289 2179 443 101.6	347 .730 1.118 281 2116 446 105.3	347 .736 1.141 272 2044 446 109.1	355 .778 1.169 276 2096 467 111.5	361 .803 1.208 273 2104 478 113.7	372 .807 1.260 262 2071 479 115.5	396 .803 1.344 249 2101 476 113.4	
120	349 .703 1.087 294 2276 436 95.9	350 .726 1.106 292 2253 447 99.2	351 .733 1.127 282 2178 448 102.8	353 .751 1.151 278 2146 455 106.0	362 .793 1.185 282 2208 477 107.9	368 .807 1.228 274 2182 481 110.1	380 .807 1.290 262 2161 478 110.7	409 .800 1.397 248 2228 475 106.5	
125	353 .718 1.094 300 2377 445 93.7	354 .730 1.114 293 2317 449 97.0	354 .736 1.138 284 2239 450 100.4	361 .772 1.164 286 2275 467 102.7	368 .801 1.200 285 2298 481 104.7	374 .807 1.250 275 2256 481 106.6	389 .803 1.326 261 2259 476 105.5	426 .791 1.453 245 2345 469 99.9	
130	357 .725 1.102 304 2456 450 91.6	357 .733 1.123 295 2378 451 94.9	359 .742 1.148 286 2316 453 97.9	368 .791 1.178 293 2405 479 99.6	374 .805 1.219 287 2380 484 101.7	380 .807 1.275 275 2341 481 102.7	400 .801 1.371 260 2381 475 99.8		
135	360 .729 1.110 305 2522 452 89.7	361 .735 1.133 296 2439 453 92.8	366 .762 1.158 294 2444 465 95.2	374 .799 1.192 297 2497 484 96.9	379 .807 1.237 287 2456 485 98.8	387 .805 1.304 274 2431 480 98.6	413 .793 1.421 257 2494 470 94.3		
140	364 .732 1.119 307 2584 454 87.9	364 .738 1.142 297 2501 454 90.8	374 .786 1.170 305 2600 480 92.4	379 .804 1.207 299 2584 487 94.3	385 .807 1.258 287 2532 485 95.8	397 .803 1.341 273 2544 478 94.0			
145	367 .734 1.127 308 2646 456 86.1	370 .754 1.151 304 2621 464 88.6	379 .796 1.183 309 2700 486 90.0	384 .807 1.224 300 2661 489 91.8	391 .807 1.283 287 2624 485 92.4	408 .801 1.385 272 2673 477 89.2			
150	370 .737 1.135 309 2707 457 84.4	377 .774 1.161 312 2763 477 86.2	384 .801 1.195 311 2787 490 87.8	389 .807 1.242 300 2736 489 89.4	398 .804 1.312 286 2717 483 88.9	420 .792 1.430 269 2783 472 84.8			
155	374 .743 1.144 312 2789 461 82.6	383 .790 1.172 320 2897 487 84.0	389 .805 1.210 313 2870 492 85.7	395 .807 1.262 300 2817 489 86.8	407 .802 1.346 285 2836 482 85.0				
160	379 .758 1.152 318 2913 470 80.7	388 .797 1.184 323 2990 491 82.1	393 .807 1.225 314 2947 493 83.7	401 .807 1.285 300 2911 489 83.9	417 .799 1.388 284 2967 480 81.0				

04 P-05 A310-324-01 PW4152 12200000E5KG375 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 15

FCOM-B0-02-12-10-015-104

Mod. : 4801 + 4863

PW Eng. : 4000

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=27.0%

EGT °C MACH
EPR IAS
KG/H/ENG TAS
NM/1000KG

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	367 .423 1.003 256 1942 285 73.3	351 .457 1.009 253 1839 302 82.2	336 .502 1.017 253 1779 326 91.7	336 .508 1.020 251 1756 329 93.7	335 .513 1.023 249 1731 331 95.8	334 .519 1.026 247 1706 334 97.9	333 .525 1.029 245 1683 337 100.0	333 .533 1.033 243 1667 340 102.1
95	368 .429 1.004 260 2004 289 72.0	351 .469 1.011 260 1931 311 80.4	340 .510 1.020 257 1852 332 89.6	339 .516 1.023 255 1826 334 91.5	338 .521 1.026 253 1800 337 93.5	337 .528 1.030 251 1777 339 95.5	337 .536 1.033 250 1760 343 97.5	337 .546 1.036 250 1754 349 99.4
100	367 .439 1.006 266 2093 296 70.6	351 .482 1.012 267 2025 319 78.7	343 .518 1.024 261 1921 337 87.6	342 .523 1.027 259 1894 339 89.5	341 .530 1.030 257 1873 342 91.3	341 .538 1.033 256 1857 346 93.2	341 .549 1.037 256 1852 352 95.0	341 .559 1.040 256 1843 357 96.9
105	367 .450 1.007 273 2188 303 69.2	351 .494 1.014 273 2119 327 77.1	346 .524 1.027 264 1989 341 85.7	345 .532 1.030 263 1970 345 87.5	345 .541 1.033 262 1956 349 89.2	345 .551 1.037 263 1951 355 90.9	345 .561 1.041 262 1941 360 92.7	345 .571 1.045 262 1931 365 94.5
110	367 .461 1.008 279 2282 310 68.0	353 .503 1.016 279 2203 333 75.6	349 .533 1.030 269 2067 347 83.9	349 .542 1.033 268 2053 351 85.5	349 .553 1.037 269 2049 357 87.1	349 .563 1.041 268 2039 362 88.8	349 .573 1.045 268 2029 367 90.5	349 .584 1.049 268 2023 373 92.2
115	367 .471 1.009 286 2375 317 66.7	356 .510 1.018 283 2276 338 74.2	353 .543 1.033 274 2152 353 82.1	353 .554 1.037 274 2146 359 83.6	353 .564 1.040 274 2137 364 85.2	353 .574 1.044 274 2127 369 86.8	353 .585 1.049 274 2120 375 88.4	353 .597 1.053 274 2118 381 90.0
120	367 .481 1.010 292 2471 324 65.6	358 .516 1.021 286 2346 342 72.8	357 .555 1.036 280 2245 361 80.3	356 .564 1.040 280 2234 366 81.8	356 .574 1.044 279 2224 371 83.4	356 .585 1.048 279 2217 377 84.9	357 .597 1.053 280 2216 383 86.4	359 .624 1.055 287 2270 399 87.8
125	367 .491 1.011 298 2566 331 64.5	361 .522 1.023 289 2414 345 71.5	360 .565 1.040 285 2335 367 78.7	360 .575 1.044 285 2323 372 80.1	360 .585 1.048 285 2315 378 81.6	360 .597 1.052 285 2313 384 83.0	362 .625 1.054 293 2373 400 84.4	364 .647 1.058 298 2409 413 85.7
130	367 .501 1.013 304 2658 337 63.4	363 .528 1.026 292 2485 349 70.2	363 .575 1.043 291 2424 374 77.1	363 .585 1.047 290 2414 379 78.5	363 .597 1.052 291 2414 386 79.9	366 .625 1.053 299 2476 402 81.2	367 .647 1.056 304 2516 415 82.5	367 .661 1.063 305 2521 422 83.7
135	370 .506 1.015 307 2731 341 62.4	366 .535 1.029 297 2567 354 69.0	366 .585 1.046 296 2514 380 75.6	367 .597 1.051 296 2514 387 76.9	369 .625 1.052 305 2580 403 78.2	371 .648 1.055 310 2623 417 79.4	371 .661 1.062 311 2626 424 80.6	371 .673 1.069 310 2622 430 81.9
140	372 .512 1.017 310 2804 344 61.4	370 .544 1.031 302 2657 360 67.8	370 .596 1.050 302 2613 388 74.1	372 .623 1.051 310 2678 403 75.3	374 .647 1.054 316 2728 417 76.5	374 .660 1.060 316 2732 425 77.7	374 .672 1.067 316 2726 430 78.9	374 .685 1.075 316 2726 437 80.2
145	374 .517 1.019 313 2874 348 60.5	373 .554 1.034 307 2752 366 66.6	375 .620 1.051 314 2774 403 72.7	377 .645 1.053 321 2832 418 73.8	377 .659 1.059 322 2838 425 74.9	377 .670 1.066 322 2830 431 76.1	377 .682 1.073 321 2827 437 77.4	378 .697 1.081 322 2832 445 78.6
150	376 .521 1.021 316 2942 351 59.6	376 .562 1.036 312 2843 372 65.4	379 .643 1.051 326 2935 418 71.2	380 .657 1.057 328 2943 426 72.4	380 .668 1.064 327 2936 432 73.5	380 .680 1.071 326 2927 437 74.7	381 .694 1.079 327 2932 445 75.8	382 .708 1.087 328 2936 452 77.0
155	379 .526 1.023 319 3014 354 58.7	378 .570 1.039 317 2933 377 64.4	383 .656 1.055 333 3051 427 69.9	383 .668 1.062 333 3052 433 70.9	383 .678 1.069 332 3032 437 72.1	383 .691 1.077 332 3034 444 73.3	384 .705 1.085 333 3037 452 74.4	386 .719 1.093 333 3038 459 75.6
160	381 .532 1.026 323 3094 358 57.9	381 .578 1.042 321 3022 383 63.3	385 .665 1.060 338 3153 433 68.6	385 .675 1.067 337 3137 438 69.7	386 .688 1.074 337 3137 444 70.8	387 .702 1.082 338 3140 452 71.9	388 .716 1.090 338 3142 459 73.0	389 .725 1.100 336 3115 463 74.3

04 P-05 A310-324-01 PW4152 12200000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 20

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=37.5%

EGT °C MACH
EPR IAS
KG/H/ENG TAS
NM/1000KG

WEIGHT (1000KG)	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
90	332 .589 1.052 244 1637 369 112.7	334 .626 1.060 249 1667 389 116.8	336 .663 1.072 254 1694 409 120.8	338 .696 1.090 256 1706 426 124.9	340 .723 1.109 255 1697 439 129.4	341 .732 1.131 247 1638 441 134.5	348 .751 1.157 242 1621 450 138.8	368 .791 1.193 245 1680 474 141.1	387 .806 1.239 239 1682 483 143.6
95	338 .608 1.057 252 1742 381 109.4	340 .652 1.065 260 1791 405 113.2	341 .682 1.081 261 1798 421 117.0	344 .716 1.099 263 1810 438 121.1	345 .729 1.120 257 1760 442 125.7	345 .736 1.145 248 1699 443 130.3	358 .776 1.175 251 1746 465 133.2	377 .802 1.216 249 1774 481 135.5	395 .807 1.270 239 1760 484 137.4
100	344 .638 1.060 265 1881 400 106.2	345 .669 1.073 267 1894 416 109.8	347 .702 1.090 269 1907 433 113.5	349 .725 1.109 267 1887 444 117.6	349 .733 1.132 259 1823 445 122.1	352 .753 1.158 254 1799 453 125.9	367 .794 1.193 258 1859 476 128.1	384 .807 1.240 250 1854 484 130.4	405 .805 1.307 238 1850 483 130.4
105	349 .659 1.066 274 2002 413 103.2	350 .686 1.081 274 1998 427 106.7	352 .719 1.099 276 2007 443 110.4	353 .730 1.120 269 1951 447 114.5	354 .736 1.145 260 1884 447 118.6	362 .778 1.174 264 1931 468 121.3	374 .803 1.214 261 1947 481 123.6	392 .807 1.268 250 1932 484 125.2	417 .803 1.355 238 1961 481 122.7
110	353 .672 1.073 280 2094 421 100.5	355 .703 1.090 282 2105 437 103.9	357 .726 1.108 279 2081 448 107.6	357 .734 1.131 271 2013 449 111.5	360 .753 1.156 266 1990 457 114.9	370 .795 1.191 270 2045 479 117.0	381 .807 1.236 262 2025 484 119.4	401 .806 1.302 250 2023 483 119.4	432 .795 1.414 235 2081 477 114.6
115	357 .688 1.080 287 2202 431 97.9	360 .719 1.097 289 2207 447 101.3	361 .730 1.118 281 2145 450 105.0	361 .736 1.142 272 2074 451 108.7	369 .777 1.170 276 2125 472 111.1	376 .803 1.209 273 2133 483 113.3	387 .807 1.261 262 2101 484 115.1	412 .803 1.345 249 2132 481 112.9	
120	362 .704 1.088 294 2308 441 95.5	364 .726 1.106 292 2283 451 98.8	364 .733 1.128 282 2208 452 102.5	367 .752 1.152 278 2178 460 105.6	376 .793 1.185 282 2240 482 107.5	382 .806 1.229 274 2213 486 109.7	395 .806 1.291 262 2192 483 110.3	425 .800 1.398 248 2260 480 106.1	
125	367 .718 1.095 300 2409 450 93.3	367 .730 1.115 293 2347 454 96.6	368 .736 1.138 283 2269 454 100.0	375 .772 1.165 286 2307 472 102.4	382 .801 1.201 285 2332 486 104.3	388 .807 1.251 275 2288 486 106.2	404 .803 1.327 261 2291 482 105.1		
130	370 .725 1.103 304 2489 454 91.3	371 .733 1.124 295 2410 456 94.5	373 .742 1.149 286 2347 458 97.6	382 .790 1.179 293 2437 484 99.3	388 .806 1.220 287 2414 489 101.3	395 .807 1.276 275 2374 486 102.3	416 .801 1.372 260 2415 480 99.4		
135	374 .729 1.111 305 2555 457 89.4	375 .735 1.133 296 2472 457 92.5	379 .760 1.159 294 2472 469 94.9	388 .798 1.193 297 2531 489 96.5	394 .807 1.238 287 2490 490 98.4	403 .805 1.306 274 2465 485 98.3			
140	377 .732 1.119 307 2618 459 87.6	378 .738 1.143 297 2535 459 90.5	388 .786 1.171 305 2633 485 92.1	394 .804 1.208 299 2619 492 94.0	400 .807 1.259 287 2568 490 95.4	412 .803 1.342 273 2580 484 93.7			
145	380 .734 1.128 308 2681 460 85.8	384 .754 1.151 304 2658 469 88.2	393 .795 1.183 309 2736 491 89.7	399 .807 1.225 300 2698 494 91.5	406 .807 1.284 287 2661 490 92.1	423 .801 1.387 272 2711 482 88.9			
150	384 .736 1.136 309 2743 461 84.1	391 .774 1.162 312 2800 481 85.9	398 .801 1.196 311 2825 494 87.5	404 .807 1.243 300 2774 494 89.1	414 .804 1.313 286 2755 488 88.6				
155	387 .742 1.145 311 2824 465 82.4	398 .790 1.173 320 2935 491 83.7	403 .805 1.211 313 2910 497 85.4	410 .807 1.263 300 2856 494 86.5	423 .802 1.347 285 2876 487 84.7				
160	393 .758 1.153 318 2951 475 80.4	402 .797 1.184 323 3029 496 81.8	408 .807 1.226 314 2987 498 83.4	416 .806 1.286 300 2950 494 83.7					

04 P-05 A310-324-01 PW4152 12200000E5KG375 0 018590 0 0 1 1.0 .0 .0 0 01 .990 .000 .000 20

FCOM-B0-02-12-10-017-230

Mod. : 4801 + 4863

PW Eng. : 4000

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STD or GE Eng. : 80C2 or PW Eng. : 7R4E1/4000

INTRODUCTION

Holding charts are established for 2 different configurations :

– clean configuration at 210 kt and at « Green Dot » speed

– slats 15/Flaps 0 at 170 kt and at « S » speed

« Green Dot » in clean configuration and « S » in 15/0 are speeds situated between minimum fuel speed and minimum drag speed.

These charts are established with air conditioning in economic mode. When using normal air conditioning, fuel consumption is increased by 0.8 %.

All charts are established with a center of gravity location corresponding to 27 %.

HOLDING - 210 KT

MAX. CRUISE THRUST LIMITS CLEAN CONFIGURATION ECON. AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**EPR** **FF (KG/H/ENG)**

WEIGHT (1000KG)	**FL 15**	**FL 50**	**FL100**	**FL120**	**FL140**	**FL160**	**FL180**	**FL200**	**FL250**	**FL290**
90	1.012 1654	1.016 1576	1.022 1480	1.025 1447	1.029 1426	1.034 1409	1.039 1392	1.045 1377	1.065 1347	1.089 1337
95	1.016 1695	1.019 1618	1.027 1525	1.031 1494	1.035 1472	1.040 1456	1.046 1440	1.053 1426	1.074 1397	1.102 1390
100	1.019 1738	1.023 1662	1.032 1572	1.036 1541	1.041 1521	1.047 1505	1.053 1490	1.060 1477	1.084 1449	1.115 1450
105	1.022 1784	1.027 1710	1.037 1622	1.042 1594	1.048 1574	1.054 1561	1.060 1548	1.068 1535	1.096 1508	1.129 1517
110	1.026 1836	1.032 1763	1.043 1679	1.049 1651	1.054 1636	1.061 1623	1.069 1610	1.078 1597	1.108 1573	1.144 1587
115	1.031 1890	1.037 1819	1.049 1737	1.055 1715	1.061 1701	1.069 1688	1.077 1675	1.087 1662	1.121 1643	1.160 1659
120	1.035 1947	1.042 1877	1.055 1803	1.061 1784	1.068 1769	1.076 1756	1.086 1743	1.097 1730	1.134 1716	1.176 1734
125	1.039 2006	1.047 1938	1.061 1873	1.068 1854	1.076 1841	1.085 1827	1.095 1814	1.107 1804	1.148 1791	1.193 1812
130	1.044 2067	1.053 2004	1.068 1945	1.075 1928	1.084 1915	1.093 1901	1.105 1890	1.118 1882	1.162 1869	1.212 1896
135	1.049 2131	1.058 2077	1.074 2021	1.082 2005	1.092 1992	1.102 1979	1.115 1971	1.129 1963	1.177 1950	1.232 1984
140	1.054 2203	1.064 2152	1.081 2099	1.090 2085	1.100 2072	1.112 2064	1.125 2055	1.141 2047	1.192 2034	1.254 2077
145	1.059 2278	1.069 2229	1.089 2180	1.098 2167	1.109 2159	1.121 2151	1.136 2143	1.153 2133	1.209 2123	1.277 2179
150	1.064 2357	1.075 2310	1.096 2264	1.106 2256	1.118 2250	1.131 2242	1.147 2233	1.166 2219	1.226 2218	
155	1.070 2438	1.082 2393	1.104 2353	1.114 2350	1.127 2344	1.142 2335	1.159 2321	1.179 2307	1.245 2316	
160	1.075 2522	1.088 2479	1.112 2448	1.123 2447	1.137 2441	1.152 2430	1.171 2411	1.192 2398		

04 P-05 A310-324-01 PW4152 14100000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01210.000 .000 .000 0 FCOM-B0-02-13-10-002-074

Per degree above (below) ISA add (subtract) 5 kg /h/eng.

HOLDING AT GREEN DOT SPEED

MAX. CRUISE THRUST LIMITS
CLEAN CONFIGURATION
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EPR
FF (KG/H/ENG)

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	FL250	FL290
90	1.020 1584	1.025 1512	1.032 1423	1.036 1393	1.041 1366	1.047 1342	1.053 1323	1.059 1313	1.072 1306	1.091 1323
95	1.022 1647	1.026 1574	1.035 1486	1.039 1456	1.045 1429	1.051 1407	1.057 1395	1.064 1384	1.078 1373	1.101 1398
100	1.023 1710	1.028 1637	1.038 1549	1.042 1520	1.048 1495	1.054 1478	1.061 1467	1.068 1455	1.086 1445	1.111 1479
105	1.025 1773	1.030 1700	1.040 1613	1.046 1585	1.051 1562	1.057 1550	1.065 1538	1.073 1526	1.093 1518	1.122 1563
110	1.026 1836	1.032 1763	1.043 1679	1.049 1651	1.054 1636	1.061 1623	1.069 1610	1.078 1597	1.100 1592	1.134 1651
115	1.028 1900	1.034 1828	1.046 1745	1.051 1722	1.057 1709	1.064 1696	1.073 1682	1.082 1669	1.108 1670	1.145 1741
120	1.029 1964	1.036 1893	1.048 1811	1.054 1796	1.060 1782	1.068 1768	1.077 1754	1.087 1741	1.115 1750	1.157 1833
125	1.031 2029	1.037 1958	1.051 1884	1.056 1870	1.063 1856	1.071 1841	1.081 1827	1.092 1812	1.124 1840	1.170 1927
130	1.032 2095	1.039 2025	1.053 1959	1.059 1944	1.066 1929	1.075 1914	1.085 1899	1.097 1887	1.133 1932	1.183 2023
135	1.033 2161	1.041 2092	1.055 2034	1.062 2019	1.069 2003	1.078 1987	1.089 1972	1.102 1965	1.143 2026	1.197 2121
140	1.035 2228	1.043 2160	1.057 2110	1.064 2093	1.072 2077	1.082 2061	1.094 2047	1.107 2046	1.152 2123	1.210 2219
145	1.036 2295	1.045 2232	1.059 2185	1.067 2168	1.075 2151	1.086 2134	1.098 2126	1.112 2128	1.162 2220	1.223 2309
150	1.037 2363	1.046 2308	1.062 2261	1.069 2243	1.079 2226	1.089 2212	1.103 2207	1.118 2212	1.172 2320	1.236 2400
155	1.039 2432	1.048 2384	1.064 2336	1.072 2318	1.082 2300	1.093 2291	1.107 2290	1.124 2304	1.182 2421	1.249 2493
160	1.040 2504	1.049 2461	1.066 2413	1.075 2394	1.085 2379	1.097 2372	1.112 2375	1.130 2402	1.193 2524	1.264 2590

04 P-05 A310-324-01 PW4152 14300000E5KG270 0 018590 0 0 1 1.0 .0 .0 0 01 1.000 .000 .000 0   FCOM-B0-02-13-10-003-074

Per degree above (below) ISA add (subtract) 5 kg /h/eng.

Mod. : 4863   PW Eng. : 4000

HOLDING - 170 KT

MAX. CRUISE THRUST LIMITS CONFIGURATION 15/0 ECON. AIR CONDITIONING ANTI-ICING OFF					ISA CG=27.0%		**EPR** **FF(KG/H/ENG)**	
WEIGHT (1000KG)	**FL 15**	**FL 50**	**FL100**	**FL120**	**FL140**	**FL160**	**FL180**	**FL200**
90	1.040 1694	1.048 1631	1.063 1569	1.069 1547	1.076 1527	1.084 1510	1.093 1496	1.103 1485
95	1.044 1756	1.054 1699	1.070 1641	1.077 1620	1.084 1602	1.093 1586	1.103 1574	1.113 1569
100	1.049 1822	1.060 1774	1.077 1718	1.085 1697	1.093 1680	1.103 1667	1.113 1661	1.125 1657
105	1.054 1898	1.066 1852	1.085 1798	1.093 1779	1.102 1764	1.112 1757	1.124 1752	1.137 1749
110	1.060 1979	1.072 1934	1.093 1883	1.102 1867	1.112 1859	1.123 1854	1.135 1850	1.150 1850
115	1.067 2072	1.080 2029	1.103 1983	1.112 1974	1.123 1967	1.135 1963	1.149 1961	1.165 1952
120	1.074 2170	1.088 2128	1.112 2093	1.122 2085	1.134 2079	1.147 2076	1.163 2068	1.181 2059
125	1.081 2271	1.096 2231	1.122 2208	1.133 2201	1.146 2197	1.161 2189	1.178 2179	1.197 2170
130	1.088 2377	1.105 2345	1.132 2327	1.144 2321	1.158 2314	1.174 2304	1.193 2294	1.216 2300
135	1.096 2487	1.113 2467	1.142 2451	1.156 2444	1.171 2434	1.189 2424	1.210 2424	1.236 2439
140	1.104 2607	1.122 2594	1.153 2578	1.168 2568	1.185 2558	1.204 2552	1.229 2566	1.257 2582
145	1.112 2739	1.131 2726	1.165 2708	1.181 2697	1.199 2687	1.222 2699	1.249 2714	1.280 2729
150	1.120 2876	1.141 2864	1.177 2842	1.194 2832	1.215 2837	1.241 2851	1.270 2865	1.303 2882
155	1.129 3018	1.151 3005	1.189 2981	1.209 2979	1.233 2992	1.260 3006	1.291 3021	1.328 3046
160	1.137 3164	1.161 3149	1.202 3127	1.225 3139	1.251 3153	1.280 3166	1.314 3185	1.355 3217

04 P-05 A310-324-01 PW4152 14100000E5KG270 0 01859015 0 1 1 .0 .0 .0 0 01170.000 .000 .000 0 FCOM-B0-02-13-10-004-074

Per degree above (below) ISA add (subtract) 5 kg /h/eng.

Mod. : 4863 PW Eng. : 4000

HOLDING - S

MAX. CRUISE THRUST LIMITS CONFIGURATION 15/0 ECON. AIR CONDITIONING ANTI-ICING OFF					ISA CG=27.0%		**EPR** **FF(KG/H/ENG)**	
WEIGHT (1000KG)	**FL 15**	**FL 50**	**FL100**	**FL120**	**FL140**	**FL160**	**FL180**	**FL200**
90	1.040 1688	1.049 1626	1.064 1565	1.070 1543	1.077 1524	1.085 1507	1.094 1493	1.104 1483
95	1.044 1762	1.053 1703	1.069 1644	1.075 1623	1.083 1604	1.091 1588	1.101 1576	1.112 1570
100	1.047 1839	1.057 1786	1.073 1725	1.080 1705	1.088 1687	1.097 1672	1.107 1664	1.118 1660
105	1.050 1915	1.061 1868	1.077 1806	1.085 1786	1.093 1769	1.103 1758	1.114 1752	1.126 1750
110	1.054 1997	1.065 1948	1.082 1888	1.090 1869	1.099 1853	1.109 1846	1.121 1842	1.134 1837
115	1.058 2079	1.069 2029	1.086 1971	1.095 1953	1.104 1941	1.115 1936	1.128 1933	1.142 1924
120	1.062 2163	1.072 2111	1.091 2054	1.100 2038	1.110 2031	1.121 2027	1.135 2021	1.151 2010
125	1.065 2245	1.076 2194	1.095 2139	1.105 2127	1.116 2122	1.128 2119	1.142 2108	1.159 2093
130	1.068 2327	1.079 2277	1.100 2226	1.110 2218	1.121 2214	1.134 2207	1.150 2196	1.168 2176
135	1.071 2411	1.083 2362	1.104 2316	1.115 2310	1.127 2306	1.141 2295	1.158 2279	1.177 2260
140	1.074 2495	1.086 2447	1.109 2408	1.120 2402	1.133 2395	1.148 2383	1.165 2363	1.185 2346
145	1.077 2578	1.091 2532	1.114 2499	1.126 2495	1.139 2484	1.155 2468	1.174 2447	1.195 2432
150	1.080 2663	1.094 2619	1.119 2592	1.131 2585	1.146 2573	1.163 2552	1.182 2533	1.204 2523
155	1.084 2748	1.098 2705	1.124 2685	1.137 2675	1.153 2660	1.171 2637	1.191 2620	1.215 2616
160	1.087 2835	1.102 2796	1.129 2778	1.143 2765	1.159 2745	1.178 2723	1.199 2708	1.225 2710

04 P-05 A310-324-01 PW4152 14100000E5KG270 0 01859015 0 1 1 .3 .0 .0 0 01168.000 .000 .000 0 FCOM-B0-02-13-10-005-085

Per degree above (below) ISA add (subtract) 5 kg /h/eng.

PW Eng. : 4000

INTRODUCTION

Descent charts are established with air conditioning in economic mode.

R When using normal air conditioning, increase fuel consumption by 0.8 %.

All tables are established with a center of gravity location corresponding to 27 %.

ISA	DESCENT 2 ENGINES	M 0.80/300/250 KT

MAX CABIN RATE OF DESCENT 350 FT/MIN

WEIGHT (1000KG)	100				130				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	IAS (KT)
410	18.6	388	118	1.039					
390	16.8	323	104	1.020	18.1	313	111	IDLE	248
370	15.2	268	92	IDLE	17.5	305	106	IDLE	260
350	14.6	260	87	IDLE	16.8	297	101	IDLE	272
330	14.0	252	83	IDLE	16.2	288	96	IDLE	284
310	13.5	245	79	IDLE	15.5	280	91	IDLE	297
290	12.8	235	73	IDLE	14.7	269	85	IDLE	300
270	12.1	225	68	IDLE	13.9	257	79	IDLE	300
250	11.3	215	62	IDLE	13.0	245	72	IDLE	300
240	10.9	210	60	IDLE	12.6	239	69	IDLE	300
220	10.2	199	54	IDLE	11.7	226	63	IDLE	300
200	9.4	190	49	IDLE	10.8	216	57	IDLE	300
180	8.7	182	44	IDLE	9.9	205	51	IDLE	300
160	7.9	172	40	IDLE	9.0	195	45	IDLE	300
140	7.2	163	35	IDLE	8.1	183	40	IDLE	300
120	6.4	152	30	IDLE	7.2	170	34	IDLE	300
100	5.6	140	26	IDLE	6.3	156	29	IDLE	300
50	2.1	62	9	IDLE	2.4	69	10	IDLE	250
15	0.0	0	0	IDLE	0.0	0	0	IDLE	250

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Mod. : 4863

PW Eng. : 4000 R

ISA	EMERGENCY DESCENT	M.84 – 340 KT

AIRBRAKES EXTENDED

WEIGHT (1000KG)	100				130				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	IAS (KT)
410	5.4	86	38	IDLE					
390	5.2	82	36	IDLE	6.3	100	44	IDLE	262
370	4.9	79	35	IDLE	6.0	97	42	IDLE	274
350	4.7	77	33	IDLE	5.8	94	40	IDLE	287
330	4.5	74	31	IDLE	5.6	91	39	IDLE	300
310	4.4	72	30	IDLE	5.4	88	37	IDLE	314
290	4.2	69	29	IDLE	5.2	85	35	IDLE	328
270	4.0	67	27	IDLE	5.0	82	34	IDLE	340
250	3.8	63	25	IDLE	4.7	77	31	IDLE	340
240	3.6	60	24	IDLE	4.5	75	30	IDLE	340
220	3.3	56	22	IDLE	4.1	69	27	IDLE	340
200	3.1	52	20	IDLE	3.8	64	24	IDLE	340
180	2.8	47	18	IDLE	3.4	59	22	IDLE	340
160	2.5	43	15	IDLE	3.1	53	19	IDLE	340
140	2.2	39	13	IDLE	2.7	48	17	IDLE	340
120	1.9	35	11	IDLE	2.3	44	14	IDLE	340
100	1.6	31	9	IDLE	2.0	39	12	IDLE	340
50	0.8	19	5	IDLE	1.0	23	6	IDLE	340
0	0.0	0	0	IDLE	0.0	0	0	IDLE	340

B0FC-02-1410-002-A105AA - R

R Code : 0353

PW Eng. : 4000

In the approach configuration corresponding to the all engine procedure, the steady gradient one engine inoperative required by the regulations is equal to 2,1 %.

The following graph allows to determine the approach climb limiting weight which satisfies the required gradient with the certified approach configurations 20/20 and 15/15.

The required gradient of 2,1 % is considered at the airport reference altitude. The power setting to « GO AROUND » thrust with the air conditioning ON. The speed is 1.3 VS of the specified configuration.

Nominal Thrust : The graphs are on pages 2 and 3.
Fan Thrust deterioration Mode (FTDM). The FTDM phenomenon, which occurs after 500 to 1250 flight cycles since the last fan blade overhaul, produces a thrust decrease of approximately 2.5 %.
The French DGAC Airworthiness Directive AD 2001-086 (B) R2 stipulates that a restoration of the leading edge contour of fan blades must be achieved every 450 engine cycles, in order to recover the nominal thrust.
The graphs for affected aircraft are in pages 7 and 8.

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 approach climb 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 graphs for CAT II approach to determine the maximum approach climb limiting weight according to airport pressure altitude and temperature.

Notes : 1. If circumstances dictate, landing may be made at a weight corresponding to the maximum structural take off wieght.
At this weight maximum vertical speed should not exceed 6 ft/s.
Air conditioning should be shut off.
If slats 20/flaps 20 approach climb limited, the approach shall be performed in slats 15/flaps 15 and landing in slats 20/flaps 20.
2. When icing conditions are encountered during the flight and TAT during the approach is below 8°C, if there is evidence of significant ice accretion, to take into account ice formation on non heated structure :
– decrease the approach climb limiting weight by 3 %
– for landing :
. The minimum approach speed is VLS + 5 kt.
. Multiply landing distance by 1.1.

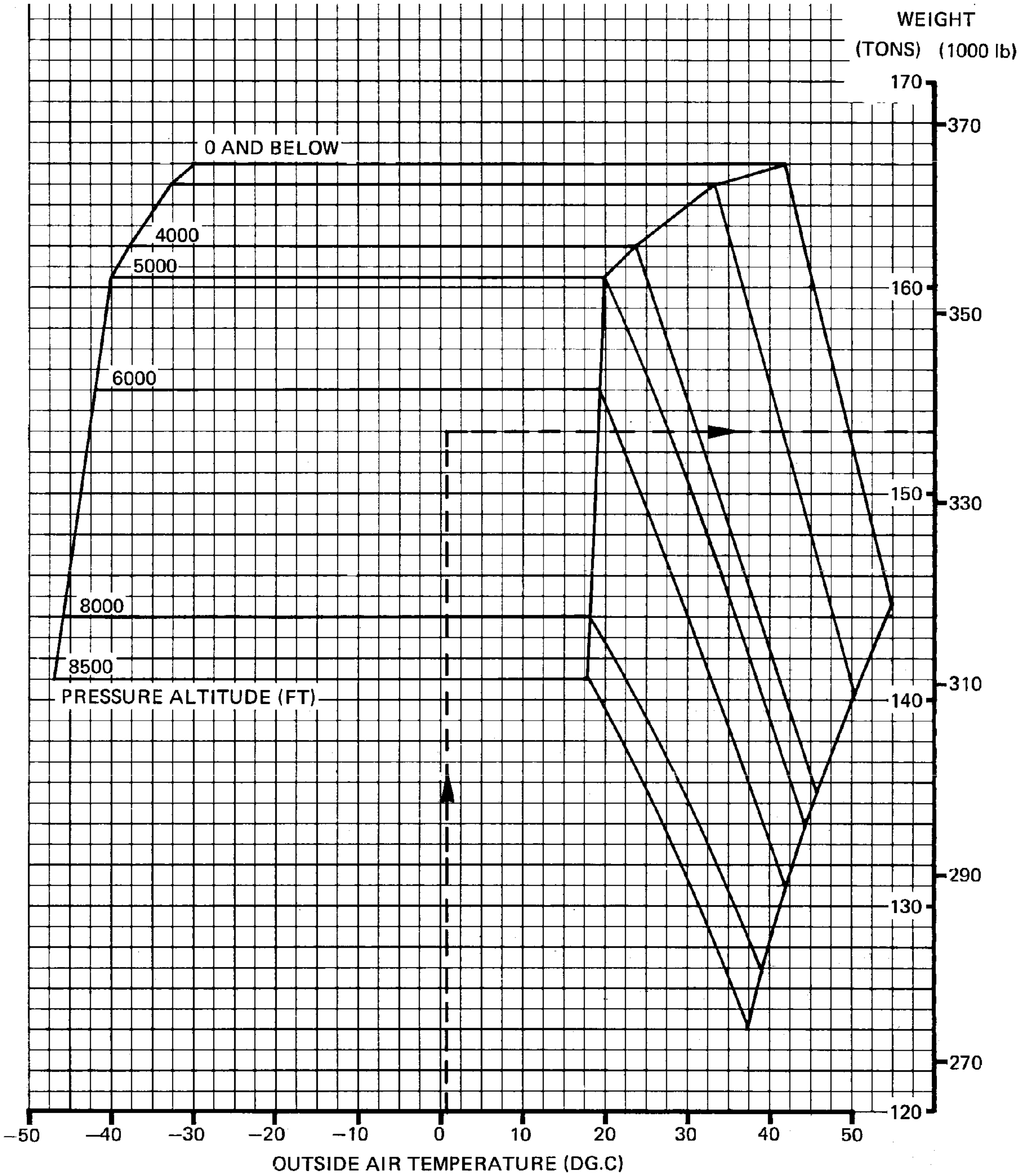
PW Eng. : 4000

R

NOMINAL THRUST

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



Notes : 1. If air conditioning is OFF, an additional 2.5 tons (5500 lb) may be added to the limiting weight.
2. If nacelle anti-ice is ON, subtract 0.5 tons (1100 lb) to the limiting weight.
3. If total anti-ice is ON, subtract 2.5 tons (5500 lb) to the limiting weight.

Mod. : 4863

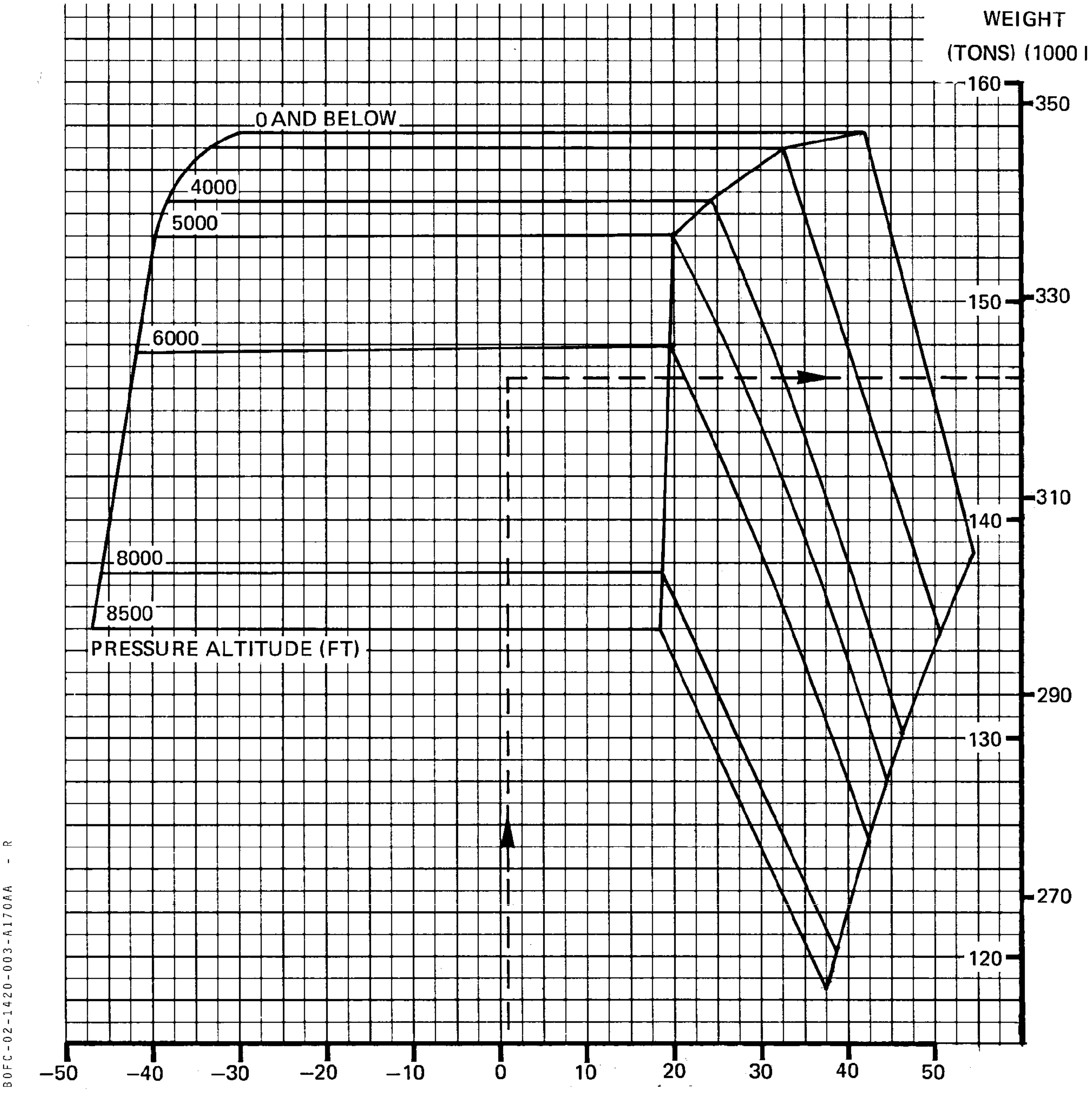
PW Eng. : 4152

R

NOMINAL THRUST

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



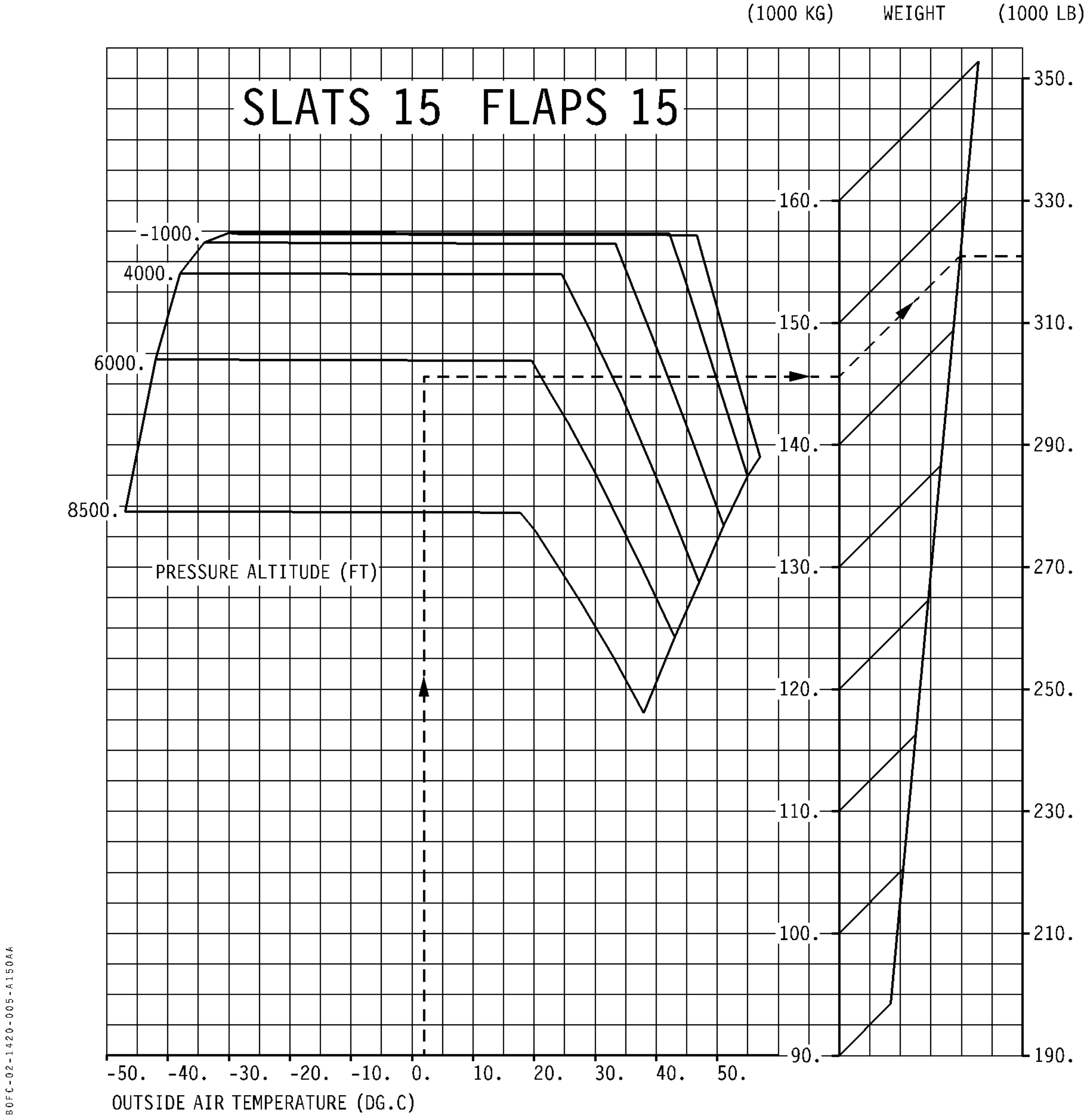
Notes : 1. If air conditioning is OFF, an additional 2.5 tons (5500 lb) may be added to the limiting weight.
2. If nacelle anti-ice is ON, subtract 0.5 tons (1100 lb) to the limiting weight.
3. If total anti-ice is ON, subtract 1 tons (2200 lb) to the limiting weight.

Mod. : 4863

PW Eng. : 4152

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.5 %
AIR CONDITIONING ON
ANTI ICING OFF



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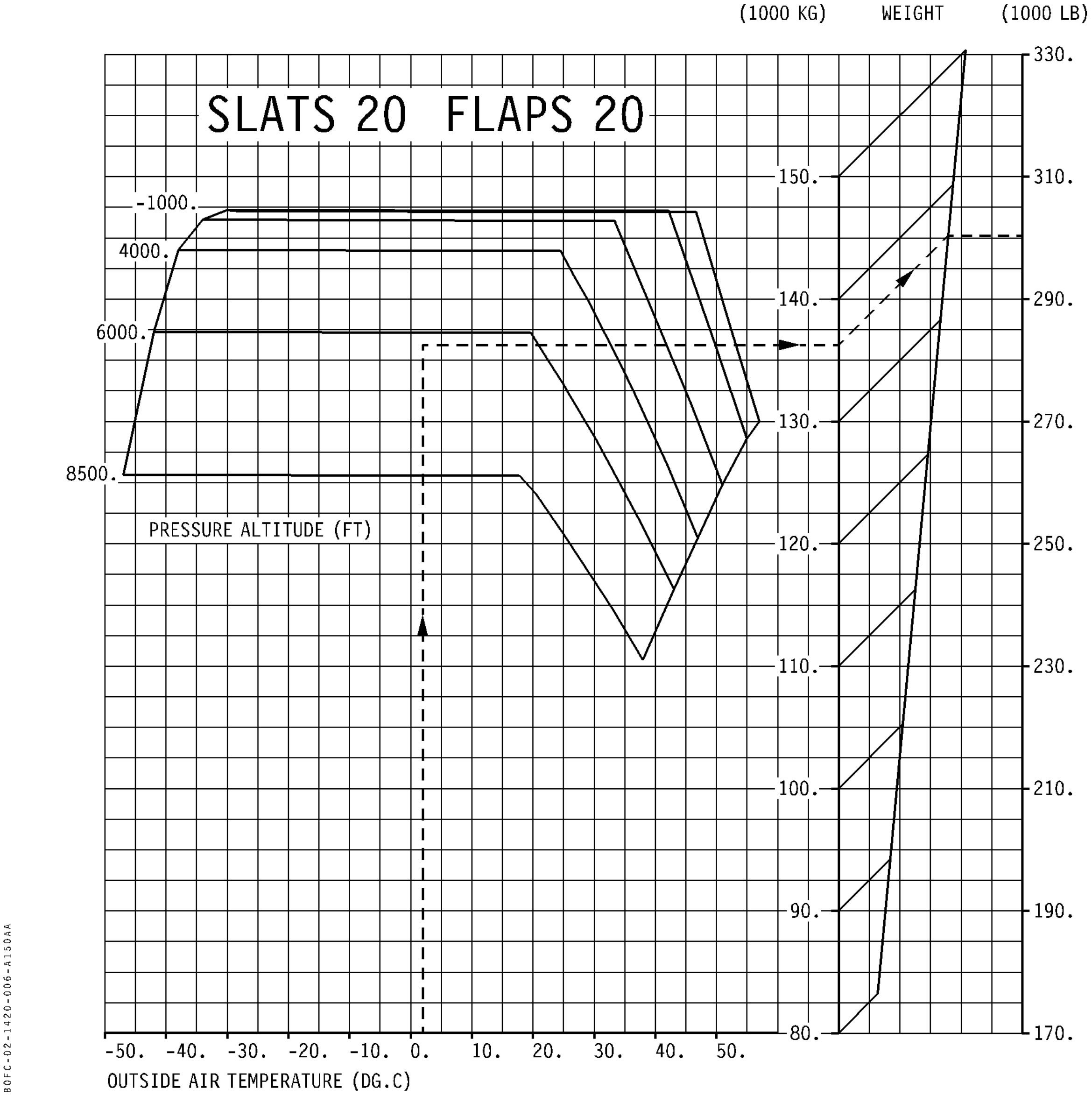
ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.5 %
AIR CONDITIONING ON
ANTI ICING OFF



Notes : 1. If air conditioning is OFF, an additional 2.5 tons (5500 lb) may be added to the limiting weight.
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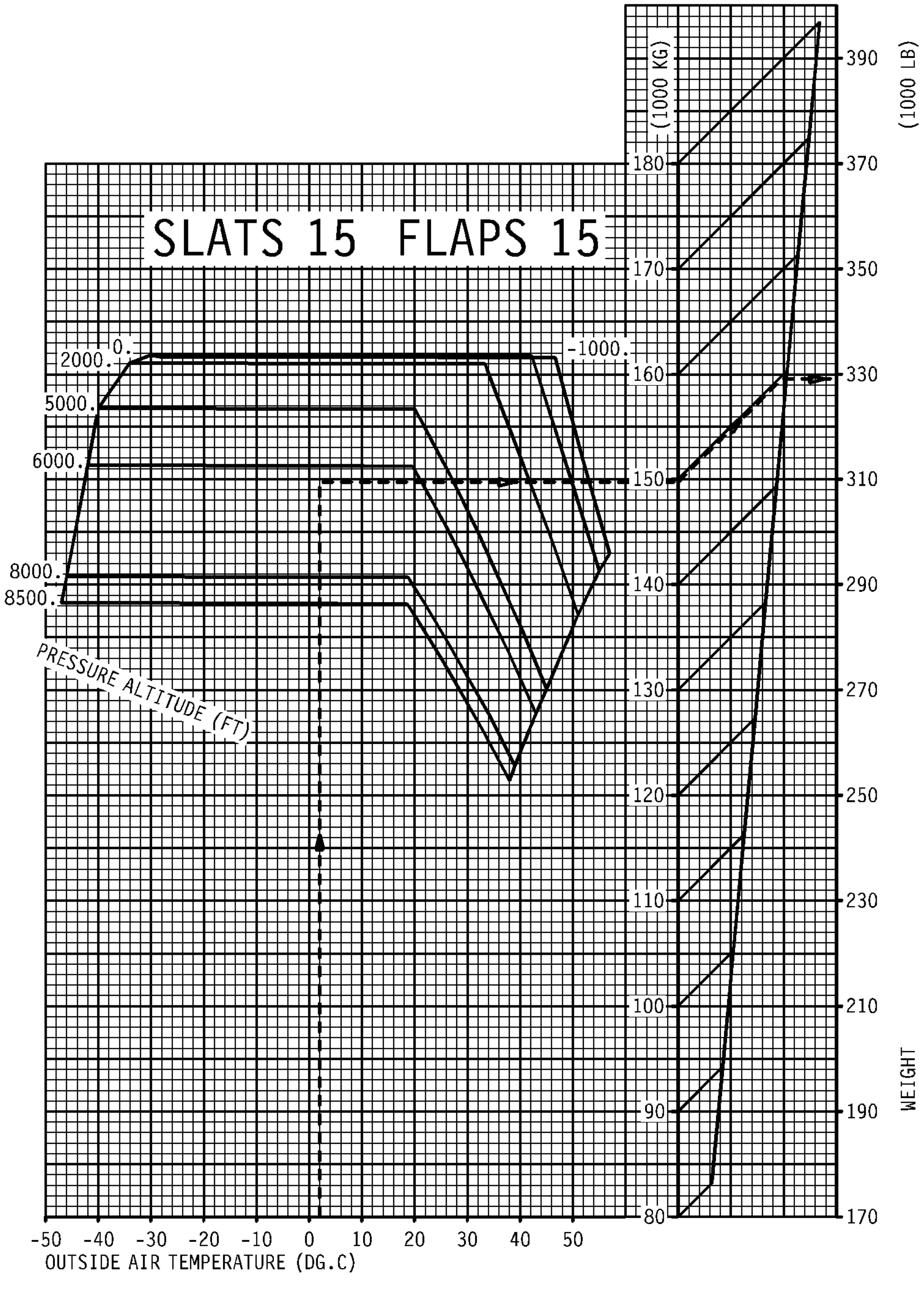
Mod. : 4863

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



Notes : 1. If air conditioning is OFF, an additional 2.5 tons (5500 lb) may be added to the limiting weight.
2. If nacelle anti-ice is ON, subtract 0.5 tons (1100 lb) to the limiting weight.
3. If total anti-ice is ON, subtract 2.5 tons (5500 lb) to the limiting weight.

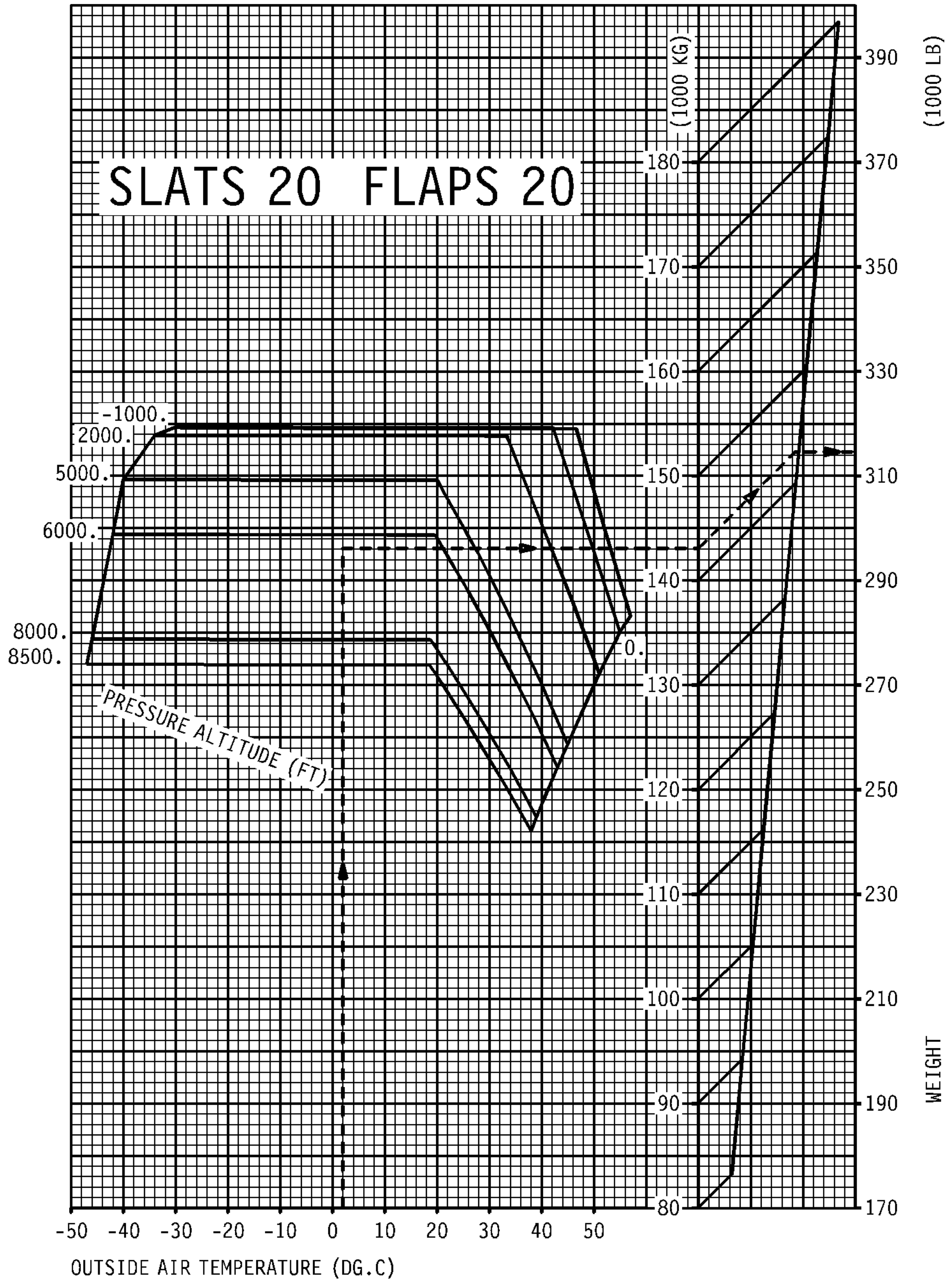
Mod. : 4863

PW Eng. : 4152

FAN THRUST DETERIORATION MODE

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



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Notes : 1. If air conditioning is OFF, an additional 2.5 tons (5500 lb) may be added to the limiting weight.
2. If nacelle anti-ice is ON, subtract 0.5 tons (1100 lb) to the limiting weight.
3. If total anti-ice is ON, subtract 1 tons (2200 lb) to the limiting weight.

Mod. : 4863

PW Eng. : 4152

CONTENTS

LANDING CONFIGURATION ▶		SLATS 20°/FLAPS 20°	SLATS 30°/FLAPS 40°
SPEED WEIGHT (1000 KG)	**F (KT IAS) 1.25 VS 15°/0°**	**1.3 VS 20°/20° (KT IAS) VREF + 10**	**VREF (KT IAS) 1.3 VS 30°/40°**
80	128	121	111
82	129	123	113
84	130	124	114
86	132	126	116
88	133	127	117
90	134	128	118
92	135	130	120
94	137	131	121
96	138	132	122
98	140	133	123
100	141	135	125
102	142	136	126
104	144	137	127
106	145	138	128
108	147	139	129
110	148	141	131
112	149	142	132
114	151	143	133
116	152	144	134
118	153	145	135
120	154	147	137
122	156	148	138
124	157	149	139
126	158	150	140
128	159	151	141
130	161	152	142
132	162	153	143
134	163	154	144
136	164	155	145
138	166	156	146
140	167	157	147
142	167	159	149
144	169	160	150
146	170	161	151
148	171	162	152
150	172	163	153
152	173	164	154
154	174	165	155
156	175	166	156
158	177	167	157
160	178	168	158

Mod. : 4863

1. GENERAL :

The actual landing distance is the distance measured between a point 50 feet above the runway threshold and the point where the complete stop of the aircraft is achieved, as demonstrated during the certification program.

In normal landing configuration approach speed is 1.3Vs of the configuration. The deceleration means are the brakes supplied by the green hydraulic system and the ground spoilers. Antiskid system is operative.

Regulation defines the required landing distance as the actual landing distance divided by 0.6, assuming the surface is dry.

If the surface is wet, the required landing distance must be at least 115 % of that for a dry surface, i.e. 1.92 times the actual landing distance on dry runway.
It must be checked before departure that the available runway length at destination is at least equal to the required landing distance for the forecasted landing weight.

Note : *The required landing distance can be less than the actual landing distance on contaminated or icy runway. Neither certification nor dispatch regulations take into account such conditions and the operating judgment of the pilot is paramount in assuring a safe operation.*

2. ACTUAL LANDING DISTANCE – ISA

SLATS 30°/FLAPS 40°

LANDING DISTANCE (METERS)									
WEIGHT (1000 KG)			**90**	**100**	**110**	**120**	**130**	**140**	**150**
VREF (KT IAS)			118	125	131	137	142	147	153
RUNWAY CONDITION		**DRY**	720	780	820	880	950	1040	1160
		WET	980	1060	1150	1240	1320	1420	1510
	COVERED WITH	**6.3 MM (1/4 IN) WATER**	1280	1420	1600	1780	2000	2230	2420
		12.7 MM (1/2 IN) WATER	1230	1350	1530	1700	1900	2100	2310
		6.3 MM (1/4 IN) SLUSH	1280	1420	1550	1700	1870	2050	2280
		12.7 MM (1/2 IN) SLUSH	1320	1450	1600	1750	1900	2100	2330
		COMPACTED SNOW	1140	1240	1340	1480	1530	1630	1730
		ICE	2700	2860	3040	3240	3420	3620	3820

SLATS 20°/FLAPS 20°

LANDING DISTANCE (METERS)									
WEIGHT (1000 KG)			**90**	**100**	**110**	**120**	**130**	**140**	**150**
1.3 Vs (KT IAS)			128	135	141	147	152	157	163
RUNWAY CONDITION		**DRY**	780	840	900	970	1060	1170	1320
		WET	1100	1200	1300	1410	1510	1610	1730
	COVERED WITH	**6.3 MM (1/4 IN) WATER**	1560	1810	2110	2350	2650	2960	3280
		12.7 MM (1/2 IN) WATER	1500	1730	1950	2220	2500	2780	3080
		6.3 MM (1/4 IN) SLUSH	1550	1730	1950	2200	2480	2750	3050
		12.7 MM (1/2 IN) SLUSH	1450	1670	1870	2100	2350	2630	2920
		COMPACTED SNOW	1330	1430	1550	1590	1740	1870	1990
		ICE	3320	3560	3720	3880	4200	4440	4680

CORRECTION ON LANDING DISTANCES

- **Wind** : per 5 kt tailwind add 10 %
  per 5 kt head wind subtract 2,5 %
- **Airport Elevation** : per 1000 ft above sea level add 5 %

- **With two reverses :**

Landing distances are decreased by :
- 5 % on dry runway
- 11 % on wet runway
- 18 % on runway covered with water or slush
- 15 % on runway covered with compacted snow
- 35 % on icy runway

Code : 0355

PW Eng. : All

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R Code : 0356

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R Code : 0357

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R Mod : 3219 or 4863

GENERAL

The autobrake system is designed to help the pilot in case of :

- aborted take-off or
- landing on short runways or
- operation with low visibility weather conditions

Furthermore, it assures a straight roll out and an optimized landing distance on contaminated runways. The table has been established for :

- dry runway
- wet runway
- runway covered with water, slush or compacted snow.

At landing the braking mode has to be selected according to :

- runway length
- configuration
- runway condition

Recommendations

- max mode is not recommended
- on a long and dry runway, use of the autobrake system is not necessary
- In order to save the brakes, use of reverse thrust is recommended.

SLATS 30° / FLAPS 40°

LANDING DISTANCE (METERS)											CORRECTION ON LANDING DISTANCE			
WEIGHT (1000 KG)			80	90	100	110	120	130	140	150	AIRPORT ELEV. ADD % per 1000 FT	REVERSE THRUST SUB %	5 KT TAILWIND ADD %	5 KT HEADWIND SUB %
RUNWAY CONDITION		MODE												
DRY		MAX	650	720	780	840	890	950	1 040	1 160	4	5	11	2
		MED	810	890	970	1 050	1 140	1 220	1 300	1 380		0		
		LOW	1 370	1 500	1 630	1 760	1 890	2 020	2 160	2 290		8		
WET		MAX	900	990	1 070	1 160	1 250	1 330	1 420	1 510	4	10	11	2
		MED	910	1 000	1 080	1 170	1 260	1 340	1 430	1 520		5		
		LOW	1 370	1 500	1 630	1 760	1 890	2 020	2 160	2 290		8		
COVERED WITH	6.3 MM (¼ IN) WATER	MAX or MED	1 230	1 370	1 510	1 710	1 920	2 160	2 390	2 630	6	19	10	2
		LOW	1 410	1 550	1 700	1 860	2 020	2 190	2 410	2 650		16		
	12.7 MM (½ IN) WATER	MAX or MED	1 190	1 320	1 460	1 630	1 840	2 050	2 260	2 500	6	17	10	2
		LOW	1 360	1 500	1 640	1 790	1 950	2 110	2 310	2 530		15		
	6.3 MM (¼ IN) SLUSH	MAX or MED	1 200	1 330	1 470	1 610	1 750	1 910	2 130	2 350	8	19	10	2
		LOW	1 370	1 510	1 650	1 790	1 940	2 090	2 250	2 410		14		
	12.7 MM (½ IN) SLUSH	MAX or MED	1 160	1 290	1 420	1 560	1 690	1 850	2 040	2 250	8	18	10	2
		LOW	1 330	1 470	1 600	1 740	1 880	2 020	2 180	2 340		14		
	COMPACTED SNOW	MAX or MED	1 050	1 150	1 250	1 350	1 440	1 540	1 640	1 730	5	14	10	2
		LOW	1 350	1 480	1 600	1 730	1 850	1 980	2 110	2 230		8		

SLATS 20° / FLAPS 20°

LANDING DISTANCE (METERS)											CORRECTION ON LANDING DISTANCE			
WEIGHT (1000 KG)			80	90	100	110	120	130	140	150	AIRPORT ELEV. ADD % per 1000 FT	REVERSE THRUST SUB %	5 KT TAILWIND ADD %	5 KT HEADWIND SUB %
RUNWAY CONDITION		MODE												
DRY		MAX	710	770	840	910	980	1 060	1 190	1 330	4	6	14	2
		MED	890	990	1 070	1 170	1 260	1 350	1 450	1 550		1		
		LOW	1 570	1 720	1 880	2 030	2 180	2 330	2 480	2 630		8		
WET		MAX	1 010	1 110	1 210	1 310	1 420	1 530	1 630	1 750	4	13	14	2
		MED	1 020	1 120	1 220	1 320	1 420	1 530	1 640	1 750		8		
		LOW	1 570	1 720	1 880	2 030	2 180	2 330	2 480	2 630		8		
COVERED WITH	6.3 MM (¼ IN) WATER	MAX or MED	1 460	1 660	1 940	2 230	2 530	2 860	3 200	3 560	6	24	10	2
		LOW	1 650	1 830	2 030	2 250	2 580	2 890	3 240	3 600		21		
	12.7 MM (½ IN) WATER	MAX or MED	1 400	1 570	1 830	2 090	2 380	2 670	2 990	3 320	6	23	10	2
		LOW	1 570	1 740	1 930	2 130	2 410	2 710	3 030	3 370		19		
	6.3 MM (¼ IN) SLUSH	MAX or MED	1 420	1 590	1 750	1 950	2 220	2 510	2 790	3 110	8	24	10	2
		LOW	1 620	1 780	1 950	2 130	2 330	2 350	2 810	3 130		21		
	12.7 MM (½ IN) SLUSH	MAX or MED	1 370	1 520	1 680	1 860	2 100	2 370	2 640	2 930	7	23	10	2
		LOW	1 550	1 710	1 870	2 040	2 230	2 420	2 670	2 960		19		
	COMPACTED SNOW	MAX or MED	1 200	1 310	1 420	1 540	1 650	1 770	1 880	2 000	5	16	10	2
		LOW	1 550	1 700	1 840	1 990	2 130	2 280	2 430	2 570		9		

R Code : 0361

PW Eng. : 7R4E1/4152

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1. 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).

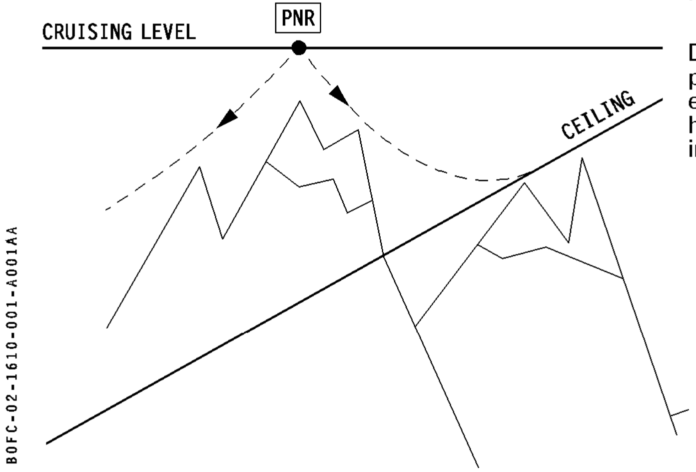
2. FLIGHT PREPARATION

ETOPS :

General information on ETOPS is given in chapter 2.18.70.

Montaneous area :

Obstacle clearance must be shown taking into account the applicable operational regulation which usually requires that, with one engine out, the net flight path clears the obstacle on the climb part by 1000 ft and on the drift down part by 2000 ft using the « EN ROUTE NET FLIGHT PATH » and « DRIFT DOWN NET CEILING » graphs. Refer to Flight Manual chapter 5. Obstacles at least 5 NM each side of the route must be considered. If the flight level and gross weight selected do not allow clearance of the en route obstacles, a point of no return (PNR) must be determined.



If an engine failure occurs after the PNR, the aircraft will drift down on course. If the failure occurs before the PNR, the aircraft will have to turn back.

Note : *If severe icing conditions are encountered, the ceiling is reduced by 2000 ft, due to ice accretion on non heated surfaces of the aircraft.*

3. DIVERSION STRATEGIES

Data for the following engine out diversion strategies are given in section 2.16.30, 2.16.40 and 2.16.50.

	STANDARD STRATEGY	OBSTACLE STRATEGY	FIXED SPEED STRATEGIES		
INITIAL DESCENT	.80/300	GREEN DOT	.80/300	.80/320	.80/340
thrust limit	MCT	MCT	MCT	MCT	MCT
CRUISE	LRC ceiling	Drift down ceiling	FL 210*	FL 190*	FL 180*
thrust limit	MCT	MCT	MCT	MCT	MCT
speed	LRC	green dot	.80/300	.80/320	.80/340
FINAL DESCENT	IDLE 300/250				
HOLDING	GREEN DOT SPEED				

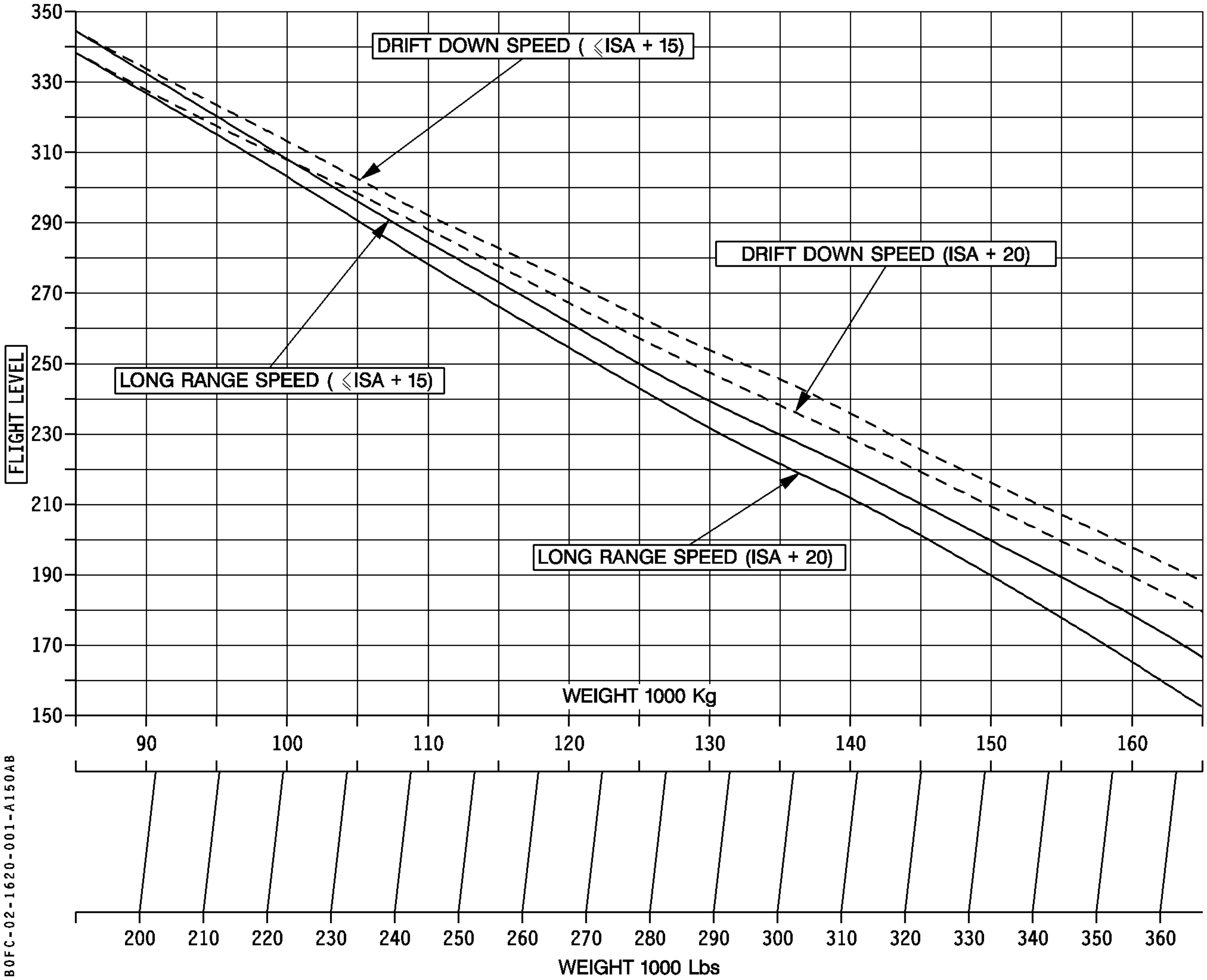
* or a predetermined altitude which clears the obstacles.

For ETOPS operations, any one of the above diversions 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 2.18.70,
. calculating the diversion fuel requirements for the single-engine ETOPS critical scenario, as provided in section 2.18.70
. 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.

ONE ENGINE GROSS CEILINGS
ANTI-ICING OFF – ONE AIR CONDITIONING PACK ON
MAX CONTINUOUS THRUST
C.G. POSITION = 27 %
NOMINAL THRUST



		⩽ ISA + 15	ISA + 20
DRIFT DOWN	ENG ANTI-ICE ON	– 200 ft	– 220 ft
	TOTAL ANTI-ICE ON	– 500 ft	– 600 ft
LONG RANGE	ENG ANTI-ICE ON	– 175 ft	– 200 ft
	TOTAL ANTI-ICE ON	– 600 ft	– 700 ft

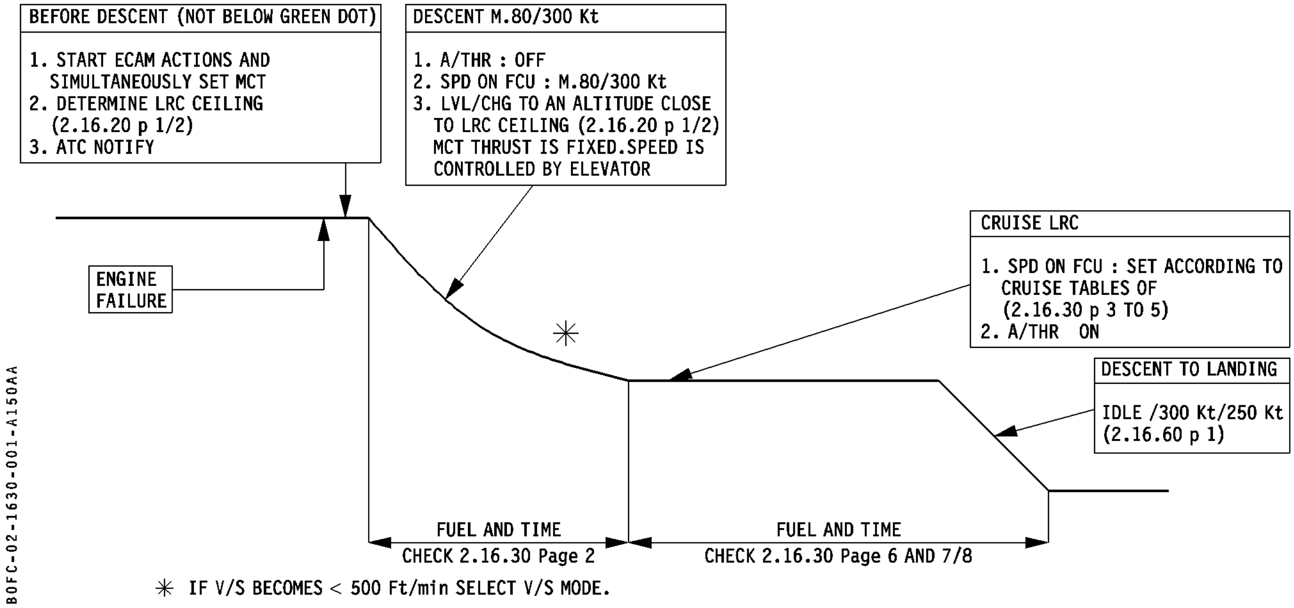
FAN THRUST DETERIORATION MODE

For weight ≤ 130000 kg/287000 lb. Ceiling value must be decreased by 600 ft.
For weight ≥ 140000 kg/309000 lb. Ceiling value must be decreased by 800 ft.
Linear variation of altitude decrement between the two weights.

Mod. : 4863 PW Eng. : 4000

1. GENERAL

Except if a specific procedure has been established before dispatch (ETOPS, mountaneous area) the recommended procedure is as follows :



BEFORE DESCENT (NOT BELOW GREEN DOT)
1. START ECAM ACTIONS AND SIMULTANEOUSLY SET MCT
2. DETERMINE LRC CEILING
R (2.16.20 p 1/2)
3. ATC NOTIFY

DESCENT M.80/300 Kt
1. A/THR : OFF
2. SPD ON FCU : M.80/300 Kt
3. LVL/CHG TO AN ALTITUDE CLOSE TO LRC CEILING (2.16.20 p 1/2) MCT THRUST IS FIXED.SPEED IS CONTROLLED BY ELEVATOR

CRUISE LRC
1. SPD ON FCU : SET ACCORDING TO CRUISE TABLES OF (2.16.30 p 3 TO 5)
2. A/THR ON

DESCENT TO LANDING
IDLE /300 Kt/250 Kt
(2.16.60 p 1)

✳ IF V/S BECOMES < 500 Ft/min SELECT V/S MODE.

2. EXAMPLE

– ASSUMED DATA

STANDARD STRATEGY IS APPLIED

Gross weight at engine failure : 140 000 kg
Flight level at engine failure : 330
Temperature : ISA
Distance to selected airport : 550 NM
No wind

– FIND FROM
2.16.20 page 1/2 Gross ceiling FL 220
2.16.30 page 2

	FL 330	FL 220	Initial Descent
Time (min)	42	24	18
Fuel burn (kg)	2804	1552	1252
Distance (NM)	285	151	134

R Initial Long Range Cruise gross weight = 138 748 kg
R Remaining cruise distance = 550-134 = 416 NM

2.16.30 page 6

Time to landing ≃ 1 H 19
R Fuel to landing ≃ 4311 + 24 x 25 = 4 911 kg

– SUMMARY
For the total distance from point of engine failure to the
R selected airport 6 163 kg of fuel are required, total flight
R time is 1 H 37 min.

DESCENT M.80 / 300 KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**MINIMUM RATE OF DESCENT = 500 FT/MIN**

WEIGHT (1000KG)	90				140				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
410	53.8	3233	375	MCT					237
390	51.7	3135	358	MCT					248
370	49.2	3013	339	MCT	44.9	2963	306	MCT	260
350	46.6	2873	319	MCT	43.6	2894	296	MCT	272
330	44.0	2724	299	MCT	42.1	2804	285	MCT	284
310	41.6	2569	280	MCT	40.3	2693	271	MCT	297
290	38.0	2332	253	V/S	37.7	2512	250	MCT	300
270	34.0	2071	222	V/S	34.0	2250	223	V/S	300
250	30.0	1819	193	V/S	30.0	1965	193	V/S	300
240	28.0	1695	179	V/S	28.0	1826	179	V/S	300
220	24.0	1448	151	V/S	24.0	1552	151	V/S	300
200	20.0	1203	124	V/S	20.0	1283	124	V/S	300
180	16.0	959	98	V/S	16.0	1019	98	V/S	300
160	12.0	718	72	V/S	12.0	760	72	V/S	300
140	8.0	477	47	V/S	8.0	504	47	V/S	300
120	4.0	238	23	V/S	4.0	251	23	V/S	300
100	.0	0	0	V/S	.0	0	0	V/S	300

CORRECTION ON FUEL CONSUMPTION (KG) AT ISO-DISTANCE BETWEEN FL330 AND FL 100 DUE TO

INITIAL WEIGHT	ENG.ANTI ICE ON	TOTAL ANTI ICE ON	△ISA (per 1° above ISA)
90000 KG	20	80	NEGLIGIBLE
140000 KG	20	70	NEGLIGIBLE

04 P-05 A310-324-01 PW4152 23200010C6KG270 0 018590 0 0 3 .0 .0 500.0 0 02 .800300.000 .000 0 FCOM-B0-02-16-30-002-150

Mod. : 4863 PW Eng. : 4000

LONG RANGE CRUISE 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EGT °C	**MACH**
EPR	**IAS**
KG/H	**TAS**
NM/1000KG	

WEIGHT (1000KG)	FL 50	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	359 .390 1.104 236 2980 253 85.1	351 .434 1.135 240 2997 277 92.4	343 .480 1.178 242 2970 301 101.3	343 .511 1.227 233 2828 314 111.0	346 .521 1.252 228 2768 318 114.7	351 .536 1.284 226 2756 324 117.6	354 .546 1.303 225 2764 329 118.9	364 .565 1.349 223 2779 337 121.3	374 .575 1.401 218 2771 340 122.8
90	364 .400 1.110 242 3146 260 82.6	352 .450 1.146 248 3202 287 89.6	346 .490 1.190 247 3117 307 98.5	350 .519 1.243 237 2967 319 107.4	354 .530 1.271 232 2920 323 110.5	361 .548 1.308 231 2934 332 113.0	366 .558 1.330 230 2945 336 114.0	374 .570 1.378 226 2937 340 115.9	388 .591 1.449 224 2995 350 116.8
95	366 .412 1.119 250 3342 268 80.2	355 .465 1.158 257 3403 297 87.2	350 .499 1.202 251 3260 313 95.9	357 .525 1.259 239 3099 322 104.0	363 .542 1.293 238 3107 331 106.4	372 .560 1.335 236 3119 339 108.5	376 .567 1.358 234 3116 341 109.5	388 .582 1.416 230 3141 347 110.6	401 .598 1.496 227 3187 354 111.0
100	367 .427 1.128 258 3555 277 78.0	358 .475 1.168 263 3568 304 85.1	356 .504 1.213 254 3384 316 93.4	365 .536 1.278 245 3277 329 100.4	372 .553 1.315 243 3286 337 102.5	381 .568 1.361 239 3287 343 104.4	386 .573 1.386 237 3284 345 105.0	401 .594 1.459 235 3356 355 105.6	418 .617 1.553 235 3473 365 105.1
105	368 .442 1.137 268 3784 287 75.9	361 .484 1.178 268 3718 309 83.1	362 .513 1.226 258 3538 321 90.8	374 .547 1.298 250 3464 336 97.0	383 .564 1.340 248 3477 344 98.8	392 .574 1.388 242 3462 347 100.2	399 .585 1.423 242 3503 352 100.5	413 .603 1.504 239 3571 360 100.8	438 .633 1.608 241 3771 375 99.4
110	370 .453 1.146 274 3971 294 74.1	364 .492 1.188 272 3866 314 81.3	368 .519 1.238 262 3680 325 88.4	383 .556 1.319 254 3642 341 93.8	391 .569 1.363 250 3635 347 95.5	404 .586 1.424 248 3687 354 96.1	411 .595 1.462 246 3717 358 96.4	429 .620 1.556 246 3859 370 95.8	
115	372 .465 1.156 282 4170 302 72.5	368 .500 1.198 277 4018 319 79.5	374 .525 1.251 265 3819 329 86.1	392 .565 1.342 259 3831 347 90.7	401 .576 1.389 253 3818 351 91.9	416 .597 1.462 252 3905 361 92.4	423 .606 1.505 251 3948 365 92.4	448 .635 1.607 253 4160 379 91.1	
120	375 .475 1.165 288 4348 309 71.0	372 .504 1.207 279 4141 322 77.7	380 .531 1.265 268 3976 333 83.7	400 .570 1.363 261 3989 350 87.8	413 .588 1.422 259 4049 358 88.4	428 .607 1.503 257 4138 367 88.7	438 .622 1.553 258 4243 374 88.2		
125	377 .483 1.173 292 4505 314 69.6	377 .510 1.216 282 4278 325 76.0	387 .541 1.281 273 4166 339 81.3	409 .576 1.386 264 4170 354 84.8	424 .598 1.458 264 4278 365 85.2	442 .622 1.548 263 4429 376 84.8	455 .636 1.599 264 4548 383 84.2		
130	380 .489 1.181 297 4657 318 68.3	382 .516 1.227 286 4430 329 74.3	394 .550 1.297 278 4355 345 79.1	420 .586 1.416 269 4399 360 81.9	434 .606 1.494 267 4493 369 82.2	458 .635 1.592 269 4727 384 81.1			
135	382 .496 1.189 301 4810 323 67.1	387 .521 1.237 288 4570 332 72.7	402 .556 1.314 281 4529 349 77.0	431 .599 1.450 275 4649 368 79.1	447 .620 1.535 273 4785 378 78.9				
140	386 .502 1.197 304 4954 326 65.8	392 .526 1.247 291 4714 335 71.2	409 .565 1.332 285 4721 354 74.9	440 .605 1.482 278 4860 372 76.5	462 .632 1.576 279 5087 385 75.7				
145	389 .505 1.204 306 5081 329 64.7	397 .531 1.258 294 4868 339 69.6	417 .572 1.351 289 4910 358 73.0	452 .618 1.519 284 5144 380 73.8					
150	393 .509 1.211 308 5204 331 63.5	403 .538 1.271 298 5054 344 68.0	423 .573 1.367 290 5052 359 71.1	465 .630 1.557 290 5443 387 71.1					
155	398 .514 1.220 312 5360 334 62.3	409 .546 1.284 303 5248 348 66.4	431 .579 1.387 293 5253 363 69.1						
160	402 .518 1.228 314 5506 337 61.2	415 .553 1.297 307 5437 353 64.9	441 .588 1.411 298 5494 369 67.1						
Engine Anti-ice ON	△FUEL = +0.6%				**Total Anti-ice ON**	△FUEL = +2%			

04 P-05 A310-324-01 PW4152 12200010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01 .990 .000 .000 0

FCOM-B0-02-16-30-003-150

Mod. : 4863

PW Eng. : 4000

LONG RANGE CRUISE 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

EGT °C	**MACH**
EPR	**IAS**
KG/H	**TAS**
NM/1000KG	

WEIGHT (1000KG)	FL 50	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	382 .389 1.104 235 3045 257 84.5	375 .434 1.135 239 3072 282 91.8	368 .480 1.178 241 3046 306 100.6	370 .511 1.229 233 2902 320 110.3	373 .521 1.253 228 2845 324 113.9	379 .536 1.286 225 2831 331 116.8	383 .545 1.305 225 2836 335 118.1	393 .564 1.350 223 2853 343 120.4	404 .574 1.403 218 2849 347 121.9
90	388 .399 1.111 242 3219 264 82.0	377 .449 1.146 248 3278 292 89.0	372 .490 1.191 247 3198 313 97.8	377 .518 1.244 237 3044 325 106.7	381 .530 1.273 232 3003 329 109.7	389 .548 1.310 231 3016 338 112.2	395 .558 1.332 230 3028 343 113.2	404 .570 1.380 225 3019 347 115.0	419 .589 1.450 224 3074 356 115.9
95	390 .412 1.119 249 3422 273 79.7	380 .465 1.159 257 3488 302 86.6	376 .499 1.202 251 3343 318 95.2	384 .524 1.260 239 3177 328 103.3	391 .542 1.294 238 3190 337 105.6	401 .560 1.337 236 3210 346 107.7	405 .567 1.360 234 3203 348 108.7	418 .581 1.418 230 3229 354 109.7	432 .596 1.498 226 3271 361 110.2
100	392 .427 1.128 258 3643 282 77.5	383 .475 1.169 263 3657 309 84.5	382 .504 1.214 254 3472 322 92.7	392 .535 1.279 244 3360 335 99.7	401 .553 1.317 243 3374 344 101.8	411 .567 1.362 239 3376 350 103.7	417 .573 1.388 237 3381 352 104.2	431 .593 1.461 235 3446 361 104.8	450 .614 1.554 233 3557 371 104.3
105	393 .441 1.138 267 3873 292 75.4	387 .484 1.179 268 3811 315 82.5	389 .512 1.227 258 3627 327 90.2	402 .546 1.299 250 3555 342 96.3	411 .563 1.342 248 3568 350 98.2	422 .574 1.390 242 3557 354 99.5	430 .585 1.425 242 3605 360 99.8	445 .602 1.507 239 3667 367 100.0	471 .631 1.611 240 3869 381 98.6
110	395 .453 1.147 274 4066 299 73.6	390 .492 1.189 272 3963 320 80.7	395 .519 1.239 261 3773 331 87.8	411 .555 1.320 254 3738 348 93.1	420 .568 1.365 250 3729 353 94.8	434 .586 1.426 247 3787 361 95.5	442 .595 1.465 246 3818 365 95.7	462 .619 1.559 246 3966 377 95.1	
115	397 .465 1.157 282 4276 308 72.0	393 .500 1.199 277 4117 325 78.9	401 .524 1.252 264 3913 335 85.5	421 .565 1.343 259 3935 354 90.0	431 .575 1.391 253 3919 358 91.2	446 .595 1.464 252 4003 367 91.7	454 .604 1.507 250 4051 371 91.7	481 .634 1.610 252 4276 386 90.3	
120	400 .475 1.165 288 4456 314 70.5	398 .504 1.208 279 4242 328 77.2	407 .531 1.266 268 4076 339 83.1	429 .570 1.364 261 4092 357 87.2	443 .587 1.425 258 4158 365 87.8	458 .604 1.504 256 4234 373 88.0	470 .619 1.554 257 4348 381 87.5		
125	402 .482 1.174 292 4615 319 69.1	403 .509 1.217 282 4383 331 75.5	415 .540 1.282 273 4271 345 80.8	439 .576 1.388 264 4283 361 84.2	454 .597 1.460 263 4385 371 84.6	473 .620 1.550 262 4538 382 84.2	488 .633 1.601 263 4659 389 83.5		
130	405 .489 1.182 296 4769 324 67.8	408 .515 1.228 285 4540 335 73.8	422 .550 1.299 277 4468 351 78.6	450 .586 1.418 269 4518 367 81.3	465 .605 1.496 267 4612 376 81.6	490 .633 1.594 268 4848 390 80.5			
135	408 .496 1.190 300 4923 328 66.6	414 .520 1.238 288 4684 338 72.2	430 .557 1.316 281 4648 355 76.4	461 .598 1.451 274 4767 375 78.6	479 .618 1.538 273 4906 384 78.3				
140	411 .501 1.197 304 5074 332 65.4	419 .525 1.248 291 4832 342 70.7	438 .564 1.334 285 4845 360 74.4	471 .603 1.483 277 4970 378 76.0	494 .631 1.578 279 5218 392 75.2				
145	415 .505 1.205 306 5203 334 64.2	424 .530 1.260 294 4989 345 69.1	446 .571 1.352 289 5034 365 72.4	483 .616 1.521 283 5267 386 73.2					
150	419 .508 1.212 308 5332 336 63.1	430 .538 1.272 298 5184 350 67.5	452 .573 1.369 290 5183 366 70.6	496 .628 1.559 289 5574 393 70.6					
155	424 .514 1.221 312 5494 340 61.9	437 .546 1.286 303 5382 355 65.9	461 .578 1.388 292 5384 369 68.6						
160	428 .518 1.229 314 5645 343 60.8	443 .553 1.299 307 5575 359 64.5	470 .588 1.413 297 5632 375 66.6						

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12200010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01 .990 .000 .000 10

Mod. : 4863

PW Eng. : 4000

LONG RANGE CRUISE 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=27.0%

EGT °C MACH
EPR IAS
KG/H TAS
NM/1000KG

WEIGHT (1000KG)	FL 50	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	407 .389 1.104 235 3118 262 83.9	400 .433 1.136 239 3143 287 91.2	394 .479 1.179 241 3116 312 100.0	397 .511 1.230 233 2981 326 109.5	400 .520 1.254 228 2917 330 113.1	406 .535 1.287 225 2902 337 116.0	411 .544 1.306 224 2907 341 117.3	422 .563 1.352 223 2928 350 119.5	435 .575 1.406 218 2937 355 120.9
90	412 .399 1.111 241 3295 268 81.4	402 .449 1.147 248 3360 297 88.4	398 .489 1.191 246 3272 318 97.2	404 .519 1.245 237 3126 331 106.0	409 .529 1.274 232 3079 336 109.0	418 .547 1.311 230 3092 344 111.4	423 .557 1.334 230 3106 349 112.4	434 .569 1.382 225 3099 354 114.2	450 .589 1.453 223 3157 363 115.0
95	415 .411 1.119 249 3496 277 79.1	405 .464 1.159 257 3573 307 86.0	402 .498 1.203 251 3423 324 94.6	411 .524 1.261 239 3260 334 102.6	419 .542 1.296 238 3275 344 104.9	430 .560 1.338 236 3293 352 107.0	435 .566 1.361 233 3283 354 107.9	448 .580 1.420 230 3314 361 108.9	464 .596 1.501 226 3365 368 109.4
100	416 .426 1.128 258 3725 287 76.9	409 .475 1.170 263 3741 314 83.9	408 .504 1.215 254 3559 328 92.1	420 .534 1.280 244 3446 341 99.0	430 .553 1.319 243 3466 350 101.1	440 .567 1.364 239 3464 357 102.9	447 .573 1.390 237 3470 359 103.4	462 .591 1.463 234 3529 367 104.1	482 .612 1.557 233 3649 378 103.5
105	418 .441 1.138 267 3969 297 74.9	412 .483 1.180 267 3899 320 82.0	415 .512 1.228 258 3720 333 89.5	429 .545 1.300 249 3640 348 95.7	441 .563 1.344 248 3663 357 97.5	452 .574 1.392 242 3655 361 98.8	460 .585 1.428 242 3702 367 99.0	476 .599 1.508 238 3753 373 99.3	
110	419 .452 1.147 274 4164 304 73.1	415 .492 1.190 272 4058 325 80.2	422 .519 1.240 261 3868 337 87.2	439 .555 1.322 254 3831 354 92.5	450 .567 1.366 249 3820 360 94.1	465 .586 1.429 248 3894 369 94.8	473 .594 1.467 246 3916 372 95.0	494 .616 1.560 245 4060 383 94.4	
115	422 .465 1.157 282 4377 313 71.4	419 .500 1.199 277 4216 331 78.4	428 .524 1.253 264 4008 340 84.9	450 .565 1.345 259 4033 361 89.4	461 .574 1.393 253 4018 364 90.6	477 .595 1.466 251 4108 374 91.1	486 .604 1.510 250 4158 378 91.0		
120	425 .474 1.166 288 4562 319 70.0	424 .504 1.209 279 4344 333 76.7	434 .530 1.267 267 4175 345 82.6	458 .568 1.365 260 4190 363 86.6	473 .586 1.426 258 4261 372 87.2	490 .604 1.507 255 4346 380 87.4	502 .619 1.557 257 4463 388 86.9		
125	427 .482 1.174 292 4726 324 68.7	429 .509 1.218 282 4492 337 75.0	442 .540 1.283 272 4374 351 80.2	469 .575 1.390 263 4392 367 83.6	485 .595 1.461 262 4486 377 84.1	506 .618 1.553 262 4653 389 83.6			
130	430 .489 1.182 296 4884 329 67.4	435 .515 1.229 285 4650 341 73.3	450 .549 1.300 277 4575 357 78.0	480 .586 1.420 269 4636 374 80.7	496 .602 1.498 265 4715 382 81.0				
135	433 .495 1.190 300 5043 333 66.1	440 .520 1.239 288 4797 344 71.7	458 .556 1.317 281 4762 362 75.9	492 .597 1.453 274 4885 381 78.0	510 .616 1.539 272 5018 390 77.8				
140	436 .501 1.198 304 5196 337 64.9	445 .525 1.249 291 4947 347 70.2	466 .564 1.335 285 4965 367 73.9	501 .601 1.484 276 5085 384 75.5					
145	440 .505 1.206 306 5328 340 63.8	451 .530 1.260 293 5103 350 68.7	474 .571 1.354 288 5156 371 71.9	515 .615 1.523 282 5397 392 72.7					
150	445 .508 1.213 308 5462 342 62.6	457 .538 1.274 298 5305 356 67.0	481 .573 1.370 289 5315 372 70.1						
155	450 .514 1.222 311 5624 346 61.4	464 .545 1.287 302 5511 361 65.5	490 .578 1.390 292 5522 376 68.1						
160	454 .518 1.230 314 5778 349 60.3	470 .552 1.300 306 5710 366 64.0	501 .588 1.415 297 5778 382 66.2						
Engine Anti-ice ON		△FUEL = +0.6%			**Total Anti-ice ON**		△FUEL = +2%		

04 P-05 A310-324-01 PW4152 12200010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01 .990 .000 .000 20

FCOM-B0-02-16-30-005-150

Mod. : 4863

PW Eng. : 4000

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE - LONG RANGE CRUISE - DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 115000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	100	**150**	**200**	**220**	**240**	**250**	**270**	**FL100 FL150**	**FL200 FL220**	**FL240 FL250**	**FL270**
100	1385 0.26	1149 0.25	984 0.24	925 0.24	869 0.24	842 0.23	795 0.23	3	1	0	0
125	1698 0.30	1437 0.30	1259 0.29	1195 0.28	1138 0.28	1111 0.28	1068 0.27	4	3	3	2
150	2010 0.35	1726 0.34	1533 0.33	1465 0.33	1407 0.32	1381 0.32	1340 0.31	6	5	5	5
175	2322 0.40	2015 0.39	1807 0.37	1736 0.37	1676 0.36	1650 0.36	1613 0.35	7	7	7	7
200	2634 0.45	2303 0.43	2081 0.42	2006 0.41	1946 0.40	1919 0.40	1886 0.39	9	9	9	10
225	2945 0.49	2590 0.48	2353 0.46	2274 0.45	2213 0.44	2186 0.44	2156 0.43	10	11	12	12
250	3256 0.54	2877 0.52	2625 0.50	2542 0.50	2480 0.49	2452 0.48	2426 0.47	12	12	14	14
275	3566 0.59	3164 0.57	2897 0.55	2810 0.54	2747 0.53	2719 0.52	2696 0.51	13	14	16	17
300	3877 1.04	3451 1.02	3170 0.59	3078 0.58	3013 0.57	2986 0.57	2965 0.55	15	16	18	19
325	4186 1.08	3737 1.06	3440 1.03	3344 1.03	3278 1.01	3250 1.01	3232 0.59	16	18	21	22
350	4494 1.13	4022 1.11	3710 1.08	3610 1.07	3543 1.05	3514 1.05	3500 1.03	18	20	23	24
375	4803 1.18	4307 1.15	3980 1.12	3876 1.11	3808 1.09	3778 1.09	3767 1.07	19	22	25	26
400	5112 1.23	4592 1.20	4251 1.16	4142 1.16	4073 1.14	4042 1.13	4034 1.11	21	24	27	29
425	5419 1.27	4876 1.25	4519 1.21	4406 1.20	4335 1.18	4303 1.18	4298 1.15	22	25	29	31
450	5727 1.32	5160 1.29	4787 1.25	4669 1.24	4597 1.22	4565 1.22	4562 1.19	23	27	32	33
475	6034 1.37	5443 1.34	5055 1.30	4933 1.29	4859 1.26	4827 1.26	4826 1.23	25	29	34	36
500	6341 1.42	5727 1.39	5323 1.34	5197 1.33	5122 1.31	5089 1.30	5090 1.27	26	31	36	38
525	6647 1.47	6009 1.43	5589 1.38	5458 1.37	5382 1.35	5348 1.34	5351 1.31	28	33	38	40
550	6952 1.51	6291 1.48	5856 1.43	5720 1.42	5642 1.39	5608 1.39	5612 1.35	29	35	40	42
575	7258 1.56	6573 1.52	6122 1.47	5981 1.46	5902 1.43	5868 1.43	5874 1.39	31	36	42	45
600	7563 2.01	6855 1.57	6388 1.52	6243 1.50	6162 1.48	6127 1.47	6135 1.43	32	38	44	47
625	7867 2.06	7136 2.02	6652 1.56	6503 1.55	6420 1.52	6385 1.51	6393 1.48	33	40	47	49
650	8171 2.11	7416 2.06	6917 2.00	6762 1.59	6678 1.56	6642 1.55	6652 1.52	35	42	49	51
675	8475 2.15	7697 2.11	7181 2.05	7022 2.03	6935 2.00	6899 1.59	6911 1.56	36	43	51	53
700	8779 2.20	7977 2.16	7446 2.09	7281 2.08	7193 2.05	7157 2.04	7169 2.00	38	45	53	56
725	9081 2.25	8256 2.20	7708 2.14	7539 2.12	7449 2.09	7412 2.08	7425 2.04	39	47	55	58
750	9383 2.30	8535 2.25	7971 2.18	7797 2.16	7705 2.13	7667 2.12	7681 2.08	40	49	57	60

FLIP20G A310-324 PW4152 3410 02701.001010 0 0 0 .0001 .000000 360 0 0350115 0 200200 65400 18590

FCOM-B0-02-16-30-006-150

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE - LONG RANGE CRUISE - DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 115000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	100	**150**	**200**	**220**	**240**	**250**	**270**	**FL100 FL150**	**FL200 FL220**	**FL240 FL250**	**FL270**
750	9383 2.30	8535 2.25	7971 2.18	7797 2.16	7705 2.13	7667 2.12	7681 2.08	40	49	57	60
775	9686 2.35	8813 2.29	8234 2.23	8055 2.21	7961 2.18	7922 2.16	7937 2.12	42	51	59	62
800	9988 2.40	9092 2.34	8497 2.27	8313 2.25	8217 2.22	8178 2.20	8193 2.16	43	52	61	64
825	10289 2.44	9369 2.39	8758 2.31	8569 2.30	8470 2.26	8431 2.25	8446 2.20	45	54	63	66
850	10589 2.49	9647 2.43	9019 2.36	8825 2.34	8724 2.30	8684 2.29	8699 2.24	46	56	65	68
875	10890 2.54	9924 2.48	9281 2.40	9081 2.38	8978 2.35	8937 2.33	8953 2.28	47	57	67	70
900	11190 2.59	10201 2.53	9542 2.45	9337 2.43	9232 2.39	9190 2.37	9206 2.33	49	59	69	72
925	11490 3.04	10477 2.57	9801 2.49	9592 2.47	9483 2.43	9441 2.42	9457 2.37	50	61	71	74
950	11789 3.09	10752 3.02	10061 2.54	9846 2.51	9735 2.48	9692 2.46	9707 2.41	52	63	73	76
975	12088 3.14	11028 3.07	10321 2.58	10101 2.56	9987 2.52	9943 2.50	9958 2.45	53	64	75	78
1000	12387 3.19	11303 3.11	10580 3.02	10355 3.00	10239 2.56	10194 2.54	10209 2.49	54	66	77	80
1025	12684 3.23	11577 3.16	10838 3.07	10608 3.04	10488 3.01	10443 2.58	10457 2.53	56	68	79	82
1050	12982 3.28	11851 3.21	11095 3.11	10860 3.09	10738 3.05	10692 3.03	10706 2.57	57	69	81	84
1075	13279 3.33	12125 3.25	11353 3.16	11113 3.13	10988 3.09	10941 3.07	10954 3.02	58	71	83	86
1100	13577 3.38	12399 3.30	11610 3.20	11366 3.17	11238 3.14	11190 3.11	11202 3.06	60	73	85	88
1125	13873 3.43	12671 3.35	11866 3.25	11617 3.22	11485 3.18	11436 3.15	11449 3.10	61	74	87	90
1150	14169 3.48	12943 3.40	12122 3.29	11868 3.26	11733 3.23	11683 3.20	11695 3.14	62	76	89	92
1175	14465 3.53	13216 3.44	12377 3.34	12119 3.30	11980 3.27	11929 3.24	11941 3.18	64	78	90	94
1200	14760 3.58	13488 3.49	12633 3.38	12370 3.35	12228 3.31	12176 3.28	12188 3.22	65	79	92	96
1225	15055 4.03	13759 3.54	12887 3.43	12619 3.39	12473 3.36	12420 3.33	12432 3.27	67	81	94	98
1250	15349 4.08	14030 3.58	13140 3.47	12868 3.43	12719 3.40	12665 3.37	12676 3.31	68	82	96	100
1275	15643 4.13	14300 4.03	13394 3.52	13118 3.48	12964 3.44	12909 3.41	12920 3.35	69	84	98	102
1300	15937 4.18	14571 4.08	13648 3.56	13367 3.52	13210 3.49	13154 3.45	13165 3.39	71	86	100	104
1325	16230 4.23	14840 4.12	13900 4.01	13615 3.56	13453 3.53	13397 3.50	13407 3.43	72	87	101	106
1350	16523 4.27	15109 4.17	14153 4.05	13863 4.01	13697 3.58	13639 3.54	13649 3.47	73	89	103	108
1375	16815 4.32	15378 4.22	14405 4.10	14110 4.05	13941 4.02	13882 3.58	13891 3.52	75	90	105	110
1400	17108 4.37	15648 4.27	14657 4.14	14358 4.10	14184 4.07	14124 4.03	14133 3.56	76	92	107	112

FLIP20G A310-324 PW4152 3410 02701.001010 0 0 0 .0001 .000000 360 0 0350115 0 200200 65400 18590

FCOM-B0-02-16-30-007-150

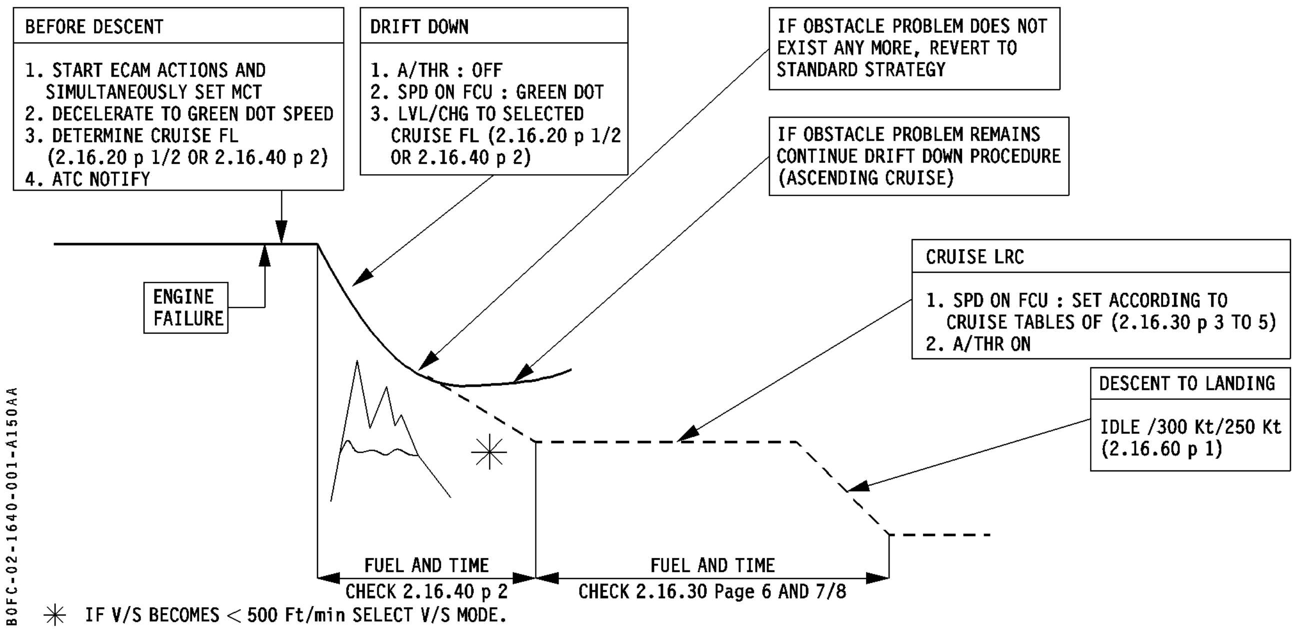
1. GENERAL

In order to maintain the highest level possible, the drift down procedure must be used.

The drift-down procedure requires maximum continuous thrust on the remaining engine at green dot speed.

- If, having reached drift-down ceiling altitude, obstacle problem persists, the drift-down procedure is continued to make an ascending cruise.
- If, after drift-down, obstacles are cleared, the subsequent cruise should be made using either, the long range cruise (LRC) by adjusting speed as a function of aircraft weight, or, by maintaining the speed given at the start of the LRC.

Note : Due to the fact that the LRC speed is higher than the drift-down speed, cruise will be made at an altitude lower than the drift down ceiling. (See graph « ONE ENGINE GROSS CEILINGS » 2.16.20 page 1/2).



BEFORE DESCENT
1. START ECAM ACTIONS AND SIMULTANEOUSLY SET MCT
2. DECELERATE TO GREEN DOT SPEED
3. DETERMINE CRUISE FL (2.16.20 p 1/2 OR 2.16.40 p 2)
4. ATC NOTIFY

DRIFT DOWN
1. A/THR : OFF
2. SPD ON FCU : GREEN DOT
3. LVL/CHG TO SELECTED CRUISE FL (2.16.20 p 1/2 OR 2.16.40 p 2)

IF OBSTACLE PROBLEM DOES NOT EXIST ANY MORE, REVERT TO STANDARD STRATEGY

IF OBSTACLE PROBLEM REMAINS CONTINUE DRIFT DOWN PROCEDURE (ASCENDING CRUISE)

CRUISE LRC
1. SPD ON FCU : SET ACCORDING TO CRUISE TABLES OF (2.16.30 p 3 TO 5)
2. A/THR ON

DESCENT TO LANDING
IDLE /300 Kt/250 Kt (2.16.60 p 1)

FUEL AND TIME CHECK 2.16.40 p 2

FUEL AND TIME CHECK 2.16.30 Page 6 AND 7/8

✳ IF V/S BECOMES < 500 Ft/min SELECT V/S MODE.

2. EXAMPLE

ASSUMED DATA :

DRIFT DOWN PROCEDURE IS SELECTED

Gross weight at engine failure = 140 000 kg
Flight level at engine failure = 330
Temperature = ISA
Distance to selected airport = 550 NM
No wind.

FIND FROM :

2.16.40 page 2 : Initial drift down speed = 254 kt
R Drift down distance = 312 NM
R Drift down fuel = 3680 kg
Drift down time = 52 min
Gross ceiling = 24 200 ft

2.16.20 page 1/2 : After drift down continue cruise either at drift down speed to maintain the level off altitude, or, if no terrain problem clearance exists; accelerate to the LRC speed. This of course requires of further loss in altitude. New max altitude for gross weight = 136 320 kg is 22 R
700 ft.

2.16.30 page 6 : From :
– Initial LRC gross weight = 136 320 kg R
– LRC level = 220
– Remaining cruise distance :
550 - 312 = 238 NM R
Find fuel and time to landing at LRC :
– Fuel 2413 + 21 × 12 = 2 665 kg R
– Time = 0 h 48 min R

SUMMARY :

For the total distance from point of engine failure to the selected airport 6 345 kg of fuel are required, total flight R
time is 1 h 40 min. R

GROSS FLIGHT PATH DESCENT AT DRIFT DOWN SPEED

MAX. CONTINUOUS THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI ICING OFF

ISA
CG=27.0%

DIST.(NM) TIME (MIN)
INIT. SPEED (KT) FUEL (100KG)
LEVEL OFF (FT)

INIT. GW	INITIAL FLIGHT LEVEL									
(1000KG)	**230**	**250**	**270**	**290**	**310**	**330**	**350**	**370**	**390**	**410**
90							187 30.4 219 15.8 33800	254 40.7 223 20.8 33900	293 46.5 226 23.5 33900	321 50.4 230 25.1 34000
95						100 16.6 219 9.1 32500	223 36.4 223 19.5 32800	269 43.5 226 22.9 32800	304 48.5 230 25.2 32900	328 51.8 234 26.7 32900
100						187 31.0 223 17.4 31600	246 40.3 226 22.3 31700	284 46.1 230 25.1 31800	312 50.0 233 26.9 31800	334 52.9 237 28.2 31900
105					102 17.1 223 10.1 30400	217 36.1 227 20.9 30700	262 43.0 230 24.6 30700	293 47.7 233 26.9 30800	319 51.4 237 28.6 30800	337 53.6 240 29.6 30800
110					183 30.8 227 18.7 29600	239 39.8 231 23.8 29700	275 45.3 234 26.7 29800	301 49.0 237 28.5 29800	324 52.3 240 30.1 29800	341 54.5 243 31.1 29900
115				99 16.8 228 10.7 28500	213 35.8 232 22.4 28700	255 42.4 234 26.1 28800	285 47.0 237 28.6 28800	309 50.4 241 30.3 28800	329 53.1 243 31.5 28900	343 54.9 247 32.3 28900
120				178 30.2 233 19.8 27700	234 39.3 236 25.3 27800	267 44.4 238 28.2 27800	295 48.6 241 30.5 27900	315 51.4 244 31.9 27900	334 54.0 247 33.1 27900	345 55.4 250 33.7 27900
125			94 16.1 234 11.1 26500	209 35.4 237 23.8 26800	250 42.0 240 27.8 26900	281 46.6 242 30.5 26900	304 50.0 245 32.4 26900	323 52.7 248 33.7 27000	339 54.8 250 34.7 27000	348 55.9 250 35.2 27000
130			172 29.3 239 20.7 25800	229 38.7 241 26.8 25900	265 44.3 244 30.3 26000	290 48.0 246 32.4 26000	312 51.2 249 34.2 26000	330 53.8 251 35.5 26100	343 55.5 254 36.3 26100	
135		85 14.6 241 10.8 24700	203 34.6 243 25.0 24900	247 41.6 245 29.7 25000	276 46.0 248 32.4 25100	301 49.8 250 34.6 25100	320 52.5 253 36.1 25100	335 54.5 255 37.1 25200	348 56.2 257 37.9 25200	
140		165 28.2 245 21.3 24000	227 38.5 248 28.6 24100	264 44.3 250 32.5 24200	289 48.2 252 34.9 24200	312 51.5 254 36.8 24200	329 53.8 256 38.1 24300	344 55.9 258 39.2 24300		
145	66 11.4 248 9.0 22800	200 34.0 250 26.4 23100	247 41.6 252 31.8 23200	277 46.4 254 35.0 23300	299 49.7 256 37.0 23300	321 52.8 258 38.9 23400	336 54.9 260 40.0 23400	350 56.8 262 41.0 23400		
150	116 19.7 253 15.9 22100	224 38.0 255 30.2 22300	261 43.9 256 34.4 22400	289 48.2 258 37.3 22400	311 51.4 260 39.4 22500	330 54.1 262 40.9 22500	345 56.1 264 42.1 22500	356 57.6 266 42.8 22500		
155	191 32.6 257 27.0 21400	241 40.6 259 33.1 21500	275 46.0 261 37.0 21600	300 49.7 262 39.5 21600	320 52.7 264 41.4 21600	336 55.0 266 42.7 21700	351 56.9 267 43.8 21700			
160	216 36.5 262 31.0 20600	258 43.2 264 36.2 20700	286 47.6 265 39.3 20700	309 51.0 267 41.6 20800	328 53.7 268 43.4 20800	343 55.9 270 44.6 20800	356 57.6 271 45.6 20800			

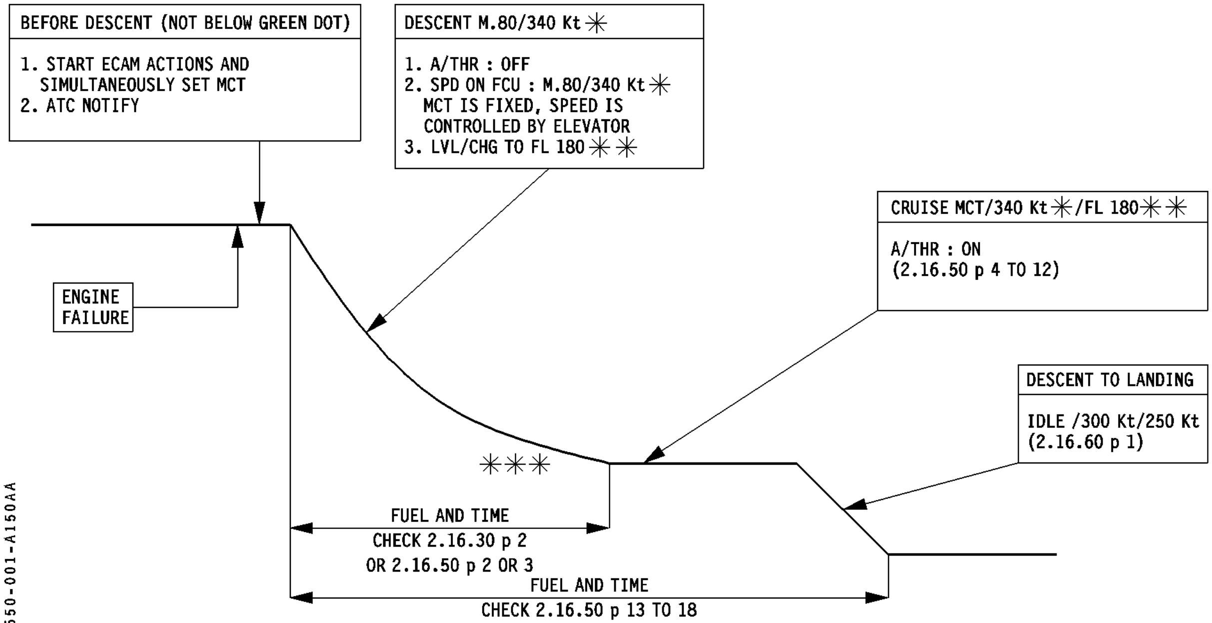
CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENG. ANTI-ICE ON	+2%	+2%	+2%	- 200FT
TOTAL ANTI-ICE ON	+3.5%	+4.5%	+4.5%	- 500FT
PER 1°C ABOVE ISA	+2.5%	+1.5%	+2.5%%	- 130FT

FOR CRUISE AT LONG RANGE SPEED
REFER TO 2.16.30 PAGES 3 TO 5

FOR IN CRUISE QUICK CHECK FOR ANY MOMENT IN CRUISE TO LANDING
AT LONG RANGE SPEED REFER TO 2.16.30 P 6 and 7/8.

1. GENERAL

R This section provides single engine performance data for
R three fixed speed diversion strategies (fixed descent and
R cruise speed schedules) recommended for ETOPS operation.



BEFORE DESCENT (NOT BELOW GREEN DOT)

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

DESCENT M.80/340 Kt ✳

1. A/THR : OFF
2. SPD ON FCU : M.80/340 Kt ✳ MCT IS FIXED, SPEED IS CONTROLLED BY ELEVATOR
3. LVL/CHG TO FL 180 ✳✳

CRUISE MCT/340 Kt ✳/FL 180 ✳✳

A/THR : ON
(2.16.50 p 4 TO 12)

DESCENT TO LANDING

IDLE /300 Kt/250 Kt
(2.16.60 p 1)

✳ USE 340 Kt OR 320 Kt OR 300 Kt AS ESTABLISHED BEFORE DISPATCH

✳✳ USE FL 180 OR ANY FL ESTABLISHED BEFORE DISPATCH

✳✳✳ IF V/S BECOMES < 500 Ft/min SELECT V/S MODE.

2. EXAMPLE

ASSUMED DATA :

R FIXED SPEED STRATEGY IS APPLIED

Gross weight at engine failure = 140 000 kg
Flight level at engine failure = 330
Temperature = ISA
Distance to selected airport = 550 NM
No wind.
Speed selected before dispatch = 340 kt
Flight level for diversion selected before dispatch = 180

FIND FROM :

2.16.50 page 17

Total flight time ≃ 1 h 25
Total fuel to landing ≃ 6 578 + 10 × 11 = 6 688 kg

R 3. INITIAL DESCENT

Refer to 2.16.30 page 2

DESCENT M.80 / 320 KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**MINIMUM RATE OF DESCENT = 500 FT/MIN**

WEIGHT (1000KG)	**90**				**140**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
410	51.2	3427	370	MCT					237
390	49.0	3329	353	MCT					248
370	46.5	3208	334	MCT	42.2	3063	300	MCT	260
350	43.9	3067	314	MCT	40.9	2994	290	MCT	272
330	41.4	2918	294	MCT	39.3	2904	279	MCT	284
310	38.9	2763	275	MCT	37.6	2794	265	MCT	297
290	36.5	2605	257	MCT	35.7	2666	250	MCT	311
270	34.0	2416	236	MCT	33.4	2497	232	MCT	320
250	30.0	2116	206	V/S	30.0	2231	206	V/S	320
240	28.0	1968	190	V/S	28.0	2072	190	V/S	320
220	24.0	1680	161	V/S	24.0	1762	161	V/S	320
200	20.0	1397	132	V/S	20.0	1458	132	V/S	320
180	16.0	1115	104	V/S	16.0	1160	104	V/S	320
160	12.0	835	77	V/S	12.0	865	77	V/S	320
140	8.0	555	50	V/S	8.0	573	50	V/S	320
120	4.0	277	25	V/S	4.0	285	25	V/S	320
100	.0	0	0	V/S	.0	0	0	V/S	320

CORRECTION ON FUEL CONSUMPTION (KG) AT ISO-DISTANCE BETWEEN FL330 AND FL 100 DUE TO

INITIAL WEIGHT	**ENG.ANTI ICE ON**	**TOTAL ANTI ICE ON**	**△ISA (per 1° above ISA)**
90000 KG	20	80	2
140000 KG	20	70	NEGLIGIBLE

04 P-05 A310-324-01 PW4152 23200010C6KG270 0 018590 0 0 3 .0 .0 500.0 0 02 .800320.000 .000 0 FCOM-B0-02-16-50-002-150

DESCENT M.80 / 340 KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**MINIMUM RATE OF DESCENT = 500 FT/MIN**

WEIGHT (1000KG)	**90**				**140**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
410	48.1	3529	358	MCT					237
390	45.9	3431	341	MCT					248
370	43.4	3309	322	MCT	39.2	3119	290	MCT	260
350	40.8	3169	302	MCT	38.0	3050	280	MCT	272
330	38.2	3019	283	MCT	36.4	2960	268	MCT	284
310	35.8	2865	263	MCT	34.7	2850	255	MCT	297
290	33.4	2707	245	MCT	32.8	2722	240	MCT	311
270	31.2	2544	227	MCT	30.8	2578	224	MCT	324
250	29.1	2381	211	MCT	28.8	2423	209	MCT	338
240	27.8	2270	200	MCT	27.5	2314	198	MCT	340
220	24.0	1944	170	V/S	24.0	2007	170	V/S	340
200	20.0	1610	140	V/S	20.0	1657	140	V/S	340
180	16.0	1285	110	V/S	16.0	1318	110	V/S	340
160	12.0	963	81	V/S	12.0	985	81	V/S	340
140	8.0	641	54	V/S	8.0	654	54	V/S	340
120	4.0	320	26	V/S	4.0	325	26	V/S	340
100	.0	0	0	V/S	.0	0	0	V/S	340

CORRECTION ON FUEL CONSUMPTION (KG) AT ISO-DISTANCE BETWEEN FL330 AND FL 100 DUE TO

INITIAL WEIGHT	**ENG.ANTI ICE ON**	**TOTAL ANTI ICE ON**	**△ISA (per 1° above ISA)**
90000 KG	30	90	NEGLIGIBLE
140000 KG	20	70	NEGLIGIBLE

04 P-05 A310-324-01 PW4152 23200010C6KG270 0 018590 0 0 3 .0 .0 500.0 0 02 .800340.000 .000 0 FCOM-B0-02-16-50-003-150

EMERGENCY DESCENT M.84 / 340 KT - 1 ENGINE OUT

IDLE THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

AIRBRAKES EXTENDED

WEIGHT (1000KG)	**90**				**140**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	IAS (KT)
410	3.4	25	26	IDLE					250
390	3.2	24	24	IDLE					262
370	3.0	22	22	IDLE	4.1	31	31	IDLE	274
350	2.8	21	21	IDLE	3.9	29	29	IDLE	287
330	2.6	20	19	IDLE	3.7	28	27	IDLE	300
310	2.5	19	18	IDLE	3.5	26	26	IDLE	314
290	2.3	18	17	IDLE	3.3	25	24	IDLE	328
270	2.2	16	16	IDLE	3.1	23	23	IDLE	340
250	1.9	15	14	IDLE	2.8	21	20	IDLE	340
240	1.8	14	13	IDLE	2.6	19	19	IDLE	340
220	1.6	11	11	IDLE	2.2	16	16	IDLE	340
200	1.3	9	9	IDLE	1.9	14	13	IDLE	340
180	1.1	7	7	IDLE	1.5	11	10	IDLE	340
160	.8	5	5	IDLE	1.2	8	8	IDLE	340
140	.5	4	4	IDLE	.8	5	5	IDLE	340
120	.3	2	2	IDLE	.4	3	3	IDLE	340
100	.0	0	0	IDLE	.0	0	0	IDLE	340

04 P-05 A310-324-01 PW4152 23310010C6KG270 0 018590 0 0-1 .0 .0 .0 0 02 .840340.000 .000 0

FCOM-B0-02-16-50-003a-150

CRUISE - MCT/300KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	**FL100**	**FL150**	**FL160**	**FL170**	**FL180**	**FL190**	**FL200**	**FL210**
85	374 .541 1.193 300 4249 345 81.3	388 .593 1.257 300 4294 371 86.5	391 .604 1.275 300 4317 377 87.3	395 .615 1.293 300 4339 383 88.2	399 .627 1.315 300 4362 388 89.0	404 .639 1.338 300 4386 394 89.9	410 .651 1.364 300 4415 400 90.6	417 .664 1.390 300 4427 406 91.7
90	375 .541 1.196 300 4288 345 80.5	390 .593 1.263 300 4345 371 85.5	394 .604 1.281 300 4369 377 86.3	398 .615 1.300 300 4393 383 87.1	402 .627 1.323 300 4417 388 87.9	407 .639 1.347 300 4442 394 88.7	414 .651 1.374 300 4478 400 89.3	421 .664 1.400 300 4491 406 90.4
95	377 .541 1.200 300 4333 345 79.7	392 .593 1.270 300 4400 371 84.4	396 .604 1.288 300 4426 377 85.2	400 .615 1.309 300 4451 383 86.0	405 .627 1.332 300 4475 388 86.8	410 .639 1.357 300 4506 394 87.5	418 .651 1.385 300 4544 400 88.0	425 .664 1.412 300 4560 406 89.1
100	379 .541 1.205 300 4381 345 78.8	394 .593 1.276 300 4456 371 83.4	398 .604 1.295 300 4483 377 84.1	403 .615 1.317 300 4507 383 84.9	407 .627 1.340 300 4533 388 85.7	414 .639 1.367 300 4571 394 86.2	422 .651 1.395 300 4610 400 86.8	428 .664 1.424 300 4628 406 87.8
105	381 .541 1.210 300 4433 345 77.9	397 .593 1.284 300 4516 371 82.2	401 .604 1.303 300 4543 377 83.0	405 .615 1.325 300 4568 383 83.8	410 .627 1.350 300 4595 388 84.5	418 .639 1.377 300 4639 394 85.0	426 .651 1.407 300 4678 400 85.5	432 .664 1.437 300 4699 406 86.4
110	383 .541 1.215 300 4490 345 76.9	399 .593 1.291 300 4580 371 81.1	404 .604 1.312 300 4607 377 81.8	408 .615 1.335 300 4633 383 82.6	414 .627 1.360 300 4668 388 83.2	422 .639 1.388 300 4714 394 83.6	430 .651 1.420 300 4755 400 84.1	436 .664 1.451 300 4779 406 85.0
115	385 .541 1.220 300 4544 345 76.0	402 .593 1.299 300 4645 371 80.0	407 .604 1.321 300 4674 377 80.6	411 .615 1.345 300 4702 383 81.4	419 .627 1.372 300 4748 388 81.8	427 .639 1.401 300 4795 394 82.2	434 .651 1.434 300 4837 400 82.7	440 .664 1.467 300 4873 406 83.3
120	387 .541 1.226 300 4608 345 74.9	405 .593 1.309 300 4721 371 78.7	410 .604 1.331 300 4750 377 79.4	415 .615 1.356 300 4784 383 80.0	423 .627 1.384 300 4834 388 80.3	431 .639 1.415 300 4880 394 80.8	438 .651 1.449 300 4923 400 81.3	445 .664 1.485 300 4974 406 81.7
125	389 .541 1.233 300 4677 345 73.8	409 .593 1.319 300 4798 371 77.4	413 .604 1.342 300 4829 377 78.1	420 .615 1.368 300 4874 383 78.5	428 .627 1.397 300 4924 388 78.9	435 .639 1.430 300 4971 394 79.3	442 .651 1.467 300 5026 400 79.6	450 .664 1.503 300 5081 406 79.9
130	392 .541 1.240 300 4747 345 72.7	412 .593 1.330 300 4881 371 76.1	417 .604 1.354 300 4916 377 76.7	425 .615 1.381 300 4971 383 77.0	433 .627 1.412 300 5021 388 77.3	440 .639 1.446 300 5067 394 77.8	447 .651 1.485 300 5136 400 77.9	456 .664 1.523 300 5200 406 78.1
135	395 .541 1.247 300 4826 345 71.6	416 .593 1.341 300 4969 371 74.8	422 .604 1.367 300 5018 377 75.1	431 .615 1.395 300 5072 383 75.4	438 .627 1.428 300 5120 388 75.8	445 .639 1.465 300 5178 394 76.1	453 .651 1.505 300 5253 400 76.2	462 .664 1.545 300 5327 406 76.2
140	398 .541 1.255 300 4908 345 70.4	420 .593 1.353 300 5062 371 73.4	428 .604 1.380 300 5122 377 73.6	436 .615 1.411 300 5176 383 73.9	442 .627 1.445 300 5226 388 74.3	450 .639 1.485 300 5300 394 74.4	459 .651 1.527 300 5388 400 74.3	463 .651 1.558 294 5328 398 74.7
145	401 .541 1.263 300 4995 345 69.1	425 .593 1.367 300 5177 371 71.8	434 .604 1.396 300 5240 377 71.9	441 .615 1.429 300 5293 383 72.3	448 .627 1.466 300 5356 388 72.5	456 .639 1.507 300 5439 394 72.5	465 .649 1.550 299 5515 399 72.3	464 .632 1.568 285 5278 387 73.3
150	404 .541 1.273 300 5090 345 67.9	431 .593 1.382 300 5298 371 70.1	439 .604 1.413 300 5361 377 70.3	446 .615 1.448 300 5416 383 70.6	454 .627 1.488 300 5496 388 70.7	463 .639 1.532 300 5594 394 70.5	466 .632 1.559 291 5470 388 71.0	464 .606 1.581 273 5206 371 71.2
155	408 .541 1.282 300 5188 345 66.6	437 .593 1.397 300 5424 371 68.5	444 .604 1.431 300 5484 377 68.7	452 .615 1.469 300 5553 383 68.9	460 .627 1.511 300 5642 388 68.8	465 .625 1.544 293 5582 385 69.1	466 .608 1.571 279 5405 374 69.1	464 .567 1.599 254 5099 347 68.0
160	411 .541 1.292 300 5288 345 65.3	442 .593 1.415 300 5546 371 67.0	450 .604 1.450 300 5610 377 67.2	458 .615 1.492 300 5696 383 67.2	464 .618 1.529 296 5699 383 67.2	465 .601 1.556 281 5516 371 67.2	467 .574 1.588 263 5313 353 66.4	

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 0

CRUISE - MCT/300KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	400 .541 1.194 300 4359 352 80.7	416 .593 1.259 300 4411 379 85.8	420 .604 1.277 300 4435 384 86.6	424 .615 1.295 300 4459 390 87.5	428 .627 1.317 300 4483 396 88.3	433 .639 1.341 300 4508 402 89.2	440 .651 1.367 300 4540 408 89.9	448 .664 1.393 300 4553 414 91.0
90	401 .541 1.197 300 4399 352 80.0	418 .593 1.265 300 4463 379 84.8	422 .604 1.283 300 4489 384 85.6	426 .615 1.303 300 4514 390 86.4	431 .627 1.325 300 4538 396 87.2	436 .639 1.350 300 4565 402 88.0	444 .651 1.377 300 4604 408 88.6	452 .664 1.403 300 4620 414 89.7
95	403 .541 1.201 300 4445 352 79.1	420 .593 1.272 300 4520 379 83.8	424 .604 1.290 300 4547 384 84.5	429 .615 1.311 300 4573 390 85.3	434 .627 1.334 300 4599 396 86.1	440 .639 1.360 300 4632 402 86.8	449 .651 1.388 300 4672 408 87.3	455 .664 1.415 300 4689 414 88.4
100	405 .541 1.206 300 4495 352 78.3	422 .593 1.278 300 4577 379 82.7	427 .604 1.297 300 4605 384 83.4	431 .615 1.319 300 4631 390 84.2	437 .627 1.343 300 4658 396 85.0	444 .639 1.369 300 4699 402 85.5	453 .651 1.398 300 4739 408 86.1	459 .664 1.427 300 4759 414 87.1
105	407 .541 1.211 300 4548 352 77.3	425 .593 1.285 300 4639 379 81.6	429 .604 1.305 300 4667 384 82.3	434 .615 1.328 300 4693 390 83.1	440 .627 1.352 300 4723 396 83.8	448 .639 1.380 300 4769 402 84.3	456 .651 1.410 300 4809 408 84.8	463 .664 1.440 300 4832 414 85.7
110	409 .541 1.216 300 4606 352 76.4	428 .593 1.293 300 4704 379 80.5	432 .604 1.314 300 4732 384 81.2	437 .615 1.337 300 4759 390 82.0	444 .627 1.363 300 4798 396 82.5	453 .639 1.391 300 4845 402 83.0	460 .651 1.423 300 4888 408 83.5	467 .664 1.454 300 4916 414 84.3
115	411 .541 1.222 300 4661 352 75.5	430 .593 1.301 300 4771 379 79.4	435 .604 1.323 300 4801 384 80.0	441 .615 1.347 300 4830 390 80.7	449 .627 1.374 300 4880 396 81.1	457 .639 1.404 300 4928 402 81.6	465 .651 1.437 300 4972 408 82.1	472 .664 1.471 300 5012 414 82.7
120	413 .541 1.228 300 4727 352 74.4	434 .593 1.311 300 4848 379 78.1	439 .604 1.333 300 4879 384 78.8	445 .615 1.359 300 4916 390 79.3	454 .627 1.387 300 4968 396 79.7	462 .639 1.418 300 5016 402 80.1	469 .651 1.452 300 5062 408 80.6	477 .664 1.488 300 5115 414 81.0
125	416 .541 1.234 300 4798 352 73.3	437 .593 1.321 300 4927 379 76.8	442 .604 1.344 300 4959 384 77.5	450 .615 1.371 300 5009 390 77.9	459 .627 1.400 300 5061 396 78.2	466 .639 1.433 300 5109 402 78.7	474 .651 1.470 300 5168 408 79.0	482 .664 1.507 300 5227 414 79.3
130	419 .541 1.241 300 4870 352 72.2	441 .593 1.332 300 5012 379 75.5	447 .604 1.356 300 5051 384 76.1	455 .615 1.384 300 5107 390 76.4	463 .627 1.415 300 5159 396 76.8	471 .639 1.449 300 5207 402 77.2	479 .651 1.489 300 5280 408 77.3	488 .664 1.527 300 5349 414 77.5
135	422 .541 1.248 300 4950 352 71.1	445 .593 1.343 300 5102 379 74.2	452 .604 1.369 300 5155 384 74.5	461 .615 1.398 300 5211 390 74.8	468 .627 1.431 300 5261 396 75.3	476 .639 1.468 300 5323 402 75.5	485 .651 1.508 300 5402 408 75.5	495 .664 1.548 300 5478 414 75.6
140	425 .541 1.256 300 5034 352 69.9	449 .593 1.355 300 5199 379 72.8	458 .604 1.383 300 5262 384 73.0	466 .615 1.414 300 5318 390 73.3	473 .627 1.448 300 5369 396 73.7	481 .639 1.488 300 5448 402 73.8	491 .651 1.530 300 5540 408 73.7	495 .648 1.560 293 5451 405 74.2
145	428 .541 1.265 300 5124 352 68.6	455 .593 1.369 300 5317 379 71.2	464 .604 1.398 300 5383 384 71.4	471 .615 1.432 300 5436 390 71.7	479 .627 1.469 300 5504 396 71.9	488 .639 1.511 300 5591 402 71.9	497 .647 1.551 298 5643 405 71.8	495 .630 1.569 284 5399 393 72.8
150	431 .541 1.274 300 5221 352 67.4	461 .593 1.384 300 5442 379 69.6	469 .604 1.416 300 5506 384 69.8	477 .615 1.451 300 5564 390 70.1	485 .627 1.492 300 5647 396 70.1	495 .639 1.535 300 5750 402 69.9	497 .630 1.560 290 5596 395 70.5	496 .603 1.583 271 5324 376 70.7
155	435 .541 1.283 300 5321 352 66.1	467 .593 1.400 300 5569 379 68.0	475 .604 1.434 300 5631 384 68.2	483 .615 1.472 300 5705 390 68.4	492 .627 1.514 300 5798 396 68.3	496 .623 1.545 292 5709 392 68.6	498 .605 1.573 278 5528 379 68.6	496 .563 1.602 252 5211 351 67.4
160	438 .541 1.293 300 5423 352 64.9	472 .593 1.417 300 5695 379 66.5	480 .604 1.453 300 5763 384 66.7	489 .615 1.495 300 5851 390 66.7	495 .616 1.530 294 5828 389 66.7	496 .598 1.558 280 5642 376 66.7	498 .571 1.590 261 5432 358 65.9	

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 10

FCOM-B0-02-16-50-005-150

Mod. : 4863

PW Eng. : 4000

CRUISE - MCT/300KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	426 .541 1.195 300 4469 358 80.1	443 .593 1.261 300 4527 386 85.2	448 .604 1.278 300 4552 391 86.0	452 .615 1.297 300 4577 397 86.8	457 .627 1.319 300 4602 403 87.7	463 .639 1.343 300 4629 410 88.5	471 .651 1.370 300 4665 416 89.2	479 .664 1.396 300 4679 422 90.2
90	427 .541 1.198 300 4509 358 79.4	446 .593 1.267 300 4580 386 84.2	450 .604 1.285 300 4607 391 85.0	455 .615 1.305 300 4633 397 85.8	460 .627 1.328 300 4659 403 86.6	466 .639 1.352 300 4689 410 87.3	475 .651 1.380 300 4731 416 87.9	483 .664 1.407 300 4747 422 89.0
95	429 .541 1.203 300 4558 358 78.6	448 .593 1.273 300 4638 386 83.1	453 .604 1.292 300 4666 391 83.9	458 .615 1.313 300 4693 397 84.7	463 .627 1.336 300 4721 403 85.5	470 .639 1.362 300 4758 410 86.1	479 .651 1.390 300 4800 416 86.6	487 .664 1.419 300 4819 422 87.6
100	431 .541 1.207 300 4608 358 77.7	450 .593 1.280 300 4697 386 82.1	455 .604 1.299 300 4726 391 82.8	460 .615 1.321 300 4753 397 83.6	466 .627 1.345 300 4781 403 84.4	474 .639 1.372 300 4826 410 84.9	484 .651 1.401 300 4869 416 85.4	490 .664 1.431 300 4890 422 86.4
105	433 .541 1.212 300 4662 358 76.8	453 .593 1.287 300 4759 386 81.0	458 .604 1.307 300 4789 391 81.7	463 .615 1.330 300 4816 397 82.5	470 .627 1.355 300 4850 403 83.2	479 .639 1.382 300 4898 410 83.6	487 .651 1.413 300 4941 416 84.2	494 .664 1.443 300 4965 422 85.1
110	435 .541 1.218 300 4722 358 75.8	456 .593 1.295 300 4826 386 79.9	461 .604 1.316 300 4855 391 80.6	466 .615 1.339 300 4884 397 81.4	474 .627 1.365 300 4927 403 81.9	483 .639 1.394 300 4976 410 82.3	491 .651 1.426 300 5021 416 82.8	499 .664 1.458 300 5053 422 83.6
115	437 .541 1.223 300 4778 358 74.9	459 .593 1.303 300 4894 386 78.8	464 .604 1.325 300 4926 391 79.5	470 .615 1.349 300 4957 397 80.2	479 .627 1.377 300 5010 403 80.5	488 .639 1.407 300 5061 410 80.9	496 .651 1.440 300 5107 416 81.4	504 .664 1.474 300 5152 422 82.0
120	440 .541 1.229 300 4846 358 73.9	462 .593 1.313 300 4973 386 77.5	468 .604 1.335 300 5005 391 78.2	475 .615 1.361 300 5047 397 78.7	484 .627 1.389 300 5100 403 79.1	492 .639 1.421 300 5150 410 79.5	500 .651 1.456 300 5202 416 80.0	509 .664 1.492 300 5257 422 80.3
125	443 .541 1.236 300 4918 358 72.8	466 .593 1.323 300 5055 386 76.3	471 .604 1.346 300 5087 391 76.9	480 .615 1.373 300 5141 397 77.3	489 .627 1.402 300 5196 403 77.6	497 .639 1.436 300 5245 410 78.1	505 .651 1.473 300 5310 416 78.3	515 .664 1.511 300 5373 422 78.6
130	445 .541 1.242 300 4991 358 71.7	470 .593 1.334 300 5141 386 75.0	476 .604 1.358 300 5184 391 75.5	485 .615 1.386 300 5242 397 75.8	494 .627 1.418 300 5295 403 76.2	502 .639 1.453 300 5348 410 76.6	511 .651 1.492 300 5425 416 76.7	515 .654 1.520 295 5370 416 77.5
135	449 .541 1.250 300 5074 358 70.6	474 .593 1.345 300 5233 386 73.7	482 .604 1.371 300 5291 391 74.0	491 .615 1.400 300 5349 397 74.3	499 .627 1.434 300 5400 403 74.7	507 .639 1.471 300 5467 410 74.9	516 .651 1.512 300 5548 416 74.9	515 .640 1.528 289 5327 407 76.4
140	452 .541 1.258 300 5160 358 69.4	479 .593 1.357 300 5335 386 72.3	488 .604 1.385 300 5400 391 72.5	496 .615 1.416 300 5457 397 72.8	504 .627 1.451 300 5512 403 73.2	513 .639 1.491 300 5595 410 73.2	517 .637 1.519 293 5511 407 73.9	515 .622 1.537 280 5280 396 75.0
145	455 .541 1.266 300 5252 358 68.2	484 .593 1.371 300 5456 386 70.7	494 .604 1.400 300 5524 391 70.9	502 .615 1.434 300 5579 397 71.2	510 .627 1.472 300 5650 403 71.4	515 .629 1.504 295 5616 403 71.8	517 .621 1.528 285 5465 396 72.5	515 .597 1.549 269 5214 380 72.9
150	459 .541 1.275 300 5351 358 66.9	491 .593 1.386 300 5583 386 69.1	500 .604 1.418 300 5649 391 69.3	508 .615 1.454 300 5710 397 69.6	514 .622 1.489 297 5725 400 69.8	516 .612 1.513 287 5571 393 70.5	517 .598 1.540 274 5404 382 70.6	516 .564 1.566 253 5131 359 69.9
155	462 .541 1.285 300 5454 358 65.6	497 .593 1.402 300 5713 386 67.5	505 .604 1.437 300 5777 391 67.7	513 .614 1.474 299 5837 396 67.9	515 .604 1.498 289 5676 389 68.5	516 .590 1.525 276 5513 378 68.6	517 .568 1.555 260 5330 363 68.1	
160	466 .541 1.294 300 5558 358 64.4	503 .593 1.419 300 5841 386 66.0	511 .604 1.456 300 5913 391 66.2	513 .597 1.483 291 5789 385 66.6	515 .583 1.509 278 5623 375 66.7	516 .560 1.539 262 5439 359 66.0		
Engine Anti-ice ON			△FUEL = +0.6%		**Total Anti-ice ON**		△FUEL = +2%	

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 20 FCOM-B0-02-16-50-006-150

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	392 .576 1.222 320 4829 368 76.2	408 .631 1.302 320 4917 395 80.4	413 .643 1.324 320 4940 401 81.2	417 .655 1.346 320 4954 407 82.2	423 .667 1.370 320 4962 413 83.2	430 .680 1.395 320 4976 419 84.2	436 .692 1.423 320 4999 425 85.1	444 .706 1.453 320 5026 432 85.9
90	393 .576 1.226 320 4869 368 75.6	410 .631 1.308 320 4963 395 79.7	415 .643 1.330 320 4988 401 80.4	420 .655 1.354 320 5005 407 81.3	426 .667 1.378 320 5018 413 82.3	433 .680 1.404 320 5035 419 83.2	440 .692 1.433 320 5062 425 84.0	447 .706 1.465 320 5096 432 84.7
95	395 .576 1.230 320 4910 368 74.9	412 .631 1.314 320 5013 395 78.9	417 .643 1.337 320 5039 401 79.6	423 .655 1.362 320 5062 407 80.4	429 .667 1.386 320 5076 413 81.4	436 .680 1.413 320 5096 419 82.3	443 .692 1.443 320 5123 425 83.0	450 .706 1.476 320 5165 432 83.6
100	396 .576 1.234 320 4953 368 74.3	415 .631 1.321 320 5066 395 78.0	419 .643 1.345 320 5094 401 78.7	426 .655 1.370 320 5123 407 79.5	433 .667 1.395 320 5137 413 80.4	439 .680 1.423 320 5159 419 81.2	446 .692 1.453 320 5189 425 82.0	454 .706 1.488 320 5237 432 82.4
105	398 .576 1.238 320 5001 368 73.6	417 .631 1.329 320 5124 395 77.1	422 .643 1.353 320 5156 401 77.8	430 .655 1.379 320 5189 407 78.4	436 .667 1.405 320 5206 413 79.3	443 .680 1.434 320 5231 419 80.1	450 .692 1.466 320 5271 425 80.7	458 .706 1.501 320 5318 432 81.2
110	400 .576 1.243 320 5052 368 72.8	419 .631 1.337 320 5184 395 76.3	426 .643 1.362 320 5222 401 76.8	433 .655 1.389 320 5256 407 77.4	440 .667 1.416 320 5275 413 78.3	446 .680 1.445 320 5302 419 79.1	454 .692 1.479 320 5350 425 79.5	462 .706 1.515 320 5403 432 79.9
115	401 .576 1.248 320 5102 368 72.1	422 .631 1.345 320 5243 395 75.4	429 .643 1.371 320 5289 401 75.8	437 .655 1.398 320 5323 407 76.5	443 .667 1.427 320 5345 413 77.3	450 .680 1.457 320 5378 419 77.9	458 .692 1.492 320 5433 425 78.3	467 .706 1.529 320 5491 432 78.6
120	403 .576 1.253 320 5160 368 71.3	425 .631 1.353 320 5309 395 74.5	433 .643 1.380 320 5358 401 74.9	440 .655 1.408 320 5393 407 75.5	446 .667 1.438 320 5418 413 76.2	453 .680 1.470 320 5463 419 76.7	462 .692 1.506 320 5522 425 77.0	467 .700 1.534 317 5498 428 77.9
125	405 .576 1.259 320 5224 368 70.4	428 .631 1.362 320 5383 395 73.4	437 .643 1.390 320 5433 401 73.8	443 .655 1.420 320 5471 407 74.4	450 .667 1.450 320 5498 413 75.1	457 .680 1.484 320 5553 419 75.5	466 .692 1.521 320 5619 425 75.7	467 .691 1.539 313 5467 423 77.3
130	407 .576 1.265 320 5286 368 69.6	432 .631 1.372 320 5462 395 72.4	441 .643 1.401 320 5514 401 72.8	447 .655 1.432 320 5553 407 73.3	454 .667 1.464 320 5593 413 73.9	462 .680 1.500 320 5651 419 74.2	468 .688 1.531 318 5651 422 74.8	466 .681 1.544 308 5430 416 76.7
135	410 .576 1.272 320 5357 368 68.7	437 .631 1.383 320 5548 395 71.3	444 .643 1.413 320 5599 401 71.6	451 .655 1.445 320 5640 407 72.2	458 .667 1.479 320 5693 413 72.5	467 .679 1.516 320 5759 419 72.8	467 .678 1.536 313 5616 416 74.1	465 .668 1.550 302 5387 409 75.9
140	413 .576 1.279 320 5434 368 67.7	441 .631 1.394 320 5637 395 70.1	448 .643 1.426 320 5689 401 70.5	455 .655 1.460 320 5739 407 70.9	463 .667 1.495 320 5799 413 71.2	466 .670 1.521 315 5724 413 72.2	466 .666 1.542 307 5574 409 73.4	463 .651 1.558 294 5328 398 74.7
145	415 .576 1.287 320 5512 368 66.8	445 .631 1.407 320 5731 395 69.0	452 .643 1.440 320 5783 401 69.4	459 .655 1.476 320 5847 407 69.6	464 .662 1.506 317 5831 410 70.2	465 .658 1.527 309 5682 406 71.4	465 .649 1.550 299 5515 399 72.3	464 .632 1.568 285 5278 387 73.3
150	418 .576 1.295 320 5595 368 65.8	449 .631 1.421 320 5829 395 67.8	456 .643 1.455 320 5886 401 68.1	463 .653 1.491 319 5940 406 68.4	463 .650 1.512 311 5789 402 69.5	464 .642 1.535 301 5631 396 70.3	466 .632 1.559 291 5470 388 71.0	464 .606 1.581 273 5206 371 71.2
155	421 .576 1.304 320 5684 368 64.7	453 .631 1.435 320 5932 395 66.6	461 .643 1.472 320 6002 401 66.8	463 .643 1.497 314 5906 399 67.6	464 .635 1.520 304 5748 393 68.4	465 .625 1.544 293 5582 385 69.1	466 .608 1.571 279 5405 374 69.1	464 .567 1.599 254 5099 347 68.0
160	424 .576 1.313 320 5773 368 63.7	458 .631 1.450 320 6040 395 65.5	462 .636 1.482 316 6025 397 65.8	463 .629 1.504 307 5864 391 66.6	464 .618 1.529 296 5699 383 67.2	465 .601 1.556 281 5516 371 67.2	467 .574 1.588 263 5313 353 66.4	

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	419 .576 1.223 320 4956 375 75.6	437 .631 1.304 320 5050 403 79.8	442 .643 1.326 320 5075 409 80.6	447 .655 1.349 320 5089 415 81.5	453 .667 1.373 320 5102 421 82.6	461 .680 1.398 320 5118 427 83.5	468 .692 1.427 320 5143 434 84.4	476 .706 1.457 320 5174 440 85.1
90	420 .576 1.227 320 4997 375 75.0	439 .631 1.310 320 5097 403 79.0	444 .643 1.333 320 5123 409 79.8	450 .655 1.356 320 5144 415 80.7	457 .667 1.381 320 5158 421 81.6	464 .680 1.407 320 5178 427 82.5	471 .692 1.436 320 5207 434 83.3	479 .706 1.469 320 5245 440 84.0
95	422 .576 1.231 320 5039 375 74.4	441 .631 1.317 320 5148 403 78.3	446 .643 1.340 320 5176 409 79.0	453 .655 1.364 320 5202 415 79.8	460 .667 1.389 320 5218 421 80.7	467 .680 1.417 320 5241 427 81.6	474 .692 1.446 320 5271 434 82.3	483 .706 1.480 320 5315 440 82.9
100	423 .576 1.235 320 5083 375 73.7	443 .631 1.324 320 5203 403 77.4	449 .643 1.347 320 5232 409 78.2	456 .655 1.373 320 5264 415 78.8	464 .667 1.398 320 5281 421 79.7	470 .680 1.427 320 5305 427 80.6	478 .692 1.457 320 5340 434 81.2	486 .706 1.492 320 5389 440 81.7
105	425 .576 1.240 320 5131 375 73.0	446 .631 1.331 320 5262 403 76.6	452 .643 1.356 320 5297 409 77.2	460 .655 1.382 320 5332 415 77.8	467 .667 1.409 320 5351 421 78.7	474 .680 1.438 320 5378 427 79.5	482 .692 1.470 320 5424 434 80.0	491 .706 1.505 320 5473 440 80.5
110	427 .576 1.244 320 5184 375 72.3	449 .631 1.339 320 5323 403 75.7	455 .643 1.365 320 5365 409 76.2	464 .655 1.391 320 5401 415 76.8	470 .667 1.419 320 5422 421 77.7	477 .680 1.449 320 5451 427 78.4	486 .692 1.483 320 5505 434 78.8	495 .706 1.519 320 5561 440 79.2
115	428 .576 1.249 320 5236 375 71.6	451 .631 1.347 320 5384 403 74.8	459 .643 1.373 320 5433 409 75.3	467 .655 1.401 320 5470 415 75.9	474 .667 1.430 320 5494 421 76.7	481 .680 1.461 320 5532 427 77.3	490 .692 1.496 320 5590 434 77.6	499 .705 1.532 320 5639 440 78.0
120	430 .576 1.255 320 5296 375 70.8	454 .631 1.355 320 5453 403 73.9	463 .643 1.383 320 5504 409 74.3	471 .655 1.411 320 5542 415 74.9	477 .667 1.441 320 5569 421 75.6	485 .680 1.474 320 5618 427 76.1	494 .692 1.510 320 5682 434 76.4	499 .698 1.535 316 5624 435 77.4
125	433 .576 1.261 320 5361 375 69.9	458 .631 1.365 320 5529 403 72.9	467 .643 1.393 320 5580 409 73.3	474 .655 1.423 320 5621 415 73.8	481 .667 1.454 320 5654 421 74.5	489 .680 1.488 320 5711 427 74.8	499 .692 1.525 320 5781 434 75.0	498 .689 1.540 312 5592 430 76.9
130	435 .576 1.267 320 5425 375 69.1	462 .631 1.375 320 5610 403 71.8	471 .643 1.404 320 5663 409 72.2	478 .655 1.435 320 5706 415 72.7	485 .667 1.468 320 5750 421 73.2	494 .680 1.503 320 5813 427 73.5	500 .686 1.532 317 5780 430 74.3	497 .678 1.545 307 5554 423 76.2
135	437 .576 1.274 320 5497 375 68.2	467 .631 1.385 320 5698 403 70.7	475 .643 1.416 320 5750 409 71.1	482 .655 1.448 320 5795 415 71.6	490 .667 1.483 320 5853 421 72.0	498 .677 1.517 319 5890 426 72.3	499 .676 1.537 312 5744 423 73.7	496 .666 1.551 301 5510 416 75.5
140	440 .576 1.281 320 5576 375 67.2	471 .631 1.397 320 5789 403 69.6	479 .643 1.429 320 5842 409 70.0	486 .655 1.463 320 5899 415 70.3	494 .667 1.499 320 5962 421 70.6	497 .667 1.522 314 5853 420 71.7	498 .664 1.543 306 5701 416 73.0	495 .648 1.560 293 5451 405 74.2
145	443 .576 1.288 320 5655 375 66.3	475 .631 1.409 320 5885 403 68.5	483 .643 1.443 320 5939 409 68.8	491 .655 1.479 320 6009 415 69.1	495 .659 1.507 316 5963 416 69.8	496 .655 1.528 308 5810 412 71.0	497 .647 1.551 298 5643 405 71.8	495 .630 1.569 284 5399 393 72.8
150	446 .576 1.296 320 5741 375 65.3	480 .631 1.423 320 5986 403 67.3	487 .643 1.458 320 6047 409 67.6	493 .651 1.492 318 6074 413 68.0	494 .647 1.513 310 5922 409 69.0	496 .640 1.536 300 5760 402 69.9	497 .630 1.560 290 5596 395 70.5	496 .603 1.583 271 5324 376 70.7
155	449 .576 1.305 320 5832 375 64.2	484 .631 1.438 320 6090 403 66.2	492 .643 1.475 320 6165 409 66.3	493 .641 1.498 313 6040 406 67.2	495 .633 1.521 303 5879 400 68.0	496 .623 1.545 292 5709 392 68.6	498 .605 1.573 278 5528 379 68.6	496 .563 1.602 252 5211 351 67.4
160	453 .576 1.315 320 5923 375 63.3	488 .631 1.453 320 6204 403 64.9	493 .634 1.483 315 6162 403 65.4	494 .627 1.505 306 5998 397 66.2	495 .616 1.530 294 5828 389 66.7	496 .598 1.558 280 5642 376 66.7	498 .571 1.590 261 5432 358 65.9	

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 10 FCOM-B0-02-16-50-008-150

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=27.0%

EGT °C	MACH
EPR	IAS
KG/H	TAS
NM/1000KG	

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	446 .576 1.225 320 5081 381 75.1	466 .631 1.306 320 5183 410 79.2	471 .643 1.329 320 5210 416 79.9	476 .655 1.352 320 5227 423 80.9	484 .667 1.376 320 5240 429 81.9	492 .680 1.401 320 5257 436 82.8	499 .692 1.430 320 5284 442 83.7	508 .706 1.461 320 5318 449 84.4
90	447 .576 1.228 320 5123 381 74.4	468 .631 1.312 320 5232 410 78.4	473 .643 1.335 320 5260 416 79.2	480 .655 1.359 320 5283 423 80.0	487 .667 1.384 320 5298 429 81.0	495 .680 1.410 320 5320 436 81.9	503 .692 1.440 320 5350 442 82.7	511 .706 1.473 320 5391 449 83.3
95	449 .576 1.232 320 5165 381 73.8	470 .631 1.319 320 5284 410 77.7	476 .643 1.342 320 5313 416 78.4	483 .655 1.367 320 5342 423 79.1	491 .667 1.392 320 5359 429 80.1	498 .680 1.420 320 5383 436 80.9	506 .692 1.449 320 5415 442 81.7	515 .706 1.484 320 5463 449 82.2
100	450 .576 1.236 320 5211 381 73.2	473 .631 1.326 320 5340 410 76.8	478 .643 1.350 320 5371 416 77.5	487 .655 1.376 320 5406 423 78.2	494 .667 1.401 320 5424 429 79.1	502 .680 1.430 320 5449 436 79.9	510 .692 1.461 320 5488 442 80.6	519 .705 1.495 320 5529 449 81.1
105	452 .576 1.241 320 5260 381 72.5	475 .631 1.333 320 5400 410 76.0	482 .643 1.358 320 5439 416 76.6	490 .655 1.385 320 5476 423 77.2	498 .667 1.412 320 5496 429 78.1	505 .680 1.441 320 5525 436 78.8	514 .692 1.474 320 5574 442 79.3	519 .699 1.498 317 5519 445 80.6
110	454 .576 1.246 320 5314 381 71.8	478 .631 1.341 320 5463 410 75.1	486 .643 1.367 320 5509 416 75.6	494 .655 1.394 320 5546 423 76.2	501 .667 1.422 320 5568 429 77.1	509 .680 1.452 320 5601 436 77.8	518 .692 1.486 320 5657 442 78.2	518 .692 1.501 314 5497 441 80.1
115	456 .576 1.251 320 5368 381 71.0	480 .631 1.349 320 5525 410 74.3	489 .643 1.376 320 5578 416 74.7	498 .655 1.404 320 5616 423 75.3	505 .667 1.433 320 5642 429 76.1	513 .680 1.464 320 5684 436 76.6	519 .688 1.493 318 5673 440 77.5	518 .685 1.505 310 5472 436 79.7
120	458 .576 1.256 320 5430 381 70.2	484 .631 1.358 320 5597 410 73.3	493 .643 1.385 320 5651 416 73.7	501 .655 1.414 320 5690 423 74.3	508 .667 1.444 320 5719 429 75.0	517 .680 1.478 320 5772 436 75.5	519 .681 1.497 315 5649 435 77.0	517 .677 1.509 306 5444 430 79.1
125	460 .576 1.262 320 5496 381 69.4	488 .631 1.367 320 5675 410 72.3	497 .643 1.395 320 5729 416 72.7	505 .655 1.426 320 5771 423 73.2	512 .667 1.457 320 5807 429 73.9	517 .673 1.481 316 5750 431 75.0	518 .673 1.501 310 5620 430 76.4	516 .666 1.514 301 5410 424 78.4
130	462 .576 1.268 320 5561 381 68.6	492 .631 1.377 320 5758 410 71.3	501 .643 1.406 320 5814 416 71.6	509 .655 1.438 320 5858 423 72.2	515 .664 1.467 318 5851 427 73.0	516 .664 1.486 312 5721 425 74.4	517 .663 1.506 306 5587 423 75.8	515 .654 1.520 295 5370 416 77.5
135	465 .576 1.275 320 5635 381 67.7	497 .631 1.388 320 5848 410 70.2	505 .643 1.419 320 5903 416 70.6	513 .655 1.452 320 5950 423 71.0	514 .655 1.471 314 5821 421 72.4	515 .654 1.491 307 5687 419 73.7	516 .651 1.512 300 5548 416 74.9	515 .640 1.528 289 5327 407 76.4
140	468 .576 1.283 320 5716 381 66.7	502 .631 1.399 320 5941 410 69.1	509 .643 1.432 320 5997 416 69.4	513 .647 1.456 316 5927 418 70.5	514 .646 1.476 309 5793 415 71.7	515 .643 1.496 302 5655 412 72.9	517 .637 1.519 293 5511 407 73.9	515 .622 1.537 280 5280 396 75.0
145	471 .576 1.290 320 5797 381 65.8	506 .631 1.412 320 6039 410 68.0	512 .639 1.441 318 6038 414 68.6	513 .638 1.461 312 5904 412 69.8	514 .636 1.481 304 5765 409 70.9	515 .629 1.504 295 5616 403 71.8	517 .621 1.528 285 5466 396 72.5	515 .597 1.549 269 5214 380 72.9
150	474 .576 1.298 320 5885 381 64.8	510 .631 1.426 320 6142 410 66.8	512 .631 1.446 314 6015 409 68.0	513 .628 1.466 306 5875 405 69.0	514 .622 1.489 297 5725 400 69.8	516 .612 1.513 287 5571 393 70.5	517 .598 1.540 274 5404 382 70.6	516 .564 1.566 253 5131 359 69.9
155	477 .576 1.307 320 5978 381 63.8	511 .623 1.431 316 6127 405 66.1	512 .620 1.452 308 5986 402 67.1	513 .614 1.474 299 5837 396 67.9	515 .604 1.498 289 5676 389 68.5	516 .590 1.525 276 5513 378 68.6	517 .568 1.555 260 5330 363 68.1	
160	481 .576 1.316 320 6071 381 62.8	511 .612 1.437 310 6098 398 65.3	512 .607 1.459 301 5949 393 66.1	513 .597 1.483 291 5788 385 66.6	515 .583 1.509 278 5623 375 66.7	516 .560 1.539 262 5439 359 66.0		

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 20

FCOM-B0-02-16-50-009-150

CRUISE - MCT/340KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**EGT °C MACH** **EPR IAS** **KG/H TAS** **NM/1000KG**

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	411 .612 1.257 340 5486 390 71.2	430 .669 1.354 340 5562 419 75.3	437 .681 1.378 340 5574 425 76.3	443 .694 1.403 340 5591 431 77.1	450 .707 1.431 340 5618 438 77.9	458 .720 1.464 340 5650 444 78.6	467 .733 1.505 340 5722 450 78.7	465 .734 1.514 334 5528 449 81.2
90	412 .612 1.261 340 5524 390 70.7	432 .669 1.360 340 5608 419 74.7	439 .681 1.384 340 5622 425 75.6	446 .694 1.410 340 5642 431 76.4	452 .707 1.438 340 5668 438 77.2	460 .720 1.471 340 5701 444 77.9	467 .731 1.506 339 5722 449 78.4	465 .731 1.517 332 5527 447 80.9
95	413 .612 1.265 340 5566 390 70.1	435 .669 1.366 340 5658 419 74.1	442 .681 1.391 340 5673 425 74.9	448 .694 1.417 340 5698 431 75.7	455 .707 1.446 340 5724 438 76.4	463 .720 1.480 340 5760 444 77.1	467 .727 1.509 337 5721 447 78.1	466 .727 1.519 330 5526 445 80.5
100	415 .612 1.269 340 5611 390 69.6	438 .669 1.373 340 5713 419 73.4	445 .681 1.398 340 5731 425 74.2	451 .694 1.426 340 5759 431 74.9	458 .707 1.456 340 5791 438 75.6	466 .720 1.490 340 5828 444 76.2	468 .724 1.511 335 5721 445 77.7	466 .723 1.522 329 5525 443 80.1
105	416 .612 1.274 340 5658 390 69.0	440 .669 1.381 340 5771 419 72.6	447 .681 1.406 340 5792 425 73.4	454 .694 1.435 340 5824 431 74.1	461 .707 1.466 340 5862 438 74.6	467 .717 1.496 339 5855 442 75.6	468 .720 1.514 334 5720 442 77.3	467 .719 1.524 326 5523 440 79.7
110	418 .612 1.278 340 5708 390 68.4	443 .669 1.388 340 5831 419 71.9	450 .681 1.415 340 5854 425 72.6	457 .694 1.443 340 5885 431 73.3	464 .707 1.476 340 5931 438 73.8	467 .713 1.499 336 5848 440 75.2	468 .715 1.517 331 5714 439 76.9	467 .713 1.528 324 5515 436 79.1
115	420 .612 1.283 340 5761 390 67.8	447 .669 1.396 340 5895 419 71.1	453 .681 1.424 340 5920 425 71.8	460 .694 1.453 340 5956 431 72.4	467 .705 1.484 339 5977 436 73.0	468 .707 1.502 334 5841 436 74.7	469 .709 1.520 328 5706 436 76.4	467 .707 1.531 320 5507 432 78.5
120	422 .612 1.289 340 5819 390 67.1	450 .669 1.405 340 5966 419 70.3	456 .681 1.433 340 5994 425 70.9	463 .694 1.464 340 6039 431 71.4	467 .700 1.487 336 5968 433 72.6	468 .702 1.505 331 5834 433 74.2	469 .703 1.523 325 5699 432 75.8	467 .700 1.534 317 5498 428 77.9
125	424 .612 1.295 340 5878 390 66.4	453 .669 1.414 340 6035 419 69.4	459 .681 1.443 340 6065 425 70.1	465 .692 1.472 339 6078 430 70.7	467 .694 1.490 333 5947 430 72.2	468 .695 1.508 328 5815 429 73.8	469 .696 1.526 322 5682 428 75.3	467 .691 1.539 313 5467 423 77.3
130	426 .612 1.300 340 5937 390 65.7	456 .669 1.424 340 6106 419 68.6	462 .681 1.453 340 6141 425 69.2	465 .686 1.475 336 6058 426 70.4	466 .687 1.493 330 5924 426 71.9	467 .688 1.512 324 5790 424 73.3	468 .688 1.531 318 5651 422 74.8	466 .681 1.544 308 5430 416 76.7
135	428 .612 1.307 340 5998 390 65.1	459 .669 1.434 340 6181 419 67.8	464 .678 1.460 338 6168 423 68.6	465 .679 1.478 333 6034 422 70.0	466 .680 1.497 327 5898 421 71.4	467 .679 1.516 320 5759 419 72.8	467 .678 1.536 313 5616 416 74.1	465 .668 1.550 302 5387 409 75.9
140	430 .612 1.313 340 6063 390 64.4	462 .669 1.444 340 6259 419 67.0	463 .672 1.463 335 6145 419 68.2	464 .672 1.482 329 6007 418 69.5	465 .671 1.501 322 5866 416 70.9	466 .670 1.521 315 5724 413 72.2	466 .666 1.542 307 5574 409 73.4	463 .651 1.558 294 5328 398 74.7
145	432 .612 1.321 340 6130 390 63.7	462 .663 1.448 337 6242 415 66.5	463 .664 1.467 331 6118 414 67.7	464 .663 1.486 324 5976 412 69.0	464 .662 1.506 317 5831 410 70.2	465 .658 1.527 309 5682 406 71.4	465 .649 1.550 299 5515 399 72.3	464 .632 1.568 285 5278 387 73.3
150	435 .612 1.328 340 6202 390 62.9	462 .655 1.452 333 6217 411 66.0	463 .655 1.471 327 6087 409 67.2	463 .653 1.491 319 5940 406 68.4	463 .650 1.512 311 5789 402 69.5	464 .642 1.535 301 5631 396 70.3	466 .632 1.559 291 5470 388 71.0	464 .606 1.581 273 5206 371 71.2
155	437 .612 1.336 340 6280 390 62.2	461 .647 1.456 329 6191 405 65.5	462 .646 1.476 322 6056 403 66.6	463 .643 1.497 314 5906 399 67.6	464 .635 1.520 304 5748 393 68.4	465 .625 1.544 293 5582 385 69.1	466 .608 1.571 279 5405 374 69.1	464 .567 1.599 254 5099 347 68.0
160	440 .612 1.345 340 6360 390 61.4	462 .639 1.460 324 6168 400 64.9	462 .636 1.482 316 6025 397 65.8	463 .629 1.504 307 5864 391 66.6	464 .618 1.529 296 5699 383 67.2	465 .601 1.556 281 5516 371 67.2	467 .574 1.588 263 5313 353 66.4	

Engine Anti-ice ON	△FUEL = +0.6%	**Total Anti-ice ON**	△FUEL = +2%

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 0 FCOM-B0-02-16-50-010-150

Mod. : 4863 PW Eng. : 4000

CRUISE - MCT/340KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	438 .612 1.259 340 5631 398 70.6	460 .669 1.357 340 5715 427 74.7	467 .681 1.381 340 5729 433 75.6	474 .694 1.406 340 5748 440 76.5	482 .707 1.435 340 5776 446 77.2	490 .720 1.467 340 5811 453 77.9	498 .732 1.505 339 5860 459 78.2	497 .732 1.515 333 5662 457 80.7
90	440 .612 1.262 340 5670 398 70.1	462 .669 1.363 340 5762 427 74.1	470 .681 1.387 340 5778 433 75.0	477 .694 1.413 340 5800 440 75.8	484 .707 1.442 340 5828 446 76.6	492 .720 1.475 340 5864 453 77.2	499 .729 1.507 338 5860 457 78.0	497 .729 1.517 331 5661 455 80.4
95	441 .612 1.266 340 5713 398 69.6	465 .669 1.369 340 5814 427 73.5	472 .681 1.394 340 5831 433 74.3	479 .694 1.421 340 5857 440 75.1	487 .707 1.450 340 5886 446 75.8	495 .720 1.484 340 5925 453 76.4	499 .726 1.510 337 5859 455 77.7	498 .726 1.520 330 5660 453 80.0
100	443 .612 1.271 340 5759 398 69.0	468 .669 1.376 340 5870 427 72.8	475 .681 1.401 340 5889 433 73.6	482 .694 1.429 340 5920 440 74.3	490 .707 1.460 340 5956 446 74.9	498 .720 1.494 340 5994 453 75.5	499 .723 1.512 335 5859 453 77.3	498 .722 1.523 328 5659 451 79.6
105	444 .612 1.275 340 5807 398 68.5	471 .669 1.383 340 5929 427 72.0	478 .681 1.409 340 5953 433 72.8	485 .694 1.438 340 5986 440 73.4	493 .707 1.470 340 6029 446 74.0	499 .716 1.497 338 5994 450 75.1	500 .719 1.515 333 5856 450 76.9	498 .717 1.525 326 5655 448 79.2
110	446 .612 1.280 340 5859 398 67.9	474 .669 1.391 340 5991 427 71.3	481 .681 1.418 340 6016 433 72.0	488 .694 1.446 340 6050 440 72.7	497 .707 1.480 340 6099 446 73.1	499 .711 1.500 336 5987 447 74.7	500 .713 1.517 330 5850 447 76.4	499 .711 1.529 323 5647 444 78.6
115	448 .612 1.285 340 5912 398 67.2	477 .669 1.399 340 6057 427 70.5	484 .681 1.427 340 6084 433 71.2	492 .694 1.456 340 6124 440 71.8	498 .703 1.485 338 6118 444 72.6	499 .706 1.503 333 5979 444 74.2	500 .708 1.521 327 5842 443 75.9	499 .705 1.532 320 5639 440 78.0
120	450 .612 1.291 340 5971 398 66.6	480 .669 1.408 340 6129 427 69.7	487 .681 1.437 340 6159 433 70.4	495 .694 1.468 340 6209 440 70.8	498 .698 1.488 336 6105 441 72.2	499 .700 1.505 330 5972 440 73.7	501 .701 1.524 324 5835 439 75.3	499 .698 1.535 316 5624 435 77.4
125	452 .612 1.296 340 6032 398 65.9	483 .669 1.417 340 6200 427 68.9	490 .681 1.446 340 6233 433 69.5	496 .690 1.473 338 6216 437 70.3	497 .692 1.491 333 6083 437 71.8	499 .694 1.509 327 5948 436 73.3	500 .694 1.527 321 5812 435 74.8	498 .689 1.540 312 5592 430 76.9
130	454 .612 1.302 340 6092 398 65.3	486 .669 1.427 340 6273 427 68.1	494 .681 1.457 340 6312 433 68.7	496 .684 1.476 335 6195 434 70.0	497 .686 1.494 329 6059 433 71.4	498 .686 1.512 323 5922 432 72.9	500 .686 1.532 317 5780 430 74.3	497 .678 1.545 307 5554 423 76.2
135	456 .612 1.309 340 6155 398 64.6	489 .669 1.437 340 6349 427 67.3	494 .676 1.461 337 6308 430 68.2	495 .678 1.479 332 6171 429 69.6	497 .678 1.498 326 6032 428 71.0	498 .677 1.517 319 5890 426 72.3	499 .676 1.537 312 5744 423 73.7	496 .666 1.551 301 5510 416 75.5
140	458 .612 1.315 340 6221 398 63.9	492 .668 1.445 339 6406 426 66.5	494 .670 1.464 334 6283 426 67.8	495 .670 1.483 328 6143 425 69.1	496 .669 1.502 321 5999 423 70.4	497 .667 1.522 314 5853 420 71.7	498 .664 1.543 306 5701 416 73.0	495 .648 1.560 293 5451 405 74.2
145	461 .612 1.323 340 6290 398 63.2	492 .661 1.449 336 6383 422 66.1	493 .662 1.468 330 6255 421 67.3	494 .661 1.487 323 6111 419 68.6	495 .659 1.507 316 5963 416 69.8	496 .655 1.528 308 5810 412 71.0	497 .647 1.551 298 5643 405 71.8	495 .630 1.569 284 5399 393 72.8
150	463 .612 1.330 340 6363 398 62.5	492 .653 1.453 332 6356 417 65.6	493 .653 1.472 326 6224 416 66.8	493 .651 1.492 318 6074 413 68.0	494 .647 1.513 310 5922 409 69.0	496 .640 1.536 300 5760 402 69.9	497 .630 1.560 290 5596 395 70.5	496 .603 1.583 271 5324 376 70.7
155	466 .612 1.338 340 6443 398 61.7	492 .646 1.457 328 6332 412 65.1	493 .645 1.477 321 6194 410 66.2	493 .641 1.498 313 6040 406 67.2	495 .633 1.521 303 5879 400 68.0	496 .623 1.545 292 5709 392 68.6	498 .605 1.573 278 5528 379 68.6	496 .563 1.602 252 5211 351 67.4
160	469 .612 1.347 340 6525 398 60.9	492 .638 1.461 323 6308 407 64.5	493 .634 1.483 315 6162 403 65.4	494 .627 1.505 306 5998 397 66.2	495 .616 1.530 294 5828 389 66.7	496 .598 1.558 280 5642 376 66.7	498 .571 1.590 261 5432 358 65.9	
Engine Anti-ice ON			△FUEL = +0.6%		**Total Anti-ice ON**		△FUEL = +2%	

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 10

CRUISE - MCT/340KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=27.0%

EGT °C MACH
EPR IAS
KG/H TAS
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL160	FL170	FL180	FL190	FL200	FL210
85	466 .612 1.261 340 5774 405 70.1	490 .669 1.360 340 5867 435 74.1	498 .681 1.383 340 5882 441 75.0	505 .694 1.409 340 5903 448 75.9	513 .707 1.438 340 5933 455 76.6	517 .714 1.460 337 5864 458 78.1	519 .719 1.477 333 5739 459 80.0	518 .719 1.487 327 5549 458 82.5
90	467 .612 1.264 340 5814 405 69.6	492 .669 1.366 340 5915 435 73.5	500 .681 1.390 340 5932 441 74.4	508 .694 1.416 340 5957 448 75.2	516 .706 1.445 340 5982 454 76.0	518 .711 1.462 336 5859 456 77.8	519 .715 1.479 331 5734 457 79.6	518 .715 1.489 324 5543 455 82.1
95	469 .612 1.268 340 5859 405 69.1	495 .669 1.372 340 5968 435 72.9	503 .681 1.396 340 5987 441 73.7	511 .694 1.424 340 6015 448 74.5	516 .703 1.447 338 5977 452 75.6	518 .707 1.464 333 5853 453 77.4	519 .710 1.481 329 5727 454 79.2	518 .710 1.492 322 5536 452 81.6
100	470 .612 1.272 340 5906 405 68.5	498 .669 1.379 340 6025 435 72.2	506 .681 1.404 340 6047 441 73.0	514 .694 1.432 340 6079 448 73.7	516 .699 1.449 336 5969 449 75.3	518 .702 1.466 331 5847 450 77.0	520 .706 1.484 327 5721 451 78.8	519 .705 1.495 320 5529 449 81.1
105	472 .612 1.277 340 5955 405 67.9	501 .669 1.386 340 6086 435 71.5	509 .681 1.412 340 6112 441 72.2	514 .690 1.434 338 6067 445 73.4	516 .694 1.451 334 5953 447 75.0	518 .698 1.469 329 5836 447 76.6	520 .701 1.487 324 5714 447 78.3	519 .699 1.498 317 5519 445 80.6
110	474 .612 1.282 340 6007 405 67.4	504 .669 1.393 340 6149 435 70.7	512 .681 1.420 340 6168 441 71.5	514 .685 1.437 336 6053 442 73.1	516 .689 1.454 331 5936 443 74.7	518 .692 1.472 326 5816 443 76.2	520 .695 1.490 321 5695 444 77.9	518 .692 1.501 314 5497 441 80.1
115	476 .612 1.287 340 6063 405 66.7	508 .669 1.402 340 6216 435 70.0	512 .676 1.422 337 6153 438 71.2	514 .680 1.439 333 6036 439 72.7	516 .683 1.457 328 5917 440 74.3	517 .686 1.475 323 5796 440 75.9	519 .688 1.493 318 5673 440 77.5	518 .685 1.505 310 5472 436 79.7
120	478 .612 1.292 340 6123 405 66.1	509 .667 1.408 339 6247 433 69.4	512 .671 1.425 335 6136 435 70.8	514 .675 1.442 330 6019 436 72.4	515 .678 1.460 325 5898 436 73.9	517 .680 1.478 320 5775 436 75.4	519 .681 1.497 315 5649 435 77.0	517 .677 1.509 306 5444 430 79.1
125	480 .612 1.298 340 6185 405 65.4	510 .662 1.410 336 6232 430 69.0	512 .666 1.427 332 6120 431 70.5	513 .669 1.445 327 6000 432 72.0	515 .671 1.463 322 5876 432 73.5	517 .673 1.481 316 5750 431 75.0	518 .673 1.501 310 5620 430 76.4	516 .666 1.514 301 5410 424 78.4
130	482 .612 1.304 340 6246 405 64.8	510 .657 1.413 333 6217 427 68.7	512 .660 1.430 329 6101 428 70.1	513 .663 1.448 324 5978 428 71.5	515 .664 1.467 318 5851 427 73.0	516 .664 1.486 312 5721 425 74.4	517 .663 1.506 306 5587 423 75.8	515 .654 1.520 295 5370 416 77.5
135	484 .612 1.310 340 6310 405 64.1	510 .651 1.416 330 6199 423 68.2	511 .653 1.433 325 6079 423 69.6	513 .655 1.452 320 5952 423 71.0	514 .655 1.471 314 5821 421 72.4	515 .654 1.491 307 5687 419 73.7	516 .651 1.512 300 5548 416 74.9	515 .640 1.528 289 5327 407 76.4
140	487 .612 1.317 340 6378 405 63.4	510 .645 1.419 327 6184 419 67.8	511 .646 1.437 322 6059 419 69.1	513 .647 1.456 316 5927 418 70.5	514 .646 1.476 309 5793 415 71.7	515 .643 1.496 302 5655 412 72.9	517 .637 1.519 293 5511 407 73.9	515 .622 1.537 280 5280 396 75.0
145	489 .612 1.324 340 6449 405 62.7	510 .639 1.422 324 6167 415 67.3	512 .639 1.441 318 6038 414 68.6	513 .638 1.461 312 5904 412 69.8	514 .636 1.481 304 5765 409 70.9	515 .629 1.504 295 5616 403 71.8	517 .621 1.528 285 5465 396 72.5	515 .597 1.549 269 5214 380 72.9
150	492 .612 1.332 340 6523 405 62.0	510 .631 1.427 320 6148 411 66.8	512 .631 1.446 314 6015 409 68.0	513 .628 1.466 306 5875 405 69.0	514 .622 1.489 297 5725 400 69.8	516 .612 1.513 287 5571 393 70.5	517 .598 1.540 274 5404 382 70.6	516 .564 1.566 253 5131 359 69.9
155	495 .612 1.340 340 6605 405 61.3	511 .623 1.431 316 6127 405 66.1	512 .620 1.452 308 5986 402 67.1	513 .614 1.474 299 5837 396 67.9	515 .604 1.498 289 5676 389 68.5	516 .590 1.525 276 5513 378 68.6	517 .568 1.555 260 5330 363 68.1	
160	498 .612 1.349 340 6689 405 60.5	511 .612 1.437 310 6098 398 65.3	512 .607 1.459 301 5949 393 66.1	513 .597 1.483 291 5789 385 66.6	515 .583 1.509 278 5623 375 66.7	516 .560 1.539 262 5439 359 66.0		
Engine Anti-ice ON			△FUEL = +0.6%		**Total Anti-ice ON**		△FUEL = +2%	

04 P-05 A310-324-01 PW4152 12300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01100.000 .000 .000 20

FCOM-B0-02-16-50-012-150

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT/300KT - FINAL DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG) TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
300		3035 0.51	3038 0.51	3039 0.51	3043 0.51	3048 0.51	7	8	8	40	40	40
325		3356 0.55	3357 0.55	3357 0.55	3360 0.55	3364 0.54	9	9	9	40	40	40
350		3677 0.59	3677 0.59	3675 0.59	3677 0.58	3680 0.58	10	10	11	40	40	40
375		3998 1.03	3996 1.03	3993 1.02	3994 1.02	3995 1.02	11	12	12	40	40	40
400	4381 1.09	4319 1.07	4316 1.07	4310 1.06	4311 1.06	4311 1.05	12	13	13	45	40	40
425	4720 1.13	4638 1.11	4634 1.11	4627 1.10	4626 1.10	4625 1.09	13	14	15	45	40	40
450	5059 1.17	4958 1.15	4952 1.14	4943 1.14	4941 1.13	4939 1.13	14	15	16	45	40	40
475	5397 1.22	5277 1.19	5270 1.18	5259 1.18	5256 1.17	5253 1.17	15	16	17	45	40	40
500	5736 1.26	5597 1.23	5588 1.22	5575 1.21	5572 1.21	5567 1.20	16	18	19	45	40	40
525	6074 1.31	5914 1.27	5904 1.26	5890 1.25	5885 1.25	5879 1.24	17	19	20	45	40	40
550	6412 1.35	6232 1.31	6221 1.30	6205 1.29	6199 1.28	6192 1.28	18	20	21	45	40	40
575	6749 1.39	6550 1.34	6537 1.34	6520 1.33	6512 1.32	6504 1.31	19	21	22	45	40	40
600	7087 1.44	6868 1.38	6853 1.38	6835 1.37	6826 1.36	6816 1.35	20	22	24	45	40	40
625	7423 1.48	7184 1.42	7168 1.41	7148 1.41	7137 1.40	7126 1.39	21	24	25	45	40	40
650	7759 1.52	7500 1.46	7483 1.45	7461 1.44	7449 1.43	7437 1.42	22	25	26	45	40	40
675	8096 1.57	7817 1.50	7798 1.49	7774 1.48	7761 1.47	7747 1.46	23	26	28	45	40	40
700	8432 2.01	8133 1.54	8113 1.53	8088 1.52	8073 1.51	8058 1.50	24	27	29	45	40	40
725	8767 2.05	8448 1.58	8426 1.57	8400 1.56	8383 1.55	8366 1.53	25	28	30	45	40	40
750	9102 2.10	8763 2.02	8740 2.01	8711 2.00	8693 1.58	8675 1.57	26	29	31	45	40	40
775	9437 2.14	9078 2.06	9053 2.05	9023 2.03	9004 2.02	8984 2.01	27	30	32	45	40	40
800	9772 2.18	9392 2.10	9367 2.08	9335 2.07	9314 2.06	9293 2.05	28	32	34	45	40	40
825	10105 2.23	9706 2.14	9679 2.12	9646 2.11	9622 2.10	9600 2.08	29	33	35	45	40	40
850	10439 2.27	10019 2.18	9991 2.16	9956 2.15	9931 2.13	9907 2.12	30	34	36	45	40	40

FLIP20G A310-324 PW4152 3411 02701.001010 0 0 0 .0000 .000100 360 0 0350130330 200200 65 65 18590

FCOM-B0-02-16-50-013-150

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT/300KT - FINAL DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
850	10439 2.27	10019 2.18	9991 2.16	9956 2.15	9931 2.13	9907 2.12	30	34	36	45	40	40
875	10773 2.31	10332 2.21	10303 2.20	10266 2.19	10240 2.17	10214 2.16	31	35	37	45	40	40
900	11107 2.36	10646 2.25	10615 2.24	10577 2.22	10548 2.21	10521 2.19	32	36	38	45	40	40
925	11439 2.40	10958 2.29	10926 2.28	10886 2.26	10855 2.25	10827 2.23	33	37	40	45	40	40
950	11771 2.44	11270 2.33	11236 2.32	11195 2.30	11163 2.28	11132 2.27	34	38	41	45	40	40
975	12103 2.49	11581 2.37	11547 2.35	11504 2.34	11470 2.32	11438 2.30	35	39	42	45	40	40
1000	12436 2.53	11893 2.41	11857 2.39	11813 2.38	11777 2.36	11744 2.34	36	40	43	45	40	40
1025	12766 2.57	12204 2.45	12167 2.43	12121 2.41	12082 2.40	12047 2.38	37	41	44	40	40	40
1050	13097 3.02	12514 2.49	12476 2.47	12428 2.45	12388 2.43	12351 2.41	38	42	45	40	40	40
1075	13428 3.06	12825 2.53	12785 2.51	12736 2.49	12693 2.47	12655 2.45	39	43	46	40	40	40
1100	13759 3.10	13135 2.57	13094 2.55	13044 2.53	12999 2.51	12959 2.49	40	44	48	40	40	40
1125	14089 3.15	13444 3.01	13402 2.59	13350 2.57	13303 2.55	13262 2.53	41	45	49	40	40	40
1150	14418 3.19	13753 3.05	13710 3.02	13656 3.00	13607 2.58	13565 2.56	42	46	50	40	40	40
1175	14748 3.23	14062 3.08	14018 3.06	13963 3.04	13911 3.02	13867 3.00	43	47	51	40	40	40
1200	15077 3.28	14372 3.12	14326 3.10	14269 3.08	14215 3.06	14170 3.04	44	48	52	40	40	40
1225	15406 3.32	14679 3.16	14632 3.14	14574 3.12	14518 3.10	14471 3.07	45	49	53	40	40	40
1250	15734 3.36	14987 3.20	14939 3.18	14879 3.16	14820 3.13	14772 3.11	45	50	54	40	40	40
1275	16062 3.41	15295 3.24	15245 3.22	15184 3.19	15123 3.17	15073 3.15	46	51	55	40	40	40
1300	16391 3.45	15602 3.28	15552 3.26	15489 3.23	15425 3.21	15374 3.18	47	52	56	40	40	40
1325	16718 3.49	15909 3.32	15857 3.30	15792 3.27	15726 3.25	15674 3.22	48	53	58	40	40	40
1350	17045 3.54	16215 3.36	16162 3.33	16096 3.31	16028 3.28	15974 3.26	49	54	59	40	40	40
1375	17372 3.58	16521 3.40	16467 3.37	16400 3.35	16329 3.32	16273 3.29	50	55	60	40	40	35
1400	17699 4.02	16828 3.44	16773 3.41	16704 3.38	16630 3.36	16573 3.33	51	56	61	40	40	35

FLIP20G A310-324 PW4152 3411 02701.001010 0 0 0 .0000 .000100 360 0 0350130330 200200 65 65 18590

FCOM-B0-02-16-50-014-150

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT / 320KT - FINAL DESCENT M.80 / 300KT / 250KT - IMC PROCEDURE 360KG / 6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG) TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
300		3070 0.51	3076 0.51	3084 0.50	3094 0.50	3079 0.50	7	7	7	45	45	45
325		3408 0.55	3411 0.54	3418 0.54	3427 0.54	3404 0.54	8	8	7	45	45	45
350		3746 0.58	3746 0.58	3751 0.58	3760 0.57	3730 0.57	9	9	8	45	45	45
375		4084 1.02	4081 1.02	4085 1.01	4093 1.01	4055 1.01	10	10	9	45	45	45
400	4436 1.08	4422 1.06	4416 1.05	4418 1.05	4426 1.04	4380 1.05	11	11	10	50	45	45
425	4791 1.12	4759 1.09	4749 1.09	4750 1.08	4757 1.08	4705 1.08	12	12	11	50	45	45
450	5147 1.16	5096 1.13	5083 1.12	5082 1.12	5088 1.11	5029 1.12	13	13	12	50	45	45
475	5502 1.20	5432 1.17	5416 1.16	5414 1.15	5419 1.15	5354 1.15	14	14	13	50	45	45
500	5857 1.24	5769 1.20	5750 1.20	5746 1.19	5750 1.18	5678 1.19	15	15	13	50	45	45
525	6211 1.28	6104 1.24	6082 1.23	6077 1.23	6080 1.22	6002 1.22	16	16	14	50	45	45
550	6565 1.32	6440 1.28	6414 1.27	6407 1.26	6409 1.25	6326 1.26	17	17	15	50	45	45
575	6919 1.36	6775 1.31	6746 1.31	6738 1.30	6739 1.29	6650 1.29	18	18	16	50	45	45
600	7273 1.40	7110 1.35	7078 1.34	7068 1.33	7068 1.32	6974 1.33	18	19	17	50	45	45
625	7626 1.45	7444 1.39	7409 1.38	7397 1.37	7396 1.36	7297 1.36	19	20	18	50	45	45
650	7978 1.49	7778 1.42	7740 1.41	7727 1.40	7724 1.39	7620 1.40	20	21	18	50	45	45
675	8331 1.53	8112 1.46	8070 1.45	8056 1.44	8052 1.43	7943 1.43	21	22	19	50	45	45
700	8684 1.57	8446 1.50	8401 1.49	8385 1.48	8380 1.47	8267 1.47	22	23	20	50	45	45
725	9035 2.01	8779 1.53	8730 1.52	8712 1.51	8707 1.50	8589 1.50	23	24	21	50	45	45
750	9387 2.05	9112 1.57	9060 1.56	9040 1.55	9034 1.54	8912 1.54	24	25	22	50	45	45
775	9738 2.09	9444 2.01	9390 2.00	9368 1.58	9360 1.57	9234 1.58	25	26	23	50	45	40
800	10090 2.13	9777 2.04	9719 2.03	9695 2.02	9687 2.01	9557 2.01	25	27	23	50	45	40
825	10440 2.17	10108 2.08	10047 2.07	10022 2.05	10012 2.04	9879 2.05	26	28	24	50	45	40
850	10790 2.21	10440 2.12	10376 2.10	10348 2.09	10337 2.08	10201 2.08	27	29	25	50	45	40

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FCOM-B0-02-16-50-015-150

FIXED SPEED STRATEGY

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT/320KT - FINAL DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG) TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
850	10790 2.21	10440 2.12	10376 2.10	10348 2.09	10337 2.08	10201 2.08	27	29	25	50	45	40
875	11141 2.25	10771 2.16	10704 2.14	10674 2.13	10662 2.11	10523 2.12	28	30	26	50	45	40
900	11491 2.29	11103 2.19	11032 2.18	11000 2.16	10987 2.15	10845 2.15	29	31	27	50	45	40
925	11840 2.33	11433 2.23	11359 2.21	11325 2.20	11311 2.18	11166 2.19	30	32	27	50	45	40
950	12189 2.38	11763 2.27	11686 2.25	11650 2.23	11634 2.22	11488 2.22	30	33	28	50	45	40
975	12538 2.42	12093 2.30	12013 2.29	11975 2.27	11958 2.25	11809 2.25	31	34	29	50	45	40
1000	12887 2.46	12423 2.34	12340 2.32	12300 2.31	12281 2.29	12130 2.29	32	34	30	50	45	40
1025	13235 2.50	12752 2.38	12666 2.36	12623 2.34	12604 2.32	12451 2.32	33	35	30	50	45	40
1050	13583 2.54	13081 2.41	12992 2.40	12947 2.38	12926 2.36	12772 2.36	34	36	31	45	45	40
1075	13931 2.58	13410 2.45	13318 2.43	13270 2.41	13248 2.39	13093 2.39	35	37	32	45	45	40
1100	14279 3.02	13739 2.49	13644 2.47	13593 2.45	13570 2.43	13414 2.43	35	38	33	45	45	40
1125	14626 3.06	14067 2.52	13968 2.50	13916 2.48	13891 2.46	13734 2.46	36	39	34	45	45	40
1150	14973 3.10	14395 2.56	14293 2.54	14238 2.52	14212 2.50	14055 2.50	37	40	34	45	45	40
1175	15319 3.14	14723 3.00	14617 2.58	14560 2.56	14532 2.53	14375 2.53	38	41	35	45	45	40
1200	15666 3.18	15051 3.03	14942 3.01	14882 2.59	14853 2.57	14696 2.57	39	42	36	45	45	40
1225	16012 3.22	15378 3.07	15266 3.05	15203 3.03	15173 3.01	15016 3.00	39	43	37	45	45	40
1250	16358 3.26	15705 3.11	15589 3.09	15524 3.06	15492 3.04	15337 3.04	40	44	38	45	45	40
1275	16703 3.31	16031 3.14	15912 3.12	15844 3.10	15811 3.08	15657 3.07	41	45	38	45	45	40
1300	17049 3.35	16358 3.18	16236 3.16	16165 3.13	16131 3.11	15978 3.11	42	46	39	45	45	40
1325	17394 3.39	16684 3.22	16558 3.19	16485 3.17	16449 3.15	16297 3.14	42	47	40	45	45	40
1350	17738 3.43	17010 3.26	16881 3.23	16805 3.21	16767 3.18	16617 3.18	43	47	41	45	45	40
1375	18083 3.47	17336 3.29	17203 3.27	17124 3.24	17085 3.22	16936 3.21	44	48	42	45	45	40
1400	18428 3.51	17661 3.33	17526 3.30	17444 3.28	17404 3.25	17256 3.24	45	49	42	45	45	40

FLIP20G A310-324 PW4152 3411 02701.001010 0 0 0 .0000 .000100 360 0 0350130330 200200 65 65 18590

FCOM-B0-02-16-50-016-150

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT/340KT - FINAL DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG) TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
300		3104 0.50	3105 0.50	3102 0.50	3096 0.50	3079 0.50	6	6	6	50	50	45
325		3459 0.54	3453 0.54	3443 0.54	3430 0.54	3404 0.54	7	6	6	50	50	45
350		3814 0.57	3800 0.57	3784 0.57	3764 0.57	3730 0.57	8	7	7	50	50	45
375		4169 1.01	4148 1.01	4124 1.01	4098 1.01	4055 1.01	8	7	8	50	50	45
400	4510 1.07	4524 1.04	4496 1.04	4465 1.04	4431 1.04	4380 1.05	10	8	8	55	50	45
425	4886 1.11	4878 1.08	4843 1.08	4805 1.08	4765 1.08	4704 1.08	11	8	9	55	50	45
450	5263 1.15	5233 1.11	5190 1.11	5145 1.11	5098 1.11	5029 1.12	11	9	10	55	45	45
475	5639 1.19	5587 1.15	5538 1.15	5485 1.15	5431 1.15	5354 1.15	12	9	10	55	45	45
500	6016 1.22	5942 1.18	5885 1.18	5826 1.18	5765 1.18	5678 1.19	13	10	11	55	45	45
525	6391 1.26	6296 1.22	6231 1.22	6165 1.22	6097 1.22	6002 1.22	13	10	11	55	45	45
550	6767 1.30	6650 1.25	6578 1.25	6505 1.25	6430 1.25	6326 1.26	14	11	12	55	45	45
575	7142 1.34	7004 1.29	6925 1.29	6845 1.29	6763 1.29	6650 1.29	15	11	13	55	45	45
600	7518 1.38	7358 1.32	7272 1.32	7184 1.32	7096 1.32	6974 1.33	15	12	13	55	45	45
625	7892 1.42	7711 1.36	7618 1.36	7523 1.36	7428 1.36	7297 1.36	16	12	14	55	45	45
650	8266 1.45	8065 1.39	7964 1.39	7862 1.39	7760 1.39	7620 1.40	17	13	14	55	45	45
675	8640 1.49	8419 1.43	8310 1.43	8201 1.43	8092 1.43	7943 1.43	17	13	15	55	45	45
700	9015 1.53	8772 1.46	8657 1.46	8540 1.46	8424 1.46	8267 1.47	18	14	15	55	45	45
725	9388 1.57	9125 1.50	9002 1.50	8879 1.50	8756 1.50	8589 1.50	19	14	16	55	45	45
750	9761 2.01	9479 1.53	9348 1.53	9218 1.53	9088 1.53	8912 1.54	19	15	16	55	45	45
775	10134 2.05	9832 1.57	9694 1.57	9557 1.57	9420 1.57	9234 1.58	20	15	17	55	45	45
800	10507 2.09	10185 2.00	10040 2.00	9895 2.00	9751 2.00	9557 2.01	21	16	17	55	45	45
825	10879 2.12	10538 2.04	10385 2.03	10233 2.03	10083 2.04	9879 2.05	21	16	18	55	45	45
850	11251 2.16	10890 2.07	10731 2.07	10571 2.07	10414 2.07	10201 2.08	22	17	18	55	45	45

FLIP20G A310-324 PW4152 3411 02701.001010 0 0 0 .0000 .000100 360 0 0350130330 200200 65 65 18590 FCOM-B0-02-16-50-017-150

Mod. : 4863 PW Eng. : 4000

IN CRUISE QUICK CHECK FROM CRITICAL POINT TO LANDING - ONE ENGINE FAILURE - MCT/340KT - FINAL DESCENT M.80/300KT/250KT - IMC PROCEDURE 360KG/6MIN

REF. INITIAL WEIGHT = 130000 KG REF. INITIAL FLIGHT LEVEL = 330	NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 27.0%	**FUEL CONSUMED (KG) TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION DUE TO					
							INITIAL WEIGHT (KG/1000KG)			INITIAL FL (KG/1000FT)		
	100	**170**	**180**	**190**	**200**	**210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**	**FL100 FL170**	**FL180 FL190**	**FL200 FL210**
850	11251 2.16	10890 2.07	10731 2.07	10571 2.07	10414 2.07	10201 2.08	22	17	18	55	45	45
875	11623 2.20	11243 2.10	11076 2.10	10910 2.10	10745 2.11	10523 2.12	23	17	19	55	45	45
900	11995 2.24	11595 2.14	11421 2.14	11248 2.14	11076 2.14	10845 2.15	23	17	19	55	45	45
925	12366 2.28	11947 2.17	11766 2.17	11585 2.17	11407 2.17	11166 2.19	24	18	20	55	45	45
950	12737 2.32	12298 2.21	12111 2.21	11923 2.21	11738 2.21	11488 2.22	25	18	20	55	45	45
975	13108 2.35	12650 2.24	12456 2.24	12261 2.24	12069 2.24	11809 2.25	25	19	21	55	45	45
1000	13479 2.39	13001 2.28	12801 2.28	12599 2.28	12399 2.28	12130 2.29	26	19	21	55	45	45
1025	13848 2.43	13347 2.31	13145 2.31	12936 2.31	12729 2.31	12451 2.32	27	20	21	55	45	45
1050	14218 2.47	13692 2.35	13490 2.34	13272 2.35	13059 2.35	12772 2.36	27	20	22	55	45	45
1075	14588 2.51	14038 2.38	13834 2.38	13609 2.38	13389 2.38	13093 2.39	28	21	22	55	45	45
1100	14958 2.55	14384 2.42	14179 2.41	13946 2.41	13718 2.42	13414 2.43	29	21	23	55	45	45
1125	15326 2.58	14728 2.45	14523 2.45	14283 2.45	14047 2.45	13734 2.46	29	22	23	55	45	45
1150	15695 3.02	15073 2.49	14867 2.48	14620 2.48	14377 2.49	14055 2.50	30	22	24	55	45	45
1175	16064 3.06	15417 2.52	15211 2.52	14956 2.52	14706 2.52	14375 2.53	31	23	24	55	45	40
1200	16432 3.10	15762 2.56	15555 2.55	15293 2.55	15035 2.55	14696 2.57	31	23	24	55	45	40
1225	16800 3.14	16105 2.59	15899 2.59	15629 2.59	15363 2.59	15016 3.00	32	24	25	55	45	40
1250	17168 3.18	16449 3.02	16243 3.02	15965 3.02	15691 3.02	15337 3.04	33	24	25	55	45	40
1275	17535 3.22	16792 3.06	16587 3.05	16301 3.05	16019 3.06	15657 3.07	33	25	26	55	45	40
1300	17903 3.25	17135 3.09	16930 3.09	16636 3.09	16348 3.09	15978 3.11	34	25	26	55	45	40
1325	18270 3.29	17479 3.13	17274 3.12	16972 3.12	16676 3.13	16297 3.14	35	26	26	55	45	40
1350	18636 3.33	17822 3.16	17617 3.16	17308 3.16	17004 3.16	16617 3.18	35	26	27	55	45	40
1375	19003 3.37	18165 3.20	17960 3.19	17643 3.19	17332 3.19	16936 3.21	36	27	27	55	45	40
1400	19370 3.41	18509 3.23	18303 3.23	17979 3.23	17661 3.23	17256 3.24	36	28	28	55	45	40

FLIP20G A310-324 PW4152 3411 02701.001010 0 0 0 .0000 .000100 360 0 0350130330 200200 65 65 18590

FCOM-B0-02-16-50-018-150

DESCENT M.80 / 300 KT / 250 KT

CLEAN CONFIGURATION NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%

WEIGHT (1000KG)	100				140				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	IAS (KT)
410	15.9	139	97	IDLE					237
390	15.2	135	92	IDLE					248
370	14.6	131	88	IDLE	17.2	153	104	IDLE	260
350	14.0	127	83	IDLE	16.6	149	99	IDLE	272
330	13.5	123	79	IDLE	16.1	145	95	IDLE	284
310	13.0	120	75	IDLE	15.5	141	91	IDLE	297
290	12.4	115	71	IDLE	14.7	136	85	IDLE	300
270	11.7	111	66	IDLE	13.9	130	79	IDLE	300
250	11.0	106	61	IDLE	13.1	124	73	IDLE	300
240	10.7	103	58	IDLE	12.7	121	69	IDLE	300
220	10.0	98	53	IDLE	11.8	115	63	IDLE	300
200	9.2	93	48	IDLE	10.9	109	57	IDLE	300
180	8.5	89	44	IDLE	10.0	103	52	IDLE	300
160	7.8	85	39	IDLE	9.1	98	46	IDLE	300
140	7.1	80	34	IDLE	8.2	92	40	IDLE	300
120	6.3	75	30	IDLE	7.3	85	35	IDLE	300
100	5.5	69	26	IDLE	6.3	78	29	IDLE	300
50	2.1	30	9	IDLE	2.4	34	10	IDLE	250
15	.0	0	0	IDLE	.0	0	0	IDLE	250

04 P-05 A310-324-01 PW4152 23100010C6KG270 0 018590 0 0-1 .0 .0 .0 0 03 .800300.000250.000 0 FCOM-B0-02-16-60-001-150

HOLDING AT GREEN DOT SPEED 1 ENGINE OUT

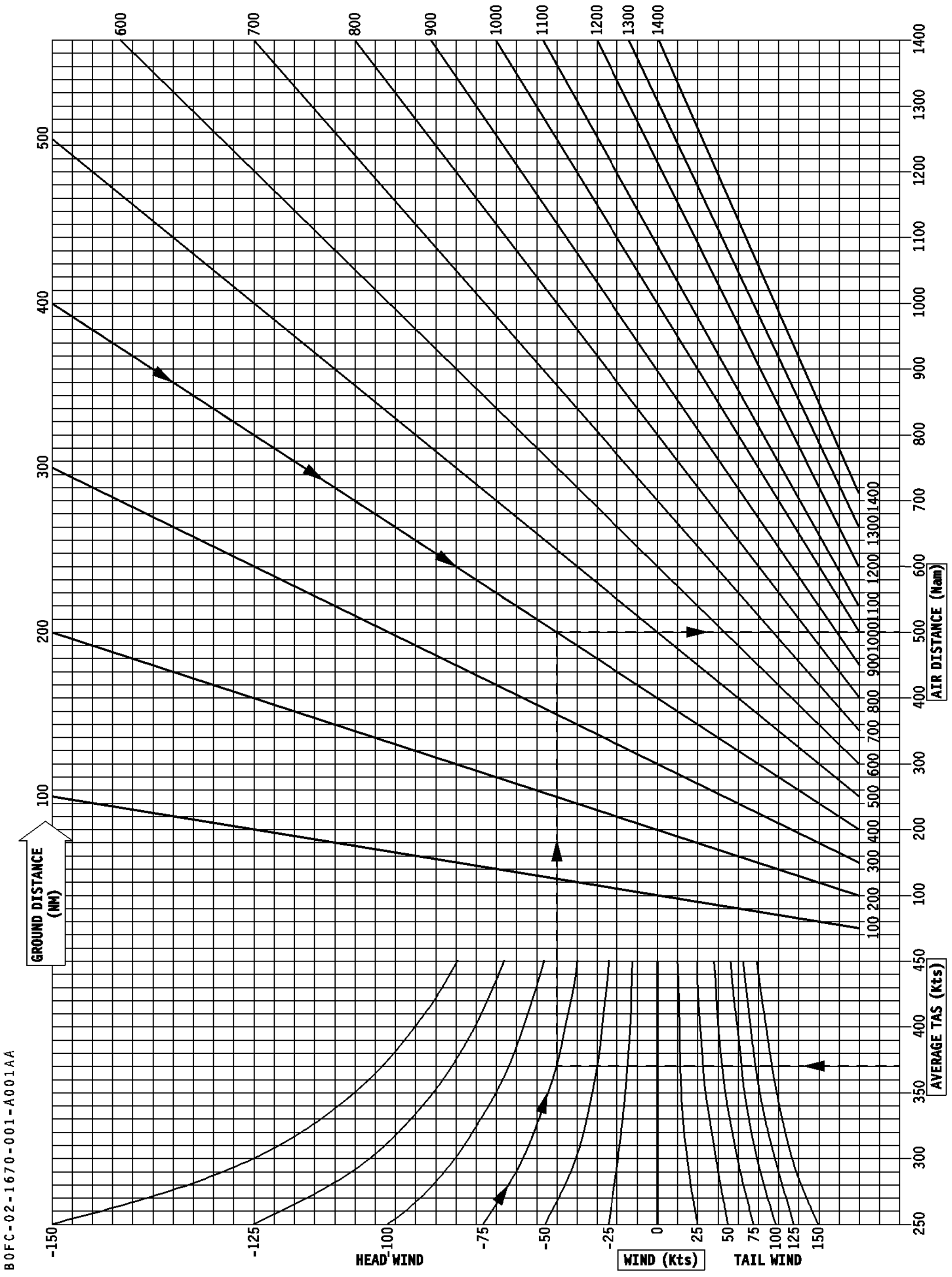
MAX. CONTINUOUS THRUST LIMITS CLEAN CONFIGURATION NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**EPR** **FF (KG/H)** **IAS**

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	FL250	FL290
85	1.087 2476 185	1.102 2438 185	1.127 2414 185	1.139 2410 185	1.153 2405 185	1.170 2393 185	1.188 2381 185	1.211 2377 185	1.283 2428 195	1.380 2569 203
90	1.093 2613 190	1.109 2583 190	1.136 2561 190	1.149 2558 190	1.164 2546 190	1.182 2534 190	1.203 2523 190	1.229 2529 190	1.307 2583 200	1.418 2752 207
95	1.100 2751 195	1.116 2729 195	1.144 2711 195	1.159 2702 195	1.175 2689 195	1.195 2675 195	1.219 2677 195	1.246 2682 195	1.333 2746 204	1.465 2952 212
100	1.106 2897 200	1.122 2876 200	1.153 2860 200	1.169 2846 200	1.187 2832 200	1.209 2825 200	1.235 2831 200	1.264 2835 200	1.362 2925 209	1.518 3178 216
105	1.111 3045 205	1.129 3026 205	1.162 3005 205	1.179 2991 205	1.199 2975 205	1.223 2980 205	1.250 2984 205	1.283 2991 205	1.392 3120 213	1.574 3423 220
110	1.117 3195 210	1.136 3178 210	1.172 3151 210	1.190 3136 210	1.212 3130 210	1.238 3136 210	1.267 3141 210	1.302 3150 210	1.426 3314 218	1.631 3693 224
115	1.123 3346 215	1.143 3332 215	1.181 3298 215	1.201 3280 215	1.225 3287 215	1.252 3291 215	1.284 3299 215	1.322 3318 215	1.463 3515 223	
120	1.128 3500 220	1.150 3489 220	1.191 3445 220	1.213 3438 220	1.238 3444 220	1.268 3449 220	1.302 3460 220	1.343 3489 220	1.505 3734 227	
125	1.134 3655 225	1.157 3639 225	1.201 3589 225	1.225 3596 225	1.252 3601 225	1.283 3609 225	1.320 3630 225	1.366 3674 225	1.554 3989 232	
130	1.140 3812 230	1.164 3789 230	1.212 3749 230	1.237 3755 230	1.266 3760 230	1.299 3771 230	1.339 3802 230	1.390 3871 230	1.603 4261 236	
135	1.146 3972 235	1.172 3940 235	1.223 3909 235	1.249 3913 235	1.280 3922 235	1.316 3942 235	1.360 3985 235	1.416 4072 235		
140	1.152 4131 240	1.180 4092 240	1.234 4069 240	1.262 4075 240	1.294 4086 240	1.333 4117 240	1.381 4185 240	1.443 4275 240		
145	1.158 4285 245	1.187 4241 245	1.245 4230 245	1.275 4238 245	1.309 4257 245	1.351 4295 245	1.404 4391 245	1.475 4493 245		
150	1.165 4440 250	1.195 4387 250	1.256 4392 250	1.288 4404 250	1.325 4433 250	1.371 4498 250	1.429 4596 250	1.508 4721 250		
155	1.171 4596 255	1.204 4543 255	1.268 4557 255	1.301 4573 255	1.341 4612 255	1.391 4706 255	1.456 4807 255	1.546 4980 255		
160	1.178 4748 260	1.213 4708 260	1.280 4725 260	1.316 4750 260	1.358 4808 260	1.413 4916 260	1.485 5035 260	1.586 5265 260		

ENG. ANTI-ICE ON	TOTAL ANTI-ICE ON	per 1°C above ISA
△FF = +0.6%	△FF = +2%	△FF = +0.25%

04 P-05 A310-324-01 PW4152 14300010C6KG270 0 018590 0 0 3 1.3 .0 .0 0 01 1.000 .000 .000 0 FCOM-B0-02-16-60-002-150

GROUND DISTANCE - AIR DISTANCE CONVERSION
FROM 50NM TO 1000NM



Example : average TAS = 370 KT, head wind = 75 kt, ground distance 400 NM, resulting air distance = 500 NM

CONTENTS

1. MINIMUM RECOMMENDED FUEL REQUIREMENTS

The total fuel quantity required to fly a given sector is the sum of the following quantities :

A. Taxi Fuel

Quantity required for start up and TAXI. Fuel calculation will be based on a consumption of **20 kg/min.**

Note : Average quantity (12 min) → **240 kg**

B. Trip Fuel

Fuel required from departure to destination includes the following quantities :

- Takeoff and climb at selected speed.
- Cruise at selected speed.
- Descent from cruising level to 1,500 ft above destination airport.
- Approach and landing. Fuel calculation will be based on a **60 kg/min** consumption.

Note : Average quantity (6 min IMC) → **360 kg**

C. Reserve Fuel

This quantity includes :

(1) « En Route » Reserve Fuel

According to national regulations and company policy (generally based on a percentage of TRIP FUEL).

(2) Alternate Fuel

Fuel required to fly from destination to alternate airport. It includes go-around (300 kg), climb to cruising level, cruise at long range speed, descent and approach procedure (240 kg for 4 minutes VMC).

(3) Holding Fuel

Holding fuel should be calculated taking into account actual alternate altitude and landing weight at alternate, using holding charts of chapter 2.13.

Note : A conservative quantity corresponding to 30 min holding at 1,500 ft above alternate airport elevation and optimum holding speed (see 2.13.10 page 2) can be taken in a general manner.
Average quantity
CLEAN CONFIGURATION→ **2,000 kg**
(1,500 ft above SL)

D. APU fuel consumption

- During ground operation, the fuel consumption is about : R

  185 kg/h (408 lb/h) Packs ON and APU GEN ON R
  125 kg/h (276 lb/h) APU GEN only R

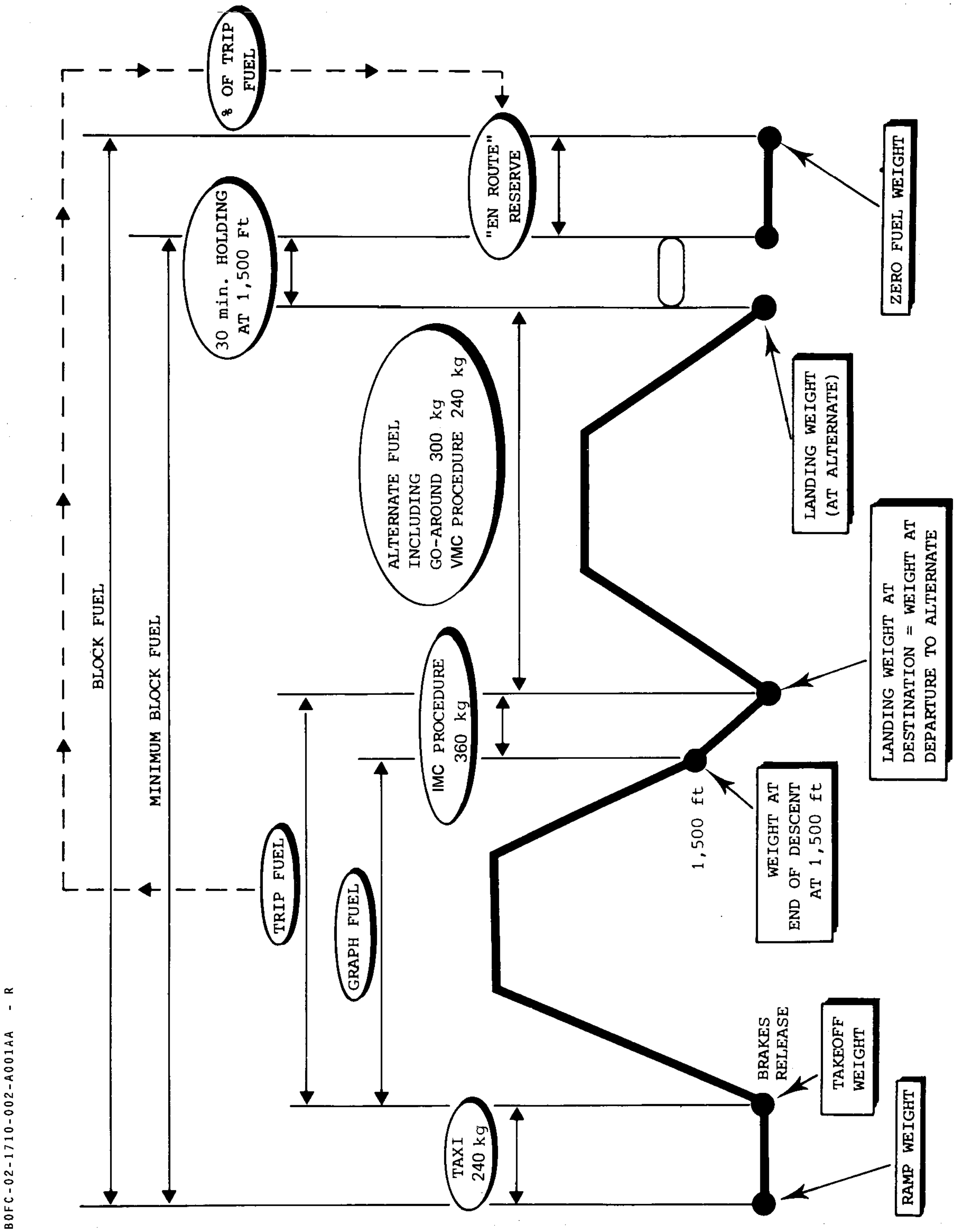
- In flight APU fuel consumption is about : R

  133 kg/h (296 lb/h) at FL 150 Packs ON and APU GEN ON R
  65 kg/h (144 lb/h) at FL 300 APU GEN only R
  61 kg/h (135 lb/h) at FL 350 APU GEN only. R

2. FLIGHT PLAN

When no precalculated flight plan is available, flight planning can be determined by using the graph or tables given in this chapter.
Fuel policy will be the same as for precalculated flight plan.

STANDARD FUEL PLAN PROFILE
FUEL AND WEIGHT DEFINITIONS



STD or GE Eng. : 80C2A2

1. GENERAL

The graph can be used either for preflight planning or for in-flight follow up, and is printed on both sides.

The front side has the following graphs and table (see page 3/4).

(A) – an air-distance/actual weight graph,
(B) – a ground-distance/air distance graph,
(C) – a flight time/air distance graph,
(D) – a correction table including :

  . climb correction to time and fuel consumption,
  . temperature correction to cruise consumption as a function of weight,
  . T/O altitude correction to consumption,

(E) – graph of maximum and optimum altitude as a function of temperature and weight.

The reverse side presents a graph : FUEL AND TIME TO ALTERNATE and a CALCULATION TABLE.

2. USE OF GRAPHS FOR FLIGHT PREPARATION

A. DEFINITIONS

- Actual weight : Gross weight of the aircraft at a given time.
- Actual WEIGHT OVERHEAD DEPARTURE : weight which the aircraft would have *if it were* at cruising level overhead the departure field.
- T/O ALTITUDE CORRECTION : given in table (D) for each 1.000 ft above sea level.
- CLIMB CORRECTION : since the air distance / actual weight graph gives *cruising consumption* it is necessary to introduce a climb correction. The climb correction given in table (D) represents the difference (to be applied to « actual weight over departure ») between climb to cruising level and corresponding cruise at this level. This correction is given as a function of weight. A climb correction is also given to be applied to the flight time.
- Cruise correction : given in table correction (D). Since the planning graphs are drawn for ISA, this correction takes into account the temperature deviations above ISA.

  Descent correction : the reference : « weight at end of descent », has been positioned on the air distance scale to take into account the gain in fuel between cruise and descent.

B. MAXIMUM ALTITUDE – OPTIMUM ALTITUDE : GRAPH (E)

- OPTIMUM ALTITUDE : at this altitude, the airplane will cover the maximum distance per kilogram of fuel (best specific range).
- MAXIMUM RECOMMENDED ALTITUDE : ensures maneuver factor of 1,3 g before buffet onset.
- MAXIMUM ALTITUDE : is determined by the thrust available at the max cruise rating.

The lower of these two latter altitudes is drawn on graph (A).

For temperature higher than ISA + 10, MAXIMUM ALTITUDE decreases linearly between ISA + 10 and ISA + 20.

C. FLIGHT LEVEL AFTER TAKE-OFF

Select the highest possible flight level above the optimum altitude with estimated weight overhead departure, but not exceeding 2,000 ft above the optimum altitude.

Check that the forecasted FLIGHT LEVEL is lower than MAXIMUM ALTITUDE at corresponding temperature.

If turbulence is expected it is recommended to remain at or below optimum altitude.

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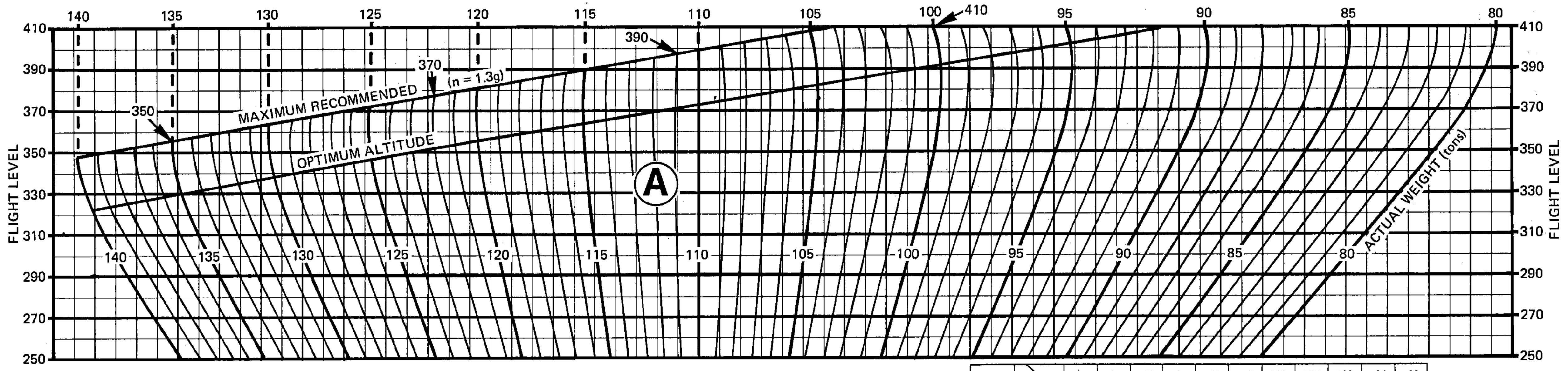

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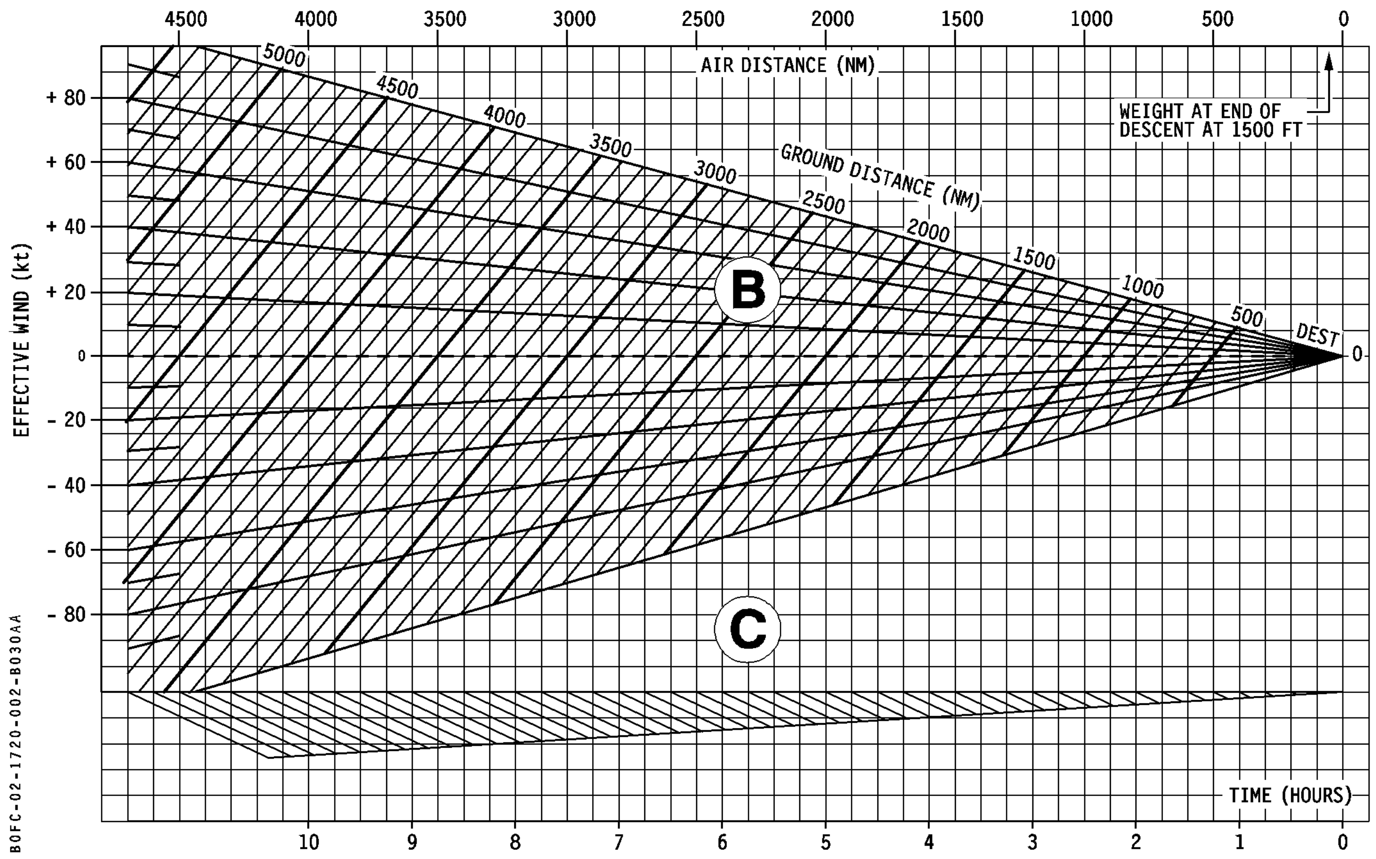


D

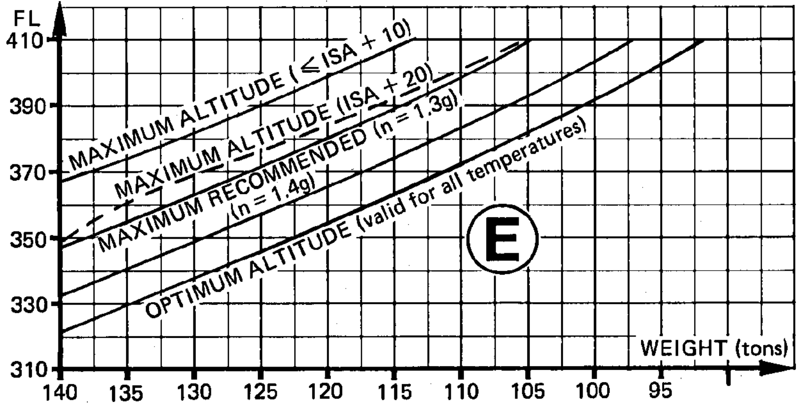
FL \ TOW	140	135	130	125	120	115	110	105	100	95	90
410									1.6	1.5	1.5
390				1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4
370		1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.5	1.4	1.3
350	1.9	1.8	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.2
330	1.9	1.8	1.7	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2
310	1.8	1.7	1.6	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1
290	1.7	1.6	1.6	1.5	1.4	1.3	1.2	1.2	1.2	1.1	1.0
270	1.6	1.5	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0
250	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	1.0	0.9

CLIMB CORRECTION ON T/O WEIGHT (valid for all temperatures)

CLIMB CORRECTION ON TIME : 4 mn | 3 mn

CRUISE CORRECTION ON T/O WEIGHT : for each degree above ISA fuel consumption increases by : 0.006 kg per NM (air distance).

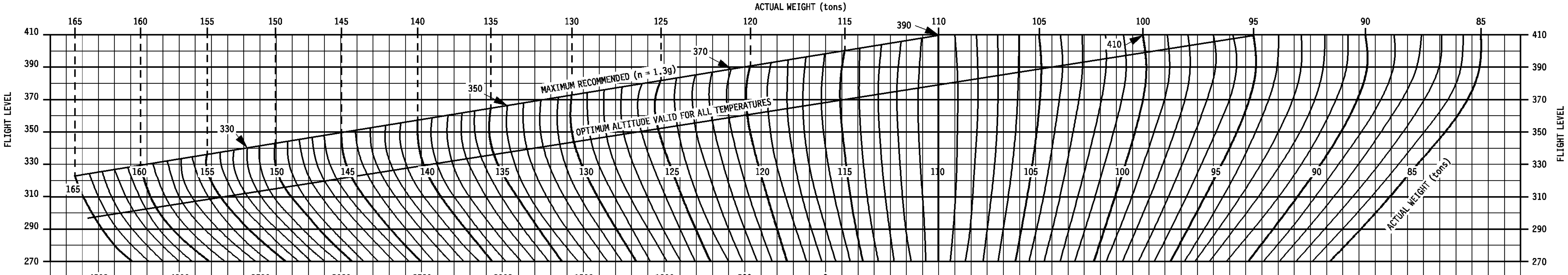
T/O ALTITUDE CORRECTION : save 0.5 kg x TOW (tons) per 1000 ft above SL.

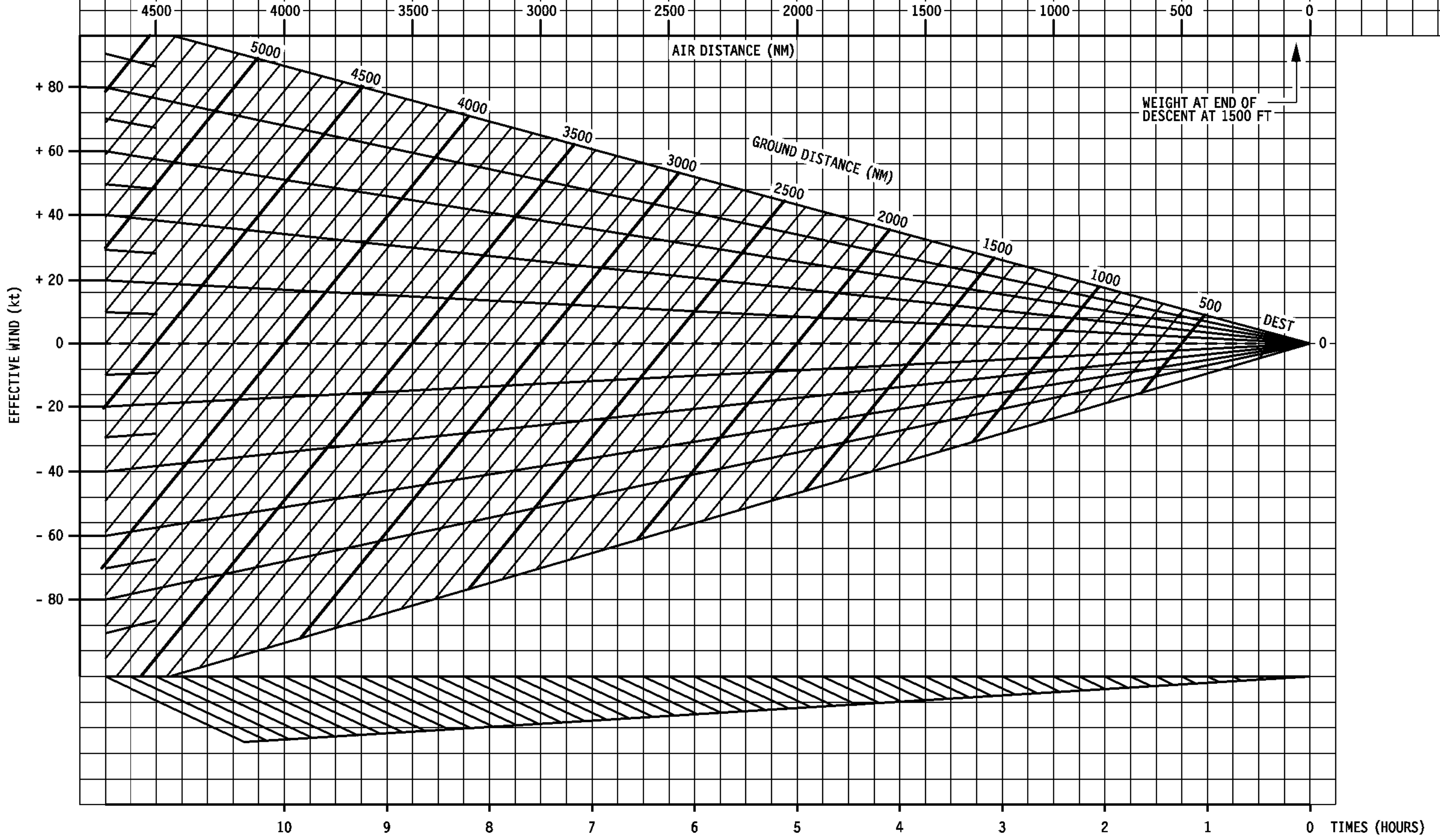


Note : Time is based on TAS 450 kt (SAT – 60°C)
Per kt above 450 kt or per °C above – 60°C subtract 1.3 mn per hour flight time.

R Code : 0078

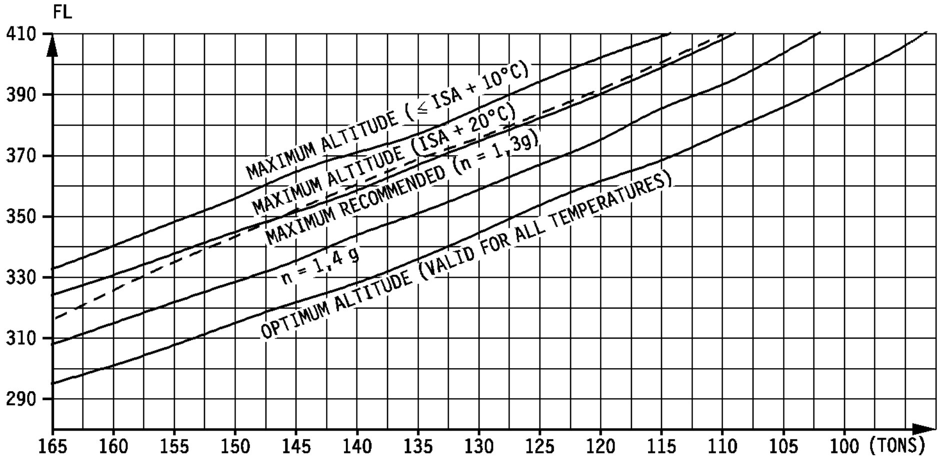
Climb : 250/300 KT/M 0.80 – Descent : M 0.80/300/250 KT – C.G. : 37.5 %





Note : *Time is based on TAS 450 kt (SAT – 60°C)*
Per kt above 450 kt (or per °C above – 60°C) subtract 1.3 mn per hour flight time.

	FL \ TOW	165	160	155	150	145	140	135	130	125	120	115	110	105	100	95	90
CLIMB CORRECTION ON T/O WEIGHT	410												1.6 -	1.6 1.7	1.5 1.7	1.5 1.6	1.4 1.6
	390			Δ W at ISA Δ W at ISA + 20							1.7 1.8	1.6 1.8	1.6 1.8	1.5 1.7	1.5 1.6	1.4 1.6	1.3 1.5
	370							1.8 -	1.8 1.9	1.7 1.9	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.6	1.4 1.6	1.4 1.5	1.3 1.4
	350				1.9 -	1.9 2.1	1.9 2.1	1.8 2.0	1.8 1.9	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.6	1.4 1.6	1.4 1.5	1.3 1.4	1.2 1.3
	330	2.1 -	2.1 -	2.0 2.2	2.0 2.2	1.9 2.1	1.9 2.0	1.8 2.0	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.6	1.4 1.6	1.3 1.5	1.3 1.4	1.2 1.3	1.2 1.3
	310	2.1 2.3	2.1 2.3	2.0 2.2	1.9 2.1	1.9 2.0	1.8 1.9	1.7 1.9	1.6 1.8	1.5 1.7	1.5 1.6	1.4 1.5	1.3 1.5	1.3 1.4	1.2 1.3	1.1 1.3	1.1 1.2
	290	2.1 2.3	2.0 2.2	1.9 2.1	1.8 2.0	1.7 1.9	1.7 1.8	1.6 1.7	1.5 1.7	1.4 1.6	1.4 1.5	1.3 1.4	1.3 1.4	1.2 1.3	1.1 1.2	1.1 1.2	1.0 1.1
	270	1.9 2.1	1.9 2.1	1.8 2.0	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.6	1.4 1.5	1.4 1.5	1.3 1.4	1.2 1.3	1.2 1.3	1.1 1.2	1.0 1.1	1.0 1.1	1.0 1.0
CLIMB CORRECTION ON TIME		5 mm		4 mm				3 mm					2 mm				
CRUISE CORRECTION ON T/O WEIGHT FOR EACH DEGREE ABOVE ISA , FUEL CONSUMPTION INCREASES BY : 0.007kg PER NM (AIR DISTANCE)																	
T/O ALTITUDE CORRECTION : SAVE 0.5 kg x TOW (tons) PER 1000 ft ABOVE SL.																	



CALCULATION TABLE

1	① MAX T/O WEIGHT at brakes release	▶
2	– CLIMB CORRECTION	–
3	▨	=
4	+ T/O ALTITUDE CORRECTION	+
5	= O/DEPT. WEIGHT	=
6	Flight planning graph END OF DESC. WEIGHT (at ISA)	▶
7	– CRUISE CORRECTION	–
8	= END OF DESC. WEIGHT	=
9	– IFR PROCEDURE	–
10	② LANDING WEIGHT AT DESTINATION	=
11	– ALTERNATE FUEL	–
12	= ALTERNATE LANDING WEIGHT	=
13	– HOLDING	–
14	= WEIGHT AT END OF HOLDING	=
15	TRIP FUEL ①–②	▨
16	– «EN ROUTE» RESERVE	–
17	③= ZERO FUEL WEIGHT (≤MZFW) (if no extra fuel)	=
18	– DOW	–
19	MAX ALLOWABLE PAYLOAD	=
20	– ACTUAL PAYLOAD	–
21	= POSSIBLE EXTRA FUEL	=
22	RAMP FUEL CALCULATION	
23	REQUIRED FUEL ①– ③	▶
24	+ TAXI	+
25	+ EXTRA FUEL	+
26	= RAMP FUEL	=
27	FLIGHT TIME CALCULATION	
28	GRAPH TIME	▶
29	+ CLIMB CORRECTION	+
30	FLIGHT TIME	=

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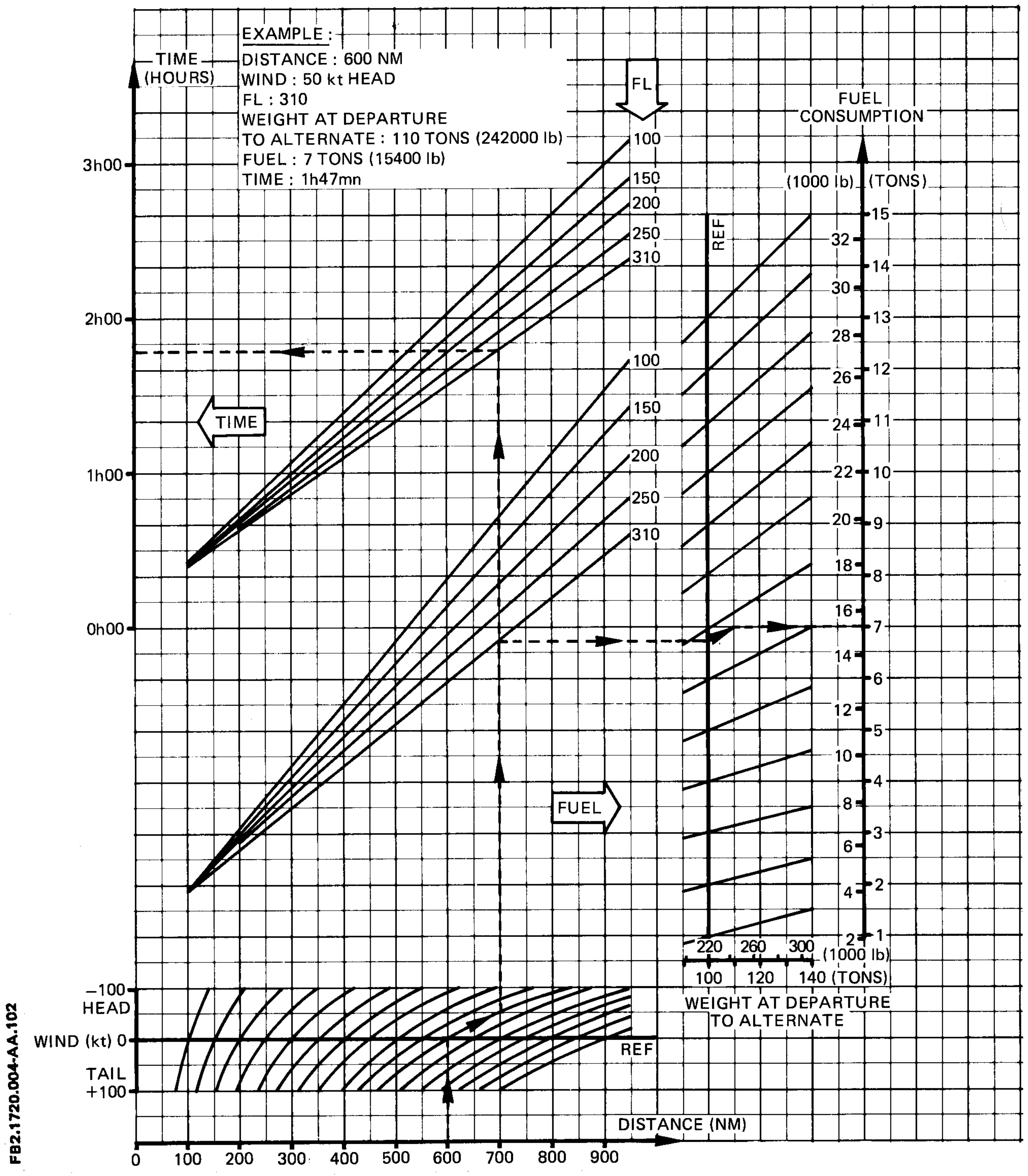
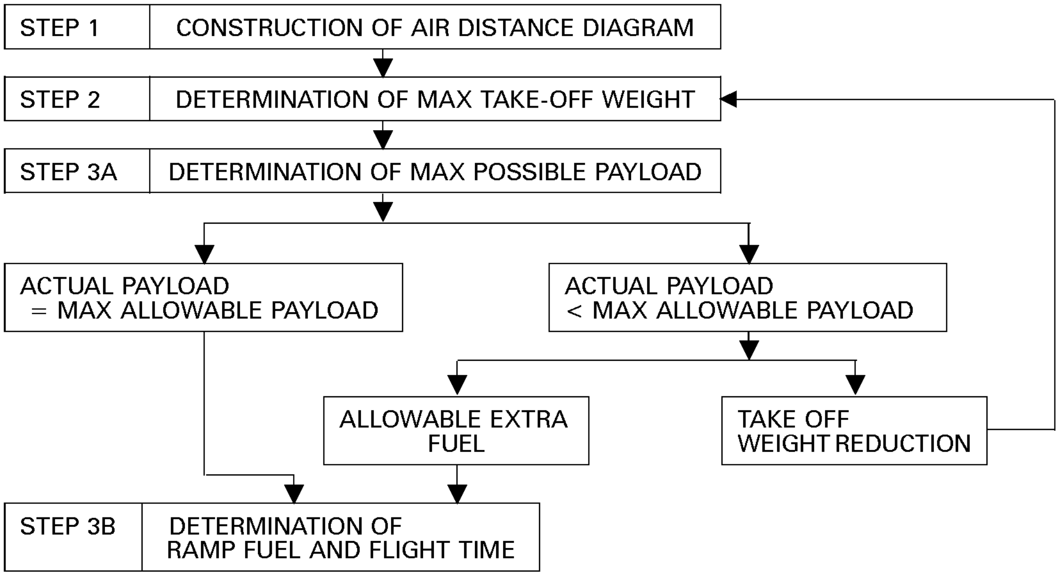
FLIGHT PLANNING FROM GO AROUND TO LANDING
INCLUDING : GO AROUND = 300 KG (660 lb), CLIMB 250/270 Kt/M O.65
CRUISE AT LONG RANGE, DESCENT M O.65/270/250 KT, VMC PROCEDURE = 240 KG (530 lb) and 4 MN



D. STEPS FOR PREPARATION OF FUEL/TIME PLAN

R



(1) STEP 1 : AIR DISTANCE

(a) Explanations

- Prepare navigation log (distance between points and wind components) from which remaining ground distance will be extracted.
- Plot these distances on ground distance scale, starting from destination and working back to departure point.
- Draw parallel oblique lines at each of these points.

- From destination (point 0) follow the wind line of the last leg until intersection with oblique line of next point. This intersection represents air position of last point.
- From air position of last, draw the parallel to effective wind line of preceeding leg until intersection with next oblique line.
- Proceed in a similar way until air position of departure point is determined.

- Draw vertical lines through air positions of check points to upper air distance scale and to lower time scale Flight time will be determined by correcting the time read on the scale with the actual value of TAS.

(b) Example data : Airport A → Airport B (See page 6)

	DISTANCE	EFFECT WIND
AIRPORT A → POINT 1	1330 NM	— 50 kt
POINT 1 → POINT 2	350 NM	0 kt
POINT 2 → POINT 3	200 NM	+ 30 kt
POINT 3 → AIRPORT B	600 NM	+ 80 kt

- Prepare navigation log.

- Plot remaining ground distances.

- Draw oblique lines corresponding to remaining distances 600, 800, 1150, 2480.

- From point 0 follow the line + 80, until intersection with oblique line 600 NM.

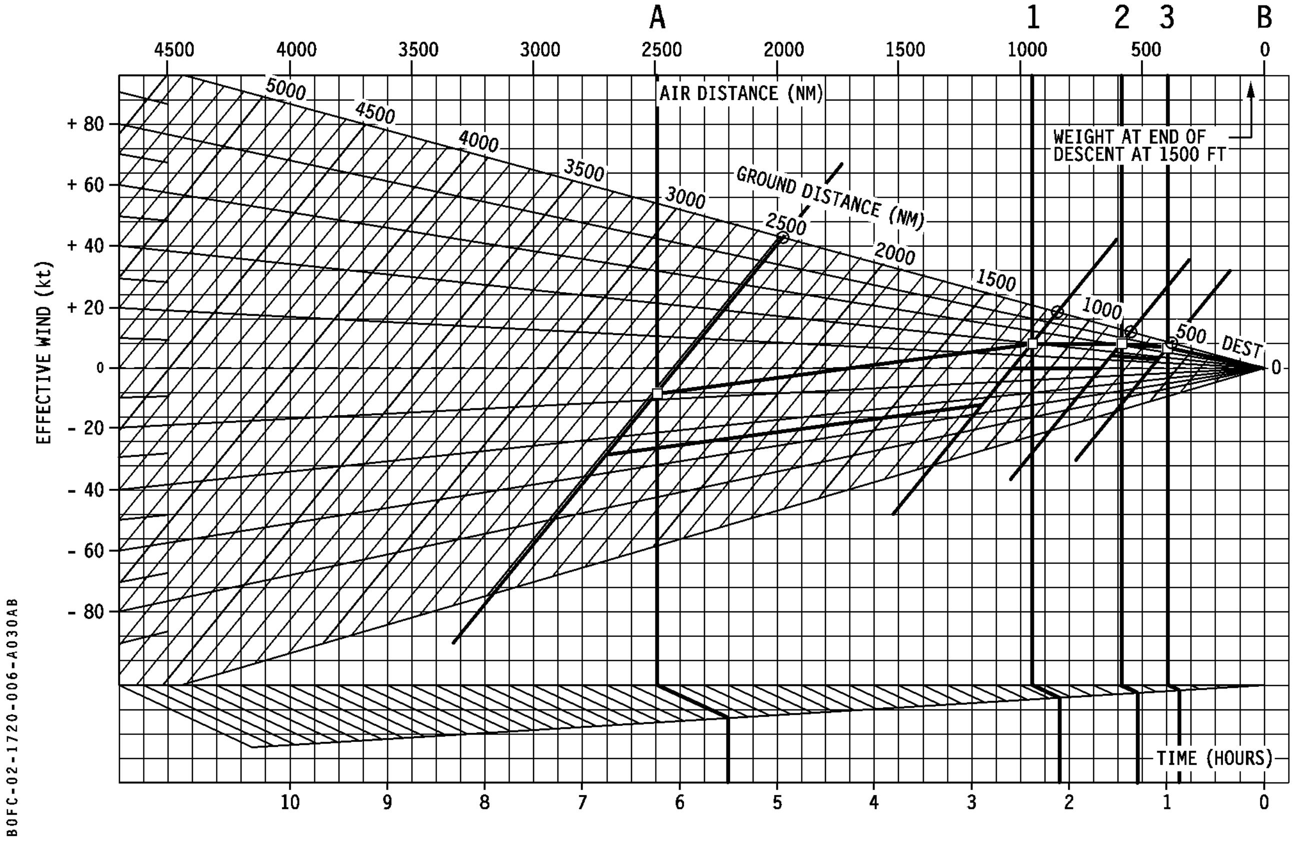
- From air position of last point, draw the parallel to wind + 30 until intersection with oblique line 800 NM.

- Proceed in the same way for all points.

- Draw vertical lines through air positions.

EXTRACT FROM NAVIGATION LOG

CHECK POINTS	DISTANCE BETWEEN POINTS	WIND COMPONENT	REMAINING DISTANCES
AIRPORT A DEPARTURE			2480
	1330	− 50	
POINT 1			1150
	350	0	
POINT 2			800
	200	+ 30	
POINT 3			600
	600	+ 80	
AIRPORT B DESTINATION	Total 2480		0



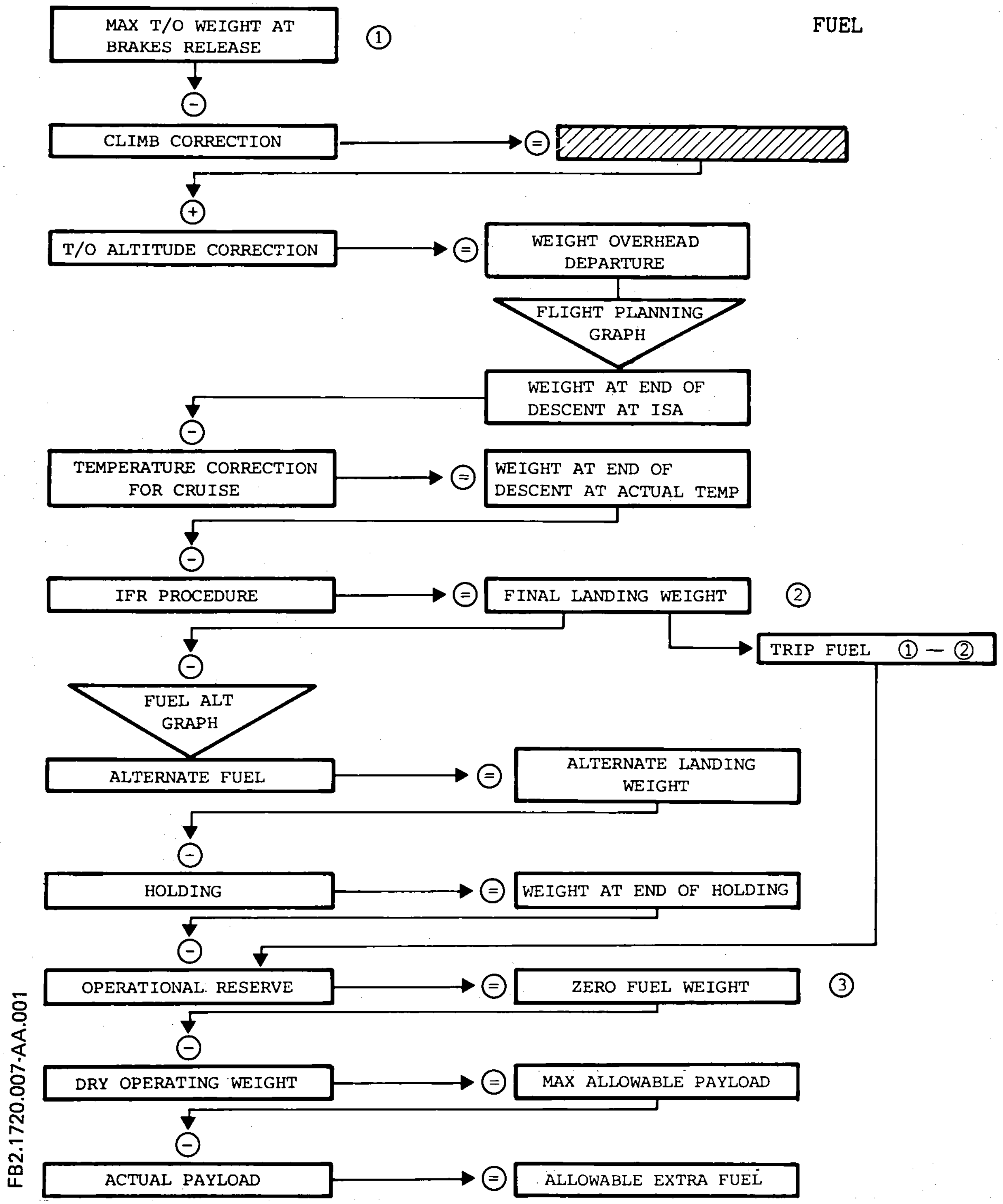
Note : Time is based on TAS 450 kt (SAT -60°C)
Per kt above 450 kt or per °C above -60°C subtract 1.3 mn per hour flight time.

R Code : 0074

(2) Step 2 : Determination of max take off weight

Use RTOLW charts, quick reference tables (refer to 2.09) or Flight Manual.

(3) Step 3 : Determination of payload, trip fuel, ramp fuel and flight time



R Code : 0075

CALCULATION TABLE

1	① MAX T/O WEIGHT at brakes release	▶				
2	– CLIMB CORRECTION	–				
3	//	=				
4	+ T/O ALTITUDE CORRECTION	+				
5	= O/DEPT. WEIGHT ▼	=				
6	Flight planning graph END OF DESC. WEIGHT (at ISA)	▶				
7	– CRUISE CORRECTION	–				
8	= END OF DESC. WEIGHT	=				
9	– IFR PROCEDURE	–				
10	② LANDING WEIGHT AT DESTINATION	=				
11	– ALTERNATE FUEL	–				
12	= ALTERNATE LANDING WEIGHT	=				
13	– HOLDING	–				
14	= WEIGHT AT END OF HOLDING	=				
15	TRIP FUEL ① – ②					////////////////////////////
16	– « EN ROUTE » RESERVE	–				
17	ZERO FUEL WEIGHT (⩽ MZFW) ③ = (if no extra fuel)	=				
18	– DOW	–				
19	MAX ALLOWABLE PAYLOAD	=				
20	– ACTUAL PAYLOAD	–				
21	= POSSIBLE EXTRA FUEL	=				

22	RAMP FUEL CALCULATION					
23	REQUIRED FUEL ① – ③	▶				
24	+ TAXI	+				
25	+ EXTRA FUEL	+				
26	= RAMP FUEL	=				

27	FLIGHT TIME CALCULATION					
28	GRAPH TIME	▶				
29	+ CLIMB CORRECTION	+				
30	FLIGHT TIME	=				

(4) Comments on calculation table :

Line 6 : determination of WEIGHT AT END OF DESCENT AT ISA.

Use flight planning graph (A).

. Take a strip of paper and plot the distance between « WEIGHT AT END OF DESCENT INDEX » on upper air distance scale and departure air position vertical line (observe that this index is not at 0 point of the scale).

. Transfer this strip of paper into the weight/distance diagram on the horizontal line corresponding to the first selected cruise level (refer § 2.C) with departure point on the 0/DEPT. WEIGHT calculated above.

If end of descent point plotted on strip of paper is more than 2.000 ft under optimum altitude, a level change en route to the next flight level is desirable.

In the former case, plot on the strip of paper the distance where the intermediate step will be made. (Ideally at the point indicated by an arrow).
Transfer the strip of paper vertically, keeping the step point on the same weight curve to final possible cruise level. Read gross weight at end of descent point and subtract 100 kg (200 lb) to take into account the additional fuel for climbing to a higher level.
This gives WEIGHT AT END OF DESCENT AT ISA.

Line 10 : *CHECK THAT LANDING WEIGHT AT DESTINATION IS LOWER THAN MAXIMUM LANDING WEIGHT.*

Line 11 : ALTERNATE FUEL is determined by considering the weight at destination equal to the weight at departure to alternate.

Line 17 : *CHECK THAT THE ZERO FUEL WEIGHT IS LOWER THAN MAX ZERO FUEL WEIGHT.*
STEP 3B/RAMP FUEL and FLIGHT TIME calculation.

. RAMP FUEL CALCULATION (line 22 to 26) : obtained by adding REQUIRED FUEL (= MAX T/0 WEIGHT - ZERO FUEL WEIGHT), TAXI FUEL (20 kg or 45 lb per min) and EXTRA FUEL (if any).

CHECK THAT IT IS LOWER THAN TANKS MAXIMUM CAPACITY.

. FLIGHT TIME CALCULATION (line 27 to 30).
Flight time = time found in graph (C) corrected for TAS
+ climb correction
(in table (D))
Time is found in graph (C) on the lower time scale corrected by the TAS or temperature value at cruising level.
In case of level change en route, take TAS or temperature at intermediate level between initial and final levels.

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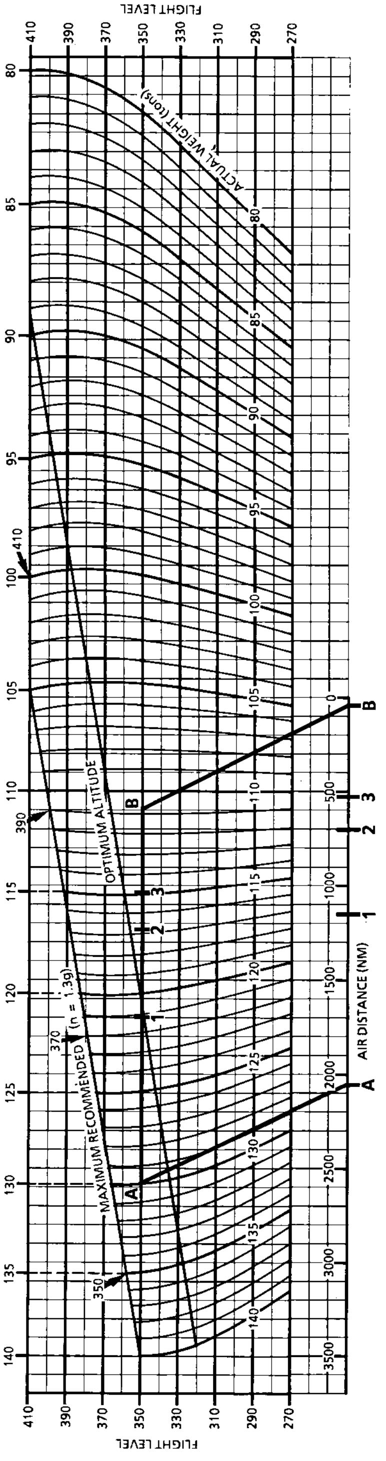
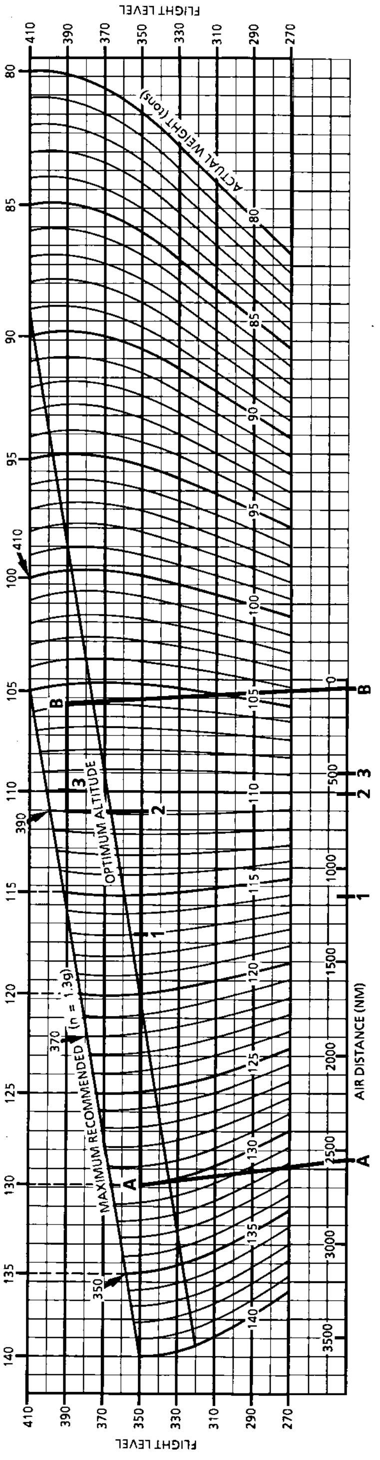
Example 1 : NO STEP CLIMB



Example 2 : STEP CLIMB



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3. EXAMPLE

Continuation of example 2 page 5 and 6 Air distance 2550 NM.

DATA : Airport elevation : 1,500 ft
Max T/O weight (RTOLW charts) : 131.7 tons
Temperature : ISA + 10 along the whole flight profile
Odd flight level

A. Fill in MAX T/O WEIGHT → 131.7 tons

B. Choose first flight level : FL 350 and subtract CLIMB CORRECTION : 1.8 T → 129.9 T

C. Add T/O ALTITUDE CORRECTION :
0.5 X 131.7 X 1.5 = 99 kg = 0.1 t
To obtain O/DEPT WEIGHT =
129.9 + 0.1 = 130.0 tons

D. Determination of WEIGHT AT END OF DESCENT AT ISA.
Plot on a strip of paper the air distance from graph.
First flight level : 350 departure weight 130.0 t
Level change at 111 t → FL 390
WEIGHT AT END OF DESCENT
106.1 — 0.1 t (level change) = 106 t

E. Subtract CRUISE CORRECTION :
0.006 X 10 X 2550 = 153 kg
to obtain END OF DESCENT WEIGHT
106 — 0.2 = 105.8 t

F. Subtract IFR procedure (6 min for example)
6 X 60 = 360 kg = 0.4 t
to obtain LANDING WEIGHT AT DESTINATION
105.8 — 0.4 = 105.4 t lower than MLW

G. Subtract ALTERNATE FUEL : → corresponding graph with WEIGHT AT DEPARTURE TO ALTERNATE = 105.4 t and 340 NM at FL 200 → 4.6 t
WEIGHT AT LANDING TO ALTERNATE
105.4 — 4.6 = 100.8 t

H. Subtract HOLDING FUEL : standard account for clean configuration → 2.1 t
WEIGHT AT END OF HOLDING : 100.8 — 2.1 = 98.7 t

I. TRIP FUEL = 131.7 — 105.4 = 26.3 t

J. Subtract « EN ROUTE » RESERVE : for example 5 % of trip fuel → 1.3 t
ZERO FUEL WEIGHT = 98.7 — 1.3 = 97.4 t
97.4 t lower than MZFW

K. Subtract DOW = 80 t to obtain MAX ALLOWABLE PAYLOAD 97.4 — 80 = 17.4

L. Subtract ACTUAL PAYLOAD = 13 t to obtain POSSIBLE EXTRA FUEL → 4.4 t
RAMP FUEL CALCULATION :
34.3 + 0.2 + 4.4 = 38.9 t
FLIGHT TIME CALCULATION :
ISA + 10 at FL 350 = 44.3°
ISA + 10 at FL 390 = 46.5° read at — 45.4° → 5 h 30 mn
+ CLIMB CORRECTION 4 mn → TOTAL 5 h 34 mn

① MAX T/O WEIGHT at brakes release	▶	1	3	1	7
– CLIMB CORRECTION	–			1	8
//	=	1	2	9	9
+ T/O ALTITUDE CORRECTION	+			0	1
= O/DEPT. WEIGHT	=	1	3	0	0
Flight planning graph END OF DESC. WEIGHT (at ISA)	▶	1	0	6	0
– CRUISE CORRECTION	–			0	2
= END OF DESC. WEIGHT	=	1	0	5	8
– IFR PROCEDURE	–			0	4
② LANDING WEIGHT AT DESTINATION	=	1	0	5	4
– ALTERNATE FUEL	–			4	6
= ALTERNATE LANDING WEIGHT	=	1	0	0	8
– HOLDING	–			2	1
= WEIGHT AT END OF HOLDING	=		9	8	7
TRIP FUEL ① – ② 2 6 3	//////////////////////////				
– « EN ROUTE » RESERVE	–			1	3
ZERO FUEL WEIGHT (≤ MZFW) ⑧ = (if no extra fuel)	=		9	7	4
– DOW	–		8	0	0
MAX ALLOWABLE PAYLOAD	=		1	7	4
– ACTUAL PAYLOAD	–		1	3	0
= POSSIBLE EXTRA FUEL	=			4	4

RAMP FUEL CALCULATION					
REQUIRED FUEL ① – ③	▶		3	4	3
+ TAXI	+			0	2
+ EXTRA FUEL	+			4	4
= RAMP FUEL	=		3	8	9

FLIGHT TIME CALCULATION				
GRAPH TIME	▶	5	3	0
+ CLIMB CORRECTION	+	0	0	4
FLIGHT TIME	=	5	3	4

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4. IN FLIGHT USE OF GRAPHS

A. RESERVE FUEL CHECK

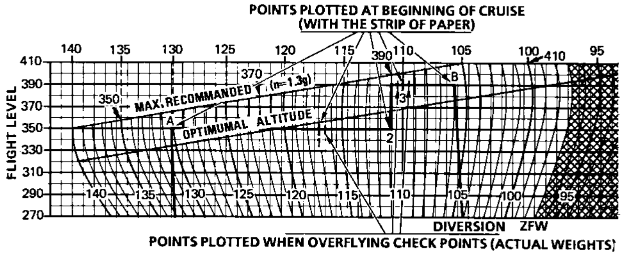
– Plot on the weight/distance diagram the curve corresponding to zero fuel weight.
The zone located on the right side from this curve is the no-fuel zone.

– Determine diversion gross weight
Diversion GROSS WEIGHT = ZFW + MINIMUM FUEL FOR DIVERTING

	ZFW
DIVERSION	+ ALTERNATE FUEL
GROSS WEIGHT	+ 30 mn HOLDING CLEAN

Plot this diversion GROSS WEIGHT CURVE on the diagram.
This curve is the « minimum reserve » curve.

EXAMPLE : DOW = 80 tons
Last minute load is 17 tons
Alternate fuel : 4.6 tons
Actual ZFW = 80 + 17 = 97 tons
Diversion weight = 97 + 2.1 + 4.6 = 103.7 tons



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B. IN FLIGHT FOLLOW-UP

At beginning of cruise, plot the actual *weight overhead departure* (which can be different from the one taken into account for *preparation*) on actual flight level line.
Actual O/DEP W = Actual TOW — CLIMB CORRECTION (GRAPH D).
With the strip of paper, plot expected weights corresponding to check points and destination (above flight level line).

When overflying a check point, calculate actual weight and plot it opposite to expected actual weight under the flight level line. With the strip of paper, determine END DESC W corresponding to that actual weight and compare it with expected END DESC W.

EXAMPLE : Actual T.O.W. = 131.7 tons

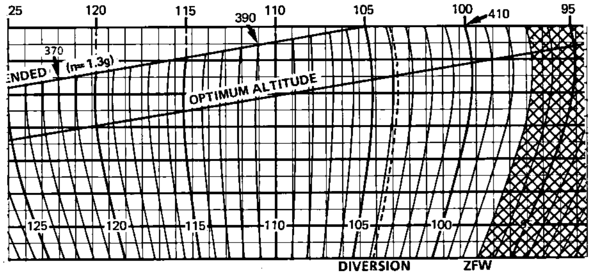
– Plot point A at 131.7 t – CLIMB CORRECTION (1.8 tons) = 129.9 tons

– Plot actual weights of check points with the strip of paper.

– When overflying a check point plot actual weight

– With the strip of paper : determine expected END DESC W.

– Compare it with DIVERSION WEIGHT.



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C. FLIGHT LEVEL CHANGE

(1) Climb at a higher level

Proceed as indicated in flight preparation.
Do not forget to subtract 100 kg at step climb.

(2) Descent at a lower level

It may be mandatory to descend at a lower level on ATC request or advisable to descend in case of turbulence.

In this case, note the actual weight at beginning of descent, plot that weight (without correction) on lower flight level line and with the strip of paper plot (above flight level line) expected weights corresponding to last check points and destination.

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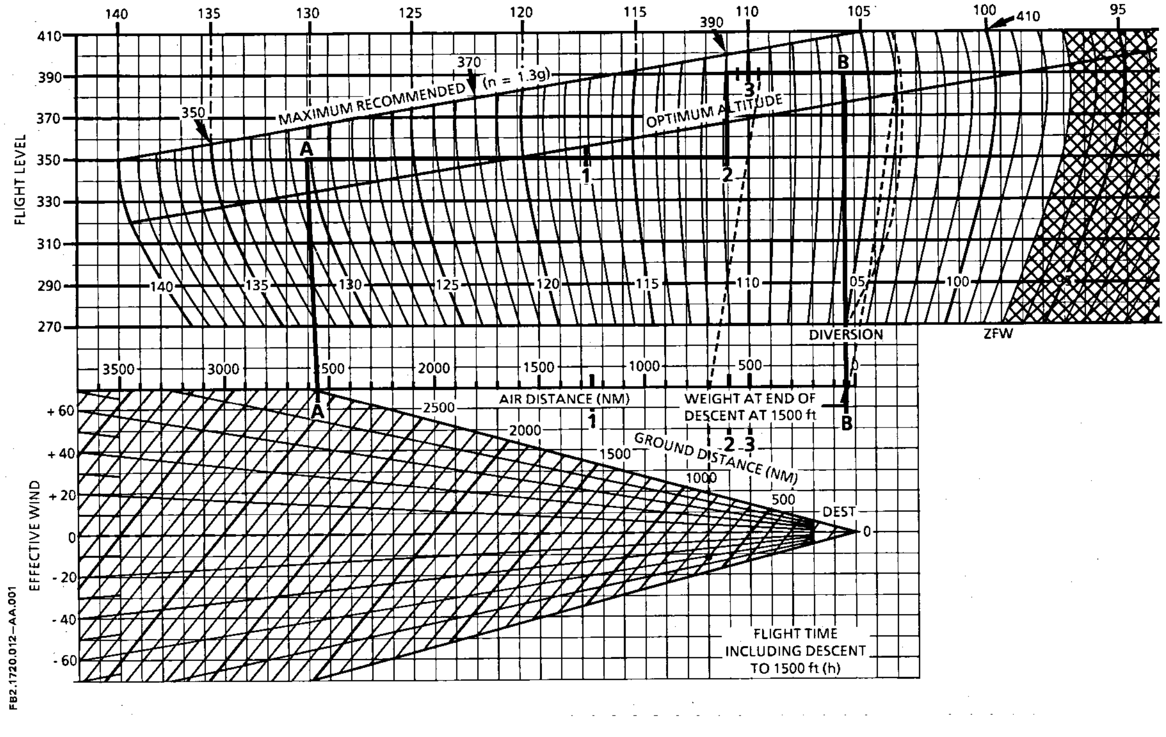
D. MAXIMUM PERMISSIBLE WIND

Let us suppose we meet the situation shown on example, i.e., actual weights (points 1 and 2 lower marks) are lower than expected weights, because stronger winds than expected have been encountered, and the step climb is not allowed by ATC.

At point 3, we want to know which wind will allow destination to be reached. We measure (with a strip of paper) the distance between actual weight at point 3 and diversion weight curve. We transfer this distance on upper air distance scale and draw a vertical line from the extremity of the vector. The intersection with *ground distance line of* point 3 (500 NM) gives maximum permissible wind.

We can read : approximately : — 60 kt.



1. GENERAL

This chapter can be used either when no precalculated flight plan is available, or for flight planning follow up. The following tables and graphs are given for the flight planning preparation.

- . Nautical ground miles to air miles conversion
- . Fuel and time to destination : 200 NM to 5000 NM
- . Fuel and time to alternate LRC (Long range IAS or Mach Numbers are given in 2.12)
- . Cruise level chart

The « fuel and time to destination » tables enable to determine cruise fuel consumption and cruise time to cover a given air distance. They include :

- . Climb : 250 kt/300 kt/M.80
- . Cruise : M.80
- . Descent : M.80/300 kt/250 kt
- . IMC procedure : 360 kg (800 lb) 6 min

- . Econ. Air conditioning
- . C.G. : 37.5 %
- . ISA

The « Alternate » table include :

- . Go-around : 300 kg (660 lb)
- . Climb : 250 kt/270 kt/M.65
- . Cruise at Long Range speed
- . Descent : M.65/270 kt/250 kt
- . VMC procedure : 240 kg (530 lb) 4 min

- . Econ. Air conditioning
- . C.G. : 27 %
- . ISA

Note : 1 In case of a flight below FL 290 for which no flight planning table is provided, the alternate table may be used by adding 120 kg (265 lb) to the fuel consumption and 2 minutes to the flight time given in the table (difference between IMC and VMC approaches). (The 300 kg (660 lb) fuel for go around will be kept since very close to the fuel consumption for take-off).

Note : 2 In case of emergency descent refer to the graphs FUEL AND TIME AT FL 100 and 140 included in chapter 2.18.20 FLIGHT WITHOUT CABIN PRESSURIZATION.

« In cruise quick check » tables are given for flight planning follow-up. They allow to determine the fuel consumption and the time from any moment during cruise to landing. They include :

- . Cruise : M.80
- . Descent : M.80/300 kt/250 kt
- . IMC procedure : 360 kg (800 lb) 6 min

- . Econ. Air conditioning
- . C.G. : 37.5 %
- . ISA

CORRECTIONS

- ● A correction on fuel consumption has to be made when the actual landing weight is different from the reference landing weight.
  Add (resp. sub) the corresponding △ Fuel per 1000 kg (lb) above (resp. below) the reference landing weight.
- ● Add (resp. sub) 0.20 % on fuel consumption per degree (C) above (resp. below) ISA.
- ● When using normal air conditioning, fuel consumption is increased by 0.8%.

2. FLIGHT PREPARATION

A. SHORT DISTANCE CALCULATION TABLE

1	① ZERO FUEL WEIGHT	▶				
2	+ HOLDING FUEL	+				
3	= ESTIMATED LANDING WEIGHT AT ALTERNATE	=				
4	+ ALTERNATE FUEL FOR REFERENCE WEIGHT	+				
5	± CORRECTIONS FOR DEVIATION FROM REFERENCE	±				
6	= ② ESTIMATED LANDING WEIGHT AT DESTINATION	=				
7	TRIP FUEL FOR REFERENCE WEIGHT					
8	± CORRECTIONS FOR DEVIATION FROM REFERENCE	±				
9	= ③ TRIP FUEL	=				
10	+ "EN ROUTE" RESERVE	+				
11	+ ②	+				
12	④ = TAKE OFF WEIGHT	=				
13	− ③	−				
14	= LDG WEIGHT AT DESTINATION	=				
15	MAX PERMISSIBLE T/O WEIGHT	▶				
16	− ④					
17	= POSSIBLE EXTRA FUEL	=				

	RAMP FUEL CALCULATION					
18	REQUIRED FUEL ④−①	▶				
19	+ TAXI	+				
20	+ EXTRA FUEL	+				
21	= RAMP FUEL	=				

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B. PREPARATION

- – Use the short distance calculation table.
- – Determine Zero Fuel Weight.
- – Add Holding Fuel : 2100 kg (4400 lb) standard amount for clean configuration (1500 ft above SL) to obtain landing weight at alternate.
- – According to the distance between destination and alternate airport and the wind component, enter the « Nautical ground miles to air miles conversion » table at long range speed and read air distance.
- – According to air distance and FL, enter the alternate table and read time and fuel required for the reference weight of 100 000 kg (220000 lb.) Correct the fuel quantity according to the difference between the actual weight and the reference weight of 100 000 kg (220000 lb) and for temperature deviation. This gives the alternate fuel, which, added to the landing weight at alternate, gives the landing weight at destination.
- – According to the distance to go and the wind component, enter the « Nautical Ground Miles to Air Miles Conversion » table and read air distance.
- – Enter the corresponding « Fuel and Time to Destination » table and read time and fuel required for the reference landing weight of 100 000 kg (220000 lb.) Make the corrections for deviation from reference, which gives the trip fuel.
- – Determine « en route » reserve : for example 5 % of trip fuel.
- – Determine Take-off weight by adding landing weight at destination, trip fuel and « en route » reserve. (check it is lower than MTOW determined from RTOLW or quick reference tables).
- – Determine possible extra fuel.

C. RAMP FUEL CALCULATION

This is obtained by the addition of : REQUIRED FUEL (refer to calculation table), TAXI FUEL and EXTRA FUEL.

NAUTICAL GROUND MILES TO AIR MILES CONVERSION
M 0.80

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KTS)			HEAD WIND	
	+120	+ 80	+ 40	0	-40	-80	-120
200	159	170	184	**200**	219	242	270
250	198	213	230	**250**	274	302	338
300	238	256	276	**300**	328	363	406
350	278	298	322	**350**	383	423	473
400	317	341	368	**400**	438	484	541
450	357	383	414	**450**	493	544	608
500	397	426	460	**500**	547	605	676
550	436	469	506	**550**	602	665	743
600	476	511	552	**600**	657	726	811
650	516	554	598	**650**	712	786	879
700	555	597	644	**700**	766	847	946
750	595	639	690	**750**	821	907	1014
800	635	682	736	**800**	876	968	1081
850	674	724	782	**850**	931	1028	1149
900	714	767	828	**900**	985	1089	1217
950	754	810	874	**950**	1040	1149	1284
1000	794	852	920	**1000**	1095	1210	1352
1050	833	895	966	**1050**	1150	1270	1419
1100	873	937	1012	**1100**	1204	1331	1487
1150	913	980	1058	**1150**	1259	1391	1555
1200	952	1023	1104	**1200**	1314	1452	1622
1250	992	1065	1150	**1250**	1369	1512	1690
1300	1032	1108	1196	**1300**	1423	1573	1757
1350	1071	1150	1242	**1350**	1478	1633	1825
1400	1111	1193	1288	**1400**	1533	1694	1892
1450	1151	1236	1334	**1450**	1588	1754	1960
1500	1190	1278	1380	**1500**	1642	1815	2028
1550	1230	1321	1426	**1550**	1697	1875	2095
1600	1270	1363	1472	**1600**	1752	1936	2163
1650	1309	1406	1518	**1650**	1807	1996	2230
1700	1349	1449	1564	**1700**	1861	2057	2298
1750	1389	1491	1610	**1750**	1916	2117	2366
1800	1428	1534	1656	**1800**	1971	2178	2433
1850	1468	1577	1702	**1850**	2026	2238	2501
1900	1508	1619	1748	**1900**	2080	2299	2568
1950	1547	1662	1794	**1950**	2135	2359	2636
2000	1587	1704	1840	**2000**	2190	2420	2704
2050	1627	1747	1886	**2050**	2245	2480	2771
2100	1666	1790	1932	**2100**	2299	2541	2839
2150	1706	1832	1978	**2150**	2354	2601	2906

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NAUTICAL GROUND MILES TO AIR MILES CONVERSION
M 0.80

GROUND DIST. (NM)	AIR DISTANCE (NM)						
		TAIL WIND	WIND COMPONENTS (KTS)			HEAD WIND	
	+120	+ 80	+ 40	0	-40	-80	-120
2200	1746	1875	2024	**2200**	2409	2662	2974
2250	1785	1917	2070	**2250**	2464	2722	3041
2300	1825	1960	2116	**2300**	2518	2783	3109
2350	1865	2003	2162	**2350**	2573	2843	3177
2400	1904	2045	2208	**2400**	2628	2904	3244
2450	1944	2088	2254	**2450**	2683	2964	3312
2500	1984	2130	2300	**2500**	2737	3025	3379
2550	2023	2173	2346	**2550**	2792	3085	3447
2600	2063	2216	2392	**2600**	2847	3146	3515
2650	2103	2258	2438	**2650**	2902	3206	3582
2700	2142	2301	2484	**2700**	2956	3267	3650
2750	2182	2343	2530	**2750**	3011	3327	3717
2800	2222	2386	2577	**2800**	3066	3388	3785
2850	2261	2429	2623	**2850**	3121	3448	3853
2900	2301	2471	2669	**2900**	3175	3509	3920
2950	2341	2514	2715	**2950**	3230	3569	3988
3000	2381	2556	2761	**3000**	3285	3630	4055
3050	2420	2599	2807	**3050**	3340	3690	4123
3100	2460	2642	2853	**3100**	3394	3751	4190
3150	2500	2684	2899	**3150**	3449	3811	4258
3200	2539	2727	2945	**3200**	3504	3872	4326
3300	2619	2812	3037	**3300**	3613	3993	4461
3400	2698	2897	3129	**3400**	3723	4114	4596
3500	2777	2983	3221	**3500**	3832	4235	4731
3600	2857	3068	3313	**3600**	3942	4356	4866
3700	2936	3153	3405	**3700**	4051	4477	5002
3800	3015	3238	3497	**3800**	4161	4598	5137
3900	3095	3323	3589	**3900**	4270	4719	5272
4000	3174	3409	3681	**4000**	4380	4840	5407
4100	3253	3494	3773	**4100**	4489	4961	5542
4200	3333	3579	3865	**4200**	4599	5082	5677
4300	3412	3664	3957	**4300**	4708	5203	5813
4400	3491	3750	4049	**4400**	4818	5324	5948
4500	3571	3835	4141	**4500**	4927	5445	6083
4600	3650	3920	4233	**4600**	5037	5566	6218
4700	3729	4005	4325	**4700**	5146	5687	6353
4800	3809	4090	4417	**4800**	5256	5808	6488
4900	3888	4176	4509	**4900**	5365	5929	6624
5000	3968	4261	4601	**5000**	5475	6049	6759
5100	4047	4346	4693	**5100**	5584	6170	6894

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FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
200	2995 0.38	2963 0.38	2942 0.38	2933 0.38	2933 0.38	2940 0.38		12	14	16	
220	3192 0.40	3147 0.40	3116 0.40	3098 0.40	3091 0.40	3094 0.40		13	15	17	
240	3389 0.43	3332 0.43	3289 0.43	3262 0.43	3249 0.43	3247 0.43	3256 0.43	13	16	18	19
260	3586 0.45	3516 0.45	3463 0.45	3427 0.46	3407 0.46	3401 0.46	3411 0.46	14	16	19	22
280	3783 0.48	3701 0.48	3637 0.48	3592 0.48	3566 0.48	3555 0.48	3567 0.48	14	17	20	25
300	3980 0.50	3886 0.50	3811 0.51	3757 0.51	3724 0.51	3710 0.51	3722 0.51	15	18	22	27
320	4177 0.53	4071 0.53	3985 0.53	3922 0.53	3883 0.54	3864 0.54	3878 0.54	15	18	23	28
340	4375 0.55	4256 0.56	4159 0.56	4088 0.56	4042 0.56	4019 0.56	4034 0.56	16	19	24	29
360	4572 0.58	4441 0.58	4333 0.58	4253 0.59	4201 0.59	4173 0.59	4190 0.59	16	20	25	31
380	4770 1.00	4626 1.01	4507 1.01	4419 1.01	4360 1.01	4328 1.01	4347 1.01	16	21	26	32
400	4967 1.03	4811 1.03	4681 1.04	4584 1.04	4519 1.04	4483 1.04	4504 1.04	17	21	27	34
420	5165 1.06	4997 1.06	4856 1.06	4750 1.06	4678 1.07	4638 1.07	4661 1.07	17	22	28	35
440	5363 1.08	5182 1.08	5030 1.09	4916 1.09	4838 1.09	4794 1.09	4819 1.09	18	23	29	37
460	5561 1.11	5368 1.11	5205 1.11	5082 1.12	4997 1.12	4949 1.12	4977 1.12	18	23	31	38
480	5759 1.13	5554 1.14	5380 1.14	5248 1.14	5157 1.14	5105 1.14	5135 1.14	19	24	32	39
500	5957 1.16	5739 1.16	5555 1.16	5414 1.17	5317 1.17	5261 1.17	5293 1.17	19	25	33	41
520	6155 1.18	5925 1.19	5730 1.19	5581 1.19	5477 1.20	5418 1.20	5452 1.20	20	25	34	42
540	6353 1.21	6111 1.21	5905 1.22	5747 1.22	5637 1.22	5574 1.22	5611 1.22	20	26	35	44
560	6551 1.23	6297 1.24	6080 1.24	5914 1.25	5797 1.25	5731 1.25	5771 1.25	21	27	36	45
580	6750 1.26	6483 1.26	6255 1.27	6081 1.27	5958 1.28	5888 1.28	5931 1.28	21	28	38	47
600	6948 1.28	6670 1.29	6431 1.29	6248 1.30	6118 1.30	6045 1.30	6091 1.30	22	28	39	48
620	7147 1.31	6856 1.31	6606 1.32	6415 1.32	6279 1.33	6202 1.33	6251 1.33	22	29	40	50
640	7346 1.33	7042 1.34	6782 1.35	6582 1.35	6440 1.35	6360 1.35	6412 1.35	23	30	41	51
660	7545 1.36	7229 1.37	6958 1.37	6750 1.38	6601 1.38	6517 1.38	6574 1.38	23	31	43	53
680	7744 1.39	7416 1.39	7134 1.40	6917 1.40	6762 1.41	6675 1.41	6735 1.41	24	31	44	54
700	7943 1.41	7602 1.42	7310 1.42	7085 1.43	6924 1.43	6834 1.43	6898 1.43	25	32	45	56
720	8142 1.44	7789 1.44	7486 1.45	7253 1.46	7085 1.46	6992 1.46	7060 1.46	25	33	46	57
740	8341 1.46	7976 1.47	7663 1.47	7420 1.48	7247 1.49	7151 1.49	7223 1.49	26	34	48	59
760	8540 1.49	8163 1.49	7839 1.50	7589 1.51	7409 1.51	7310 1.51	7386 1.51	26	34	49	60
780	8740 1.51	8350 1.52	8015 1.53	7757 1.54	7571 1.54	7469 1.54	7550 1.54	27	35	50	62
800	8939 1.54	8537 1.54	8192 1.55	7925 1.56	7733 1.56	7628 1.56	7714 1.56	27	36	51	63
820	9139 1.56	8725 1.57	8369 1.58	8093 1.59	7895 1.59	7788 1.59	7878 1.59	28	37	53	65
840	9338 1.59	8912 2.00	8545 2.00	8262 2.01	8058 2.02	7948 2.02	8043 2.02	28	37	54	66

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

Mod : 4801 + 4863

PW Eng. : 4000

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT/250KT - IMC PROCEDURE 360 KG/ 6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
840	9338 1.59	8912 2.00	8545 2.00	8262 2.01	8058 2.02	7948 2.02	8043 2.02	28	37	54	66
860	9538 2.01	9100 2.02	8722 2.03	8431 2.04	8220 2.04	8107 2.04	8208 2.04	29	38	55	67
880	9738 2.04	9287 2.05	8899 2.06	8600 2.06	8383 2.07	8268 2.07	8373 2.07	29	39	57	69
900	9938 2.06	9475 2.07	9077 2.08	8768 2.09	8546 2.09	8428 2.09	8539 2.09	30	40	58	70
920	10138 2.09	9663 2.10	9254 2.11	8938 2.12	8709 2.12	8589 2.12	8705 2.12	30	41	59	72
940	10338 2.12	9850 2.12	9431 2.13	9107 2.14	8872 2.15	8749 2.15	8871 2.15	31	41	61	73
960	10538 2.14	10038 2.15	9609 2.16	9276 2.17	9035 2.17	8910 2.17	9038 2.17	31	42	62	75
980	10738 2.17	10226 2.18	9786 2.18	9446 2.19	9198 2.20	9072 2.20	9205 2.20	32	43	63	76
1000	10939 2.19	10414 2.20	9964 2.21	9615 2.22	9362 2.23	9233 2.23	9368 2.23	32	44	65	78
1020	11139 2.22	10603 2.23	10142 2.24	9785 2.25	9526 2.25	9395 2.25	9535 2.25	33	44	66	79
1040	11340 2.24	10791 2.25	10319 2.26	9955 2.27	9690 2.28	9556 2.28	9703 2.28	33	45	68	81
1060	11540 2.27	10979 2.28	10497 2.29	10125 2.30	9854 2.30	9718 2.30	9871 2.30	34	46	69	82
1080	11741 2.29	11168 2.30	10676 2.31	10295 2.32	10018 2.33	9881 2.33	10040 2.33	34	47	70	84
1100	11942 2.32	11357 2.33	10854 2.34	10465 2.35	10182 2.36	10043 2.36	10209 2.36	35	48	72	85
1120	12143 2.34	11545 2.35	11032 2.37	10635 2.38	10346 2.38	10206 2.38	10378 2.38	36	48	73	87
1140	12344 2.37	11734 2.38	11211 2.39	10806 2.40	10511 2.41	10369 2.41	10548 2.41	36	49	75	88
1160	12545 2.39	11923 2.41	11389 2.42	10977 2.43	10676 2.44	10532 2.44	10718 2.44	37	50	76	90
1180	12747 2.42	12112 2.43	11568 2.44	11147 2.45	10841 2.46	10695 2.46	10888 2.46	37	51	78	91
1200	12948 2.45	12301 2.46	11747 2.47	11318 2.48	11006 2.49	10859 2.49	11059 2.49	38	52	79	93
1220	13149 2.47	12491 2.48	11926 2.49	11490 2.51	11171 2.51	11023 2.51	11230 2.51	38	53	81	94
1240	13351 2.50	12680 2.51	12105 2.52	11661 2.53	11336 2.54	11187 2.54	11402 2.54	39	53	82	96
1260	13553 2.52	12869 2.53	12284 2.55	11832 2.56	11502 2.57	11351 2.57	11574 2.57	39	54	84	98
1280	13754 2.55	13059 2.56	12463 2.57	12004 2.59	11668 2.59	11516 2.59	11747 2.59	40	55	85	99
1300	13956 2.57	13248 2.59	12643 3.00	12176 3.01	11834 3.02	11681 3.02	11920 3.02	41	56	87	101
1320	14158 3.00	13438 3.01	12822 3.02	12347 3.04	12000 3.04	11846 3.04	12093 3.04	41	57	88	102
1340	14360 3.02	13628 3.04	13002 3.05	12519 3.06	12166 3.07	12011 3.07	12267 3.07	42	58	90	104
1360	14562 3.05	13818 3.06	13182 3.08	12691 3.09	12332 3.10	12177 3.10	12441 3.10	42	58	91	106
1380	14764 3.07	14008 3.09	13361 3.10	12864 3.12	12499 3.12	12342 3.12	12615 3.12	43	59	93	107
1400	14967 3.10	14198 3.11	13541 3.13	13036 3.14	12665 3.15	12508 3.15	12790 3.15	44	60	94	109
1420	15169 3.13	14388 3.14	13721 3.15	13208 3.17	12832 3.18	12675 3.18	12965 3.18	44	61	96	110
1440	15372 3.15	14579 3.16	13902 3.18	13381 3.19	12999 3.20	12841 3.20	13141 3.20	45	62	98	112
1460	15574 3.18	14769 3.19	14082 3.21	13554 3.22	13166 3.23	13008 3.23	13317 3.23	45	63	99	114
1480	15777 3.20	14960 3.22	14262 3.23	13727 3.25	13334 3.25	13174 3.25	13493 3.25	46	64	101	115

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-005-085

Mod : 4801 + 4863

PW Eng. : 4000

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT/250KT - IMC PROCEDURE 360 KG/ 6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
1480	15777 3.20	14960 3.22	14262 3.23	13727 3.25	13334 3.25	13174 3.25	13493 3.25	46	64	101	115
1500	15980 3.23	15151 3.24	14443 3.26	13900 3.27	13501 3.28	13342 3.28	13670 3.28	46	64	103	117
1520	16183 3.25	15341 3.27	14624 3.28	14073 3.30	13669 3.31	13509 3.31	13847 3.31	47	65	104	118
1540	16386 3.28	15532 3.29	14805 3.31	14246 3.32	13836 3.33	13677 3.33	14025 3.33	48	66	106	120
1560	16589 3.30	15723 3.32	14987 3.33	14420 3.35	14004 3.36	13844 3.36	14203 3.36	48	67	108	122
1580	16792 3.33	15915 3.34	15168 3.36	14593 3.38	14172 3.39	14012 3.39	14407 3.39*	49	68	109	123
1600	16996 3.35	16106 3.37	15350 3.39	14767 3.40	14340 3.41	14181 3.41	14576 3.41*	49	69	111	125
1620	17199 3.38	16297 3.40	15532 3.41	14941 3.43	14509 3.44	14349 3.44	14746 3.44*	50	70	113	127
1640	17403 3.40	16489 3.42	15713 3.44	15116 3.45	14677 3.46	14518 3.46	14915 3.46*	51	71	115	128
1660	17607 3.43	16681 3.45	15895 3.46	15290 3.48	14847 3.49	14687 3.49	15085 3.49*	51	72	117	130
1680	17810 3.46	16872 3.47	16078 3.49	15465 3.51	15016 3.52	14856 3.52	15255 3.52*	52	73	119	132
1700	18014 3.48	17064 3.50	16260 3.52	15639 3.53	15185 3.54	15026 3.54	15425 3.54*	52	74	120	133
1720	18218 3.51	17256 3.52	16442 3.54	15814 3.56	15355 3.57	15197 3.57	15596 3.57*	53	74	122	135
1740	18422 3.53	17448 3.55	16625 3.57	15989 3.58	15525 3.59	15368 3.59	15767 4.00*	54	75	123	137
1760	18626 3.56	17640 3.57	16808 3.59	16164 4.01	15694 4.02	15539 4.02	15938 4.02*	54	76	125	138
1780	18830 3.58	17833 4.00	16991 4.02	16340 4.04	15865 4.05	15711 4.05	16109 4.05*	55	77	126	140
1800	19035 4.01	18025 4.03	17174 4.04	16515 4.06	16035 4.07	15883 4.07	16280 4.07*	56	78	128	142
1820	19239 4.03	18217 4.05	17357 4.07	16691 4.09	16206 4.10	16055 4.10	16452 4.10*	56	79	129	143
1840	19444 4.06	18410 4.08	17540 4.10	16867 4.12	16376 4.13	16228 4.13	16624 4.13*	57	80	131	145
1860	19648 4.08	18603 4.10	17723 4.12	17043 4.14	16547 4.15	16401 4.15	16796 4.15*	57	81	132	147
1880	19853 4.11	18796 4.13	17907 4.15	17219 4.17	16718 4.18	16574 4.18	16968 4.18*	58	82	134	149
1900	20058 4.14	18988 4.15	18090 4.17	17395 4.19	16890 4.20	16748 4.20	17140 4.20*	59	83	135	150
1920	20263 4.16	19181 4.18	18274 4.20	17571 4.22	17061 4.23	16922 4.23	17313 4.23*	59	84	137	152
1940	20468 4.19	19374 4.21	18458 4.23	17748 4.25	17233 4.26	17096 4.26	17485 4.26*	60	85	139	154
1960	20673 4.21	19568 4.23	18642 4.25	17925 4.27	17405 4.28	17270 4.28	17658 4.28*	61	86	140	155
1980	20878 4.24	19761 4.26	18826 4.28	18102 4.30	17577 4.31	17445 4.31	17832 4.31*	61	87	142	157
2000	21084 4.26	19954 4.28	19010 4.30	18279 4.32	17749 4.34	17620 4.34	18005 4.34*	62	88	143	159
2020	21289 4.29	20148 4.31	19195 4.33	18456 4.35	17921 4.36	17795 4.36	18179 4.36*	62	88	145	161
2040	21495 4.31	20341 4.33	19379 4.35	18633 4.38	18094 4.39	17970 4.39	18352 4.39*	63	89	146	162
2060	21700 4.34	20535 4.36	19564 4.38	18810 4.40	18266 4.41	18146 4.41	18526 4.41*	64	90	148	164
2080	21906 4.36	20729 4.38	19749 4.41	18988 4.43	18439 4.44	18322 4.44	18701 4.44*	64	91	150	166
2100	22112 4.39	20923 4.41	19934 4.43	19166 4.45	18612 4.47	18498 4.47	18875 4.47*	65	92	151	168
2120	22318 4.41	21117 4.44	20119 4.46	19344 4.48	18785 4.49	18675 4.49	19050 4.49*	66	93	153	169

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-006-085

Mod : 4801 + 4863

PW Eng. : 4000

SIMU S4 for training only 1PM

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT/250KT - IMC PROCEDURE 360 KG/ 6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
2120	22318 4.41	21117 4.44	20119 4.46	19344 4.48	18785 4.49	18675 4.49	19050 4.49*	66	93	153	169
2140	22524 4.44	21311 4.46	20304 4.48	19522 4.51	18959 4.52	18852 4.52	19224 4.52*	66	94	155	171
2160	22730 4.47	21506 4.49	20489 4.51	19700 4.53	19132 4.55	19029 4.55	19399 4.55*	67	95	156	173
2180	22937 4.49	21700 4.51	20675 4.54	19878 4.56	19306 4.57	19206 4.57	19575 4.57*	68	96	158	174
2200	23143 4.52	21895 4.54	20861 4.56	20057 4.58	19480 5.00	19384 5.00	19750 5.00*	68	97	159	176
2220	23349 4.54	22089 4.56	21046 4.59	20235 5.01	19654 5.02	19562 5.02	19926 5.02*	69	98	161	178
2240	23556 4.57	22284 4.59	21232 5.01	20414 5.04	19828 5.05	19740 5.05	20102 5.05*	70	99	163	180
2260	23763 4.59	22479 5.02	21418 5.04	20593 5.06	20002 5.08	19919 5.08	20278 5.08*	70	100	164	182
2280	23969 5.02	22674 5.04	21605 5.06	20772 5.09	20177 5.10	20098 5.10	20454 5.10*	71	101	166	183
2300	24176 5.04	22869 5.07	21791 5.09	20952 5.12	20352 5.13	20277 5.13	20631 5.13*	72	102	168	185
2320	24383 5.07	23064 5.09	21978 5.12	21131 5.14	20527 5.15	20457 5.15	20808 5.15*	72	103	169	187
2340	24591 5.09	23260 5.12	22164 5.14	21311 5.17	20702 5.18	20637 5.18	20985 5.18*	73	104	171	189
2360	24798 5.12	23455 5.14	22351 5.17	21491 5.19	20878 5.21	20817 5.21	21162 5.21*	74	105	175	191
2380	25005 5.15	23650 5.17	22538 5.19	21671 5.22	21054 5.23	20998 5.23	21340 5.23*	75	106	177	193
2400	25213 5.17	23846 5.20	22725 5.22	21851 5.25	21229 5.26	21179 5.26	21518 5.26*	75	107	178	194
2420	25420 5.20	24042 5.22	22912 5.25	22031 5.27	21406 5.29	21433 5.29	21696 5.29*	76	108	180	196
2440	25628 5.22	24238 5.25	23099 5.27	22212 5.30	21582 5.31	21617 5.31	21874 5.31*	77	109	182	198
2460	25836 5.25	24435 5.27	23287 5.30	22393 5.32	21758 5.34	21801 5.34	22052 5.34*	77	111	184	200
2480	26044 5.27	24631 5.30	23474 5.32	22573 5.35	21935 5.36	21986 5.36	22231 5.36*	78	112	186	202
2500	26252 5.30	24827 5.32	23662 5.35	22754 5.38	22112 5.39	22171 5.39	22410 5.39*	79	113	188	204
2520	26460 5.32	25024 5.35	23850 5.38	22935 5.40	22289 5.42	22356 5.42	22590 5.42*	79	114	190	205
2540	26669 5.35	25221 5.37	24038 5.40	23117 5.43	22466 5.44	22542 5.44	22770 5.44*	80	115	191	207
2560	26877 5.37	25418 5.40	24226 5.43	23298 5.45	22643 5.47	22728 5.47	22951 5.47*	81	116	193	209
2580	27085 5.40	25615 5.43	24414 5.45	23480 5.48	22821 5.50	22915 5.50	23132 5.50*	82	117	195	212
2600	27294 5.43	25812 5.45	24603 5.48	23661 5.51	22998 5.52	23102 5.52	23313 5.52*	82	118	197	214
2620	27503 5.45	26009 5.48	24792 5.50	23843 5.53	23176 5.55	23289 5.55	23494 5.55*	83	119	199	215
2640	27711 5.48	26207 5.50	24980 5.53	24025 5.56	23354 5.57	23476 5.57	23675 5.57*	84	120	201	217
2660	27920 5.50	26404 5.53	25169 5.56	24207 5.58	23533 6.00	23664 6.00	23857 6.00*	84	121	203	215
2680	28129 5.53	26602 5.55	25359 5.58	24390 6.01	23711 6.03	23853 6.03	24039 6.03*	85	122	205	217
2700	28338 5.55	26800 5.58	25548 6.01	24572 6.04	23890 6.05	24041 6.05	24221 6.05*	86	124	207	219
2720	28547 5.58	26997 6.01	25737 6.03	24755 6.06	24069 6.08	24230 6.08	24404 6.08*	87	125	209	220
2740	28757 6.00	27195 6.03	25927 6.06	24938 6.09	24248 6.11	24422 6.11	24587 6.11*	87	126	211	222
2760	28966 6.03	27393 6.06	26117 6.09	25121 6.12	24427 6.13	24614 6.13	24801 6.13*	88	127	213	224

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT /250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
2760	28966 6.03	27393 6.06	26117 6.09	25121 6.12	24427 6.13	24614 6.13	24801 6.13*	88	127	213	224
2780	29176 6.05	27592 6.08	26307 6.11	25304 6.14	24606 6.16	24807 6.16	24985 6.16*	89	128	215	226
2800	29385 6.08	27790 6.11	26497 6.14	25487 6.17	24787 6.18	25000 6.18	25170 6.18*	89	129	217	228
2820	29595 6.10	27988 6.13	26687 6.16	25671 6.19	24968 6.21	25195 6.21	25356 6.21*	90	130	219	230
2840	29805 6.13	28187 6.16	26877 6.19	25855 6.22	25150 6.24	25389 6.24	25542 6.24*	91	131	221	232
2860	30015 6.16	28385 6.18	27068 6.21	26039 6.25	25332 6.26	25584 6.26	25728 6.26*	92	133	223	233
2880	30225 6.18	28584 6.21	27258 6.24	26223 6.27	25514 6.29	25780 6.29	25914 6.29*	92	134	225	235
2900	30435 6.21	28783 6.24	27449 6.27	26407 6.30	25696 6.32	25976 6.32	26101 6.32*	93	135	227	237
2920	30645 6.23	28982 6.26	27640 6.29	26591 6.32	25879 6.34	26172 6.34	26288 6.34*	94	136	230	239
2940	30856 6.26	29181 6.29	27831 6.32	26776 6.35	26062 6.37	26383 6.37*	26475 6.37*	95	137	232	241
2960	31066 6.28	29380 6.31	28022 6.34	26961 6.38	26245 6.39	26569 6.39*	26663 6.39*	95	140	234	243
2980	31277 6.31	29580 6.34	28213 6.37	27146 6.40	26428 6.42	26756 6.42*	26851 6.42*	96	141	236	244
3000	31487 6.33	29779 6.36	28405 6.40	27331 6.43	26612 6.45	26942 6.45*	27039 6.45*	97	143	238	246
3020	31698 6.36	29979 6.39	28596 6.42	27516 6.45	26795 6.47	27129 6.47*	27227 6.47*	98	144	241	248
3040	31909 6.38	30179 6.42	28788 6.45	27701 6.48	26979 6.50	27316 6.50*	27416 6.50*	99	145	243	250
3060	32120 6.41	30379 6.44	28980 6.47	27887 6.51	27164 6.52	27503 6.52*	27605 6.52*	99	146	245	251
3080	32331 6.43	30579 6.47	29172 6.50	28072 6.53	27433 6.55	27691 6.55*	27795 6.55*	100	148	247	253
3100	32542 6.46	30779 6.49	29364 6.53	28258 6.56	27620 6.58	27878 6.58*	27985 6.58*	101	149	249	255
3120	32754 6.49	30979 6.52	29556 6.55	28444 6.58	27807 7.00	28066 7.00*	28175 7.00*	102	150	251	257
3140	32965 6.51	31179 6.54	29749 6.58	28630 7.01	27994 7.03	28254 7.03*	28365 7.03*	102	151	253	259
3160	33177 6.54	31380 6.57	29941 7.00	28817 7.04	28182 7.06	28442 7.05*	28556 7.06*	103	152	255	260
3180	33388 6.56	31580 6.59	30134 7.03	29003 7.06	28369 7.08	28631 7.08*	28747 7.08*	104	154	257	262
3200	33600 6.59	31781 7.02	30327 7.05	29190 7.09	28557 7.11	28820 7.11*	28938 7.11*	105	155	259	264
3220	33813 7.01	31982 7.05	30520 7.08	29377 7.12	28746 7.13	29009 7.13*	29130 7.13*	106	156	261	266
3240	34025 7.04	32183 7.07	30713 7.11	29564 7.14	28934 7.16	29199 7.16*	29322 7.16*	107	157	263	268
3260	34237 7.06	32384 7.10	30907 7.13	29751 7.17	29123 7.19	29388 7.18*	29515 7.19*	107	159	265	269
3280	34450 7.09	32585 7.12	31100 7.16	29938 7.19	29312 7.21	29578 7.21*	29708 7.21*	108	162	267	271
3300	34663 7.11	32786 7.15	31294 7.18	30126 7.22	29502 7.24	29769 7.24*	29901 7.24*	109	163	266	273
3320	34875 7.14	32988 7.17	31488 7.21	30314 7.25	29691 7.27	29959 7.26*	30099 7.27*	110	165	268	275
3340	35088 7.17	33189 7.20	31682 7.24	30502 7.27	29882 7.29	30150 7.29*	30293 7.29*	111	166	270	276
3360	35302 7.19	33391 7.23	31876 7.26	30690 7.30	30072 7.32	30341 7.32*	30487 7.32*	112	168	272	278
3380	35515 7.22	33593 7.25	32070 7.29	30878 7.32	30263 7.34	30533 7.34*	30682 7.34*	112	169	274	280
3400	35728 7.24	33795 7.28	32265 7.31	31067 7.35	30454 7.37	30724 7.37*	30877 7.37*	113	170	276	282

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-008-085

Mod : 4801 + 4863

PW Eng. : 4000

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT /250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
3400	35728 7.24	33795 7.28	32265 7.31	31067 7.35	30454 7.37	30724 7.37*	30877 7.37*	113	170	276	282
3420	35941 7.27	33998 7.30	32459 7.34	31255 7.38	30645 7.40	30916 7.39*	31073 7.40*	114	172	278	284
3440	36155 7.29	34202 7.33	32654 7.36	31444 7.40	30837 7.42	31109 7.42*	31269 7.42*	115	173	280	286
3460	36369 7.32	34406 7.35	32849 7.39	31633 7.43	31029 7.45	31301 7.45*	31466 7.45*	116	175	282	287
3480	36582 7.34	34610 7.38	33044 7.42	31822 7.45	31221 7.48	31494 7.47*	31664 7.48*	117	176	284	289
3500	36796 7.37	34814 7.40	33239 7.44	32097 7.48	31413 7.50	31687 7.50*	31863 7.50*	117	178	286	291
3520	37010 7.39	35018 7.43	33434 7.47	32288 7.51	31606 7.53	31880 7.52*	32061 7.53*	118	179	288	293
3540	37224 7.42	35222 7.46	33630 7.49	32479 7.53	31799 7.55	32073 7.55*	32261 7.55*	119	181	290	295
3560	37438 7.44	35427 7.48	33825 7.52	32671 7.56	31992 7.58	32267 7.58*	32460 7.58*	122	182	292	297
3580	37653 7.47	35631 7.51	34021 7.55	32863 7.58	32186 8.01	32461 8.00*	32661 8.01*	123	184	294	299
3600	37867 7.50	35836 7.53	34217 7.57	33055 8.01	32380 8.03	32656 8.03*	32861 8.03*	124	185	296	300
3620	38081 7.52	36041 7.56	34415 8.00	33247 8.04	32574 8.06	32850 8.05*	33062 8.06*	125	187	298	302
3640	38296 7.55	36246 7.58	34612 8.02	33440 8.06	32768 8.08	33045 8.08*	33263 8.08*	126	188	300	304
3660	38511 7.57	36451 8.01	34809 8.05	33633 8.09	32963 8.11	33240 8.11*	33465 8.11*	127	190	302	306
3680	38726 8.00	36656 8.04	35007 8.07	33826 8.11	33158 8.14	33435 8.13*	33667 8.14*	128	191	304	308
3700	38941 8.02	36862 8.06	35205 8.10	34019 8.14	33353 8.16	33631 8.16*	33870 8.16*	129	193	306	310
3720	39156 8.05	37067 8.09	35403 8.13	34213 8.17	33549 8.19	33827 8.18*	34073 8.19*	129	194	308	312
3740	39371 8.07	37273 8.11	35601 8.15	34407 8.19	33747 8.22	34023 8.21*	34276 8.22*	130	196	310	314
3760	39587 8.10	37479 8.14	35799 8.18	34601 8.22	33947 8.24	34220 8.24*	34480 8.24*	131	198	310	315
3780	39802 8.12	37685 8.16	35998 8.20	34796 8.25	34147 8.27	34417 8.26*	34685 8.27*	132	199	312	317
3800	40018 8.15	37891 8.19	36292 8.23	34990 8.27	34348 8.29	34614 8.29*	34890 8.29*	133	201	314	319
3820	40234 8.18	38097 8.22	36492 8.26	35185 8.30	34550 8.32	34812 8.32*	35096 8.32*	134	202	316	321
3840	40450 8.20	38304 8.24	36693 8.28	35381 8.32	34752 8.35	35009 8.34*	35302 8.35*	135	204	318	323
3860	40666 8.23	38510 8.27	36894 8.31	35576 8.35	34954 8.37	35208 8.37*	35508 8.37*	136	206	321	325
3880	40882 8.25	38717 8.29	37095 8.33	35772 8.38	35156 8.40	35406 8.39*	35715 8.40*	137	207	323	327
3900	41098 8.28	38924 8.32	37297 8.36	35967 8.40	35359 8.43	35605 8.42*	35922 8.43*	138	209	325	329
3920	41314 8.30	39131 8.34	37498 8.38	36163 8.43	35562 8.45	35804 8.45*	36130 8.45*	141	211	327	330
3940	41531 8.33	39338 8.37	37700 8.41	36359 8.45	35766 8.48	36003 8.47*	36338 8.48*	142	212	329	332
3960	41747 8.35	39546 8.39	37902 8.44	36556 8.48	35971 8.50	36202 8.50*	36547 8.50*	143	214	331	334
3980	41964 8.38	39753 8.42	38104 8.46	36753 8.51	36176 8.53	36402 8.52*	36756 8.53*	144	215	333	336
4000	42181 8.40	39961 8.45	38306 8.49	36949 8.53	36381 8.56	36602 8.55*	36965 8.56*	145	217	336	338
4020	42398 8.43	40169 8.47	38509 8.51	37146 8.56	36586 8.58	36803 8.58*	37175 8.58*	146	219	338	340
4040	42615 8.45	40377 8.50	38711 8.54	37344 8.58	36792 9.01	37004 9.00*	37386 9.01*	147	220	340	342

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-009-085

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT /250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
4040	42615 8.45	40377 8.50	38711 8.54	37344 8.58	36792 9.01	37004 9.00*	37386 9.01*	147	220	340	342
4060	42832 8.48	40585 8.52	38914 8.57	37541 9.01	36998 9.04	37205 9.03*	37596 9.04*	149	222	342	344
4080	43049 8.51	40793 8.55	39117 8.59	37739 9.04	37205 9.06	37406 9.05*	37808 9.06*	150	224	344	346
4100	43266 8.53	41002 8.57	39321 9.02	37937 9.06	37412 9.09	37607 9.08*	38019 9.09*	151	223	347	347
4120	43484 8.56	41210 9.00	39525 9.04	38135 9.09	37619 9.11	37809 9.11*	38232 9.11*	152	225	349	349
4140	43702 8.58	41419 9.03	39728 9.07	38333 9.11	37827 9.14	38011 9.13*	38444 9.14*	153	226	351	351
4160	43921 9.01	41723 9.05	39932 9.10	38532 9.14	38035 9.17	38215 9.16*	38657 9.17*	154	228	353	353
4180	44139 9.03	41934 9.08	40137 9.12	38731 9.17	38244 9.19	38419 9.18*	38871 9.19*	155	231	356	355
4200	44358 9.06	42144 9.10	40341 9.15	38930 9.19	38453 9.22	38623 9.21*	39085 9.22*	156	233	358	357
4220	44577 9.08	42355 9.13	40546 9.17	39129 9.22	38662 9.24	38828 9.24*	39300 9.25*	157	234	360	359
4240	44795 9.11	42567 9.15	40750 9.20	39329 9.25	38925 9.27	39033 9.26*	39535 9.27*	158	236	362	361
4260	45014 9.13	42779 9.18	40955 9.22	39529 9.27	39137 9.30	39238 9.29*	39740 9.30*	160	238	364	363
4280	45234 9.16	42990 9.20	41161 9.25	39729 9.30	39349 9.32	39444 9.31*	39945 9.32*	161	240	367	365
4300	45453 9.19	43202 9.23	41366 9.28	39930 9.32	39564 9.35*	39651 9.34*	40151 9.35*	162	242	368	367
4320	45672 9.21	43415 9.26	41572 9.30	40131 9.35	39769 9.38*	39857 9.37*	40356 9.37*	163	244	370	369
4340	45891 9.24	43627 9.28	41778 9.33	40331 9.38	39974 9.40*	40064 9.39*	40562 9.40*	164	246	372	371
4360	46111 9.26	43840 9.31	41984 9.35	40533 9.40	40180 9.43*	40271 9.42*	40768 9.43*	165	248	375	373
4380	46330 9.29	44053 9.33	42190 9.38	40734 9.43	40385 9.45*	40479 9.45*	40975 9.45*	166	250	377	375
4400	46550 9.31	44266 9.36	42396 9.41	40935 9.45	40591 9.48*	40687 9.47*	41181 9.48*	168	252	379	377
4420	46770 9.34	44479 9.38	42603 9.43	41137 9.48	40797 9.50*	40896 9.50*	41388 9.50*	169	254	381	379
4440	46989 9.36	44693 9.41	42810 9.46	41339 9.51	41004 9.53*	41104 9.52*	41596 9.53*	170	256	384	381
4460	47298 9.39	44906 9.44	43016 9.48	41541 9.53	41210 9.56*	41313 9.55*	41804 9.56*	171	255	386	383
4480	47520 9.41	45120 9.46	43224 9.51	41744 9.56	41417 9.58*	41523 9.58*	42011 9.58*	172	256	388	385
4500	47741 9.44	45334 9.49	43431 9.53	41947 9.58	41624 10.01*	41733 10.00*	42219 10.01*	173	258	390	387
4520	47963 9.47	45548 9.51	43639 9.56	42150 10.01	41831 10.03*	41943 10.03*	42428 10.03*	175	260	392	389
4540	48185 9.49	45762 9.54	43847 9.59	42353 10.04	42038 10.06*	42154 10.05*	42636 10.06*	176	261	394	391
4560	48407 9.52	45976 9.56	44055 10.01	42556 10.06	42246 10.09*	42365 10.08*	42845 10.08*	177	263	396	393
4580	48630 9.54	46191 9.59	44264 10.04	42760 10.09	42454 10.11*	42576 10.11*	43054 10.11*	178	265	398	395
4600	48852 9.57	46406 10.01	44472 10.06	42964 10.11	42666 10.14*	42788 10.13*	43263 10.14*	179	267	401	397
4620	49075 9.59	46620 10.04	44681 10.09	43170 10.14	42874 10.16*	43000 10.16*	43473 10.16*	181	268	403	399
4640	49298 10.02	46835 10.07	44890 10.12	43377 10.17	43083 10.19*	43212 10.18*	43683 10.19*	182	270	405	401
4660	49521 10.04	47051 10.09	45099 10.14	43584 10.19	43293 10.21*	43425 10.21*	43894 10.21*	183	272	407	403
4680	49744 10.07	47266 10.12	45309 10.17	43792 10.22	43503 10.24*	43639 10.24*	44105 10.24*	184	273	409	405

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-010-085

Mod : 4801 + 4863

PW Eng. : 4000

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT /250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
4680	49744 10.07	47266 10.12	45309 10.17	43792 10.22	43503 10.24*	43639 10.24*	44105 10.24*	184	273	409	405
4700	49967 10.09	47481 10.14	45518 10.19	44000 10.25	43713 10.27*	43853 10.26*	44316 10.27*	185	275	411	407
4720	50190 10.12	47697 10.17	45728 10.22	44208 10.27	43924 10.29*	44067 10.29*	44527 10.29*	187	277	414	409
4740	50414 10.14	47913 10.19	45938 10.25	44416 10.30	44135 10.32*	44282 10.31*	44739 10.32*	188	279	416	411
4760	50637 10.17	48129 10.22	46148 10.27	44625 10.32	44346 10.34*	44497 10.34*	44951 10.34*	189	281	418	413
4780	50861 10.20	48346 10.25	46358 10.30	44834 10.35	44557 10.37*	44713 10.37*	45164 10.37*	188	282	420	416
4800	51085 10.22	48562 10.27	46569 10.32	45043 10.38	44769 10.40*	44929 10.39*	45376 10.39*	189	284	422	418
4820	51309 10.25	48779 10.30	46779 10.35	45253 10.40	44981 10.42*	45145 10.42*	45589 10.42*	190	286	425	420
4840	51533 10.27	48996 10.32	46990 10.37	45462 10.43	45194 10.45*	45362 10.45*	45802 10.45*	192	288	427	422
4860	51758 10.30	49213 10.35	47201 10.40	45672 10.45	45406 10.47*	45579 10.47*	46016 10.47*	193	289	429	424
4880	51983 10.32	49431 10.37	47413 10.43	45883 10.48	45619 10.50*	45796 10.50*	46230 10.50*	194	291	431	426
4900	52209 10.35	49648 10.40	47624 10.45	46093 10.51	45832 10.53*	46014 10.52*	46444 10.52*	195	293	434	428
4920	52435 10.37	49866 10.43	47836 10.48	46304 10.53	46046 10.55*	46232 10.55*	46658 10.55*	197	295	436	430
4940	52661 10.40	50084 10.45	48048 10.50	46516 10.56	46259 10.58*	46451 10.58*	46873 10.58*	195	297	438	432
4960	52888 10.42	50302 10.48	48261 10.53	46727 10.58	46473 11.00*	46670 11.00*	47088 11.00*	197	298	440	434
4980	53114 10.45	50520 10.50	48474 10.56	46939 11.01	46688 11.03*	46889 11.03*	47303 11.03*	198	300	443	436
5000	53341 10.48	50739 10.53	48687 10.58	47151 11.04	46902 11.05*	47109 11.05*	47518 11.05*	199	302	445	438
5020	53568 10.50	50957 10.55	48900 11.01	47363 11.06	47117 11.08*	47329 11.08*	47734 11.08*	200	305	447	440
5040	53795 10.53	51176 10.58	49113 11.03	47576 11.09	47332 11.11*	47550 11.11*	47950 11.11*	202	307	450	443
5060	54023 10.55	51395 11.00	49327 11.06	47789 11.11	47548 11.13*	47770 11.13*	48167 11.13*	203	309	453	445
5080	54250 10.58	51614 11.03	49541 11.08	48002 11.14	47764 11.16*	47993 11.16*	48384 11.16*	204	311	455	447
5100	54478 11.00	51834 11.06	49755 11.11	48216 11.17	47980 11.18*	48217 11.18*	48602 11.18*	205	313	457	449
5120	54706 11.03	52053 11.08	49969 11.14	48481 11.19	48197 11.21*	48475 11.21*	48820 11.21*	207	315	460	451
5140	54934 11.05	52274 11.11	50183 11.16	48697 11.22	48414 11.24*	48701 11.24*	49038 11.23*	208	317	462	453
5160	55162 11.08	52496 11.13	50398 11.19	48913 11.25	48631 11.26*	48928 11.26*	49256 11.26*	209	319	465	455
5180	55390 11.10	52717 11.16	50613 11.21	49129 11.27	48849 11.29*	49155 11.29*	49475 11.29*	210	321	467	458
5200	55618 11.13	52939 11.18	50828 11.24	49346 11.30	49067 11.31*	49383 11.32*	49694 11.31*	212	323	469	460
5220	55847 11.16	53161 11.21	51043 11.27	49563 11.32	49285 11.34*	49611 11.34*	49913 11.34*	213	325	472	462
5240	56076 11.18	53383 11.24	51259 11.29	49780 11.35	49504 11.36*	49840 11.37*	50133 11.36*	214	327	474	463
5260	56305 11.21	53606 11.26	51475 11.32	49997 11.38	49723 11.39*	50069 11.39*	50353 11.39*	216	330	475	465
5280	56534 11.23	53829 11.29	51691 11.34	50215 11.40	49942 11.42*	50299 11.42*	50573 11.42*	217	332	478	467
5300	56763 11.26	54051 11.31	51907 11.37	50433 11.43	50162 11.44*	50529 11.45*	50794 11.44*	218	334	480	469
5320	56992 11.28	54274 11.34	52123 11.40	50652 11.45	50382 11.47*	50760 11.47*	51015 11.47*	219	336	482	471

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-10a-270

Mod : 4801 + 4863

PW Eng. : 4000

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB 250KT/300KT/M.80 - CRUISE M.80-DESCENT M.80/300KT /250KT - IMC PROCEDURE 360 KG/6MIN

REF. LANDING WEIGHT = 100000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
5320	56992 11.28	54274 11.34	52123 11.40	50652 11.45	50382 11.47*	50760 11.47*	51015 11.47*	219	336	482	471
5340	57222 11.31	54498 11.36	52340 11.42	50871 11.48	50602 11.49*	50991 11.50*	51236 11.49*	221	338	485	473
5360	57452 11.33	54721 11.39	52557 11.45	51090 11.51	50822 11.52*	51223 11.52*	51458 11.52*	222	340	487	476
5380	57682 11.36	54945 11.42	52775 11.47	51309 11.53	51043 11.55*	51456 11.55*	51680 11.55*	223	342	490	478
5400	57912 11.38	55169 11.44	52993 11.50	51529 11.56	51265 11.57*	51689 11.58*	51902 11.57*	225	344	492	480
5420	58143 11.41	55393 11.47	53211 11.52	51749 11.58	51486 12.00*	51922 12.00*	52125 12.00*	226	346	494	482
5440	58373 11.44	55618 11.49	53430 11.55	51969 12.01	51708 12.02*	52156 12.03*	52348 12.02*	227	348	497	485
5460	58604 11.46	55842 11.52	53648 11.58	52190 12.04	51930 12.05*	52390 12.05*	52571 12.05*	229	351	499	487
5480	58835 11.49	56067 11.54	53867 12.00	52411 12.06	52153 12.08*	52626 12.08*	52795 12.07*	230	353	502	489
5500	59066 11.51	56292 11.57	54087 12.03	52636 12.09	52375 12.10*	52862 12.11*	53020 12.10*	233	355	504	491
5520	59297 11.54	56517 12.00	54306 12.05	52863 12.12	52599 12.13*	53099 12.13*	53246 12.13*	234	357	507	494
5540	59529 11.56	56743 12.02	54526 12.08	53091 12.14	52822 12.15*	53336 12.16*	53472 12.15*	235	359	510	505
5560	59760 11.59	56968 12.05	54746 12.11	53320 12.17	53047 12.18*	53574 12.19*	53698 12.18*	237	362	512	506
5580	59992 12.01	57194 12.07	54966 12.13	53550 12.19	53272 12.20*	53812 12.21*	53925 12.20*	238	364	514	507
5600	60224 12.04	57421 12.10	55186 12.16	53779 12.22	53498 12.23*	54051 12.24*	54153 12.23*	240	367	516	508
5620	60456 12.07	57647 12.12	55407 12.18	54009 12.25	53725 12.26*	54291 12.26*	54381 12.26*	241	369	518	509
5640	60688 12.09	57874 12.15	55627 12.21	54240 12.27	53952 12.28*	54534 12.29*	54609 12.28*	242	371	520	511
5660	60920 12.12	58101 12.17	55849 12.24	54491 12.30*	54179 12.31*	54760 12.32*	54837 12.31*	244	373	522	513
5680	61153 12.14	58328 12.20	56070 12.26	54716 12.32*	54406 12.33*	54986 12.34*	55066 12.33*	245	376	524	515
5700	61386 12.17	58556 12.23	56291 12.29	54943 12.35*	54634 12.36*	55213 12.37*	55296 12.36*	247	378	527	518
5720	61621 12.19	58783 12.25	56513 12.31	55169 12.37*	54862 12.39*	55440 12.39*	55525 12.39*	248	380	529	520
5740	61856 12.22	59011 12.28	56735 12.34	55396 12.40*	55091 12.41*	55667 12.42*	55756 12.41*	250	382	531	523
5760	62092 12.24	59239 12.30	56958 12.37	55623 12.43*	55320 12.44*	55894 12.44*	55986 12.44*	251	385	533	525
5780	62328 12.27	59468 12.33	57180 12.39	55850 12.45*	55549 12.46*	56122 12.47*	56217 12.46*	253	387	535	528
5800	62564 12.29	59696 12.35	57458 12.42	56078 12.48*	55779 12.49*	56349 12.49*	56448 12.49*	240	389	538	530
5820	62801 12.32	59925 12.38	57683 12.44	56306 12.50*	56010 12.52*	56578 12.52*	56680 12.52*	241	392	540	533
5840	63037 12.35	60154 12.41	57907 12.47	56534 12.53*	56240 12.54*	56806 12.55*	56912 12.54*	243	394	542	535
5860	63274 12.37	60383 12.43	58132 12.49	56762 12.55*	56471 12.57*	57035 12.57*	57145 12.57*	244	396	544	538
5880	63511 12.40	60612 12.46	58358 12.52	56991 12.58*	56702 12.59*	57264 13.00*	57378 12.59*	245	398	547	540
5900	63748 12.42	60842 12.48	58583 12.55	57220 13.01*	56934 13.02*	57494 13.02*	57612 13.02*	247	401	549	543
5920	63986 12.45	61072 12.51	58809 12.57	57450 13.03*	57166 13.05*	57724 13.05*	57847 13.04*	248	403	551	545
5940	64223 12.47	61302 12.53	59035 13.00	57680 13.06*	57400 13.07*	57955 13.07*	58081 13.07*	250	405	553	548
5960	64461 12.50	61532 12.56	59261 13.02	57910 13.08*	57633 13.10*	58186 13.10*	58316 13.10*	251	408	556	551

FLIP23 A310-324 PW4152 3420 03751.000021 0250300 .8000 .000000 360 0350350100 0 175124 60114 18590

FCOM-B0-02-17-30-10a-270

Mod : 4801 + 4863

PW Eng. : 4000

NAUTICAL GROUND MILES TO AIR MILES CONVERSION
LONG RANGE

	TAIL			WIND COMPONEND - KTS			HEAD
DIST TO GO	+120	+80	+40	0	-40	-80	-120
200	148	162	179	200	226	259	305
225	167	182	201	225	254	292	343
250	185	203	224	250	282	324	382
275	204	223	246	275	310	357	420
300	222	243	268	300	339	389	458
325	241	264	291	325	367	422	496
350	260	284	313	350	395	454	534
375	278	304	336	375	423	487	573
400	297	325	358	400	452	519	611
425	315	345	381	425	480	552	649
450	334	365	403	450	508	584	687
475	352	386	425	475	536	617	726
500	371	406	448	500	565	649	764
525	390	426	470	525	593	682	802
550	408	446	493	550	621	714	840
575	427	467	515	575	649	747	878
600	445	487	537	600	678	779	917
625	464	507	560	625	706	812	955
650	483	528	582	650	734	844	993
675	501	548	605	675	762	877	1031
700	520	568	627	700	791	909	1069
725	538	589	650	725	819	942	1108
750	557	609	672	750	847	974	1146
775	575	629	694	775	875	1007	1184
800	594	650	717	800	904	1039	1222
825	613	670	739	825	932	1072	1260
850	631	690	762	850	960	1104	1299
875	650	711	784	875	988	1137	1337
900	668	731	806	900	1017	1169	1375
925	687	751	829	925	1045	1202	1413
950	705	772	851	950	1073	1234	1452
975	724	792	874	975	1102	1267	1490
1000	743	812	896	1000	1130	1299	1528

FB2.1730.011-AA.001

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT INCLUDING GO-AROUND 300KG - CLIMB 250KT/270KT/M.65 - LONG RANGE CRUISE DESCENT M.65/270KT/250KT - VMC PROCEDURE 240KG/4MIN

REF. LANDING WEIGHT AT ALTERNATE = 100000KG
ECONOMIC AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 27.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	100	150	200	250	270	290	310	FL100 FL150	FL200 FL250	FL270 FL290	FL310
100	1907 0.24	1848 0.24	1836 0.23	1855 0.23				6	7		
125	2219 0.29	2128 0.28	2090 0.27	2087 0.27	2091 0.27	2097 0.27		7	8	9	
150	2531 0.34	2409 0.33	2343 0.32	2318 0.31	2315 0.30	2313 0.30	2316 0.30	9	9	10	11
175	2842 0.39	2689 0.38	2596 0.36	2549 0.35	2538 0.34	2530 0.34	2525 0.34	10	11	11	12
200	3153 0.44	2968 0.42	2849 0.41	2780 0.38	2762 0.38	2746 0.37	2733 0.37	11	12	13	13
225	3464 0.49	3248 0.47	3101 0.45	3011 0.42	2985 0.42	2961 0.41	2942 0.41	12	13	14	14
250	3774 0.54	3527 0.52	3354 0.49	3241 0.46	3207 0.45	3177 0.45	3150 0.44	14	15	15	15
275	4083 0.59	3805 0.56	3605 0.54	3471 0.50	3430 0.49	3392 0.48	3359 0.48	15	16	16	17
300	4393 1.04	4083 1.01	3857 0.58	3701 0.54	3652 0.53	3607 0.52	3566 0.51	16	17	18	18
325	4702 1.09	4361 1.06	4108 1.03	3930 0.58	3874 0.57	3822 0.56	3774 0.55	17	18	19	19
350	5010 1.14	4639 1.10	4359 1.07	4159 1.02	4096 1.01	4036 0.59	3982 0.58	19	20	20	20
375	5318 1.19	4916 1.15	4609 1.12	4388 1.06	4317 1.04	4250 1.03	4189 1.02	20	21	22	21
400	5626 1.24	5193 1.20	4860 1.16	4616 1.10	4538 1.08	4464 1.07	4395 1.06	21	22	23	23
425	5933 1.29	5470 1.24	5109 1.20	4844 1.14	4759 1.12	4678 1.10	4602 1.09	23	24	24	24
450	6240 1.34	5746 1.29	5359 1.25	5072 1.18	4979 1.16	4891 1.14	4808 1.13	24	25	26	25
475	6547 1.39	6021 1.34	5608 1.29	5299 1.22	5199 1.20	5104 1.18	5015 1.16	25	26	27	26
500	6853 1.44	6297 1.38	5857 1.34	5526 1.26	5419 1.23	5317 1.21	5220 1.20	26	28	28	27
525	7158 1.49	6572 1.43	6105 1.38	5753 1.31	5638 1.27	5529 1.25	5426 1.23	28	29	30	29
550	7464 1.54	6846 1.48	6353 1.43	5979 1.35	5857 1.31	5741 1.29	5631 1.27	29	30	31	30
575	7769 1.59	7121 1.52	6601 1.47	6205 1.39	6076 1.35	5953 1.33	5836 1.30	30	31	32	31
600	8073 2.04	7395 1.57	6849 1.52	6431 1.43	6294 1.39	6165 1.36	6041 1.34	31	33	33	32
625	8377 2.09	7668 2.02	7096 1.56	6656 1.47	6513 1.43	6376 1.40	6246 1.37	33	34	35	33
650	8681 2.14	7942 2.07	7343 2.01	6881 1.51	6730 1.47	6587 1.44	6450 1.41	34	35	36	34
675	8984 2.19	8215 2.11	7589 2.05	7106 1.55	6948 1.50	6798 1.47	6654 1.45	35	37	37	36
700	9287 2.24	8487 2.16	7836 2.10	7331 2.00	7165 1.54	7009 1.51	6858 1.48	36	38	39	37
725	9590 2.29	8760 2.21	8082 2.14	7555 2.04	7382 1.58	7219 1.55	7062 1.52	38	39	40	38
750	9892 2.34	9032 2.26	8327 2.19	7779 2.08	7599 2.02	7429 1.59	7265 1.55	39	40	41	39
775	10194 2.39	9303 2.30	8572 2.23	8002 2.12	7815 2.06	7639 2.02	7468 1.59	40	42	43	41
800	10495 2.44	9574 2.35	8817 2.28	8225 2.16	8031 2.10	7848 2.06	7671 2.02	41	43	44	42

FLIP23 A310-324 PW4152 3510 02701.000020 0250270 .6501 .000000 240 300300350100 0 164 90 60114 18590

FCOM-B0-02-17-30-012-085

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
200	1809 0.35	1709 0.35	1626 0.35	1555 0.36	1500 0.36	1479 0.36	1501 0.36		2	6	10
220	2010 0.38	1898 0.38	1806 0.38	1728 0.38	1669 0.38	1652 0.38	1687 0.38	1	3	8	13
240	2210 0.40	2087 0.40	1985 0.41	1901 0.41	1837 0.41	1824 0.41	1872 0.41	1	3	9	15
260	2410 0.43	2276 0.43	2165 0.43	2074 0.43	2006 0.43	1996 0.43	2057 0.43	2	4	11	18
280	2610 0.45	2464 0.45	2345 0.46	2246 0.46	2174 0.46	2167 0.46	2241 0.46	3	5	13	21
300	2810 0.48	2653 0.48	2524 0.48	2419 0.49	2342 0.49	2338 0.49	2425 0.49	3	6	14	23
320	3010 0.50	2841 0.51	2703 0.51	2591 0.51	2510 0.51	2508 0.51	2608 0.51	4	7	16	26
340	3210 0.53	3029 0.53	2882 0.53	2763 0.54	2678 0.54	2679 0.54	2790 0.54	4	8	18	28
360	3410 0.55	3217 0.56	3061 0.56	2935 0.56	2846 0.57	2849 0.57	2972 0.57	5	8	19	31
380	3610 0.58	3405 0.58	3240 0.59	3107 0.59	3013 0.59	3018 0.59	3153 0.59	5	9	21	33
400	3809 1.00	3593 1.01	3419 1.01	3278 1.02	3180 1.02	3187 1.02	3334 1.02	6	10	22	36
420	4009 1.03	3781 1.03	3597 1.04	3450 1.04	3347 1.04	3356 1.04	3514 1.04	6	11	24	38
440	4208 1.06	3969 1.06	3776 1.06	3621 1.07	3513 1.07	3525 1.07	3693 1.07	7	12	26	41
460	4407 1.08	4157 1.08	3954 1.09	3792 1.09	3680 1.10	3693 1.10	3872 1.10	7	12	27	43
480	4606 1.11	4344 1.11	4132 1.11	3963 1.12	3846 1.12	3861 1.12	4050 1.12	8	13	29	45
500	4805 1.13	4531 1.14	4310 1.14	4134 1.15	4012 1.15	4028 1.15	4228 1.15	8	14	30	48
520	5004 1.16	4719 1.16	4488 1.17	4305 1.17	4177 1.17	4195 1.17	4405 1.17	9	15	32	50
540	5203 1.18	4906 1.19	4666 1.19	4475 1.20	4343 1.20	4362 1.20	4582 1.20	9	16	33	52
560	5402 1.21	5093 1.21	4843 1.22	4646 1.22	4508 1.23	4529 1.23	4758 1.23	10	16	35	55
580	5601 1.23	5280 1.24	5021 1.24	4816 1.25	4673 1.25	4695 1.25	4934 1.25	10	17	36	57
600	5799 1.26	5467 1.26	5198 1.27	4986 1.28	4838 1.28	4860 1.28	5109 1.28	11	18	38	59
620	5998 1.28	5653 1.29	5375 1.30	5156 1.30	5003 1.30	5026 1.30	5283 1.30	11	19	39	61
640	6196 1.31	5840 1.31	5552 1.32	5326 1.33	5168 1.33	5191 1.33	5457 1.33	12	19	41	64
660	6395 1.33	6027 1.34	5729 1.35	5496 1.35	5332 1.36	5356 1.36	5631 1.36	12	20	42	66
680	6593 1.36	6213 1.37	5906 1.37	5665 1.38	5496 1.38	5520 1.38	5804 1.38	13	21	43	68
700	6791 1.38	6400 1.39	6083 1.40	5835 1.41	5660 1.41	5685 1.41	5976 1.41	13	22	45	70
720	6989 1.41	6586 1.42	6259 1.42	6004 1.43	5824 1.44	5849 1.44	6148 1.44	14	22	46	72
740	7187 1.43	6772 1.44	6436 1.45	6173 1.46	5988 1.46	6013 1.46	6320 1.46	14	23	48	74
760	7385 1.46	6958 1.47	6612 1.48	6342 1.48	6151 1.49	6176 1.49	6491 1.49	15	24	49	76
780	7583 1.49	7144 1.49	6789 1.50	6511 1.51	6315 1.51	6340 1.51	6661 1.51	15	25	50	78
800	7780 1.51	7330 1.52	6965 1.53	6679 1.54	6478 1.54	6503 1.54	6832 1.54	16	25	52	80
820	7978 1.54	7516 1.54	7141 1.55	6848 1.56	6641 1.57	6665 1.57	7001 1.57	16	26	53	82
840	8175 1.56	7701 1.57	7317 1.58	7016 1.59	6804 1.59	6828 1.59	7170 1.59	17	27	54	84

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
840	8175 1.56	7701 1.57	7317 1.58	7016 1.59	6804 1.59	6828 1.59	7170 1.59	17	27	54	84
860	8373 1.59	7887 2.00	7492 2.00	7185 2.01	6967 2.02	6990 2.02	7339 2.02	17	28	56	86
880	8570 2.01	8073 2.02	7668 2.03	7353 2.04	7130 2.04	7152 2.04	7507 2.04	18	28	57	88
900	8767 2.04	8258 2.05	7843 2.06	7521 2.07	7292 2.07	7313 2.07	7675 2.07	18	29	58	90
920	8965 2.06	8443 2.07	8019 2.08	7688 2.09	7454 2.10	7475 2.10	7842 2.10	19	30	59	92
940	9162 2.09	8628 2.10	8194 2.11	7856 2.12	7616 2.12	7636 2.12	8009 2.12	19	30	61	94
960	9359 2.11	8814 2.12	8369 2.13	8024 2.14	7778 2.15	7797 2.15	8175 2.15	20	31	62	96
980	9556 2.14	8999 2.15	8544 2.16	8191 2.17	7940 2.18	7957 2.18	8341 2.18	20	32	63	98
1000	9753 2.16	9184 2.17	8719 2.18	8358 2.20	8101 2.20	8117 2.20	8506 2.20	21	33	64	100
1020	9949 2.19	9368 2.20	8894 2.21	8525 2.22	8263 2.23	8277 2.23	8671 2.23	21	33	66	102
1040	10146 2.21	9553 2.23	9069 2.24	8693 2.25	8424 2.25	8437 2.25	8836 2.25	21	34	67	103
1060	10343 2.24	9738 2.25	9243 2.26	8859 2.27	8585 2.28	8596 2.28	9000 2.28	22	35	68	105
1080	10539 2.27	9922 2.28	9418 2.29	9026 2.30	8746 2.31	8755 2.31	9163 2.31	22	35	69	107
1100	10735 2.29	10107 2.30	9592 2.31	9193 2.33	8907 2.33	8914 2.33	9327 2.33	23	36	70	108
1120	10932 2.32	10291 2.33	9766 2.34	9359 2.35	9067 2.36	9073 2.36	9489 2.36	23	37	72	110
1140	11128 2.34	10475 2.35	9940 2.36	9526 2.38	9228 2.38	9231 2.38	9652 2.38	24	37	73	112
1160	11324 2.37	10660 2.38	10114 2.39	9692 2.40	9388 2.41	9389 2.41	9814 2.41	24	38	74	73
1180	11520 2.39	10844 2.40	10288 2.42	9858 2.43	9548 2.44	9547 2.44	9975 2.44	25	39	75	75
1200	11716 2.42	11028 2.43	10462 2.44	10024 2.46	9708 2.46	9705 2.46	10136 2.46	25	39	76	77
1220	11912 2.44	11212 2.45	10636 2.47	10190 2.48	9868 2.49	9862 2.49	10297 2.49	26	40	77	80
1240	12108 2.47	11395 2.48	10809 2.49	10355 2.51	10028 2.51	10019 2.51	10458 2.51	26	41	78	82
1260	12303 2.49	11579 2.51	10983 2.52	10521 2.53	10187 2.54	10176 2.54	10617 2.54	26	41	79	84
1280	12499 2.52	11763 2.53	11156 2.55	10686 2.56	10346 2.57	10332 2.57	10777 2.57	27	42	80	86
1300	12694 2.54	11946 2.56	11329 2.57	10852 2.59	10505 2.59	10488 2.59	10936 2.59	27	43	82	88
1320	12890 2.57	12129 2.58	11502 3.00	11017 3.01	10664 3.02	10644 3.02	11095 3.02	28	43	83	91
1340	13085 2.59	12313 3.01	11675 3.02	11182 3.04	10823 3.05	10800 3.05	11253 3.05	28	44	84	93
1360	13280 3.02	12496 3.03	11848 3.05	11346 3.06	10982 3.07	10956 3.07	11411 3.07	29	45	85	95
1380	13476 3.04	12679 3.06	12020 3.07	11511 3.09	11140 3.10	11111 3.10	11569 3.10	29	45	86	97
1400	13671 3.07	12862 3.08	12193 3.10	11676 3.12	11298 3.12	11266 3.12	11726 3.12	29	46	87	99
1420	13866 3.10	13045 3.11	12365 3.13	11840 3.14	11456 3.15	11421 3.15	11883 3.15	30	47	88	101
1440	14061 3.12	13228 3.14	12538 3.15	12005 3.17	11614 3.18	11575 3.18	12039 3.18	30	47	89	103
1460	14255 3.15	13411 3.16	12710 3.18	12169 3.19	11772 3.20	11729 3.20	12195 3.20	31	48	90	105
1480	14450 3.17	13594 3.19	12882 3.20	12333 3.22	11930 3.23	11883 3.23	12351 3.23	31	49	91	107

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	310	330	350	370	390	410	FL290 FL310	FL330 FL350	FL370 FL390	FL410
1480	14450 3.17	13594 3.19	12882 3.20	12333 3.22	11930 3.23	11883 3.23	12351 3.23	31	49	91	107
1500	14645 3.20	13776 3.21	13054 3.23	12497 3.25	12087 3.25	12037 3.25	12506 3.25	32	49	92	109
1520	14839 3.22	13959 3.24	13226 3.25	12661 3.27	12245 3.28	12191 3.28	12661 3.28	32	50	93	111
1540	15034 3.25	14141 3.26	13397 3.28	12824 3.30	12402 3.31	12344 3.31	12816 3.31	32	51	94	113
1560	15228 3.27	14324 3.29	13569 3.31	12988 3.32	12559 3.33	12497 3.33	12970 3.33	33	51	95	115
1580	15423 3.30	14506 3.31	13741 3.33	13151 3.35	12716 3.36	12650 3.36	13124 3.36	33	52	96	116
1600	15617 3.32	14688 3.34	13912 3.36	13314 3.38	12872 3.38	12802 3.38	13279 3.38	34	53	97	118
1620	15811 3.35	14871 3.37	14083 3.38	13477 3.40	13029 3.41	12955 3.41	13434 3.41	34	53	98	120
1640	16005 3.37	15053 3.39	14254 3.41	13640 3.43	13186 3.44	13107 3.44	13588 3.44	35	54	99	122
1660	16199 3.40	15235 3.42	14425 3.43	13803 3.45	13343 3.46	13260 3.46	13743 3.46	35	54	100	124
1680	16393 3.42	15417 3.44	14596 3.46	13966 3.48	13500 3.49	13412 3.49	13896 3.49	35	55	101	126
1700	16587 3.45	15598 3.47	14767 3.49	14129 3.51	13656 3.52	13565 3.52	14050 3.52	36	56	102	127
1720	16780 3.47	15780 3.49	14938 3.51	14291 3.53	13813 3.54	13717 3.54	14203 3.54	36	56	103	129
1740	16974 3.50	15962 3.52	15108 3.54	14453 3.56	13969 3.57	13868 3.57	14355 3.57	37	57	104	131
1760	17168 3.53	16143 3.54	15279 3.56	14616 3.58	14125 3.59	14020 3.59	14508 3.59	37	57	105	133
1780	17361 3.55	16325 3.57	15449 3.59	14778 4.01	14281 4.02	14171 4.02	14660 4.02	37	58	106	134
1800	17554 3.58	16506 4.00	15619 4.01	14940 4.04	14437 4.05	14322 4.05	14812 4.05	38	59	106	136
1820	17748 4.00	16687 4.02	15790 4.04	15102 4.06	14593 4.07	14473 4.07	14963 4.07	38	59	107	138
1840	17941 4.03	16869 4.05	15960 4.07	15263 4.09	14748 4.10	14624 4.10	15115 4.10	39	60	108	140
1860	18134 4.05	17050 4.07	16129 4.09	15425 4.11	14904 4.12	14775 4.12	15266 4.12	39	60	109	141
1880	18327 4.08	17231 4.10	16299 4.12	15586 4.14	15059 4.15	14925 4.15	15416 4.15	39	61	110	143
1900	18520 4.10	17412 4.12	16469 4.14	15748 4.16	15214 4.18	15075 4.18	15567 4.18	40	62	111	145
1920	18713 4.13	17592 4.15	16639 4.17	15909 4.19	15369 4.20	15225 4.20	15717 4.20	40	62	112	146
1940	18906 4.15	17773 4.17	16808 4.20	16070 4.22	15524 4.23	15374 4.23	15866 4.23	40	63	113	148
1960	19099 4.18	17954 4.20	16977 4.22	16231 4.24	15679 4.26	15524 4.26	16016 4.26	41	63	113	149
1980	19291 4.20	18134 4.23	17147 4.25	16392 4.27	15834 4.28	15673 4.28	16165 4.28	41	64	114	151
2000	19484 4.23	18315 4.25	17316 4.27	16552 4.29	15988 4.31	15822 4.31	16314 4.31	42	65	115	153
2020	19676 4.25	18495 4.28	17485 4.30	16713 4.32	16143 4.33	15971 4.33	16462 4.33	42	65	116	154
2040	19869 4.28	18676 4.30	17654 4.32	16873 4.35	16297 4.36	16120 4.36	16611 4.36	42	66	117	156
2060	20061 4.31	18856 4.33	17822 4.35	17034 4.37	16451 4.39	16268 4.39	16759 4.39	43	66	117	157
2080	20253 4.33	19036 4.35	17991 4.38	17194 4.40	16605 4.41	16417 4.41	16906 4.41	43	67	118	159
2100	20446 4.36	19216 4.38	18160 4.40	17354 4.42	16759 4.44	16565 4.44	17054 4.44	44	67	119	160
2120	20638 4.38	19396 4.40	18328 4.43	17514 4.45	16912 4.46	16712 4.46	17201 4.46	44	68	120	161

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590 FCOM-B0-02-17-30-015-085

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG
ECONOMIC AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 37.5 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
2120	20638 4.38	19396 4.40	18328 4.43	17514 4.45	16912 4.46	16712 4.46	17201 4.46	44	68	120	161
2140	20830 4.41	19576 4.43	18497 4.45	17674 4.48	17066 4.49	16860 4.49	17348 4.49	44	69	121	163
2160	21022 4.43	19756 4.45	18665 4.48	17833 4.50	17219 4.52	17008 4.52	17494 4.52	45	69	121	164
2180	21214 4.46	19936 4.48	18833 4.50	17993 4.53	17373 4.54	17155 4.54	17641 4.54	45	70	122	166
2200	21406 4.48	20115 4.51	19001 4.53	18153 4.55	17526 4.57	17302 4.57	17787 4.57	46	70	123	167
2220	21598 4.51	20295 4.53	19169 4.56	18312 4.58	17679 4.59	17449 4.59	17932 4.59	46	71	124	169
2240	21789 4.53	20475 4.56	19337 4.58	18471 5.01	17832 5.02	17596 5.02	18078 5.02	46	71	124	170
2260	21981 4.56	20654 4.58	19505 5.01	18630 5.03	17985 5.05	17742 5.05	18223 5.05	47	72	125	171
2280	22173 4.58	20834 5.01	19672 5.03	18789 5.06	18137 5.07	17888 5.07	18368 5.07	47	72	126	173
2300	22364 5.01	21013 5.03	19840 5.06	18948 5.08	18290 5.10	18034 5.10	18512 5.10	48	73	127	174
2320	22556 5.03	21192 5.06	20007 5.08	19107 5.11	18442 5.13	18180 5.13	18657 5.13	48	74	127	175
2340	22747 5.06	21372 5.08	20175 5.11	19266 5.14	18595 5.15	18326 5.15	18801 5.15	48	74	128	177
2360	22938 5.08	21551 5.11	20343 5.14	19424 5.16	18747 5.18	18472 5.18	18945 5.18	49	75	129	178
2380	23129 5.11	21730 5.14	20511 5.16	19583 5.19	18899 5.20	18617 5.20	19089 5.20	49	75	130	179
2400	23320 5.14	21909 5.16	20679 5.19	19741 5.21	19051 5.23	18762 5.23	19232 5.23	49	76	130	180
2420	23511 5.16	22088 5.19	20846 5.21	19899 5.24	19202 5.26	18907 5.26	19375 5.26	50	76	131	182
2440	23702 5.19	22267 5.21	21014 5.24	20057 5.27	19354 5.28	19052 5.28	19518 5.28	50	77	132	183
2460	23893 5.21	22445 5.24	21182 5.26	20215 5.29	19506 5.31	19197 5.31	19661 5.31	51	77	133	184
2480	24084 5.24	22624 5.26	21349 5.29	20374 5.32	19657 5.33	19341 5.33	19803 5.33	51	78	133	185
2500	24275 5.26	22803 5.29	21517 5.32	20532 5.34	19808 5.36	19485 5.36	19946 5.36	51	78	134	187
2520	24465 5.29	22981 5.31	21684 5.34	20690 5.37	19959 5.39	19629 5.39	20088 5.39	52	79	135	188
2540	24656 5.31	23159 5.34	21852 5.37	20848 5.40	20110 5.41	19773 5.41	20229 5.41	52	79	135	189
2560	24846 5.34	23338 5.37	22019 5.39	21006 5.42	20261 5.44	19917 5.44	20371 5.44	52	80	136	190
2580	25036 5.36	23516 5.39	22186 5.42	21164 5.45	20412 5.46	20060 5.47	20512 5.46	53	81	137	191
2600	25227 5.39	23694 5.42	22353 5.45	21321 5.47	20563 5.49	20204 5.49	20654 5.49	53	81	137	193
2620	25417 5.41	23872 5.44	22520 5.47	21479 5.50	20714 5.52	20348 5.52	20795 5.52	53	82	138	194
2640	25607 5.44	24050 5.47	22687 5.50	21636 5.53	20864 5.54	20492 5.54	20936 5.54	54	82	139	195
2660	25797 5.46	24228 5.49	22854 5.52	21794 5.55	21015 5.57	20636 5.57	21077 5.57	54	83	139	196
2680	25987 5.49	24406 5.52	23020 5.55	21951 5.58	21165 6.00	20780 6.00	21217 6.00	55	83	140	197
2700	26177 5.51	24584 5.54	23187 5.57	22108 6.00	21316 6.02	20924 6.02	21358 6.02	55	84	141	198
2720	26367 5.54	24761 5.57	23353 6.00	22265 6.03	21466 6.05	21068 6.05	21498 6.05	55	84	141	199
2740	26557 5.57	24939 6.00	23520 6.03	22422 6.06	21616 6.07	21212 6.07	21638 6.07	56	85	142	200
2760	26746 5.59	25117 6.02	23686 6.05	22579 6.08	21766 6.10	21355 6.10	21777 6.10	56	85	143	202

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
2760	26746 5.59	25117 6.02	23686 6.05	22579 6.08	21766 6.10	21355 6.10	21777 6.10	56	85	143	202
2780	26936 6.02	25294 6.05	23852 6.08	22735 6.11	21915 6.13	21498 6.13	21917 6.13	56	86	143	203
2800	27125 6.04	25471 6.07	24018 6.10	22892 6.13	22065 6.15	21642 6.15	22056 6.15	57	86	144	204
2820	27315 6.07	25649 6.10	24184 6.13	23048 6.16	22215 6.18	21785 6.18	22195 6.18	57	87	144	205
2840	27504 6.09	25826 6.12	24350 6.15	23205 6.19	22364 6.20	21927 6.20	22333 6.20	57	87	145	206
2860	27694 6.12	26003 6.15	24516 6.18	23361 6.21	22513 6.23	22070 6.23	22472 6.23	58	87	146	207
2880	27883 6.14	26180 6.17	24682 6.21	23517 6.24	22662 6.26	22212 6.26	22610 6.26	58	88	146	208
2900	28072 6.17	26357 6.20	24848 6.23	23673 6.26	22811 6.28	22355 6.28	22748 6.28	58	88	147	210
2920	28261 6.19	26534 6.22	25013 6.26	23829 6.29	22960 6.31	22497 6.31	22885 6.31	59	89	147	211
2940	28451 6.22	26711 6.25	25179 6.28	23985 6.32	23109 6.34	22639 6.34	23023 6.34	59	89	148	212
2960	28640 6.24	26887 6.28	25344 6.31	24141 6.34	23258 6.36	22781 6.36	23160 6.36	59	90	149	213
2980	28829 6.27	27064 6.30	25510 6.33	24296 6.37	23407 6.39	22923 6.39	23297 6.39	60	90	149	214
3000	29018 6.29	27240 6.33	25675 6.36	24452 6.39	23555 6.41	23064 6.41	23434 6.41	60	91	150	215
3020	29207 6.32	27417 6.35	25840 6.39	24607 6.42	23703 6.44	23206 6.44	23570 6.44	61	91	150	216
3040	29395 6.34	27593 6.38	26005 6.41	24763 6.45	23852 6.47	23347 6.47	23707 6.47	61	92	151	217
3060	29584 6.37	27770 6.40	26170 6.44	24918 6.47	24000 6.49	23488 6.49	23843 6.49	61	92	151	218
3080	29773 6.40	27946 6.43	26335 6.46	25073 6.50	24148 6.52	23629 6.52	23979 6.52	62	93	152	219
3100	29961 6.42	28122 6.45	26500 6.49	25228 6.52	24296 6.54	23770 6.54	24115 6.54	62	93	153	220
3120	30150 6.45	28299 6.48	26664 6.51	25383 6.55	24443 6.57	23910 6.57	24250 6.57	62	93	153	221
3140	30338 6.47	28475 6.51	26829 6.54	25537 6.58	24591 7.00	24051 7.00	24386 7.00	63	94	154	222
3160	30527 6.50	28651 6.53	26994 6.57	25692 7.00	24739 7.02	24191 7.02	24521 7.02	63	94	154	223
3180	30715 6.52	28827 6.56	27158 6.59	25847 7.03	24886 7.05	24331 7.05	24656 7.05	63	95	155	224
3200	30903 6.55	29003 6.58	27322 7.02	26001 7.05	25033 7.07	24472 7.07	24791 7.07	64	95	155	225
3220	31091 6.57	29179 7.01	27487 7.04	26156 7.08	25181 7.10	24611 7.10	24925 7.10	64	96	156	226
3240	31279 7.00	29355 7.03	27651 7.07	26310 7.11	25328 7.13	24751 7.13	25059 7.13	64	96	157	227
3260	31467 7.02	29530 7.06	27816 7.10	26464 7.13	25475 7.15	24891 7.15	25193 7.15	65	96	157	228
3280	31655 7.05	29706 7.08	27980 7.12	26618 7.16	25622 7.18	25030 7.18	25327 7.18	65	97	158	229
3300	31843 7.07	29881 7.11	28144 7.15	26772 7.18	25768 7.21	25170 7.21	25461 7.21	66	97	158	230
3320	32031 7.10	30057 7.14	28309 7.17	26926 7.21	25915 7.23	25309 7.23	25594 7.23	66	98	159	230
3340	32219 7.12	30232 7.16	28473 7.20	27080 7.24	26061 7.26	25448 7.26	25728 7.26	66	98	159	231
3360	32406 7.15	30408 7.19	28637 7.22	27233 7.26	26208 7.28	25587 7.28	25861 7.28	67	99	160	232
3380	32594 7.17	30583 7.21	28801 7.25	27387 7.29	26354 7.31	25725 7.31	25994 7.31	67	99	161	233
3400	32781 7.20	30758 7.24	28965 7.28	27540 7.31	26500 7.34	25864 7.34	26126 7.34	67	99	161	234

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590 FCOM-B0-02-17-30-017-085

Mod. : 4801 + 4863 PW Eng. : 4000

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

REF. INITIAL WEIGHT = 115000 KG
ECONOMIC AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 37.5 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
3400	32781 7.20	30758 7.24	28965 7.28	27540 7.31	26500 7.34	25864 7.34	26126 7.34	67	99	161	234
3420	32969 7.23	30933 7.26	29129 7.30	27694 7.34	26646 7.36	26002 7.36	26259 7.36	68	100	162	235
3440	33156 7.25	31108 7.29	29292 7.33	27847 7.37	26792 7.39	26141 7.39	26391 7.39	68	100	162	236
3460	33343 7.28	31283 7.31	29456 7.35	28001 7.39	26938 7.41	26279 7.41	26523 7.41	68	101	163	236
3480	33530 7.30	31458 7.34	29620 7.38	28154 7.42	27084 7.44	26417 7.44	26655 7.44	69	101	163	237
3500	33718 7.33	31633 7.36	29783 7.40	28307 7.44	27230 7.47	26555 7.47	26787 7.47	69	101	164	238
3520	33905 7.35	31807 7.39	29947 7.43	28460 7.47	27375 7.49	26693 7.49	26918 7.49	69	102	164	239
3540	34092 7.38	31982 7.42	30110 7.46	28613 7.50	27521 7.52	26830 7.52	27050 7.52	70	102	165	240
3560	34278 7.40	32157 7.44	30273 7.48	28766 7.52	27666 7.54	26968 7.55	27181 7.55	70	103	165	240
3580	34465 7.43	32331 7.47	30436 7.51	28919 7.55	27811 7.57	27105 7.57	27312 7.57	70	103	166	241
3600	34652 7.45	32506 7.49	30599 7.53	29071 7.57	27956 8.00	27242 8.00	27442 8.00	71	103	166	242
3620	34839 7.48	32680 7.52	30762 7.56	29224 8.00	28101 8.02	27379 8.02	27573 8.02	71	104	167	243
3640	35026 7.50	32854 7.54	30925 7.58	29376 8.03	28246 8.05	27516 8.05	27704 8.05	71	104	167	243
3660	35213 7.53	33028 7.57	31088 8.01	29529 8.05	28391 8.08	27654 8.08	27836 8.08	72	105	168	244
3680	35400 7.55	33202 7.59	31251 8.04	29681 8.08	28535 8.10	27792 8.10	27967 8.10	72	105	168	245
3700	35586 7.58	33377 8.02	31414 8.06	29833 8.10	28680 8.13	27930 8.13	28099 8.13	72	105	169	246
3720	35773 8.00	33550 8.05	31576 8.09	29985 8.13	28824 8.15	28068 8.15	28230 8.15	73	106	169	246
3740	35960 8.03	33724 8.07	31739 8.11	30137 8.16	28969 8.18	28206 8.18	28361 8.18	73	106	170	247
3760	36146 8.06	33898 8.10	31901 8.14	30289 8.18	29113 8.21	28344 8.21	28492 8.21	73	106	170	248
3780	36333 8.08	34072 8.12	32064 8.16	30441 8.21	29257 8.23	28481 8.23	28623 8.23	74	107	171	249
3800	36519 8.11	34246 8.15	32226 8.19	30593 8.23	29401 8.26	28619 8.26	28753 8.26	74	107	171	249
3820	36705 8.13	34419 8.17	32388 8.22	30744 8.26	29545 8.28	28756 8.28	28884 8.28	75	108	172	250
3840	36892 8.16	34593 8.20	32550 8.24	30896 8.29	29689 8.31	28894 8.31	29014 8.31	75	108	172	251
3860	37078 8.18	34766 8.22	32712 8.27	31047 8.31	29832 8.34	29031 8.34	29144 8.34	75	108	172	252
3880	37264 8.21	34940 8.25	32874 8.29	31199 8.34	29976 8.36	29168 8.36	29274 8.36	76	109	173	252
3900	37450 8.23	35113 8.28	33036 8.32	31350 8.36	30119 8.39	29305 8.39	29403 8.39	76	109	173	253
3920	37636 8.26	35287 8.30	33198 8.34	31501 8.39	30263 8.42	29442 8.42	29533 8.42	76	109	174	254
3940	37822 8.28	35460 8.33	33360 8.37	31652 8.42	30406 8.44	29579 8.44	29662 8.44	77	110	174	254
3960	38008 8.31	35633 8.35	33521 8.40	31803 8.44	30549 8.47	29715 8.47	29791 8.47	77	110	175	255
3980	38194 8.33	35806 8.38	33683 8.42	31954 8.47	30692 8.49	29852 8.49	29920 8.49	77	110	175	256
4000	38380 8.36	35979 8.40	33845 8.45	32105 8.49	30835 8.52	29988 8.52	30049 8.52	78	111	176	257
4020	38565 8.38	36153 8.43	34006 8.47	32255 8.52	30978 8.55	30124 8.55	30178 8.55	78	111	176	257
4040	38751 8.41	36325 8.45	34167 8.50	32406 8.55	31121 8.57	30260 8.57	30306 8.57	78	111	176	258

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590 FCOM-B0-02-17-30-018-085

Mod. : 4801 + 4863 PW Eng. : 4000

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.80 - DESCENT : M.80/300KT/250KT - IMC PROCEDURE 360 KG/6MIN

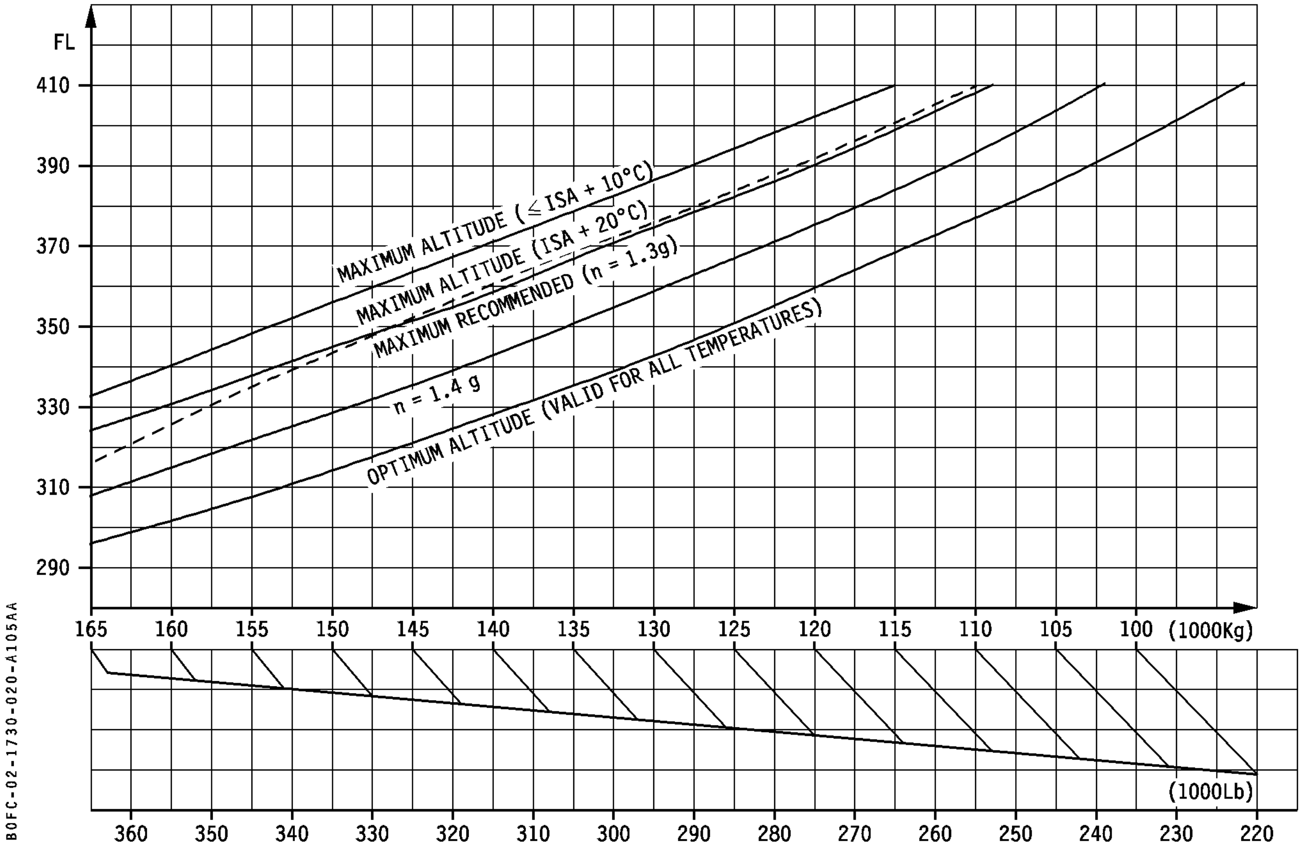
REF. INITIAL WEIGHT = 115000 KG ECONOMIC AIR CONDITIONING ANTI-ICING OFF	ISA CG = 37.5 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)			
	290	**310**	**330**	**350**	**370**	**390**	**410**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**	**FL410**
4040	38751 8.41	36325 8.45	34167 8.50	32406 8.55	31121 8.57	30260 8.57	30306 8.57	78	111	176	258
4060	38937 8.43	36498 8.48	34329 8.53	32556 8.57	31263 9.00	30396 9.00	30435 9.00	79	112	177	259
4080	39122 8.46	36671 8.50	34490 8.55	32707 9.00	31406 9.02	30532 9.02	30563 9.02	79	112	177	259
4100	39308 8.49	36844 8.53	34651 8.58	32857 9.02	31548 9.05	30668 9.05	30691 9.05	79	112	178	260
4120	39493 8.51	37017 8.56	34812 9.00	33007 9.05	31691 9.08	30803 9.08	30819 9.08	80	113	178	261
4140	39678 8.54	37189 8.58	34974 9.03	33157 9.08	31833 9.10	30939 9.10	30946 9.10	80	113	179	261
4160	39864 8.56	37362 9.01	35135 9.05	33307 9.10	31975 9.13	31074 9.13	31074 9.13	80	113	179	262
4180	40049 8.59	37534 9.03	35297 9.08	33457 9.13	32117 9.15	31210 9.15	31201 9.15	81	114	180	262
4200	40234 9.01	37707 9.06	35458 9.11	33607 9.15	32259 9.18	31345 9.18	31328 9.18	81	114	180	263
4220	40419 9.04	37879 9.08	35619 9.13	33757 9.18	32401 9.21	31480 9.21	31455 9.21	81	114	181	264
4240	40604 9.06	38051 9.11	35780 9.16	33907 9.21	32543 9.23	31615 9.23	31582 9.23	82	115	181	264
4260	40789 9.09	38224 9.13	35941 9.18	34056 9.23	32684 9.26	31750 9.26	31709 9.26	82	115	182	265
4280	40974 9.11	38396 9.16	36102 9.21	34206 9.26	32826 9.29	31884 9.29	31835 9.29	82	115	182	266
4300	41158 9.14	38568 9.19	36263 9.23	34355 9.28	32967 9.31	32019 9.31	31962 9.31	82	116	183	266
4320	41343 9.16	38740 9.21	36424 9.26	34504 9.31	33108 9.34	32153 9.34	32088 9.34	83	116	183	267
4340	41528 9.19	38912 9.24	36585 9.29	34653 9.34	33250 9.36	32288 9.36	32214 9.36	83	116	184	267
4360	41712 9.21	39084 9.26	36746 9.31	34803 9.36	33391 9.39	32422 9.39	32340 9.39	83	116	184	268
4380	41897 9.24	39255 9.29	36906 9.34	34952 9.39	33532 9.42	32556 9.42	32466 9.42	84	117	184	268
4400	42081 9.26	39427 9.31	37067 9.36	35101 9.41	33673 9.44	32690 9.44	32591 9.44	84	117	185	269
4420	42266 9.29	39599 9.34	37227 9.39	35250 9.44	33814 9.47	32824 9.47	32717 9.47	84	117	185	269
4440	42450 9.32	39771 9.36	37388 9.41	35399 9.47	33954 9.49	32958 9.49	32842 9.49	85	118	186	270
4460	42635 9.34	39942 9.39	37548 9.44	35548 9.49	34095 9.52	33091 9.52	32967 9.52	85	118	186	270
4480	42819 9.37	40114 9.42	37708 9.47	35696 9.52	34235 9.55	33225 9.55	33092 9.55	85	118	187	271
4500	43004 9.39	40285 9.44	37869 9.49	35845 9.54	34375 9.57	33358 9.57	33217 9.57	86	119	187	271

FLIP23 A310-324 PW4152 3610 03751.000021 0250300 .8000 .000000 360 0350350115 0 164 90 60114 18590

FCOM-B0-02-17-30-019-085

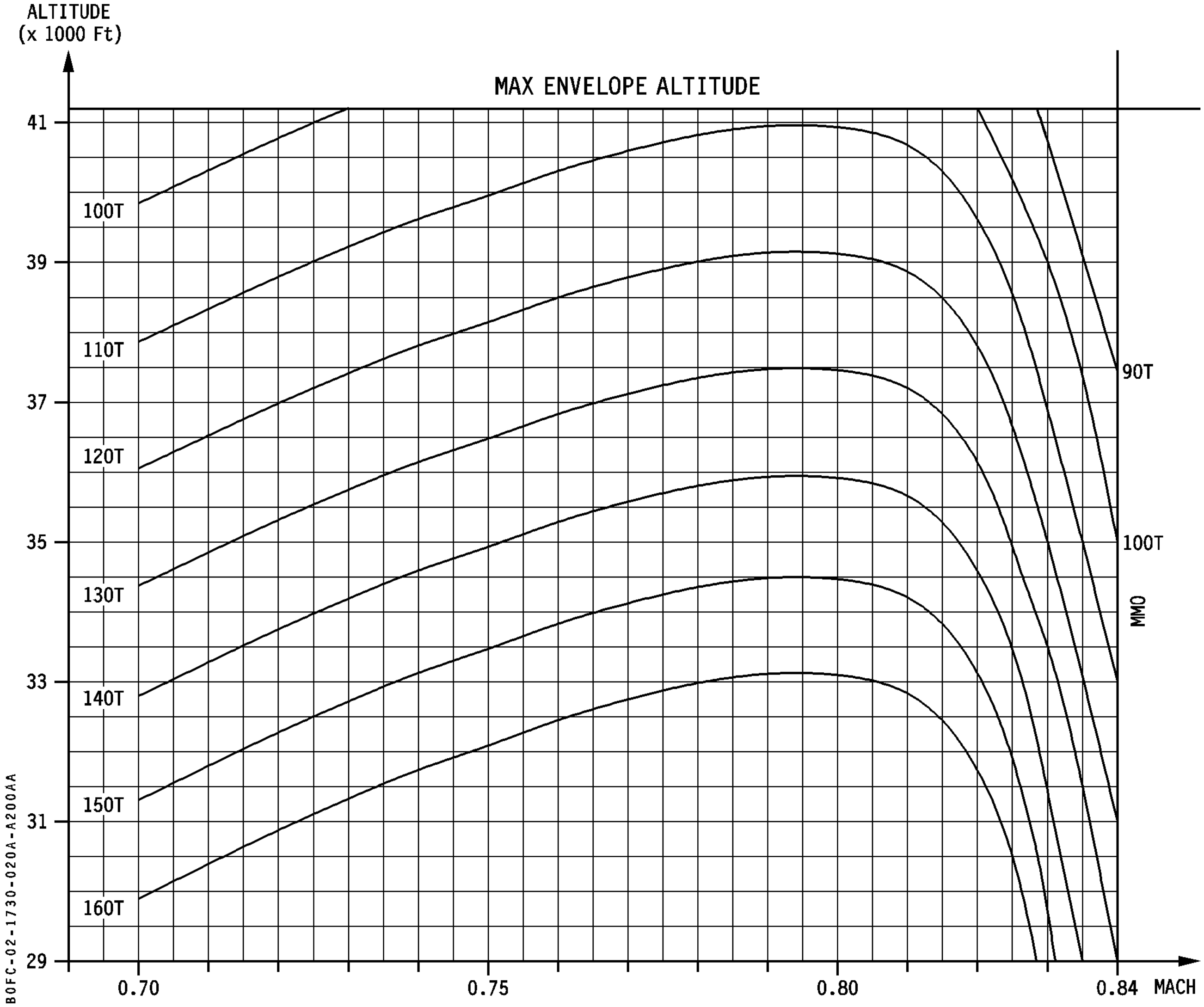
M = 0.80
C.G. POSITION = 37.5 %



R Code : 0092

CRUISE AT 0.3 G BUFFET MARGIN (n = 1.3 g)

R
R
R
R
R
R
R
R
R
R



CG POSITION 37.5 %
CLEAN CONFIGURATION

- THE ABOVE GRAPH PROVIDES DIRECT READING INFORMATION REGARDING THE SET OF CONDITIONS (GROSS WEIGHT, ALTITUDE, MACH NUMBER) ASSURING A 0.3 g BUFFET MARGIN (n = 1.3 g).

Mods : 4801 + 4863

CONTENTS

Code : 0417

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This chapter contains information or/and recommendations applicable whenever there is a deviation from the usual flight configuration or when significant environmental conditions have to be taken into account.

The circumstances envisaged in this chapter may have an effect on performance or/and lead to consider an appropriate flight profile for planning purpose.

1. GENERAL

A flight without cabin pressurization can be necessary due to aircraft system deficiency (see MEL) or after a decompression in flight. Depending on the cause of the pressure loss or absence, the distance to fly, the topographic conditions and the meteorological conditions the flight level and airspeed will be chosen.

2. OXYGEN REQUIREMENTS

A. CREW MEMBERS

See FAR 121.329 or JAR-OPS 1-770 as applicable

B. PASSENGER (FAR 121.329 or JAR OPS 1.770)

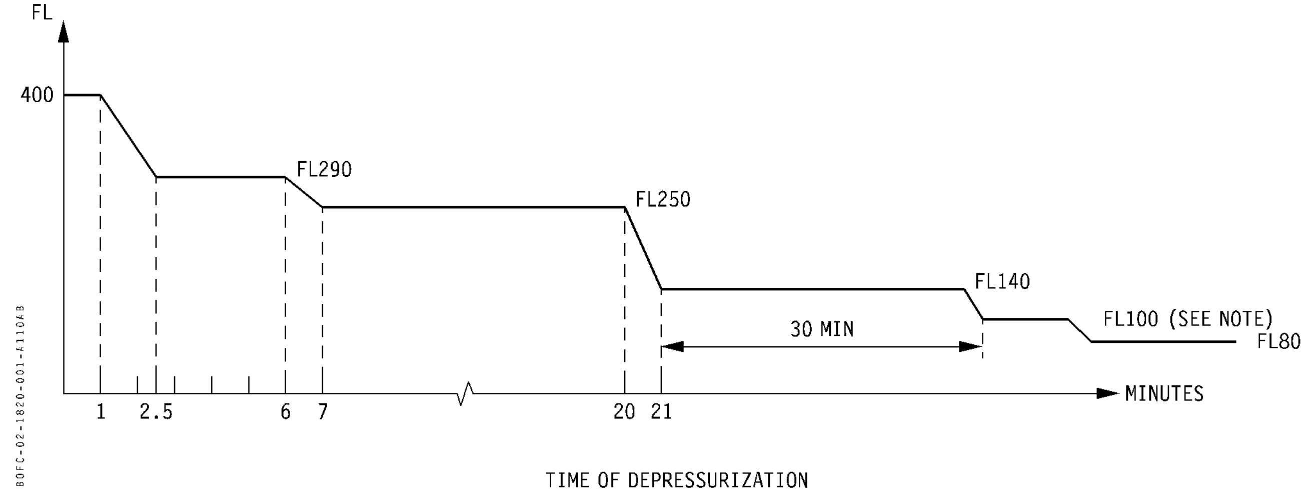
For flights at cabin pressure altitudes above 10.000 ft, up to and including 14.000 ft, enough oxygen for that part of the flight at those altitudes, that is of more than 30 minutes duration, for 10 % of the passengers.

For flights at cabin pressure altitudes above 14.000 ft, up to and including 15.000 ft, enough oxygen for that part of the flight at those altitudes for 30 % of the passengers.

For flights at cabin pressure altitudes above 15.000 ft, enough oxygen for each passenger, is carried during the entire flight at those altitudes.

EMERGENCY DESCENT IN CASE OF RAPID DEPRESSURIZATION

In case of depressurization, oxygen is supplied to passengers through individual modules, the capacity of which is so that the aircraft must descend and remain below the following profile.



Note : Between FL 80 and FL 100, oxygen must be provided for 2 % of the passengers. This is achieved by portable oxygen. When this is no longer achievable, descend to FL 80. For performance at FL 80/250 kt, use data for FL 100/LRC given in 2.18.20 p 3 (two engines) or 2.16.30 P 6 to 8 (one engine) and increase fuel consumption by 10 %.

Mod : 8199 or 11641 or 11717

3. FLIGHT PLANNING AND EXECUTION

A. ALTITUDE

Flight route planning should consider the above stated restriction in cabin altitude. When ascending above 9.550 ± 350 ft, the EXCESS CAB ALT warning will be activated. When ascending above 14.000 ft, the passenger oxygen masks will be provided automatically. Therefore the maximum altitude for prolonged flight is recommended as FL 100. The minimum altitude should be selected by respecting :

- the MSA (minimum safe altitude),
- the turbulence which is uncomfortable for passengers and,
- the low OAT which can be a discomfort to passengers when the cabin is ventilated by ram air only.

B. LONG RANGE CRUISE DATA

The normal climb charts will be used for the flight planning, along with the long range cruise chart. Take into account a slight increase in specific fuel consumption over the published figures during climb. In case of loss of pressurization, after an emergency descent, use graphs « LRC at FL 100 or 140 ».

C. AIRSPEED

In case structural damage was the cause of the decompression, airspeed should be limited to the minimum ; using slats and flaps as necessary to establish low speed conditions. On the other hand, turbulent conditions are uncomfortable for passengers and gust response should be minimized by reducing airspeed.

D. SYSTEMS

Failure occurring in flight :

Apply appropriate abnormal or emergency procedure

Failure present at dispatch

. If flight with both packs inoperative :
- PACK VALVES 1 and 2 . . . . OFF
- RAM AIR . . . . ON

. If both CABIN PRESSURE systems are inoperative or if structural damage exists :
- PACK VALVES 1 and 2 . . . . ON
- MAN PRESS . . . . ON
- V/S CTL . . . . UP (full open)
  Check outflow valve fully open.
- RAM AIR . . . . OFF

Take-off

Limit the A/C rate of climb to about 500 ft/mn

Climb :

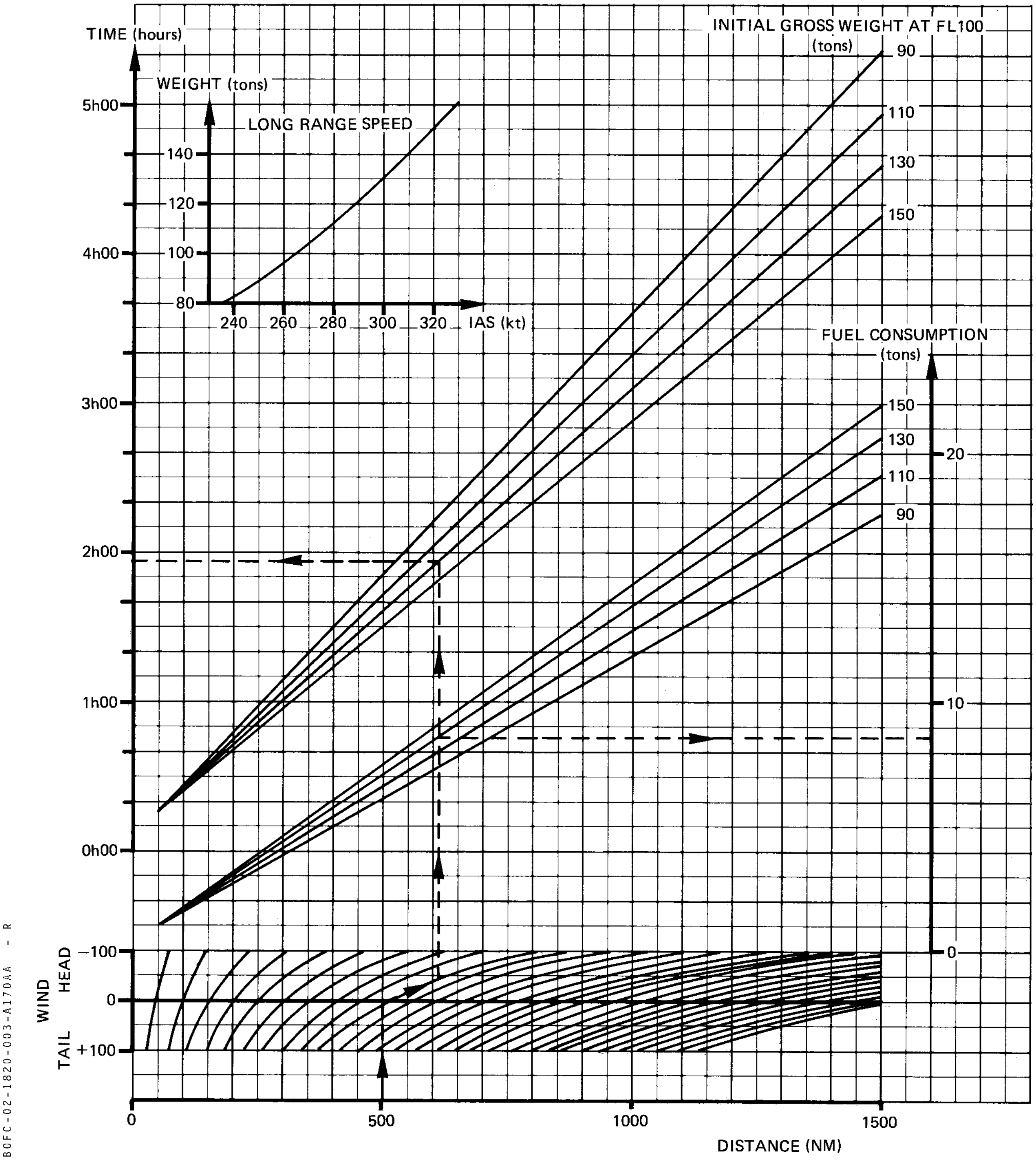
The EXCESS CAB ALT warning may occur. Use the ECAM CLR pb. to clear the warning.

Descent

Limit the A/C rate of descent to about 300 ft/mn

Perform the final approach normally.

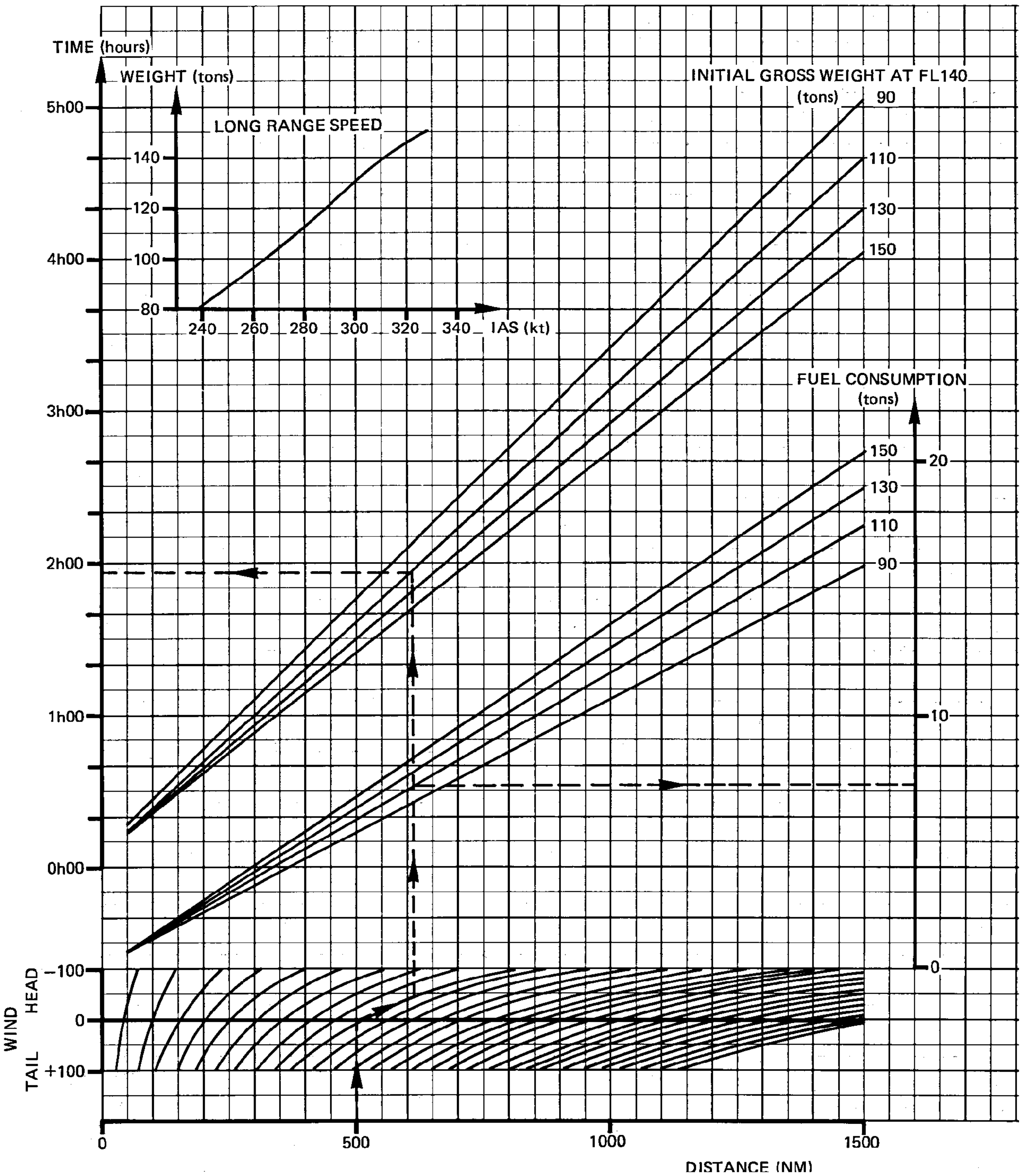
FUEL AND TIME TO DESTINATION AT FL 100 – 2 ENGINES
FROM ANY POINT IN CRUISE TO LANDING – LONG RANGE
INCLUDING LANDING PROCEDURE = 360 KG



Mod. : 4863

PW Eng. : 4000

FUEL AND TIME TO DESTINATION AT FL 140 – 2 ENGINES FROM ANY POINT IN CRUISE TO LANDING – LONG RANGE INCLUDING LANDING PROCEDURE = 360 KG



BOFC-02-1820-004-A170AA - R

Mod. : 4863

PW Eng. : 4000

1. GENERAL

With the slats failed in the fully retracted position, the airplane may be ferried in the conditions stated below.

However, each airline has to get approval from its national authorities to perform such a flight.

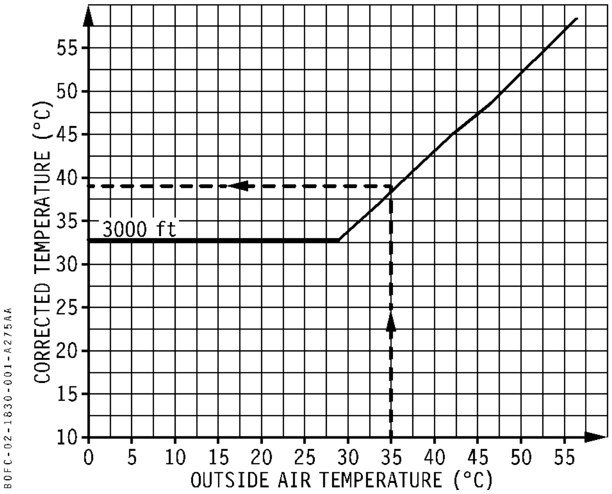
Note : *check that kruger flaps have been secured in the retracted position.*

2. MAX T.O. WEIGHT DETERMINATION

- Take-off must be performed under no wind or headwind conditions.
- Take-off will be performed with flaps 20°.
- Take-off will be performed with full thrust.
- Using the graphs on next page, enter with runway slope, airport temperature and pressure altitude and determine on one hand the weight limited by the runway and on the other hand the weight limited by second segment, brake energy and tire speed.
- Retain the lowest one as Max T.O. weight.
- No obstacle has been taken into account. In case of obstacles on the climb out flight path, take-off weather conditions will be restricted to VMC.

Fan thrust deterioration mode (FTDM)

- determine the corrected temperature with graph page 3/4, from the pressure altitude and the actual temperature. This corrected temperature must be read from this graph as schematically shown below. For 3000 ft pressure altitude and OAT = 35°C, corrected temperature = 39°C.



- use this temperature to determine the weight limited by the runway (graph page 2) and the weight limited by second segment.
- other limitations (tire speed, brakes energy) are determined with actual temperature.
- obstacles : same as normal mode.

3. TAKE-OFF SPEEDS

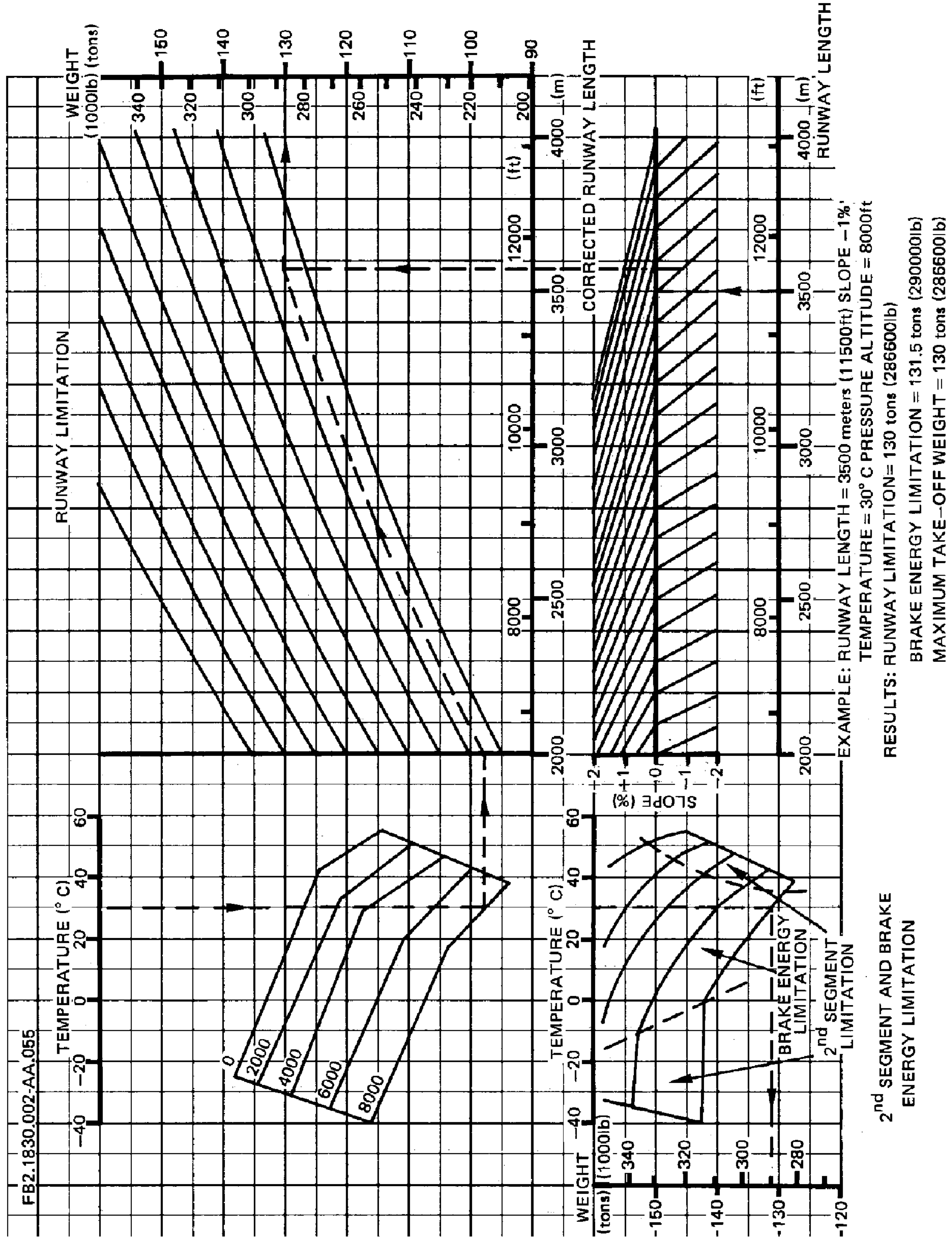
T/O weight (tons)	90	100	110	120	130	140	150
V2 (kt IAS)	137	144	152	158	164	170	176

V1 = V2 – 11 kt if not limited by brake energy. If brake energy limited V1 = V2 - 15 kt
VR = V2 – 4 kt
Safe pitch attitude : 8°
Minimum flaps retraction speed : F

Note : *The F speed displayed on the speed scale is the minimum flaps retraction speed corresponding to the aircraft configuration.*

4. LANDING

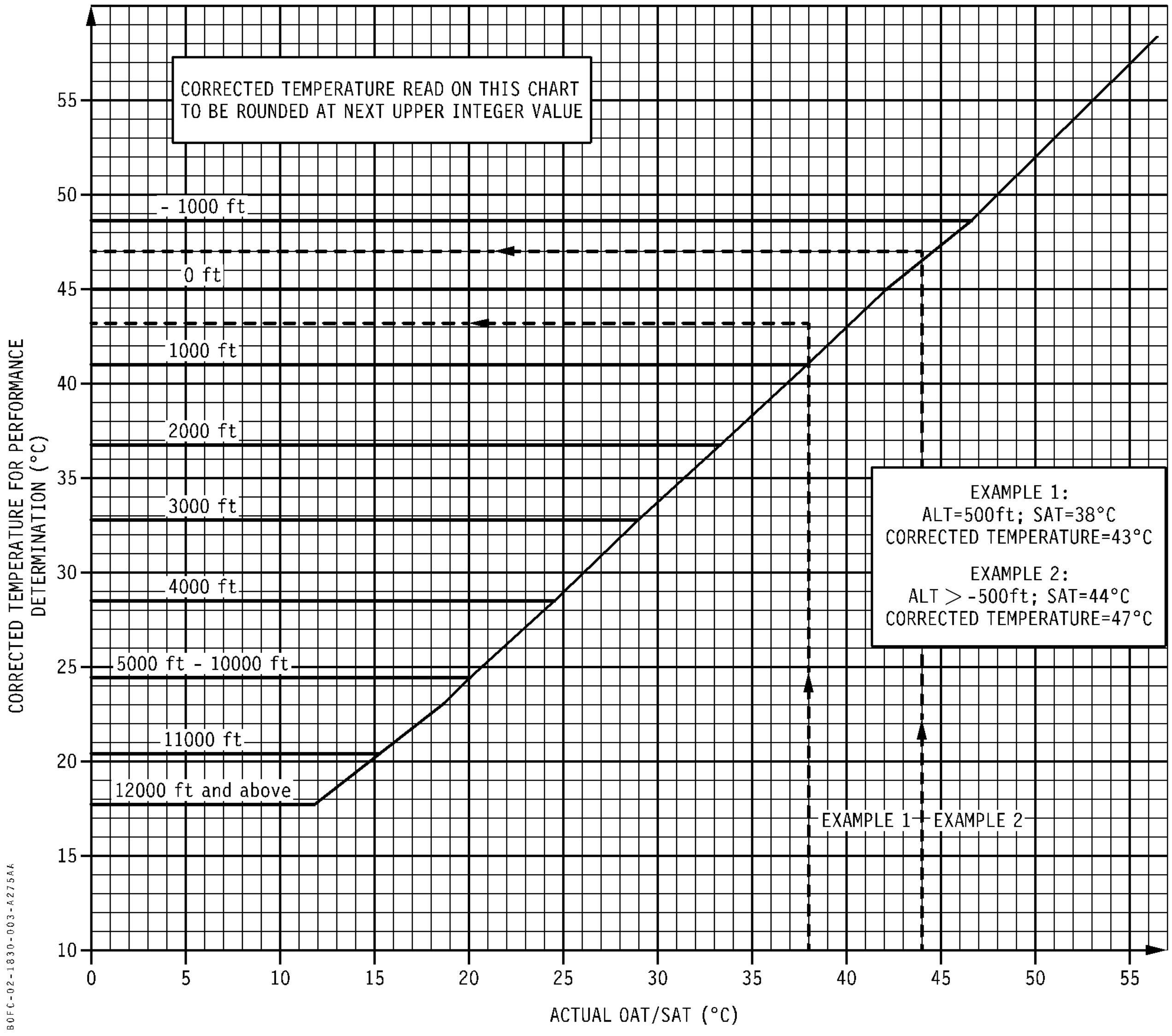
Refer to abnormal procedure DUAL FLAPS OR SLATS SYS FAULT.



EXAMPLE: RUNWAY LENGTH = 3500 meters (11500ft) SLOPE −1%
TEMPERATURE = 30° C PRESSURE ALTITUDE = 8000ft

RESULTS: RUNWAY LIMITATION= 130 tons (286600lb)
BRAKE ENERGY LIMITATION = 131.5 tons (290000lb)
MAXIMUM TAKE−OFF WEIGHT = 130 tons (286600lb)

FAN THRUST DETERIORATION MODE
CORRECTED TEMPERATURE FOR RUNWAY AND SECOND SEGMENT LIMITATIONS



CORRECTED TEMPERATURE READ ON THIS CHART
TO BE ROUNDED AT NEXT UPPER INTEGER VALUE

EXAMPLE 1:
ALT=500ft; SAT=38°C
CORRECTED TEMPERATURE=43°C

EXAMPLE 2:
ALT > -500ft; SAT=44°C
CORRECTED TEMPERATURE=47°C

1. GENERAL

This chapter applies to dispatch with the landing gear down. However, some limitations, procedures, go-around and in-flight performance also apply in case of in-flight landing gear retraction failure.

Ferry flight is permitted with the landing gear in the down position and the gear doors closed in the conditions stated below.

2. LIMITATIONS

2.1 Limitations applicable in case of in-flight landing gear retraction failure :

- Fuel predictions of FMS must be disregarded
- Vertical mode of FMS must not be used
- Do not fly into expected icing conditions
- Ditching with landing gear down has not been demonstrated
- TCAS (if installed) must be in TA only.

2.2 Limitations applicable in case of dispatch with the landing gear in the down position and gear doors closed :

- Maximum speed VMO/MMO : 255 kt/M0.65

  Note : *VMO/MMO values are different from VLE because airworthiness requirements are different for VLE and VMO determination.*
- Fuel predictions of FMS must be disregarded
- Vertical mode of FMS must not be used
- Do not fly into expected icing conditions
- Ditching with landing gear down has not been demonstrated
- TCAS (if installed) must be in TA only
- Dispatch with flap track fairing missing is not allowed
- Dispatch with kruger inoperative is not allowed.

3. PROCEDURES

3.1 Procedures applicable in case of in-flight landing gear retraction failure :

- Manually disarm AUTO BRK as the automatic disarming (normally occurring at gear retraction) will not occur.

3.2 Procedures applicable in case of dispatch with the landing gear in the down position and gear doors closed :

Before takeoff

The LG DOWN VMO/MMO SELECTION switch in the avionics compartment must be activated.

Takeoff

Takeoff with tail wind is not recommended.
It is recommended to use Slats 15/Flaps 0 as takeoff configuration.

After takeoff

Manually disarm AUTO BRK as the automatic disarming at gear retraction will not occur.

4. PERFORMANCE

Flying with the landing gear down and the gear doors closed has an effect on :

- Second segment gradient condition, final takeoff condition and en-route condition.
  The takeoff weight to be retained is the most limiting of these three conditions.
- Go around performance

  Note : *Corrections to approach climb gradient published in paragraph 6 of this chapter also apply in case of in-flight landing gear retraction failure.*
- In flight performance and flight planning

  Note : *Corrections to in flight performance and flight planning published in paragraph 7 of this chapter also apply in case of in-flight landing gear retraction failure.*

Mod : STD or 5229 or 5606

R 5. DETERMINATION OF MAX TAKE OFF WEIGHT :

Penalties on performance affect :
- 2nd segment gradient condition
- Final take off condition

A. 2ND SEGMENT GRADIENT CONDITION :

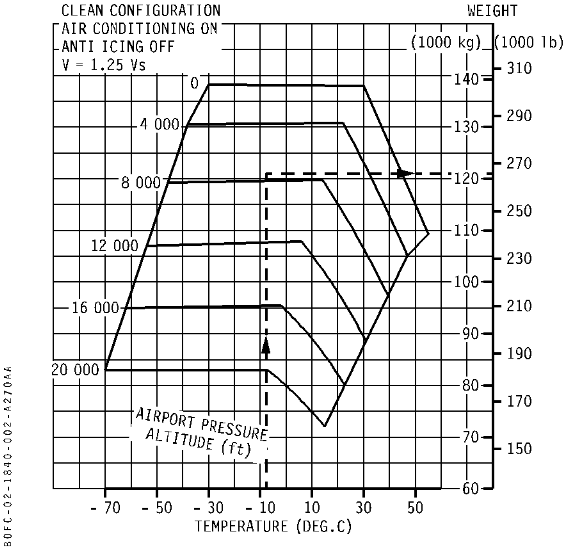
The RTOLW charts or the quick reference tables give the basic information necessary for normal take off. In view of simplification, a constant weight reduction is applied whatever is the limitation. This weight reduction covers the most critical case presented by obstacle overflying.

Take-off configuration	15/0	15/15	20/20
Weight reduction	19 %	15 %	11 %

method : define for the prevailing conditions on the airport (temperature, pressure, wind runway...) the max take off weight using the RTOLW chart or the quick reference graphs, then apply the above weight reduction.

B. FINAL TAKE OFF CONDITION :

- Determine with the following graph the max take off weight associated with the final take off condition.
- Retain the lowest weight according to the most limiting condition (2nd segment or final take off).
- Check that in case of engine failure the terrain on the route can be cleared by 1000 ft (climbing) or 2000 ft (descending), using the en route net flight path on page 6.
  Read the speeds corresponding to this weight in the RTOLW chart or in the quick reference tables.



6. APPROACH CLIMB PERFORMANCE R

Refer to 2.14 for approach climb requirements.
Further decrease the basic limiting weight by :
- 14 % in configuration 15/15
- 12 % in configuration 20/20

7. FLIGHT PLANNING R

A. CLIMB

Climb at 240 kt with both engines at maximum climb power setting. The table page 3 gives the time, distance and fuel consumption according to take-off weight.

B. CRUISE/DESCENT R

The recommended cruise/descent speed is 240 kt. Page 4 gives cruise table and page 8 gives descent table at this speed.
Obviously, the ceiling on one engine may be a limiting factor, and the choice of the route should reflect this concern.

C. ENGINE FAILURE

In case of engine failure, the airplane will drift down to the ceiling shown on page 5.
The power setting for drift down will be Max Continuous.
The drift down speed below 15 000 ft pressure altitude will be :

Weight (1000 kg)	90	95	100	105	110	115	120	125	130	135	140
Drift Down Speed (kt)	170	175	180	185	190	195	200	205	210	215	220

This speed shall be increased by 2 kt per 1 000 ft from pressure altitude above 15 000 ft.

D. HOLDING R

Page 7 gives the holding parameters with slats out. This configuration being the less penalizing for holding.

Mod : 4863 + 8616

PW Eng. : 4000

CLIMB 2 ENGINES - 240 KT - GEAR DOWN

MAX. CLIMB THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**FROM BRAKES RELEASE PT.** **TIME (MIN) FUEL (KG)** **DIST.(NM) TAS (KT)**

FL	WEIGHT AT BRAKES RELEASE (1000KG)								
	100	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**
270	19 3010 97 309								
250	14 2441 70 294	16 2636 76 295	17 2856 84 297	18 3101 92 298	20 3389 101 299				
230	12 2078 55 282	12 2228 59 283	13 2392 64 284	14 2570 69 285	16 2770 74 286	17 2991 81 286	18 3240 88 287	20 3523 97 289	
220	11 1933 49 277	11 2067 52 278	12 2214 56 279	13 2372 61 279	14 2546 65 280	15 2738 71 280	16 2949 76 281	18 3186 83 283	19 3449 91 284
200	9 1685 39 267	9 1796 42 268	10 1917 45 269	11 2046 48 269	12 2186 52 269	12 2338 55 269	13 2502 59 270	14 2681 64 271	15 2876 69 272
180	7 1475 32 258	8 1570 34 259	8 1671 36 259	9 1779 39 260	10 1895 42 260	10 2020 44 260	11 2154 47 260	12 2299 51 261	12 2454 54 262
160	6 1292 26 249	7 1372 28 250	7 1458 30 250	8 1550 32 250	8 1648 34 250	9 1753 36 250	9 1864 38 251	10 1984 41 251	10 2111 43 253
140	5 1125 21 240	6 1194 23 241	6 1267 24 241	6 1345 26 241	7 1428 27 241	7 1517 29 241	8 1611 31 241	8 1712 33 242	9 1818 35 243
120	4 971 17 230	5 1030 18 231	5 1092 19 232	5 1158 21 232	6 1228 22 232	6 1303 23 231	6 1382 25 231	7 1467 26 232	7 1556 28 234
100	4 826 14 220	4 875 14 221	4 927 15 221	4 982 16 222	5 1041 17 221	5 1104 18 221	5 1170 19 221	6 1241 20 222	6 1315 22 223
50	2 487 6 183	2 514 7 184	2 544 7 185	2 576 7 185	3 610 8 184	3 646 8 183	3 685 9 183	3 727 9 185	3 770 10 187
15	1 262 2 121	1 276 2 123	1 291 2 123	1 309 3 123	1 327 3 121	1 348 3 119	1 370 3 119	2 394 3 122	2 419 3 125

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CRUISE 2 ENGINES - 240 KT - GEAR DOWN

MAX. CRUISE THRUST LIMITS
ECON. AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=27.0%

EGT °C **MACH**
EPR **IAS**
KG/H/ENG **TAS**
NM/1000KG

WEIGHT (1000KG)	FL100	FL150	FL170	FL190	FL210	FL230	FL250	FL270
95	355 .434 1.155 240 3216 277 43.1	350 .477 1.201 240 3145 299 47.5	350 .496 1.225 240 3137 308 49.1	355 .516 1.253 240 3145 318 50.6	362 .536 1.286 240 3169 328 51.8	371 .558 1.327 240 3202 339 52.9	382 .581 1.378 240 3254 350 53.7	395 .605 1.443 240 3316 361 54.4
100	356 .434 1.158 240 3247 277 42.7	352 .477 1.205 240 3180 299 47.0	352 .496 1.230 240 3171 308 48.6	357 .516 1.258 240 3181 318 50.0	364 .536 1.292 240 3207 328 51.2	373 .558 1.334 240 3241 339 52.2	385 .581 1.387 240 3301 350 52.9	399 .605 1.456 240 3366 361 53.6
105	358 .434 1.161 240 3280 277 42.3	354 .477 1.210 240 3217 299 46.5	354 .496 1.235 240 3210 308 48.0	359 .516 1.264 240 3222 318 49.3	366 .536 1.299 240 3249 328 50.5	376 .558 1.342 240 3286 339 51.5	389 .581 1.397 240 3355 350 52.1	
110	359 .434 1.165 240 3316 277 41.8	356 .477 1.214 240 3258 299 45.9	356 .496 1.240 240 3250 308 47.4	361 .516 1.270 240 3266 318 48.7	369 .536 1.306 240 3295 328 49.8	379 .558 1.351 240 3333 339 50.8	392 .581 1.409 240 3409 350 51.3	
115	360 .434 1.168 240 3354 277 41.3	358 .477 1.219 240 3302 299 45.3	359 .496 1.246 240 3294 308 46.8	364 .516 1.277 240 3313 318 48.0	372 .536 1.315 240 3345 328 49.0	383 .558 1.361 240 3393 339 49.9	396 .581 1.423 240 3469 350 50.4	
120	362 .434 1.172 240 3396 277 40.8	360 .477 1.225 240 3349 299 44.6	361 .496 1.252 240 3343 308 46.1	366 .516 1.285 240 3364 318 47.3	375 .536 1.324 240 3399 328 48.3	387 .558 1.372 240 3455 339 49.0	400 .581 1.437 240 3532 350 49.5	
125	364 .434 1.176 240 3440 277 40.3	362 .477 1.231 240 3399 299 44.0	363 .496 1.259 240 3395 308 45.4	369 .516 1.292 240 3417 318 46.5	379 .536 1.333 240 3456 328 47.5	391 .558 1.384 240 3521 339 48.1	404 .581 1.453 240 3601 350 48.5	
130	366 .434 1.181 240 3487 277 39.8	365 .477 1.237 240 3452 299 43.3	366 .496 1.266 240 3451 308 44.7	372 .516 1.301 240 3475 318 45.8	383 .536 1.343 240 3516 328 46.7	395 .558 1.396 240 3591 339 47.1		
135	367 .434 1.186 240 3535 277 39.2	367 .477 1.244 240 3507 299 42.6	369 .496 1.274 240 3508 308 43.9	376 .516 1.310 240 3536 318 45.0	387 .536 1.353 240 3580 328 45.8	399 .558 1.410 240 3661 339 46.2		
140	369 .434 1.190 240 3586 277 38.7	370 .477 1.250 240 3564 299 41.9	372 .496 1.282 240 3568 308 43.2	380 .516 1.319 240 3600 318 44.2	391 .536 1.365 240 3653 328 44.9	403 .558 1.426 240 3735 339 45.3		

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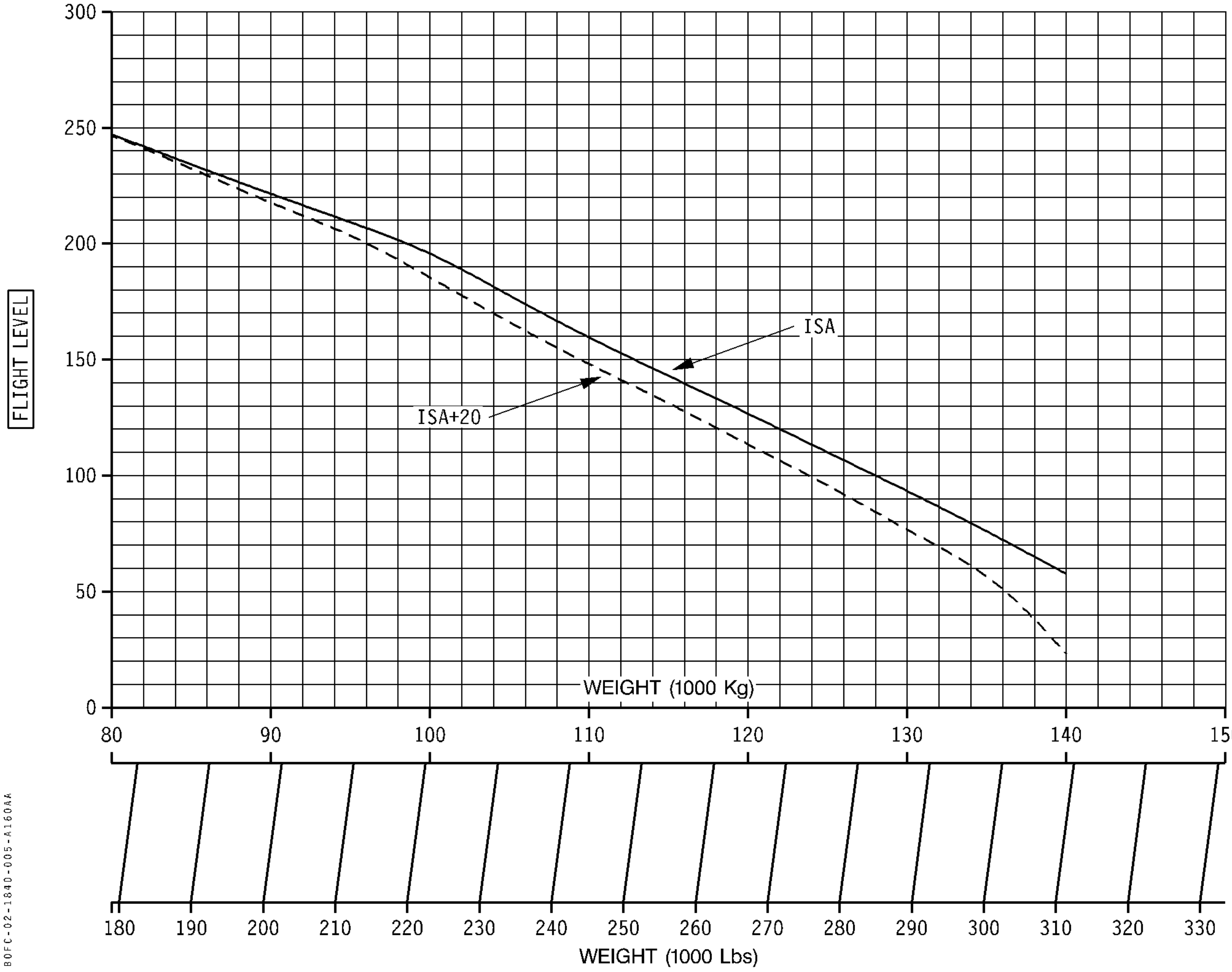
Per 10° C above ISA subtract 0.2 NM/t to specific range.

ONE ENGINE GROSS CEILINGS
DRIFT DOWN SPEED
ANTI-ICING OFF – ONE AIR CONDITIONING PACK ON
MAX CONTINUOUS THRUST
C.G. POSITION = 27 %
R
NOMINAL THRUST



	ISA	ISA + 20
ENG ANTI-ICE ON	– 250 ft	– 400 ft
TOTAL ANTI-ICE ON	– 800 ft	– 1 200 ft

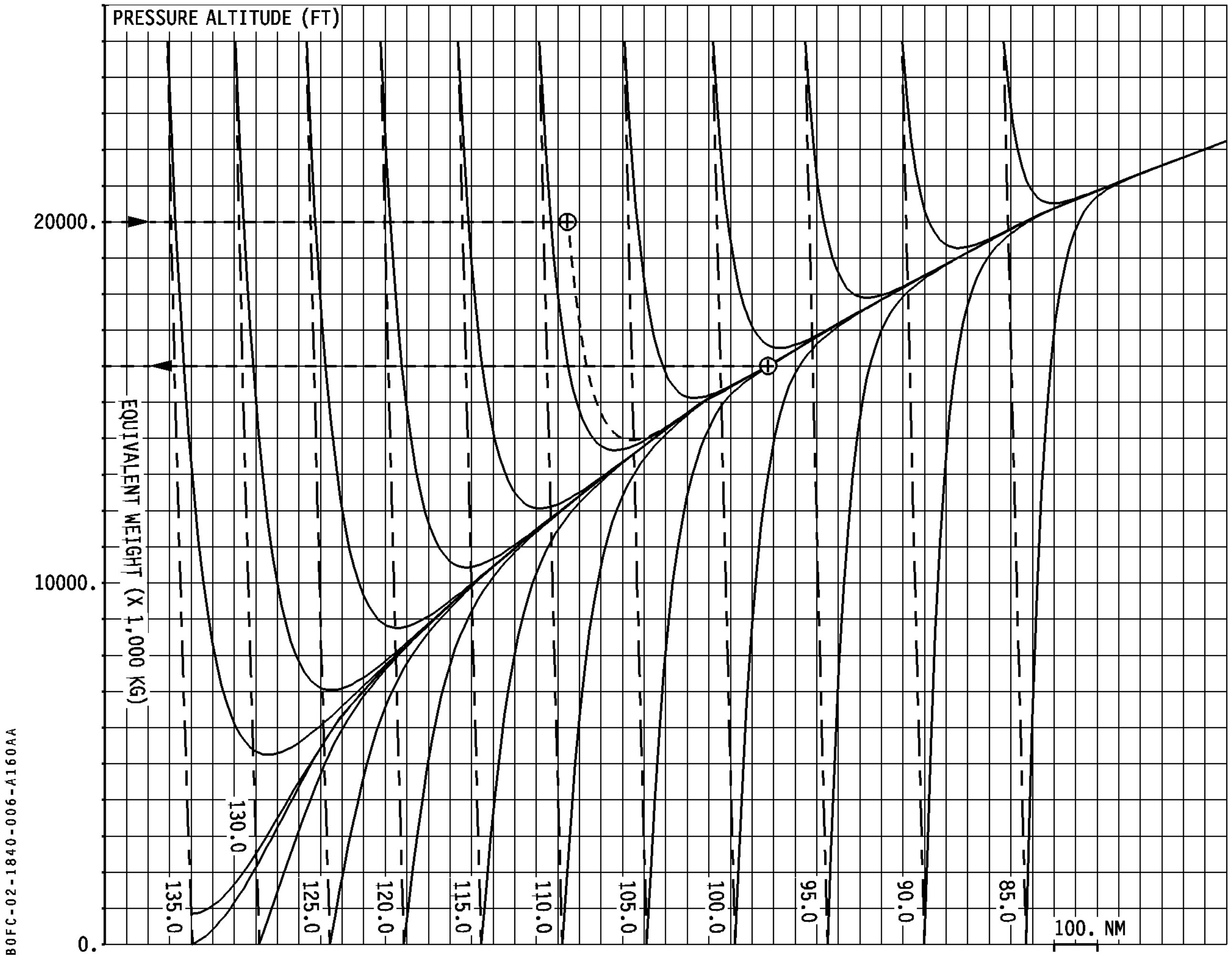
R **FAN THRUST DETERIORATION MODE :**

R Ceiling value must be decreased by 800 ft.

Mod. : 4863

PW Eng. : 4000

« EN ROUTE » NET FLIGHT PATH
AIR CONDITIONING ON – ANTI ICING OFF
1 ENGINE OUT – 1 ENGINE AT MAX CONTINUOUS THRUST
C.G. = 18 %
ISA
R
NOMINAL THRUST



R
FAN THRUST DETERIORATION MODE

R The En-Route Net flight path must be decreased by 800 ft.

Mod. : 4863

PW Eng. : 4000

HOLDING 2 ENGINES-GEAR DOWN S−Speed

MAX. CRUISE THRUST LIMITS CONFIGURATION 15/0 ECON. AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**EPR** **FF(KG/H/ENG)**

WEIGHT (1000KG)	**FL 15**	**FL 50**	**FL100**	**FL120**	**FL140**	**FL160**	**FL180**	**FL200**
140	1.134 3429	1.155 3405	1.196 3354	1.218 3360	1.243 3367	1.272 3366	1.306 3369	1.345 3386
135	1.129 3296	1.149 3275	1.187 3227	1.207 3218	1.231 3231	1.258 3231	1.290 3230	1.327 3241
130	1.123 3166	1.142 3143	1.179 3101	1.197 3083	1.219 3091	1.245 3097	1.275 3096	1.309 3100
125	1.118 3044	1.136 3019	1.170 2983	1.187 2966	1.208 2958	1.233 2970	1.260 2969	1.292 2969
120	1.113 2911	1.130 2885	1.162 2854	1.178 2837	1.196 2820	1.219 2827	1.246 2833	1.276 2832
115	1.107 2790	1.124 2766	1.154 2738	1.169 2722	1.186 2705	1.207 2697	1.232 2709	1.260 2708
110	1.101 2658	1.118 2636	1.146 2609	1.160 2596	1.176 2581	1.195 2565	1.218 2569	1.244 2576
105	1.095 2540	1.112 2515	1.139 2486	1.152 2477	1.167 2462	1.184 2447	1.204 2437	1.229 2448
100	1.089 2427	1.106 2393	1.131 2364	1.144 2356	1.157 2346	1.173 2331	1.192 2317	1.214 2317
95	1.083 2304	1.099 2262	1.124 2235	1.135 2225	1.148 2218	1.163 2206	1.180 2192	1.199 2179
90	1.078 2195	1.092 2152	1.117 2118	1.128 2108	1.139 2100	1.153 2092	1.169 2079	1.187 2066

03 H-04 A310-324-01 PW4152 14101000E5KG270 0 01859015 0 1 1 . 3 0 . 0 0 . 0 0 01209.000 0.000 0.000 0 FCOM-B0-02-18-40-007-060

DESCENT 2 ENGINES - 240 KT - GEAR DOWN

IDLE THRUST ECON. AIR CONDITIONING ANTI-ICING OFF	ISA CG=27.0%	**MAX CABIN RATE OF DESCENT -350 FT/M**

WEIGHT (1000KG)	**110**				**130**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	TIME (MIN)	FUEL (KG)	DIST. (NM)	EPR	IAS (KT)
270	7.8	141	38	IDLE	8.6	157	42	IDLE	240
250	7.2	135	35	IDLE	8.0	150	39	IDLE	240
240	6.9	132	33	IDLE	7.7	147	37	IDLE	240
220	6.4	125	30	IDLE	7.1	140	33	IDLE	240
200	5.8	118	27	IDLE	6.5	132	30	IDLE	240
180	5.2	110	24	IDLE	5.8	123	27	IDLE	240
160	4.6	102	21	IDLE	5.1	114	23	IDLE	240
140	4.0	93	18	IDLE	4.5	104	20	IDLE	240
120	3.4	83	15	IDLE	3.8	93	17	IDLE	240
100	2.8	72	12	IDLE	3.1	80	14	IDLE	240
50	1.2	34	5	IDLE	1.3	38	6	IDLE	240
15	.0	0	0	IDLE	.0	0	0	IDLE	240

04 P-05 A310-324-01 PW4152 23101000E5KG270 0 018590 0 0-1-350.0 15.0 0 01240.000 .000 .000 0

FCOM-B0-02-18-40-008-060

1. GENERAL

This section presents the recommandations of Airbus Industrie for operations from wet runways or from runways which are covered with contaminants such as standing water, slush, or snow.

The performance data are not certified and shall be considered as guidance only.

Note : *When no RTOLW chart specifically computed for the relevant wet or contaminated runway condition is available, the conservative performance data published in this section can be used.*

CAUTION

Do not takeoff on icy runway.

2. DEFINITION

Damp : A runway is damp when it is not perfectly dry, but when the water which is on it does not give it a shiny appearance.

Wet : A runway is considered as wet when it has a shiny appearance due to a thin layer of water on it, but when this layer does not exceed 3 mm depth, not leading to a risk of hydroplaning.

Standing water : is caused by heavy rainfall and/or insufficient runway drainage. Its depth is more than 3 mm.

Slush : is water saturated with snow, which spatters when stepping firmly on it. It is encountered at temperatures around 5°C and its density is approximately 0.85 Kg/liter (7.1 lbs/US GAL.)

Wet snow : is a condition where, if compacted by hand, snow will stick together and tend to form a snowball. Its density is approximately 0.4 Kg/liter (3.35 lbs/US GAL)

Dry snow : is a condition where snow can be blown if loose, or if compacted by hand, will fall apart again upon release. Its density is approximately 0.2 Kg/liter (1.7 lbs/US GAL)

Compacted snow : is a condition where snow has been compressed (a typical friction coefficient is 0.2)

ICY : is a condition where the friction coefficient is 0.05 or below.

The performance given in this chapter have been divided into two categories which are distincted by the depth of the contaminant. For each of these categories it has been defined an equivalent depth of contaminant for which the performance deterioration is the same.

(1) WET RUNWAY and EQUIVALENT (see performance in paragraph 4).

Equivalent of wet runway is runway covered with less than :

- 2 mm (0.08 inch) slush
- 3 mm (0.12 inch) standing water
- 4 mm (0.16 inch) wet snow
- 15 mm (0.59 inch) dry snow

(2) CONTAMINATED RUNWAY (see performance in paragraph 5)

A linear equivalence between depth of slush and snow has been defined :

- 12.7 mm (1/2 inch) wet snow is equivalent to 6.3 mm (1/4 inch) slush
- 25.4 mm (1 inch) wet snow is equivalent to 12.7 mm (1/2 inch) slush
- 50.8 mm (2 inches) dry snow is equivalent to 6.3 mm (1/4 inch) slush.
- 101.6 mm (4 inches) dry snow is equivalent to 12.7 mm (1/2 inch) slush

Notes : *1 – On a damp runway we consider that there is no performance limitation.*

2 – It is not recommended to takeoff from a runway covered with more than 4 inches of dry snow or 1 inch of wet snow.

3. OPERATIONAL CONDITIONS

Performance data as published in this section are based on the following assumptions :

- one engine failed at V_1
- uniform depth and density of the contaminant layer over the complete length of the runway
- antiskid and ground spoilers are operative
- friction coefficient based on studies and checked by actual tests
- 15 ft screen height instead of 35 ft at the end of TOD

In addition, for contaminated runways only :

- drag due to rolling resistance of the wheels
- drag due to spray on airframe and gears
- one engine with reverse thrust for deceleration phase
- maximum take off thrust is used.

Notes : *1 – In case of inoperative system, refer to MEL dispatch conditions.*

2 – In case of obstacles the net flight path overflies them by 15 ft instead of 35 ft.

4. TAKEOFF PERFORMANCE DETERMINATION

The determination of maximum takeoff weight (or flex temperature on wet runway and equivalent only) is based on the use of the RTOLW charts. Apply the corresponding instructions given in the following tables.

Notes : *1 – Apply all the corrections (QNH, bleed) as usual.*

2 – The method is based on the use of the RTOLW charts established at optimum V2/Vs. In case of fix V2/Vs, the results may be slightly different.

WET RUNWAY - USE OF RTOLW CHART

R A. Determine maximum takeoff weight or flexible temperature and associated takeoff speeds on dry runway.

R B. Apply the following decrements to maximum takeoff weight or flexible temperature and to takeoff speeds versus takeoff configuration and runway length :

R R *Note : The speed decrements must be applied even if the actual takeoff weight is lower than the maximum takeoff weight, and whatever the thrust used for takeoff (maximum or flexible).*

1. Braking with reverse thrust:

R

TAKEOFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 8000 and above
FLEX T/0 : Temperature decrement (° C)	4	1	0	7	5	2	7	6	2
MAX T/0 : Weight decrement (1000 kg)	2.5	1.0	0	3.5	3.0	1.5	3.5	3.0	1.5
V_1 decrement (kt)	3*	0*	0*	11	9	8	11	10	9
V_R and V_2 decrement (kt)	1	1	0	2	1	1	2	1	1

R

2. Braking without reverse thrust:

R

TAKEOFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 8000 and above
FLEX T/0 : Temperature decrement (° C)	7	2	0	11	7	2	11	10	4
MAX T/0 : Weight decrement (1000 kg)	4.5	2.0	0	5.5	5.0	2.0	6.0	5.5	2.5
V_1 decrement (kt)	7*	2*	0*	14	13	12	16	14	13
V_R and V_2 decrement (kt)	2	2	0	3	3	3	3	3	3

R

* Further decrease V_1 by :
- 1 kt per 2000 ft pressure altitude
- 1 kt per 6° C difference between OAT or flexible temperature and TREF (no further decrement when OAT below TREF).

Note : Minimum V1 value due to VMCG limitation : 119 kt IAS in 15/0 and 118 kt in 15/15 and 20/20.

1. *Actual TOW = Maximum TOW.*
   R *If V1 is lower than minimum V1 take this last value as V1 and further decrease weight by 2000 kg per kt difference between both values.*
2. *Actual TOW lower than maximum TOW.*
   If V1 corresponding to actual TOW is lower than minimum V1 :
   If maximum TOW has a V1 equal to or above minimum V1, retain minimum V1 as V1 and decrease flexible temperature by 3° C per kt difference between both values.
   R *In some seldom cases where V1 corresponding to maximum TOW falls below minimum V1, decrease maximum TOW by 2000 kg per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V1 equal to minimum V1 and decrease flexible temperature by 3° C per kt difference between this last value and V1 corresponding to the actual TOW.*

R 5. TAKEOFF PERFORMANCE DETERMINATION ON CONTAMINATED RUNWAY

A. 6.3 mm (1/4 inch) water

R – Determine maximum takeoff weight on dry runway.
R – Apply the following decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**			**SLATS 15/FLAPS 15**			**SLATS 20/FLAPS 20**	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	26.0	22.0	15.0	25.0	25.0	20.5	20.0	20.0

R – Enter the following tables with the corrected weight to determine MTOW.
R – Then determine takeoff speeds associated with the actual takeoff weight.

SLATS 15/FLAPS 0

CORRECTED WEIGHT (1000 kg)	**100**	**105**	**109**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	82	99	109	**EQUAL TO CORRECTED WEIGHT**										

ACTUAL WEIGHT (1000 kg)	**82 and below**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	128	130	134	138	141	145	148	151	154	158	160	164	166	170	173	176	178
V_R (kt IAS)	124	126	130	134	137	141	144	147	150	154	156	160	162	166	169	172	174
V_1 (kt IAS)	119	119	119	119	119	119	120	123	126	130	132	136	138	142	145	148	150

SLATS 15/FLAPS 15

CORRECTED WEIGHT (1000 kg)	**< 112**	**112**	**115**	**120**	**122**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 15/15 impossible restart the process from a RTOLW in 15/0	94	106	117	122	**EQUAL TO CORRECTED WEIGHT**							

ACTUAL WEIGHT (1000 kg)	**94 and below**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	128	132	135	138	141	144	147	150	153	156	159	161	164	165
V_R (kt IAS)	122	126	129	132	135	138	141	144	147	150	153	155	158	159
V_1 (kt IAS)	118	118	118	118	118	118	120	123	126	129	132	134	137	138

SLATS 20/FLAPS 20

CORRECTED WEIGHT (1000 kg)	**< 118**	**118**	**120**	**125**	**128**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 20/20 impossible restart the process from a RTOLW in 15/0 or 15/15	100	105	122	128	**EQUAL TO CORRECTED WEIGHT**						

ACTUAL WEIGHT (1000 kg)	**100 and below**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	133	135	139	141	145	147	150	152	156	158	160	162
V_R (kt IAS)	123	127	129	133	135	139	141	144	146	150	152	154	156
V_1 (kt IAS)	118	118	118	118	118	118	120	123	125	129	131	133	135

R *Note : MTOW is lower than corrected weight when takeoff speeds are limited by VMCA and/or VMCG.*

B. 12.7 mm (1/2 inch) water

R – Determine maximum takeoff weight on dry runway.
R – Apply the following decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**			**SLATS 15/FLAPS 15**			**SLATS 20/FLAPS 20**	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	24.0	20.0	12.5	23.5	23.5	19.0	20.5	19.0

R – Enter the following tables with the corrected weight to determine MTOW.
R – Then determine takeoff speeds associated with the actual takeoff weight.

SLATS 15/FLAPS 0

CORRECTED WEIGHT (1000 kg)	**100**	**105**	**108**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	85	102	108	**EQUAL TO CORRECTED WEIGHT**										

ACTUAL WEIGHT (1000 kg)	**85 and below**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	130	134	138	141	145	148	151	154	158	160	164	166	170	173	176	178
V_R (kt IAS)	126	130	134	137	141	144	147	150	154	156	160	162	166	169	172	174
V_1 (kt IAS)	119	119	119	119	119	121	124	127	131	133	137	139	143	146	149	151

SLATS 15/FLAPS 15

CORRECTED WEIGHT (1000 kg)	**< 111**	**111**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 15/15 impossible restart the process from a RTOLW in 15/0	94	109	120	**EQUAL TO CORRECTED WEIGHT**							

ACTUAL WEIGHT (1000 kg)	**94 and below**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	128	132	135	138	141	144	147	150	153	156	159	161	164	165
V_R (kt IAS)	123	127	130	133	136	139	142	145	148	151	154	156	159	160
V_1 (kt IAS)	118	118	118	118	118	118	121	124	127	130	133	135	138	139

SLATS 20/FLAPS 20

CORRECTED WEIGHT (1000 kg)	**< 114**	**114**	**115**	**120**	**123**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 20/20 impossible restart the process from a RTOLW in 15/0 or 15/15	99	103	114	123	**EQUAL TO CORRECTED WEIGHT**							

ACTUAL WEIGHT (1000 kg)	**99 and below**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	133	135	139	141	145	147	150	152	156	158	160	162
V_R (kt IAS)	124	128	130	134	136	140	142	145	147	151	153	155	157
V_1 (kt IAS)	118	118	118	118	118	120	122	125	127	131	133	135	137

R *Note : MTOW is lower than corrected weight when takeoff speeds are limited by VMCA and/or VMCG.*

C. 6.3 mm (1/4 inch) slush

R – Determine maximum takeoff weight on dry runway.
R – Apply the following decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**			**SLATS 15/FLAPS 15**			**SLATS 20/FLAPS 20**	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	20.5	17.0	10.0	21.5	20.0	14.5	20.5	14.5

R – Enter the following tables with the corrected weight to determine MTOW.
R – Then determine takeoff speeds associated with the actual takeoff weight.

SLATS 15/FLAPS 0

CORRECTED WEIGHT (1000 kg)	**99**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	84	91	105	**EQUAL TO CORRECTED WEIGHT**										

ACTUAL WEIGHT (1000 kg)	**84 and below**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	134	138	141	145	148	151	154	158	160	164	166	170	173	176	178
V_R (kt IAS)	125	130	134	137	141	144	147	150	154	156	160	162	166	169	172	174
V_1 (kt IAS)	119	119	119	119	119	122	125	128	132	134	138	140	144	147	150	152

SLATS 15/FLAPS 15

CORRECTED WEIGHT (1000 kg)	**< 111**	**111**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 15/15 impossible restart the process from a RTOLW in 15/0	96	109	120	**EQUAL TO CORRECTED WEIGHT**							

ACTUAL WEIGHT (1000 kg)	**96 and below**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	132	135	138	141	144	147	150	153	156	159	161	164	165
V_R (kt IAS)	124	127	130	133	136	139	142	145	148	151	154	156	159	160
V_1 (kt IAS)	118	118	118	118	118	118	121	124	127	130	133	135	138	139

SLATS 20/FLAPS 20

CORRECTED WEIGHT (1000 kg)	**< 114**	**114**	**115**	**120**	**123**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 20/20 impossible restart the process from a RTOLW in 15/0 or 15/15	99	103	114	123	**EQUAL TO CORRECTED WEIGHT**							

ACTUAL WEIGHT (1000 kg)	**99 and below**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	133	133	135	141	145	147	150	152	156	158	160	162
V_R (kt IAS)	123	127	129	133	135	139	141	144	146	150	152	154	156
V_1 (kt IAS)	118	118	118	118	118	120	122	125	127	131	133	135	137

Note : MTOW is lower than corrected weight when takeoff speeds are limited by VMCA and/or VMCG.

Mod. : 4863 + 5443 PW Eng. : 4152

D. <u>12.7 mm (1/2 inch) slush</u>

R – Determine maximum takeoff weight on dry runway.
R – Apply the following decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**			**SLATS 15/FLAPS 15**			**SLATS 20/FLAPS 20**	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	23.5	20.5	22.0	24.5	24.0	23.5	24.5	20.5

R – Enter the following tables with the corrected weight to determine MTOW.
R – Then determine takeoff speeds associated with the actual takeoff weight.

SLATS 15/FLAPS 0

CORRECTED WEIGHT (1000 kg)	**95**	**99**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	89	99	**EQUAL TO CORRECTED WEIGHT**												

ACTUAL WEIGHT (1000 kg)	**85 and below**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	130	134	138	141	145	148	151	154	158	160	164	166	170	173	176	178
V_R (kt IAS)	126	130	134	137	141	144	147	150	154	156	160	162	166	169	172	174
V_1 (kt IAS)	119	119	119	120	124	127	130	133	137	139	143	145	149	152	155	157

SLATS 15/FLAPS 15

CORRECTED WEIGHT (1000 kg)	**< 106**	**106**	**110**	**112**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 15/15 impossible restart the process from a RTOLW in 15/0	93	107	112	**EQUAL TO CORRECTED WEIGHT**									

ACTUAL WEIGHT (1000 kg)	**93 and below**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	127	132	135	138	141	144	147	150	153	156	159	161	164	165
V_R (kt IAS)	123	128	131	134	137	140	143	146	149	152	155	157	160	161
V_1 (kt IAS)	118	118	118	118	120	123	126	129	132	135	138	140	143	144

SLATS 20/FLAPS 20

CORRECTED WEIGHT (1000 kg)	**< 108**	**108**	**110**	**112**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 20/20 impossible restart the process from a RTOLW in 15/0 or 15/15	99	104	112	**EQUAL TO CORRECTED WEIGHT**									

ACTUAL WEIGHT (1000 kg)	**99 and below**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	133	135	139	141	145	147	150	152	156	158	160	162
V_R (kt IAS)	124	128	130	134	136	140	142	145	147	151	153	155	157
V_1 (kt IAS)	118	118	118	120	122	126	128	131	133	137	139	141	143

R *<u>Note</u> : MTOW is lower than corrected weight when takeoff speeds are limited by VMCA and/or VMCG.*

E. Compacted snow

R – Determine maximum takeoff weight on dry runway.
R – Apply the following decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**			**SLATS 15/FLAPS 15**			**SLATS 20/FLAPS 20**	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	8.0	5.5	8.5	10.0	9.5	9.0	10.5	4.5

R – Enter the following tables with the corrected weight to determine MTOW.
R – Then determine takeoff speeds associated with the actual takeoff weight.

SLATS 15/FLAPS 0															
CORRECTED WEIGHT (1000 kg)	**91**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	82	95	**EQUAL TO CORRECTED WEIGHT**												

ACTUAL WEIGHT (1000 kg)	**82 and below**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	128	130	134	138	141	145	148	151	154	158	160	164	166	170	173	176	178
V_R (kt IAS)	124	126	130	134	137	141	144	147	150	154	156	160	162	166	169	172	174
V_1 (kt IAS)	119	119	119	119	122	126	129	132	135	139	141	145	147	151	154	157	159

SLATS 15/FLAPS 15													
CORRECTED WEIGHT (1000 kg)	**< 106**	**106**	**110**	**112**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 15/15 impossible restart the process from a RTOLW in 15/0	97	107	112	**EQUAL TO CORRECTED WEIGHT**									

ACTUAL WEIGHT (1000 kg)	**94 and below**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	128	132	135	138	141	144	147	150	153	156	159	161	164	165
V_R (kt IAS)	123	127	130	133	136	139	142	145	148	151	154	156	159	160
V_1 (kt IAS)	118	118	118	118	120	123	126	129	132	135	138	140	143	144

SLATS 20/FLAPS 20													
CORRECTED WEIGHT (1000 kg)	**< 111**	**111**	**115**	**118**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**157**
MTOW (1000 kg)	Takeoff in 20/20 impossible restart the process from a RTOLW in 15/0 or 15/15	99	112	118	**EQUAL TO CORRECTED WEIGHT**								

ACTUAL WEIGHT (1000 kg)	**99 and below**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**	**145**	**150**	**155**	**160**
V_2 (kt IAS)	129	133	135	139	141	145	147	150	152	156	158	160	162
V_R (kt IAS)	123	127	129	133	135	139	141	144	146	150	152	154	156
V_1 (kt IAS)	118	118	118	118	119	123	125	128	130	134	136	138	140

R *Note : MTOW is lower than corrected weight when takeoff speeds are limited by VMCA and/or VMCG.*

6. SPRAY PATTERN

There is a little chance of fluid ingestion in the engines, which in any case, should not jeopardize safety. The risk of ingestion is independent of the contaminant depth.

During power setting and initial acceleration, a small ingestion is possible, which should disappear when the aircraft speed is over 60 kt.

7. CROSSWIND

Refer to PROCEDURES AND TECHNIQUES – INCLEMENT WEATHER OPERATIONS

8. TAXIING

When taxiing on slippery surfaces, maintain an adequate distance to the preceeding aircraft. Taxy at a maximum speed of 10 kt. Note that antiskid is not operating at low speed.

Nose wheel steering should be used in small but progressive movements supported by differential power when necessary in small radius turns.

Retract slats and flaps in slush conditions to avoid contamination of the mechanism and subsequent damage by frozen slush.

Extend the high lift devices for T/0 configuration and perform the taxi checklist at the end of taxiing.

9. TAKEOFF

Set the thrust as symmetrically as possible to avoid yawing moments in the first part of the takeoff roll.

For contaminated runway use full engine thrust.

R Avoid large or rapid rudder inputs.

Hold the control column firmly but not excessively in the forward position to increase nose wheel contact. Do not lift the nose wheel in an attempt to avoid contamination of the aircraft, since this will produce additional drag.

Rotate, lift off, retract gear and high lift devices in the normal manner.

Takeoff should not be aborted for minor deficiencies even at low speeds.

R Maintain directional control with the rudder, this also
R provides small inputs to the nosewheel. Regain center line with differential braking when stopping distance permits.

10. LANDING

Landing on contaminated runways without anti-skid should be avoided.

Approach at normal speed. Use maximum reverse thrust as soon as possible after touch down.

Apply brakes normally with steady pressure. Maintain directional control with the rudder as long as possible. R

After reaching taxi speed, use nose wheel steering R
with care.

The use of auto-braking is strongly recommended provided the contaminant is evenly distributed.

In crosswind conditions do not decrab completely as the aircraft will yaw on the slippery runway due to its weathercock stability.

When landing distance permits the centerline can be regained by using differential braking. Use the reversers in the usual way, knowing that if it becomes necessary, the full reverse could be maintained until the aircraft is fully stopped. When the aircraft is at taxiing speed, follow the taxiing recommendations.

CAUTION : It is recommended not to use single reverser when landing on wet or contaminated runways when cross winds exceed 20 kt.

11. AFTER LANDING AND PARKING

If the approach was made in icing condition or snow, or if the runway was covered by snow or slush do not retract the slats and flaps to the fully retracted position to avoid damage to the structure by frozen slush and/or snow. Shut down the engines, have the ground crew check that there is no significant amount of ice, slush or snow in the flap and slat mechanism.

When the mechanisms are clean, retract slats and flaps using the green system electro-hydraulic pumps.

When the mechanisms are contaminated, keep slats and flaps extended.

12. EXAMPLE

Initial conditions

Runway length : 3500 m (11500 ft)
OAT = 48° C
No wind
Pressure altitude : 0 ft
Slats 15°/Flaps 0°
Determination of takeoff performance from RTOLW-chart :

WEIGHT 1000 kg	– 10	– 5	0
150.0	35 4-4 .0 **** 151-153-157	46 2-4 .2 **** 156-157-161	48 2-4 1.0 **** 163-164-167
147.5	43 4-4 1.4 **** 149-152-156	48 2-4 .7 **** 157-157-161	50 2-4 1.1 **** 163-163-166
145.0	47 4-4 .8 **** 151-151-156	50 4-4 1.0 **** 158-158-162	52 4-4 1.1 **** 162-162-166
142.5	50 4-4 .4 **** 152-152-156	52 4-4 1.2 **** 160-160-163	54 4-4 1.0 **** 162-162-166
140.0	52 4-4 .9 **** 153-153-157	54 4-4 1.2 **** 159-159-162	56 4-4 1.0 **** 162-162-165
137.5	55 4-4 .1 **** 155-155-159	56 4-4 1.2 **** 158-158-161	58 4-4 1.0 **** 160-160-164

a. **Takeoff performance on dry runway**
Maximum TOW = 151000 kg
V_1 = 163 kt, V_R = 164 kt, V_2 = 167 kt.

b. **Takeoff performance determination for wet runway** (braking with reverse thrust, see page 2).

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**		
RUNWAY LENGTH (m) (ft)	**3000 10000**	**3500 11000**	**4000 13000 (and above)**
FLEX T/O : Temperature decrement (°C)	4	1	0
MAX T/O : Weight decrement (1000 lb)	2.5	1.0	0
V_1 decrement (kt)	3*	0*	0*
V_R and V_2 decrement (kt)	1	1	0

* Further decrease V_1 by :
- 1 kt per 2000 ft pressure altitude
- 1 kt per 6° C difference between OAT or flexible temperature and TREF (no further decrement when OAT below TREF)

- Maximum TOW = 151000 – 1000
  = 150000 kg (on wet runway).

Assumed actual takeoff weight : 140000 kg

- Associated corrected speeds and temperature values :

  Flex temp = 56 – 1 = 55°C
  V_1 correction : 0kt + correction due to TFEX=55°C : 2kt (TREF=42°C)
  V_1= 163 – 2 = 161 kt (check above V_{MCG} limitation)
  V_R= 164 – 1 = 163 kt
  V_2= 167 – 1 = 166 kt

c. **Takeoff performance determination for runway covered with 1/2 inch water** (see page 4)

TAKEOFF CONFIGURATION	**SLATS 15/FLAPS 0**		
RUNWAY LENGTH (m) (ft)	**3000 10000**	**3500 11500**	**4000 13000 and above**
Weight decrement (1000 kg)	24	22	12.5

- Corrected weight = 151000 – 22000 = 129000 kg

SLATS 15/FLAPS 0								
CORRECTED WEIGHT (1000 kg)	**100**	**105**	**108**	**110**	**115**	**120**	**125**	**130**
MTOW (1000 lb)	85	102	108	EQUAL TO CORRECTED WEIGHT				

- Maximum takeoff weight = 129000 kg

Assumed actual takeoff weight : 103000 kg

ACTUAL WEIGHT (1000 lb)	**85 and below**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**
V_2 (kt IAS)	130	134	138	141	145	148	151	154	158
V_R (kt IAS)	126	130	134	137	141	144	147	150	154
V_1 (kt IAS)	119	119	119	119	119	121	124	127	131

- Associated speeds

  V_2 = 143 kt
  V_R = 139 kt
  V_1 = 119 kt

Remark : Linear interpolation is permitted between adjacent columns on all tables.

1. GENERAL

The system design and engine installation reliability of this airplane comply with the capability criteria for ETOPS flights of CTC 20 (DGAC), AC 120–42 A (FAA), CAP 513 (CAA UK) or AMJ 120-42/IL N°20 (draft, JAA) when configured, maintained and operated in accordance with the provisions of the relevant Airbus Industrie « Standard for Extended Range Operations », also referred to as the CMP document (Configuration, Maintenance and Procedure).

This statement of capability does not constitute an operational approval to conduct extended range operations.

The supplement 13 (section 6-02-13) to the Flight Manual refers to the approved Standard for Extended Range Operations and defines the applicable limitations, procedures and performance.

The operator has the responsability to also show compliance with his national regulation and to obtain operational approval from his national authorities.

2. OPERATIONAL LIMITATIONS

A. Definitions

For the purpose of AC 120-42 A and AMJ 120-42, Extended Range Operations are those intended to be conducted over a route that contains a point further than 60 minutes from an adequate airport at the selected one-engine-inoperative speed in still air and ISA (or prevailing delta ISA) conditions.

An adequate airport is an airport which satisfies the aircraft performance requirements applicable at the expected landing weight, and is sufficiently equipped to be safely used. In particular it should be expected that at the anticipated time of use it will be available and equipped with the necessary services including ATC, meteorological information and at least one let down aid for an instrument approach.

A suitable airport is a confirmed adequate airport which satisfies the dispatch weather minima requirements for ceiling and visibility within the required validity period. Airport conditions should also ensure that a safe landing with one engine and/or airframe system inoperative is possible.

B. Area of operation

The maximum distance from an adequate airport must be determined for ISA (or prevailing delta ISA) and no wind conditions taking into account the aircraft performance with one engine inoperative and the other engine at not more than MCT.

To determine the maximum distance from an adequate airport, a diversion speed strategy must be defined as well as an aircraft reference weight for performance determination.

The same diversion speed strategy (refer to FCOM section 2.16) must be considered for :

- establishing the area of operation ;
- calculating the single-engine fuel planning,
- conducting the diversion in case of engine failure (conditions permitting).

The ETOPS reference gross weight is to be assessed by the operator for each route or area of operation and shall be a conservative representative value of the aircraft gross weight at the critical point of the route or at the various critical points of all the routes included in the area of operation.

The one engine inoperative descent and cruise speed law must be selected so that the associated net flight path clears the enroute obstacles with the regulatory margin.

The FCOM section 2.16.50 provides data for 3 speed schedules. The associated approved net flight path are published in the Flight Manual Supplement 13.

When the diversion strategy is selected, the maximum distance from a diversion airport, for different maximum diversion times, can be directly determined using the table provided in this section. The area of possible ETOPS operation can then be drawn on plotting charts.

Another method to determine the maximum distance to a diversion airport is to read the one-engine-inoperative TAS (at the FL for best TAS) in the cruise tables of section 2.16.50 taking into consideration the appropriate strategy and minimum altitude to clear obstacles. In that case the maximum distance to a diversion airport will be found in multiplying this one-engine-inoperative-TAS by the maximum diversion time.

Operators whose authorities require an approved one-engine-inoperative speed to be stated in the Flight Manual must use this speed.

3. DISPATCH CONSIDERATION

A. MMEL/MEL

The dispatch requirements applicable to an ETOPS flight are identified, in the Airbus Industrie MMEL, by the following provisos :

- ″For ER operations...″,

  or
- ″Except for ER operations″.

The ETOPS dispatch requirements are not to be considered once airborne (e.g. to assess the aircraft status prior to entering the ETOPS segment).

B. Communication and navigation facilities

The COM system design has provision to install 3 VHF and 2 HF transceivers, insuring full compliance with ETOPS requirements on any kind of routes.

The NAV system meets the ETOPS requirements for enroute or approach navigation.

The configuration defined by 2 IRS in conjunction with 2 FMS comply with the MNPS criteria and is approved as sole means of navigation for flight up to the maximum aircraft endurance.

Above 73°N, heading information will be lost or become unreliable depending on aircraft equipment.

Note : For operation within MNPS area, the approval from the national authorities must be obtained.

C. Fuel and oil supply

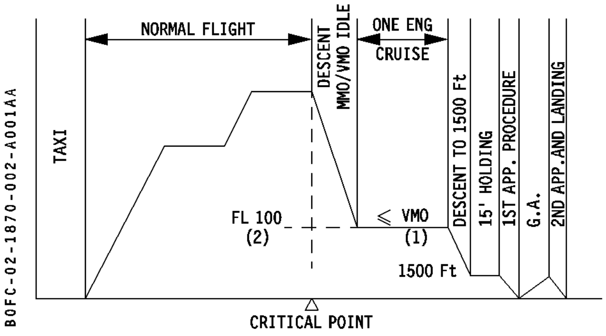
Fuel and oil supply must be determined considering both the engine and pressurization failure or the pressurization failure alone occuring at the most critical point on the route. Forecast wind and temperature conditions must be considered as well as forecast icing conditions.

An ETOPS critical fuel planning, considering these two scenarios, must be established and compared to the standard fuel planning (non ETOPS).

D. ETOPS fuel scenarios

For establishing the ETOPS Critical Fuel planning, two diversion scenarios must be considered as follows :

1° Pressurization failure + engine failure



(1) Selected speed in accordance with the speed strategy selected for the ETOPS area of operation.

(2) or above if required by obstacle clearance and/or if supplementary oxygen is available.

2° Pressurization failure

Same flight profile, but with 2 engines operative and diversion cruise at LRC at FL 100 or above.

For each scenario, the required block fuel shall be computed in accordance with the operator's ETOPS fuel policy and with the regulatory ETOPS critical fuel reserves described hereafter.

Depending on the strategy and on the one-engine-inoperative speed selected for the single-engine diversion scenario, any one of these two scenarios may happen to result in the highest fuel requirement.

The scenario resulting in the highest fuel requirement is referred to as the ETOPS critical fuel scenario, the associated minimum block fuel requirement is referred to as the ETOPS critical fuel planning.

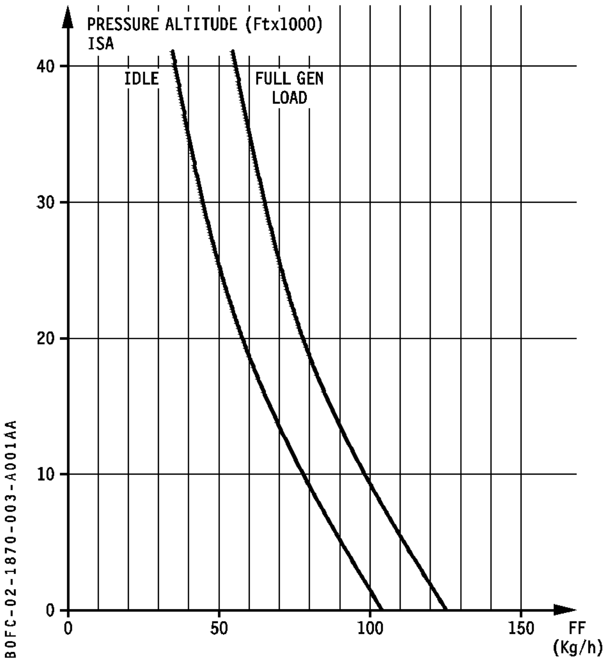
E. ETOPS critical fuel reserves

For the computation of the ETOPS critical fuel reserves and of the complete ETOPS critical fuel planning, the diversion fuel shall include the following fuel provisions :

- fuel burn-off from the critical point to the end of descent (e.g. 1500 ft) at the diversion airport,
- 5 % of the above fuel burn-off, as contingency fuel,
- 5 % fuel mileage penalty or a demonstrated performance factor,
- 15 minutes holding at 1500 ft at green dot speed,
- first (IFR) approach/go-around/second (VFR) approach,
- effect of any CDL and/or MEL item,
- if icing conditions are forecast :
  - * effect of NAI + WAI systems,
  - * effect of ice accretion on the unheated surfaces of the aircraft :

  The fuel provisions associated with the effects of NAI/WAI systems and the ice accretion on the unheated surfaces can be adjusted as a function of the forecast exposure time.

  The fuel provision for ice accretion on the unheated surfaces is in percentage three times the forecast exposure time in hours. For example, assuming a 1.5 hours total exposure time (en route to, and at the diversion airport), the fuel provision is 4.5 % of the fuel burnt during the considered exposure time. In case of moderate icing forecast, the above fuel provision is divided by two.
- For operations above 138 minute diversion time, if the above effect of ice accretion is less than 5 %, this effect should be rounded–up to 5 % to provide a provision for weather avoidance.
- APU fuel consumption, if required as a power source (MEL).



APU Fuel Consumption

Based on experience, it is Airbus Industrie recommendation to consider the following non mandatory fuel provisions :

- effect of a demonstrated performance factor, for all standard and ETOPS fuel requirement computations,
- carriage of contingency fuel from the departure to the CP, when computing the ETOPS critical fuel planning.

The complete ETOPS critical fuel planning for the ETOPS critical fuel scenario (i.e. from the departure to the CP and then from the CP to the diversion airport) shall be compared to the standard fuel planning (i.e. from the departure to the destination and alternate) computed in accordance with the company fuel policy and applicable operational requirements. The highest of both fuel requirements shall be considered as the minimum required block fuel for the subject flight.

F. Dispatch fuel requirement from Critical Point to landing

ETOPS diversion fuel requirements for dispatch are provided at the end of this section. Data for the engine failure case alone are not provided as this scenario is never critrical.

G. Cockpit preparation

Additional system checks are required prior to each ETOPS flight. These checks are listed in the Standard Operating Procedures.

H. Dispatch weather minima

Weather forecasts for en route alternate must meet the operator's applicable weather minimum requirements. If the applicable requirement is AC 120-42A or AMJ 120-42, the following applies :

An airplane can be dispatched for an ETOPS flight provided the meteorological forecasts, at each enroute alternate airports, for a period starting one hour before the earliest expected time of landing and ending one hour after the latest expected time of landing, meet the following regulatory dispatch weather minima requirements.

Note 1 : Minima lower than following ones can be established taking into consideration the peculiarities of a specific route provided these minima have been agreed by the national operational authorities and reported in the route specification.

Note 2 : Once the aircraft is airborne, dispatch weather minima do not apply anymore. Normal or company minima apply to each enroute alternate.

1. AC 120-42A dispatch weather minima (FAA) :

	Ceiling (ft)	**Visibility (m)**
● **Precision approach :**		
– 1 ILS/MLS	DH + 400	Greater of (3200 or PM + 1600)
– 2 ILS/MLS (separate runways)	DH + 200	Greater of (1600 or PM + 800)
● **Non precision approach**	Greater of (800 or MDH + 400)	Greater of (3200 or PM + 1600)

Notes : ● PM = published minima
● DH = decision height
● MDH = minimum descent height
● Separate runways = runways which do not intersect each other

Note : Should a circling approach be anticipated at a given enroute alternate, the corresponding published circling minima must be considerd and increased by adding 400 ft to the published ceiling minima and 1600 m to the published visibility minima.

2. AMJ 120-42/IL 20 dispatch weather minima (JAA)

The operator must use either table 1 or table 2, but not a combination of both.

Table 1

Approach Facility Configuration	Alternate Airfield Ceiling	Weather Minima Visibility
For aerodromes with at least one operational navigation facility, providing a precision or non-precision runway approach procedure or a circling manoeuvre from an instrument approach procedure	A ceiling derived by adding 400 feet to the authorised DH, MDH (DA/MDA) or circling minima	A visibility derived by adding 1500 meters to the authorised landing minima
The weather minima below apply at airports which are equipped with precision or non-precision approaches on at least two separate runways (two separate landing surfaces)		
For airports with at least two operational navigation facilities providing a precision or non-precision runway approach procedure to separate suitable runways	A ceiling derived by adding 200 feet to the higher of the two authorised DH/MDH (DA/MDA) for the approaches	A visibility derived by adding 800 meters to the higher of the two authorised landing minima

Table 2

Type of Approach	Planning Minima (RVR visibility required and ceiling if applicable)			
	Aerodrome with			
	at least 2 separate approach procedures based on 2 separate aids serving 2 separate runways	at least 2 separate approach procedures based on 2 separate aids serving 1 runway	or	at least 1 approach procedure based on 1 aid serving 1 runway
Precision Approach Cat II, III (ILS, MLS)	Precision Approach Cat I Minima	Non-Precision Approach Minima		
Precision Approach Cat I (ILS, MLS)	Non-Precision Approach Minima	Circling minima or, if not available non-precision approach minima plus 200 ft/1000 m		
Non-Precision Approach	The lower of non-precision approach minima plus 200 ft/1000 m or circling minima	The higher of circling minima or non-precision approach minima plus 200 ft/1000 m		
Circling Approach	Circling minima			

4. DIVERSION DURING EXTENDED RANGE OPERATIONS

A. Diversion decision making

The technical criteria governing a re-routing or diversion decision can be classified into four categories, as follows :

- loss of MNPS capability, before entering the MNPS area (as applicable)
- weather minima at diversion airport(s) going below the company/crew en-route minima, before reaching the ETOPS Entry Point, or diversion airport(s) becoming unsuitable for any reason,
- failure cases (refer to Note) requiring a diversion to the nearest airport (cases leading to a LAND ASAP message on the ECAM and/or in the QRH).

  Note : Failure cases requiring LAND ASAP
  - *IN FLT ENG FIRE*
  - *APU FIRE*
  - *SINGLE ENG OPERATION (Engine Shutdown or Continued Engine Operation at Idle Thrust)*
  - *LOSS OF BOTH ENG. GENERATORS*
  - *SMOKE/MIN EQPT BAY SMOKE/AVNCS SMOKE*
  - *BAT SMOKE (if applicable)*
  - *CARGO COMPT SMOKE (included only in the US AFM)*
  - *DUAL HYD. SYS LO PR.*
- failure cases resulting in increased fuel consumption, exceeding the available fuel reserves.

Comments and recommendations

- Electrical Generation

	AVAILABLE GENERATORS AT DISPATCH	AFTER 1st GEN FAILURE	AFTER 2nd GEN FAILURE or APU not available	AFTER 3rd GEN FAILURE
NORMAL DISPATCH	2 ENG. GEN 1 APU GEN 1 STBY GEN (b)	START APU (a) NO DIVERSION	NO DIVERSION REQUIRED (c)	DIVERSION REQUIRED
MEL OR * NORMAL	2 ENG GEN 1 APU GEN	NO DIVERSION REQUIRED (c)	DIVERSION REQUIRED	NOT APPLICABLE
* MEL DISPATCH	2 ENG GEN 1 STBY GEN (b)			
* MEL DISPATCH	1 ENG GEN 1 APU GEN 1 STBY GEN (b)			

(*) For operations with a diversion time greater than 120 minutes, all 4 electrical generators are required to be operative at dispatch.

R (a) For start limitation refer to Operating Limitations
R chapter.

(b) STBY GEN channel must be tested during cockpit preparation if a test of the STBY GEN channel is required for ETOPS operations.

(c) Crew may choose to divert after assessment of the overall situation.
Aircraft status in the present failure case, and if a subsequent generator failure occurs, must be considered taking into account actual meteorological conditions, suitable airport characteristics and approach facilities or any pertinent operational condition.

- Fire Protection

  In case of CARGO SMOKE warning, even if the Flight Manual does not require LAND ASAP, a diversion must be initiated, the nearest suitable airport should be selected irrespective of the fire suppression system protection time. Refer also to FCOM 2.04.10 page 1 on this subject.

- Fuel System

  Some failure cases may lead to fuel gravity feeding which implies unusable fuel quantity and flight at lower altitude. Due consideration of fuel remaining available and fuel consumption may necessitate diversion.

- Hydraulic system

  In case of green system failure STBY GEN is lost. After first electrical ENG GEN subsequent failure : Start APU. Diversion decision is identical to the dispatch without STBY GEN.

B. Diversion performance data

The FCOM section 2.16 provides descent and cruise procedures, and associated performance data for the following diversion strategies :

- Standard strategy.
- Obstacle strategy.
- Fixed speed strategy.

For ETOPS operations, any one of the above diversions strategies can be used provided that the selected strategy and speed schedule is used in :

- establishing the Area of Operation (maximum diversion distance),
- calculating the diversion fuel requirements for the single-engine ETOPS fuel scenario,
- 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.

C. Guidelines for diversion procedure

The following guidelines should be followed in case of diversion :

- Complete the related failure procedure,
- Inform ATC,
- Initiate the descent,
- Determine the nearest suitable alternate,
- Divert to the selected enroute alternate,
- Apply the pre-planned diversion strategy and speed schedules or adjust the speed as dictated by the assessment of the present situation.

D. Determination of 60 minutes maximum diversion distance (JAR-OPS 1.245)

Use the distance given below to decide if a route is an ETOPS one according to JAR-OPS 1.245

MTOW (kg)	Maximum Diversion Distance (NM)
153 000	431
157 000	427
160 000	425
164 000	421

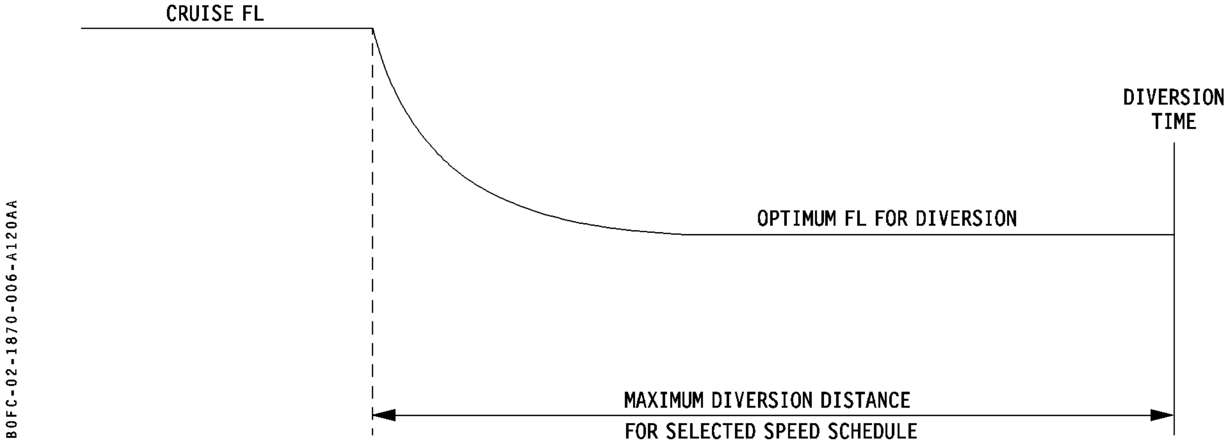
The following computation conditions have been used in accordance with the interpretation of the JAR-OPS 1.245 :

- Reference weight : the aircraft gross weight after one hour of flight having taken off at sea level at the maximum structural takeoff weight given by the flight manual.
- ISA conditions
- No wind
- Diversion level after engine failure : FL 170
- Single engine diversion speed schedule : VMO/MM0

Note : Using the JAR-OPS 1.245 method, obstacles have not to be considered to determine if a route is or is not an ETOPS route.

E. Maximum distance (still air and ISA) to diversion airport, in nautical miles

SPEED SCHEDULE	REFERENCE GROSS WEIGHT (KG)	OPTIMUM FL FOR DIVERSION	DISTANCE (NM)				
			Diversion time (min)				
			60	90	120	150	180
M.80 / 300 kt	85 000	260	440	660	880	1100	1320
	100 000	250	435	650	870	1085	1300
	115 000	240	430	640	855	1065	1280
	130 000	220	420	630	835	1040	1245
	145 000	200	415	615	815	1015	1215
	160 000	180	405	600	790	985	1180
M.80 / 320 kt	85 000	240	450	675	895	1120	1340
	100 000	230	445	665	885	1110	1330
	115 000	210	440	655	870	1090	1305
	130 000	200	435	650	860	1075	1285
	145 000	180	425	635	840	1045	1255
	160 000	160	420	620	820	1020	1220
M.80 / 340 kt	85 000	210	455	680	905	1135	
	100 000	200	450	675	900	1125	1350
	115 000	190	445	665	890	1110	1335
	130 000	180	440	655	875	1090	1310
	145 000	160	435	645	855	1070	1280
	160 000	150	425	650	835	1040	1250

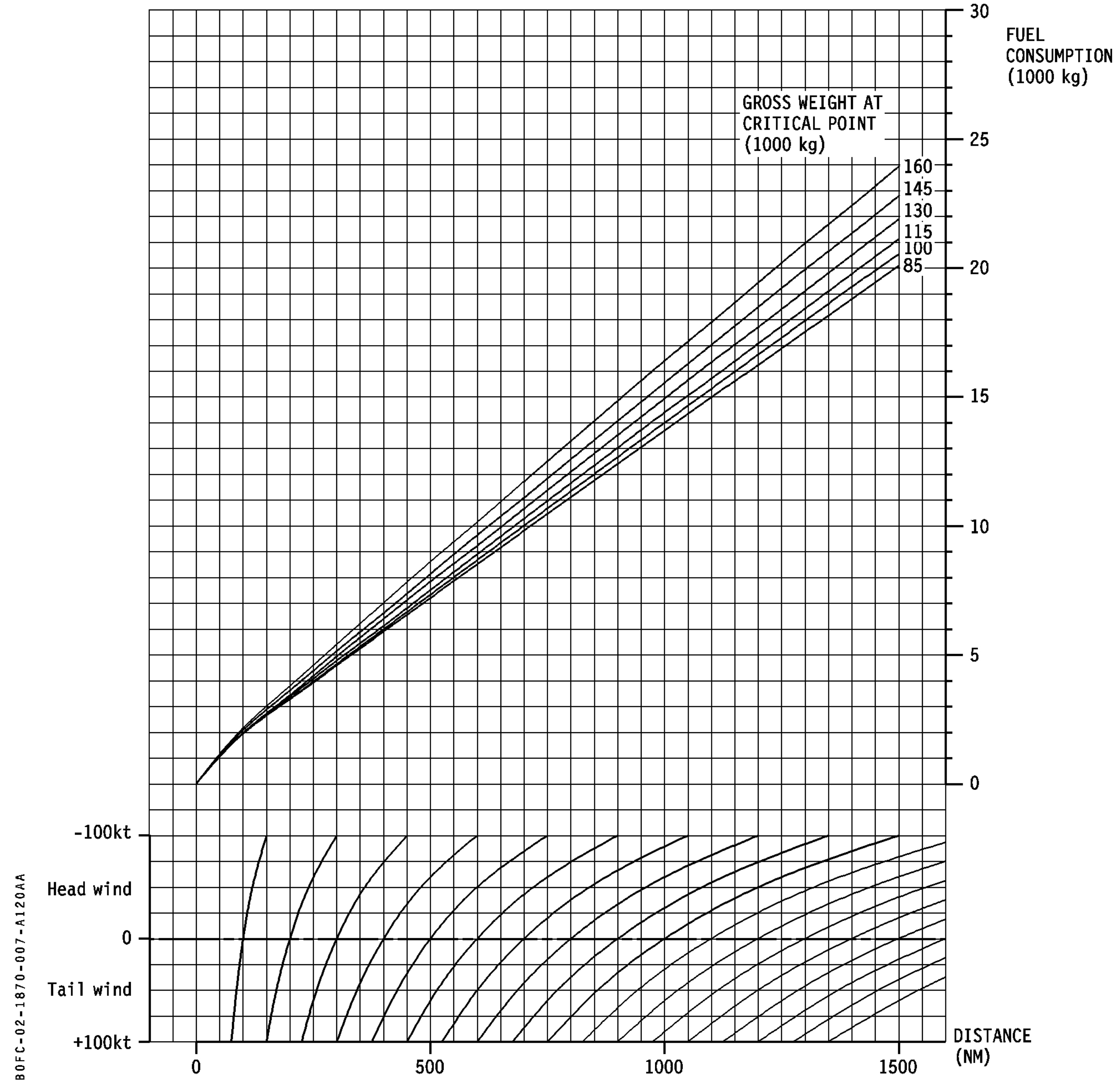


- For △ ISA up to + 10°C : add 1NM/hour/°C;
- For △ ISA > + 10°C : Check effect of △ ISA on TAS in Section 2.16.30 thru 2.16.50.

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING
ONE ENGINE OUT – CRUISE AT 300 KT

Including : emergency descent – cruise 300kt at FL 100
R **final descent 250kt – holding 15 min at FL 15**
R **IMC procedure – Go Around – 2nd IMC procedure**
5% allowance for wind errors – APU fuel burn

R R R R R R R R R R R

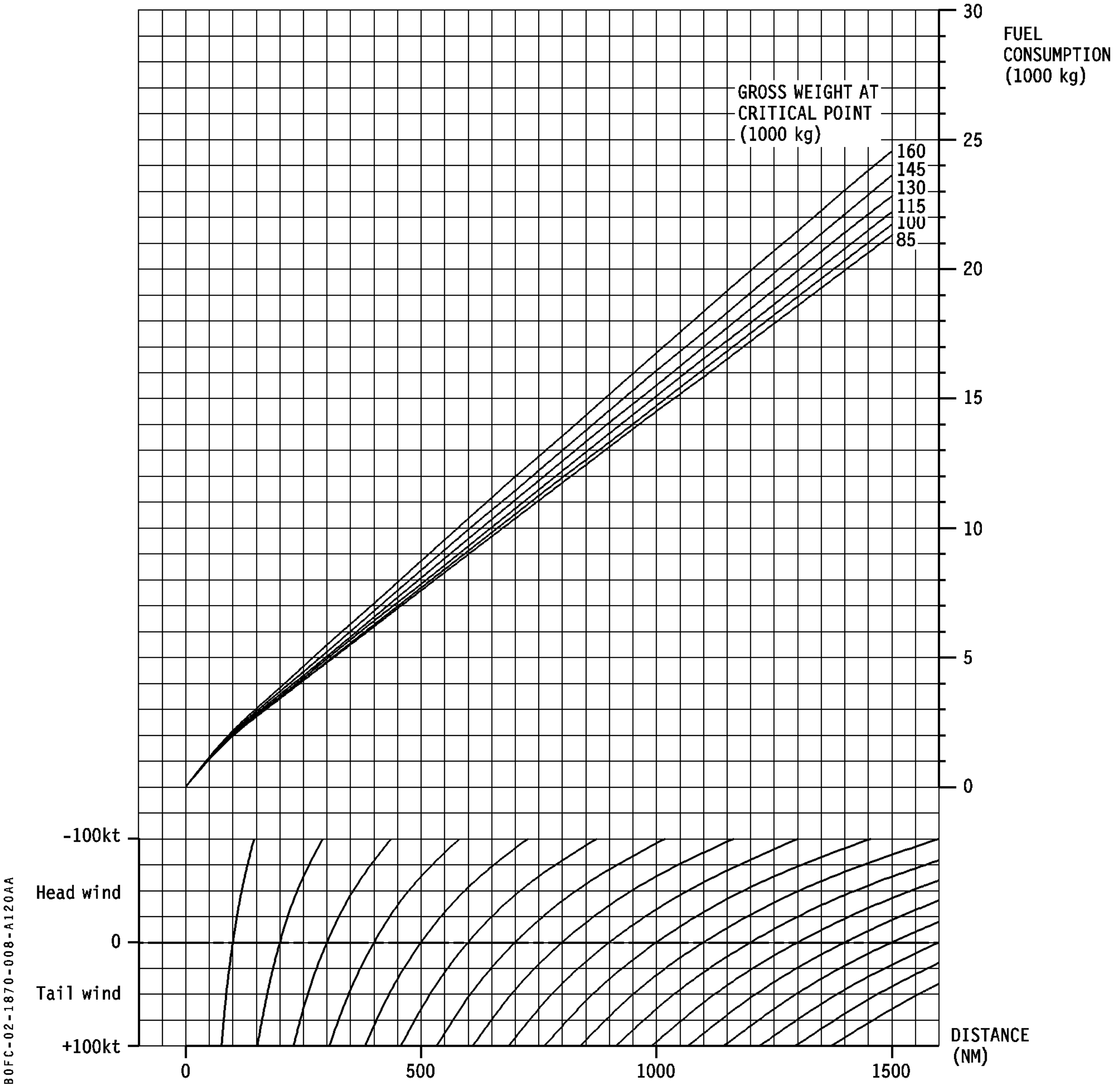


Mod. : 4863

PW Eng. : 4000

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING
ONE ENGINE OUT – CRUISE AT 320 KT

Including : emergency descent – cruise 320kt at FL 100
R **final descent 250kt – holding 15 min at FL 15**
R **IMC procedure – Go Around – 2nd IMC procedure**
5% allowance for wind errors – APU fuel burn



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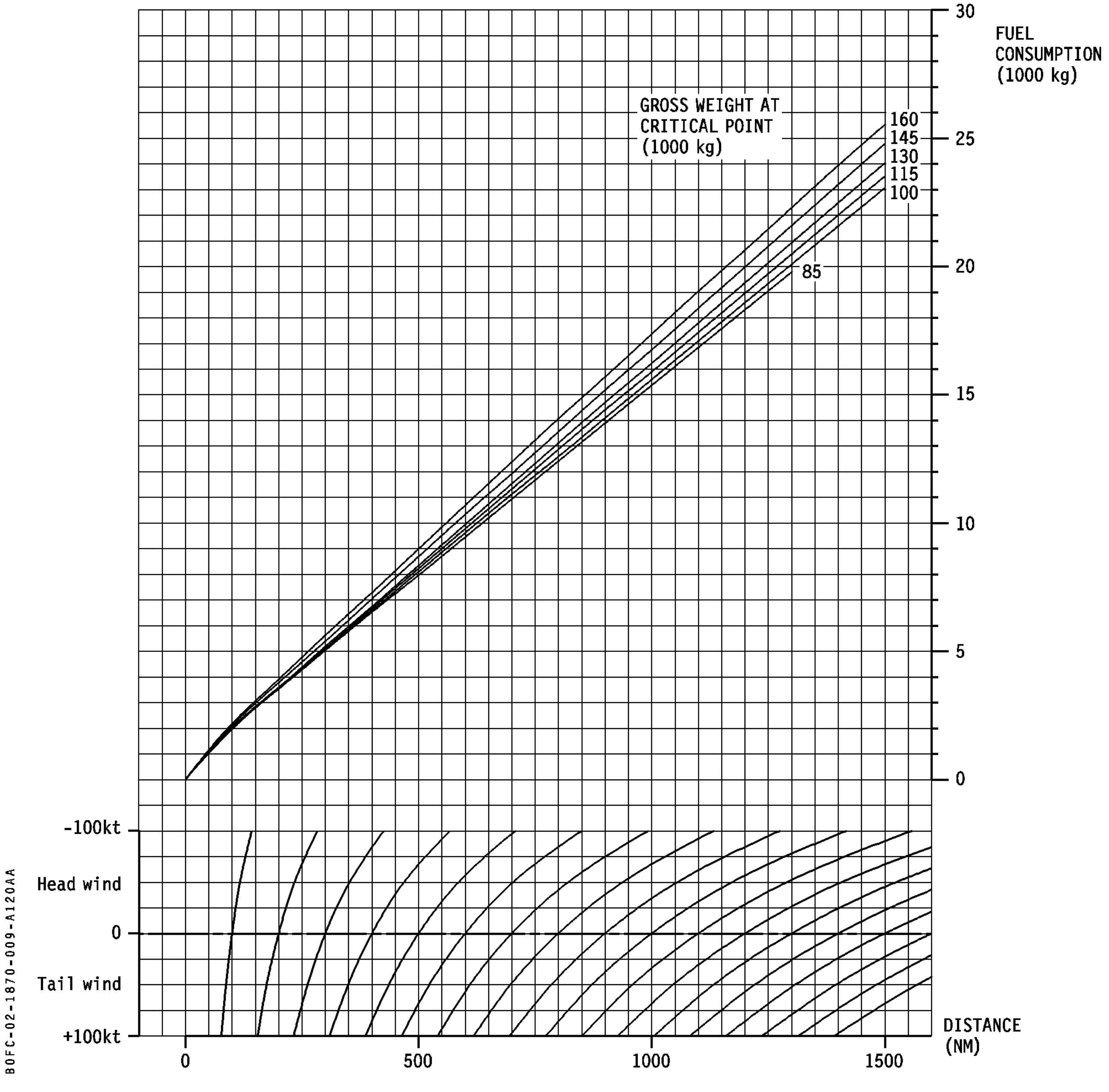
Mod. : 4863

PW Eng. : 4000

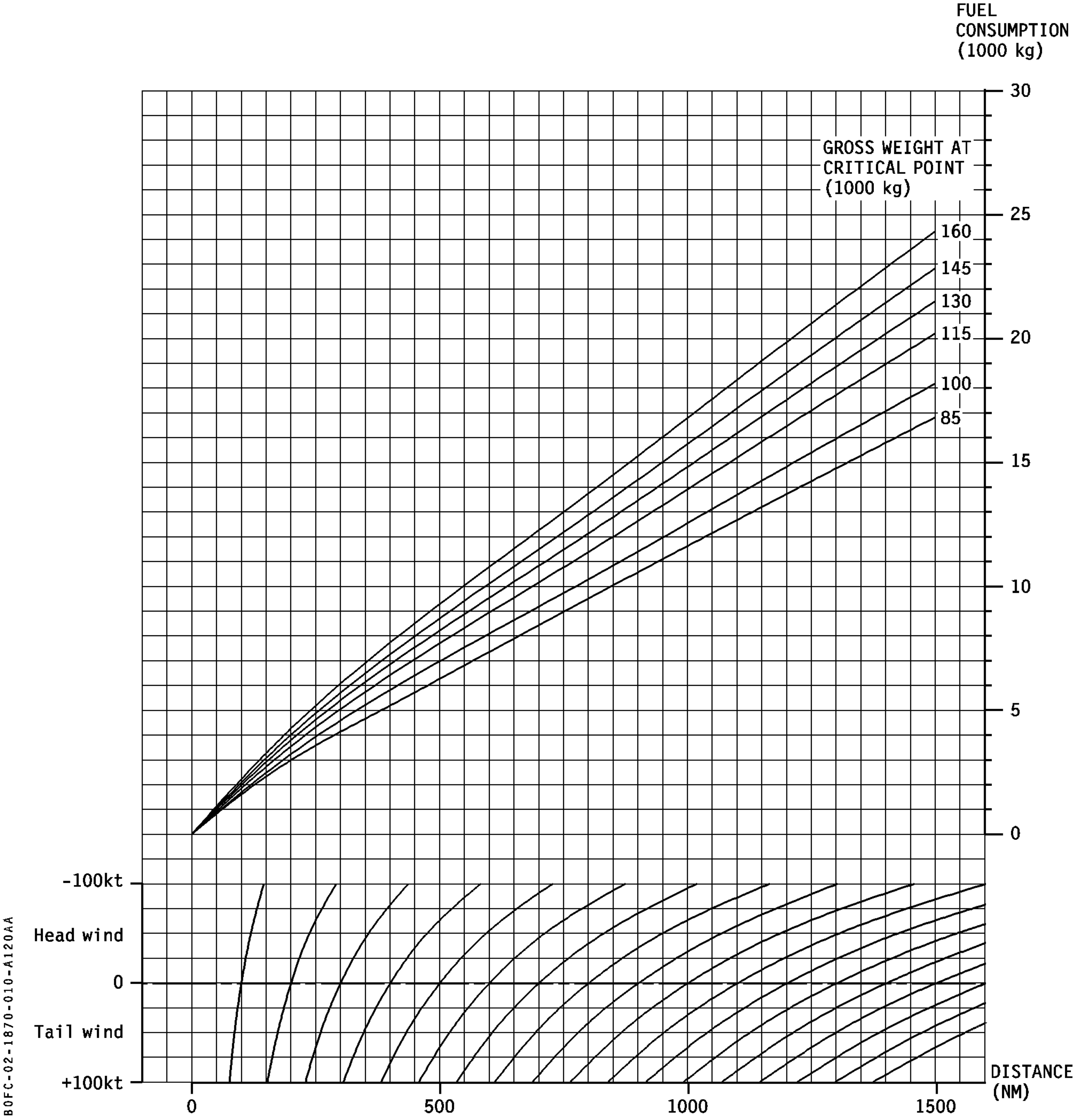
ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING
ONE ENGINE OUT – CRUISE AT 340 KT

Including : emergency descent – cruise 340kt at FL 100
R **final descent 250kt – holding 15 min at FL 15**
R **IMC procedure – Go Around – 2^{nd} IMC procedure**
5% allowance for wind errors – APU fuel burn



ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING
ONE ENGINE OUT – LONG RANGE CRUISE

Including : emergency descent – long range cruise at FL 100
R **final descent 250kt – holding 15 min at FL 15**
R **IMC procedure – Go Around – 2nd IMC procedure**
5% allowance for wind errors – APU fuel burn

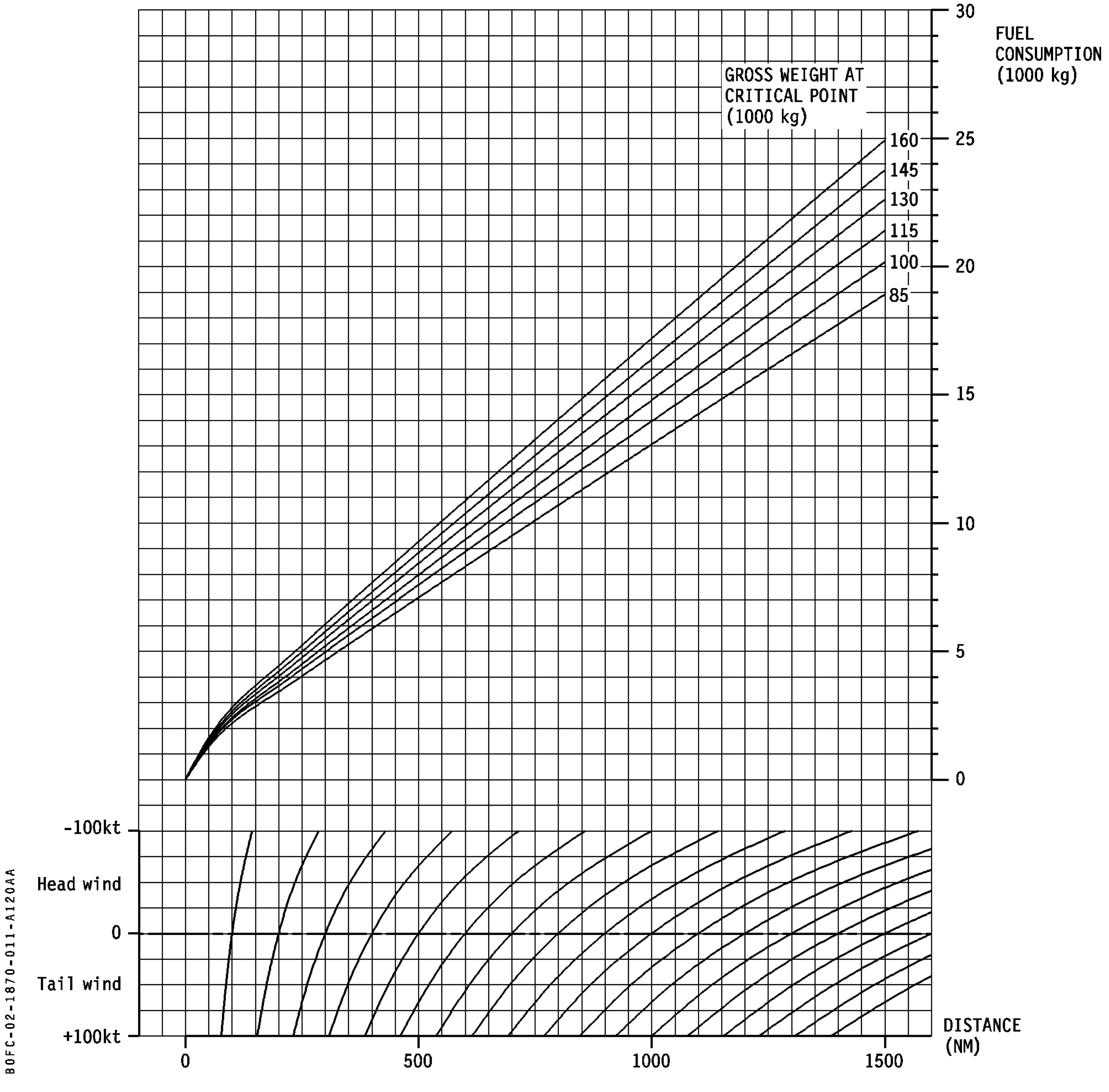


Mod. : 4863

PW Eng. : 4000

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING ALL ENGINES – LONG RANGE CRUISE

Including : emergency descent – long range cruise at FL 100
R **final descent 250kt – holding 15 min at FL 15**
R **IMC procedure – Go Around – 2nd IMC procedure**
5% allowance for wind errors



Mod. : 4863

PW Eng. : 4000

1. GENERAL

Reduced Vertical Separation Minimum (RVSM) airspace is any airspace or route between FL290 and FL410 (inclusive) where aircraft are separated vertically by 1000 ft instead of 2000 ft.

The A310 system design complies with the design criteria of JAA Information leaflet N° 6 and FAA 91-RVSM Interim guidance Material for RVSM operations.

The statement of RVSM capability is also indicated in the AFM.

To meet RVSM requirements, the aircraft must be upgraded in accordance with RVSM modifications 11468 or 11469 (SB A310-34-2112).

2. OPERATIONAL APPROVAL

The above statement of capability does not constitute an operational approval to fly in RVSM airspace. The operational approval is to be granted by the operator's national authorities after assessment of the airline capability to meet RVSM requirements.

The above mentioned JAA/FAA documents also cover requirements to obtain operational approval.

3. REQUIRED EQUIPMENT FOR RVSM

RVSM regulations require the following equipment to be operative :

- 2 ADCs and 2 main Altimeters
- 1 ATC transponder
- 1 Auto Pilot Function
- 1 FCU
- 1 FWC

The Airbus Industrie MMEL has been approved making reference to the list of required equipment published in the AFM.

4. PROCEDURES

The SOPs (FCOM 2.03) and the ABN and EMER procedures (FCOM 2.05 and 2.04) apply. For flights in RVSM airspace, these procedures must be complemented by the following :

4.1. Flight Preparation

The crew must pay particular attention to conditions that may affect operation in RVSM airspace. These include but may not be limited to :

- verifying that the particular aircraft is approved for RVSM operations,
- reported and forecast weather on the route of flight
- review of maintenance logs and forms to determine the condition of equipment required for flight in RVSM airspace. Ensure that maintenance action has been taken to correct defects to required equipment.
- check that both main altimeters indication (QNH reference) does not differ from the airport elevation by more than 75 ft.
- check on ground that the two main altimeter indications are within the tolerances provided in FCOM 2.02.15.

4.2. In flight procedures

Prior to entry into RVSM airspace

The required equipment for RVSM listed above must be operating normally.

Should any of this equipment fail prior to entering the RVSM airspace, the crew must request a new clearance so as to avoid flight in this airspace. Main altimeter indications should be checked to agree within the tolerances in FCOM 2.02.15.

Main and standby altimeter indications should be recorded.

Within RVSM airspace

AP should be engaged in CMD within RVSM airspace for cruise and flight level changes.

During transitions between flight levels, the aircraft should not overshoot or undershoot the cleared flight levels by more than 150 ft.

At intervals of approximately one hour, check that main altimeter indications agree within the tolerances in FCOM 2.02.15. The usual scan of flight deck instruments is an adequate means of compliance.

Use the ATC and the AP, associated with one of the ADC which is within tolerance.

4.3. Post Flight

The crew must report any malfunction or deviation in maintaining the assigned altitude (including loss or malfunction of any of the required equipment or altimeter tolerances outside of those provided in 2.02.15), and provide sufficient detail to enable maintenance to troubleshoot and repair the system.

4.4. Abnormal and Emergency Procedures

When in RVSM airspace, the following contingencies which affect the ability to maintain the assigned flight level must be notified to ATC.

- failure of both Autopilots,
- loss of altimeter system redundancy,
- failure of any other equipment affecting the ability to maintain the assigned flight level, or
- encountering severe or very severe turbulence.

Note : Appendix 5 of above mentioned JAA/FAA regulation contain detailed guidance for contingency procedures for North Atlantic airspace.

If unable to notify ATC and obtain ATC clearance prior to deviating from the assigned flight level, the crew must follow the established contingency procedure and obtain ATC clearance as soon as possible.

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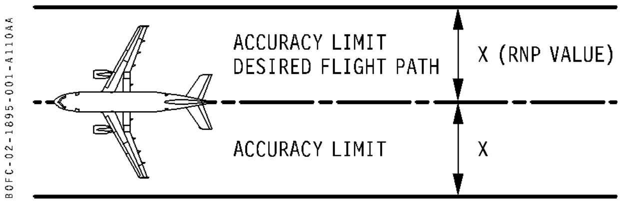
1. GENERAL

The aircraft navigation system required by regulation to fly within a RNP airspace shall comply with RNAV functionality criteria and with navigation position accuracy and integrity criteria.

When referring to RNP-X, the value of X is the navigation accuracy expressed in NM, which has to be met with a probability of 95 %.

A RNP value can be associated to an airspace, a route, a SID, a STAR, a RNAV approach or a RNAV missed approach procedure.
Depending of the RNP value and the airspace environment (ground radio navaid), different navigation equipment may be necessary.
An operational approval from the airline's national authorities may be necessary.



1. RNP CAPABILITY

1.1 NAVIGATION SYSTEM CAPABILITY (for reference only) :

- RNP-10 capability in oceanic or remote areas is shown in compliance with § 12.b of FAA Notice 8400.12A.
- Navigation system with GPS PRIMARY Function meets certification requirements of FAA AC 20-130A and TSO C 129 in class C1 (for navigation system with multiple sensor inputs).
- European BRNAV (RNP-5) capability is shown in compliance with certification requirements of FAA AC 90-45A.
- P-RNAV (RNP-1) capability meets the certification requirements of JAA TGL 10 (compliance with § 8.2 "Database integrity" has not been demonstrated).

1.2 FMS ACCURACY

In order to match a given RNP value, the FMS estimated position accuracy (also called Estimated Position Error) must be better than the RNP value. This is obviously dependent on the FMS navigation-updating mode (GPS, DME/DME, VORDME, or IRS).

On the CDU PROG page the required and the estimated position accuracy are displayed and determine the HIGH/LOW accuracy indication (refer to FCOM 1.19.40).

The required accuracy can be either the default value, which is a function of the phase of flight, or a value manually entered by the crew.

When flying in RNP environment, the crew can insert the appropriate RNP value in the REQUIRED ACCUR field of the PROG page.

- when HIGH is displayed, the RNP requirement is estimated fulfilled
- when LOW is displayed, the RNP requirement is estimated not fulfilled, in that case :
  - crew crosscheck navigation with raw data if available,
  - if the cross check is negative, or if raw data is not available, crew inform ATC

When leaving RNP environment, the crew will clear the manually entered required accuracy.

1.2.1 Without GPS PRIMARY function

RNP accuracy criteria are met provided the radio navaid coverage supports it for :

- RNP-1 en route and in terminal area provided a required accuracy of 1.2 NM(1) is manually entered in CDU.
- RNP-0.3 in approach provided a required accuracy of 0.36 NM(1) is manually entered in CDU.

Note : (1) Radial equivalent to the specified XTK/ATK accuracy

1.2.2 With GPS PRIMARY function

RNP requirements are met, provided GPS PRIMARY is available, for :

- RNP-1 en route

- RNP-0.5 in terminal area provided AP or FD in NAV mode is used

- RNP-0.3 in approach provided AP or FD in NAV mode is used

2. BRNAV IN EUROPEAN AIRSPACE

In this airspace the radio navaid coverage is assumed to support RNP-5 accuracy.

2.1 Required equipment

The minimum required equipment to enter BRNAV airspace is :

- One RNAV system which means :
  - 1 FMS
  - 1 CDU
  - 1 VOR for FM navigation update
  - 1 DME for FM navigation update
  - 1 IRS
- Flight Plan Data on 2 ND's
  - For aircraft without FMS switching option, 2 FMS are necessary to have 2 ND F-PLN displays.

Code : 0417

2.2 Procedures

Except when GPS PRIMARY is available crosscheck periodically FMS position with radio navaid raw data.

The manual selection of a required navigation accuracy on CDU is optional.

- If manual entry of a required accuracy is desired, use the radial equivalent to 5 nm XTK/ATK accuracy that is 6.1 nm.
- When leaving the RNP-5 airspace, or when entering terminal area, revert to the default required accuracy or enter appropriate value on CDU.

Check navigation accuracy with navaid raw data or GPS MONITOR page, if one of the following CDU or ECAM messages is displayed :

- NAV ACCUR DOWNGRAD
- FMC POSITION MISMATCH
- VERIFY A/C POSITION
- ECAM : FM/GPS POS DISAGREE

  - If accuracy check confirms that RNP-5 capability is lost or if both FMS are failed : inform ATC and revert to conventional navigation
  - If accuracy check confirms that only one FMS position is incorrect, resume navigation with the other FMS.

If IRS ONLY navigation, the BRNAV capability is kept during 2 hours independently of the estimated accuracy displayed on CDU.

3. RNP-10 IN OCEANIC OR REMOTE AREAS

In this kind of airspace the aircraft is expected to fly for a long period of time outside radio navaid coverage.

There is no limitation for aircraft fitted with GPS.

3.1 Required equipment

Minimum required equipment to enter a RNP-10 airspace is :

- 2 long range navigation systems, which means :
  - 2 FMS
  - 2 CDU
  - 2 GPS (if required by flight time outside radio navaid coverage)
  - 2 IRS

Refer also to Regional Supplementary Procedures of ICAO Doc 7030 for specific requirements in a particular airspace.

3.2 Procedures

The manual selection of a required accuracy on CDU is optional.

- If manual entry of a required accuracy is desired, use the radial equivalent to 10 NM XTK/ATK accuracy that is 12.2 NM.
- When leaving the RNP-10 airspace, revert to the default required accuracy or enter appropriate value.

Check navigation with POSITION MONITOR page and GPS MONITOR page, if one of the following CDU or ECAM messages is displayed :

- FMC POSITION MISMATCH
- VERIFY A/C POSITION
- ECAM : FM/GPS POS DISAGREE

  - Use AP with the navigation system checked correct
  - If unable to determine which system is correct, inform ATC and look for navaid raw data confirmation as son as possible

In IRS ONLY navigation, the RNP-10 capability is kept during 5.7 hours, according to FAA Notice 8400.12A., independently of the estimated accuracy displayed on CDU.

4 P-RNAV FOR EUROPEAN TERMINAL PROCEDURES

For terminal procedures requiring P-RNAV capability within european airspace, radio navaid coverage is assumed to support RNP-1 accuracy.

4.1 Required equipment

The minimum required equipment to fly a P-RNAV procedure is :

- One RNAV system which means :
  - 1 FMS
  - 1 CDU
  - 1 VOR or GPS for FMS navigation update
  - 1 DME or GPS for FMS navigation update
  - 1 IRS
  - 1 FD
- Flight Plan Data on 2 ND's
  - For aircraft without FMS switching option, 2 FMS are necessary to have 2 ND F-PLN displays.

For terminal procedures with legs below the MSA, or without appropriate radar coverage, two RNAV systems may be mandated by the procedure chart.

4.2 Procedures

When GPS PRIMARY is not available, crosscheck periodically FMS position with radio navaid raw data.

The terminal procedure (RNAV SID, RNAV STAR, RNAV TRANSITION,...) must be loaded from the FMS navigation database, and checked for reasonableness by comparing the F-PLN page waypoint sequencing, tracks, distances and altitude constraints with the procedure chart.

The procedure, as loaded from the navigation database should not be modified unless instructed to do so by the ATC (DIR TO..., insertion of waypoints loaded from the navigation database).
If GPS PRIMARY is not available, check or enter RNP-1 in the CDU and check HIGH accuracy is displayed.
When leaving the terminal procedure, revert to the default RNP or enter the appropriate value on the CDU.

Check navigation accuracy with navaid raw data or GPS MONITOR page, if one of the following CDU or ECAM messages is displayed :

- NAV ACCUR DOWNGRAD
- FMC POSITION MISMATCH
- VERIFY A/C POSITION
- ECAM : FM/GPS POS DISAGREE

● If accuracy check confirms that RNP-1 capability is lost or if both FMS are failed : inform the ATC and revert to conventional navigation.

● If accuracy check confirms that only one FMS position is incorrect, resume navigation with the other FMS.

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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 2 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 2 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.

CONTENT AND COVERAGE

An OEB :

- Is temporary and usually focuses on one operational subject only
- Is included in the FCOM Chapter 2.19.20. 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.

Note : *After installation of the OEB corrective modification/Service Bulletins (SB), if an Operator reinstalls any spare equipment for which there was an OEB associated to, it is the Operator's responsibility to ensure that this OEB be applied again for the applicable aircraft.*

OEBs IN THE FCOM :

OEBs are filled 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.

OEBs IN THE QRH :

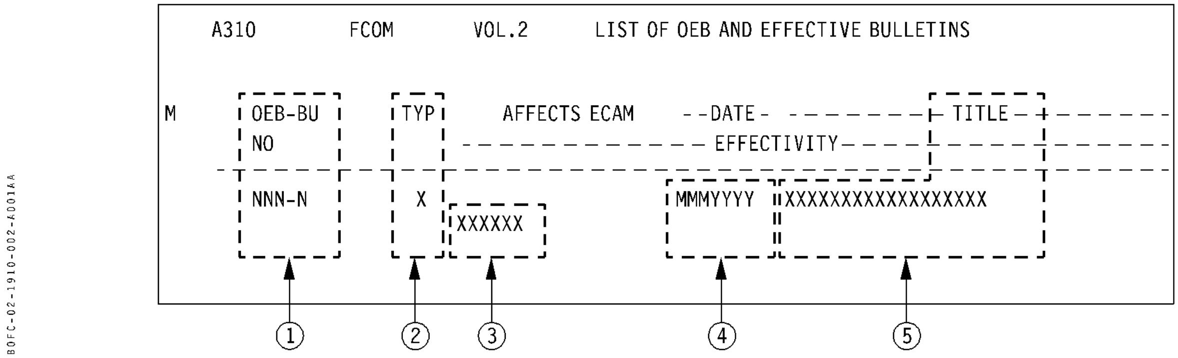
Each FCOM OEB has an associated "OEB PROC" in the OEB section of the QRH (19.00) that includes :

- The title of the OEB PROC
- 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.

LEOEB :

On the first page of both FCOM 2.19.20 section and 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 FCOM (QRH) LEOEB is updated and reissued each time an OEB (OEB PROC) is revised or added to the QRH, or when there is an OEB (OEB PROC) validity change.



① OEB NUMBER :
Indicates the number of the OEB and its issue.

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 OEB before flight.

③ EFFECTIVITY :
Indicates the validity of the OEB, i.e. the aircraft that the OEB is applicable to at the time that the LEOEB is issued.
This information appears just below, and to the right of, the OEB number and TYPE OF OEB for each OEB.

④ DATE :
Indicates the date (month/year) at which the OEB number was last issued.

⑤ TITLE :
Indicates the title of the OEB.

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. Responsible people within the Operator's organization are requested to ensure the rapid distribution to all flight crewmembers concerned.

The RED OEBs must be distributed immediately to all flight crews.

M	OEB-BU NO	-DATE--	-----------TITLE----------- ----------EFFECTIVITY----------
	125-3	JUN1998	IDG CONNECTOR ARCING ALL
	129-4	JUN1998	ENG ANTI ICE BELOW 15000 FT ALL
	148-3	NOV2006	"RA FAIL" FLAG ON THE VSI ALL

M	OEB-BU NO	-DATE--	-----------TITLE-----------	----------EFFECTIVITY----------
	801-1	JAN2005	INTRODUCING FCOM BULLETIN	ALL
	802-1	JAN2005	UNDERSTANDING BUFFET MARGIN	ALL
	803-1	JAN2005	GREEN DOT SPEED	ALL
	804-1	JAN2005	CRUDE OIL SMOKE AREAS	ALL
	805-1	JAN2005	RADIO ALTI FLUCTUATIONS	ALL
	806-2	MAR2006	FQI ACCURACY	ALL
	807-1	JAN2005	APPROACH ENERGY MANAGEMENT	ALL
	808-1	JAN2005	MMEL AND MEL USE	ALL
	809-1	JAN2005	CDL USE	ALL
	810-1	JAN2005	WINDSHEAR PHENOMENOM	ALL
	811-1	JAN2005	PREVENTING UNNECESSARY IFSD	ALL
	812-1	JAN2005	ENG LACK OF THROTTLE RESPONS	ALL
	813-1	JAN2005	ENG LOSS OF THROTTLE CONTROL	ALL
	814-1	JAN2005	FUEL TEMPERATURE LIMITATIONS	ALL
	815-1	JAN2005	VOLCANIC ACTIVITY-ASH	ALL
	816-1	JAN2005	CROSSWIND LANDING TECHNIQUE	ALL
	817-2	JUN2008	AVOIDING TAIL STRIKES	ALL
	818-1	JAN2005	ELECTRONIC INTERFERENCE	ALL
	819-1	JAN2005	AVOID DISORDER IN COCKPIT	ALL
	820-1	JAN2005	FMS NAVIGATION DATA BASE	ALL
	821-1	JAN2005	ON GRD BLEED LEAK-HIGH OAT	ALL
	822-1	JAN2005	DISPATCH WITH ACT NOT USED	ALL
	823-1	JAN2005	PRE-STALL AND MACH NB BUFFET	ALL
	824-1	JAN2005	FCU ALTITUDES OVERSHOOT	ALL
	825-1	JAN2005	BEING PREPARED FOR GO-AROUND	ALL
	826-1	JAN2005	ECAM/QRH USE FOR SMOKE PROC	ALL
	827-1	JAN2005	USE OF RUDDER	ALL
	828-1	JAN2005	EGPWS DATABASE	ALL

M	OEB-BU NO	-DATE--	-----------TITLE-----------	----------EFFECTIVITY----------

Airbus Industrie

Flight Operations Support

BP N°33, 31707 Blagnac Cedex France

Operations Engineering Bulletin

A310

Issued by AI/ST-F	**File in FCOM 2.19**	**Bulletin/Issue N°: 125/3** **Date : June 98**

SUBJECT : **INTERMITTENT ELECTRICAL POWER SUPPLY – INTERRUPTION CAUSED BY IDG FEEDER CONNECTOR PIN/SOCKET ARCING**

R Applicable to : All aircraft equipped with PW4000 or CF6-80C2 engines.

R Cancelled by : Mod 10679 (SB 71-2017) for PW engines or Mod 10680 (SB 71-2018) for GE engines.

1 - REASON FOR ISSUE

The purpose of this OEB is to provide flight crews with background information and operational recommendations regarding the potential intermittent electrical power supply interruption caused by IDG feeder connector pin/socket arcing, on aircraft fitted with PW4000 or GE CF6-80C2 engines.

2 - BACKGROUND INFORMATION

The aircraft electrical power is supplied by two three-phase Integrated Drive Generators (IDG).

The IDG three phases and neutral are connected to the aircraft electrical system by a set of 4 cables known as the IDG feeder.

To allow for engine removal, the IDG feeder can be disconnected, at the engine/pylon interface, at the level of a type connector.

In-service experience has evidenced that the pin/socket retention force may come to be degraded resulting in pin/socket arcing and consequent intermittent electrical power supply interruption affecting one or several phases.

The above phenomenon is usually evidenced by one or a combination of the following typical occurrences (or the recurrence thereof) :

- Flickering of PFD, ND, ECAM or FMS/CDU CRT's,

- Disengagement of ATS, YAW DAMPER or PITCH TRIM,

- Warnings and/or flags affecting ADC, FAC or FWS data.

3 - PROCEDURE

Should the IDG feeder pin/socket arcing be suspected, as evidenced by one or a combination of the above typical occurrences (or the recurrence thereof), proceed as follows :

- using the BUS EQUIPMENT LIST (QRH), positively identify the affected generator,

- apply the following procedure :

  APU ....START

  Note : APU should be started (if available) only if current altitude is compatible with APU in-flight restart envelope.

  GEN (affected) ....OFF/R

- perform a log book entry for maintenance assessment and corrective action prior to the next flight.

Issued by AI/ST-F	**File in FCOM 2.19**	**Bulletin/Issue N°: 129/4** **Date : June 98**

SUBJECT : **SELECTION OF ENG ANTI ICE BELOW 15000 FT**

R Applicable to : All aircraft equipped with PW4000 engines.

R Cancelled by : Mod 8874 (SB 73-2020) or Mod 10265 (SB 73-2022) or Mod 10633 (SB 73-2028) or Mod 10767 (SB 73-2029) or Mod 11113 (SB 73-2030) or Mod 11624 (SB 73-2032).

1 - REASON FOR ISSUE

To provide background information and operational recommendations for the selection of ENG ANTI ICE, for any operation below 15000 ft.

2 - BACKGROUND INFORMATION

So as to provide a greater ventilation of the HPC rotor drum and thus prevent the potential for HPC blade tip rub and engine surge when performing a snap reacceleration with a heat soaked engine, it is required to force a higher idle level by **selecting the ENG ANTI ICE to ON for any operation below 15000 ft.**

This requirement is enforced by **AD 91-05-20** and Consigne de Navigabilité **90-141-114 (b) Rev 1** or further revision.

The provision of this OEB is to be complied with until the installation of FADEC SCN 10E, or subsequent standard **on both engines**, per above listed Airbus Industrie Modifications or Service Bulletins.

3 - PROCEDURE

The following procedure must be complied with, as follows :

- BEFORE TAKEOFF : select ENG ANTI ICE ON.

- AFTER TAKEOFF : keep ENG ANTI ICE ON until after crossing 15000 ft.

- CLIMB : above 15000 ft, set ENG ANTI ICE OFF, if not required by icing conditions.

- DESCENT : set ENG ANTI ICE ON before reaching 15000 ft.

AIRBUS

Flight Operations Support

BP N°33, 31707 Blagnac Cedex France

Operations Engineering Bulletin

A310

Issued by STL	**File in FCOM 2.19**	**Bulletin/Issue N°148/3** **Date : November 2006**

SUBJECT : ATA 34 - TCAS / VSI INDICATOR FAULT INDICATION AND PARTIAL DISPLAY IN SOME MULTIPLE AIRCRAFT ENCOUNTER

APPLICABLE TO: All aircraft fitted with the following configuration :
TCAS CHANGE 7:

HONEYWELL: MOD 12025 OR MOD 12034 (SB 34-2148)
R OR MOD 12339 (SB 34-3160)

Or

ROCKWELL-COLLINS: MOD 12043 (SB 34-2149) or MOD 12354 (SB 34-2159)

and

THALES TCAS / VSI indicator:
MOD 10107 (SB 34-2069)

CANCELLED BY: New VSI part number - MOD 12766 (SB 34-2191)

I – REASON FOR ISSUE

The purpose of this OEB is to inform all A310 operators whose aircraft are fitted with TCAS CHANGE 7.0 about potential THALES TCAS / VSI indicator fault indication and partial display.
Reason for Issue 2 : corrective action now available
R Reason for Issue 3 : applicability updated

II – DESCRIPTION

During a multiple aircraft encounter (e.g. intruders are encountered both above and below simultaneously), the "MAINTAIN VERTICAL SPEED, MAINTAIN" Resolution Advisory message may be triggered as circumstances dictate. Although this audio message is correctly generated, the "RA FAIL" flag may be simultaneously and unduly displayed on the Vertical Speed Indicator (VSI). If this occurs, the VSI does not display the red and green arc as it should.

As soon as this particular conflict is cleared, the "RA FAIL" flag disappears and TCAS / VSI indicator automatically returns to normal operation.

III – OPERATIONAL RECOMMENDATIONS

In case of TCAS Resolution Advisory, the corresponding audio message must be followed even if the "RA FAIL" flag is displayed on the VSI.
If the "MAINTAIN VERTICAL SPEED, MAINTAIN" Resolution Advisory message is triggered, the current vertical speed must be maintained to keep the current flight path accordingly.

The awareness of the traffic situation is still available through the traffic advisory information which is correctly displayed on the VSI.

IV – CORRECTIVE ACTION

The logic default described paragraph II and can be corrected by Service Bulletin (34-2191) installing a new VSI Part Number.

A310 FCOM BULLETIN

N° 801/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : INTRODUCING FCOM BULLETIN

Applicable to : All aircraft

FCOM BULLETINS give more information concerning technical/operational matters closely related to the two volumes of the FCOM. This information will be different in content from that of the OPERATION ENGINEERING BULLETINS.

OEBs are issued as the need arises to quickly transmit technical and procedural information when a specific problem arises which has an operational impact.

The FCOM BULLETIN is issued when deemed advisable. It deals with one subject and includes additional or summarized information with regard to aircraft operation, system descriptions, performance, regulations... and contains data which is not elligible for incorporation in the FCOM itself. Each subject has an individual subject number.

FCOM BULLETINS have no impact on published procedures.

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R The List of Effective FCOM BULLETINS is given in
R FCOM 2.19.20. FCOM BULLETINS and OEBs share
R the same listing. The list of effective FCOM
R BULLETINS comes after the list of effective OEBs.

R The List of Effective OEBs/FCOM BULLETINS is
R updated at each new issue of an OEB or FCOM
R BULLETIN.

It is recommended to file FCOM BULLETINS in FCOM volume 2 section 20.

A310 FCOM BULLETIN

N° 802/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : UNDERSTANDING AND MANAGING THE BUFFET MARGIN
Subject extracted from former FCOM Bulletin N°02/2 - Subject N°2

Applicable to : All aircraft

I – REASON FOR ISSUE AND SCOPE

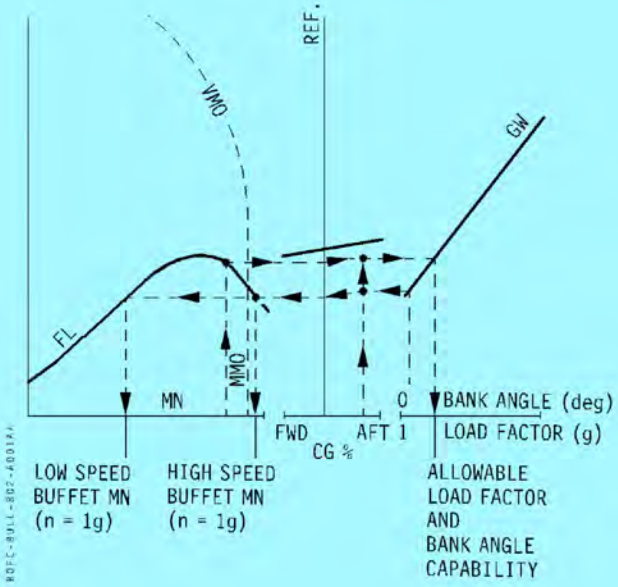
- The purpose of this FCOM BULLETIN is to provide flight crews with summarized information regarding the BUFFET MARGIN.

II – BACKGROUND INFORMATION

II. 1. FCOM GRAPHICAL INFORMATION

- Information regarding the BUFFET MARGIN (margin relative to buffet onset) is provided in the FCOM under two forms, as follows :

– BUFFET ONSET Chart (FCOM Vol. 2 OPERATING LIMITATIONS)



* The BUFFET ONSET chart (presented here above in a schematic form) provides for a given set of flight conditions (MN, FL, CG, GW), the following information :

○ Load Factor which, if reached, would result in buffet onset.

Note : Starting from a level flight under 1 g, the BUFFET MARGIN can be, therefore, defined as follows :

BUFFET MARGIN = ALLOWABLE LOAD FACTOR – 1

○ Bank Angle, resulting in the same load factor, representing the available maneuvering capability before reaching the buffet onset.

○ High Speed and Low Speed buffet speeds (in MN) under 1 g.

* The BUFFET ONSET chart can be refered to whenever an accurate assessment of the available buffet margin is considered.

* It is to be stressed that Gross Weight, Flight Level and Mach Number have a direct combined effect on the available buffet margin. The following correlation factors can be memorized as resulting in a 0.10 g decrease in buffet margin :

○ being 10 tons heavier, at given FL and MN,

or

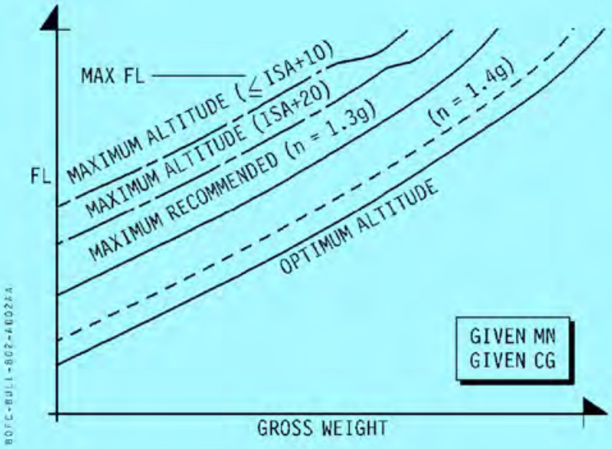
○ increasing altitude by 2000 ft, at given GW and MN,

or

○ deviating by 0.02 MN from the optimum maneuvrability MN (e.g. 0.80 on A310) at given GW and FL.

- * Considering the above correlation factors, the altitude and Mach number can be selected/traded so as to maintain/recover the desired buffet margin.

– CRUISE LEVEL CHART (FCOM Vol. 2 FLIGHT PLANNING)



- * The CRUISE LEVEL CHART (presented here above in a schematic manner) provides, for a given Mach number the following information :
  - ○ OPTIMUM ALTITUDE : The optimum altitude is defined so as to provide the maximum fuel performance (maximum specific range), at given MN, as a function of the GW. The buffet margin available at the optimum altitude is greater than 0.4 g (n > 1.4 g).
  - ○ MAXIMUM RECOMMENDED ALTITUDE : The maximum recommended altitude is defined so as to provide a 0.3 g buffet margin (n = 1.3 g), thus allowing adequate cruise maneuvering capability. At the maximum recommended altitude, the fuel performance remains within 1.5 % of the above optimum.
  - ○ MAXIMUM ALTITUDE : This is the maximum altitude, as a function of the GW, which can be sustained in level flight at given Mach number and temperature, using the maximum cruise setting.

III – FMS COMPUTATION AND DISPLAY

- ● The FMS also computes and defines an OPTIMUM ALTITUDE and a MAXIMUM ALTITUDE using complex multi-variables algorythms, as follows :

– OPTIMUM ALTITUDE :

- * The optimum altitude is calculated, based on the selected strategic mode, by minimizing the total cost for a given FPLN, taking into account the initial gross weight as well as the predicted wind and temperature profiles.
- * For typical revenue service operation (ECON strategic mode, typical cost index), the FMS OPTIMUM ALTITUDE is equal to the FCOM OPTIMUM ALTITUDE and thus provides also a buffet margin greater than 0.4 g (n >1.4 g)

Note : For detailed background, reference can be made to the FCOM 2-02-19, USE OF SPERRY (SMITHS) FMS, MACH FOR STRATEGIC MODE (OPTIMUM CRUISE MACH) AND OPTIMUM ALTITUDE FOR STRATEGIC MODE (OPTIMUM CRUISE ALTITUDE) charts.

– MAXIMUM ALTITUDE :

- * The FMS MAXIMUM ALTITUDE is provided as an absolute altitude combining the following criteria :

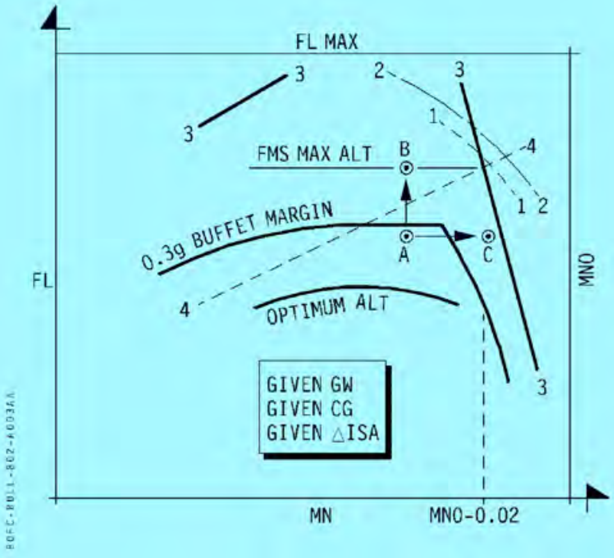
1 – Maximum altitude which can be sustained in level flight at the maximum CR setting.

2 – Maximum altitude which can be reached with a minimum vertical speed of + 300 ft/mn at the maximum CL setting.

3 – Maximum altitude which can be reached before buffeting with the following buffet margin :
  - ○ SPERRY FMS : 0.2 g
  - ○ SMITHS FMS : 0.2 g or 0.3 g depending on selected pin programming.

4 – Maximum altitude which can be flown with a speed/mach higher than GREEN DOT and lower than VMO/MMO.

- * The above criteria are summarized on the graph presented hereafter in a schematic manner :



- * The FMS MAXIMUM ALTITUDE (MAX FL) is displayed on the following FMS pages :
  - INIT B (SPERRY), as soon as weight data have been entered,
  - PROGRESS (SPERRY)/PERFormance (SMITHS) page.
- * Flight crews should be aware that when operating with the FMS buffet margin set to 0.2 g, the buffet margin available when flying at the FMS MAXIMUM ALTITUDE can be significantly lower than 0.3 g (n = 1.3 g)
- * Considering a set of initial conditions (e.g. point Ⓐ), the effect of altitude (point Ⓑ) and Mach number (point Ⓒ) on the available buffet margin are clearly illustrated, thus supporting the recommendation for selecting/trading altitude and Mach number so as to maintain/recover the desired buffet margin.

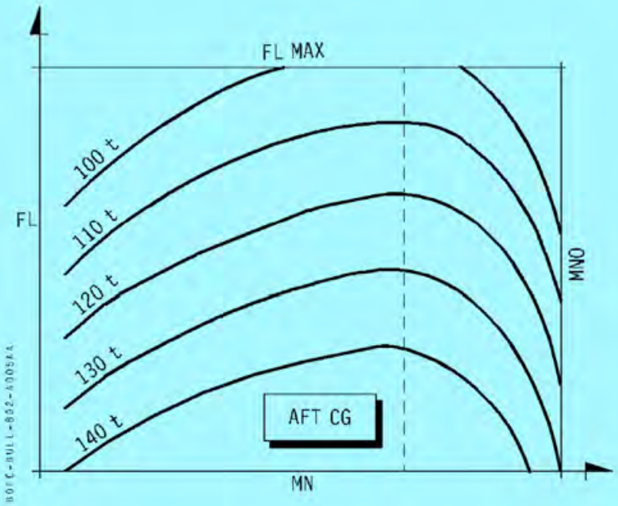
IV – MANAGING THE AVAILABLE BUFFET MARGIN

- The FCOM and FMS guidance, in term of BUFFET MARGIN, is provided so as to offer operational flexibility. However, it is the flight crew responsibility to assess the adequate and necessary BUFFET MARGIN with regards to the actual flight conditions, in term of :
  - Gross weight,
  - Altitude,
  - Mach number,
  - Turbulence,
  - Desired maneuverability (desired bank angle capability).
- Based on the above referenced FCOM general recommendations, as well as specific operational recommendations such as :
  - Flying at or below the optimum altitude for FLIGHT IN SEVERE TURBULENCE to provide sufficient buffet margin (FCOM PROCEDURES AND TECHNIQUES – INCLEMENT WEATHER OPERATION – FLIGHT IN SEVERE TURBULENCE)
  - Considering a 15° maximum bank angle selection when flying in non-NAV AP guidance – i.e. HDG SEL – (FCOM PROCEDURES AND TECHNIQUES – USE OF AFS – LATERAL MODES).
- FMS MAXIMUM ALTITUDE can be flown provided that :
  - no turbulence is encoutered or predicted,
  - flight plan features limited heading changes (almost straight flight along the considered period).
- For typical operation, the cruise altitude and Mach number should be selected in order to ensure a BUFFET MARGIN equal to or greater than 0.3 g (n = 1.3 g) as follows :
  - Altitude : OPTIMUM ALTITUDE ± 2 000 ft, thus also keeping the fuel performance (Specific Range) within 1.5 % of the optimum,
  - Mach number : FMS target speed or selected fixed Mach number.

- Whenever deviating from the above recommendations e.g. :
  - High initial cruise altitude or early step climb for ATC reasons,
  - High Mach number operation, such as MIN TIME STRATEGIC MODE or fixed Mach number in TACTICAL (PERF) MODE,

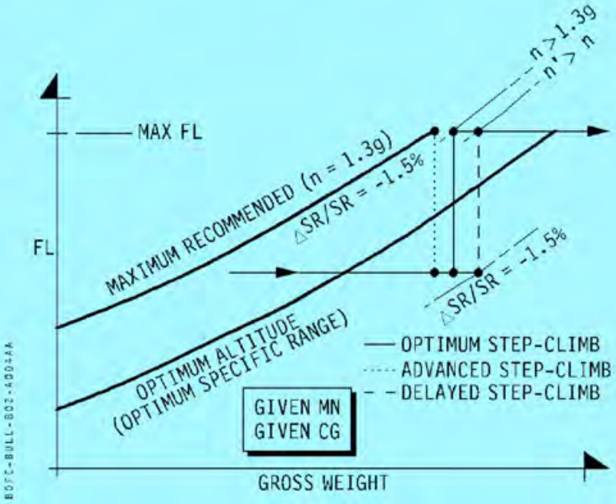
  the BUFFET MARGIN should be managed by the flight crew.

- So as to assist the flight crews in their decision making process, the BUFFET ONSET chart and the CRUISE LEVEL CHART have been complemented with a new chart, titled MANAGEMENT OF BUFFET MARGIN, (presented hereafter in a typical form) providing direct reading information regarding the set of flight conditions (Altitude, Gross Weight, Mach Number) assuring a 0.3 g BUFFET MARGIN (n = 1.3 g). This chart has been incorporated in the FCOM Vol. 2 – FLIGHT PLANNING – MANAGEMENT OF BUFFET MARGIN.



- Whenever the available BUFFET MARGIN is a concern (e.g. encountered or predicted turbulence) the step climb decision and point should be carefully evaluated, considering :
  - the present Gross Weight and BUFFET MARGIN,
  - the estimated BUFFET MARGIN at intended step climb altitude,
  - the overall saving, as confirmed by the FMS STEP CLIMB PREDICTION.

  <u>Note</u> : *As illustrated on the CRUISE LEVEL CHART provided hereafter, delaying a step climb may provide the desired BUFFET MARGIN retention, with a negligible impact on the trip fuel burn-off.*



V – <u>CONCLUSION</u>

- The FCOM and the FMS provide guidance information in term of BUFFET MARGIN and/or resulting capability in term of :
  - maneuverability (bank angle)
  - optimum, maximum recommended and maximum altitudes.
- However, it remains the flight crew responsibility and initiative to assess and maintain the BUFFET MARGIN considered adequate and necessary for the prevailing flight conditions.

A310 FCOM BULLETIN

N° 803/1

DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : GREEN DOT SPEED
Subject extracted from former FCOM Bulletin N° 03/2 – Subject N°3
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE

Differences on GREEN DOT indications between FMS, PFD (FAC) and FCOM may occur. This bulletin explains the reasons of these differences and shows that these differences have no impact on the safety or on the operation of the aircraft.

2. GREEN DOT DEFINITION

The green dot speed is defined to give the best climb gradient capability in clean configuration (close to the best lift to drag ratio). It is used for different purposes :

2.1. For the ENGINE OUT CONFIGURATION it represents :
- The FINAL TAKE OFF SPEED and thus the optimum climb speed.
- The DRIFT DOWN SPEED which provides the best descent flight path and thus ensures the best obstacle clearance.

2.2. With ALL ENGINES OPERATING it indicates the speed allowing the best climb gradient. For exemple it represents the target speed in LVL CH mode or PROF (MAX CLB), when during climb the ATC requests to expedite through a given FL.

2.3. The GREEN DOT SPEED is very close to the MAX ENDURANCE SPEED ; it is therefore used as :
- Recommended speed for holding pattern in clean configuration.
- Lower limit for ECON SPD target (SPERRY) or optimum cruise speed (SMITHS).

2.4. The GREEN DOT SPEED is finally the recommended MANEUVERING SPEED in clean configuration, which provides adequate margin relative to VS (between 1.4 VS and 1.5 VS), for example to follow a circuit for approach or for holding pattern.

From these four objectives, the first one is the predominant objective and has led to the definition of GREEN DOT SPEED by the formula :

A310 :

GD (kt) = GW + 100 + 2 kts per 1 000 ft above 20 000 ft

where GW = Gross weight expressed in tons.

This formula has been certified and is used to compute the NET FLIGHT PATH, and to determine the Final Takeoff point in the Takeoff paths as published in the Approved Flight Manual (AFM).

3. GREEN DOT COMPUTATION :

The crew obtains GREEN DOT speed value by three different ways :

1) Flight Augmentation Computer (FAC) → PFD Speed Scale
2) FMS → Takeoff / Approach page on CDU
3) FCOM as published in FCOM Vol.2 TAKE OFF and in the QRH.

All using the same algorithms.
The observed differences come only from the weight determination.

3.1. FCOM GREEN DOT :

The FCOM indicates the speeds as a function of the actual weight, resulting from the formula determined for certification and approved in the AFM as indicated above.

3.2. FAC GREEN DOT :

The FAC uses the same formula ; the difference comes from the weight determination :
The weight is deduced from the measure of various aircraft parameters provided by the ADC : Angle of attack, speed, load factors, altitude.

3.3. FMS GREEN DOT :

The FMS uses also the same formula ; the difference comes also from the weight determination.

The gross weight is processed as follows :

Once the crew has inserted the various weights on the INIT page B (SPERRY) or on START page 2 (SMITHS) when engines are not running, or on the Fuel page (engines running), the FMS updates continuously the aircraft current weight using Fuel Quantity and fuel flow data.

The GREEN DOT SPEED as provided on the CDU Takeoff page is computed using the expected Takeoff weight.

The GREEN DOT SPEED as provided on the CDU Approach/Go Around pages is computed using the expected landing weight.

The GREEN DOT SPEED computed by the FMS represents also the lower limit for the ECON SPEED. It is also computed using the current aircraft gross weight as processed with Fuel Flow and Fuel Quantity data and the current aircraft altitude.

4. POSSIBLE COMPUTATION DIFFERENCES

4.1. BELOW 20 000 ft

4.1.1 Effect of Angle of Attack (AOA) probe calibration.

The AOA probe calibration and setting tolerance is ± 0.3°.

This tolerance leads to a variation on the gross weight assessment and thus to a corresponding variation in the green dot computation (on the order of ± 5 kts).

4.1.2 Effect of CG position and of thrust.

The GREEN DOT SPEED formula has been determined for a fixed (forward) CG position of 17 % with one engine at max continuous thrust and the other engine in windmilling condition.

Shifting the CG aftwards (forward) decreases (increases) the AOA at a given A/C lift coefficient (given GW, given airspeed). This leads also to a variation of the gross weight assessment and to a corresponding variation in the green dot computation (on the order of ± 3 kts/10 % CG variation).

Thrust effect is similar to center of gravity effect.

A thrust variation results in AOA variation at a given A/C GW and airspeed (for a thrust variation from idle to max climb it may change the Green Dot computation by up to 7 kts).

4.2. ABOVE 20 000 ft

Apart from the thrust effect which becomes less sensible above 20 000 ft, the influences described in section 4.1 remain applicable.

A new effect has to be added which is the compressibility effect. This effect introduces a modification of the relation lift coefficient-angle of attack as a function of mach number and is not considered by the FAC.

This also leads to a variation on the Gross Weight assessment and consequently on GD computation (this difference varies with GW and Mach number and may reach up to ± 8 kts).

4.3. EXAMPLES

To illustrate the above effects two cases have been chosen (A310-300) :

1st case :

Weight : 100 Tons
Altitude : 41 000 ft
Mach : 0.82 – AFT CG position
Green Dot (FCOM) = 242 kts

Effect	Potential variation on GD (given by FAC)
Probes calibration and tolerance	± 4.4 kts
CG position effect (27 to ~ 37 %)	– 2.2 kts
Compressibility effect	+ 8 kts
Total	Between + 1.4 kts and + 10.2 kts

In this example the difference GDFAC – GDFCOM may reach up to 10 kts.

2nd case :

Weight : 154 Tons
Altitude : 33 000 ft
Mach : 0.79 – Flight at AFT CG
Green Dot (FCOM) = 280 kts

Effect	Potential variation on GD (given by FAC)
Probes calibration and tolerance	± 5 kts
CG position effect	– 2.5 kts
Compressibility effect	– 8 kts
Total	Between – 5.5 kts and – 15.5 kts

The difference GDFAC – GDFCOM may reach up to 15.5 Kts.

5. CONCLUSION

The green dot speed as computed by the FAC and indicated on the Speed Scale of the PFD may deviate from its theoretical value.

This has no operational consequence :

- When the FAC Green Dot Speed is used as target speed for a single engine drift down, a ± 10 kts variation on target speed leads to a ± 300 ft variation on the Engine Out Gross ceiling which is far above the net ceiling (in average 5000 ft above).
- When the FAC Green Dot Speed is used as target speed for holding, a ± 10 kts variation has a negligeable effect on the fuel consumption (about 1 %).
- When the FAC Green Dot Speed is used as maneuvering speed it is systematically above VLS. Therefore flying FAC Green Dot Speed gives always adequate margins versus VS, when limiting bank angle to 30°.
- The Green Dot used as lower limit for ECON SPEED target by the FMS should not be considered as an operational limitation.
  Moreover it does not apply to the tactical mode (chosen cruise Mach number).

A310 FCOM BULLETIN

N° 804/1

DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : OPERATION IN AREAS CONTAMINATED BY CRUDE OIL SMOKE

Subject extracted from former FCOM Bulletin N° 04/1 – Subject N°5
No technical change from previous issue

Applicable : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM BULLETIN is to provide flight crews with background information and operational recommendations for operation in areas contaminated with crude oil smoke.

2. BACKGROUND INFORMATION

- Although no detailed and direct information is available concerning the particulars of the crude oil smoke contamination, information provided by french meteorological and petroleum institutes estimate the oil smoke clouds to be composed of :
  - 90 % heavy particles which would not reach over 5 000 ft,
  - 10 % lighter particles likely to culminate up to, approximately, 25 000 ft.
- Crude oil smoke is understood to be mainly composed of greasy/oily particles and non-abrasive soot. The associated gases are understood to have a high sulphur content.
- In the event of a crude oil smoke cloud encounter, the immediate operation of engines and aircraft systems is not anticipated to be adversely affected.
- However extended or repeated exposure is anticipated to result in engines and airframe/systems contamination. Separate information is planned to be released for maintenance personnel awareness.

3. OPERATIONAL RECOMMENDATIONS

- Although forecasting the horizontal and vertical extension of the contaminated areas (using usual meteorological forecasting models) appears to be largely impeded by the particular nature of the smoke emission as well as by factors such as convection or turbulence, records should be established and kept up-dated gathering any available information regarding the extension or variations of the contaminated area.
- Flight into areas of known crude oil smoke contamination should be avoided, mainly during night time or day time IMC, as crude oil smoke may not be visible.
- Crude oil smoke being composed of small particles, the weather radar should not be relied upon for detection as no weather radar return is to be expected.
- Should a crude oil smoke cloud be encountered, the flight crew should be alert to consider the following procedure steps, as required by particular conditions :

CREW OXYGEN MASKS/
SMOKE GOGGLES . . . . AS REQUIRED

- As smoke/fumes may be present in the cockpit and result in breathing disconfort and/or eyes irritation.

PASSENGER OXYGEN . . . . . . AS REQUIRED

- No breathing difficulties are anticipated except, depending on contamination, for passengers with known breathing deficiency.

ENGINE PARAMETERS . . . . MONITOR

- Although limited exposure is not anticipated to affect the engine inlet sensors and, consequently, the compressor stability and fuel control functions.

- Any parameter shift should be reported in log book for maintenance awareness and action.

- Flight crew should be also aware of the possible following conditions and alert to react, as required :

  - one or several smoke warnings triggering as a result of contamination within the air conditioning system,

  - unreliable airspeed indication, due to pitot/static system contamination,

  - reduced VHF communication range and/or VHF interference caused by incorrect static discharge due to accumulation of greasy particles on the aircraft skin,

  - reduced visibility due to oily deposit and carbon particles collecting on the windshields.

- When operating in areas contaminated with crude oil smoke, a particular attention should be paid to the following areas, during the normal aircraft walkaround inspection, for any evidence of oily deposit and/or carbon particles contamination :

  - radome,
  - windshields,
  - airframe probes and sensors,
  - engine fan blade and inlet probes and sensors.

- In case of finding or doubt, maintenance determination/confirmation should be called for, and maintenance action taken, as required.

4. FOLLOW-UP

- The above background and recommendations are provided on the basis of preliminary information being available regarding crude oil smoke and its potential effects on aircraft operation.

- This FCOM BULLETIN will be complemented and/or revised, as dictated by in-service experience.

A310 FCOM BULLETIN

N° 805/1
DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : RADIO ALTIMETER FLUCTUATIONS ON CONTAMINATED SURFACE
Subject extracted from former FCOM Bulletin N° 05/2 – Subject N° 9
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM BULLETIN is to provide flight crews with background information and operational guidance regarding **radio altimeter fluctuations on contaminated surfaces** (ramp, taxiway, runway).

2. BACKGROUND INFORMATION

- Radio altimeter fluctuations on contaminated runways has been observed during both aircraft development and revenue service.
- Radio altimeter antenae and coaxial cables have been selected to minimize this phenomenon, although various degrees of fluctuations may be observed during :

  - aircraft parking,
  - taxi-in and taxi-out,
  - takeoff roll and landing-roll,

  due to :

  - parasitic reflections on contaminated surface and adjacent obstacles,

  or

  - water streaming, between antenae, along fuselage skin.

- However **the observed fluctuations do not occur when the aircraft is airborne**. This can be explained by :

  - The greater antena pulse reflection angle which minimizes the potential for parasitic reflections,
  - The flow-off phenomenon which wipes out any streaming water between radio altimeter antenae.

- the above is supported by experience in as much as whenever radio altimeter fluctuations have been observed :

  - at taxi-out and take-off : they stopped after lift-off,
  - at roll-out and taxi-out : they were not present during final approach and flare phases.

3. OPERATIONAL ASPECT

- Providing no red warning (red RA on PFD) is generated, the radio altimeter fluctuation can be attributed to the surface (ramp, taxiway, runway) contamination and the aircraft dispatched without maintenance action.

A310 FCOM BULLETIN

N° 806/2
DATE : MAR 06
File in FCOM 2.20
Issued by STLW

SUBJECT : FQI ACCURACY
Subject extracted from former FCOM Bulletin N°05/2 - Subject N°11

Applicable to : All aircraft

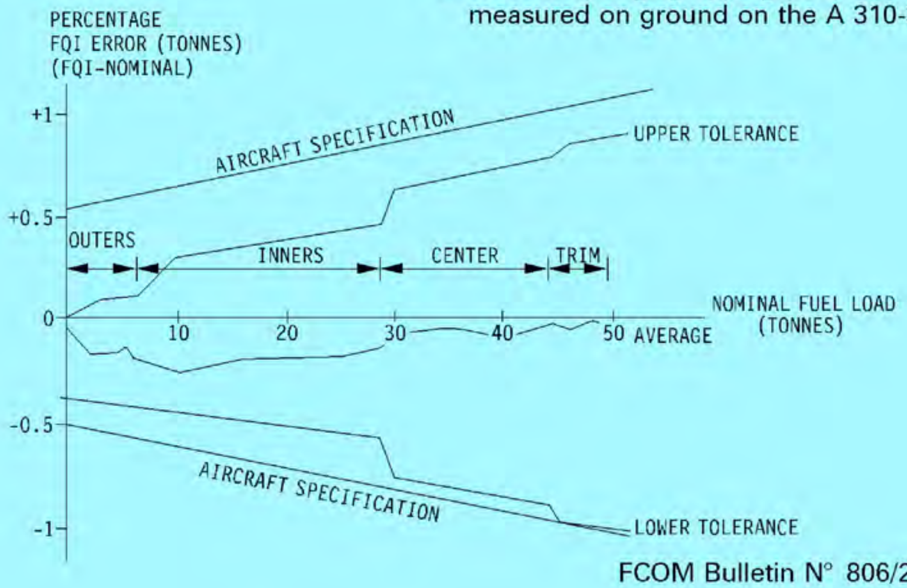
1. REASON FOR ISSUE

The purpose of this FCOM BULLETIN is to provide flight crews with background information regarding Fuel Quantity Indication (FQI) accuracy.
R The issue 2 of this bulletin is published to correct
R the tolerances of the FQI system.

2. BACKGROUND INFORMATION

R - The accuracy of the FQI system, whatever the
R aircraft is on the ground or in flight is ± 1% of
R the maximun tank capacity ± 1% of the actual
R fuel quantity.

- The tolerance of the fuel flow (FF) meter is ± 1%. The accuracy of the fuel used (FU) indication which is an integration of the FF is estimated to be better than ± 1.5%.
- The accuracy of the Magnetic Level Indicators (dipsticks) is approximately ± 5 %.
- APU fuel consumption is not included in the FU indication. It is always less than 185 kg/h.
- Each aircraft's calibration is checked to be within limits prior to delivery.
- As per regulation, each tank FQI will read zero at or before the tank is empty.
- The following graph gives the FQI errors measured on ground on the A 310-300 fleet.



- The graph shows :
  - All FQI errors are within the designed requirement.
  - Fuel on board quantity is generally higher than quantity indicated by FQI.
- All A310 A/C types show similar FQI errors.
- As a matter of good airmanship, crews check the fuel on board (FOB) plus fuel used (FU) against the block fuel during flight. Whereas this type of monitoring would detect fuel leaks, when used as a check on real fuel on board during the flight,the following inherent errors must be considered :
  - on BLOCK FUEL (error constant through flight) = ± 1 % of the max tank capacity ± 1 % of indicated Block Fuel.
  - on FU (error increasing during flight) = ± 1.5 % of Fuel Used.
  - on FOB (error decreasing during flight) = ± 1 % of the max tank capacity ± 1 % of the indicated Fuel On Board.

As an example :

- A/C max capacity : 50 tonnes
- Block fuel : 40 tonnes → error = ± 900 kg
- FOB : 10 tonnes → error = ± 600 kg
- FU : 30 tonnes → error = ± 450 kg

Thus in an extreme case :

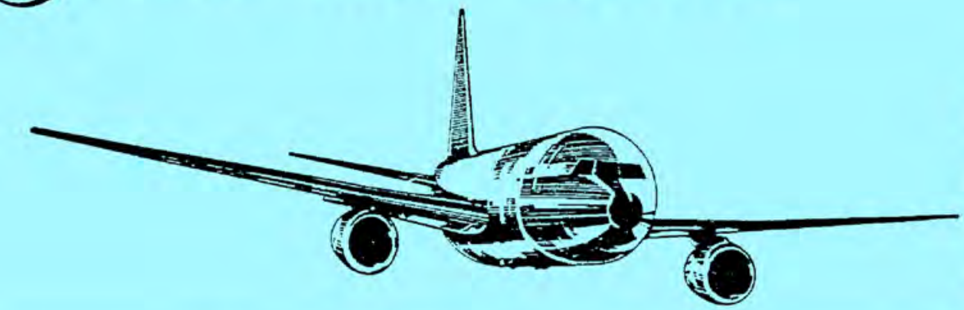
BLOCK FUEL = FOB + FU ± 1950 kg (+ APU FU if any)

and this with no system fault.

3. OPERATIONAL GUIDELINES

- In pratical terms, the Block Fuel maximum error may be reduced. This will depend on a responsible judgement based on knowledge of a particular A/C FQI calibration curve. I.e, assuming no FQI modification following A/C delivery, this curve will be reasonably constant (on ground) and thus for a given uplift, real error can be deduced. This calibration may be done by any operator when deemed necessary. Nevertheless it is not applicable to in-flight reading.
- Remember **max error on FOB is ± 1% of max gaugeable fuel quantity ± 1% of actual fuel quantity in flight.**
- **FU is the primary parameter to determine fuel consumption. (max error ± 1.5 %)**
- Dipsticks do not give a more accurate result than FQI and therefore **they should not be used to check FQI.** They only have to be used when FQI is inoperative.

A310 FCOM BULLETIN



N° 807/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : ENERGY LEVEL MANAGEMENT DURING APPROACH
Subject extracted from former FCOM Bulletin N° 06/2 – Subject N° 13
No technical change from previous issue

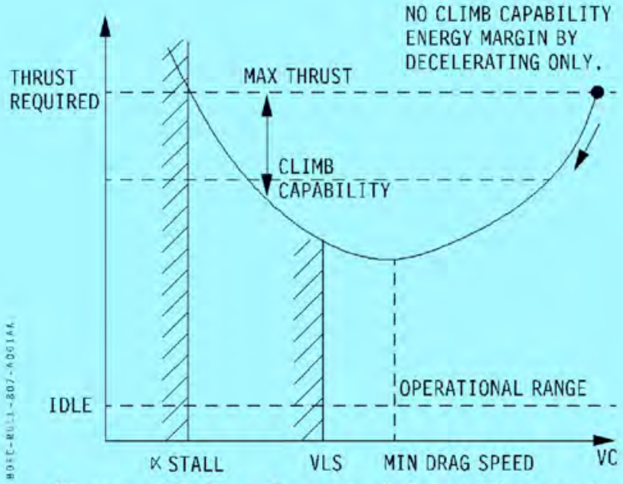
Applicable to : All aircraft

1. REASON OF ISSUE AND SCOPE

The purpose of this FCOM bulletin is to provide flight crews with background information and operational recommendations regarding the management of the energy level (primarily during approach).

2. BACKGROUND INFORMATION

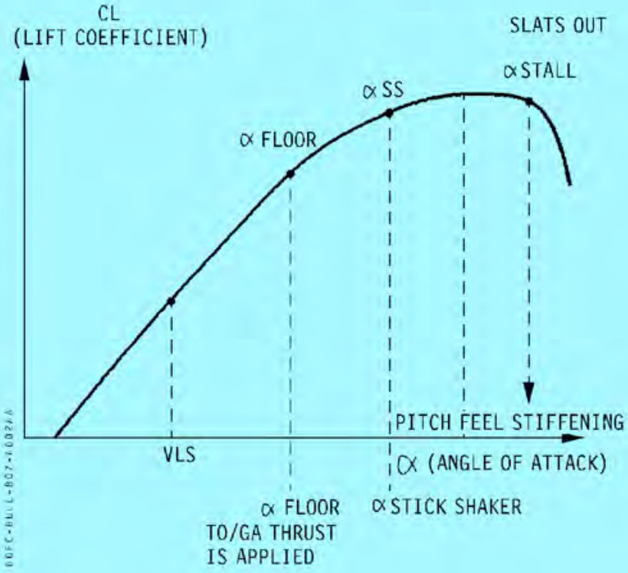
The following typical graph, generally valid for all airplane models, shows the evolution of the thrust required to compensate the drag. Speed becomes lower than VLS during the approach/landing phase.



At speed below the speed for minimum drag the thrust required to maintain level flight increases. At low thrust and speed below VLS there is no energy margin, the consequence could be a high rate of descent.

3. LOW SPEED ENVELOPE.

A310 is a conventional aircraft at low speed having a stall warning system, alpha floor and either good natural stall characteristics or enhanced characteristics provided by the FLC system dependent on configuration.



VLS : is the lowest limit of the normal flight envelope. It is defined as a margin with respect to the stall. VLS depends on A/C configuration and flight phase but it is not G - load dependent. For altitudes lower than 25 000 ft VLS is equal to 1.2 V_s at take-off or 1.3 V_s in other flight phases.

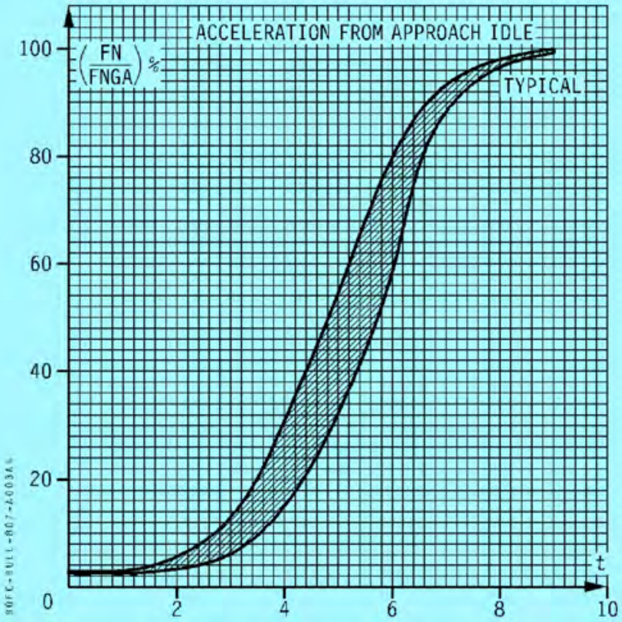
α floor : When the pre-programmed angle of attack is detected thrust latch (THRL) engages if autothrottle is armed. This function is available from lift-off to 100 ft radio altitude before landing.

V_{ss} : is the speed at which activation of the aural stall warning and stick shaker occurs. Vss is G-load dependent.

Stall warning does not prevent a loss of flight path manoeuvrability when the A/C is below normal operational speed. It is not designed to protect against a lack of speed monitoring during approach.

4 ENGINE RESPONSE NEAR IDLE

The following diagram shows a typical engine response to a quick throttle movement from idle to TO-GA in approach condition.

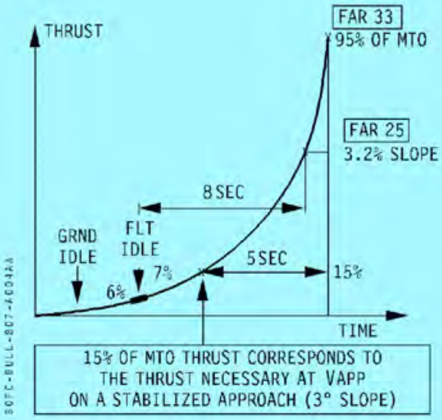


Engine response time from IDLE to achieve TOGA is about 8 seconds.

– Applicable certification requirements

There are 2 requirements relative to engine response, one being an engine certification rule (FAR 33), the other an aircraft certification rule (FAR 25/JAR).

The FAR 33 requirement specifies a time of 5 seconds or less to accelerate from 15 % to 95 % of the take-off thrust, without bleed air extraction. It must be noticed that current approach idle setting correspond to thrust levels of 6-7 % of maximum take-off thrust. This requirement is therefore not appropriate to our purpose.
The FAR 25 requirement says that the thrust achieved 8 seconds after an acceleration from idle should allow a rate of climb of at least 3.2%, in the landing configuration

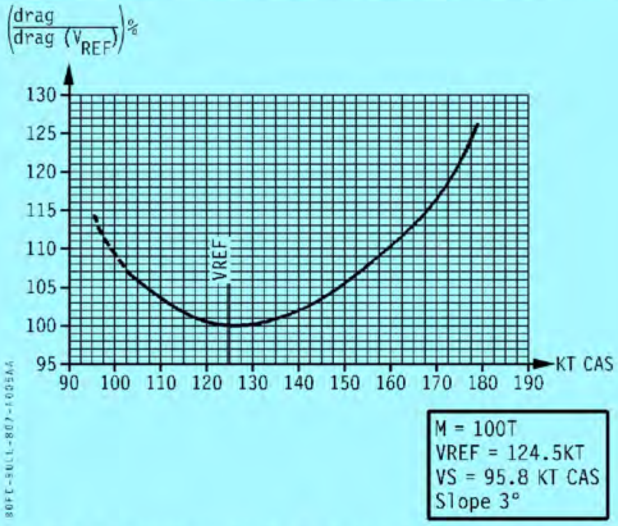


There is no requirement for the time taken to accelerate from idle to take off power.

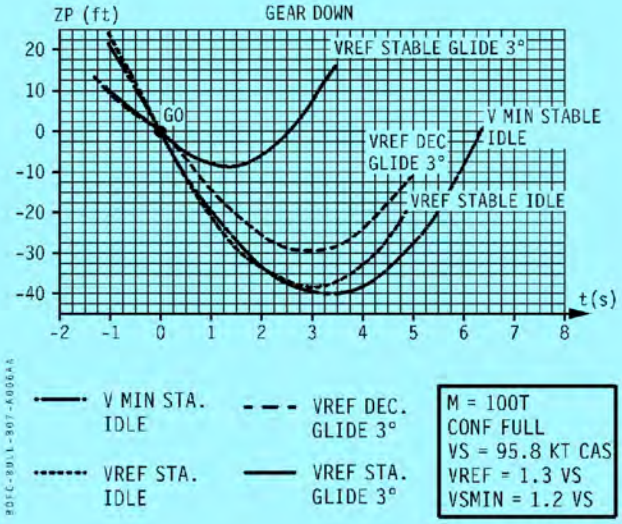
5 ENERGY

Approach at or below Vapp at idle thrust is potentially hazardous, since at this speed, there may be no energy available to alter the flight path so as to maintain or gain altitude until sufficient thrust is applied.

The following graph shows the effect on the drag when the speed becomes lower than Vref.



As a consequence this results in an increased altitude loss as shown below when thrust or speed are lower than normal, in order to regain a rate of climb.



6 CONCLUSIONS

- Regarding the above items :
  - When at very low speed (below normal operating speed) margin to keep the flight path will be decreased.
  - A very low speed and thrust during approach will result in a significant increase in rate of descent and consequently height loss.
  - Engine response time from IDLE to achieve TO-GA is about 8 seconds.

When flying at low altitude, speed must always be carefully monitored.

A310 FCOM BULLETIN

N° 808/1
DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : MMEL AND MEL USE
Subject extracted from former FCOM Bulletin N° 06/2 – Subject N° 16

Applicable to : All aircraft

1. 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.

2. 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 and approved by DGAC for non US operators and issued and approved by FAA for US operators.

3. FROM THE MMEL TO AN MEL

Regulation requires that each operator prepares and keeps current a MEL using the MMEL as a guide line. **The MMEL cannot in any case be used as a 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.

4. CONTENTS OF THE MEL

An airline's MEL should contain at least the following sections :

- The list of ECAM cautions/warnings associated with corresponding MMEL entries extracted from MMEL Section 00E.
- The list agreed/approved by relevant National Authorities of all equipment which may be inoperative for dispatch. This list is established using the approved section 01 of the MMEL.
- Associated Operational Procedures extracted from MMEL Section 02.
- Associated Maintenance Procedures extracted from MMEL Section 03 or AMM (Aircraft Maintenance Manual).

5. HOW TO USE AN MEL

When a failure is detected and identified, the crew must enter in the airline's MEL to determine if a subsequent dispatch is allowed and under which conditions.

- The 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 in para.6.).
  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 a * is associated with the item, inoperative equipment, component, system or function must be placarded in the cockpit.
- If a (o) is associated with the item, an operational procedure must be applied.

  Either on the ground or/and in flight, crew actions are required and described in the operational procedures section of the MEL.
- If a (m) is associated with the item, a maintenance procedure must be applied.

  On ground, before dispatch, maintenance actions are required and described in the maintenance procedures section of the MEL or in the AMM.

6. ATA 100 BREAKDOWN

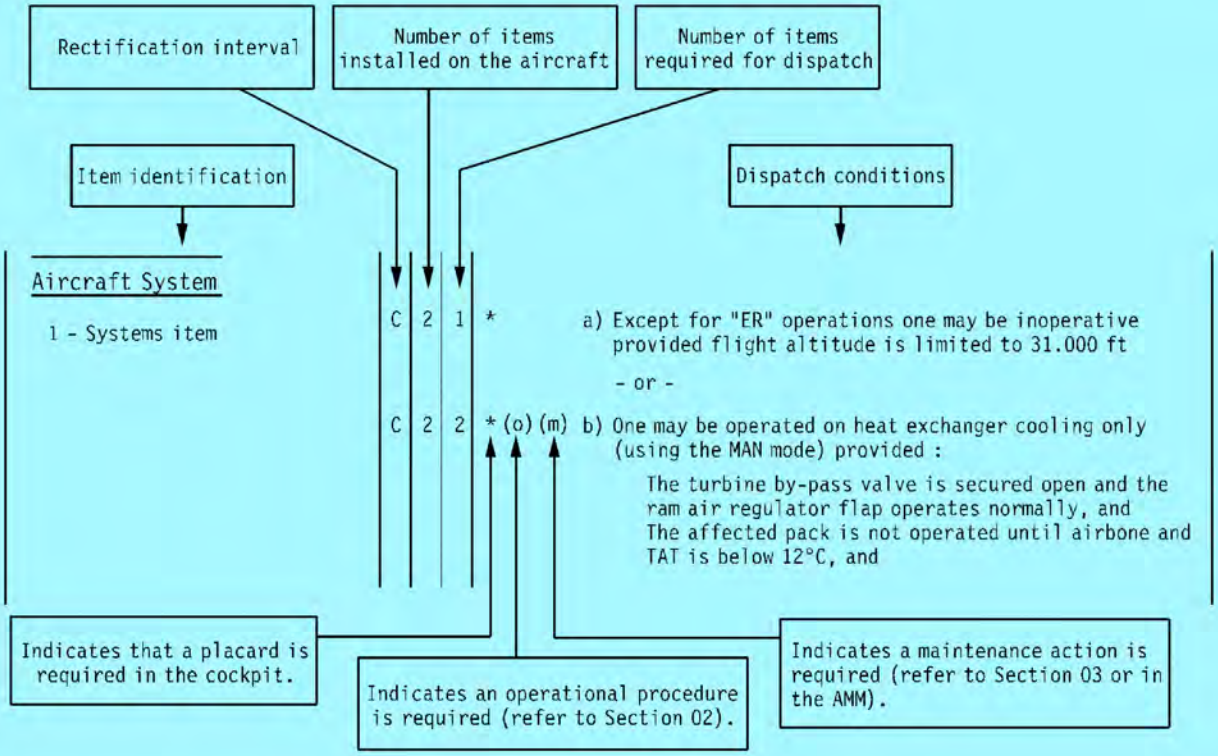
The ATA (Air Transport Association) breakdown is the official reference for the classification of airplanes systems and / or functions.

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 systems and functions classification in the ATA chapter.

Only the two first digits are used in the A310 MMEL. The list of ATA chapters is given in chapter 00 of the MMEL.

7. EXAMPLE



A310 FCOM BULLETIN

N° 809/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : CONFIGURATION DEVIATION LIST USE

Applicable to : All aircraft

1. REASON FOR ISSUE

During maintenance checks or during a preflight exterior inspection, it can be noticed that some airframe or engine parts of the aircraft may be missing or damaged. This does not systematically prevent from dispatching the aircraft under certain conditions. For secondary airframe or engine part missing, the dispatch authorization and associated conditions are provided by the Configuration Deviation List (CDL). This chapter of the Flight Manual is the reference for this kind of situation, as well as the MMEL is the reference for inoperative equipment or functions. This FCOM Bulletin summarizes the functioning and rules of the CDL.

2. PURPOSE OF THE CDL

The Configuration Deviation List is a part of the Flight Manual which allows the aircraft dispatch with secondary airframe or engine parts missing in order to avoid as much as possible delays and cancellations. As a part of the Flight Manual, the **CDL is approved by Airworthiness Authorities.**

Although the CDL belongs to the limitation chapter of the Flight Manual (Chapter 2), it is inserted in the appendix part of the A310 Flight Manual (in 6.03.00), as required by regulation. It may be included in the operator Dispatch Deviation Guide or Minimum Equipment List.

Associated to the dispatch authorization, the CDL provides operational restrictions (like performance penalties, weather condition restrictions...etc) and if necessary reference to maintenance actions that are to be applied before the aircraft dispatch.

3. HOW TO USE THE CDL

When a missing element of the airframe is detected, the crew must check in the CDL to determine if a subsequent dispatch is allowed and under which conditions.

Any part not included in the CDL must be considered as necessary for the flight. That is to say, the **dispatch is not authorized with a missing part that is not included in the CDL.**

All the items are listed following ATA chapter classification. An illustration is provided for information (the illustration is not approved by the Airworthiness Authorities) with each item in order to facilitate the identification and the location of the various aircraft parts.

If a "(m)" is associated with the item, a maintenance action must be applied before dispatch. The maintenance action is described in the AMM (Aircraft Maintenance Manual). Paragraph 8 gives an example of a CDL page with associated conditions.

4. REPAIR DELAY

When not specified, repairs must be made at the first airport where repairs or replacement of the item may reasonably be made. This allows a certain flexibility in the dispatch condition, however it must be kept in mind that flying under CDL is a deviation to the normal aircraft condition and that extending the period with a missing part may generate additional degradation which may require the aircraft to be taken out of service.

5. ACCUMULATION OF MISSING PARTS

- **No more than one part or one combination of parts of one system can be missing.**

This means that no more than one CDL item (that can be a group of parts of the same nature) or item combination is allowed per ATA chapter except if otherwise specified in the list.

- **Parts of different systems may be simultaneously missing.**

Items from different systems (ATA chapters) can be missing simultaneously except if otherwise specified.

6. PERFORMANCE PENALTIES

Performance penalties can be given as dispatch condition for some items. This paragraph explains how to handle them, especially in case of parts simultaneously missing.

- **Performance penalties are cumulative unless specific penalties for particular combination of missing parts are indicated :**

Example :

Item 1 missing involves a MTOW penalty of 150 kg.
Item 2 missing involves a MTOW penalty of 200 kg.
If item 1 and item 2 are missing simultaneously, the MTOW penalty is 350 kg.

- **If no performance penalty is indicated for an item, no more than three such items can be missing without taking further penalty. For each missing item, from the fourth, takeoff, landing, en route limiting weight must be reduced by 50 kg (100 lb).**

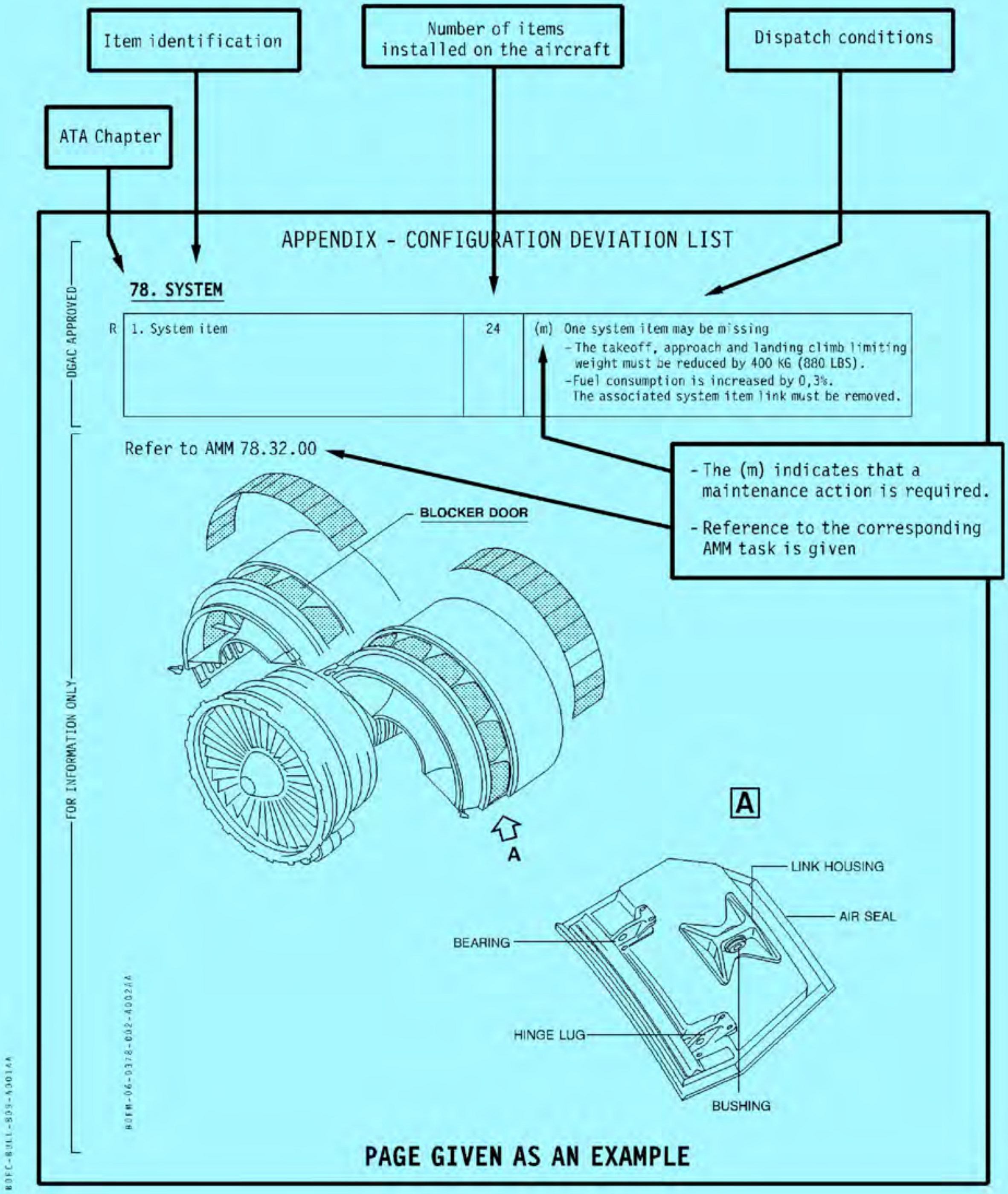
Example :

Item 1 missing but no performance penalty indicated. Same thing for item 2, item 3 and 4.
If items 1 to 3 are missing simultaneously, there is no penalty.
If items 1 to 4 are missing simultaneously, the penalty is then 50 kg.

7. DAMAGED PART

In case a part of the airframe is damaged but not missing, the damage tolerance must be checked in the AMM and in the SRM (Structure Repair Manual) for dispatch authorization. If the damaged part have to be removed, it may then be covered by the CDL to allow dispatch.

8. EXAMPLE OF CDL PAGE



APPENDIX - CONFIGURATION DEVIATION LIST

78. SYSTEM

R	1. System item	24	(m) One system item may be missing - The takeoff, approach and landing climb limiting weight must be reduced by 400 KG (880 LBS). -Fuel consumption is increased by 0,3%. The associated system item link must be removed.

Refer to AMM 78.32.00

- The (m) indicates that a maintenance action is required.
- Reference to the corresponding AMM task is given

PAGE GIVEN AS AN EXAMPLE

A310 FCOM BULLETIN

N° 810/1

DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : WINDSHEAR PHENOMENON
Subject extracted from former FCOM Bulletin N° 06/2 – Subject N° 17

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

The purpose of this FCOM BULLETIN is to provide flight crews with summarized information regarding the windshear phenomenon.

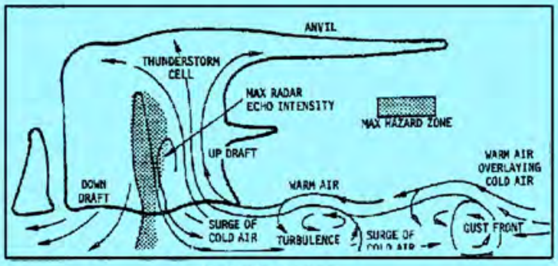
2. METEOROLOGICAL CONDITIONS

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.

2.1 Windshear associated with convective clouds and storm cells

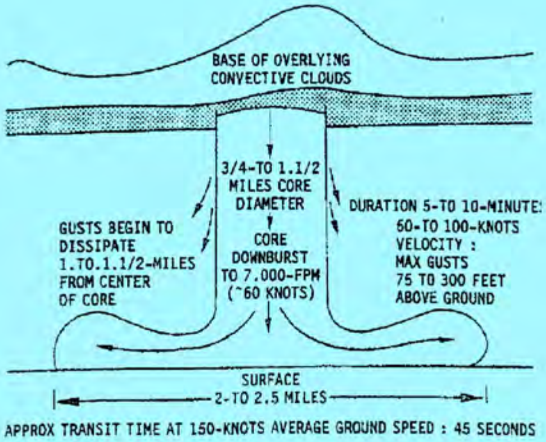
- The air-mass thunderstorm develops from localized earth surface heating with air rising and cooling to form cumulus clouds. As these keep growing, heavy rain and hail precipitation begins to develop in the higher areas thereby cutting off the updraft energy source and eventually dissipating the thunderstorm cell. A surge of cold air emerging from the heavy rain and associated downdraft can produce :
  . a downburst, i.e. strong downdrafts inducing an outburst of damaging winds on or near the ground,
  . a gust front with blowing dust on the earth surface,
  . a shear boundary with turbulent flow due to interaction with the warm, undisturbed environmental air,



Air-Mass Thunderstorm

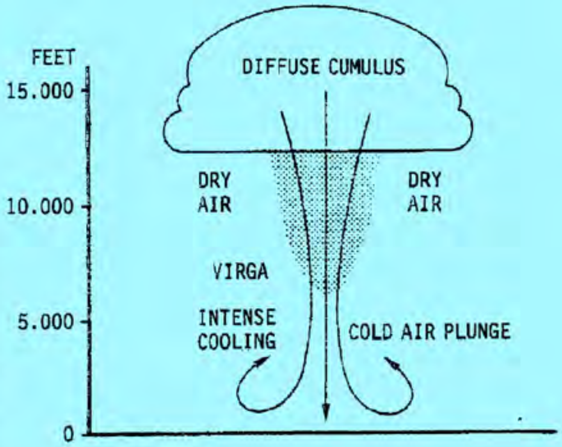
BOFC-BULL-810-A001AA - R

- 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.
- Microburst consist of intense, no rotating, highly localized downward airflows with velocities up to 7 000 ft/min that may emanate below a convective cloud base. Some of these microbursts will expose penetrating aircraft to major safety hazards whatever technique is used in anticipation / reaction.



Wet Microburst Cross-section

Microbursts can take 2-5 minutes to develop maximum intensity and may then be sustained for an equal period of time. They tend to develop in groups which may be merged delaying dissipation to 30 minutes. Present knowledge contends that approximately one in a hundred heavy rain thunderstorms produce microbursts. It was determined that microbursts can also occur in relatively dry conditions. Once it gains sufficient downward momentum a downflow with evaporative cooling accelerates to the earth's surface to induce a «dry microburst» with very light or non-existant precipitation, called virga. «Wet microbursts» are expected to occur in the wet regions of the world. Dry microbursts are commonly seen in the dry areas and most likely below cumulus cloud when dew point is 30° C or more below ambient temperature.



Changes in meteorological conditions associated with both macro and microbursts tend to be very complicated.

CONDITIONS	MACROBURSTS	MICROBURSTS
Air temperature	: ISA + 15° decreasing	ISA + 15° increasing or decreasing
Dew point spread	: increase (20-40°C)	increase (20-40°C)
Surface pressure	: rise or fall (up to 2/3 mb)	rise of fall (up to 2/3 mb)

2.2 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 results 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 ft AGL.

The magnitude of the windshear may become significant when :

. The temperature difference accross 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.

2.3 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 accross an inversion may trigger very variable wind conditions.

3. DETECTION OF CONDITIONS

3.1 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 actual 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 lift off up to 1000 ft RA.
- at landing, from 1000 ft RA down to 50 ft RA.

3.2 BRIEFING AND PREPARATION

a) ANALYSE the weather informations during preflight :

- . weather messages provided by the airline,
- . aviation surface observations,
- . NOTAMS,
- . SIGMETS, particularly convective sigmets,
- . terminal forecasts,
- . area forecasts, possibly mentionning the Low Level Wind Shear Alert System (LLWSAS) installed on the periphery of certain airports (USA only).

b) BE AWARE of pilot reports (PIREPS) on wind shear. PIREPS should include :

- . location of shear encountered,
- . altitude of shear encountered,
- . airspeed changed experienced (knots gained or lost)
- . type of aircraft undergoing the shear,

Note : *It is also strongly recommended that pilots 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, cumulonimbus mammatus and altocumulus.

d) DO NOT IGNORE the existence of other types of windshear due to local obstructions, topographical and meteorological conditions described in 3 c).

Note : *It is critical for pilots to realize that each particular windshear observational evidence should be considered cumulative : simultaneous conditions may increase severity of effects.*

e) EXAMINE the approach or takeoff area with the airplane weather radar to determine whether thunderstorm cells are in the vicinity of the airport or intended flight path,

- . Since areas having high rainfall rates are ordinarily accompanied by turbulence, radar echoes from precipitation can be associated with turbulence, especially for thunderstorms with small lines, tornadoes, protruded fingers, V-shaped targets and scalloped edges,
- . in some instances the radar echoes may be severely attenuated in passing through large areas of moderate rainfall rate, small areas of high rainfall rate or dry hail (no liquid coating for reflection),
- . since radar echoes are due to precipitation reflection, dry environment situations and conditions to dry microbursts may not be detectable by weather radar ;
- . flight operations below 10000 ft such as takeoff 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.

f) MONITOR closely the airplane instruments whenever windshear is suspected :

. any rapid change in the relationship between airspeed and groundspeed represents a windshear ; the IRS installed on the aircraft allows to compare airplane groundspeed with its airspeed, both displayed on the ND's.

. airspeed tendency :
 - acceleration in headwind / updraft,
 - deceleration in tailwind / downdraft,

indicated by a pointer arrow starting from the speed symbol on the PFD's,

. direction and intensity of wind (computed by the IRS and displayed on ND's) allows to compare 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 stick shaker speed (shown by a red and black strip along the speed scale of the PFD's),

. vertical deviation of flight path vector (FPV) bird symbol (displayed on the PFD's and calculated by the IRS) when below the horizon line means the aircraft's flight path is converging toward the ground,

. 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,

. wind correction angle needed to keep the localizer or VOR needle centered and giving an indication of the wind direction :
 - increasing yaw right / roll left, left with increasing crosswind left,
 - increasing yaw left / roll right, right with increasing crosswind right,

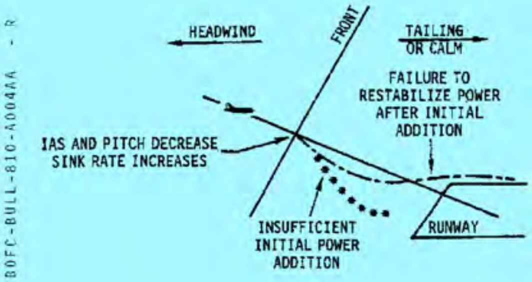
. power needed :
to hold the glideslope :
 - less power necessary suggesting a strong tail wind,
 - more power necessary suggesting a strong headwind,
to hold a climb angle :
 - less power necessary suggesting a strong headwind,
 - more power necessary suggesting a strong tailwind,

4. INFLUENCE OF WINDSHEAR ON AIRCRAFT PERFORMANCE

4.1 Decreased performance

Headwind to tailwind
Headwind to calm
Calm to tailwind
Headwind to decreased headwind.

APPROACH WITH A TAILWIND SHEAR



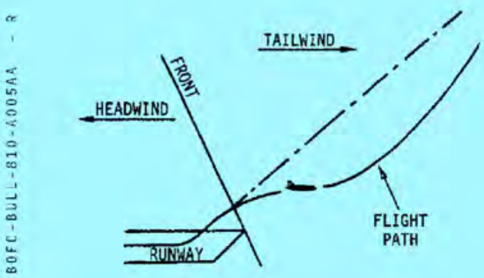
. Airspeed decreases, lift decreases,
. Aircraft nose begins to pitch down,
. Aircraft begins to drop below the glide slope,
In this case the Aircraft is both slow an low in a « power deficient » state.

Consequences :

. either the pilot pulls the nose up to recapture the glide slope without having added sufficient power : the Aircraft will loose altitude very rapidly and may even reach the ground before the power deficiency is corrected resulting in a hard landing.

. or sufficient power is set to regain the glideslope before reaching the ground : the « double reverse » problem arises 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.

TAKEOFF WITH A TAILWIND SHEAR



. Airspeed decreases, lift decreases,
. Aircraft nose begins to pitch down,
. Aircraft drops below its nominal flight path,

Consequences :

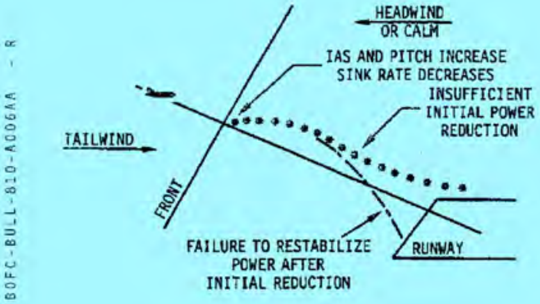
Because of aircraft inertia, attitude and ground speed will be initially maintained upon encountering windshear but airspeed will decrease, causing a reduction in lift which will result in a downward acceleration and a nose down pitching moment.

Assuming 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 different flight path below the nominal one.

4.2 Increased performance

Tailwind to headwind
Calm to headwind
Tailwind to calm
Headwind to increased headwind

APPROACH WITH A HEADWIND SHEAR



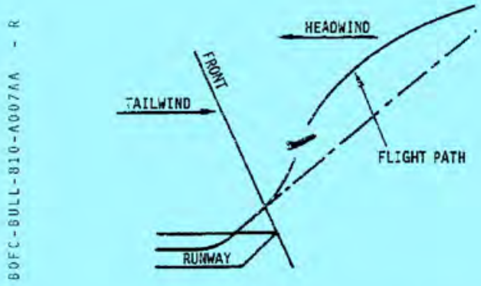
The reverse of the previous case prevails :
. airspeed increases, lift increases,
. Aircraft nose begins to pitch up,
. Aircraft balloons above the glide slope,
In this case the Aircraft is both fast and high in a « power excessive » state.

Consequences :

. either the pilot does not initially reduce power and the aircraft will gain altitude and airspeed resulting in a long, fast landing and the possibility of an overrun.

. or the pilot reduces thrust to regain the glideslope and the initial airspeed : the « double reverse » problem arises if throttles are not re-opened leading to a high sink rate and possibly a short and hard landing.

TAKEOFF WITH A HEADWIND SHEAR



The reverse of the previous case prevails :
. airspeed increases, lift increases,
. Aircraft nose begins to pitch up,
. Aircraft rises above its nominal flight path

Two more comments should be made

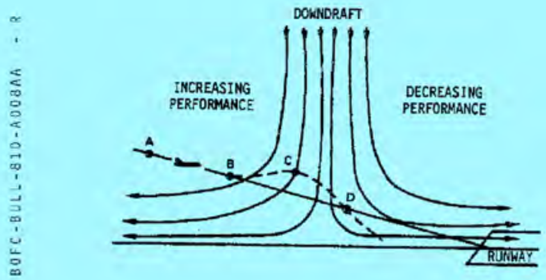
. A headwind shear should not cause a problem since it normally leads to increased aircraft performance.

. The resulting increase in lift may however lead to an excessive angle af attack which could eventually trigger stickshaker activation.

4.3 Increased performance followed by decreased performance

Downdraft + tailwind shear

APPROACH THROUGH MICROBURST



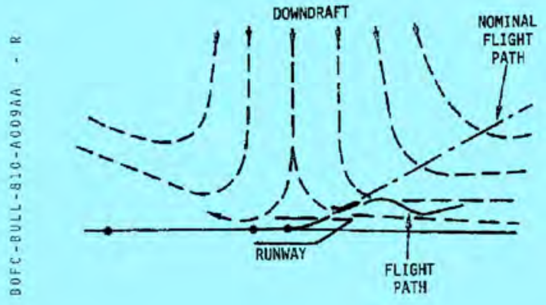
- . at point A the aircraft is on speed and on glide slope.
- . at point B it encounters an increasing headwind. Its airspeed and pitch increases and it balloons above the glide slope.
- . at point C the « moment of thruth » occurs :

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 consequences are that sink rate becomes rapidly excessive and that ground impact becomes very difficult to avoid.

Consequences :

- . a go-around initiated at point C or sooner would probably be successful since the aircraft is fast and high at this point,
- . gradual groundspeed decay shortly after point B coupled with rapidly increasing airspeed could have allowed detection of impending signs of downdraft,

TAKEOFF THROUGH MICROBURST



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

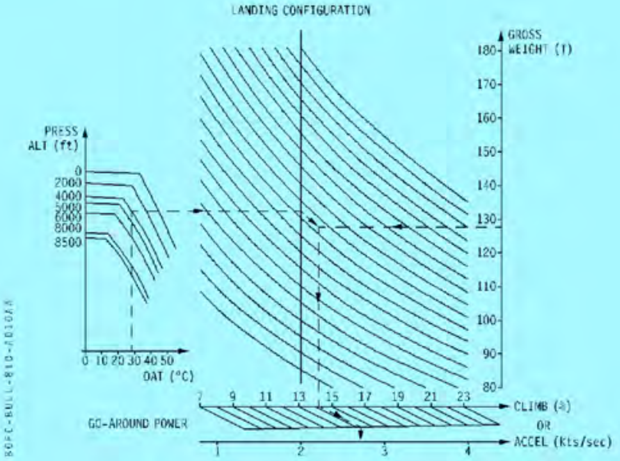
Consequences :

- . Initally the pilot may not appreciate fully 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 a microburst the angle of attack is instantly decreased causing an immediate loss of lift. As the A / C accelerates downward, the relative wind is altered restoring the angle of attack. R

4.4 Climb and acceleration capability

- Engine-out capability provides twin engine aircraft with a thrust / weight ratio that permits very ample aircraft response to windshear conditions. At typical initial climb, approach and go-around speeds, an aircraft may require 20 to 30 seconds to clear the distance affected by most severe windshear effects. Optimum use of the aircraft's climb and acceleration capability has to be negotiated over this time span to counter the loss of height or lift in the encounter.
- This section graphically discusses an aircraft's ability to withstand windshear through optimized use of its climb and acceleration capability. Control of pitch attitude and full thrust allows management of this by trading airspeed margin for altitude down to stick shaker in extreme case.
  Level flight acceleration capability can be compared directly to horizontal windshear. In the following graphic example (GW = 126.7 T, OAT = 27°C, Press. Alt. = 4 000 ft, VAPP = 145 kts) the aircraft has the capability to maintain level flight in a 2.7 kt / s increasing tailwind shear and will eventually be accelerating relative to the ground at 2.7 kt / s with constant airspeed. If the horizontal shear exceeds the level flight acceleration capability the aircraft will lose airspeed and descend unless pitch attitude is increased to change angle of attack.

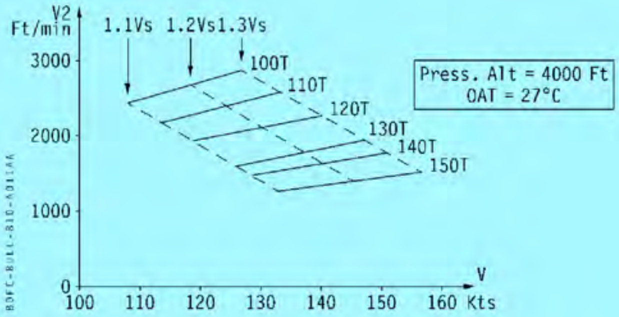
CLIMB GRADIENT OR LEVEL FLIGHT ACCELERATION CAPABILITY



Likewise, climb gradient capability at constant airspeed can be compared directly to a downdraft. In the example just referred to the aircraft has the capability to maintain level flight in a 2 040 ft / min downdraft without any airspeed change. If the downdraft exceeds this climb gradient capability the aircraft will descend unless pitch attitude is increased to adapt angle of attack.

As illustrated below, climb gradient capability can be maintained at a marginal loss by bleeding off airspeed until a maximum pitch attitude of 17.5°.

CLIMB GRADIENT MAINTAINABILITY



- In practice, windshear conditions will very often be a combination of horizontal an vertical shear components. This will make it necessary to establish a tradeoff between climb gradient and acceleration requirements.

  Note : Refer to the procedures in« PROCEDURES AND TECHNIQUE » INCLEMENT WEATHER OPERATION

A310 FCOM BULLETIN

N° 811/1
DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : PREVENTING UNNECESSARY ENGINE IN-FLIGHT SHUTDOWNS
Subject extracted from former FCOM Bulletin N°07/2 – Subject N°19

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- This FCOM BULLETIN has been reissued for the following reasons :
  - Incorporation of former FCOM BULLETIN N° 05/2 - Subject N° 7 **LOSS OF ENGINE PARAMETER INDICATION** in Paragraph 5 of this FCOM BULLETIN.
  - References have been updated (FCOM pages, FCTM pages, ...)
- The purpose of this FCOM BULLETIN is to foster the concept of PREVENTING UNNECESSARY ENGINE IN-FLIGHT SHUTDOWNS by :
  - creating the required **industry mindset,**
  - providing airlines management and flight crews with an **enhanced awareness** and **understanding** of engine related indications and their relation to engine malfunctions,
  - providing flight crews with **amplified guidelines** for **fault validation** through the cross-check and/or monitoring of other engine parameters.
  - providing flight crews with **enhanced procedures** to **maximize the engine recovery or restartability.**
- Before proceeding any further, it should be emphasized that the above concept is **not** intended :
  - to encourage flight crews to deviate from the published procedures and guidelines,
  - to restrict, in any manner, the flight crew authority to take a conservative precautionary decision, depending on the prevailing circumstances and/or available clues.

2. BACKGROUND INFORMATION

- In the frame of ETOPS activities, all IFSD events are thoroughly analyzed. **Design, maintenance and operational factors are equally investigated.**
- The typical operational factors being evaluated are :
  - **crew awareness** : symptoms, indications, warnings.
  - **action guidance availability and adequacy** :
    - * ECAM procedure,
    - * Paper check-list (QRH) additional procedural steps or information,
    - * Advisory conditions guidelines,
    - * Operations Engineering Bulletins (OEB),
    - * Background information (FCOM).
  - **crew decision/action** compliance with the published procedure.
  - **engine restartability** aspect.

- Along these lines, so as to minimize the number of IFSD events and meet the goal of 0.02 total IFSD rate per thousand hours, required for ETOPS operation with 180 minutes diversion time, an **In-Flight Shutdown team** was created by one engine manufacturer, gathering specialists from the engine and airframes manufacturers, as well as customer airlines.
- This FCOM BULLETIN provides a synthesis of the actions taken, as a result of these activities, in terms of :
  - **Operational documentation,**
  - **Flight crew training policy.**
- Whenever directly applicable or transferable, the decisions taken have been extended to other engines types and models. **The material contained in this FCOM BULLETIN, as well as the corresponding procedures or recommendations changes, are therefore applicable to all engine/airframe combinations.**

3. ABNORMAL PROCEDURES (FCOM 2.05.70)

- **ENGINE STALL** :
  - The published procedures have been entirely re-assessed, and revised, as required, to **enhance surge margin augmentation** and **surge recovery** by considering :

    * priority steps,

    and

    * conditional steps.
- **ENGINE FAIL** :
  - The published procedure and associated expanded information has been revised to consider a **possible normal windmilling or starter assisted relight,** using the ENG RESTART IN FLIGHT procedure, if the flame out was due to external causes (e.g. massive rain ingestion) and/or **if no damage is suspected.**
- **ENG OVER LIMIT** :
  - The published procedure applicable to the JT9D-7R4 and PW 4000 engines has been revised to reflect a **simplified concept,** considering only **two options,** as follows :

    * the engine parameter(s) can be returned and maintained within limits : normal engine operation may be resumed to next landing.

    or

    * the engine parameter(s) cannot be returned or maintained within limits : if conditions permits, the engine must be shutdown.
- **ENG RESTART IN FLIGHT** :
  - The published procedure has been revised with the concern of **maintaining the aircraft pressurization,** by re-opening the pack valves, in case of unsuccessful restart attempts.
- **ENG OIL LO PR** :
  - The published procedures are being revised so as to enhance the **confirmation of the OIL LO PRESS condition** by the OIL PRESS reading, prior to initiating the ECAM procedure for engine shutdown.
  - The ECAM conditional step :

    ■ IF OIL PRESS BELOW XX PSI :

    Has been amplified by incorporating the following expanded information :

    - **If the low oil pressure condition (OIL LO PRESS local warning light and ENG OIL LO PR ECAM procedure) is not confirmed by the OIL PRESS reading on the RH ECAM ENGINE page, continue normal operation while monitoring the OIL PRESS reading and other engine primary and secondary parameters (a low oil pressure switch defect may be suspected).**
  - **The first step of the guidelines, associated with the ADVISORY condition (OIL PRESS < YY PSI), in FCOM 2.05.90 has been correspondingly refined as follows :**
    - **If the OIL LO PRESS local warning light and associated ENG OIL LO PR ECAM procedure are note activated, continue normal engine operation (an oil pressure transmitter defect may be suspected).**
- **ENG OIL TEMP HI** :
  - The published procedures have been re-evaluated with a view of possibly **confirming the ENG OIL TEMP HI,** by cross-check and monitoring of other engine parameters.
  - The engineering analysis conducted confirmed by development testing, evidenced **two different oil temperature responses** to engine malfunction, thus dictating **two different ENG OIL TEMP HI procedure concepts,** as follows :

  - **Pratt & Whitney engines** : the engine oil temperature may be the first and/or only engine parameter to reflect an engine malfunction or impending failure and, hence, the engine shutdown is warranted should the sole OIL TEMP exceeds the transient or maximum certified limits.
    The procedure concept remains unchanged.
  - **General Electric engines** : the engine oil temperature will not be the first nor the only engine parameter to reflect an engine malfunction or impending failure. Taking credit of this feature, a **more flexible procedure concept** has been developed to allow the **confirmation of the ENG OIL TEMP HI condition, by cross-check and monitoring of other engine parameters,** prior to initiating the engine shutdown procedure.

4. ADVISORY CONDITIONS (FCOM 2.05.90)

- The table of ADVISORY CONDITIONS related to the ENGINE (FCOM 2.05.90) has been entirely re-written so as to emphasize the following features of the **ADVISORY concept :**
  - The ADVISORY concept is meant for **crew awareness** (attention getter) and **monitoring.**
  - The guidelines associated with ADVISORY conditions are meant to **assist rather than direct** the crew decision and action.
- Along these lines, the existing guidelines have been amplified so as to enhance :
  - The **fault condition validation** through cross-check and monitoring of :
    - affected engine other parameters and behaviour,
    - opposite engine parameters.
  - Further **parameters monitoring.**

5. LOSS OF ENGINE PARAMETER INDICATION

- An engine parameter may be lost or become blanked as the result of either :
  - an hardware discrepancy (sensor/probe, connector/terminal block, wiring harness, ...),

  or

  - a failed indication software check (case of engine parameter signals being processed by the FADEC or by an electronic indicator).
- The loss of engine parameter indication may affect any one of engine primary or secondary parameters, such as :
  - EPR (as applicable);
  - N1 or N2,
  - EGT.
- Should an engine parameter indication be lost or become blanked, without any other indication and/or evidence of engine malfunction, the engine can be operated normally for the remainder of the flight.

6. FCOM BULLETINS

- Two FCOM BULLETINS topics address issues originating from the IFSD related activities :
  - **SUBJECT N° 812 : ENGINE LACK OF THROTTLE RESPONSE**
  - **SUBJECT N° 813 : ENGINE LOSS OF THROTTLE CONTROL**

SUBJECTS N° 812 and 813 segregate the **lack of throttle response** (engine response aspect) from the **loss of throttle control** (throttle control mechanical or electrical system operation).

They extend the scope of the topic to the less frequent occurrences of :

- **engine auto-acceleration,**

or

- **engine failing to decelerate** in response to a throttle retard command.

7. FLIGHT CREW TRAINING

- A cooperative effort was initiated to transfer the lesson learnt and messages stemming out of the IFSD related activities into the **airframe manufacturer's training programs.**
- So as to be fully efficient, the revised operational procedures, recommendations and guidelines must be highlighted to flight crews at **all stages** of their training :
  - Transition course,
  - Line training,
  - Reccurent training/proficiency checks,
  - ETOPS training.

- As far as operator's training programs are concerned, the following suggestions are offered for consideration :
  - **Transition training course** :
    - * The existing Simulator Drill Briefing Notes (or equivalent) should be expanded to **address and comment additional scenarios related to engine abnormal conditions.**
  - **Line training course**
    - * The training captain's briefings (pre-flight and cruise briefings) should be expanded to **address and comment the concept of PREVENTING UNNECESSARY IN-FLIGHT SHUTDOWN** (while confirming the flight crew authority to take a conservative precautionary decision, should prevailing circumstances and/or available clues so dictate).
  - **ETOPS training course**
    - * In addition to the above suggestions, a particular emphasis should be placed on the **management of ADVISORY conditions.**

8. IN-SERVICE EXPERIENCE REPORTING

- The IFSD events, as well as other operational or engineering issues with operational repercussion, are periodically addressed in the following documents :
  - A310 **Quaterly Service Reports,** issued by the Product Support-Service Engineering department,
  - A310 **Technical Follow-Up (TFU)** system, issued by the Product Support–Technical Support department.
- These documents are forwarded to each operator's engineering department and are also **available form the local AIRBUS Field Service office.**
- **Inter-offices procedures** have been set-up so as to **enhance the use of the TFU system,** for **operational events** and **engineering issues with operational repercussion**, by providing :
  - a **detailed description** of the **phenomenon** and **operational repercussions.**
  - a **detailed cross-reference** to the applicable **operational recommendations** (FCOM, MMEL, OEB, FCOM Bulletin).

9. CONCLUSION

- Operators (Fleet captains, Training captains and individual flight crews) are encouraged to thoroughly **consider** the above material, in conjunction with the various referenced, documents, and largely **promote** (whenever and wherever applicable) the various **concepts, procedures, recommendations** and **guidelines** stemming out of the continued analysis of IFSD events.

A310 FCOM BULLETIN

N° 812/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : ENGINE LACK OF THROTTLE RESPONSE
Subject extracted from former FCOM Bulletin N°07/2 - Subject N°20
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM BULLETIN topic is to provide flight crews with background information, and understanding, as well as with operational guidelines, regarding the **lack of engine response to throttle lever command.**
- This bulletin :
  - segregates the **lack of throttle response** (engine response aspect) from the **loss of throttle control** (throttle control mechanical or electrical system operation) : this latter aspect is being developed in SUBJECT N° 813, hereafter.
  - describes the **engine operating characteristics during transient operation** (acceleration and deceleration).
  - extends the scope of the topic to the less frequent occurences of :

    * **engine auto-acceleration**,

    or

    * **engine failing to decelerate** in response to a throttle retard command.
- The following aspects are developed hereafter :
  - Background information,
  - Engine control basic operating characteristics,
  - Transient operation : engine acceleration and deceleration,
  - Factors affecting the engine acceleration capability,
  - Factors affecting the engine deceleration capability,
  - Operational guidelines.

2. BACKGROUND INFORMATION

- The lack of engine response to throttle lever command may be caused by a variety of system malfunctions or conditions, typically involving :
  - Fuel Control Scheduling,
  - Compressor Airflow Scheduling (Variable Stator Vanes operating off-schedule),
  - Gas path deterioration,
  - Operating conditions (Bleed load),
  - Environmental conditions (Rain, Hail or Sleet ingestion).
- Slow engine acceleration or lack of engine response to throttle lever command may result in a rejected take-off or in a precautionary in-flight shut-down.

3. ENGINE CONTROL BASIC OPERATING CHARACTERISTICS

- The basic operating characteristics of the engine fuel control system are defined by the following operating curves, drawn on **Figure 1,** in a "Fuel / Air Ratio versus N2" graph :

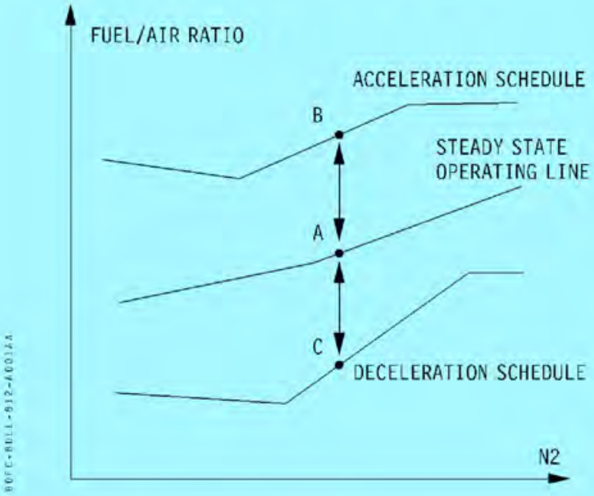


Figure 1

  - **Acceleration Schedule** : this curve defines the maximum fuel / air ratio (maximum amount of fuel) which can be delivered by the fuel control system, at a given N2.
  - **Deceleration Schedule :** this curve defines the minimum fuel / air ratio delivered by the fuel control system, at a given N2.
  - **Steady State Operating Line** (also refered to as the **Required-to-Run Line**) : this curve defines the fuel / air ratio (amount of fuel) required to sustain steady state (stabilized) engine operation, at a given N2.

- At given N2, the difference between the maximum fuel / air ratio which can be delivered by the fuel control system (**Point B** on the Acceleration Schedule) and the fuel / air ratio required to sustain steady state operation (**Point A** on the Steady State Operating Line) is refered to as the **Fuel Margin** and represents the engine acceleration capability :
  - **The greater the Fuel Margin, the higher the engine acceleration capability.**

- Conversely, the difference between the fuel / air ratio delivered to sustain steady state operation at a given N2 (**Point A** on the Steady State Operating Line) and the minimum fuel / air ratio which would be delivered when retarding the throttle lever (**Point C** on the Deceleration Schedule) represents the engine deceleration capability :
  - **The greater this difference, the higher the engine deceleration rate.**

4. TRANSIENT OPERATION : ENGINE ACCELERATION AND DECELERATION

- During an **engine acceleration** (refer to **Figure 2**, hereafter), as the throttle lever is advanced from **Point A** to **Point B**, the fuel/air ratio increases until the **Acceleration Schedule** is reached.
  As the engine accelerates, the fuel/air ratio follows the **Acceleration Schedule** until it reaches the **Governing Line** corresponding to the new throttle position. At that time, the fuel/air ratio decreases along this **Governing Line** until the engine stabilizes, **Point B**, in a new steady state condition.

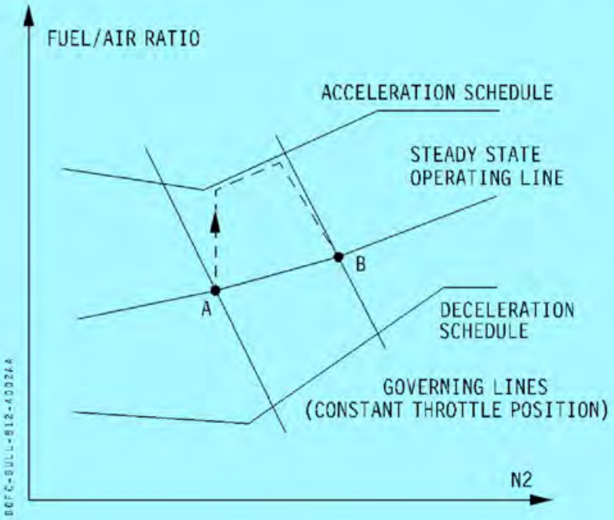


Figure 2

- Conversely, during an **engine deceleration** (refer to **Figure 3**, hereafter), as the throttle lever is retarded from **Point C** to **Point D**, the fuel/air ratio decreases until the **Deceleration Schedule** is reached. As the engine decelerates, the fuel/air ratio follows the **Deceleration Schedule** until it reaches the **Governing line** corresponding to the new throttle position. At that time, the fuel/air ratio increases along this **Governing line** until the engine stabilizes, **Point D**, in a new steady state condition.

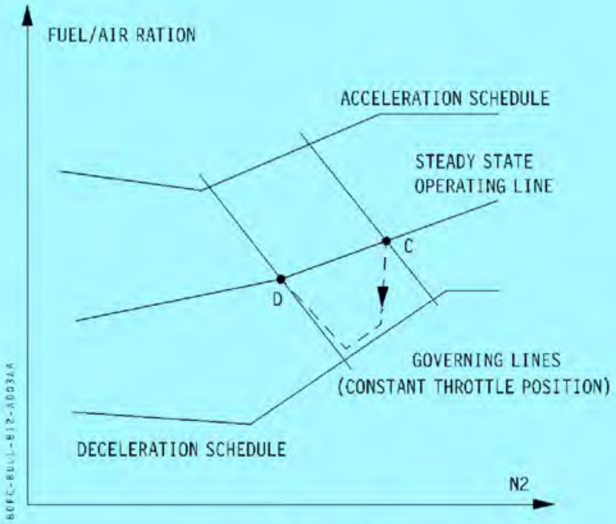


Figure 3

5. FACTORS AFFECTING THE ENGINE ACCELERATION CAPABILITY

- The engine "as new" acceleration capability (fuel margin) may come to be reduced as the result of variations in the respective positions of the Acceleration Schedule and the Steady State Operating Line, as follows (refer to **Figure 4,** hereafter) :
  - **Downward shift** (lean shift) **of the Acceleration Schedule**, possibly caused by :
    - * wear affecting the Acceleration Schedule mechanism (cam, cam follower,...) of the fuel control unit (applicable only to hydromechanical controls).
    - * mis-adjustment of the fuel density (specific gravity) selector on the fuel control unit.
  - **Upward shift of the Steady State Operating Line**, as the result of :
    - * Bleed load extraction : Nacelle Anti-Ice, Wing Anti-Ice, Fuel Heating (as applicable), Bleed air system leakage,
    - * Gas path deterioration,
    - * Massive water ingestion (e.g. rain, hail or sleet).

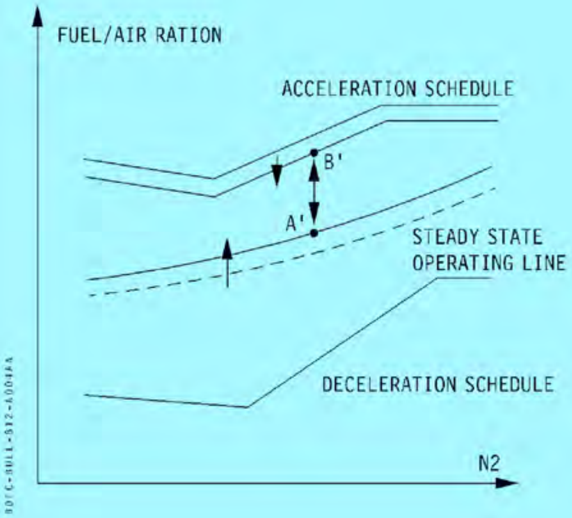


Figure 4

- Under extreme conditions (refer to **Figure 5**, here after), **the Steady State Operating Line may come to intersect the Acceleration Schedule** resulting in a zero, or even negative, fuel margin, with the following consequences on the engine operation :
  - **Zero fuel margin (Point A and A')** : Lack of acceleration upon throttle lever command, the engine remains hanging in its steady state condition,
  - **Negative fuel margin (Point B)** : engine auto-deceleration, usually refered to as Roll-back or Run-down, resulting in a thrust loss and, possibly, sub-idle operation or flame-out.

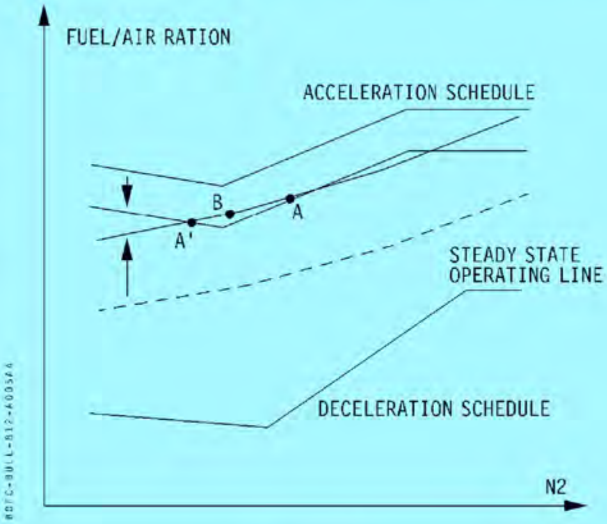


Figure 5

- **High altitude, low ambiant temperature, low Mach number** are operational factors also affecting the available fuel margin, at given engine condition.

- **Fuel filter icing** and / or **clogging** may also result in slow engine acceleration or lack of throttle response.

- Slow engine acceleration or lack of throttle response, when advancing throttle lever from the idle position, may be the result of the **idle setting being trimmed below the published limits.**

6. FACTORS AFFECTING THE ENGINE DECELERATION CAPABILITY

- The engine "as new" deceleration characteristics may happen to become altered as the result of variations in the respective positions of the Deceleration Schedule and the Steady State Operating Line, as follows (refer to **Figure 6**, hereafter) :
  - **Increased deceleration rate** (possibly resulting in deceleration surge events), due to the **downward shift (lean shift) of the Deceleration Schedule**, caused by :
    - * wear affecting the Deceleration Schedule mechanism (cam, cam follower, ...) of the fuel control unit (applicable only to hydromechanical controls).
  - **Decreased deceleration capability** (possibly resulting in the engine failure to decelerate in response to a throttle retard command) due to a **large upward shift (rich shift) of the Deceleration Schedule**, caused by :
    - * excessive wear or significant miss-rigging affecting the Deceleration Schedule mechanism of the fuel control unit (mechanical controls only).

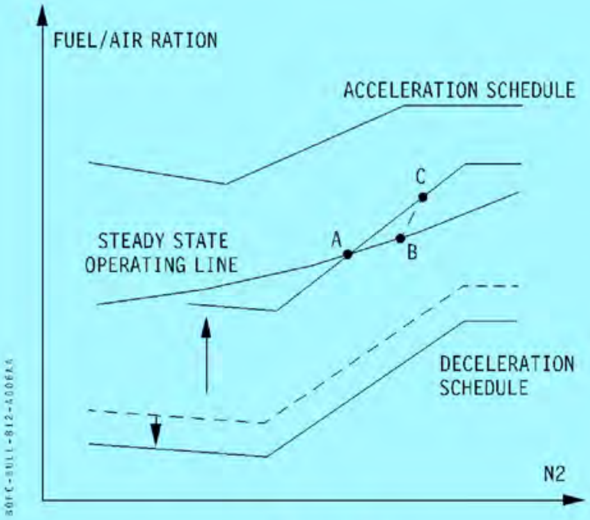


Figure 6

- Under extreme conditions, **the shifted Deceleration Schedule may come to intersect the Steady State Operating Line**, resulting in a **zero or negative deceleration capability**, with the following consequences on the engine operation :
  - **zero deceleration capability** (**Point A**, on **Figure 6**, here above) : **Lack of deceleration** in response to a throttle retard command,
  - **Negative deceleration capability** (**Point B**) : engine **auto-acceleration** until a new steady state condition (fuel/air ratio versus N2) is reached (**Point C**).

- Should one of the above infrequent conditions occurs, **the engine control may be regained by increasing the air bleed extraction** (i.e. selecting the ENG ANTI-ICE and WING ANTI-ICE to ON, selecting the airconditioning mode to normal flow).
  As indicated under § 5., increasing the air bleed load will shift the Steady State Operating line upward, possibly enough to provide sufficient margin to allow the engine to decelerate from its hung condition (Point A) or to limit the magnitude of the auto-acceleration (Point B).

7. OPERATIONAL GUIDELINES

- The **acceleration characteristics** of an engine exhibiting a slow acceleration or lack of throttle response may be enhanced by considering the following actions, flight conditions permitting :
  - reducing bleed air extraction,
  - reducing non-essential high load electrical users (e.g. galleys),
  - activating the fuel heating system, as applicable and only if fuel filter icing is suspected,
  - reducing altitude, (as the fuel margin increases with decreasing altitude),
  - increasing airspeed (recovery of a low idle hang-up condition),
  - minimizing the hydraulic demand (e.g. delaying the slats/flaps and/or landing gear extension) during the recovery attempt.

- Should the condition develop into a roll-back or flame-out, the ENGINE FAIL or BOTH ENGINE FLAME-OUT procedures should be referred to.

- The **deceleration characteristics** of an engine exhibiting a lack of response to a throttle retard command, or departing into an uncommanded auto-acceleration, may be enhanced by **increasing the air bleed load.**

- In case of lack of throttle response in an idle or above idle condition, **the engine can be kept operating** (so as to take benefit of the available electrical, hydraulic and pneumatic power services), **unless certified limits are exceeded.**

- Should the engine control be not recovered and the engine be in an out-of-idle condition, the engine should be shutdown for the approach and the SINGLE ENG OPERATION procedure applied (in accordance with FCOM ABNORMAL PROCEDURES).

A310 FCOM BULLETIN

N° 813/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : ENGINE LOSS OF THROTTLE CONTROL
Subject extracted from former FCOM Bulletin N°07/2 - Subject N°21
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM BULLETIN topic is to provide flight crews with background information and understanding, as well as with operational guidelines, regarding the possible **loss of engine throttle control in flight.**

2. BACKGROUND INFORMATION

- The loss of throttle control may be caused by a variety of system malfunctions or conditions, depending on the engine type of control, as follows :

  - Non-FADEC engines :

    * **throttle control freezing,** usually as the result of water ingress in the throttle control push-pull cable sheath and subsequent water freezing, in the un-heated portions of the cable routing (i.e. pylon area),

    * **throttle control jamming,** usually as the result of a push-pull cable over-temperature exposure (typically due to a bleed air leak in the vincinity of the cable routing),

    * **throttle control disconnection,** usually located at the level of the connection between the push-pull cable and the rack-box located on the fuel control unit (HMC or MEC).

  - FADEC engines

    * **disagreement between the two throttle lever resolver signals** (generated by the center pedestal-mounted resolvers and sent to the FADEC channels) :

      . **both signals disagree but are within a reasonnable range** : the FADEC select the **higher throttle position signal,** which may result in a power level in excess of the desired thrust setting.

      . **both signals disagree but one signal is out of reasonnable range** : the FADEC select the **other signal**, although the THROTTLE FAULT ECAM warning message and procedure are activated, the engine operation may not be affected.

    * **Loss of both throttle lever resolver signals to the FADEC** :

      . the FADEC will retain the **last healthy value of the throttle position signal(s)** and will set and freeze the thrust setting based on this value, thus resulting in a power level which may be higher or lower than the desired thrust setting.

3. OPERATIONAL GUIDELINES

- In the event of a loss of throttle control, the **applicable procedures** must be referred to, as follows :

  - **Non-FADEC engines : THROTTLE JAM,**
  - **FADEC engines : THROTTLE FAULT.**

- In flight, in case of a loss of throttle control in an idle or above-idle condition, **the engine can be kept operating** (so as to take benefit of the available electrical, hydraulic and pneumatic power services), **unless certified limits are exceeded.**

- Before approach, should the engine throttle control be not recovered and the engine be in an **out-of-idle condition,** the **engine should be shutdown** for the approach and the SINGLE ENG OPERATION procedure applied (in accordance with FCOM ABNORMAL PROCEDURES).

A310 FCOM BULLETIN

N° 814/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : UNDERSTANDING AND MANAGING THE FUEL TEMPERATURE LIMITATIONS
Subject extracted from former FCOM Bulletin N° 07/2 – Subject N° 22
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM BULLETIN topic is to provide flight crews with back ground information, as well as with operational guidelines, for a better **understanding and management of fuel temperature limitations.**

2. UNDERSTANDING THE PUBLISHED TAT OR FUEL TEMPERATURE LIMITATIONS

- The FCOM Vol. 2 OPERATING LIMITATIONS-SYSTEMS combines two completely different fuel temperature limitations, as follows :
  - **Fuel freezing point limitation** : This limitation provides an operating margin to prohibit the operation under fuel temperature conditions which could result in the **precipitation of waxy products in the fuel,** with consequential effects on the engine operation (instability, power loss or flame-out).
  - **Fuel heat management system limitation** (as applicable) : this limitation reflects the engine capability to warm-up a water-saturated fuel to such a point that no **accumulation of ice cristals** may clog the fuel filter.

    Note : This later limitation applies only to certain engine models, as follows :

    * *CF6-80C2 : dispatch and in flight limitation,*

    * *PW4000 : dispatch limitation only.*
- **The most restrictive of the two above limitations is to be considered.**

3. ASSESSING THE TANK FUEL TEMPERATURE

- The tank fuel temperature is defined with reference to the **OUTR TK**, for the following reasons :
  - the OUTR TK is the **coldest tank**, due to its low thermal inertia (relative thickness, capacity, thin air gap insulation above fuel surface),
  - the OUTR TK is the **back-up** tank in case of loss of fuel feed capability from CTR and INR tanks.
- **In absence of outer tank fuel temperature indication** (Pre Mod 5875 for A310), the tank fuel temperature is assessed through a **correlation with the TAT.**
- From development testing, confirmed by additional records obtained in revenue service, it was assessed that after thermal stabilization **(typically 2 to 3 hours after the top of climb)** the outer tank fuel temperature is **within 2° C of the TAT**, as illustrated by figures 1 thru 9, hereafter.
  - **Figures 1 thru 3** reflect the **flight test data** collected during the development testing of the A310-200 and A310-300,

- **Figure 4 thru 6** reflect the **modelling of the tank fuel temperature profile,** as derived from the above flight test data,

- **Figures 7 thru 9** reflect data collected during **revenue service flights,** which are fully consistent with the above flight test data and the models derived thereof.

- The following summarizes the **observations** and **conclusions** resulting from the analysis of Figures 1 thru 9 :

  - Prior to thermal stabilization, **the TAT is a conservative indicator of the actual OUTR tank fuel temperature** (however, in case of TAT increase – warmer area or step-descent – the TAT/OUTR tank fuel temperature relationship is reversed, as illustrated by Figures 6 and 9).

  - The **tank fuel temperature profile** (gradient of temperature decay) is a function of :

    * the initial tank fuel temperature (**Figures 1 and 2**).

    * The magnitude of the TAT changes (**Figures 3 thru 5**).

  - The **time to fuel thermal stabilization** is essentially **independent from the above factors.** Whatever the initial tank fuel temperature and the magnitude of the TAT change, the tank fuel temperature will decrease (respectively increase) **with a rate function of these factors** (Figure 4) to reach a complete thermal stabilization after typically **2 to 3 hours (Figures 1, 2, 3 and 7, 8, 9).**

  - The fuel temperature in the **CTR tank** (absence of direct contact with ouside static or total temperature), **INR tank** (high thermal inertia) and **TRIM tank** (mixing of CTR and INR tanks fuel during aft transfers) is **typically 3 to 8° C above that of the OUTR tank (Figures 1 thru 3).** Engine fuel feeding from the OUTR tanks is therefore the limiting criteria.

  - The **tank fuel temperature response** to any significant change in the TAT, typically features a **10-minute time-lag (Figures 1, 2, 3 and 7, 8).**

- After the installation of a fuel temperature probe in the LH OUTR TK (Mod. 5875), a **direct tank fuel temperature reading** is available (on the ECAM MEMO page) with a **+/– 2° C accuracy.**

4. DEFINING THE APPLICABLE TAT OR FUEL TEMPERATURE LIMITATION(S)

- Whether the OUTR TK fuel temperature is assessed through a correlation with the TAT or by direct reading, **the resulting value is accurate within ± 2° C** (correlation accuracy or indicating system accuracy), thus resulting in a **common definition** of the applicable **TAT or OUTR TK fuel temperature limitation,** relative to the Fuel Freezing Point, as follows :

ACTUAL FUEL FREEZING POINT
+ ENGINE MANUFACTURER MARGIN
+ 2° C (+ 3° C for FAA)

- If the **actual freezing point** of the fuel being used for the flight is unknown, the minimum fuel **specification values** provided in FCOM Vol. 2 OPERATING LIMITATIONS-SYSTEMS must be used.

- The **engine manufacturer's margin** depends on the engine design philosophy in terms of **overall heat management** (management of interactive heat exchanges between the cold soaked incoming fuel and the engine oil/IDG oil). The capability of the engine heat management system also governs the possible consideration of additional fuel temperature limitations so as to prevent fuel filter clogging due to the accumulation of ice particles :

  - the **engine's manufacturer margins** relative to the Fuel Freezing Point are respectively as follows :

    * **Pratt and Whitney : 0° C,**

    * **General Electric : 3°C**

  - The **additional fuel temperature limitations,** as applicable, are defined for each individual engine model in the FCOM Vol. 2 OPERATING LIMITATIONS-SYSTEMS.

- **The most restrictive of the two above limitations must be complied with at any time during the full flight regime.**

5. OPERATIONAL GUIDELINES

- The management and accomodation of the fuel temperature limitations can be handled primarily at **flight planning** level by :

  - Assessing the **forecasted SAT/TAT temperature profile** over the route (temperature forecasts are usually accurate within **+/– to 2° C).**

- Assessing the **potential** for encountering SAT/TAT lower than the applicable TAT limitation (Pre Mod 5875) or resulting in an OUTR TK fuel temperature being lower than the applicable tank fuel temperature limitation (Post Mod. 5875)
- As required, the following **alternatives** may be considered :
  - * Planning the flight at a **lower altitude** and/or a **faster Mach Number** so as to increase the TAT. However the extra fuel burn shall be accounted for in the fuel/payload computation.
    - *Note 1 : Whenever the tropopause is substantially low (e.g. polar tropopause, winter period), decreasing the altitude may not provide the corresponding expected increase in SAT / TAT.*
    - *Note 2 : Although increasing the Mach Number by 0.01 will result in an increase in TAT in the order of 0.5 to 1°C, to the expense of a significant increase in fuel consumption, this option may be considered, whenever adopting a random route or a lower cruise altitude is not operationally realistic or possible.*
  - * Planning the flight via a **random route** avoiding an area of extremely low SAT. However the extra fuel burn may also limit the available payload.

    *Note : . Adopting a **random route** may not be possible in areas constrained by a **track system** (e.g. North Atlantic, North Pacific).*
  - * Planning the flight at normal altitude and Mach Number, but considering an **additional amount of contingency fuel** to account for a possible Mach Number increase, re-routing or step-down, should the actual SAT/TAT or OUTR TK fuel temperature, when in flight, so dictate.

- **On aircraft not featuring the OUTR TK fuel temperature indication** (Pre Mod 5875) it is recommended to **record the TAT** (e.g. on the computerized flight plan log), at periodic intervals (at least when checking each waypoint), so as to keep track of the **TAT history** throughout the flight.

  Should a TAT increase – warmer area or step-descent – be observed (thus resulting in an **inversion of the TAT – to – OUTR TK fuel temperature relationship**, as illustrated on Figures 6 and 9), reference should be made to the **coldest TAT previously observed** (i.e. prior to the TAT increase) so as to recover a conservative indicator of the actual OUTR TK fuel temperature. This coldest TAT value should have been previously checked to comply with the applicable limitation.

6. AIRCRAFT ENVIRONMENTAL ENVELOPE

- An extended environmental envelope has been approved by the certification authorities, only if associated with the fuel temperature indication system.
- For this reason, the extended envelope (FCOM Vol. 2 OPERATING LIMITATIONS-AIRCRAFT GENERAL) is effective only for the post Mod 5875 configuration.
- All aircraft systems have been checked and confirmed to be capable of the extended envelope, however the full benefit of this extended envelope may be limited by the tank fuel temperature limitation.

7. CONCLUSION

- The environmental envelope and the fuel temperature limitation are **operating limits** and therefore should not be deliberately violated.
- These limitations can be better understood and accomodated using the information and flight planning and monitoring guidelines provided hereabove.
- Should these limitations be unintentionally exceeded, crew action must be taken to come back within the prescribed limits as rapidely as practically possible.

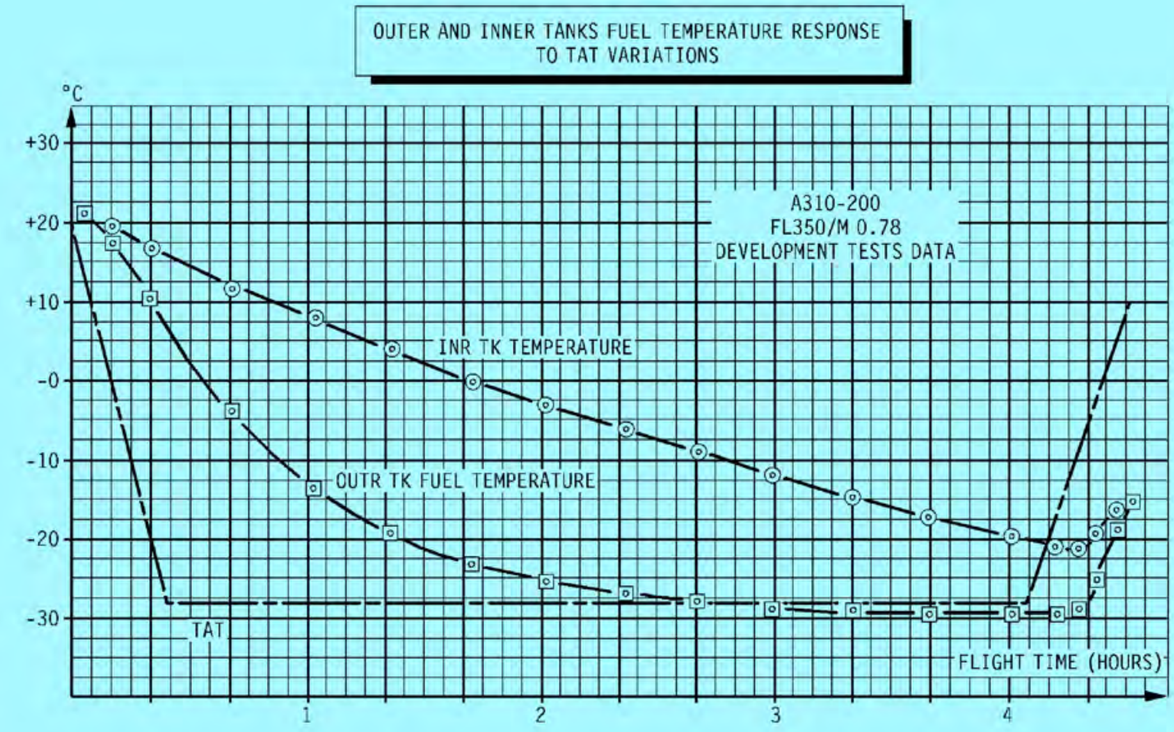


Figure 1

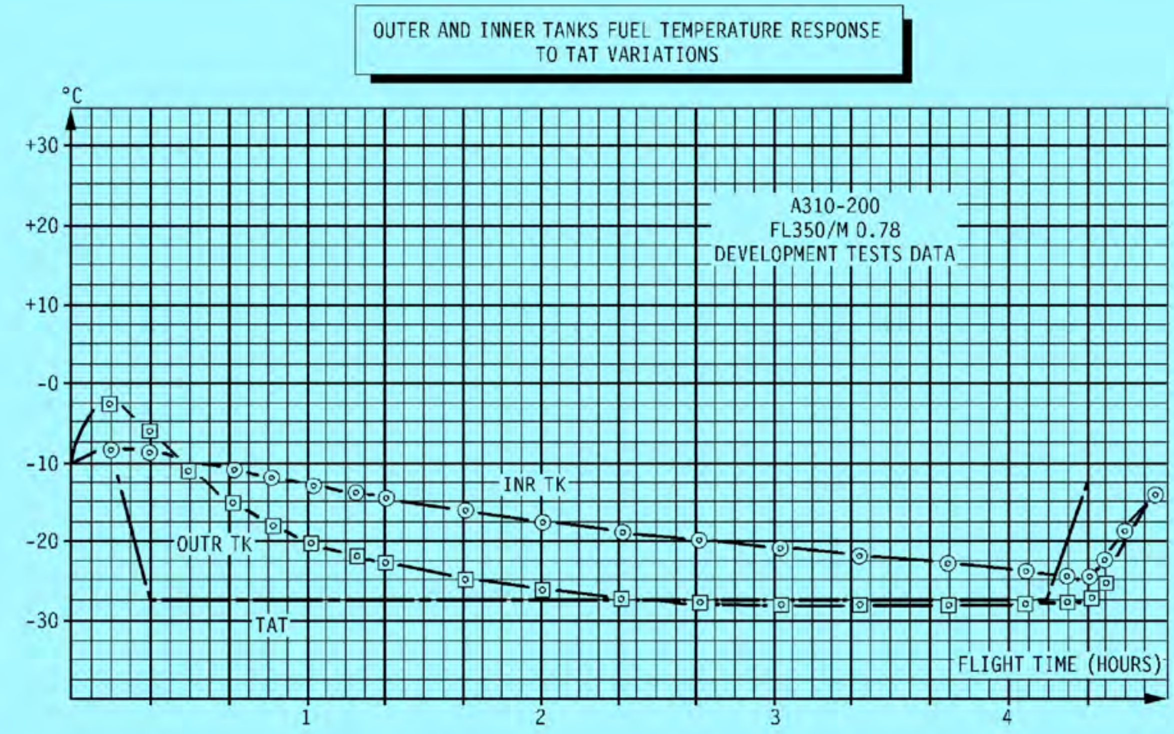


Figure 2

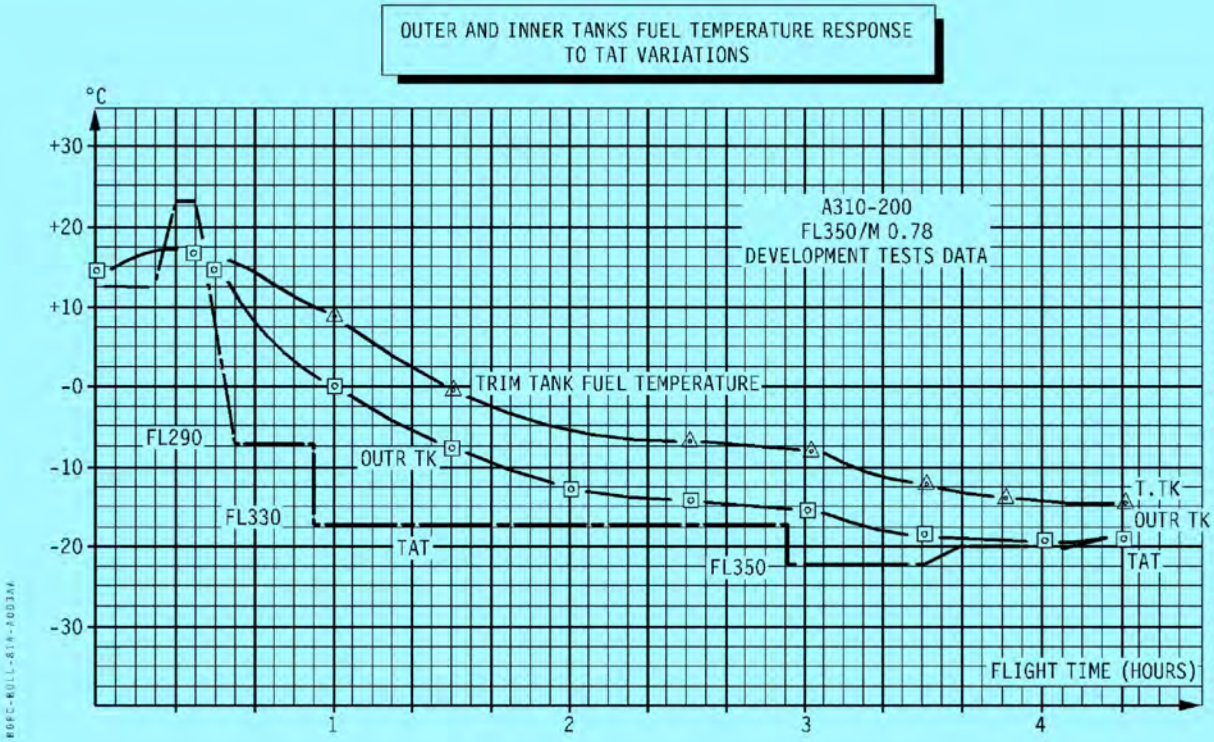

OUTER AND INNER TANKS FUEL TEMPERATURE RESPONSE TO TAT VARIATIONS

Figure 3

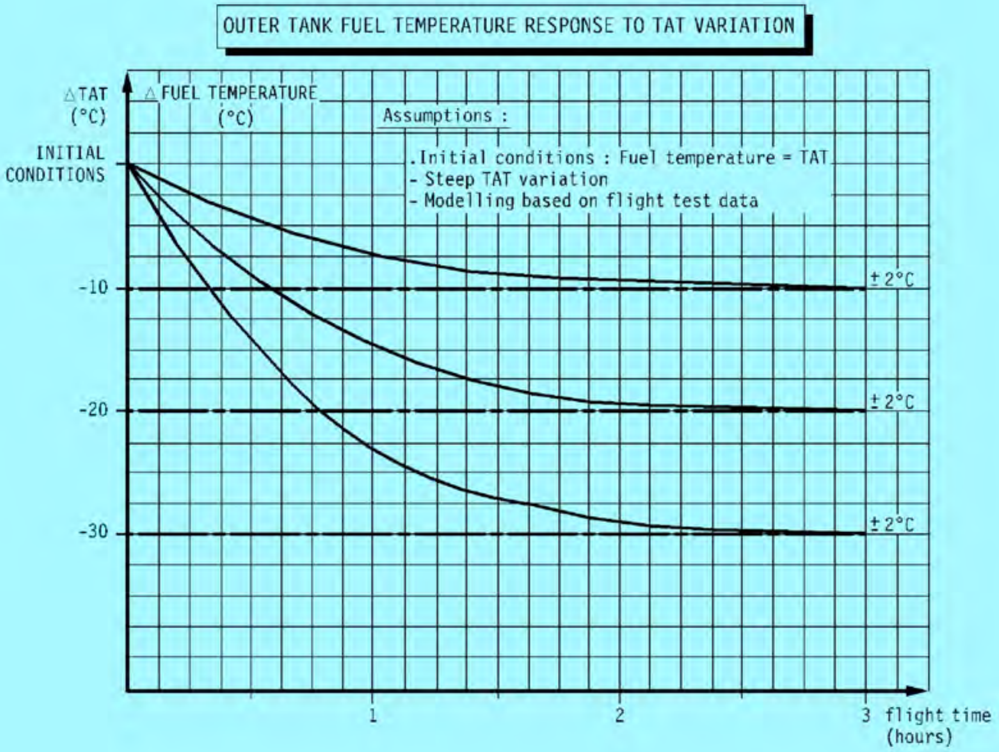


Figure 4

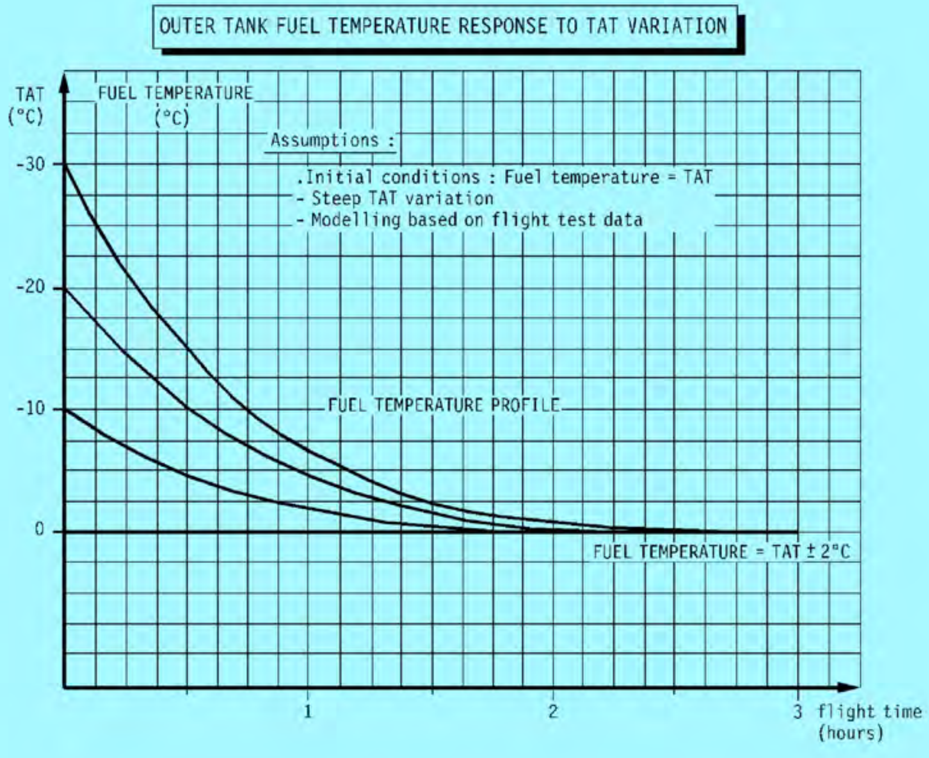


Figure 5

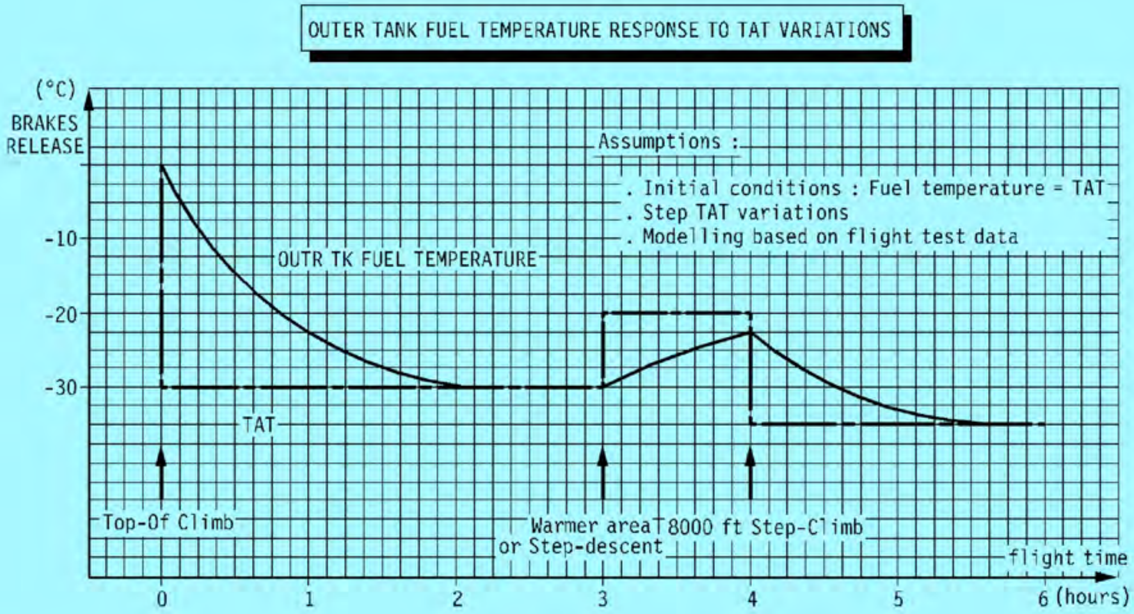

OUTER TANK FUEL TEMPERATURE RESPONSE TO TAT VARIATIONS
(°C)
BRAKES RELEASE
-10
-20
-30
Assumptions :
. Initial conditions : Fuel temperature = TAT
. Step TAT variations
. Modelling based on flight test data
OUTR TK FUEL TEMPERATURE
TAT
Top-Of Climb
Warmer area or Step-descent
8000 ft Step-Climb
flight time
0
1
2
3
4
5
6 (hours)
80FC-BULL-814-A006AA

Figure 6

OUTER TANK FUEL TEMPERATURE RESPONSE TO TAT VARIATIONS

A310-300
Revenue service flight UIO-MIA

Figure 7

OUTER TANK FUEL TEMPERATURE RESPONSE TO TAT VARIATIONS

A310-300
Revenue service flight MIA-UIO

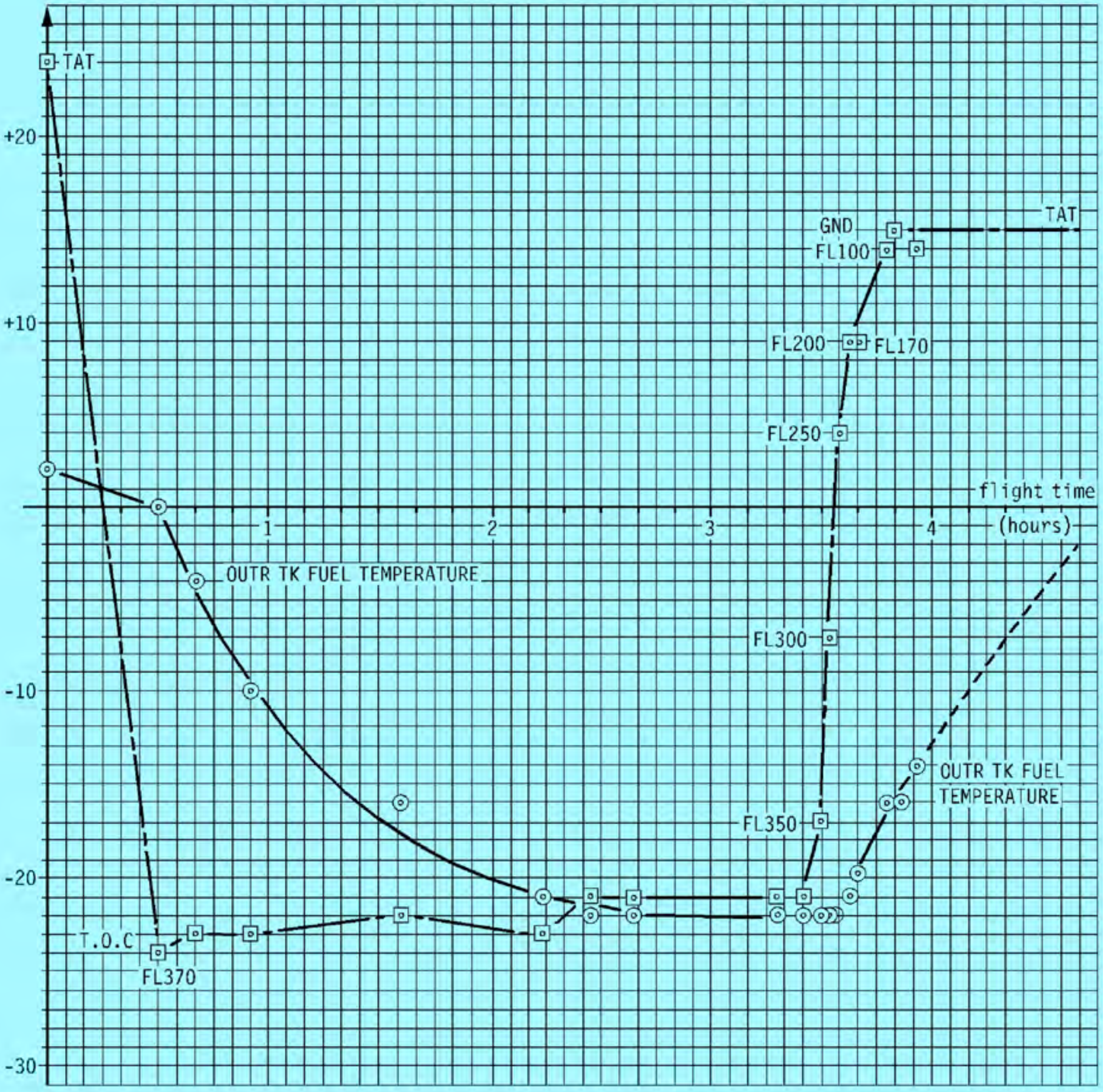


Figure 8

OUTER TANL FUEL TEMPERATURE RESPONSE
TO TAT VARIATIONS-STEP DESCENT CASE

A310-300
Revenue service flight VIE-JFK

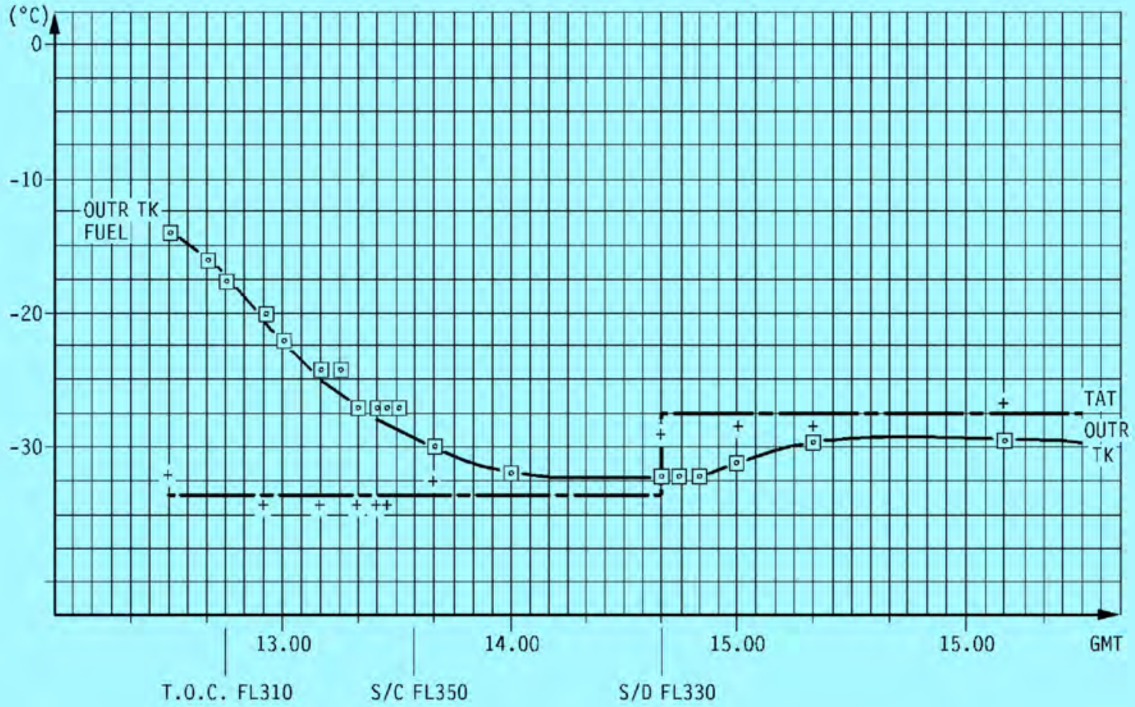


Figure 9

A310 FCOM BULLETIN

N° 815/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : VOLCANIC ACTIVITY AWARENESS
VOLCANIC ASH ADVISORY

Subject extracted from former FCOM Bulletin N°08/1 – Subject N°24
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM Bulletin is to provide flight crews with background information, as well as operational guidelines, regarding VOLCANIC ACTIVITY AWARENESS and VOLCANIC ASH ADVISORY.

2. BACKGROUND INFORMATION

- Partial or total **engine power loss events** caused by **volcanic ash ingestion,** while infrequent, are major **flight safety concerns.**
- The lessons learnt from past experience and the recognition of the volcanic threat to aviation safety have lead AIRBUS to propose recommendations for establishing **an airline program** for **Volcanic Activity Awareness and Volcanic Ash advisory.**
- **Flight crew procedures** will not be addressed herein since AIRBUS recommendations for OPERATION IN AREAS CONTAMINATED BY VOLCANIC ASH are published, in all **Flight Crew Operating Manuals (FCOM),** in the consolidated INCLEMENT WEATHER OPERATION section (PROCEDURES AND TECHNIQUES Chapter).

3. RECOMMENDATIONS

- Airlines can play an instrumental role in the overall volcanic activity notification and volcanic ash advisory process.
- Airlines are key contributors at both ends of the airways volcano watch and warning loop as follows :
  * **Flight Crews**, in reporting to the ATC (by immediate radio transmission or/and by filling the ICAO Special Air Report – model VAR) any **observation** of volcanic activity or any **encounter** with a volcanic ash cloud.
  * **Flight Operations Departments,** in providing flight crews with :
    - **Pre-departure Area Briefing and Route Forecast,**
    - En-route up-dating information and advisories.
- The following communication links can be used to obtain timely up-dated information on the volcano eruptive activity :
  * **Volcanic Watch Function** :
    - The Volcanic Watch Function consists in **collecting, compilling, processing** and **up-dating detailed information** regarding the **active and pre-eruptive volcanoes** likely to affect the **company area of operation.**
    - This function can be assigned to the following departments, as applicable :
      . **Flight Operations,**
      or
      . **Flight Safety Office.**
    - So as to assess the volcanic threat for each company route the following information sources and communication links can be used :
      . **Air Information Service** (AIS), for active **NOTAM's.**

. Meteorologial Watch Offices, Airport Offices and Regional Area Forecast Centers for active **SIGMET**'s.

. On-site **Aviation Authorities** for additional information, such as data and maps related to the ash cloud observed and forecasted extension.

. **International organisations** such as **ICAO, IATA, IFALPA**.

. **Inter-airlines agreements.**

. **Company outside stations.**

– The Volcanic Watch Function **provides synthetized and up-dated information** to all operational departments (Flight Operations, Dispatch, Outside Stations,...) as follows :

. **Map**(s) of **active volcanoes** and **hazard areas,**

. Relevant **data** to be included in the **Pre-departure Area Briefing** and **Route Forecast.**

. **Specific procedures** for **en-route information up-dating** (e.g. HF company frequency, ACARS, en route FIS and ATC).

* **Flight crews pre-flight briefing and documentation** :

– All flight crews, operating a flight to/from/through an area likely to be affected by volcanic activity, should be provided with the following **Information** and **documents :**

. **On a systematic basis** :

◇ **Map(s) of active volcanoes and hazards area**

◇ **ICAO Special Air Report – Model VAR (refer to the sample appended hereafter).**

. **As dictated by current volcanic eruptive activity** :

◇ Last active **NOTAM**'s,

◇ Last active **SIGMET's**

◇ **Data** or **map(s)** reflecting the **observed ash cloud location, extension and/or trajectory forecast.**

◇ **Upper wind analysis** and **forecast** at selected flight levels.

◇ **Satellite images.**

* **En-route information up-dating** :

– The activity of an erupting volcano usually features **series of eruptions** sometimes separated by only a few hours. **En-route up-dating of the pre-flight briefing information** is therefore of paramount importance to **minimize the potential for volcanic ash cloud encounter.**

– The following communication links can be used to obtain timely up-dated information on the volcano eruptive activity :

. **Company FLIGHT WATCH frequency,**

. **ACARS,**

. **VOLMET** broadcasts (SIGMETs),

. **FLIGHT Information Service** (SIGMET's)

– **Detailed up-date** should be sollicitated and obtained regarding the following aspects :

. **Notification of new eruption(s),**

. **Location, height, extension and forecasted trajectory of volcanic ash cloud.**

. Notification of **airspace restrictions** (closure of air routes, activation of contingency routes).

* **Flight crew initial and recurrent training** :

– **So as to build-up a flight crew mind-set** regarding the **Volcanic Ash threat, volcanic ash awareness** should be addressed as part of the flight crew **initial** and **recurrent training,** as follows :

. **Understanding volcanic ash and volcanic ash clouds,** as any other **weather systems,** and their threat to jet aircraft operation,

. **Highlighting the published procedures** related to volcanic ash cloud **avoidance, recognition of encounter** and **encounter recovery.**

. Placing a particular attention, during the simulator session related to the BOTH ENGINE FLAME OUT procedure, to the **slow engine acceleration characteristics** to be expected upon engine restart after volcanic ash ingestion.

. Stressing the **Instrumental contribution of flight crew air reports** and the **use of the ICAO Special Air Report of volcanic activity (model VAR).**

4. CONCLUSION

- Although significant achievements have been realized, over the past decade, in setting up the **International Airways Volcano Watch** network and in casting the foundations of a **Worldwide Communications and Alert System,** the international effort is continuing for :

  * **consolidating** and **extending** the Airways Volcano Watch network,

  * **achieving** the Worldwide Communication and Alert System, to provide swift warnings/advisories to airlines and en-route flight crews.

- Although the Volcanic Ash Threat to Aviation Safety is a worldwide issue requiring **international actions, individual pro-active actions** of all concerned will bring a **vital contribution** to the overall effort.

MODEL VAR

Aircraft identification
(as per item 7 Pilot-in- Dep. from ...... Date ...... Time ...... UTC
Operator .... of flight plan)........ command .... Arr. at .... Date ...... Time ...... UTC

	Addressee						
	AIREP SPECIAL						
Section 1	1 Aircraft identification						
	2 Position						
	3 Time						
	4 Flight level or altitude						
	5 VOLCANIC ACTIVITY OBSERVED AT			(position or beaning and distance from aircraft)			
	6 Air temperature						
	7 Spot wind						
	8 Supplementary information (Brief description of activity including vertical and lateral extent mouvement, rate of growth, etc. as available)						
Section 2	The following information is not for transmission by RTF						
		TICK ☑ THE APPROPRIATE BOX					
	9 Density of ash cloud	(a) wispy	☐	(b) moderate dense	☐	(c) very dense	☐
	10 Colour of ash cloud	(b) white (c) black	☐ ☐	(b) light grey	☐	(c) dark grey	☐
	11 Eruption	(a) continuous	☐	(b) intermittent	☐	(c) not visible	☐
	12 Position of activity	(a) summit (d) multiple	☐ ☐	(b) side (e) not observed	☐ ☐	(c) single	☐
	13 Other observed features of eruption	(a) lightning (d) ash fall out	☐ ☐	(b) glow (e) mushrooming cloud	☐ ☐	(c) large rocks (f) nil	☐ ☐
	14 Effect on aircraft	(a) communications (d) pilot static (g) nil	☐ ☐ ☐	(b) nav. systems (e) windscreen	☐ ☐	(c) engines (f) windows	☐ ☐
	15 Other effects	(a) turbulence (d) ash deposits	☐ ☐	(b) St. Elmos Fire	☐	(c) fumes	☐
	16 Other information	Add any information considered usefull					

ICAO SPECIAL AIR REPORT OF VOLCANIC ACTIVITY

BOFC-BULL-815-A001AA

A310 FCOM BULLETIN

N° 816/1

DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : CROSSWIND LANDING TECHNIQUE
Subject extracted from former FCOM Bulletin N°08/1 – Subject N°25

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

The aim of this FCOM BULLETIN is to provide flight
R crews with data and recommendations when
R coming to land in crosswind conditions.

2. BACKGROUND INFORMATION

R When the aircraft flies towards the runway in
R crosswind conditions, it comes with a certain drift
R angle. It is not recommended that the aircraft flares
R and touches down with this drift or crab angle ;
R particularly in case of large crab angle.

R Two different landing techniques or a combination
R of both can be used : the "wing down technique"
R and the "crab angle" technique.

R The data presented hereafter is intended to help in
R optimizing the choice of the most appropriate
R technique depending on wind intensity. It fosters
R FCOM PROCEDURES AND TECHNIQUES –
R INCLEMENT WEATHER OPERATIONS on crosswind
R landings.

2.1 Demonstrated crosswind (reference Flight Manual)

- "Demonstrated crosswind" is the maximum crosswind which was experienced during the flight test campain for which sufficient recorded data is available. It is not necessarily the maximum crosswind that the aircraft is able to cope with.
- It is also deliberate that demonstrated crosswind is not given in the limitation section but is in the performance section of the Flight Manual.
- Demonstration of crosswind capability is made on dry or wet runways and it is usually considered that given figures are equally applicable to dry or wet runways.
- Calculations have been performed to estimate the maximum crosswind components that the aircraft are capable of coping with. (Refer to the table below)
- The maximum crosswind for automatic landing is defined in the limitation section of the Flight Manual. In this case it has to be understood as a limitation.

	Maximum demonstrated (kt)	Maximum calculated (kt)	Maximum autoland (kt)
A310	28	37	20

2.2 Effect of runway contamination

- It is a matter of fact that a poor runway friction coefficient will affect both braking action and the capability to sustain high crosswind components.
- The table below applicable to all Airbus models indicates the maximum recommended crosswinds related to estimated runway braking action.

Reported braking action	Reported runway friction coefficient	Maximum crosswind (kt)	Equivalent runway condition
Good	⩾ 0,4	Maximum	1
Good/medium	0,39 to 0,36	30	1
Medium	0,35 to 0,3	25	2/3
Medium/poor	0,29 to 0,26	20	2/3
Poor	⩽ 0,25	15	3/4
Unreliable		5	4/5

Equivalent runway condition :
1 : Dry, damp, or wet runway (less than 3 mm water depth)
2 : Runway covered with slush

3 : Runway covered with dry snow
4 : Runway covered with standing water with risk of hydroplaning or wet snow
5 : Runway with high risk of hydroplaning

2.3 Landing with one engine inoperative

The maximum crosswind capability must be reduced by 2 kt in case of landing with one engine inoperative.

2.4 Landing with one thrust-reverser inoperative

The remaining thrust-reverser should not be used when the crosswind component is higher than 20 kt.

3. CROSSWIND LANDING TECHNIQUE

Final approach

- The final approach under crosswind conditions may be conducted :
  - With a steady sideslip : the "wing down" technique consists in aligning the fuselage with the runway centerline using a combination of into-wind aileron and opposite rudder to correct the drift.
  - With "crab angle" : the technique is to keep wings level and a crab angle down to touchdown or at least close to it. Actual touchdown with large crab angle still applied should be avoided. Therefore rudder is used to decrab and align the aircraft just prior to touchdown.
    This wings-level / crabbed approach is recommended by Airbus.
- Touchdown with a crab angle almost immediately results in the fuselage alignment, and therefore produces a yaw rate sometimes uncomfortable for passengers.

Decrab technique

The Airbus recommended decrab technique is a **normal cross control smooth action on the rudder and on the yoke** in order to achieve the following operational objectives :

- On the rudder, **in order to zeroe the crab angle** (or significantly **reduce the crab** angle in case of high crosswind).
- Laterally on the yoke, in order **to keep wings level** (and if needed prevent the aircraft to drift away from runway centerline with slight into-wind wing down).

This decrab technique shall be applied **during the flare, preferably not too early,** in order to avoid too many lateral adjustments.

Crosswind landing technique for high crosswind intensity

- For high wind intensity it may be necessary to touchdown using a combination of both techniques. The graphs that are published at the end of this bulletin show bank angle versus crab angle for three magnitudes of crosswind intensity (10, 20, and 30 kt) and indicate the relevant flight controls and geopetrical limits.

These graphs are computed for **steady state** conditions and are given as guidance for pilots to choose the appropriate technique.

- Up to a crosswind of 20 kts a zero crab angle landing can be performed with a maximum of about 5 degrees of bank.
- Above 20 kts crosswind, zero crab angle landing would require a higher bank angle and, between 25 and 30 kt, a rudder control limit may be reached on A310.

- Therefore, above a certain magnitude of crosswind, a combination of bank and crab angle at touchdown is desirable.
- Crab angles up to 5 degrees are usually comfortable for both pilots and passengers and in the roll axis sufficient margin remains to preserve geometrical limitations.

  Bank angle to ground contact is a function of the pitch. At normal touchdown pitch, the approximate bank angle limit is 11 degrees on A310.

  At near zero pitch, the engine will hit the ground first ; when at high pitch, the wing tip will touch first.

Crosswind landing technique on contaminated runway

- With a reduced runway friction coefficient, at touchdown the aircraft will yaw due to crosswind as an effect of weathercock stability. In that case, the pilot should not attempt to decrab completely before touchdown.

  On a very slippery runway, a touchdown with crab angle is recommended. The crab angle is then zeroed when lateral ground reaction becomes sufficient to modify the aircraft trajectory.

  Maintaining the fuselage aligned on a slippery runway may lead to the aircraft skidding sidewise.

  When touching down with a crab angle on a contaminated runway :

  - either the surface friction coefficient is high enough to decrab the aircraft immediately and it is therefore unlikely that the aircraft will subsequently skid sideways ;

  or

R – surface friction coefficient is not sufficient to
R decrab the aircraft immediately and it is better
R to initially keep this crab angle.

To offset the effect, the optimum procedure is a combination of both procedures with a smooth transition between them.

Nose wheel steering

- In general, use of the nose wheel steering of the handwheel is not recommended and unnecessary at high speed.

  On A310 the rudder pedals crosswind also command nose wheel steering at all speeds with a constant authority of 6 degrees maximum nosewheel rotation angle.

  Nosewheel steering through rudder pedals is suitable for ensuring a smooth transition from aerodynamic control to ground control.

  The handwheel should not be used before reaching taxi speed.

4. CROSSWIND LANDING GRAPHS

- The graphs shown hereafter (Figures 1 to 3) give, for a typical landing weight and full flaps configuration, the relation between bank angle and crab angle as a function of airspeed.

  Rudder limits are shown on the graph, with a specific crosswind component.

- Roll geometry limits, being well beyond flight control limits, are not indicated.

- Graphs can be used by entering a desired crab angle to find the required bank angle or vice versa. Vref for the reference weight of computation can be found on the speed axis of the graph.

5. CONCLUSION

R ● The wings-level/crabbed approach is
R recommended by Airbus.

R ● However, actual touchdown with large crab
R angle still applied should be avoided. Therefore,
R the decrab technique as described in § 3 here
R above should be applied just prior to touchdown.

A310 CRAB ANGLE VERSUS BANK ANGLE IN CROSSWIND CONDITIONS

GW = 120 000Kg SLATS/FLAPS = 30/40
10 Kt CROSSWIND COMPONENT

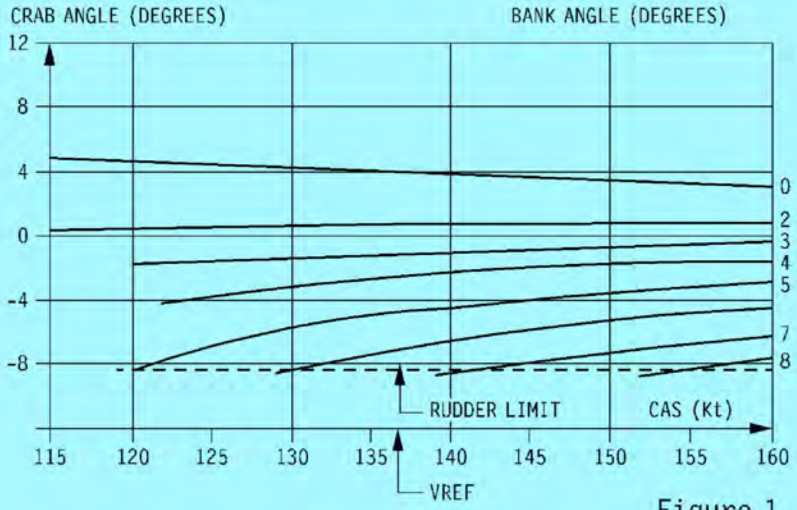


Figure 1

A310 CRAB ANGLE IN CROSSWIND CONDITIONS

GW = 120 000Kg SLATS/FLAPS = 30/40
20 Kt CROSSWIND COMPONENT

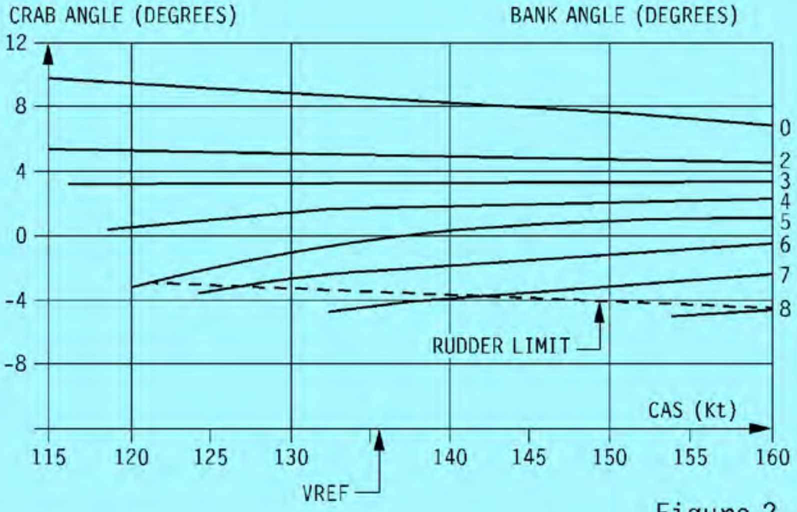


Figure 2

A310 CRAB ANGLE IN CROSSWIND CONDITIONS

GW = 120 000Kg SLATS/FLAPS = 30/40
30 Kt CROSSWIND COMPONENT

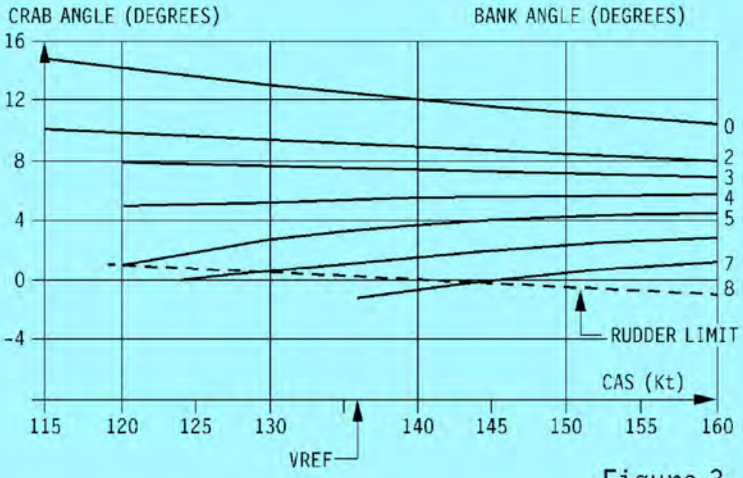


Figure 3

A310 FCOM BULLETIN

N° 817/2

DATE : JUN 08

File in FCOM 2.20

Issued by STLW

SUBJECT : AVOIDING TAIL STRIKES
Subject extracted from former FCOM Bulletin N°08/1 – Subject N°26

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

R The purpose of this FCOM Bulletin is to provide
R flight crews with background information and
R operational guidelines regarding "avoiding tail
R strikes".
R The issue 2 of this bulletin is published to
R standardize the format of the angles given in the
R tables.

2. BACKGROUND INFORMATION

The lessons from experience with inadvertent tail strikes have lead Airbus to consider the causes of such incidents and ways to avoid them.

3. OPERATIONAL GUIDELINES

- The causes of inadvertent tail strikes are associated very often with a degraded or hostile environment such as crosswind, birds on runway, heavy rain etc..
- The first consideration in avoiding a tail strike is to be aware of the aircraft geometry limits.

3.1 Aircraft geometry limits

Two pitch attitudes are of primary importance :

- the geometry limit corresponding to main gear oleo fully extended (θ_1)
- the geometry limit corresponding to main gear oleo fully compressed (θ_2).

Main Gear Oleo Position	Pitch attitude θ
Fully extended θ_1	15.2°
Fully compressed θ_2	13.2°

Touch-down attitude criteria

The following table provides the ground clearance in degrees at landing (all numbers are mean value).

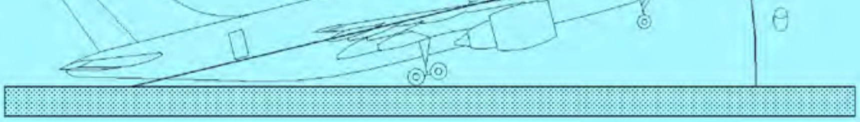
θ max at Touchdown (main gear oleo fully extended)	θ APPR (Attitude at V_{REF} (1))	θ Touchdown (Attitude at Touchdown V_{REF} – 8 kt(2))	Margin (3)
15.2°	5°	9.3°	5.9°

(1) Flight path in approach = – 3°

(2) Flight path at touch-down = – 1°. Vertical velocity = approximately 3 ft/second.

(3) Margin = θ max- θ touch-down.

When the approach speed is increased by 5 kt, the
margin increases by approximately 1.3° (attitude at R
touch-down decreased by 1.3°). R



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We may conclude that tail strikes are mainly a function of landing attitude θ. But rate of rotation and the indicated airspeed have also to be considered.

3.2 Tail strikes at takeoff

Early rotation, over rotation, rotation with large roll input, excessive pitch rate, improper shock absorber servicing, or a combination of these factors are the main causes of tail strikes at takeoff.

Early rotation

Early rotation occurs when :

- a too low VR is computed
- the rotation is initiated prior to VR.

- Erroneous VR computation may occur when the takeoff speeds are not crosschecked, or when incorrect loadsheet data is used. At hot-and-high elevation airfield, the error can be critical, if a too low VR is used.
- Rotation initiated prior to VR due to :
  - Flaps improperly set for the calculated VR
  - Improper pitch trim setting
  - Bird or obstacle avoidance leading to early rotation
  - Early rotation due to turbulence or windshear encountered during the takeoff roll. In such an event, FAA recommends rotation 2000 ft before the end of the runway.

Over-rotation or excessive pitch rate

These two causes are generally associated with a second factor in tail strike incidents (one engine out, aircraft out of trim, improper use of FD pitch command bar, additive inputs from both pilots, early rotation, etc.).

The following results have been obtained during flight test certification. The manufacturer has to demonstrate a safe takeoff at V_R – 10 Kt (2 engines) and V_R – 5 Kt (1 engine).

The pitch and the pitch rate obtained during these tests are indicated for information purposes only and are in no case certified limits.

Note : V_R represents the speed at aircraft rotation in order to obtain V_2 at 35 ft in the event of an engine failure.

The usual rotation of 3°/second prevents a tail strike unless the rotation is initiated at a speed which is far too low. This rotation is obtained in 5 to 6 seconds for an average 15 to 18° takeoff attitude.

After tail strike

If a tail strike occurs, apply the AFTER TAIL STRIKE procedure.

Selected results are presented below.

	Aircraft	Weight kg	CG	Config.	Rotation speed	θ°/s	θ at lift-off
R	A310	137 430	17.9 %	15/0	V_R-10 2 engines	6.8 °/s	11.6°
R		134 430	18. %	15/0	V_R-5 1 engine out	6°/s	11.2°

3.3. Tail strike at landing

Industry statistics show that tail strikes are more likely to occur at landing than at takeoff (2 to 1).

Deviation from normal landing technique, and pitch up effect of landing at aft CG seem to be the principal causes.

3.3.1. Ground reaction at aft CG

At pronounced aft CG, the ground reaction at touch-down has a pitch-up effect when the attitude exceeds a given value.

The aft CG maximum value and the corresponding maximum attitude, are presented below.

Above this max attitude, pitch-up will occur and will have to be manually counteracted.

Aircraft	CG	θ touch down (VREF-8)	max attitude	Margin
A310	36.5 %	8.7°	13.2°	4.5°

R

Margin : Max attitude – θ touch-down
Margin must be 2° at least. Therefore, when this is inadequate, the landing speed has to be increased.

θ **Touch-down** : mean value of pitch attitude at touch-down assuming a deceleration of 8 kt during flare (VREF-8), and a flight path of - 1° at touch-down (approximately 3 ft/second).

3.3.2. Deviation from normal landing technique

Deviation from normal landing technique remains the most common cause of tail strikes specifically :

. Allowing the speed to decrease well below VAPP
. Prolonged hold-of for a smooth landing
. Flare started too high
. Too high sink rate, just prior reaching the flare height.
. Bouncing at touchdown
. Failure to lower the nose gear after MLG touchdown.

- **Allowing speed to decrease well below VAPP before flare**

Flying at too low speed means high AOA and high pitch attitude, thus reducing ground clearance. When reaching flare height, the pilot will have to significantly increase the pitch to reduce the sink rate. This may lead the pitch to go beyond the critical angle.

Wind gradient on finals may also lead to an inappropriate attitude during the flare. A windshear from headwind to tailwind leads to lower aerodynamic speed. In this event, the first reflex of the pilot is to increase the attitude, as he approaches the ground.

- **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.

- **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.

- **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.

- **Bouncing a touchdown**

In case of bounce 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.

- **Failure to lower the nose gear after MLG touchdown**

  Keeping the nose high increases the risk of tail strike if an additional factor such as an unexpected wind gust or spoiler deployment for example, adds a pitch up moment.

3.3.3. Landing technique

The first important point in avoiding tail strikes is to reach the flare height with the appropriate speed and the correct path angle (– 3°) towards the touch-down point.

Autothrust and the Flight Path Vector (FPV) are very good assets in judging correctly to the flare height.

- **Flare technique**

  From stabilized approach conditions, the fare height is about 30 ft.

  The thrust reduction is progressive from 35 ft. It has to be coordinated with the pitch rate, especially when crosswinds are encountered.

  The attitude increment between the start of flare and touch-down is close to 4.5°, assuming an 8 kt speed decay and –1° flight path angle at touch-down (3 ft/second).

  Because of the downward visibility of all modern aircraft, it may be difficult to judge an abnormal pitch attitude. The PNF should monitor the pitch attitude on the PFD and call "PITCH, PITCH" whenever the pitch attitude exceeds 10°.

  After touchdown, the pilot must fly the nosewheel smoothly, but without delay, onto the runway, remaining prepared to counteract any residual pitch up effect of the ground spoilers. Moreover, deflected elevators increase the load on the main gear, providing better breaking.

- **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.

A310 FCOM BULLETIN

N° 818/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : ELECTRONIC INTERFERENCE FROM PORTABLE EQUIPMENT CARRIED ON BY PASSENGERS

Subject extracted from former FCOM Bulletin N°08/1 – Subject N°28

No technical change from previous issue

Applicable to : All aircraft

- Airlines often wonder whether they should allow passengers to operate electronic devices in the cabin without any limit.

  Federal Aviation Regulation (FAR) section 91.21 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 exist 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 recommendations is that no electric or electronic devices should be used during Takeoff and landing.**

- During any flight phase, Airbus recommends to **prohibit** the use of any device that intentionally produces signals (Mobile phones, Radio transmitters, and remote-control toys...).

A310 FCOM BULLETIN

N° 819/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : AVOID DISORDER IN THE COCKPIT
Subject extracted from former FCOM Bulletin N°09/1 – Subject N°29
No technical change from previous issue

Applicable to : All aircraft

1. 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.

2. 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 place 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.

3. 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.

A310 FCOM BULLETIN

N° 820/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : FMS NAVIGATION DATA BASE
Subject extracted from former FCOM Bulletin N°10/1 - Subject N°32
No technical change from previous issue

Applicable to : All aircraft

1. 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.

2. INCORRECT NAV DATA BASE CASES

2.1 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.

2.1.1. Nav data base not updated on time

When a Nav Data Base is not updated on time, results 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.

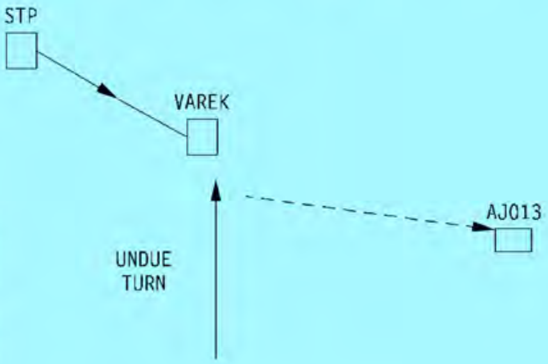
2.1.2. Nav data base incorrect coding

Nav data base error leading to FMS position error :

- Example
  Erroneous position of runway threshold at EDDF (0.5 NM of error) inducing a false updating at takeoff, and a too high altitude at landing over the threshold during non precision approach.

Generally 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.



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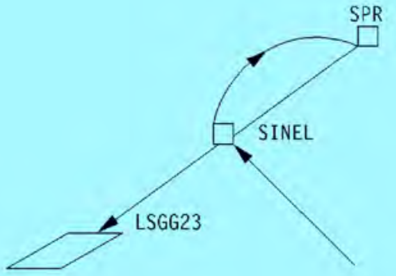
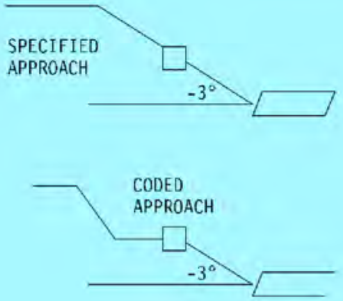
- 2nd example
  STAR PERIK 1 and GORON 1 AT Genova (LSGG).
  These STARs end at WPT SINEL located in the middle of the APPR 23.
  This creates a F-PLN discontinuity and the procedure is not flyable. The Nav D.B. error is linked to both coding and procedure concept.



- 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.



2.1.3 Coding errors

Coding errors generally have very similar effects on the FMS 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).

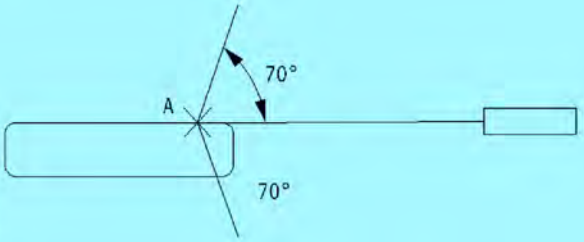
2.2 Problems linked to ARINC 424 specification

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/ACCEL 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.

2.2.1 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 required by ATC, then the crew has all means to insert it into the F-PLN, and be then provided with realistic estimates.

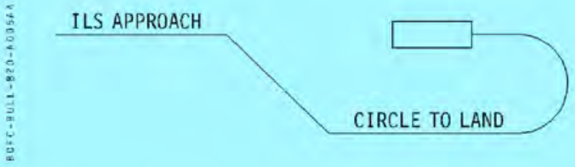
As a consequence, realistic coding of procedure turns should be requested.

2.2.2 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.



3. RECOMMENDATIONS

Tomorrow, the increasing number of RNAV approaches will require faultless Nav Data Base approach procedures since it will not always be systematically possible to monitor the guidance by using raw data.

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 CDU 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 2.

4. CONCLUSION

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.

A310 FCOM BULLETIN

N° 821/1
DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : BLEED LEAKS DURING AIR CONDITIONING ON GROUND USING THE APU BLEED IN HIGH OAT.

Suject extracted from former FCOM Bulletin N°11/1 – Subject N°34
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE

Several operators have reported experiencing LH BLEED LEAK warnings during turn arounds with high OAT. These warnings are often spurious and caused by the high OAT together with a minor seepage from the bleed ducts or air conditioning pack clamps. No LEAK warnings are generated in flight. The LH BLEED LEAK warning is most often generated due to the fact that this loop covers the area around the air conditioning packs.

In order to determine whether such bleed leak warnings experienced are real or spurious the following procedure has been developed.

2. RECOMMENDATION

If the cabin doors are kept closed whenever possible, the air conditioning demand is reduced and the occurrence of false bleed leak warnings may be reduced.

If it can be established that the LH BLEED LEAK warning does not occur with the PACKS OFF, then it is considered as spurious.
To determine if the warning does or does not occur with the PACKS OFF, use the following procedure :

i. PACK 1+2 . . . . OFF
LH BLEED VALVE . . . . OFF/R
APU BLEED . . . . OFF

The leak warning will remain present as long as a high temperature is sensed outside the pneumatic duct, regardless of the position of the bleed valves. When the heat has dissipated, the warning will disappear.

ii. When the LEAK warning has disappeared :
LH BLEED VALVE . . . . AUTO
APU BLEED . . . . ON

If the LEAK warning reappears :

- This indicates a real warning, carry out ECAM procedure. Maintenance action is due.

iii. If the LEAK warning does not reappear :

- After engine start and APU bleed switched OFF
PACK 1+2 . . . . ON

If the LEAK warning reappears, the warning is real : carry out the ECAM procedure, maintenance action is due.

Note : *Any occurence of BLEED LEAK warnings should be reported in the logbook, indication of the OAT will be useful to maintenance.*

A310 FCOM BULLETIN

N° 822/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : DISPATCH WITH ADDITIONAL CENTER TANK(S) (ACT) NOT USED
Subject extracted from former FCOM Bulletin N°11/1 – Subject N°35
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE

The purpose of this bulletin is to provide the flight crew with operational recommendation to dispatch the a/c when the ACT(s) cannot be used.

2. HISTORICAL BACKGROUND

Some operators experienced failures of the ACT system, such that it cannot be used, but do not have sufficient time to remove the tank(s) before the next flight. Therefore, they wish to deactivate the system in order to continue to fly with ACT(s) installed ensuring that no fuel gets into the ACT(s). One of the reasons could be due to a leak of the ACT(s) bladder.

3. SOLUTION

The transfer valve must be deactivated in the closed position (Refer to A310 MMEL 01-28 item 45 "TRANSFER VALVE").

As a consequence of the above MMEL action :

- No transfer is possible and the ACT(s) is (are) isolated.
- There is no fuel in this (these) tank(s) or fuel in this (these) tank(s) is considered as unusable and as part of ZFW and is taken into account for CG determination.

4. CONCLUSION

The above dispatch condition and associated maintenance procedure are less constraining than the removal of the tank(s) and allow the aircraft to be dispatched.

A310 FCOM BULLETIN

N° 823/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : UNDERSTANDING PRE-STALL AND MACH NUMBER BUFFET
Subject extracted from former FCOM Bulletin N°11/1 – Subject N°36
No technical change from previous issue

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

- The purpose of this FCOM Bulletin topic is to provide flight crews with an enhanced understanding of the **pre-stall** and **Mach number buffet** phenomena, from both an aerodynamics and flight mechanics (maneuverability) standpoints, as well as with operational guidelines for recognition of and recovery from a buffet onset condition.
- As far as normal flight operations procedures and recommendations are concerned, comprehensive information is available in the FCOM BULLETIN N° 802 (**Understanding and Managing the Buffet Margin**) and associated cross-referenced FCOM topics.
- The information contained in this FCOM Bulletin is general in nature and is applicable to any modern jet transport.
- This FCOM Bulletin may appear, at first, to be very detailed and academic, it was prepared in response to operator's request for such detailed background information.

2. WHERE DOES BUFFET COME FROM ?

- Whether it is referred to as the pre-stall or Mach number buffet, in all cases the buffet is the result of the **airflow separation**, caused by pressure gradients, at the upper surface of the wing airfoil.
- This airflow separation results in the airflow becoming turbulent and in the lift being unstable in magnitude and position, thus transmitting vibrations to the wings and, depending on its position, to the horizontal tail unit.
- **The buffet level reflects the aircraft response to the disruption created by the airflow separation,** the buffet concept is therefore **not an aerodynamic phenomenon only** (driven only by the wing aerodynamic characteristics) but the **overall signature of the airframe aerodynamic and structural characteristics** in response to the airflow separation.
- However, this reference to the airflow separation is the only aspect common to both the pre-stall and Mach number buffet. Indeed, the origin of pressure gradients and the way the airflow separation will progress and affect the lift capability is markedly different in the respective cases.
- Defining the point where the buffet becomes objectionable to the pilot is very subjective. For certification purposes, the **Buffet Onset** is defined by buffet conditions resulting in a **0.2 g peak-to-peak vertical acceleration measured at the Captain seat**.
- As recalled later in this bulletin, the concept of **Buffet Margin** relates only to the **Mach number buffet** and is to be understood **relative to the Buffet Onset,** which provides margins relative to the **Deterent Buffet** (defined as a level sufficient to dissuade the pilot from continuing to increase his pull force or to increase the Mach number).
- It should also be stressed that the buffet speed referred to as the **low speed buffet** is usually misunderstood as related to the **pre-stall** condition, whereas it relates to the **Mach number buffet** condition as explained in § **6** hereafter.

3. EFFECT OF THE ANGLE-OF-ATTAK (AoA) AND MACH NUMBER ON THE LIFT COEFFICIENT

- The airfoil/aircraft lift coefficient (**CL**) is a function of both the **Angle of Attack (AoA)** and **Mach number (MN)** over the entire speed range, as illustraded on **Figure 1**.

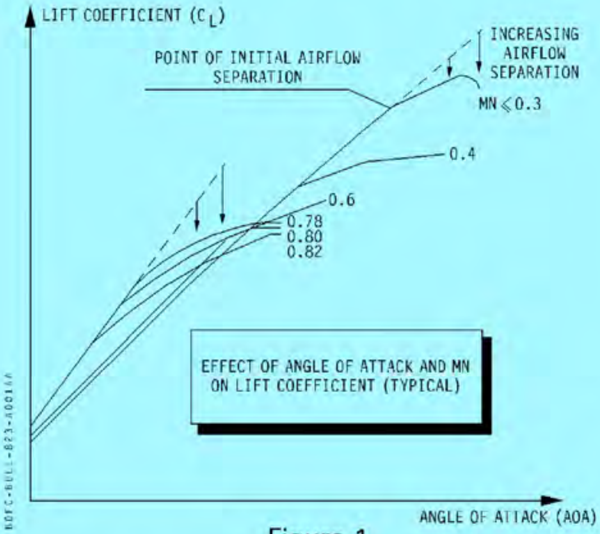


Figure 1

- The AoA effect is intuitive and is appraised by all pilots when training for approach-to-stall/stall/stall recovery.
- The MN effect is less intuitive. Although the MN effect is continuous, starting from low speeds, this effect becomes significant above MN = 0.4 to 0.6.
- With increasing MN the mechanism associated with the airflow separation and buffet switches from a **pre-stall** type to a **Mach number** type, as explained in details in § **4** and **5** hereafter.
- The **Figure 1** illustrates the following aspects :

- MN effect on the Lift Coefficient (CL)/Angle of Attack (AoA) relationship (slope of the linear portion of the curve),
- MN effect on the characteristics of the CL decay due to the airflow separation,
- MN effect on the maximum Lift Coefficient (CL MAX).

- The **Figure 2** illustrates, in a different form, this latter effect together with the effect of MN on the Lift Coefficient where the Buffet Onset is reached. This Figure will be used later in this Bulletin when discussing the maneuverability aspects (§ **6** hereafter).

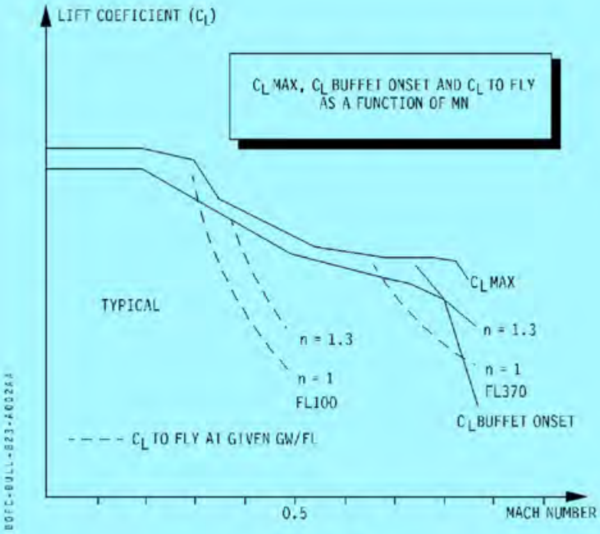


Figure 2

4. PRE-STALL BUFFET

- The aerodynamic mechanisms driving the pre-stall buffet and stall are well known from basic training days and are briefly recalled hereafter for comparison purposes only :
  - In the low speed range, the airfoil **lift coefficient** (**CL**) is essentially a linear function of the **Angle of Attack** (referred to hereafter as AoA).
  - If the angle of attack is increased, the pressure distribution across the airfoil chord changes (i.e. the minimum pressure — suction — increases in magnitude and moves forwards due to the airflow acceleration around the leading edge) resulting in increasing pressure gradients.

    These increasing pressure gradients acting on a low energy boundary layer will result in the progressive separation of the boundary layer and of the overall airflow.
  - The turbulence created by the airflow separation, the resulting fluctuation of the lift magnitude and position, as well as the separation wake possibly affecting the tail unit, contribute to producing buffeting.
  - As the airflow separation progresses (starting ahead of the trailing edge and moving forwards), the **lift curve** (lift coefficient as a function of the angle of attack) departs from its linear relationship and collapses with increasing airflow separation, until the complete breakdown of the airflow around the airfoil (stall), at or near the point referrred to as the point of **maximum lift coefficient** (refer to **Figure 1** for illustration).

- The progression of the airflow separation as well as the level of buffet annunciating the stall are characteristics which may vary largely from one aircraft design to the other.

- **In summary, the pre-stall buffet onset is an indicator of the impending collapse and breakdown of the lift capability, and resulting stall.**

5. MACH NUMBER BUFFET

- The aerodynamic mechanisms associated with the Mach number buffet are usually less well known and sometimes misunderstood as regards their effect on the lift capability.

- Above MN = 0.4 to 0.6, the effect of the Mach number on the lift coefficient becomes more significant as explained here below.

- As the aircraft speed increases, the air flow velocity at the upper surface of the wing airfoil increases correspondingly. At some time the airflow velocity will reach the sonic velocity at one point of the airfoil, the associated aircraft MN is referred to as the **critical MN**.

- As the aircraft MN further increases, the sonic portion of the airflow will extend and become supersonic. This supersonic zone is referred to as the **supercritical zone**.

- The supersonic airflow returning to subsonic speeds, ahead of the airfoil trailing edge, results in a shockwave and associated local pressure gradients (recompression). This shockwave moves forward or aft as a function of the MN and lift coefficient.

- As the MN or AoA increases and increasing pressure gradients are generated by the shockwave, the boundary layer and airflow starts separating, at the trailing edge (in the mid part of the wing span), resulting in the shockwave location moving slightly forward and becoming unstable, thus producing turbulence and fluctuating lift, and associated aircraft buffetting.

- Modern airfoils, referred to as **supercritical airfoils**, feature a supersonic airflow (supercritical zone) extending on a large portion of the chord, thus resulting in a more even distribution of the lift accross the airfoil chord.

  This feature results in a lower airflow MN in the supercritical zone and particularly ahead of the shockwave. The lower airflow MN reduces the recompression pressure gradients across the shockwave, and, thus, minimizes the interaction between the shockwave and the aft boundary layer.

  In practical terms, supercritical airfoils reduce the recompression shock and, thus, retard the airflow separation and buffet onset.

- Should the MN or load factor (hence the AOA) be further increased, although the **separation effect and associated buffet becomes stronger** (because of increasing pressure gradients), the airfoil **lift capability** is not significantly affected, as explained hereafter.

- Indeed, as the MN or the AoA is increased after the start of the airflow separation at the airfoil trailing edge, the airflow separation progresses forward resulting in a decay of the **Lift Coefficient** as a function of the **AoA** (as illustrated by **Figure 1**) but, because the airflow separation remains limited to that portion of the airfoil chord located aft of the shock, there is no complete breakdown of the overall airflow and, hence, **no sudden reduction in the overall lift capability.**

- **Unlike the low speed buffet, the high speed buffet cannot develop into a classic stall condition !**

- Should the MN or AoA be allowed to further increase, the airflow separation further progresses forward and inboard (leaving the outboard wing unaffected is a leading wing design criteria) resulting in the lift distribution moving forward, thus producing a **pitch-up** moment, which is immediately compensated if the aircraft has a **stability augmentation system** (e.g. **alpha trim**).

- Should the AoA be allowed to increase further beyond, getting closer to or into the deterent buffet, the increasing airflow separation and associated change in the downwash on the horizontal stabiliser would result in a strong **pitch down** moment (occuring actually before reaching the theoretical maximum lift coefficient).

- However, although extremely severe and sudden turbulence conditions may result in angle-of-attack excursions in the pitch-up and pitch-down range, these natural behaviours will not (usually) be recognized by the flight crew, from the overall flight path disturbance and recovery.

- **In summary, reaching the Mach number buffet onset primarily results in ridding inconfort, without impending loss of lift capability or longitudinal stability.**

6. MANEUVERABILITY ASPECTS

- The maneuverability of an aircraft at low speed lies in the **available speed margin**, similarly at high speed the maneuverability lies in the **available buffet margin**.
- The **Buffet Margin** is expressed in terms of **load factor margin** (e.g. 0.3 g) and represents the load factor (i.e. 1.3. g) which can be sustained (in a pull-up or turn) before reaching the buffet onset (at given GW/FL/MN, as explained in FCOM Bulletin 802).
- Looking back briefly into basic aerodynamics provides an easy appraisal and illustration of the **buffet margin** and **maneuverability** aspects.
- For a given airfoil profile, the airflow velocity pattern around the profile is a function of the lift being produced (lift coefficient/angle of attack hence gross weight/load factor, at given MN/FL).

  The **MN** at which the **buffet onset** will occur is hence also a function of the gross weight/load factor and FL, as illustrated by **Figures 2 and 3**.

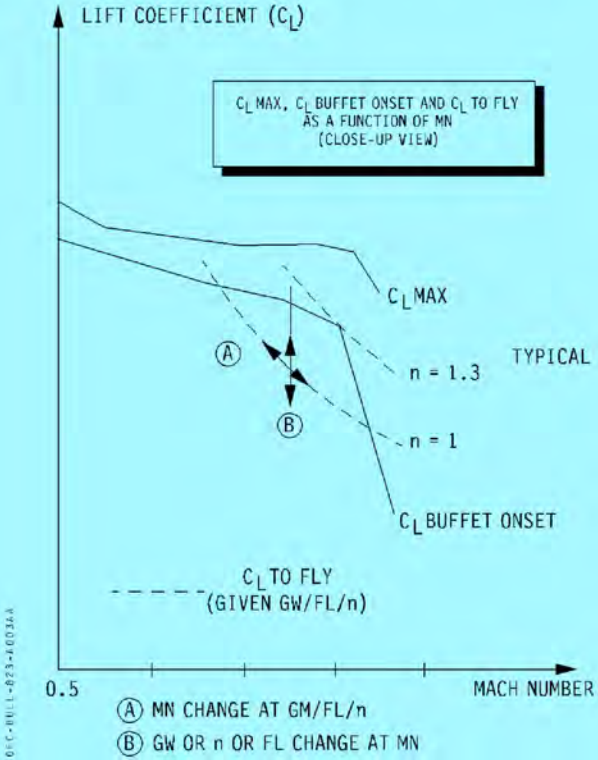


Figure 3

- If we consider, instead of an increasing MN, an increase in load factor (g) at constant MN, as occurs when entering a turn, the following reasoning can be made.

  As the turn is entered and sustained, the load factor increases with a corresponding increase in angle of attack and lift coefficient until the CL FOR BUFFET ONSET is reached.
- When operating at a set of conditions (GW/FL/MN) providing a 1.3.g buffet margin (FCOM Vol. 2 – FLIGHT PLANNING – MANAGEMENT OF BUFFET MARGIN), this will occur when the bank angle results in a 1.3 g load factor (just under 40° bank under perfectly stable conditions – refer to FCOM Vol. 2 OPERATING LIMITATIONS).

  However, perfectly stable conditions are rarely achieved in normal operation (e.g. turbulence or variation in pitch inputs) and the buffet may be sensed at a lower bank angle because it occurs at given AoA/load factor and not at given bank angle).
- The **Figure 2** and **3** provide an immediate illustration of the **margin** being available, at a given set of conditions (GW, FL, MN and load factor), between :

  - the CL required to fly (referred to hereafter as C_{L1})

  and

  - the CL for buffet onset (referred to hereafter as C_{L2})
- From **Figures 2** and **3**, it is obvious that any change in any condition (MN or FL or GW or load factor) or set of conditions will result in a corresponding change in the **Lift Coefficient** (CL) **margin** ($C_{L2} - C_{L1}$).
- With reference to **Figure 3** symbol Ⓐ , it can be evidenced that at given GW/FL/load factor the CL FOR BUFFET ONSET can be reached for two Mach number values, usually referred to as the **low** and **high buffet speeds.**

  However, if the high buffet speed intuitively relates to Mach number buffet, the low buffet speed should not be considered as related to pre-stall buffet. Indeed, at high Mach number and altitude, both the low and high buffet speed relates to the onset of Mach number buffet.
- With reference to **Figure 3** symbol Ⓑ , it can be evidenced that at given MN and FL, the CL FOR BUFFET ONSET will be reached for a load factor (or equivalent gross weight) such that :

  $n = \frac{C_{L2}}{C_{L1}}$, with (**n – 1**) being the available load factor margin to buffet onset, usually referred to as **buffet margin**.

- The available load factor margin (or **buffet margin**), or the load factor at which the buffet onset is reached, can be plotted as a function of MN (at given GW/FL) as illustrated by **Figure 4** hereafter.

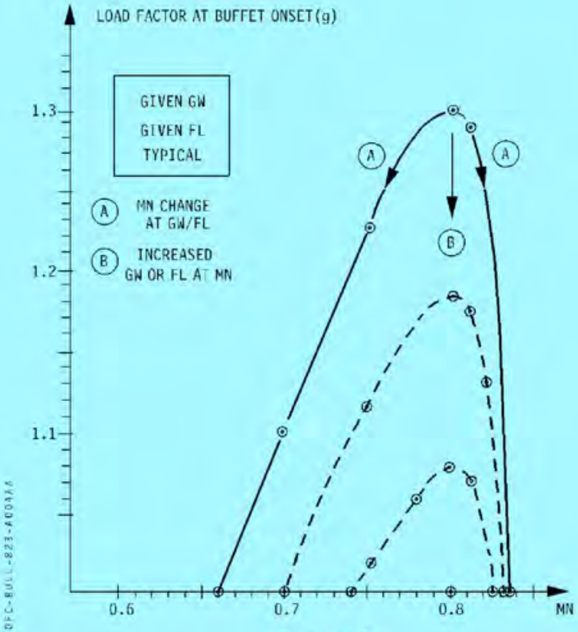


Figure 4

- The **Figure 4** reveals a MN value providing the maximum available load factor at buffet onset (respectively buffet margin), at given GW/FL. This MN value constitutes the **maximum maneuverability MN**.

  Persisting beyond the buffet onset would only result in added discomfort without any significant increase in maneuverability.

  Reducing the load factor by relaxing the pull force will cause the buffet level to reduce.

- If the load factor/AoA is further increased, the buffet level will also increase, due to increasing pressure gradients. Eventually, the deterent buffet will be reached, at which point the ultimum load factor capability will have been attained.

- If the altitude is increased (at given GW and flying at the maximum maneuverability MN), the available load factor/buffet margin decreases until an altitude is reached at which the buffet occurs at n = 1, at this MN. This altitude constitutes the aerodynamic ceiling for this GW.

- Similary, if increasing GW are considered (at given FL and flying at the maximum maneuverability MN), the available load factor / buffet margin decreases until a GW value at which the buffet occurs at n = 1, at this MN. The subject FL constitutes the maximum aerodynamic ceiling for this GW value.

- Flying at the aerodynamic ceiling is not operationally practical nor economically effective in revenue service operation. This is the reason why the **FCOM maximum recommended altitude (1.3 g)** and the **FMS MAX ALT (> 1.2 g)** provide a maneuverability margin while offering adequate operational flexibility.

- The **Figure 5** presents a different illustration of the maneuverability margin by providing the lift capability balance as a function of the MN.

  - with reference to the lift equation for level flight

    $GW = 0.7 \times Ps \times S \times C_L \times M^2$

    it can be stated that at given GW, given FL (given Ps) and for a given aircraft (given S) the lift capability required to fly in level flight is reflected by the term **$C_L \times M^2$**, which is therefore a constant.

  - with reference to the **Figures 2** or **3**, the lift capability at the buffet onset is similarly reflected by the term **C_L FOR BUFFET ONSET x M^2** which is a function of the MN, as illustrated by Figure 5.

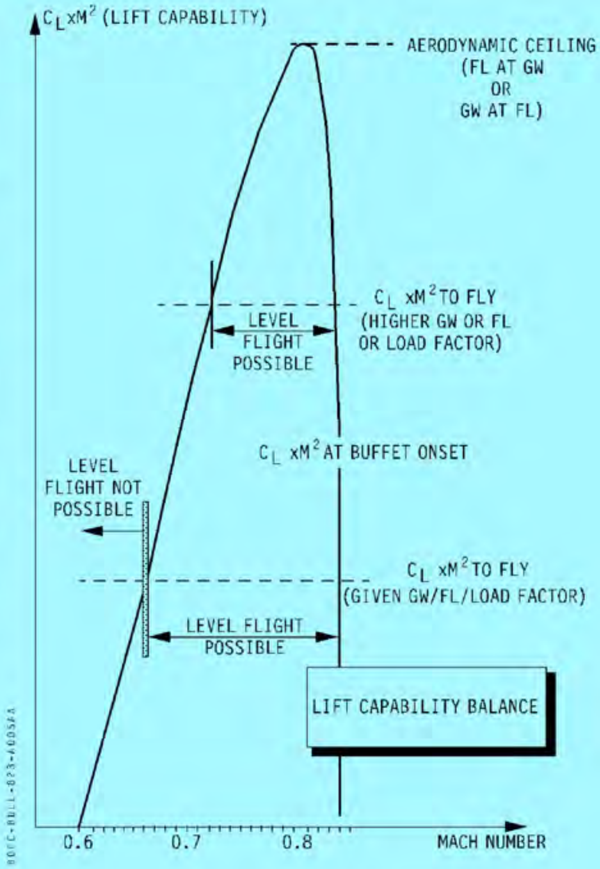


Figure 5

- from **Figure 5**, it can be inferred that, at given conditions (GW/FL/load factor), **sustained level flight, without buffet, is possible only when** :

  $(C_L \times M^2)$ TO FLY < $(C_L \times M^2)$ FOR BUFFET ONSET

  i.e. between the low and high buffet speeds.

  The higher the GW, the FL or the load factor, the narrower the MN range permitting level flight.

- in practical terms, this means that **persisting beyond the point of buffet onset** (in terms of load factor/AoA or MN) **does not permit to maintain level flight without progressing towards the deterent buffet.**

- **Thus, when encountering buffet at high Mach number/load factor, an increasing level of discomfort is to be expected, but there is no risk of a sudden loss of lift (stall), reduction in turn capability or loss of control.**

  However, the recovery actions – suggested in the § 8 hereafter – should be initiated as soon as possible.

7. RECOGNIZING THE MACH NUMBER BUFFET FROM THE PRE-STALL BUFFET

- Recognizing the Mach number buffet from the pre-stall buffet may not be evident for the flight crew unless the following becomes a **cruise management routine** :
  - awareness of the initial **speed margin** (margin to pre-stall buffet) and **buffet margin** (margin to Mach number buffet) for prevailing flight conditions in terms of GW/FL/MN (refer to FCOM Vol. 2)
  - alertness and training to recover from a pre-stall buffet condition (approach to stall) and from a Mach number buffet condition.
- On the A310, the PFD speed scale indexes (VLS, Green Dot) as well as the FMS MAX ALT/MMO-0.02 guidance limits provide visual awareness and protection in terms of speed and buffet margins.

8. RECOVERY FROM AN HIGH SPEED (MACH NUMBER) BUFFET CONDITION

- As indicated in the FCOM BULLETIN N° 802, any change in the following flight conditions will result in a corresponding change in the available buffet margin :
  - FL at given GW/MN
  - MN at given GW/FL,
  - Load factor at given GW/FL/MN.
- Should the buffet margin be managed in accordance with the guidelines provided in FCOM BULLETIN 802 and with the corresponding operational procedures and recommendations set forth in the FCOM, **high speed buffet should not be encountered during normal operation.**
- However, the following operational scenarios may result in unintentionally consumming/reducing the available buffet margin :
  - avoidance maneuver (load factor effect),
  - target MN overshoot in standing waves (MN effect),
  - unanticipated severe turbulence/gust (AoA effect).
- Should Mach number buffet be experienced (at the low or high buffet speed), the following recovery guidelines are proposed :
  - keep AP in CMD,
  - reduce bank angle demand or return to wing leveled / level flight conditions (as applicable) to reduce the load factor,
  - control pitch to reduce the load factor input (as applicable),
  - check the airspeed relative to the speed limits (VLS) and to Green Dot or to the turbulence penetration speed,
  - reduce the selected MN (if required, e.g. in tactical mode or in case of high cost index operation),
  - consider reducing altitude to increase buffet margin (e.g. in case of severe turbulence).

9. CONCLUSIONS

- The pre-stall and Mach number buffet conditions are drastically different aerodynamic phenomena in the way they develop and affect the airfoil lift capability.

  The Mach number buffet cannot develop into a stall condition.

- The **VLS concept** provides built-in margin relative to the stall speed – below 25000 ft – and to the Mach number buffet onset (low side) – above 25000 ft.
- The definition of the **buffet onset** provides built-in margin relative to the deterent Mach number buffet.
- The management of the **buffet margin** guarrantees a maneuvering capability consistent with the prevailing flight conditions, while offering adequate operational flexibility.
- Should the Mach number buffet onset be unintentionally encountered, **adequate awareness and alertness** will allow the flight crew to recognize and understand the occurence and apply the corresponding recovery actions provided in paragraph **8** herabove.

A310 FCOM BULLETIN

N° 824/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : POSSIBLE OVERSHOOT OR UNDERSHOOT OF SELECTED FCU ALTITUDE (AUTOPILOT AND FMS)
Subject extracted from former FCOM Bulletin N°12/2 - Subject N°37
No technical change from previous issue

Applicable to : All aircraft

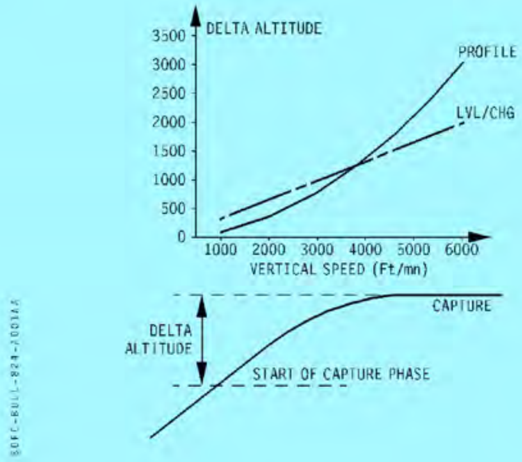
1. REASON FOR ISSUE

Operators have reported occurrences of overshoot of selected FCU ALTITUDES.

The investigation led to highlight that, the cases reported are the consequences of the combination of late FCU altitude selections and the AP and FMS altitude capture laws.

2. UNDERSTANDING OF AUTOPILOT AND FMS ALTITUDE CAPTURE LAWS

The delta altitude required by the AP and FMS to capture the altitude selected on the FCU is a function of the aircraft current vertical speed, as illustrated in the graph below.



- For both, the AP and FMS, the delta altitude required by the two systems for capturing the selected altitude increases as the vertical speed increases.
- Changing the FCU altitude when being too close of the new altitude target, in climb or descent phase, will lead to overshooting/undershooting this selected altitude.
- To illustrate the above statement the following typical scenario has been chosen :

Initial conditions : Climb phase

- A/C current vertical speed = 4000 ft/mn
- Altitude selected on the FCU : 20000 ft

Crew action

- When the A/C is passing 16000 ft the crew lowers the FCU altitude from 20000 ft to 17000 ft, thus leaving only 1000 ft for the new capture phase.

Consequences

The overshoot will be approximately 330 ft if the mode engaged is LVL/CHG (1330 ft required for capture) and approximately 380 ft if the mode engaged is profile (1380 ft required for the capture)

3. CONCLUSION

A/C behaviour to overshoot or undershoot selected altitude is explained by crew late action to select FCU altitude and the design of AP and FMS control laws.

Flight crews can keep in mind the following figures : At 3000 ft/min vertical speed, when selecting a different altitude on the FCU :

- In LVL/CHG mode, changes must be completed at least 1000 ft before the selected altitude.
- In PROFILE mode, changes must be completed at least 780 ft before the selected altitude.

Otherwise, overshoots and undershoots of selected altitude are possible.

A310 FCOM BULLETIN

N° 825/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : BEING PREPARED GO AROUND
OPERATIONAL RECOMMENDATIONS FOR MANUAL GO AROUND
Sugnect extracted from former FCOM Bulletin N° 13/3 – Subject N° 38
No technical change from previous issue

Applicable to : All aircraft

REASON FOR ISSUE AND SCOPE

The purpose of this FCOM Bulletin is threefold :

- recall the general recommendations for the management of the descent and approach (minimizing the potential for a Go Around),
- enhance the importance of :
  - the preparedness for a possible Go Around,
  - the commitment to conduct a Go Around, if so required, (being "Go Around-prepared"),
- recall the general recommendations for conducting a manual Go Around (ensuring a safe conduct of the maneuver),

Because the chain of events leading to a possible Go Around is starting as early as the top-of-descent, this FCOM Bulletin recalls the related operational recommendations starting from the Descent Preparation.

GENERAL

Because a Go Around is not a frequent occurrence, this FCOM bulletin recalls the importance of being **Go Around-prepared** :

- having in mind a clear pattern in terms of briefing, callouts, flow and sequence of actions, task sharing and cross-monitoring,
- being ready and committed to abandon an approach should the conditions in terms of weather minimas or flight path stabilization not meet the predefined targets,
- once the Go Around is initiated, being fully committed to positively fly and conduct the planned missed-approach procedure (both vertically and laterally).

RECOMMENDATIONS

Concept of "next target" or "gate"

Throughout the entire flight a "next target" should be defined at all times.

The "next target" should be any required combination of :

- A position,
- An altitude,
- A speed,
- A configuration

For the approach and landing, the successive "next targets" should constitute "gates" that must be met for the approach to be continued.

If it is anticipated that the "next target" will not be met, the required corrective action(s) must be taken without delay.

The "stabilization point" constitutes a particular "gate" along the final approach, should the required configuration and speed not be obtained or the flight path not be stabilized when reaching the "stabilization point", a Go Around must be considered.

As a reference, a callout must be performed by the PNF if a flight parameter exceeds the following limits during the final approach :

- vertical speed in excess of – 1000 ft/mn,
- speed lower than VAPP – 5 kt or greater than VAPP + 10 kt,
- LOC or GS deviation more than 1 dot

PF/PNF Task Sharing

The following applies to any flight phase but bears a particular importance and criticality in the very dynamic phase associated with initiating a Go Around (particularly should a warning be activated during this phase).

The **PF** must concentrate on the flight path and energy management, by either :

- Supervising the autopilot vertical and lateral guidance and the autothrust operation (awareness of the FMA status and FMA changes),

or

- Flying manually, with adapted FD guidance and ND display.

  If manual thrust is selected, a callout "Manual Thrust" must be performed by the PF and acknowledged by the PNF who will then more closely monitor the speed, speed trend and thrust, and callout any excessive deviation.

The **PNF** must concentrate on monitoring tasks and on performing the actions requested by the PF, this includes :

- performing the standard PNF tasks (SOP actions, FCU actions in manual flying, ECAM and QRH actions in case of failure),
- monitoring the thrust setting,
- monitoring the vertical speed and radio altitude,
- monitoring the pitch attitude and bank angle, the speed and speed trend, the vertical speed, the LOC and GS deviation, and calling out any excessive deviation.

Descent Preparation – Approach Briefing

In order to prevent any delay in the initiation of the descent and to ensure an optimum management of the descent profile, the following recommendations are worth being recalled :

- the Descent Preparation and Approach Briefing should be completed typically 10 minutes before the top-of-descent point.
- should a STAR be included in the F-PLN but be expected not to be flown, due to anticipated radar vectors, then the STAR should be checked (track, distance and constraints in terms of altitude and speed) versus the anticipated routing in order to adjust the top-of-descent point accordingly.
- A stabilization point should be defined (in terms of altitude, configuration and speed).
- whenever available, wind forecast entries should be dutifully performed in the FMS for way points close to the top-of-descent point and along the descent.
- should a missed-approach be included in the FMS F-PLN, the missed approach should be reviewed against the applicable approach chart.

Descent Monitoring

The descent profile should be monitored, should the flight path be significantly above the desired descent profile (e.g. due to ATC constraint or higher than anticipated tail wind) the desired descent flight path can be recovered by :

- keeping a high airspeed (as long as practical),
- using speed brakes,
- extending the landing gear, should the use of speed brakes not be sufficient.

Approach Briefing

In order to enhance the "Go Around preparedness", a formal "Go Around" briefing should be conducted highlighting the key points of the maneuver and the task sharing under normal or contingency conditions.

The Go Around part of the Approach Briefing should recall the following aspects :

- target stabilization point,
- GA callout
- PF/PNF task sharing (flow of respective actions, including desired guidance – mode engagement – speed target, GA altitude, deviations callout),
- missed-approach lateral navigation and vertical profile.

Final Approach

As the approach Briefing is performed at the end of the cruise, it is recommended to rebrief the main points of the missed-approach when established on the final approach course or after completing the LANDING checklist (as deemed most suitable).

When flying with the AP in CMD and in order to be ready to react and take over manually, the following aspects should not be underestimated :

- Seat and armrest adjustment, which is of primary importance for a good aircraft handling in a dynamic phase of flight,
- Flying one hand on the control wheel/one hand on the throttle levers.

Understanding the flight dynamics of the Go Around

Unlike the takeoff rotation during which the aircraft is pre-trimmed and the thrust already set, the initiation of a Go Around involves a very dynamic sequence of actions and changes (thrust, configuration) affecting the pitch balance.

When initiating a GA at DA/DH, the PF is expected to minimize the altitude loss during this maneuver. Therefore the PF must **simultaneously** apply a nose up pitch command on the control column and trigger the GO levers (in the following sequence the aircraft is assumed to be initially trimmed).

- This first (nose up) elevator input will initiate a pitch attitude change that will minimize the altitude loss,
- Within a few seconds, the thrust will increase to TOGA, providing a significant additional nose up pitching effect,
- Retracting one step of flaps also results in a slight nose up pitching effect.

As a result of the above three nose up effects :

- the pitch attitude rate increases,
- the nose up pitch force required, to reach and maintain the target pitch attitude, decreases until a nose down pitch force is required to prevent reaching an excessive pitch attitude.

To **maintain the desired pitch attitude** target (and prevent overshooting this target), the PF must therefore :

- **release the backward (nose up) input** on the control column,
- **apply progressively, as the thrust increases, an increasing forward (nose down) input** on the control column,
- **re-trim the aircraft (nose down), as necessary.**

  (as an example, an aircraft trimmed at 6 to 7 degrees nose up for a stabilized final approach must be re-trimmed to 3 to 4 degrees nose up during a manual Go Around).

The above description is only aimed at recalling and illustrating the mechanism of the Go Around maneuver. In fact, the PF should simply "fly the aircraft" while closely monitoring the PFD.

If the pitch attitude is not **positively** controlled, the pitch will continue to increase and will reach values where the speed will decrease despite the TOGA thrust.

Transitionig from "almost VMC" to "IMC" conditions

One of the main reasons for performing a Go Around is related to weather minima.

When approaching the DA/DH or the MDA/H, one crew member is attempting to acquire the required visual references. During this period of time, this crew member is in "almost VMC" conditions.

Should a Go Around be performed, an immediate transition back to IMC must take place.

It is therefore of primary importance that the other crew member keeps IMC references and be ready to make appropriate callouts if one flight parameter (speed, pitch attitude, bank angle, thrust,....) deviates from the normal and safe value.

To ease this transition, all efforts should be made to initiate the Go Around with wings level and with no roll rate.

Flying a manual Go Around maneuver

The operational recommendations and task sharing for the safe conduct of a manual Go Around can be summarized as follows :

For the **PF** :

- when calling "Go Around – Flaps", **without delay** :
  - trigger the Go levers (follow-through the A/THR operation),
  - announce loudly the FMA "Thrust/Go Around" (be aware of the AP engagement status, i.e. AP in CMD or manual flying).
  - rotate (at a rate of – typically – 3 degrees/seconds),
  - follow the SRS orders (not exceeding 18 degrees pitch attitude),
- as thrust increases, **be prepared to counteract the thrust pitch-up moment,**
- **trim the aircraft nose down** as required,
- the pitch attitude should not be allowed to develop beyond 25 degrees, as such a pitch attitude would result in a significant speed loss ; an immediate and firm elevator nose down command (together with a nose down pitch trim order) would allow to recover the target pitch attitude.

For the **PNF** :

- when hearing the "Go Around – Flaps" callout, **without delay** :
  - retract one step of flaps,
  - check the FMA :
    - THR/GO AROUND,
    - AP/FD engagement status
  - announce "Positive Climb" and retract the landing gear, on PF command,
  - monitor :
    - the airspeed and speed trend,
    - the pitch attitude and bank angle,
    - the thrust increase (GA thrust on the TRP and on the N1/EPR indicators),
  - continue monitoring the flight parameters and callout any excessive deviation :
    - R speed : if dropping below VLS – 5 kt,
    - speed trend : if negative,
    - pitch attitude : if in excess of 20 degrees,
    - bank angle : if in excess of 15 degrees (30 degrees if the missed-approach procedure requires a turn),
    - thrust : if a significant thrust loss is observed.

CONCLUSIONS

Because a Go Around is not a frequent occurrence, the importance of **being Go Around-prepared must be emphasized.**

While conducting a Go Around maneuver, the strict compliance with the PF/PNF task sharing and the optimum use of the crew resources management (e.g. for monitoring and callout of any flight parameter excessive deviation) bear a paramount importance.

The manual Go Around technique must :

- Minimize the initial altitude loss,
- Prevent from reaching an excessive pitch attitude by :
  - following SRS orders **(not exceeding 18 degrees pitch attitude),**
  - considering a 25 degrees pitch attitude as an ultimate barrier from which the pilot should return immediately.

A310 FCOM BULLETIN

N° 826/1
DATE : JAN 05
File in FCOM 2.20
Issued by STLW

SUBJECT : PHILOSOPHY REGARDING THE USE OF ECAM/QRH FOR THE SMOKE PROCEDURES
Subject extracted from former FCOM Bulletin N°14/1 – Subject N°39

Applicable to : All aircraft

REASON FOR ISSUE AND SCOPE

In 1999, Airbus Industrie conducted a comprehensive review of its smoke–related procedures. This review was founded on fruitful discussions with a number of operators, enabling Airbus Industrie to fully benefit from their experience.

These proactive discussions led to some adaptations of the smoke procedures and to the publication of a new single smoke paper procedure, which proved to be satisfactory to airworthiness authorities and to our customers worldwide.

The procedure gathers the adequate existing smoke procedures for the so–called "hard to identify" smoke origins, with the goal of saving precious time by facilitating the access and handling.

This procedure has been incorporated in the applicable sections of FCOM / QRH with revision 30 for the A310 and revision 25 for the A300–600.

This is the purpose of this FCOM Bulletin to provide background information and recommendations on how to handle this procedure.

BACKGROUND

The review enabled to classify the different smoke origins according to their characteristics, and therefore enabled to identify the following two categories :

- ***"Easy to identify"*** smoke origins : this includes CARGO SMOKE and BATTERY SMOKE. The main characteristics of these types of smoke warnings are that they are always covered by an ECAM and/or local warning and dedicated procedure. In addition, the smoke source is easy to locate and treat :
  - CARGO SMOKE is covered by an ECAM warning and the cargo compartment is fitted with an extinguishing system.
  - BATTERY SMOKE is identified via the BAT OVHT warning (aircraft fitted with mod 7483) and fought by action to set OFF affected battery.

  Note : *aircraft without mod 7483 : BATTERY SMOKE is covered by an ECAM warning and fought by action to set OFF affected battery.*

- ***"Hard to identify"*** smoke origins : this concerns AVIONICS SMOKE, AIR CONDITIONING SMOKE, CABIN EQUIPMENT SMOKE, and MINIMUM EQUIPMENT BAY SMOKE. The characteristics of these types of smoke origins are that they may or may not be covered by ECAM warnings and that they are more difficult for the crew to locate and treat. In addition, depending on the situation, the approach is different, as no extinguishing system is available (except for the cabin) and the crew can only try to remove the smoke and stop smoke generation by isolating faulty system(s).

For each of these "hard to identify" smoke sources, an adequate procedure was already available prior to the review : either displayed on ECAM and complemented by the FCOM / QRH or available in the FCOM / QRH. But the need for a single procedure became apparent in order to cope with the difficulty of identifying and fighting the smoke.

In short, the objectives of this review were to :

- Standardise Airbus fleet procedures to ensure a consistent approach for mixed−fleet airlines ;
- Facilitate handling by grouping all the "hard to identify" smoke procedures in a single smoke procedure layout ;
- Identify common actions to be applied whatever the smoke source, in order to save precious time ;
- Assist the crew in its search for the smoke origin ;
- Apply appropriate procedure when the smoke origin is identified.

This new approach would make it easier for the flight crew to find, identify and apply the most appropriate procedure corresponding to the smoke source.

RECOMMENDATIONS

The implementation method is as follows. In case of smoke coming from a "hard to identify" source, the optimised way of coping with the smoke is to directly refer to the single paper procedure published in the QRH, made of the following three parts :

- **Common actions**
  These actions must be adopted and applied by the crew, as soon as smoke is perceived (visual and/or olfactory), with or without ECAM activation, before trying to determine the smoke origin. These immediate actions enable the crew to quickly refer to the most commonly adopted steps in smoke−related cases, in particular in the case of AVIONICS / MINIMUM EQUIPMENT BAY SMOKE.
- **Recommendations in case of dense smoke**
  In case of dense smoke, the crew must initiate a descent as soon as possible, in order not to waste time and to immediately apply the SMOKE REMOVAL procedure. Indeed, this SMOKE REMOVAL procedure requires the crew to descend to FL 100 / MEA / MORA, to be able to open the cockpit windows.
- **Specific actions**
  These procedural steps are to be applied, once the origin of the smoke has been identified. They correspond to the procedures already available before the review, and concern :
  - AIR CONDITIONING,
  - CABIN EQUIPMENT,
  - AVIONICS,
  - MINIMUM EQUIPMENT BAY.

For AVIONICS SMOKE and MINIMUM EQUIPMENT BAY SMOKE procedures, the ECAM actions have been recalled in the QRH single smoke paper procedure at the beginning of the relevant specific actions part.

Therefore, the smoke fighting can be done without referring to the ECAM : the QRH is self−contained and going directly to the QRH without performing the ECAM is fully safe.

On the other hand, for each of the "easy to identify" smoke sources, there is no change in the ECAM / QRH philosophy : the crew applies ECAM first and then refers to the QRH.

CONCLUSION

To summarize the Airbus recommendations concerning this specific single smoke paper procedure :

- In case of so−called "hard to identify" smoke, with or without ECAM activation, the crew directly goes to the QRH single paper procedure,
- The crew applies the common actions,
- Then, tries to determine the origin of the smoke,
- And depending on this origin, applies the adequate specific actions.
- Furthermore, at any time, and if necessary, the crew can decide to initiate a descent to apply the SMOKE REMOVAL procedure.

It is important to mention that this new paper procedure includes all the steps of the available ECAM procedures (AVIONICS SMOKE and MINIMUM EQUIPMENT BAY SMOKE), that can be found in the specific action part. Therefore, using directly the QRH provides a safe and quick way to fight the smoke source without the need for referring to the ECAM procedure. Nonetheless, the displayed ECAM procedures are still correct and can still be applied. The crew has every reason to remain confident in the ECAM procedures but referring to the ECAM first does not permit to take benefit of the new single procedure concept.

The recommendations given in this FCOM Bulletin apply whatever the ECAM SGU standard and therefore the philosophy to apply the QRH first in case of "hard to identify " smoke source is not challenged by the W30 and W32 ECAM SGU standards.

This new single smoke paper procedure has been widely evaluated and is well supported by all involved parties, including Airbus' training department. Consequently, Airbus instructors are now fully acquainted with this new layout and are currently familiarising trainees on how to implement the new procedure, to further assist pilots in handling aircraft smoke situations.

We are confident that this improvement, combined with the use of enlarged letters for smoke procedures where the oxygen masks and goggles are required, will provide flight crews with the necessary clues to efficiently fight sources of smoke. This will contribute towards improving the industry's level of safety by reducing smoke risks.

A310 FCOM BULLETIN

N° 827/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : USE OF RUDDER ON TRANSPORT CATEGORY AIRPLANES
Subject extracted from former FCOM Bulletin N°15/1 – Subject N°40
No technical change from previous issue

Applicable to : All aircraft

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, highlight 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 Operating Limitations chapter) ;
- 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.

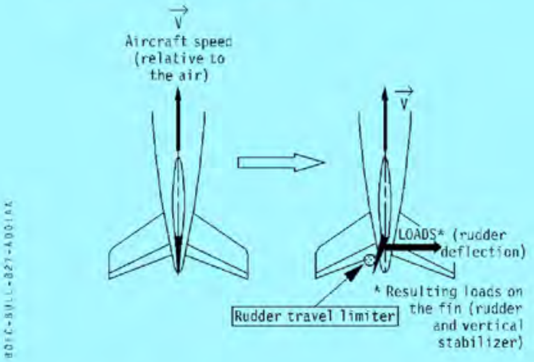
The rudder deflection, necessary to achieve these yawing moments, and the resulting sideslip angles place significant aerodynamic loads on the rudder and on the vertical stabilizer.

Both 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 the required level of structural strength.

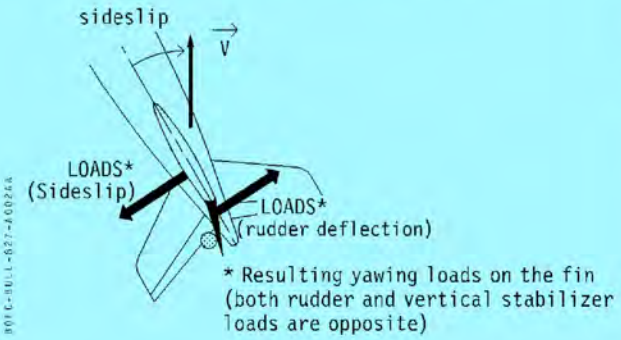
CERTIFICATION REQUIREMENTS

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 is suddenly displaced to the maximum available deflection at the current aircraft speed.

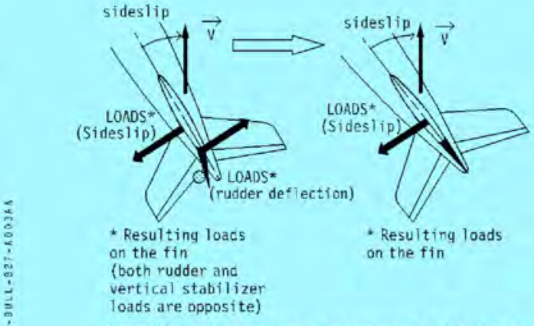


2 – With the rudder deflected as shown above, the aircraft yaws to the resulting overswing sideslip angle, and then stabilizes at a somewhat smaller steady-state sideslip angle.



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

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



Certification yawing maneuver design load

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 asymmetric 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 to be expected once in service.

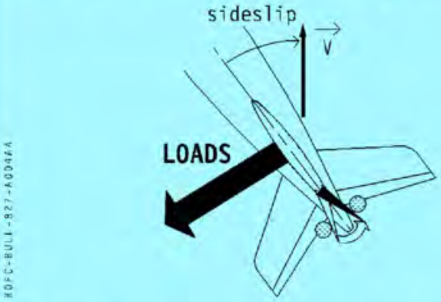
According to JAR/FAR 25 requirements, the ultimate loads are defined as the limit loads multiplied by a prescribed safety factor of 1.5 unless otherwise specified.
The aircraft structure must be able to support limit loads without detrimental permanent deformation and ultimate loads without failure for 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 sudden full, or nearly full, rudder movement that is opposite the sideslip.

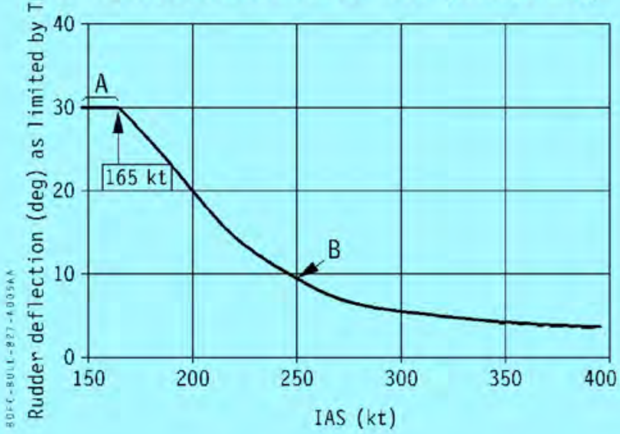
RUDDER CONTROL

The rudder surface is controlled by 3 actuators, commanded by a cable run from the rudder pedals, to which input yaw damping and turn coordination functions are added by the rudder control system.

The rudder travel limiter system, controlled by the Feel and Limitation Computers (FLC), 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.
This also limits 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 (IAS), as shown below :

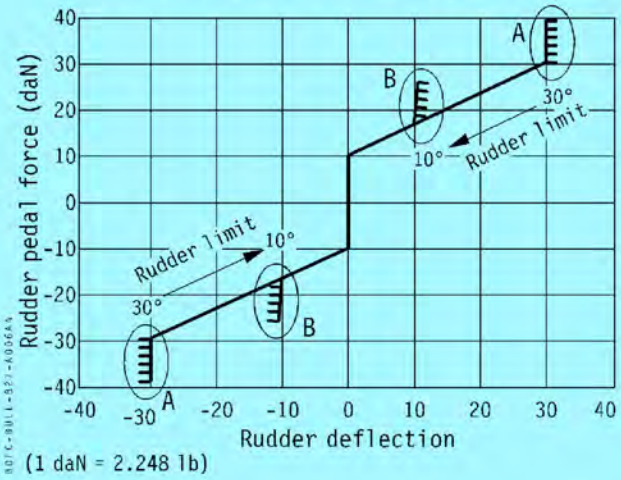
A310/A300-600 Rudder TLU (inside FLC)



- 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 higher speeds , pedal displacements and forces are smaller.

Therefore, as speed increases, the rudder deflection required by any lateral maneuver (eg, engine failure and maximum asymmetric thrust) decreases, and consequently, so do rudder pedal displacement and associated forces.
Rudder pedals displacement is almost linearly proportional to rudder deflection.

A310/A300-600 Rudder feel system



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.
The rudder pedal limiter will give a direct feel feedback of the allowed rudder travel as a function of speed :

- To start moving the rudder pedals from the neutral position, a minimum force of +/- 10 daN must be applied ("breakout force").
- At low speeds, i.e. up to 165 kt, see ref "A", maximum rudder deflection (30 degrees) 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 250 kt, see ref "B", the maximum available rudder deflection is reduced to approximately 10 degrees. It is consequently obtained with less rudder pedals displacement which represents a 18 daN force applied on the pedals (60% 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 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.

Note : *At low speed, as deemed necessary, rudder pedals may be used to complement this automatic 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 lateral 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 some abnormal situations such as :

- Loss of both yaw damper systems. The rudder may be used as deemed necessary, for turn coordination to prevent excessive sideslip.
- Runaway rudder trim. The rudder pedals may be used to return the rudder to neutral.
- Aileron jam. The rudder may be used to initially control the roll.
- Landing gear unsafe indication (gear not downlocked). When a main landing gear is not downlocked, the rudder may be used to establish sideslip in an attempt to downlock the landing gear by aerodynamic side forces.
- Landing with landing gear not downlocked. The rudder can be used for directional control on ground.

In all these normal or abnormal circumstances, proper rudder maneuvers will not affect the aircraft's structural integrity.

Note : *In the event of total rudder travel system failure, refer to the relevant RUDDER TRAVEL FAULT procedure.*

2. 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 inputs must not be applied. Such inputs can lead to loads higher than the limit, or possibly the ultimate loads 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 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".

These upset recovery techniques are summarized in this FCOM Chapter Procedures and Techniques (2.02.09).

A310 FCOM BULLETIN

N° 828/1

DATE : JAN 05

File in FCOM 2.20

Issued by STLW

SUBJECT : EGPWS DATABASE

Applicable to : All aircraft

1. REASON FOR ISSUE AND SCOPE

This FCOM BULLETIN is sent to all FCOM holders since EGPWS will be rendered mandatory by JAA and FAA early 2005.

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 airports where terrain data is missing from the database. During operation around such airports, the enhanced function must be switched off when the aircraft position is less than 15NM from the runway.

The purpose of this bulletin is to provide operators and flight crews with additional information regarding EGPWS database and EGPWS system reaction when airport/terrain data is not included in the database.

FCOM Volume 2 OPERATING LIMITATIONS – SYSTEMS provides limitations of the system.

2. 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 :

- Terrain Awareness and Display (TAD)
- Terrain Clearance Floor (TCF)

These two functions are described in FCOM Volume 1 – FLIGHT INSTRUMENTS – GROUND PROXIMITY WARNING SYSTEM.

3. 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 (0.25 NM x 0.25 NM) is used around 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 (5 NM x 5 NM) is used outside airports where such a coarse terrain database cannot interfere with normal en-route trajectories. The database also contains the position of the airport runway center point. This concerns all hard surface runways whatever the surface type is longer than or equal to 3500 ft.

Additionally, the database gives the possibility of incorporating data regarding man-made obstacles in the vicinity of the major airports.

4. 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 (5 NM x 5 NM) 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 illuminates, the aural warnings "TERRAIN AHEAD" and "TERRAIN AHEAD, PULL-UP" sound and the terrain image pops up on the Navigation Display. When within 15 NM, it is recommended to switch off the enhanced functions (EGPWS TERR MODE pushbutton switched to OFF on the Captain's switching panel) for operations from/to runways not incorporated in the database (FCOM Volume 2 OPERATING LIMITATIONS – SYSTEMS).

5. 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.

The latest database version can be downloaded from the internet website www.egpws.com.

6. 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.
It is the airlines responsibility to identify with the database manufacturer the airports where terrain data is missing.

Airbus strongly recommends that the latest database be loaded on the EGPWC as soon as it is available.

Airbus also 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.