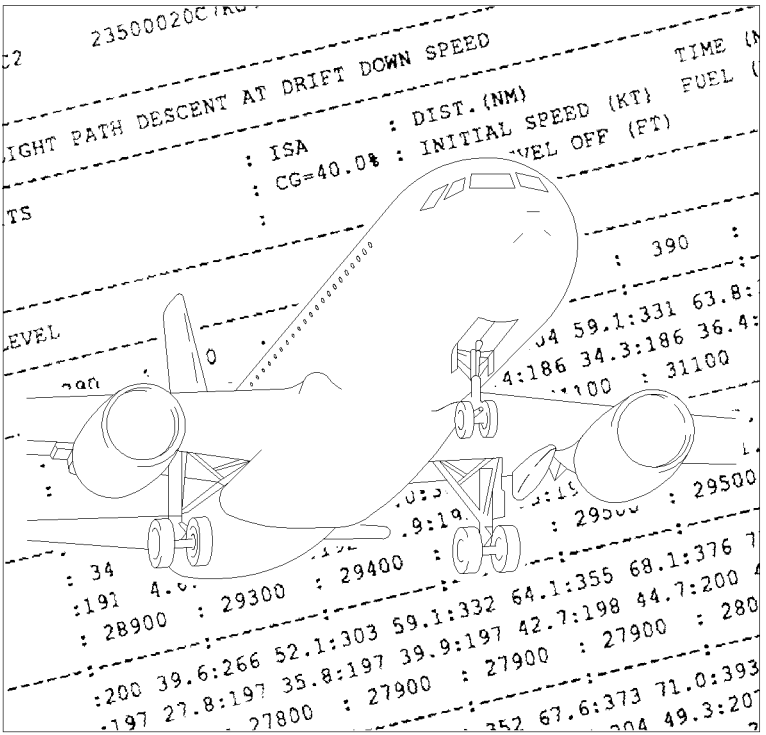
A319/A320/A321

FLIGHT CREW OPERATING MANUAL



FLIGHT PREPARATION

2

AIRBUS®

FOREWORD

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

COMMENTS — QUESTIONS — SUGGESTIONS

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

R

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

FOR TECHNICAL OR PROCEDURAL CONTENT

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

FOR PRINTING AND DISTRIBUTION

NFC5-02-0010-001-A001AA

CONTENT

This manual provides operating crewmembers with information on the technical, procedural, and performance characteristics of the aircraft.
It is suitable for training purposes and may be used as a flight crew operating manual.
The content is divided into four volumes :

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

USE

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

WARNINGS, CAUTIONS AND NOTES

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

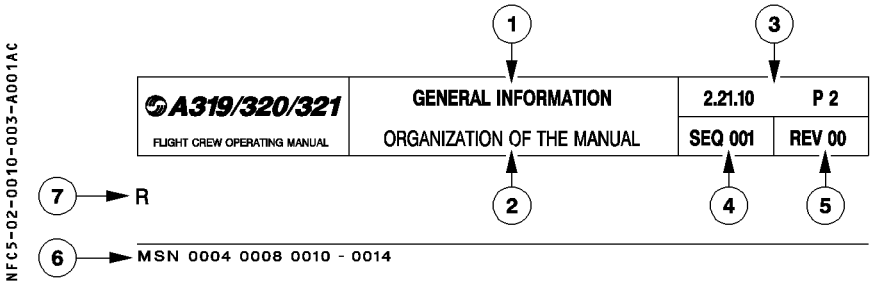
COMPLEMENTARY INFORMATION

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

OPTIONAL EQUIPMENT

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

PAGINATION



(1) Chapter title

(2) Subchapter title

(3) FCOM volume number, chapter number, section number, page number

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

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

(6) Aircraft MSN
- 0004 0008 means that the page is applicable to aircraft MSN 0004 and MSN 0008
- 0010-0014 means that the page is applicable from aircraft MSN 0010 to MSN 0014
- ALL means that the page is applicable to all aircraft covered by the manual.

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

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

REVISIONS

NORMAL REVISIONS

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

R INTERMEDIATE REVISIONS

R They are issued between normal revisions to cover changes in the definition of the aircraft
R or changes in the composition of the fleet of an airline. They are numbered in ascending
R sequence e.g. 20A, 20B, 20C... for intermediate revisions issued between normal revisions
R 20 and 21.
R They are accompanied by filing instructions and an updated list of effective pages.

TEMPORARY REVISIONS

Printed on yellow paper, the Temporary Revisions (TR) are issued to cover urgent matters arising between normal revisions. They are accompanied by filing instructions and an updated customized list of effective TR.
A yellow temporary revision record sheet is at the front of each volume. It is to be filled by the FCOM's owner.

INCORPORATION OF SERVICE BULLETINS IN THE MANUAL

When a service bulletin has been accomplished on one or more aircraft of the operator fleet, and notified to Airbus Industrie, all affected manuals will reflect the new aircraft configuration at next revision. If judged necessary by Airbus Industrie or requested by the operator, a temporary revision or an intermediate revision is issued between normal revisions.

OPERATIONS ENGINEERING BULLETINS

The Operations Engineering Bulletins (OEB) are issued as the need arises to give operators revised or new, but significant, technical and procedural information.
OEBs come with an OEB record sheet. This record sheet is to be filled by the FCOM's owner.
They are accompanied by filing instructions and an updated customized list of effective OEBs.

HOW TO INSERT A REVISION

FILING INSTRUCTIONS

Use the filing instructions as follows :

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

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

LIST OF EFFECTIVE PAGES (LEP)

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

BEST WAY TO GET UPDATED DOCUMENTATION

R As soon as any change has been completed on any airplane, the best way to get
R updated documentation is to advise :

AIRBUS INDUSTRIE
BP 33
31707 BLAGNAC CEDEX
FRANCE
Telex : TLSBP7X.. or 530526F
FAX 33.5.61.93.28.06
ATTN : Customer Service Directorate – Technical Documentation Services (AI/SE – D)

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

CODE	DESIGNATION
0001	Mod : 20268 = (20268+25800)
0002	STD = Mod : 22013 = 24373 = 30961 = (24373+30961)
0003	Mod : 20268 = (20139+20268+22129)
0004	Mod : 20268 = (20268+L) = (20139+20268+22129) = (20139+20268+22129+L)
0005	Mod : (20268+25647) = (20268+25647+ACA)
0006	STD = Mod : 25800 = (24404+25502) = (24405+25501) = (24404+25502+25800) = (24405+25501+25800)
0007	Mod : (22013+26249) = (24105+26249) = (24701+26249)
0008	Mod : 24404 = 24405 = (24404+25800) = (24405+25800) = (25800+27727) = (24404+25800+27727) = (24405+25800+27727)
0009	STD = Mod : 25800 = (24405+25501) = (24405+25501+25800)
0010	Mod : 24405 = (24405+25800) = (25800+27727) = (24405+25800+27727)
0011	Mod : 22013 = 24105 = (20268+22013) = (20268+24105)
0012	Mod : (21103+22013+24981) = (21103+22013+24981+25710) = (21103+21897+22013+24981+25905) = (21103+21897+21898+22013+24981+25905) = (21103+21897+22013+24981+25710+25905) = (21103+21897+21898+22013+24981+25710+25905) = (20040+20065+21103+21897+21898+22013+24981+25710+25905)
0013	IAE V2522 = V2524 = V2527M = V2530 = V2533 = (Mod : 28160+IAE V2500 = V2527 = V2527E)
0014	CFM 56-5-A4 = A5 = (Mod : 28160+CFM 56-5-A1 = A3)
0015	CFM 56-5-B1 = B2 = B3 = B5 = B6 = B7 = (Mod : 28160+CFM 56-5-B4) , 0016 Mod : 26093 = 26243 = 26716 = 26717 = 26799 = 26968 = 27780 = 27831 = 27832 = 28283 = 28416
0017	Mod : 24404 = (24404+25800) = (25800+27727) = (24404+25800+27727)
0018	Mod : 25530 = (25530+25800) = (25800+27727) = (25530+25800+27727)
0019	STD = Mod : 25800 = (24404+25502) = (24404+25502+25800)
0020	Mod : 20268 = (20268+25800)
R R 0021	Mod : (20024+20167) = (20024+20167+21120+23869) = (20024+20167+21120+22802+23869)
0022	Mod : (20024+25710) = (20024+20164+25710) = (20024+20586+25710)
0023	Mod : (20268+25530) = (20268+25530+25800) = (20268+25800+27727) = (20268+25530+25800+27727)
0024	Mod : (20024+20167) = (20024+20167+22802) =(20024+20167+21120+23869) = (20024+20167+21120+22802+23869)
0025	Mod : (20024+20167+22013) = (20024+20167+22013+22802) = (20024+20167+20586+22013+22802)
0026	Mod : (20024+20167+21120) = (20024+20167+21120+22802)
0027	Mod : (20024+20167+21120+22013) = (20024+20167+20586+21120+22013)
0028	Mod : (24105+28238) = (21103+24105+28238)
0029	STD = Mod : 22802 = (20586+22802)
0030	Mod : 22013 = (22013+22802) = (20586+22013+22802)
0031	Mod : 20024 = (20024+22802) = (20024+20586+22802)
0032	Mod : (20024+20167+22013) = (20024+20167+20586+22013)
0033	Mod : (20164+24373) = (20164+22013+24373)

CODE	DESIGNATION
0034	Mod : (21103+24981+25905+28569) = (21103+22013+24981+25905+28569) = (20040+20065+20106+20107+21103+22013+24981+25905)
0035	Mod : (21103+22013+24981+25905) = (20040+20065+21103+22013+24981+25905)
R 0036	Mod : (21103+22013+24981+25905) = (21103+24981+25905+28569) = (21103+21897+22013+24981+25905) = (21103+22013+24981+25710+25905) = (21103+22013+24981+25905+28569) = (20040+20065+21103+22013+24981+25905) = (21103+21897+21898+22013+24981+25905) = (21103+21897+22013+24981+25710+25905) = (21103+21897+21898+22013+24981+25710+25905) = (20040+20065+20106+20107+21103+22013+24981+25905) = (20040+20065+21103+21897+21898+22103+24981+25710+25905)
0037	Mod : (20024+25710+28652) = (20024+20164+25710+28652) = (20024+20586+25710+28652)
0038	Mod : (20024+22013+25415) = (20024+22013+25415+28652)
0039	Mod : 20024+20167+22013+25415+28652
0040	Mod : (20024+22013+25415) = (20024+22013+28652) = (20024+22013+25415+28562)
0041	Mod : 22461 = 23408 = (22461+23408)
0044	Mod : 22461 = 23108 = 23871 = (22461+26018) = (22461+26645) = (23108+26018) = (23871+26018) = (23871+26645) = (22461+23108+23109) = (22461+26018+26645) = (23871+26018+26645) = (22461+23108+23109+26018)
0045	Mod : (20268+22461) = (20268+23408) = (20268+22461+23408) = (20139+20268+22129+22461+23408)
0046	Mod : (25615+26018+26645) = (23108+25615+26018+26645)
0047	Mod : (25615+26018) = (23108+25615+26018)
0048	Mod : 20268 = (20268+25800) = (20268+24405+25501) = (20268+24405+25501+25800)
0049	Mod : (20268+24405) = (20268+24405+25800) = (20268+25800+27727) = (20268+24405+25800+27727)
0050	Mod : (20268+24404) = (20268+24404+25800) = (20268+25800+27727) = (20268+24404+25800+27727)
0051	Mod : 20268 = (20268+25800) = (20268+24404+25502) = (20268+24404+25502+25800)
0052	Mod : 20268 = (20268+25800)
0053	Mod : (20268+28238) = (20268+25800+28238)
0054	Mod : 20268 = (20268+25647)
0055	STD = Mod : (20139+22129) = (20139+22129+28160+28917)
0056	Mod : 20139 = (20139+28160+28917)
0057	Mod : (21103+28507) = (20040+20065+20106) = (20106+20107+21103) = (20107+21103+28507) = (20040+20065+20106+20107) = (20040+20065+20106+21103) = (20040+20065+20106+20107+21103)
0058	Mod : 22461 = 23408 = (22461+23408)
0059	Mod : 21103 = (20040+20065+21103) = (21103+21897+21898) = (20106+20107+21103+21897+21898)
0060	Mod : (22013+28569) = (21103+22013+28569) = (20040+20065+20106+20107+21103+22013)
0061	Mod : (21103+24105) = (20040+20065+21103+24105) = (21103+21897+21898+24105)
0062	Mod : (21103+22013) = (20040+20065+21103+22013) = (21103+21897+21898+22013)
0063	Mod : (21103+24105+24821) = (20040+20065+21103+24105+24821) = (21103+21897+21898+24105+24821)

	CODE	DESIGNATION
R	0064	Mod : (21103+22013+28999) = (21103+22013+24981+25710+28999) =
R		(21103+22013+24981+25710+28653+28999)
	0065	STD = Mod : (20040+20065) = (21103+25710) = (20040+20065+20106) = (20040+20065+20106+20107) = (20040+20065+20106+20107+21103) = (20040+20065+20106+20107+21103+22013) = (20040+20065+20106+21103) = (20040+20065+20103) = (20040+20065+21103+22013) = (20106+20107+21103) = (20106+20107+21103+21897+21898) = (20107+21103) = 21103 = (21103+21897+21898) = (21103+21897+21898+22013) = (21103+22013) = (21103+22013+24981) = (21103+22013+24981+25710) = (21103+22013+28569)
	0066	Mod : 20164 = (20164+22013) = (20164+30961) = (20164+24373+30961)
	0067	Mod : (20268+24044+28721+31607) = (20268+24044+28960+31607)
	0068	Mod : (20268+25647) = (20268+ACA+CMM)
R	0069	Mod : (20268+25647) = (ACA = CMM = MXA) = (20268+ACA = CMM = MXA) =
R		(20268+25647+ACA = CMM = MXA)
R	0075	Mod : (20268+24044+25647) = (20268+24044+ACA) =
R		(20268+24044+25647+ACA)
	0076	Mod : (20268+28721) = (20268+28960)
	0077	Mod : (20268+24044+28721) = (20268+24044+28960)
	0078	Mod : (20268+28238) = (20268+25800+28238)
R	0079	Mod : 20268 = (20268+25647)
R	0080	Mod : (20268+25647) = (ACA = CMM) = (20268+25647+ACA = CMM)
R	0081	STD = Mod : 24105 = 27773 = (24105+27773) = (24105+27773+28471)
R	0082	Mod : (20268+24044+25647) = (20268+24044+ACA) =
R		(20268+24044+25647+ACA) = (20268+24044+25647+28960+ACA)
R	0083	Mod : (20024+20167+22013+30422) = (20024+20167+22013+25453+30422)
R	0084	Mod : (20024+25453) = (20024+20164+25453) = (20024+20586+25453)
R	0085	Mod : (20024+30422) = (20024+20164+30422) = (20024+20586+30422) =
R		(20024+25453+30422) = (20024+20164+25453+30422) =
R		(20024+20586+25453+30422)
R	0086	Mod : (20024+22013+25453) = (20024+22013+30422) =
R		(20024+22013+25453+30422)
R	0087	Mod : (20024+22013+25453+31286) = (20024+22013+30422+31286) =
R		(20024+22013+25453+30422+31286)
R	0090	Mod : (20268+24946+26965) = (20268+24946+27773) = (20268+25951+26965) =
R		(20268+25951+27773) = (20268+26760+26965) = (20268+26760+27773) =
R		(20268+26965+32150) = (20268+26965+32238) = (20268+26965+32239) =
R		(20268+26965+32311) = (20268+27773+32150) = (20268+27773+32238) =
R		(20268+27773+32239) = (20268+27773+32311)
R	0091	Mod : (20268+25615+24946+26965) = (20268+25615+24946+27773) =
R		(20268+25615+25951+26965) = (20268+25615+25951+27773) =
R		(20268+25615+26760+26965) = (20268+25615+26760+27773) =
R		(20268+25615+26965+32150) = (20268+25615+26965+32238) =
R		(20268+25615+26965+32239) = (20268+25615+26965+32311) =
R		(20268+25615+27773+32150) = (20268+25615+27773+32238) =
R		(20268+25615+27773+32239) = (20268+25615+27773+32311)
R	0092	Mod : (24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) =
R		(26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) =
R		(26965+32239) = (26965+32311) = (27773+32150) = (27773+32238) =
R		(27773+32239) = (27773+32311)
R	0093	Mod : 25530 = (25530+25800) = (25800+27727) = (25530+25800+27727)
R	0094	Mod : (24946+25615+26965) = (24946+25615+27773) = (25615+25951+26965) =
R		(25615+25951+27773) = (25615+26760+26965) = (25615+26760+27773) =
R		(25615+26965+32150) = (25615+26965+32238) = (25615+26965+32239) =
R		(25615+26965+32311) = (25615+27773+32150) = (25615+27773+32238) =
R		(25615+27773+32239) = (25615+27773+32311)

CODE	DESIGNATION
0095	Mod : (20268+24946+26965) = (20268+24946+27773) = (20268+25951+26965) = (20268+25951+27773) = (20268+26760+26965) = (20268+26760+27773) = (20268+26965+32150) = (20268+26965+32238) = (20268+26965+32239) = (20268+26965+32311) = (20268+27773+32150) = (20268+27773+32238) = (20268+27773+32239) = (20268+27773+32311) = (20268+24946+26965+US) = (20268+24946+27773+US) = (20268+25951+26965+US) = (20268+25951+27773+US) = (20268+26760+26965+US) = (20268+26760+27773+US) = (20268+26965+32150+US) = (20268+26965+32238+US) = (20268+26965+32239+US) = (20268+26965+32311+US) = (20268+27773+32150+US) = (20268+27773+32238+US) = (20268+27773+32239+US) = (20268+27773+32311+US)
0103	Mod : (20268+25647+CFM 56-5-B6) = (ACA = MXA+CFM 56-5-B6)

R

N°	ISSUE DATE	
01	SEP 1987	
02	MAR 1988	
03	MAY 1988	
04	JUL 1988	
05	AUG 1988	
06	OCT 1988	
07	JAN 1989	
08	MAR 1989	
09	APR 1989	
10	AUG 1989	
11	DEC 1989	
12	SEP 1990	
13	JUL 1991	
14	MAY 1992	
15	DEC 1992	
16	JUN 1993	
17	NOV 1993	
18	MAY 1994	
19	MAY 1995	
20	SEP 1996	
21	JUN 97	
22	JAN 98	
23	AUG 98	
24	JAN 99	
25	JUN 99	
26	DEC 99	
27	MAY 00	
28	OCT 00	

R

N°	ISSUE DATE	
29	MAR 01	
30	SEP 01	
31	APR 02	
32	SEP 02	

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

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

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

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

MSN	REGISTRATION
1068	F-GTFM
1145	F-GYJM

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

2 01 00 001 001 REV033

- TECHNICAL AMENDMENT
  1)Table of content is updated.

2 01 30 003 200 REV033 CODE 0033

- TECHNICAL AMENDMENT
  1)Procedures for APU start/shutdown during refueling are moved to FCOM 2.01.30 p 10a.

2 01 30 007 100 REV033 M:20024

- TECHNICAL AMENDMENT
  1)Procedures for APU start/shutdown during defueling are moved to FCOM 2.01.30 p 10a.

2 01 30 008 100 REV033 20024

- TECHNICAL AMENDMENT
  1)Procedures for APU start/shutdown during refueling are moved to FCOM 2.01.30 p 10a.

2 01 30 010A 001 REV033

- TECHNICAL AMENDMENT
  1)The policy on APU operation during refueling/defueling is modified to allow APU start attempt and shutdown during refueling/defueling. However :
  -no start attempt is authorized following an automatic shutdown or a failed start
  -a manual APU shutdown is requested in the event of a fuel spill during refueling/defueling.

2 01 30 011 100 REV033 MOD:20024

- TECHNICAL AMENDMENT
  1)Page modified to clarify use of MMIs.

2 01 30 011A 001 REV033

- TECHNICAL AMENDMENT
  1)Page created to clarify use of MMIs.

2 01 30 012 100 REV033 20024

- INCORPORATION OF MOD 20024
- TECHNICAL AMENDMENT
  1)Page created to clarify use of MMIs.

2 01 30 013 001 REV033 CODE 0029

- TECHNICAL AMENDMENT
  1)Fuel quantities units are added.
  2)Table values are updated.

2 01 30 014 001 REV033 CODE 0029

- TECHNICAL AMENDMENT

V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	REASONS OF CHANGE
							1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	015	001	REV033	CODE 0029	- TECHNICAL AMENDMENT 1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	016	001	REV033	CODE 0029	- TECHNICAL AMENDMENT 1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	017	001	REV033	CODE 0029	- TECHNICAL AMENDMENT 1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	018	001	REV033	CODE 0029	- TECHNICAL AMENDMENT 1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	019	001	REV033	CODE 0029	- TECHNICAL AMENDMENT 1)Fuel quantities units are added. 2)Table values are updated.
2	01	30	020	100	REV033	CODE 0031	- TECHNICAL AMENDMENT 1)Fuel quantities units are added.
2	01	30	021	100	REV033	CODE 0031	- INCORPORATION OF MOD 20024 - TECHNICAL AMENDMENT 1)Fuel quantities units are added.
2	02	14	008	100	REV033	22013=24105	- TECHNICAL AMENDMENT 1)Update of minimum speeds check.
2	02	20	008	100	REV033	22013=24105	- TECHNICAL AMENDMENT 1)To replace the check of V2 only, by the check of all speeds versus minimum speeds (VMC and VMU). To replace the check of all speeds versus minimum speeds (VMC and VMU) by the check of V2 only versus VMU.
2	03	10	001	001	REV026	CODE 0081	- INCORPORATION OF MOD 27773
2	03	20	001	001	REV033		- TECHNICAL AMENDMENT

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                               ----------------------REASONS OF CHANGE--------------------
-------------------------------------------------------------------------------------------
                          1)Removal of the recommendations for the
                            use of the autobrake system.
                            Refer to FCOM 3.03 S.O.P.

2 04 10  002       100 REV033  22013:24105

                      - TECHNICAL AMENDMENT
                         1)To clarify the conditions of use of
                           the performance corrections in the
                           CAUTION note.

2 05 70  001       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
                      - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                      - TECHNICAL AMENDMENT
                         1)To provide fuel tankering data for
                           A319-111/-112.

2 05 70  002       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
                      - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                      - TECHNICAL AMENDMENT
                         1)To provide fuel tankering data for
                           A319-111/-112.

2 05 70  003       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
                      - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                      - TECHNICAL AMENDMENT
                         1)To provide fuel tankering data for
                           A319-111/-112.

2 05 70  004       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
                      - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                      - TECHNICAL AMENDMENT
                         1)To provide fuel tankering data for
                           A319-111/-112.

2 05 70  005       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
                      - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                      - TECHNICAL AMENDMENT
                         1)To provide fuel tankering data for
                           A319-111/-112.

2 05 70  006       135 REV033  CODE 0093/56-5-B5/B6

                      - INCORPORATION OF MOD 25530
                      - INCORPORATION OF MOD 25800
                      - INCORPORATION OF MOD 27727
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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------REASONS OF CHANGE----------

2 05 70 006 135 REV033 CODE 0093/56-5-B5/B6

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
- TECHNICAL AMENDMENT
  1)To provide fuel tankering data for
  A319-111/-112.

2 05 70 007 135 REV033 CODE 0093/56-5-B5/B6

- INCORPORATION OF MOD 25530
- INCORPORATION OF MOD 25800
- INCORPORATION OF MOD 27727
- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
- TECHNICAL AMENDMENT
  1)To provide fuel tankering data for
  A319-111/-112.

2 05 70 008 135 REV033 CODE 0093/56-5-B5/B6

- INCORPORATION OF MOD 25530
- INCORPORATION OF MOD 25800
- INCORPORATION OF MOD 27727
- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
- TECHNICAL AMENDMENT
  1)To provide fuel tankering data for
  A319-111/-112.

LIST OF EFFECTIVE PAGES (LEP) -

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	2	00	00	001	001	REV021	CONTENTS	ALL
	2	00	10	001	001	REV031	ORGANIZATION OF THE MANUAL	ALL
	2	00	10	002	001	REV021	ORGANIZATION OF THE MANUAL	
	2	00	10	003	001	REV022	ORGANIZATION OF THE MANUAL	ALL
	2	00	10	004	001	REV022	ORGANIZATION OF THE MANUAL	
	2	00	10	005	001	REV021	ORGANIZATION OF THE MANUAL	ALL
R	2	00	20	001	001	REV033	LIST OF CODES	ALL
R	2	00	20	002	001	REV033	LIST OF CODES	
N	2	00	20	003	001	REV033	LIST OF CODES	ALL
N	2	00	20	004	001	REV033	LIST OF CODES	
	2	00	30	001	001	REV028	LIST OF NORMAL REVISIONS	ALL
	2	00	30	002	001	REV032	LIST OF NORMAL REVISIONS	
	2	00	35	001	001	REV022	RECORD OF TEMPORARY REVISION	ALL
R	2	00	36	001	001	REV033	LIST OF EFFECTIVE TEMPO.REVI	ALL
R	2	00	70	001	001	REV033	CROSS REFERENCE TABLE	ALL
R	2	00	75	001	001	REV033	HIGHLIGHTS	ALL
R	2	00	80	001	001	REV033	LIST OF EFFECTIVE PAGES	ALL
R	2	00	85	001	001	REV033	LIST OF MODIFICATIONS	ALL
R	2	01	00	001	001	REV033		ALL
	2	01	10	001	001	REV031		ALL
	2	01	20	001	100	REV021	21103	1145
	2	01	20	002	230	REV028	CODE 0061	
	2	01	20	001	100	REV021	21103	1068
	2	01	20	002	303	REV029	CODE 0063	
	2	01	20	002A	001	REV029	CODE 0065	ALL
	2	01	20	003	100	REV020	MOD:21329	ALL
	2	01	20	004	100	REV026	M:23320	
	2	01	20	005	100	REV026	M:23320	ALL
	2	01	20	006	100	REV026	M:23320	
	2	01	30	001	200	REV023	M: 20024+20167	ALL
	2	01	30	002	200	REV020	MOD:20024+20164	
R	2	01	30	003	200	REV033	CODE 0033	ALL
R	2	01	30	004	100	REV028	M:20164	
	2	01	30	005	100	REV020	MOD:20024	ALL
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R	2	01	30	016	001	REV033	CODE 0029	
R	2	01	30	017	001	REV033	CODE 0029	ALL
R	2	01	30	018	001	REV033	CODE 0029	
N	2	01	30	019	001	REV033	CODE 0029	ALL
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N	2	01	30	021	100	REV033	CODE 0031	ALL
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	2	01	40	002	230	REV028	M:20268+24105	
	2	01	40	003	210	REV028	MOD:20268+24105	ALL
	2	01	40	004	230	REV030	MOD 20268+24105	
	2	01	40	005	230	REV030	MOD 20268+24105	ALL
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	2	02	00	002	001	REV022		
	2	02	05	001	001	REV022		ALL
	2	02	10	001	001	REV022		ALL
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	2	02	10	003	100	REV025	CODE 0011	ALL
	2	02	10	004	100	REV025	M:22013 OR 24105	
	2	02	10	005	100	REV025	M:22013-24105	ALL
	2	02	10	006	110	REV026	M:24105	
	2	02	12	001	110	REV025	M:24105	ALL
	2	02	12	002	040	REV025	CFM 56-5-B6	
	2	02	12	003	110	REV025	M:24105	ALL
	2	02	12	004	040	REV025	CFM 56-5-B6	
	2	02	12	005	040	REV022	CFM 56-5-B6	ALL
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	2	02	14	004	050	REV030	CFM 56-5-B6	
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	2	02	18	001	100	REV025	M:22013 OR 24105	ALL
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	2	02	18	005	045	REV025	CFM 56-5-B6	ALL
	2	02	18	006	045	REV022	CFM 56-5-B6	
	2	02	18	007	100	REV022	M:22013 OR 24105	ALL
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	2	02	20	005	100	REV025	M:24105	ALL
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	2	02	24	002	050	REV031	CFM 56-5-B6	
	2	02	25	001	195	REV031	20268/CFM 56-5-B6	ALL
	2	02	25	002	165	REV022	M:20268 CFM 56-5-B6	
	2	02	25	003	165	REV022	M:20268 CFM 56-5-B6	ALL
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	2	02	40	003	150	REV025	M:20268 CFM 56-5-B6	ALL
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	2	02	40	008	185	REV025	M:20268/CFM 56-5-B6	
	2	02	40	009	185	REV025	M:20268/CFM 56-5-B6	ALL
	2	02	40	010	001	REV020		
	2	02	40	011	185	REV025	M:20268/CFM 56-5-B6	ALL
	2	02	40	012	185	REV025	M:20268/CFM 56-5-B6	
	2	02	40	013	185	REV025	M:20268/CFM 56-5-B6	ALL
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	2	04	10	004	190	REV028	20268/CFM 56-5-B6	
	2	04	10	005	190	REV026	MOD:20268 CFM 56-5-B6	ALL
	2	04	10	006	190	REV026	MOD:20268 CFM 56-5-B6	
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2 04 10	015	140	REV026	M:20268 CFM 56-5-B6	ALL
2 04 15	001	001	REV020		ALL
2 04 20	001	001	REV021		ALL
2 04 20	002	001	REV020		
2 04 20	003	001	REV027		ALL
2 04 20	004	001	REV024		
2 04 20	005	001	REV029		ALL
2 04 20	006	235	REV027	M:24105+25800/56-5-B5/B6/B7	
2 04 20	007	220	REV027	CODE 0023/CFM 56-5-B5/B6	ALL
2 04 20	008	110	REV023	MOD:24105	
2 04 25	001	100	REV030	M:22013+24105+28160	ALL
2 04 25	002	100	REV020	M:22013+24105+28160	
2 04 25	003	035	REV023	CODE 0015	ALL
2 04 25	004	050	REV021	CFM 56-5-B5/B6	
2 04 25	005	130	REV023	M:20268 CFM 56-5-B5/B6 OR L	ALL
2 04 25	006	135	REV027	M:25800/56-5-B5/B6	
2 04 25	007	220	REV029	CODE 0023/CFM 56-5-B5/6	ALL
2 04 25	008	220	REV029	CODE 0023/CFM 56-5-B5/6	
2 04 25	009	230	REV029	CODE 0023/CFM 56-5-B5/6	ALL
2 04 25	010	220	REV029	CODE 0023/CFM 56-5-B5/6	
2 04 25	011	150	REV023	M:20268 CFM 56-5-B5/B6	ALL
2 04 25	012	145	REV031	20268 CFM 56-5-B5/B6	
2 04 35	001	001	REV020		ALL
2 04 35	002	001	REV021		
2 04 40	001	001	REV025		ALL
2 04 40	002	001	REV020		
2 04 40	003	001	REV021		ALL
2 04 40	004	001	REV020		
2 04 40	005	001	REV021		ALL
2 04 40	006	001	REV025		
2 04 40	007	001	REV025		ALL
2 04 40	008	001	REV025		
2 04 40	009	110	REV031	26249	ALL
2 04 40	010	110	REV030	26017/CFM ALL	
2 04 40	010A	010	REV031	CFM ALL	ALL

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2 04 40	013	140	REV027	CODE 0018 CFM 56-5-B5/B6	ALL
2 04 40	014	140	REV027	CODE 0018 CFM 56-5-B5/B6	
2 04 45	001	025	REV023	CFM 56-5-B1/B2/B3/B4/B5/B6	ALL
2 04 45	002	025	REV023	CFM 56-5-B1/B2/B3/B4/B5/B6	
2 04 50	001	001	REV029		ALL
2 04 50	002	105	REV030	23779	
2 04 50	003	001	REV027		ALL
2 04 51	001	100	REV025	CODE 0016	ALL
2 04 51	002	100	REV025	CODE 0016	
2 04 51	003	100	REV027	CODE 0016	ALL
2 04 51	004	100	REV025	CODE 0016	
2 04 60	001	001	REV030		ALL
2 05 00	001	001	REV021		ALL
2 05 10	001	120	REV024	M:25800/56-5-B	ALL
2 05 10	002	103	REV021	M:24105	
2 05 10	003	001	REV020		ALL
2 05 10	004	001	REV021		
2 05 15	001	001	REV020		ALL
2 05 15	002	001	REV021		
2 05 15	003	001	REV020		ALL
2 05 15	004	001	REV022		
2 05 15	005	220	REV031	CODE 0023/CFM 56-5-B5/6	ALL
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2 05 15	007	220	REV031	CODE 0023/CFM 56-5-B5/6	ALL
2 05 15	008	220	REV031	CODE 0023/CFM 56-5-B5/6	
2 05 15	009	220	REV031	CODE 0023/CFM 56-5-B5/6	ALL
2 05 20	001	220	REV031	CODE 0023/CFM 56-5-B5/6	ALL
2 05 20	002	220	REV031	CODE 0023/CFM 56-5-B5/B6/T=L	
2 05 20	003	120	REV021	MOD 24105	ALL
2 05 30	001	120	REV024	M:25800/56-5-B	ALL
2 05 30	002	220	REV027	CODE:0023/56-5-B5/B6	
2 05 30	003	220	REV027	CODE:0023/56-5-B5/B6	ALL
2 05 30	004	220	REV027	CODE:0023/56-5-B5/B6	
2 05 30	005	220	REV027	CODE:0023/56-5-B5/B6	ALL
2 05 30	006	220	REV027	CODE:0023/56-5-B5/B6	

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	2	05	30	018	220	REV027	CODE:0023/56-5-B5/B6	
	2	05	30	019	220	REV027	CODE:0023/56-5-B5/B6	ALL
	2	05	30	020	220	REV027	CODE:0023/56-5-B5/B6	
	2	05	30	021	220	REV027	CODE:0023/56-5-B5/B6	ALL
	2	05	30	022	220	REV027	CODE:0023/56-5-B5/B6	
	2	05	30	023	220	REV027	CODE 0023/CFM 56-5-B5/B6	ALL
	2	05	30	024	220	REV027	CODE 0023/CFM 56-5-B5/B6	
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	2	05	40	002	220	REV027	CODE 0023/CFM 56-5-B5/B6	
	2	05	40	003	220	REV027	CODE 0023/CFM 56-5-B5/6	ALL
	2	05	40	004	220	REV027	CODE 0023/CFM 56-5-B5/6	
	2	05	40	005	220	REV027	CODE 0023/CFM 56-5-B5/6	ALL
	2	05	40	006	220	REV027	CODE 0023/CFM 56-5-B5/6	
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	2	05	40	008	220	REV027	CODE 0023/CFM 56-5-B5/6	
	2	05	40	009	220	REV027	CODE 0023/CFM 56-5-B5/6	ALL
	2	05	40	010	220	REV027	CODE 0023/CFM 56-5-B5/6	
	2	05	40	011	220	REV027	CODE 0023/CFM 56-5-B5/6	ALL
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	2	05	60	003	150	REV021	MOD:24105	ALL
	2	05	60	004	150	REV021	MOD:24105	
N	2	05	70	001	135	REV033	CODE 0093/56-5-B5/B6	ALL
N	2	05	70	002	135	REV033	CODE 0093/56-5-B5/B6	

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
N	2	05	70	003	135	REV033	CODE 0093/56-5-B5/B6	ALL
N	2	05	70	004	135	REV033	CODE 0093/56-5-B5/B6	
N	2	05	70	005	135	REV033	CODE 0093/56-5-B5/B6	ALL
N	2	05	70	006	135	REV033	CODE 0093/56-5-B5/B6	
N	2	05	70	007	135	REV033	CODE 0093/56-5-B5/B6	ALL
N	2	05	70	008	135	REV033	CODE 0093/56-5-B5/B6	

M V T	REV	MOD SB	MP	TITLE	VALIDITY
.	032A	20024	.....	FUEL- INSTALL A CENTRE TANK SYSTEM-	ALL
.	032A	20164	.....	FUEL - REFUEL/DEFUEL SYSTEM - INSTALL A FUEL QUANTITY PRE-SELECTOR IN FLIGHT COMPARTMENT -	ALL
.	032A	20167	.....	STRUCTURE - REINFORCE STRUCTURE TO ALLOW MTOW 72T-MLW 63T-MZFW 59T DESIGN WEIGHTS	ALL
.	032A	20268	.....	WINGS-WING TIP FENCES-INTRODUCE WING TIPS INCLUDING FENCES-	ALL
.	032A	21103	.....	EQUIPMENT/FURNISHINGS - CARGO COMPARTMENT - REARRANGE COMPARTMENT 4 INTO TWO ZONES -	ALL
.	032A	21329	.....	DOORS-CARGO COMPT DOORS-MODIFY LOCKING INDICATION	ALL
.	032A	21897	.....	EQUIPMENT/FURNISHINGS-FWD CARGO COMPT- INSTALL CLS AND FULL BULK COMPONENTS	F-GTFM
.	032A	21898	.....	EQUIPMENT/FURNISHINGS-AFT CARGO COMPT- INSTALL CLS AND FULL BULK COMPONENTS	F-GTFM
.	032A	23124	.....	AIR CONDITIONING - PRESSURIZATION CONTROL - IMPROVE CONTROLLER TO ENABLE USE OF EXTERNAL MODE	ALL
.	032A	23320	.....	DOORS-CARGO COMPARTMENT DOOR HYDRAULIC SYSTEM-INTRODUCE MODIFIED DOOR SELECTOR VALVE	ALL

M V T	REV	MOD SB	MP	TITLE VALIDITY
.	032A	23779		MINOR IMPROVEMENTS INTRODUCED FROM A/C 508 (ST2) TO A/C 521 (ST2) ALL
.	032A	24105		FUSELAGE - REAR FUSELAGE - ADAPT SECTION 17/19 STRUCTURE TO A319 DEFINITION ALL
.	032A	24373		FUEL - TANK LEVEL SENSING - INTRODUCE MODIFIED LOW FUEL PRESSURE WARNING CONTROL ALL
.	032A	24821		EQUIPMENT/FURNISHINGS : AFT CARGO COMPARTMENT PROVIDE ADDITIONAL CONTAINER CAPABILITY F-GTFM
.	032A	24946		LANDING GEAR - MLG - MESSIER - INTRODUCE BRAKES P/N C202253 ALL
.	032A	25141		NACELLES/PYLONS-PYLON STRUCTURE- ADAPT PRIMARY STRUCTURE TO A321-200 VERSION ALL
.	032A	25287		POWERPLANT - GENERAL - INSTALL ON A319 ENGINE RATED VERSION OF CFM 56-5B6 23500 LBS ALL
.	032A	25530		ENGINE - COMBUSTION SECTION - INTRODUCE DOUBLE ANNULAR COMBUSTOR ON CFM56-5B6 (CFM56-5B6/2) ALL
.	032A	25800		POWER PLANT-GENERAL-INTRODUCE CFM56-5B/P ALL
.	032A	26017		INDICATING/RECORDING SYSTEMS-FLIGHT WARNING COMPUTER (FWC)-INTRODUCE FWC ST2 E2 ALL

M V T	REV	MOD SB	MP	TITLE	VALIDITY
.	032A	26018	.....	INDICATING/RECORDING SYSTEMS-DISPLAY MANAGEMENT COMPUTER (DMC)-INTRODCUE DMC V32 STD	ALL
.	032A	26249	.....	AIR CONDITIONING-FLOW CONTROL AND INDICATING INTRODUCE MODIFIED AIR CONDITIONING FLOW CONTROL	ALL
.	032A	26645	.....	AUTO-FLIGHT-FAC INTRODUCE FAC STD BAM 0513	ALL
.	032A	26968	.....	AUTO FLIGHT-FMGC-INTRODUCE FMGC CAM0102 FOR A319 AUTOLAND AND GPS/ACARS FOR CFM ENGINES	ALL
.	032A	27276	.....	FLIGHT CONTROLS-ELAC SYSTEM-INTRODUCE ELAC SOFTWARE "L80"	ALL
.	032A	27727	.....	ENGINE -COMBUSTION SECTION- INTRODUCE CFM56-5B DAC II PIP ENGINES	ALL
.	032A	28164	.....	LANDING GEAR - WHEELS AND BRAKES - INSTALL CARBON BRAKES TYPE SEPCARB III PLUS - MESSIER BUGATTI	ALL
N	033	31395 27-1135 02	.....	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC STD L81	ALL

01.00 CONTENTS

01.10 GENERAL

01.20 CARGO LOADING

01.30 FUEL

01.40 WEIGHT AND BALANCE

DEFINITIONS

R – **MANUFACTURER'S EMPTY WEIGHT (MEW)**
The weight of the structure, power plant, furnishings, systems and other items of equipment that are considered an integral part of the aircraft. It is essentially a "dry" weight, including only those fluids contained in closed systems (e.g. hydraulic fluid).

R – **OPERATIONAL EMPTY WEIGHT OEW)**
The manufacturer's weight empty plus the operator's items i.e. the flight and cabin crew and their baggage, unusable fuel, engine oil, emergency equipment, toilet chemicals and fluids, galley structure, catering equipment, seats, documents etc.

– **DRY OPERATING WEIGHT (DOW)**
R The total weight of an aircraft ready for a specific type of operation excluding all usable
R fuel and traffic load.
R Operational Empty Weight plus items specific to the type of flight i.e. catering,
R newspapers, pantry equipment etc.

– **TAKEOFF FUEL**
The weight of the fuel onboard at takeoff.

– **OPERATING WEIGHT**
R The weight obtained by addition of the operational empty weight and the takeoff fuel.

– **TOTAL TRAFFIC LOAD**
The weight of the payload including cargo loads, passengers and passengers bags.

– **ZERO FUEL WEIGHT (ZFW)**
R The weight obtained by addition of the total traffic load and the dry operating weight.

– **TAKEOFF WEIGHT (TOW)**
The weight at takeoff. It is equal to the addition of the zero fuel weight and takeoff fuel.

– **TRIP FUEL**
The weight of the fuel necessary to cover the normal leg without reserves.

– **LANDING WEIGHT**
The weight at landing. It is equal to takeoff weight minus trip fuel.

GENERAL

The aircraft has two lower deck cargo compartments :
– Forward cargo compartment, compartment 1.
– Aft cargo compartment, subdivided into compartments 3, 4 and 5.
The main access doors to forward and aft compartments are hydraulically operated.
A bulk cargo door ◁* gives additional access to the aft cargo compartment. It is manually operated.

DESCRIPTION

Each compartment is divided into sections, and is designed to be category D (for A320 and A319) or category C (A321, A319 ◁* and A320 ◁*) as defined by FAR.
A placard in each compartment indicates the maximum authorized gross weight.
The compartments have separate lighting.

RESTRAINT SYSTEM

Divider nets subdivide the compartments to allow them to be partially loaded and to retain the bulk.
Door nets which protect the doors from shifting cargo, must be used whenever the compartment contain cargo.

CARGO LOADING SYSTEM ◁*

A semi-automatic cargo loading system, which may be installed in forward and aft compartments, loads pallets and containers.

CARGO CAPACITY

R **FULL BULK**

R In full bulk configuration, the maximum load for each compartment and section are as
R follows :

– **Forward**
Compartment 1 : 2 268 kg (5 000 lb)

– **Aft**
R Compartment 41: 1 326 kg (2 924 lb)
R Compartment 42 : 1 695 kg (3 736 lb)

CARGO LOADING SYSTEM (CLS)

R When the Cargo Loading System (CLS) is installed in the FWD and AFT cargo, the
R maximum load for each compartment and section are as follows :

R – **Forward**
R Compartment 1 : 2 268 kg (5 000 lb)

– **Aft**
R Compartment 41: 1 134 kg (2 500 lb)
R Compartment 42 : 1 134 kg (2 500 lb)
R The following table lists the loading possibilities (including the Maximum Gross Weight per
R container/pallet).
R

ULD	ATA	NAS 3610	IATA	Allowable MGW		Maximum number	
				kg	lb	fwd	aft
Half size	LD3-46	2K2	G	1134	2500	2	2
Full size	LD3-46W	2K2	H	1134	2500	2	2
60.4 × 61.5 in		2K3	K	1134	2500	2	2
60.4 × 61.5 in		2K3	X	1134	2500	2	2

R *Note : The bulk compartment is always used in bulk configuration with a maximum load*
R *of 1497 kg (3300 lb).*

GENERAL

The aircraft has two lower deck cargo compartments :
– Forward cargo compartment, compartment 1.
– Aft cargo compartment, subdivided into compartments 3, 4 and 5.
The main access doors to forward and aft compartments are hydraulically operated.
A bulk cargo door ◁* gives additional access to the aft cargo compartment. It is manually operated.

DESCRIPTION

Each compartment is divided into sections, and is designed to be category D (for A320 and A319) or category C (A321, A319 ◁* and A320 ◁*) as defined by FAR.
A placard in each compartment indicates the maximum authorized gross weight.
The compartments have separate lighting.

RESTRAINT SYSTEM

Divider nets subdivide the compartments to allow them to be partially loaded and to retain the bulk.
Door nets which protect the doors from shifting cargo, must be used whenever the compartment contain cargo.

CARGO LOADING SYSTEM ◁*

A semi-automatic cargo loading system, which may be installed in forward and aft compartments, loads pallets and containers.

CARGO CAPACITY

CARGO LOADING SYSTEM (CLS)

The maximum load for each compartment and section is as follows :

– **Forward**
Compartment 1 : 2268 kg (5000 lb)

– **Aft**
Compartment 41 : 1134 kg (2500 lb)
Compartment 42 : 1134 kg (2500 lb)
Compartment 43 : 753 kg (1660 lb)

The following table lists the loading possibilities, including the Maximum Gross Weight per container/pallet.

ULD	ATA	NAS 3610	IATA	Allowable MGW		Maximum number	
				kg	lb	fwd	aft
Half size	LD3-46	2K2	G	1134	2500	2	2
Full size	LD3-46W	2K2	H	1134	2500	2	2
Full size	LD3/40-46	2K2	H	753	1660		1
60.4 × 61.5 in		2K3	K	1134	2500	2	2
60.4 × 61.5 in		2K3	X	1134	2500	2	2

Note : The bulk compartment is always used in bulk configuration with a maximum load of 1497 kg (3300 lb).

R **FULL BULK**

R When the full bulk configuration exists on the aircraft and is used, the maximum load for
R each compartment and section is as follows :

R – **Forward**
R Compartment 1 : 2268 kg (5000 lb)

R – **Aft**
R Compartment 41 : 1326 kg (2924 lb)
R Compartment 42 : 1695 kg (3736 lb)

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CARGO DOOR OPERATION

NORMAL OPERATION

OPENING

On door

– **ACCESS DOOR OPERATING HANDLE . . . . . RELEASE**
Push handle flap inward.

– **DOOR . . . . . UNLOCK**
Move door operating handle downward (105°) from LOCKED to UNLOCK position.

On door service panel

– **SERVICE PANEL ACCESS DOOR . . . . . OPEN**

– **LEVER OF MANUAL SELECTOR VALVE . . . . . HOLD ON OPEN**
The yellow hydraulic system is pressurized (YELLOW ELEC PUMP energized). Operation of the flight controls and PTU is inhibited.

● **When the door is fully open (green light on the service panel is on) :**

– **LEVER OF MANUAL SELECTOR VALVE . . . . . RELEASE**
When released, the lever returns to the neutral position and shuts down the electric pump.

CLOSING

On door service panel

– **LEVER OF MANUAL SELECTOR VALVE . . . . . HOLD ON CLOSE**
At first the lever locks in an intermediate position, maintaining a pre-set pressurization to prevent the door from dropping open. The operator can then move the lever to CLOSE and the door closes. When it is fully closed, the lever returns to the neutral position and shuts down the electric pump.
Ensure that green indicator light goes off.

On door

– **DOOR . . . . . LOCK**
Immediately push the door operating handle upwards to the locked position. When the door is locked, the cargo doors view ports appear green, the CARGO door indication on ECAM extinguishes, and the handle flap mechanism locks the operating handle.

On door service panel

– **ACCESS DOOR . . . . . CLOSE**

AUXILIARY OPERATION

In case of an electrical failure or if the electric pump fails, the operator can open or close the doors by working the hand pump.

HAND PUMP OPENING

On door

– **DOOR . . . . . UNLOCK**
Unlock the operating handle as if for normal operation.

On door service panel

– **SERVICE PANEL ACCESS DOOR . . . . . OPEN**

– **LEVER OF MANUAL SELECTOR VALVE . . . . . HOLD ON OPEN**

On ground service panel

– **HAND PUMP . . . . . OPERATE**
The door opens.

● **When the door is fully open (green light on the service panel is on) :**

On door service panel

– **LEVER OF MANUAL SELECTOR VALVE . . . . . RELEASE**

On door service panel

– LEVER OF MANUAL SELECTOR VALVE . . . . . HOLD ON CLOSE

On ground service panel

– HAND PUMP . . . . . OPERATE
The door closes.

On door service panel

– LEVER OF MANUAL SELECTOR VALVE . . . . . RELEASE
Release when door is fully closed.

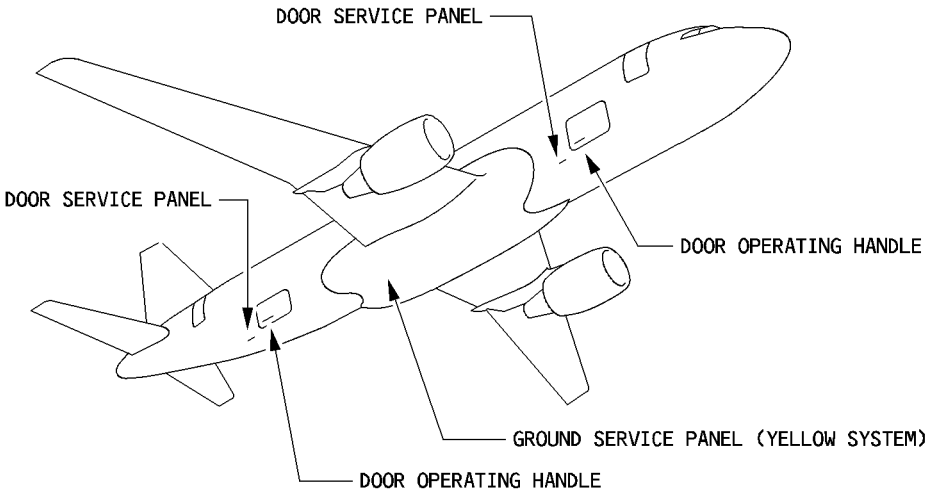
On door

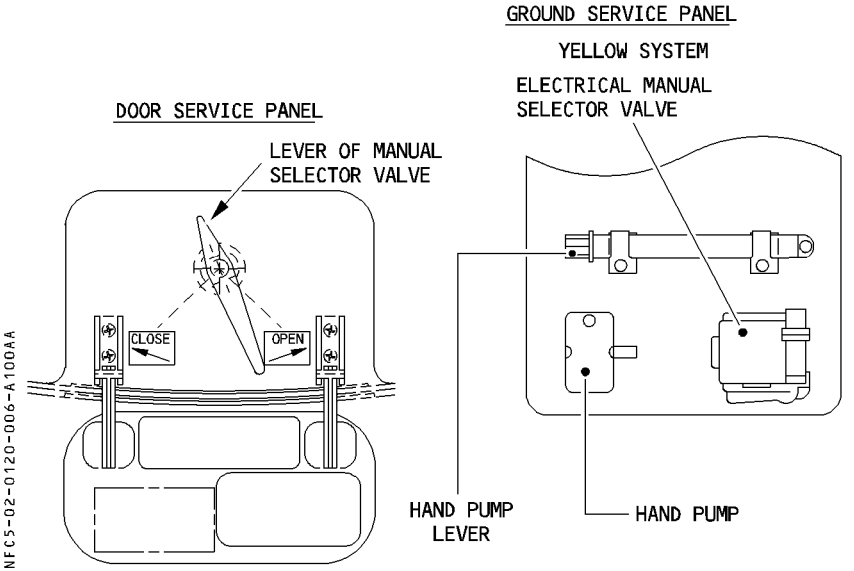
– DOOR . . . . . LOCK
Lock the operating handle as for normal operation.

On door service panel and ground service panel

– ACCESS DOORS . . . . . CLOSE

LOCATION OF SERVICE PANELS



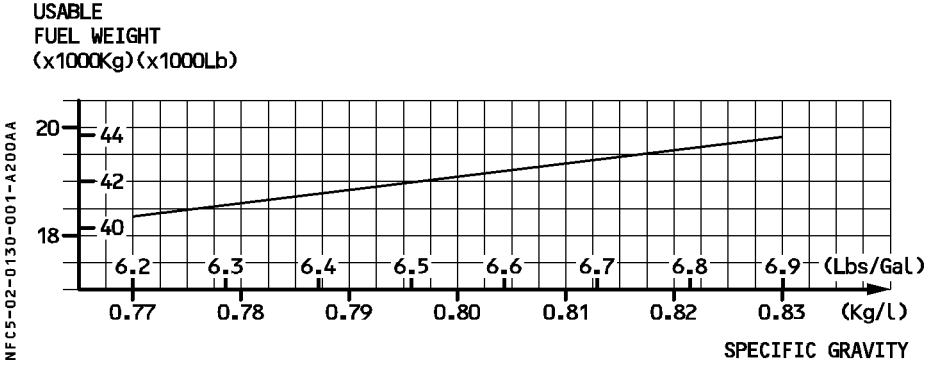


GENERAL INFORMATION

USABLE FUEL VOLUME

	WING TANKS		CENTER TANK	TOTAL
	OUTER CELL	INNER CELL		
LITERS	1760	13849	8250	23859
US GALLONS	464	3659	2180	6303

R ### USABLE FUEL WEIGHT

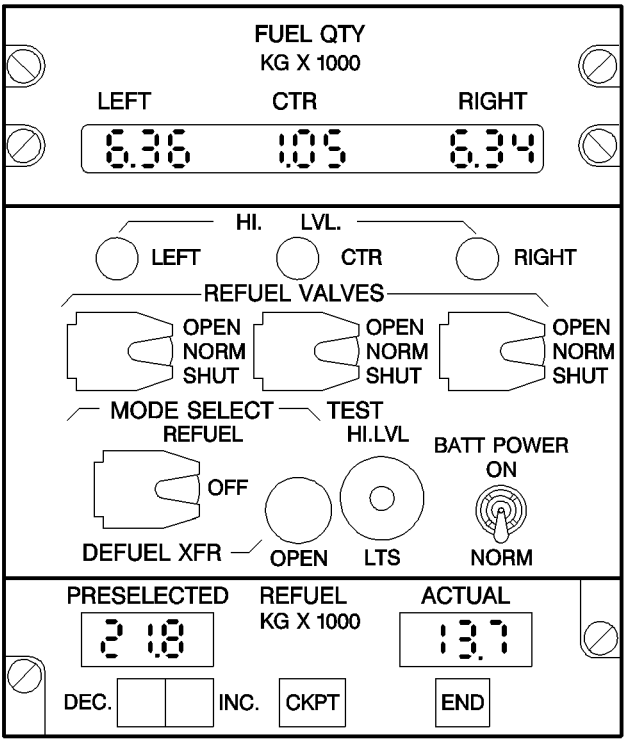


REFUELING

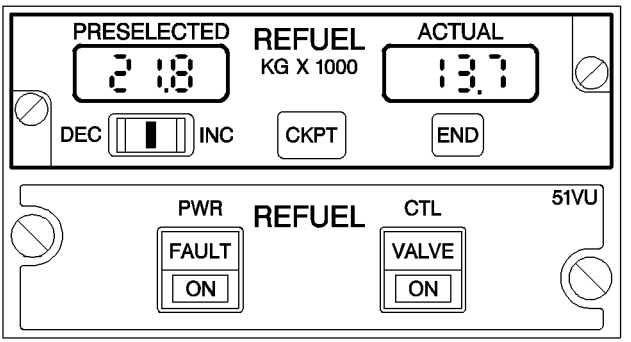
- During automatic refueling, fuel goes to the center tank and outer cell of wing tanks simultaneously. When the outer cell of wing tank is full, fuel overflows into the inner cell. The wing tanks fill first, then the center tank.
  During manual refueling, fill the wing tanks first, then the center tank.
- With the tanks filled to the maximum capacity, there is enough space in each tank to allow for a 2 % thermal expansion of the fuel without its spilling through the vent system.
- R During refuel, the flight crew should avoid any electrical transients (switching between R APU, external and engine electrical supply) Electrical transients may cause the refuel to R stop.

REFUELING CONTROL PANEL

EXTERNAL PANEL



COCKPIT PANEL



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REFUELING

PREPARATION

– **ACCESS PLATFORM** . . . . . **IN POSITION**

– **SAFETY PRECAUTIONS** . . . . . **APPLY**
Make certain that no HF transmission is performed during refueling, and that the tanker and the aircraft are properly grounded. Connect a tanker grounding cable to the aircraft's grounding point on the main landing gear.

R *Note : For APU start/shutdown during refueling, refer to FCOM 2.01.30 p 10a.*

– **MAX REFUELING PRESSURE** . . . . . **50 PSI (3.5 bars)**

On refueling control panel :

– **TEST** . . . . . **LTS**
Lights on the panel come on. FUEL QTY and the PRESELECTED and ACTUAL displays show 8's.

– **TEST** . . . . . **HIGH**
The HI LVL lights change state, if the high level sensors and their circuits are serviceable.

AUTOMATIC REFUELING

From cockpit refueling control panel

– **REFUEL PWR pb** . . . . . **ON**
Cockpit panel takes priority. The CKPT light comes on and REFUELG is displayed on the ECAM MEMO.

– **PRESELECTOR** . . . . . **SET**

– **REFUEL CTL pb** . . . . . **ON**
Refueling starts. When refueling is finished, the END light comes on.

– **REFUEL PWR pb** . . . . . **OFF**

On cockpit overhead FUEL panel :

– **MODE SEL pb** . . . . . **MAN FOR 10 SEC THEN AUTO**
To delatch the center tank pumps.

From external refueling control panel

– **REFUEL VALVES** . . . . . **CHECK NORM and GUARDED**

– **PRESELECTOR** . . . . . **SET**

– **MODE SELECT** . . . . . **REFUEL**

– **START REFUELING**
When the refueling is finished the END light comes on.

– **ACTUAL QUANTITY** . . . . . **CHECK**
The actual quantity must be within 100 kg (220 lb) of the preselected quantity.

– **MODE SELECT** . . . . . **OFF and GUARDED**

MANUAL REFUELING

– **REFUEL VALVES** . . . . . **SHUT**

– **MODE SELECT** . . . . . **REFUEL**

– **REFUEL VALVES (tanks to be filled)** . . . . . **OPEN**

– **START REFUELING**

– **FUEL QTY** . . . . . **MONITOR**

● **When the contents of the tanks reach the required level :**

– **Corresponding REFUEL VALVES** . . . . . **SHUT**

– **MODE SELECT** . . . . . **OFF and GUARDED**

– **REFUEL VALVES** . . . . . **NORM and GUARDED**

GROUND FUEL TRANSFER

On cockpit overhead FUEL panel

- **PUMPS (of the tanks not to be defueled) . . . . . OFF**
- **MODE SEL . . . . . MAN**
- **PUMPS (of the tanks to be defueled) . . . . . ON**

● **if left wing and/or center tanks is (are) to be defueled :**

- **X FEED . . . . . ON**
  OPEN light comes on.

On refueling control panel :

- **REFUEL VALVES (of tanks not to be filled) . . . . . SHUT**
- **REFUEL VALVES (of tanks to be filled) . . . . . OPEN**
- **MODE SELECT . . . . . DEFUEL/XFR**
  OPEN light comes on.
- **FUEL QTY . . . . . MONITOR**

● **When the tank contents reach the required level :**

- **Corresponding REFUEL VALVES . . . . . SHUT**
- **MODE SELECT . . . . . OFF and GUARDED**
  OPEN light goes out.
- **REFUEL VALVES . . . . . NORM and GUARDED**
- **Set cockpit FUEL panel to normal configuration.**

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DEFUELING

Note : Defueling by suction is not possible.

– **ACCESS PLATFORM . . . . . IN POSITION**

– **SAFETY PRECAUTIONS . . . . . APPLY**
Make certain that no HF transmission is performed during defueling and that the tanker and the aircraft are properly grounded. Connect a tanker grounding cable to the aircraft's grounding point on the main landing gear.

R *Note : For APU start/shutdown during defueling, refer to FCOM 2.01.30 p 10a.*

– **MAX DEFUELING PRESSURE . . . . . 11 PSI (0.75 bar)**

On cockpit overhead FUEL panel :

– **PUMPS . . . . . OFF**

On refueling control panel :

– **REFUEL VALVES . . . . . SHUT**

– **MODE SELECT (OPEN light comes on) . . . . . DEFUEL/XFR**

On cockpit overhead FUEL panel :

– **MODE SEL . . . . . MAN**

– **PUMPS (of the tank(s) to be defueled) . . . . . ON**

– **X FEED (OPEN light comes on) . . . . . ON**

– **FUEL QTY . . . . . MONITOR**

● **When the tank contents reach the required level**

– **Corresponding PUMPS . . . . . OFF**

• **On refueling control panel :**

– **MODE SELECT (OPEN light goes out) . . . . . OFF and GUARDED**

– **REFUEL VALVES . . . . . NORM and GUARDED**

– **Set cockpit FUEL panel to normal configuration.**

OVERWING GRAVITY REFUELING

Overwing gravity refueling is done at the refuel point in the top of each wing. Fuel is delivered directly into the outer cell from which the inner cell is filled by opening the intercell transfer valves. Fill center tank by transfer from the right wing tank (open the X FEED valve in case of transfer from the left wing tank).

– SAFETY PRECAUTIONS . . . . . APPLY
Make certain that no HF transmission is performed during refueling and that the tanker and the aircraft are properly grounded. Connect a tanker grounding cable to the aircraft's grounding point on the main landing gear.

R *Note : For APU start/shutdown during refueling, refer to FCOM 2.01.30 p 10a.*

– TRANSFER VALVES (on ECAM FUEL page) . . . . . CHECK POSITION

- **If transfer valves closed :**

– MODE SELECT (on refueling control panel) . . . . . Check OFF

– FUEL/XFR VALVE 1/WING/L and R C/B's 1QP and 2QP, and FUEL/XFR VALVE 2/WING/L and R C/B's 3QP and 4QP . . . . . PULL for 5 sec then PUSH
Intercell transfer valves will stay open until the next refuel selection.

RH WING REFUELING PROCEDURE

***– OVERWING REFUEL CAP . . . . . REMOVE**

***– REFUELING . . . . . START**

- **If the center tank is required :**

– RH REFUEL VALVE . . . . . SHUT

– CTR REFUEL VALVE . . . . . OPEN

– MODE SELECT . . . . . DEFUEL/XFR
OPEN light comes ON.

– RH WING TK PUMPS . . . . . ON
Fuel is transfered to the center tank.

- **When the center tank reaches the required level :**

– WING TK PUMPS . . . . . OFF

– REFUEL VALVES . . . . . NORM

● **When the wing tank reaches the required level :**

***– REFUELING . . . . . STOP**

***– OVERWING REFUEL CAP . . . . . INSTALL**

LH WING REFUELING

Perform the steps for RH wing refueling procedure marked * then :

– MODE SELECT . . . . . REFUEL then OFF
Check on FUEL page that the intercell transfer valves close.

Note : The overwing refuel point is not at the highest point of the wing and therefore the wing tanks cannot be filled to full.

REFUELING WITH ONE ENGINE RUNNING

- Refuel with one engine running only at airports where no external ground pneumatic power is available and only when APU is unserviceable.
- Only the RH fuel couplings can be used.
- Overwing gravity filling is not permitted.
- Disembark all passengers.
- Obtain airport authorization.
  The Airport Fire Department should standby at the aircraft during the entire refueling procedure.
- Point the aircraft into the wind at a location where the slope is negligible.
  Set the parking brake and check its pressure.
  Run engine n° 1 at ground idle with its generator connected.
- Do not start engine n° 2, shut down engine n° 1 or attempt to start the APU before all fueling operations have been completed.
- Position the fuel truck under the extremity of the right wing. Its pressure should not exceed 30 psi.
- Follow manual refueling procedure.

OPERATION MONITORING

During the entire refueling procedure :

- Monitor the fuel truck shut off valve.
- Be sure that the fueling company is keeping permanent control of the emergency fuel shut off device.
- Have a flight crew member in the cockpit monitoring all systems and the running engine.
- Have a qualified ground crew member at the fueling station to operate the refuel valve switches.
- Monitor the refueling closely and be prepared to close the refuel valves in order not to exceed the following fuel quantities :

DENSITY (kg/l)	0.77	0.78	0.79	0.8	0.81	0.82	0.83
L(R) WING (kg)	5710	5780	5860	5930	6005	6080	6160
CENTER (kg)	6030	6110	6190	6270	6350	6430	6500

After second engine start :

- **Reset the 3DMCs in order to reinitialize the fuel used values :**
  - **– DMC 1 SPLY C/B (E11 on 49VU) . . . . . PULL**
  - **– DMC 2 SPLY C/B (Q8 on 121 VU) . . . . . PULL**
  - **– DMC 3 SPLY C/B (Q9 on 121 VU) . . . . . PULL**
  - **– DMC 3 SPLY STBY (E10 on 49 VU) . . . . . PULL**
  - **After 5 seconds :**
    - **– All C/B's . . . . . PUSH**

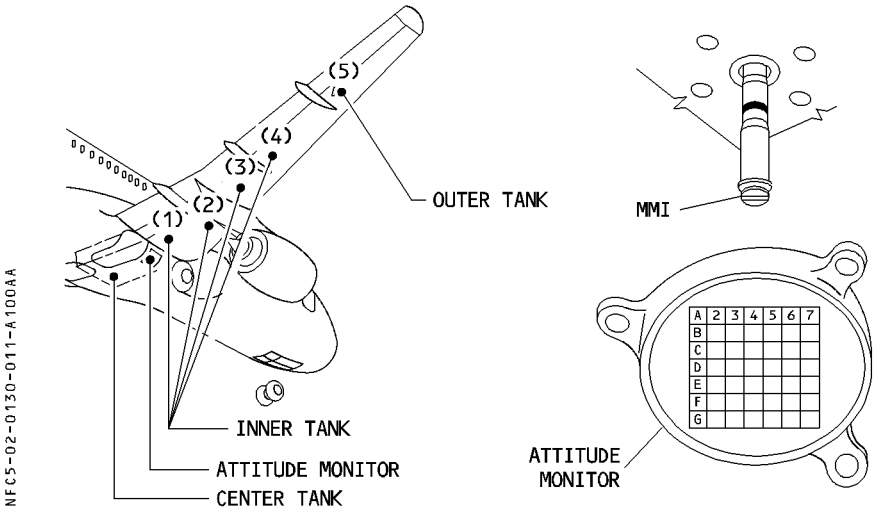
Note : The T.O MEMO does not appear automatically since one engine is kept running.

R **APU START/SHUTDOWN DURING REFUELING/DEFUELING**

R APU starts or shutdowns are permitted during refuel/defuel procedures. If it is necessary
R to operate the APU, the limits that follow apply :
R a) An APU start is not permitted during a refuel/defuel procedure if the APU has failed to
R start or an automatic shutdown has occured
R b) A normal APU shutdown must be completed if a fuel spill has occured during the refuel
R defuel procedure.

USE OF MANUAL MAGNETIC INDICATORS (MMI)

Indicators are disposed as follows :
· five in each wing tank, four in inner tank and one in outer tank
· one in the center tank



– **A/C ATTITUDE** . . . . . **NOTE**
Note the grid square letter and grid square number shown by the bubble on the attitude monitor.

– **ACCESS PLATFORM** . . . . . **IN POSITION**

TO DETERMINE FUEL QUANTITY IN THE OUTER TANK

– **MMI number 5 . . . . . UNLOCK and WITHDRAW**
The crewmember must withdraw the MMI slowly until he feels the magnetic attraction between the rod and float magnets.
Do not use force when withdrawing the MMI as this will disengage the float magnet from the rod magnet and bring the rod down onto the mechanical stop.

– **ROD GRADUATION (which aligns with bottom wing surface) . . . . . READ**

– **MMI . . . . . IN PLACE and LOCKED**

– **Use the table for the applicable aircraft wing side, aircraft attitude (grid square letter and number), and the MMI stick number 5, to find the volume of fuel in the outer tank (See the following pages).**

– **Multiply the result by the specific gravity to find the fuel weight.**

TO DETERMINE FUEL QUANTITY IN THE INNER TANK

– **MMI (from number 4 to number 1) . . . . . UNLOCK and WITHDRAW**
The crewmember must withdraw the MMI slowly until he feels the magnetic attraction between the rod and float magnets.
Do not use force when withdrawing the MMI as this will disengage the float magnet from the rod magnet and bring the rod down onto the mechanical stop.

– **ROD GRADUATION (which aligns with bottom wing surface) . . . . . READ**

– **MMI . . . . . IN PLACE and LOCKED**
MMIs shall be withdrawn from number 4 to number 1 until one MMI measures fuel.

– **Use the table for the applicable aircraft wing side, aircraft attitude (grid square letter and number), and the applicable MMI stick number to find the volume of fuel in the inner tank (See the following pages).**

– **Multiply the result by the specific gravity to find the fuel weight.**

TO DETERMINE FUEL QUANTITY IN THE CENTER TANK

– **CENTER TANK MMI . . . . . UNLOCK and WITHDRAW**
The crewmember must withdraw the MMI slowly until he feels the magnetic attraction between the rod and float magnets.
Do not use force when withdrawing the MMI as this will disengage the float magnet from the rod magnet and bring the rod down onto the mechanical stop.

– **ROD GRADUATION (which aligns with bottom wing surface) . . . . . READ**

– **MMI . . . . . IN PLACE and LOCKED**

– **Use the table for the center tank, and for the applicable aircraft attitude (grid square letter and number) to find the volume of fuel in the center tank (See the following pages).**

– **Multiply the result by the specific gravity to find the fuel weight.**

WING TANKS (LITERS)

MMI N°	MMI READING	LITERS ATTITUDE MONITOR READING A* LEFT WING 1	2	3	4	G 5	RIGHT WING 6	7	MMI READING	LITERS ATTITUDE MONITOR READING A RIGHT WING 1	2	3	4	G 5	LEFT WING 6	7**
1	2	50	50	50	50	50	50	50	2	50	50	50	50	50	50	50
	4	100	100	100	100	100	100	100	4	50	50	50	50	50	50	50
	6	100	100	100	100	100	100	100	6	100	100	100	100	100	100	100
	8	150	150	150	150	150	150	150	8	150	150	150	150	150	150	150
	10	200	200	200	200	200	200	200	10	200	200	200	200	200	200	150
	12	250	250	250	250	250	250	250	12	250	250	250	250	250	250	200
	14	300	300	300	300	300	300	300	14	300	300	300	300	300	300	250
	16	350	350	350	350	350	350	350	16	350	350	350	350	350	350	300
	18	450	450	450	450	450	400	400	18	400	400	400	400	400	400	350
	20	500	500	500	500	500	500	500	20	450	450	450	450	450	450	400
	22	550	550	550	550	550	550	550	22	500	500	500	500	500	500	450
	24	650	650	650	650	650	650	600	24	550	550	550	550	550	550	550
	26	750	750	750	750	750	700	700	26	650	650	650	650	650	650	600
	28	800	800	800	800	800	800	800	28	700	700	700	700	700	700	700
	30	900	900	900	900	900	900	900	30	800	800	800	800	800	800	750
	32	1050	1050	1050	1050	1050	1000	1000	32	900	900	900	900	850	850	850
	34	1150	1150	1150	1150	1150	1150	1100	34	950	950	950	950	950	950	950
	36	1250	1250	1250	1250	1250	1250	1250	36	1050	1050	1050	1050	1050	1050	1050
	38	1350	1350	1350	1350	1350	1350	1350	38	1150	1150	1150	1150	1150	1150	1150
	40	1500	1500	1500	1500	1500	1500	1500	40	1250	1250	1250	1250	1250	1250	1250
	42	1600	1600	1600	1600	1600	1600	1600	42	1350	1350	1350	1350	1350	1350	1350
	44	1750	1750	1750	1750	1750	1750	1750	44	1450	1450	1450	1450	1450	1450	1450
	46	1900	1900	1900	1900	1900	1900	1900	46	1550	1550	1550	1550	1550	1550	1550
	48	2000	2000	2000	2000	2000	2000	2050	48	1700	1700	1700	1700	1700	1700	1700
	50	2200	2200	2200	2200	2200	2200	2200	50	1800	1800	1800	1800	1800	1800	1800
	52	2350	2350	2350	2350	2350	2350	2400	52	1950	1950	1950	1950	1950	1950	1950
	54	2500	2500	2500	2500	2500	2550	2550	54	2000	2000	2050	2050	2050	2050	2050
	56	2650	2650	2700	2700	2700	2650	2700	56	2200	2200	2200	2200	2200	2200	2200
	58	2800	2800	2800	2800	2850	2850	2850	58	2300	2300	2300	2300	2300	2350	2350
	60	2950	2950	2950	3000	3000	3050	3050	60	2450	2500	2500	2500	2500	2500	2500
	62	3100	3100	3150	3150	3150	3200	3250	62	2600	2600	2650	2650	2650	2650	2650
	63	3150	3150	3200	3200	3250	3300	3350	63	2650	2650	2700	2700	2700	2700	2700
	MAX	3450	3450	3450	3500	3500	3600	3600	MAX	2950	2950	2950	2950	2950	3000	3000

* GRID SQUARE LETTER
** GRID SQUARE NUMBER

MMI°	MMI READING	LITERS ATTITUDE READING A LEFT WING 1	2	3	G 4	5	RIGHT WING 6	7	MMI READING	LITERS ATTITUDE READING A RIGHT WING 1	2	3	G 4	5	LEFT WING 6	7
2	2	2300	2250	2200	2200	2200	2200	2200	2	2850	2850	2850	2850	2850	2850	2800
	4	2500	2450	2400	2400	2350	2350	2350	4	3050	3050	3050	3050	3050	3000	3000
	6	2650	2600	2600	2600	2550	2500	2500	6	3200	3200	3200	3200	3200	3200	3150
	8	2750	2750	2750	2700	2700	2650	2650	8	3300	3300	3300	3300	3300	3300	3250
	10	2900	2900	2900	2900	2850	2850	2850	10	3500	3500	3500	3500	3450	3450	3400
	12	3100	3100	3100	3100	3100	3050	3000	12	3650	3650	3600	3600	3600	3600	3600
	14	3250	3250	3250	3250	3250	3250	3200	14	3800	3800	3750	3750	3750	3750	3750
	16	3450	3450	3450	3450	3450	3400	3400	16	3950	3900	3900	3900	3900	3900	3900
	18	3700	3650	3650	3650	3650	3600	3600	18	4050	4050	4050	4050	4050	4050	4050
	20	3900	3900	3900	3900	3850	3850	3850	20	4200	4200	4200	4200	4200	4200	4200
	22	4100	4100	4050	4050	4050	4050	4050	22	4250	4250	4250	4300	4300	4300	4300
	24	4300	4300	4300	4300	4300	4300	4300	24	4400	4400	4400	4400	4450	4450	4450
	26	4500	4500	4500	4500	4500	4500	4550	26	4500	4500	4550	4550	4550	4600	4600
	28	4700	4700	4750	4750	4750	4750	4750	28	4600	4650	4650	4700	4700	4750	4800
	30	4950	4950	4950	4950	5000	5000	5000	30	4750	4750	4800	4800	4850	4850	4900
	32	5100	5100	5150	5150	5150	5200	5200	32	4850	4850	4900	4900	4950	5000	5000
	MAX								MAX							
3	2	4400	4350	4300	4250	4200	4150	4050	2	5050	5050	5100	5100	5100	5100	5100
	4	4700	4700	4650	4600	4500	4400	4300	4	5150	5150	5200	5200	5200	5200	5200
	6	4950	4950	4900	4850	4800	4700	4550	6	5250	5250	5300	5300	5300	5300	5300
	8	5150	5100	5100	5050	5000	4950	4800	8	5350	5350	5400	5400	5400	5400	5400
	10	5250	5250	5250	5250	5200	5150	5050	10	5450	5450	5500	5500	5500	5500	5500
	12	5400	5400	5400	5400	5350	5300	5250	12	5500	5500	5550	5600	5600	5600	5650
	14	5600	5600	5550	5550	5500	5500	5450	14	5600	5650	5650	5700	5700	5700	5750
	16	5750	5750	5700	5700	5700	5650	5600	16	5650	5700	5700	5750	5750	5800	5800
	18	5900	5900	5850	5850	5850	5850	5800	18	5800	5800	5850	5850	5900	5900	5950
	20	6000	6000	6000	6000	6000	6000	6000	20	5900	5900	5950	5950	6000	6000	6050
4	2	5700	5600	5550	5500	5450	5400	5300	2	6000	6050	6100	6100	6100	6100	6100
	4	5850	5750	5700	5650	5600	5550	5500	4	6100	6100	6150	6150	6150	6200	6200
	6	6000	5900	5850	5800	5750	5700	5650	6	6200	6200	6200	6250	6250	6250	6300
	8	6150	6100	6050	6000	5950	5900	5850	8	6250	6300	6300	6350	6350	6350	6400
	10	6300	6300	6250	6200	6150	6150	6100	10	6350	6400	6400	6400	6450	6450	6450
	12	6450	6400	6400	6400	6350	6300	6250	12	6450	6450	6450	6500	6500	6550	6550
	14	6550	6500	6500	6500	6500	6450	6450	14	6500	6550	6550	6550	6600	6600	6650
	16	6600	6600	6600	6600	6600	6600	6550	16	6600	6600	6600	6650	6650	6700	6750
	18	6650	6650	6650	6650	6650	6650	6650	18	6650	6700	6700	6750	6750	6750	6800
	MAX								MAX							
5	2	650	600	550	550	550	500	500	2	700	700	700	700	700	700	700
	4	700	650	650	600	600	550	550	4	750	750	750	750	750	750	750
	6	750	700	700	650	650	650	600	6	800	800	800	800	750	750	750
	8	750	750	750	750	700	700	700	8	800	800	800	800	800	800	800
	10	800	800	800	750	750	750	750	10	850	850	850	850	850	850	850
	12	800	800	800	800	800	800	800	12	850	850	850	850	850	850	850
	14	850	850	850	850	850	850	850	14	850	850	850	850	850	850	850
	MAX	850	850	850	850	850	850	850	MAX	850	850	850	850	850	850	850

MMIN°	MMI READING	LITERS ATTITUDE MONITOR READING B* LEFT WING 1	2	3	4	F 5	RIGHT WING 6	7	MMI READING	LITERS ATTITUDE MONITOR READING B RIGHT WING 1	2	3	4	F 5	LEFT WING 6	7**
1	2	50	50	50	50	50	50	50	2	50	50	50	50	50	50	50
	4	50	50	50	50	50	50	50	4	50	50	50	50	50	50	50
	6	100	100	100	100	100	100	100	6	100	100	100	100	100	100	100
	8	150	150	150	150	150	150	150	8	150	150	150	150	150	150	150
	10	200	200	200	200	200	200	200	10	200	200	200	200	200	200	150
	12	250	250	250	250	250	250	250	12	250	250	250	250	250	250	200
	14	300	300	300	300	300	300	300	14	300	300	300	300	300	300	250
	16	350	350	350	350	360	350	350	16	350	350	350	350	350	350	300
	18	400	400	400	400	400	400	400	18	400	400	400	400	400	400	350
	20	450	450	450	450	450	450	450	20	450	450	450	450	450	450	450
	22	550	550	550	550	550	550	550	22	500	500	500	500	500	500	500
	24	600	600	600	600	600	600	600	24	550	550	550	550	550	550	550
	26	700	700	700	700	700	700	700	26	650	650	650	650	650	650	650
	28	800	800	800	800	800	800	800	28	700	700	700	700	700	700	700
	30	900	900	900	900	900	900	850	30	800	800	800	800	800	800	800
	32	1000	1000	1000	1000	1000	1000	950	32	900	900	900	900	900	900	850
	34	1100	1100	1100	1100	1100	1100	1100	34	1000	1000	1000	1000	950	950	950
	36	1200	1200	1200	1200	1200	1200	1200	36	1100	1100	1100	1100	1050	1050	1050
	38	1300	1300	1300	1300	1300	1300	1300	38	1200	1200	1200	1200	1200	1150	1150
	40	1450	1450	1450	1450	1450	1450	1450	40	1300	1300	1300	1300	1300	1300	1300
	42	1550	1550	1550	1550	1550	1550	1550	42	1400	1400	1400	1400	1400	1400	1400
	44	1700	1700	1700	1700	1700	1700	1700	44	1500	1500	1500	1500	1500	1500	1500
	46	1800	1800	1800	1800	1800	1800	1800	46	1600	1600	1600	1600	1600	1600	1600
	48	1950	1950	1950	1950	1950	1950	1950	48	1700	1700	1700	1700	1700	1700	1700
	50	2100	2100	2100	2100	2100	2100	2100	50	1850	1850	1850	1850	1850	1850	1850
	52	2250	2250	2250	2250	2250	2250	2250	52	1950	1950	1950	1950	1950	1950	1950
	54	2400	2400	2400	2400	2400	2400	2450	54	2100	2100	2100	2100	2100	2100	2100
	56	2550	2550	2600	2600	2600	2600	2600	56	2250	2250	2250	2250	2250	2250	2250
	58	2750	2750	2750	2750	2750	2750	2750	58	2400	2400	2400	2400	2400	2400	2400
	60	2850	2850	2850	2850	2900	2900	2950	60	2550	2550	2550	2550	2550	2550	2550
	62	3000	3000	3000	3050	3050	3050	3100	62	2700	2700	2700	2700	2700	2700	2700
	63	3050	3050	3050	3100	3150	3150	3200	63	2750	2750	2750	2750	2750	2750	2750
	MAX	3350	3350	3350	3350	3400	3450	3500	MAX	3000	3000	3000	3000	3000	3000	3000

* GRID SQUARE LETTER
** GRID SQUARE NUMBER

MMI N°	MMI READING	LITERS ATTITUDE MONITOR READING B LEFT WING 1	2	3	4	F 5	6	RIGHT WING 7	MMI READING	LITERS ATTITUDE MONITOR READING B RIGHT WING 1	2	3	4	F 5	6	LEFT WING 7
2	2	2350	2350	2300	2300	2250	2200	2200	2	2800	2750	2750	2750	2700	2700	2650
	4	2550	2500	2500	2450	2450	2400	2400	4	2950	2950	2900	2900	2900	2900	2850
	6	2750	2700	2700	2650	2650	2600	2600	6	3100	3100	3100	3100	3100	3050	3050
	8	2850	2850	2800	2800	2800	2750	2750	8	3200	3200	3200	3200	3200	3200	3150
	10	3000	3000	3000	3000	3000	2950	2900	10	3400	3400	3350	3350	3350	3350	3300
	12	3150	3150	3200	3150	3150	3150	3100	12	3550	3550	3550	3550	3500	3500	3450
	14	3350	3350	3350	3350	3350	3300	3300	14	3750	3700	3700	3700	3650	3650	3650
	16	3550	3550	3550	3550	3500	3500	3450	16	3900	3850	3850	3850	3850	3800	3800
	18	3750	3750	3750	3750	3700	3700	3650	18	4050	4000	4000	4000	4000	4000	3950
	20	4000	3950	3950	3950	3950	3900	3900	20	4200	4150	4150	4150	4150	4150	4150
	22	4150	4100	4100	4100	4100	4100	4100	22	4250	4250	4250	4250	4250	4250	4250
	24	4300	4300	4300	4300	4300	4300	4300	24	4400	4400	4400	4400	4400	4400	4400
	26	4500	4500	4500	4500	4500	4500	4500	26	4500	4500	4500	4550	4550	4550	4550
	28	4700	4700	4700	4700	4700	4750	4750	28	4650	4650	4650	4650	4700	4700	4750
	30	4850	4900	4900	4900	4950	4950	4950	30	4750	4750	4800	4800	4850	4850	4900
	32	5050	5100	5100	5100	5100	5150	5150	32	4850	4900	4900	4950	4950	5000	5050
	MAX								MAX							
3																
	2	4550	4500	4500	4450	4400	4350	4300	2	5000	5000	5000	5000	5000	5000	4950
	4	4800	4800	4800	4750	4650	4600	4500	4	5100	5100	5100	5100	5100	5100	5100
	6	5050	5000	5000	5000	4900	4850	4750	6	5200	5200	5200	5250	5200	5200	5200
	8	5150	5150	5150	5150	5100	5000	5000	8	5300	5300	5350	5350	5350	5350	5350
	10	5300	5300	5300	5300	5250	5200	5150	10	5400	5400	5450	5450	5450	5450	5450
	12	5450	5450	5450	5450	5400	5400	5350	12	5500	5500	5550	5550	5550	5550	5550
	14	5600	5600	5600	5550	5550	5550	5500	14	5600	5600	5650	5650	5650	5650	5700
	16	5700	5700	5700	5700	5700	5700	5700	16	5700	5700	5700	5750	5750	5750	5800
	18	5850	5850	5850	5850	5850	5850	5850	18	5800	5800	5800	5850	5850	5850	5900
	20	6000	6000	6050	6050	6050	6000	6000	20	5900	5900	5950	5950	6000	6000	6000
	MAX								MAX							
4																
	2								2	5950	5950	6100	6000	6050	6050	6050
	4	5850	5750	5700	5650	5600	5600	5600	4	6050	6050	6100	6100	6100	6100	6150
	6	6000	6000	5950	5900	5850	5800	5800	6	6150	6150	6200	6200	6200	6200	6200
	8	6150	6150	6100	6100	6050	6000	6000	8	6250	6250	6250	6300	6300	6300	6300
	10	6300	6300	6250	6250	6250	6200	6150	10	6350	6350	6350	6400	6400	6400	6400
	12	6400	6400	6400	6400	6350	6350	6300	12	6400	6450	6450	6450	6500	6500	6500
	14	6500	6500	6500	6500	6500	6450	6450	14	6500	6500	6550	6550	6600	6600	6600
	16	6600	6600	6600	6600	6550	6550	6550	16	6600	6600	6600	6650	6650	6700	6700
	18	6760	6770	6770	6770	6770	6770	6760	18	6750	6770	6800	6830	6850	6870	6880
	MAX								MAX							
5																
	2	650	650	600	600	600	550	550	2	750	700	700	700	700	700	700
	4	750	700	700	650	650	600	600	4	750	750	750	750	750	750	750
	6	750	750	750	700	700	650	650	6	800	800	800	800	750	750	750
	8	800	800	750	750	750	750	700	8	800	800	800	800	800	800	800
	10	800	800	800	800	800	750	750	10	850	850	850	850	800	800	800
	12	850	850	800	800	800	800	800	12	850	850	850	850	850	850	850
	14	850	850	850	850	850	850	850	14	850	850	850	850	850	850	850
	MAX	850	850	850	850	850	850	850	MAX	850	850	850	850	850	850	850

MMIN°	MMI READING	LITERS ATTITUDE MONITOR READING C* LEFT WING				E	RIGHT WING	
		1	2	3	4	5	6	7
1	2	50	50	50	50	50	50	50
	4	50	50	50	50	50	50	50
	6	100	100	100	100	100	100	100
	8	150	150	150	150	150	150	150
	10	200	200	200	200	200	200	200
	12	250	250	250	250	250	250	250
	14	300	300	300	300	300	300	300
	16	350	350	350	350	350	350	350
	18	400	400	400	400	400	400	400
	20	450	450	450	450	450	450	450
	22	550	550	550	550	500	500	500
	24	600	600	600	600	600	600	600
	26	700	700	700	700	650	650	650
	28	750	750	750	750	750	750	750
	30	850	850	850	850	850	850	850
	32	950	950	950	950	950	950	950
	34	1050	1050	1050	1050	1050	1050	1050
	36	1200	1150	1150	1150	1150	1150	1150
	38	1300	1300	1300	1250	1250	1250	1250
	40	1400	1400	1400	1400	1400	1400	1400
	42	1500	1500	1500	1500	1500	1500	1500
	44	1600	1600	1600	1600	1600	1600	1600
	46	1750	1750	1750	1750	1750	1750	1750
	48	1850	1850	1850	1850	1900	1900	1900
	50	2000	2000	2000	2000	2000	2000	2050
	52	2150	2150	2150	2150	2150	2150	2200
	54	2300	2300	2300	2300	2300	2300	2350
	56	2450	2500	2500	2500	2500	2500	2500
	58	2600	2650	2650	2650	2650	2650	2700
	60	2800	2800	2800	2800	2850	2850	2850
	62	2900	2950	2950	2950	2950	2950	3000
	63	2950	3000	3000	3000	3050	3050	3100
	MAX	3250	3250	3300	3350	3350	3350	3400

MMI READING	LITERS ATTITUDE MONITOR READING C RIGHT WING				E	LEFT WING	
	1	2	3	4	5	6	7**
2	50	50	50	50	50	50	50
4	50	50	50	50	50	50	50
6	100	100	100	100	100	100	100
8	150	150	150	150	150	150	150
10	200	200	200	200	200	200	150
12	250	250	250	250	250	250	200
14	300	300	300	300	300	300	250
16	350	350	350	350	350	350	350
18	400	400	400	400	400	400	400
20	450	450	450	450	450	450	450
22	500	500	500	500	500	500	500
24	600	600	600	600	600	550	550
26	650	650	650	650	650	650	650
28	750	750	750	750	750	700	700
30	800	800	800	800	800	800	800
32	900	900	900	900	900	900	900
34	1000	1000	1000	1000	1000	1000	1000
36	1100	1100	1100	1100	1100	1100	1100
38	1200	1200	1200	1200	1200	1200	1200
40	1300	1300	1300	1300	1300	1300	1300
42	1400	1400	1400	1400	1400	1400	1400
44	1550	1550	1500	1500	1500	1500	1500
46	1650	1650	1650	1650	1650	1650	1650
48	1800	1750	1750	1750	1750	1750	1800
50	1900	1900	1900	1900	1900	1900	1900
52	2000	2000	2000	2000	2000	2000	2050
54	2150	2150	2150	2150	2150	2150	2200
56	2300	2300	2300	2300	2300	2300	2350
58	2450	2450	2450	2450	2450	2500	2500
60	2600	2600	2600	2600	2600	2650	2650
62	2750	2750	2750	2750	2800	2800	2800
63	2800	2800	2800	2800	2850	2850	2850
MAX	3100	3100	3100	3100	3100	3100	3100

* GRID SQUARE LETTER
** GRID SQUARE NUMBER

MMIN°	MMI READING	LITERS ATTITUDE READING C	LEFT WING 1	2	3	4	E 5	RIGHT WING 6	7	MMI READING	LITERS ATTITUDE MONITOR READING C	RIGHT WING 1	2	3	4	E 5	LEFT WING 6	7
2	2	2450	2400	2400	2400	2350	2350	2350		2	2700	2650	2650	2600	2600	2550	2550	
	4	2650	2600	2600	2600	2550	2550	2500		4	2850	2800	2800	2800	2800	2750	2750	
	6	2800	2800	2800	2800	2750	2750	2700		6	3000	3000	3000	3000	3000	2950	2900	
	8	2900	2900	2900	2900	2900	2850	2850		8	3100	3100	3100	3100	3100	3100	3050	
	10	3100	3100	3100	3100	3100	3050	3000		10	3300	3300	3300	3250	3250	3250	3200	
	12	3250	3250	3250	3250	3250	3250	3200		12	3450	3450	3450	3450	3450	3400	3350	
	14	3450	3450	3450	3450	3400	3400	3350		14	3650	3650	3600	3600	3600	3550	3550	
	16	3650	3650	3650	3600	3600	3550	3550		16	3800	3800	3800	3750	3750	3750	3700	
	18	3850	3850	3800	3800	3800	3750	3750		18	4000	3950	3950	3950	3900	3900	3900	
	20	4050	4050	4000	4000	4000	3950	3950		20	4150	4100	4100	4100	4100	4100	4100	
	22	4200	4200	4150	4150	4150	4100	4100		22	4250	4250	4200	4200	4200	4200	4200	
	24	4350	4350	4300	4300	4300	4300	4300		24	4350	4350	4350	4350	4350	4350	4350	
	26	4500	4500	4500	4500	4500	4500	4500		26	4500	4500	4500	4500	4500	4500	4550	
	28	4650	4650	4650	4700	4700	4700	4700		28	4650	4650	4650	4650	4700	4700	4700	
	30	4850	4850	4850	4850	4900	4900	4900		30	4750	4800	4800	4800	4850	4850	4850	
	32	5000	5000	5000	5050	5050	5050	5100		32	4900	4900	4950	4950	5000	5000	5050	
	MAX									MAX								
3	2	4650	4650	4650	4600	4600	4500	4500		2	4900	4900	4900	4900	4900	4850	4800	
	4	4900	4900	4900	4900	4800	4750	4650		4	5050	5100	5100	5100	5100	5050	5000	
	6	5100	5100	5100	5050	5050	5000	4900		6	5150	5200	5200	5200	5200	5150	5150	
	8	5200	5200	5200	5200	5200	5150	5100		8	5250	5300	5300	5300	5300	5300	5300	
	10	5300	5350	5350	5350	5300	5300	5250		10	5350	5400	5400	5400	5400	5400	5400	
	12	5450	5450	5450	5450	5450	5450	5400		12	5500	5500	5500	5500	5550	5550	5550	
	14	5600	5600	5600	5600	5600	5600	5550		14	5600	5600	5600	5650	5650	5650	5650	
	16	5700	5700	5700	5700	5700	5700	5700		16	5700	5700	5750	5750	5750	5750	5800	
	18	5800	5850	5850	5850	5850	5850	5850		18	5800	5800	5850	5850	5900	5900	5900	
	20	5950	5950	6000	6000	6000	6000	6000		20	5900	5950	5950	6000	6000	6000	6000	
4	2	5800	5750	5750	5700	5700	5700	5700		2	5900	5900	5900	5900	5950	5950	5950	
	4	5950	5900	5900	5850	5850	5800	5800		4	6000	6000	6000	6050	6050	6050	6050	
	6	6050	6050	6000	6000	6000	5950	5950		6	6100	6100	6150	6150	6150	6150	6150	
	8	6200	6150	6150	6150	6150	6100	6100		8	6200	6250	6250	6250	6250	6250	6250	
	10	6300	6300	6300	6300	6300	6250	6250		10	6300	6350	6350	6350	6350	6350	6350	
	12	6400	6400	6400	6400	6400	6400	6400		12	6400	6400	6450	6450	6450	6450	6450	
	14	6500	6500	6500	6500	6500	6500	6500		14	6500	6500	6500	6550	6550	6550	6550	
	16	6600	6600	6600	6600	6600	6600	6600		16	6550	6600	6600	6600	6600	6600	6600	
	18	6730	6740	6750	6750	6760	6760	6770		18	6750	6750	6770	6790	6800	6810	6820	
	MAX									MAX								
5	2	700	700	650	650	600	600	600		2	750	700	700	700	700	650	650	
	4	750	750	700	700	650	650	650		4	750	750	750	750	700	700	700	
	6	750	750	750	750	700	700	700		6	800	800	750	750	750	750	750	
	8	800	800	800	750	750	750	750		8	800	800	800	800	800	800	800	
	10	800	800	800	800	800	800	800		10	850	850	850	800	800	800	800	
	12	850	850	850	800	800	800	800		12	850	850	850	850	850	850	850	
	14	850	850	850	850	850	850	850		14	900	900	850	850	850	850	850	

MMI N°	MMI READING	LITERS ATTITUDE MONITOR READING D* BOTH WINGS 1	2	3	4	5	6	7
1	2	50	50	50	50	50	50	50
	4	100	100	100	100	100	100	100
	6	100	100	100	100	100	100	100
	8	150	150	150	150	150	150	150
	10	200	200	200	200	200	200	200
	12	250	250	250	250	250	250	250
	14	300	300	300	300	300	300	300
	16	350	350	350	350	360	350	350
	18	400	400	400	400	400	400	400
	20	450	450	450	450	450	450	450
	22	500	500	500	500	500	500	500
	24	600	600	600	600	600	600	600
	26	650	650	650	650	650	650	650
	28	750	750	750	750	750	750	750
	30	850	850	850	850	850	850	850
	32	950	950	950	950	950	950	950
	34	1050	1050	1050	1050	1050	1000	1000
	36	1150	1150	1150	1150	1150	1100	1100
	38	1250	1250	1250	1250	1250	1250	1250
	40	1350	1350	1350	1350	1350	1350	1350
	42	1450	1450	1450	1450	1450	1450	1450
	44	1550	1550	1550	1550	1550	1550	1550
	46	1700	1700	1700	1700	1700	1700	1700
	48	1800	1800	1800	1800	1800	1800	1800
	50	1950	1950	1950	1950	1950	1950	1950
	52	2100	2100	2100	2100	2100	2100	2100
	54	2250	2250	2250	2250	2250	2250	2250
	56	2400	2400	2400	2400	2400	2400	2400
	58	2550	2550	2550	2550	2550	2600	2600
	60	2700	2700	2700	2700	2700	2750	2750
	62	2850	2850	2850	2850	2850	2900	2900
	63	2900	2900	2900	2900	2900	2950	2950
	MAX	3050	3050	3100	3100	3100	3150	3150
2	2	2550	2550	2500	2500	2450	2450	2450
	4	2750	2700	2700	2700	2650	2650	2600
	6	2900	2900	2850	2850	2850	2800	2800
	8	3000	3000	2950	2950	2950	2950	2900
	10	3200	3150	3150	3150	3150	3100	3050
	12	3350	3350	3350	3350	3300	3300	3250
	14	3550	3550	3550	3500	3500	3450	3450
	16	3750	3750	3700	3700	3650	3650	3600

MMI READING	LITERS ATTITUDE MONITOR READING D BOTH WINGS 1	2	3	4	5	6	7**	MMI N°
18	3950	3900	3900	3850	3850	3850	3800	2
20	4100	4100	4050	4050	4050	4000	4000	
22	4200	4200	4150	4150	4150	4150	4150	
24	4350	4350	4350	4300	4300	4300	4300	
26	4500	4500	4500	4500	4500	4500	4500	
28	4650	4650	4650	4650	4650	4700	4700	
30	4800	4800	4800	4850	4850	4850	4900	
32	4950	4950	5000	5000	5000	5050	5100	
MAX								
								3
2	4800	4800	4800	4800	4750	4750	4600	
4	5000	5000	5000	5000	4950	4900	4850	
6	5100	5150	5150	5100	5100	5100	5050	
8	5250	5250	5250	5250	5250	5200	5200	
10	5350	5350	5350	5400	5400	5350	5350	
12	5450	5500	5500	5500	5500	5500	5500	
14	5600	5600	5600	5600	5600	5600	5600	
16	5700	5700	5700	5750	5750	5750	5750	
18	5800	5800	5850	5850	5850	5900	5900	
20	5900	5900	5950	5950	5950	6000	6000	
MAX								
								4
2	5900	5850	5800	5800	5800	5800	5800	
4	6000	5950	5950	5950	5950	5950	5950	
6	6100	6100	6050	6050	6050	6050	6050	
8	6200	6200	6200	6200	6200	6200	6200	
10	6300	6300	6300	6300	6300	6300	6300	
12	6400	6400	6400	6400	6400	6400	6400	
14	6500	6500	6500	6500	6500	6500	6500	
16	6600	6600	6600	6600	6600	6600	6600	
18	6750	6750	6770	6800	6800	6810	6820	
MAX								
								5
2	700	700	700	650	650	650	600	
4	750	750	750	700	700	700	650	
6	800	800	750	750	750	750	700	
8	800	800	800	800	800	750	750	
10	850	800	800	800	800	800	800	
12	850	850	850	850	850	850	850	
14	850	850	850	850	850	850	850	
MAX	850	850	850	850	850	850	850	

* GRID SQUARE LETTER

** GRID SQUARE NUMBER

CENTER TANK (LITERS)

MMI READING	LITERS ATTITUDE MONITOR READING LINES A AND G*						
	1	2	3	4	5	6	7
2	300	300	350	350	350	350	350
4	400	450	450	500	500	500	500
6	600	600	650	650	650	650	650
8	750	750	750	750	750	750	750
10	900	850	850	850	850	850	900
12	1050	1000	1000	1000	1000	1000	1050
14	1250	1250	1200	1200	1200	1200	1200
16	1450	1450	1400	1400	1400	1400	1400
18	1650	1650	1600	1600	1600	1600	1600
20	1900	1850	1850	1850	1850	1800	1800
22	2100	2050	2050	2050	2050	2000	2000
24	2300	2250	2250	2250	2200	2200	2150
26	2450	2450	2450	2450	2450	2400	2350
28	2700	2650	2650	2650	2600	2550	2550
30	2900	2850	2850	2850	2800	2800	2750
32	3050	3050	3050	3050	3000	3000	2950
34	3250	3250	3250	3250	3200	3200	3150
36	3500	3500	3450	3450	3450	3400	3400
38	3700	3700	3700	3700	3650	3650	3600
40	3900	3900	3900	3900	3900	3850	3800
42	4100	4100	4100	4100	4100	4050	4050
44	4350	4350	4350	4300	4300	4250	4250
46	4550	4550	4550	4550	4500	4500	4450
48	4750	4750	4750	4700	4700	4650	4650
50	4950	4950	4950	4950	4900	4900	4850
52	5150	5150	5150	5150	5100	5100	5050
54	5400	5400	5400	5400	5350	5300	5250
56	5600	5600	5600	5600	5550	5500	5450
58	5800	5800	5800	5750	5750	5700	5650
60	6000	6000	6000	5950	5950	5900	5900
62	6200	6200	6200	6150	6150	6100	6100
64	6400	6400	6400	6400	6350	6300	6300
66	6600	6600	6600	6600	6550	6550	6500
68	6800	6800	6750	6750	6750	6700	6700
70	7000	6950	6950	6950	6900	6900	6900
72	7200	7200	7150	7150	7100	7100	7050
74	7400	7400	7350	7350	7300	7300	7300
76	7600	7600	7600	7550	7550	7500	7500
78	7850	7800	7800	7800	7750	7700	7700
MAX	7950	7900	7900	7900	7850	7800	7800

MMI READING	LITERS ATTITUDE MONITOR READING LINES B AND F						
	1	2	3	4	5	6	7**
2	300	300	300	300	300	300	350
4	400	450	450	450	500	500	500
6	600	600	650	650	650	650	600
8	750	750	750	750	750	750	750
10	900	850	850	850	850	850	900
12	1050	1000	1000	1000	1000	1000	1050
14	1250	1200	1200	1200	1200	1200	1200
16	1450	1450	1450	1450	1400	1400	1400
18	1700	1700	1650	1650	1600	1600	1600
20	1900	1900	1900	1850	1850	1850	1800
22	2100	2100	2100	2050	2050	2000	2000
24	2300	2300	2250	2250	2200	2200	2150
26	2500	2500	2450	2450	2400	2350	2350
28	2700	2700	2650	2650	2600	2550	2500
30	2900	2900	2900	2850	2800	2800	2750
32	3100	3100	3100	3050	3050	3000	2950
34	3300	3300	3300	3250	3250	3200	3150
36	3500	3500	3500	3450	3450	3400	3400
38	3700	3700	3700	3700	3650	3650	3600
40	3950	3950	3950	3900	3900	3850	3800
42	4150	4150	4150	4100	4100	4050	4000
44	4350	4350	4350	4300	4300	4250	4200
46	4550	4550	4550	4550	4500	4500	4450
48	4750	4750	4750	4750	4700	4700	4650
50	4950	4950	4950	4950	4900	4900	4850
52	5150	5150	5150	5150	5150	5100	5050
54	5400	5400	5400	5400	5350	5300	5250
56	5600	5600	5600	5600	5550	5500	5450
58	5800	5800	5800	5800	5750	5750	5700
60	6000	6000	6000	6000	5950	5950	5900
62	6200	6200	6200	6200	6150	6150	6100
64	6400	6400	6400	6400	6350	6350	6300
66	6600	6600	6600	6600	6550	6550	6500
68	6800	6800	6800	6800	6750	6750	6700
70	7000	7000	7000	6950	6950	6950	6900
72	7200	7200	7150	7150	7150	7100	7100
74	7400	7400	7350	7350	7350	7300	7300
76	7600	7600	7600	7550	7550	7500	7500
78	7800	7800	7800	7750	7750	7700	7700
MAX	7900	7900	7850	7850	7850	7800	7800

* GRID SQUARE LETTER
** GRID SQUARE NUMBER

MMI READING	LITERS ATTITUDE MONITOR READING LINES C AND E							MMI READING	LITERS ATTITUDE MONITOR READING LINES D						
	1	2	3	4	5	6	7		1	2	3	4	5	6	7
2	250	300	300	300	300	300	300	2	300	300	300	300	300	300	300
4	400	450	450	500	500	500	450	4	450	450	500	500	500	500	500
6	600	600	650	650	650	600	600	6	600	600	650	650	650	650	600
8	750	750	750	750	750	750	750	8	750	750	750	750	750	750	750
10	850	850	850	850	850	850	850	10	900	900	900	900	900	900	900
12	1050	1000	1000	1000	1000	1000	1000	12	1050	1000	1000	1000	1000	1000	1050
14	1250	1200	1200	1200	1200	1200	1200	14	1250	1250	1200	1200	1200	1200	1200
16	1450	1450	1450	1400	1400	1400	1400	16	1500	1450	1450	1450	1400	1400	1400
18	1650	1650	1650	1650	1600	1600	1600	18	1700	1700	1700	1650	1650	1650	1600
20	1900	1900	1900	1900	1900	1850	1800	20	1900	1900	1900	1900	1900	1850	1850
22	2100	2100	2100	2100	2050	2050	2000	22	2100	2100	2100	2100	2050	2050	2000
24	2300	2300	2250	2250	2250	2200	2200	24	2300	2300	2300	2250	2250	2200	2200
26	2500	2500	2450	2450	2400	2400	2350	26	2500	2500	2450	2450	2400	2400	2350
28	2700	2650	2650	2650	2600	2600	2550	28	2700	2700	2700	2650	2600	2600	2550
30	2900	2900	2850	2850	2800	2800	2750	30	2900	2900	2900	2900	2850	2800	2750
32	3100	3100	3100	3100	3050	3050	3000	32	3100	3100	3100	3100	3050	3050	3000
34	3300	3300	3300	3250	3250	3200	3200	34	3300	3300	3300	3300	3250	3250	3200
36	3500	3500	3500	3500	3450	3450	3400	36	3500	3500	3500	3500	3450	3450	3400
38	3700	3700	3700	3700	3700	3650	3600	38	3700	3750	3750	3700	3700	3650	3650
40	3950	3950	3950	3950	3900	3900	3850	40	3950	3950	3950	3950	3900	3900	3850
42	4150	4150	4150	4150	4100	4100	4050	42	4150	4150	4150	4150	4100	4100	4050
44	4350	4350	4350	4350	4300	4300	4250	44	4350	4350	4350	4350	4300	4300	4250
46	4550	4550	4550	4550	4500	4500	4450	46	4550	4550	4550	4550	4500	4500	4450
48	4750	4750	4750	4750	4750	4700	4650	48	4750	4750	4750	4750	4700	4700	4650
50	4950	4950	4950	4950	4900	4900	4850	50	4950	4950	4950	4950	4900	4900	4850
52	5150	5150	5150	5150	5100	5100	5050	52	5200	5200	5200	5150	5100	5100	5050
54	5400	5400	5400	5400	5350	5300	5250	54	5400	5400	5400	5400	5350	5300	5250
56	5600	5600	5600	5600	5550	5500	5450	56	5600	5600	5600	5600	5550	5500	5450
58	5800	5800	5800	5800	5750	5700	5650	58	5800	5800	5800	5800	5750	5700	5650
60	6000	6000	6000	6000	5950	5950	5900	60	6000	6000	6000	6000	5950	5950	5900
62	6200	6200	6200	6200	6150	6100	6100	62	6200	6200	6200	6200	6150	6150	6100
64	6400	6400	6400	6400	6350	6300	6300	64	6400	6400	6400	6400	6350	6350	6300
66	6600	6600	6600	6600	6550	6550	6500	66	6600	6600	6600	6600	6550	6550	6500
68	6800	6800	6800	6750	6750	6700	6700	68	6800	6800	6800	6800	6750	6750	6700
70	7000	7000	7000	6950	6950	6900	6900	70	7000	7000	7000	7000	6950	6950	6900
72	7200	7200	7150	7150	7150	7150	7100	72	7200	7200	7200	7150	7150	7150	7100
74	7400	7400	7400	7350	7350	7300	7300	74	7400	7400	7400	7350	7350	7350	7300
76	7600	7600	7600	7550	7550	7500	7500	76	7600	7600	7600	7550	7550	7550	7500
78	7800	7800	7800	7750	7750	7700	7700	78	7800	7800	7800	7750	7750	7700	7700
MAX	7900	7900	7850	7850	7850	7800	7800	MAX	7900	7900	7900	7900	7850	7850	7800

LOAD and TRIM SHEET

This chart allows the determination of Aircraft CG location (MAC) function of dry operating weight, pantry adjustment, cargo loads, passengers and fuel on board.

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 limits is included or
- a modification (cabin layout, cargo arrangement ...) which influences the operational limits is made.

It is the airline responsibility to define a load and trim sheet and to keep it up to date.

R On page 2 is a description of the Load and Trim Sheet utilization (see example p. 3), for a
R typical passenger arrangement.

Refer to customized load and trim sheet for preparing a revenue flight.

R **DATA**

R Dry Operating Weight = 40500 kg and CG = 25.5 % (H-arm = 17.27 m)
R Deviation or adjustment = + 100 kg in zone F
R Cargo = 4000 kg with the following distribution :
R cargo 1 = 1500 kg ; cargo 4 = 2000 kg ; cargo 5 = 500 kg
R Passengers = 120 pax with the following distribution :
R cabin OA = 50 ; cabin OB = 70
R Fuel = 14000 kg

DESCRIPTION

R a) Enter Master data in (1).
R b) Compute Dry Operating Weight Index using the formula indicated in (2) and report in (3).
R c) Dry Operating Index = 50.85.
R d) Enter weight deviation or adjustment in (4) and read corresponding index variation in
R (5) : + 1.21.
R e) Calculate corrected index and report in (6) : 51.06.
R f) Enter master data in table (7) and determine Zero Fuel Weight : 54680 kg and Takeoff
R Weight : 68680 kg.
R g) Enter cargo weight and passenger number per compartment in (8).
R h) Enter index scale (9) with corrected index and proceed through cargo and passenger
R scales (10).
R i) From the final point draw a vertical line which intersects (12) the zero fuel weight
R horizontal line (11).
R j) Check if the intersection point is within the Zero Fuel Weight operational limits, if not
R rearrange cargo loading.
R k) Read in table (13) the fuel index correction : – 4 and carry forward in fuel scale (14).
R l) From this point draw a vertical line which intersects (16) the takeoff weight horizontal
R line (15).
R m) Check if the intersection point is within the Takeoff Weight operational limits.
R n) Read zero fuel weight and CG position : 31 % and fill in table (17).
R o) Read takeoff CG position : 28.4 % and fill in table (18).

CAUTION

If there is no customized trim sheet for your airline in this section 2.01.40,
do not use the information enclosed herein for day to day operation as margins and load C.G. vary with cabin and cargo layout.

AIRBUS — LOAD and TRIM SHEET

A319-100
VERSION : 142 YC

DRY OPERATING WEIGHT CONDITIONS	
WEIGHT (kg)	H-arm (m)
1 40 500	17.27
2 I = (H-arm - 17.2500) x W / 1000 + 50	
3 DRY OPERATING WEIGHT INDEX	50.85

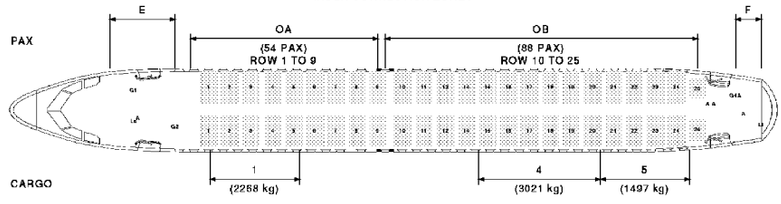
AIRCRAFT REGISTER :	
DATE :	PREPARED BY :
FLT Nbr :	CAPT. SIGNATURE :
FROM :	TO :

DRY OPERATING WEIGHT		40 500
WEIGHT DEVIATION (PANTRY)	±	+ 100
CORRECTED DRY OPERATING WEIGHT	=	40 600
CARGO	+	4 000
PASSENGERS 1 2 0 x 8 4	+	10 080
ZERO FUEL WEIGHT (7)	=	54 680
TOTAL FUEL ONBOARD	+	14 000
TAKEOFF WEIGHT	=	68 680

4

ZONES	E	F	G	H
WEIGHT DEVIATION (kg)	0	+100		

INDEX CORRECTION ZONES

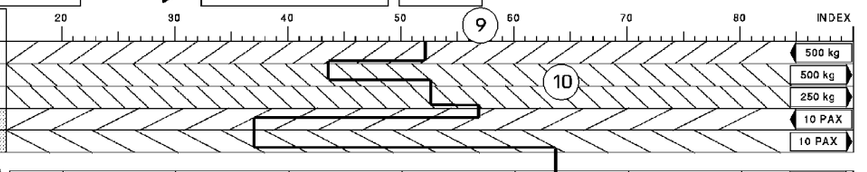


BASIC INDEX CORRECTION				
DRY OPERAT. WEIGHT DEVIATION	ZONES			
	E	F	G	H
+100 kg	-1,01	+1,21		
-100 kg	+1,01	-1,21		
5 INDEX CORRECTION		+1.21		

6 CORRECTED INDEX 52.06

ALL WEIGHTS IN KILOGRAMS

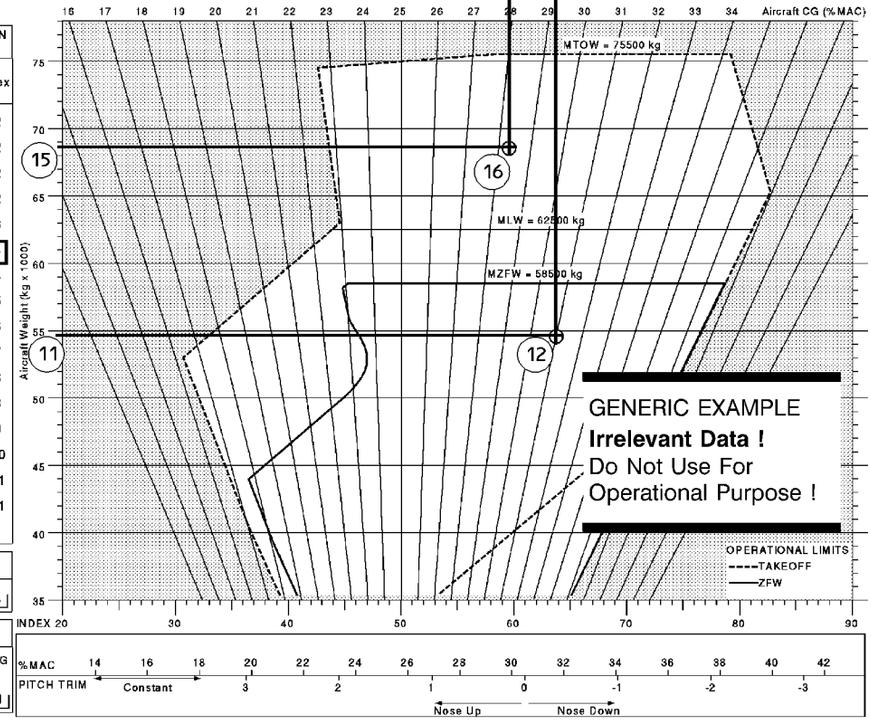
8 ZONES	Nbr	WEIGHT(kg)
CARGO 1		1500
CARGO 4		2000
CARGO 5		500
CABIN OA	50	
CABIN OB	70	



FUEL INDEX - 4

13 FUEL INDEX CORRECTION density 0.785 kg/l

Weight (kg)	Index	Weight (kg)	Index
3500	+1	11500	–2
4000	+1	12000	–2
4500	+0	12500	–2
5000	+0	13000	–2
5500	–1	13500	–3
6000	–1	14000	–4
6500	–2	14500	–4
7000	–2	15000	–5
7500	–2	15500	–6
8000	–3	16000	–7
8500	–3	16500	–8
9000	–3	17000	–8
9500	–3	17500	–9
10000	–3	18000	–10
10500	–3	18500	–11
11000	–3	FULL	–11



18 TAKEOFF
CG % MAC 28.4

17 ZFW CDU INPUT

WEIGHT (kg x 1000)	AIRCRAFT CG % MAC
54.7	31.0

FUEL INDEX TABLE PER TANK

The fuel index table has been established assuming a fuel distribution in accordance with refuel distribution given in section 2.01.30 of this volume.
If after refueling the actual distribution deviates from the chart values, the actual and the trim sheet CG will show a discrepancy. The following tables allow to determine the fuel index taking into account the actual fuel quantity in each tank. To determine the actual takeoff CG enter the tables with the actual fuel quantities in each tank, read the fuel index for each tank and use their sum to enter the trim sheet. Check that the actual CG is inside the operational limits. If the CG is outside the limits transfer fuel to achieve a distribution in accordance with the chart or rearrange the load.

Note : These tables are valid only when used with the following formulae for the index :
I=W×(Harm–17.25)/1000+K or I= [(CG–25)×W×0.000042]+K
(Weight in kg, Harm in m)

Example

DATA : Fuel in left inner fuel tank = 4500 kg
Fuel in right inner fuel tank = 4500 kg
Fuel in left outer fuel tank = 200 kg
Fuel in right outer fuel tank = FULL
Fuel in center tank = 0 kg

		Weight	Index	
Inner tank	Left	4500	–	3
	Right	4500	–	3
Outer tank	Left	200		0
	Right	691	+	2
Center tank		0		0
TOTAL		9891	–	4

Enter the trim sheet with a fuel index of – 4

FUEL INDEX TABLES PER TANK

Note : These tables are valid only when used with the following formulae for the index :
I=W×(Harm–17.25)/1000+K or I=[(CG–25)×W×0.000042]+K
(Weight in kg, Harm in m)

Inner Tank		Outer Tank		Center Tank	
Weight	Index	Weight	Index	Weight	Index
400	0	200	0	400	0
800	– 1	400	1	800	– 1
1200	– 1	600	1	1200	– 1
1600	– 2	FULL	2	1600	– 2
2000	– 2			2000	– 3
2400	– 2			2400	– 3
2800	– 3			2800	– 4
3200	– 3			3200	– 5
3600	– 3			3600	– 5
4000	– 3			4000	– 6
4400	– 3			4400	– 6
4800	– 3			4800	– 7
5200	– 3			5200	– 8
FULL	– 2			5600	– 8
				6000	– 9
				6400	– 10
				FULL	– 10

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TAKEOFF CHARTS

Takeoff charts are required to provide performance at takeoff. It is possible to present the charts in two different ways, one of which is selected by the airline. The different presentations are :

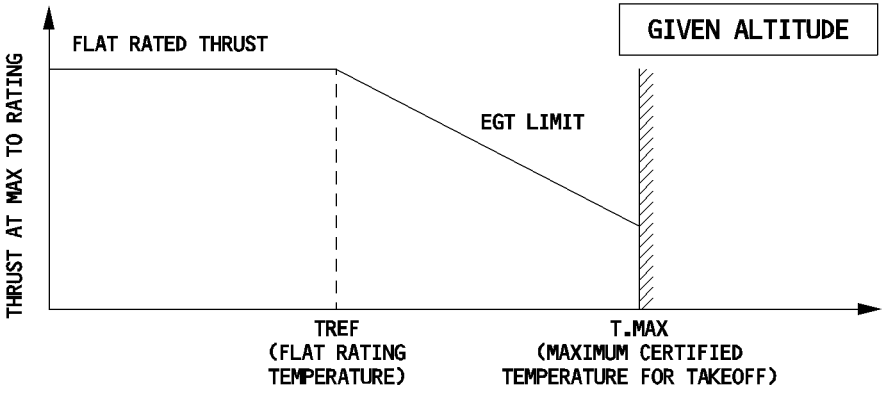
– temperature entry (temperature provided in the left column)
– weight entry (weight provided in the left column).

Both presentations are described here after. Sections 2.02.10, 2.02.12 and 2.02.14 are relative to temperature entry while 2.02.16, 2.02.18 and 2.02.20 are relative to weight entry.

The airline may request Airbus to delete anyone set of sections from the customized FCOM.

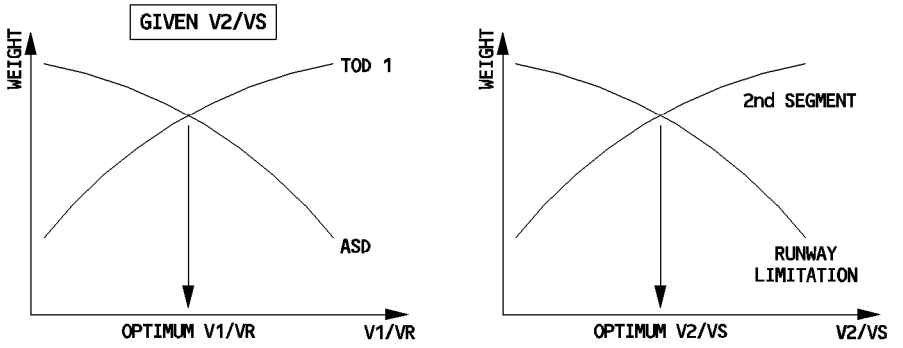
TAKEOFF PERFORMANCE

Takeoff optimization is calculated for a given runway and its obstacles and for given conditions of flap setting, temperature, wind and QNH. The calculation produces a maximum permissible takeoff weight (or a maximum takeoff temperature for an actual weight).
The takeoff thrust produced by the engine varies as follows :



NFC5-02-0210-001-A001AA

The optimization process calculates the speeds which will produce the maximum takeoff weight. To do so, it takes into account the different takeoff limitations such as TOD, ASD, TOR, second segment..., as shown on the figure charts below.



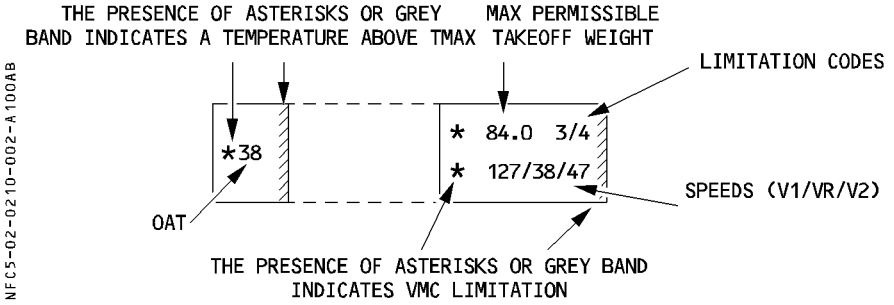
NFC5-02-0210-001-B001AA

On a typical runway, the performance of a twin engine aircraft, is generally limited by the one engine out operation at takeoff. The optimum V2/VS and optimum V1/VR are consequently unique.

TAKEOFF CHART DESCRIPTION

The takeoff chart (RTOW : Regulatory Takeoff Weight) is calculated for a specific aircraft version and for a particular runway specified at the top of the chart. The top of the chart also gives some information about the runway and lists the calculation assumptions.
The chart is given for 2 different configurations and 5 wind values per configuration. This allows the crew to select the configuration that gives either :
– the highest permissible takeoff weight, or, for a given weight,
– the highest flexible temperature.
If different configurations give equivalent performance, the crew should select the configuration associated with the lowest takeoff speeds.
For each temperature value (and for a given configuration and wind), the chart provides the following information :

R



The available limitation codes are :

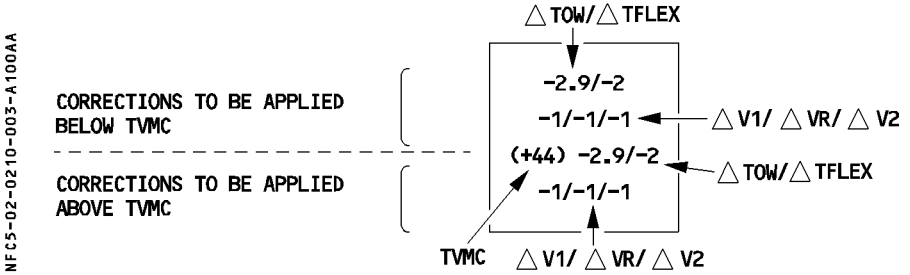
– First segment	: 1
– Second segment	: 2
– Runway length	: 3
– Obstacles	: 4
– Tire speed	: 5
– Brake energy	: 6
– Maximum computation weight	: 7
– Final takeoff	: 8
– VMU	: 9

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

Each takeoff chart is computed for a given set of conditions (air conditioning, QNH, anti ice...) specified at the top of the chart. If the actual takeoff conditions are different, the crew must apply corrections. Two types of corrections are available :
– Conservative corrections on 2.02.24 p 1 (to be used when not provided on the chart).
– Corrections (less restrictive) listed on the chart, to be applied as explained below.

DESCRIPTION OF THE CORRECTIONS ON TAKEOFF CHART

The corrections are presented on 4 lines :



TVMC is a temperature value given per column. This is a fictitious value that indicates the temperature above which the speeds are close to a VMC limitation or are VMC limited.

Note : The lower two lines may be shaded on certain chart formats.

R MINIMUM SPEED

R Minimum V1/VR/V2 due to VMC are provided on the bottom right side of the takeoff chart.
R They are only applicable in case of speed corrections.
R These speeds are conservative. They may be slightly higher than V1/VR/V2 displayed on
R the takeoff chart.

R FLEX TEMPERATURE INDICATOR

R On the temperature entry chart, the temperature column may display asterisks or have a
R gray band to indicate temperature values above TMAX and which are flex temperature.

ADDITIONAL INFORMATION

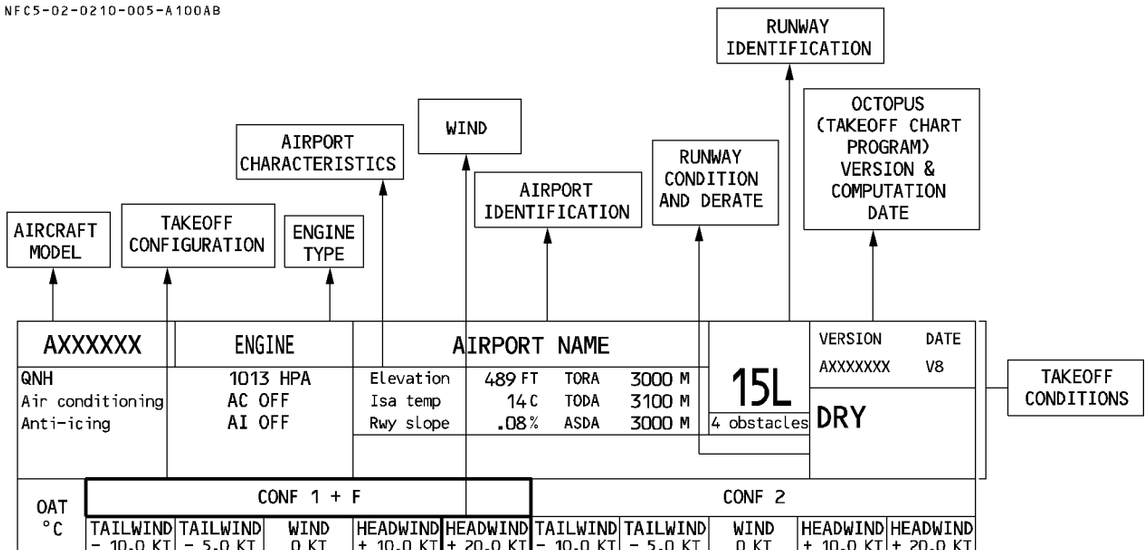
ONE ENGINE OUT CLIMB PROCEDURE

The performance given in the chart is consistent with the flight path specified for the aircraft with one engine out and takes into account significant obstacles.
When the procedure to be followed is not the standard instrument departure, the chart describes a specific procedure (EOSID).
When the specified procedure requires a turn, except if otherwise stated on the RTOW chart, the turn should be performed with a maximum bank of 15° until the aircraft reaches 1500 feet or green dot.
The acceleration height (or altitude) ensures that the net flight path clears the highest obstacle by at least 35 feet when accelerating in level flight to green dot speed after an engine failure, in the most adverse conditions.

TAKEOFF ON A WET RUNWAY

Takeoff charts computed for wet runway with a 15 feet screen height and/or use of reverse thrust may produce, in some conditions, a maximum takeoff weight (or flexible temperature) higher than that obtained for a dry runway. It is thus mandatory to compare both charts (dry and wet) and retain the lower of the two weights (or flexible temperature) and the associated speeds determined for a wet runway.

Note : The crew need not compare the charts if the top of the wet runway chart specifies "DRY CHECK". (The comparison has already been inserted in the WET runway calculation).



OAT °C	CONF 1 + F					CONF 2				
	TAILWIND − 10.0 KT	TAILWIND − 5.0 KT	WIND 0 KT	HEADWIND + 10.0 KT	HEADWIND + 20.0 KT	TAILWIND − 10.0 KT	TAILWIND − 5.0 KT	WIND 0 KT	HEADWIND + 10.0 KT	HEADWIND + 20.0 KT
−20	86.5 3/4 151/56/58	88.5 3/4 156/59/61	90.6 3/4 161/62/64	92.0 3/4 164/65/67	93.0 3/4 167/69/71	86.4 3/4 151/57/57	88.4 3/4 156/60/60	90.4 3/4 161/64/64	91.8 3/4 164/66/66	92.9 3/4 167/70/70
−10	85.8 3/4 149/55/57	87.8 3/4 154/57/59	89.8 3/4 159/60/62	91.2 3/4 162/63/65	92.3 3/4 165/67/68	85.7 3/4 149/55/55	87.7 3/4 154/59/59	89.7 3/4 159/62/62	91.1 3/4 162/64/64	92.3 3/4 165/67/67
0	85.0 3/4 147/54/56	87.0 3/4 152/56/58	89.1 3/4 157/58/61	90.5 3/4 160/61/63	91.6 3/4 163/65/66	85.0 3/4 147/54/54	87.0 3/4 152/57/57	88.9 3/4 157/60/60	90.3 3/4 160/62/62	91.6 3/4 163/65/65
10	84.2 3/4 145/53/56	86.3 3/4 150/55/58	88.3 3/4 155/57/59	89.7 3/4 158/59/61	90.9 3/4 161/63/64	84.3 3/4 145/52/52	86.3 3/4 150/56/56	88.2 3/4 155/58/58	89.6 3/4 158/61/61	91.0 3/4 161/63/63
20	83.3 3/4 144/53/55	85.4 3/4 149/55/57	87.4 3/4 153/57/59	88.8 3/4 156/58/60	90.1 3/4 160/61/62	83.5 3/4 144/51/51	85.5 3/4 149/54/54	87.4 3/4 153/57/57	88.8 3/4 156/59/59	90.1 3/4 159/61/61
30	82.1 3/4 143/52/54	84.2 3/4 147/54/56	86.2 3/4 152/56/57	87.5 3/4 155/57/59	88.9 3/4 158/59/60	82.4 3/4 142/50/50	84.3 3/4 147/53/53	86.2 3/4 152/55/55	87.5 3/4 155/57/57	88.9 3/4 158/59/59
46	72.8 3/4 141/45/47	74.3 3/4 145/48/49	75.9 3/4 150/50/51	76.9 3/4 153/53/54	78.0 3/4 154/54/55	72.6 3/4 141/46/46	74.2 3/4 145/49/49	75.7 3/4 150/51/51	76.9 3/4 153/53/53	77.9 3/4 155/55/55
48	71.4 3/4 141/45/46	73.0 3/4 145/47/48	74.5 3/4 149/50/51	DO NOT USE FOR OPERATIONAL PURPOSE				74.3 3/4 150/51/51	75.4 3/4 153/53/53	76.4 3/4 154/54/54
50	70.1 3/4 140/44/46	71.6 3/4 145/47/48	73.1 3/4 149/49/50					72.9 3/4 150/50/50	73.9 3/4 152/52/52	74.9 4/4 153/53/53
*52	68.8 3/4 140/44/45	70.2 3/4 145/46/47	71.7 3/4 149/49/50	72.6 4/4 150/50/51	73.5 4/4 151/51/52	68.6 3/4 140/45/45	70.0 3/4 145/47/47	71.5 3/4 150/50/50	72.5 3/4 151/51/51	73.4 4/4 153/53/53
*54	67.4 3/4 140/43/44	68.9 3/4 145/46/47	70.2 3/4 148/48/49	71.1 4/4 149/49/50	72.0 4/4 150/50/51	67.3 3/4 140/44/44	68.7 3/4 145/47/47	70.1 3/4 149/49/49	71.0 4/4 151/51/51	71.9 4/4 152/52/52
INFLUENCE OF RUNWAY CONDITION										
WET	+.0/+0 0/+0/+0 (+54)−.4/−1 0/+0/+0	+.0/+0 −1/+0/+0 (+54)−.4/−1 −1/+0/+0	.0/−1 −1/+0/+0 (+54)−.2/−1 −1/+0/+0	.0/−1 0/+0/+0 (+54)−.4/−1 0/+0/+0	−.2/−1 −1/+0/+0 (+54)−.6/−1 −1/+0/+0	+.0/+0 −1/+0/+0 (+54)−.2/−1 −1/+0/+0	+.0/+0 0/+0/+0 (+54)−.4/−1 0/+0/+0	+.0/+0 0/+0/+0 (+54)−.2/−1 0/+0/+0	+.0/+0 0/+0/+0 (+54)−.2/−1 0/+0/+0	−.2/−1 −1/+0/+0 (+54)−.4/−1 −1/+0/+0
D QNH HPA	INFLUENCE OF DELTA PRESSURE									
−10	−.8/−2 0/−1/−1 (+54)−.8/−2 0/+0/+0	−.9/−2 0/−1/−1 (+54)−.9/−2 0/+0/+0	−1.4/−3 0/−1/−1 (+54)−1.4/−3 0/+0/+0	−1.0/−2 −1/−1/−1 (+34)−1.0/−2 −1/+0/+0	−1.0/−2 −1/−1/−1 (+54)−1.0/−2 −1/+0/+0	−.8/−2 0/−1/−1 (+54)−.8/−2 0/+0/+0	−.8/−2 0/−1/−1 (+54)−.8/−2 0/+0/+0	−1.0/−2 0/0/0 (+54)−1.0/−2 0/+0/+0	−1.2/−2 +0/+0/+0 (+54)−1.2/−2 +0/+0/+0	−1.1/−2 −1/−1/−1 (+54)−1.1/−2 −1/+0/+0
+10	+.6/+0 +1/+0/+0 (+54)+.2/+0 +1/+0/+0	+.6/+0 +1/+0/+0 (+54)+.2/+0 +1/+0/+0	+.0/+0 +1/+1/+1 (+54)+.0/+0 +1/+1/+1	+.6/+0 +1/+1/+1 (+54)+.2/+0 +1/+1/+1	+.6/+0 +1/+1/+1 (+54)+.2/+0 +1/+1/+1	+.5/+0 +0/+0/+0 (+54)+.3/+0 +0/+0/+0	+.5/+0 +1/+0/+0 (+54)+.1/+0 +1/+0/+0	+.4/+0 +1/+1/+1 (+54)+.2/+0 +1/+1/+1	+.3/+0 +1/+1/+1 (+54)+.1/+0 +1/+1/+1	+.2/+0 +0/+1/+1 (+54)+.0/+0 +0/+1/+1
LABEL FOR INFLUENCE DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	MTOW(1000 KG) codes V1min/VR/V2(KT) LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final takeoff 9=VMU		*VMC *LIMITATION	Tref (OAT) =29 C Tmax (OAT) =50 C		Min acc height 784Ft Max acc height 1965Ft MIN V1/VR/V2 = 120/22/28 CHECK VMU LIMITATION CORRECT. V1/VR/V2 = .1Kt/1000 Kg		Min QNH alt 1280Ft Max QNH alt 2461Ft		

MINIMUM & MAXIMUM ACC. HEIGHT AND ALT.

INFLUENCE CORRECTION
△WEIGHT △TFLEX
△V1/△V_R/△V2
(TVMC) △WEIGHT △TFLEX
△V1/△V_R/△V2

TAKEOFF PARAMETERS

MAX WEIGHT (1000 KG) (72.0)	LIMITATION CODE (4-4)

V_1 (KT IAS) − V_R (KT IAS) − V_2 (KT IAS)
(150) (150) (151)

MINIMUM VALUES OF V1/VR/V2 TO WHICH TAKEOFF SPEEDS MUST BE LIMITED WHEN DECREMENTS ARE APPLIED

V1/VR/V2 DECREMENTS FOR WEIGHTS BELOW THE LOWEST WEIGHT OF A COLUMN

A319XXX	ENGINES	AIRPORT NAME					VERSION DATE
QNH	1013.00 HPA	Elevation	489 FT	TORA	3000 M	15L	AXXXXXXX **V10
Air cond.	AC OFF	Isa temp	14 C	TODA	3000 M		
Anti-icing	AI OFF	rwy slope	.08 %	ASDA	3000 M	4 obstacles	DRY
All reversers operating							
No reversers on dry runway							

OAT	CONF 1+F					CONF 2				
C	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
-20	70.4 4/4 153/53/56	71.4 4/4 155/55/58	DOT NOT USE FOR OPERATIONAL PURPOSE						72.7 4/4 156/56/58	73.5 2/4 157/57/60
-10	70.1 4/4 153/53/56	71.1 4/4 154/54/57							72.5 4/4 155/55/57	73.2 2/4 156/56/58
0	69.7 3/4 152/52/55	70.7 4/4 153/53/56	71.7 4/4 154/54/56	72.6 4/4 155/55/58	73.4 4/4 155/55/58	69.2 4/4 148/48/51	70.2 4/4 150/50/52	71.3 4/4 151/51/54	72.1 4/4 153/53/55	72.9 2/4 155/55/57
10	69.3 3/4 152/52/55	70.3 4/4 152/52/55	71.3 4/4 153/53/56	72.1 4/4 154/54/57	72.9 4/4 155/55/58	68.8 4/4 148/48/50	69.7 4/4 149/49/51	70.8 4/4 150/50/53	71.6 4/4 151/51/53	72.4 2/4 153/53/55
20	68.8 3/4 150/50/53	69.8 4/4 151/51/54	70.8 4/4 153/53/55	71.5 4/4 153/53/56	72.4 4/4 154/54/57	68.3 4/4 147/47/49	69.2 4/4 148/48/50	70.3 4/4 149/49/51	71.1 4/4 149/49/51	71.8 2/4 151/51/53
30	68.3 3/4 148/48/51	69.3 3/4 150/50/53	70.4 4/4 151/51/54	71.0 4/4 152/52/55	71.8 4/4 153/53/55	67.8 3/4 147/47/49	68.8 4/4 147/47/49	69.7 4/4 148/48/51	70.5 4/4 148/48/50	71.3 2/4 150/50/52
32	68.2 3/4 148/48/50	69.2 3/4 150/50/53	70.3 4/4 151/51/54	70.9 4/4 153/53/56	71.7 4/4 153/53/55	67.7 3/4 147/47/49	68.7 4/4 147/47/49	69.6 4/4 148/48/50	70.4 4/4 148/48/50	71.2 2/4 149/49/51
34	68.1 3/4 147/47/50	69.1 3/4 150/50/53	70.2 4/4 151/51/54	70.8 4/4 152/52/55	71.6 4/4 152/52/55	67.7 4/4 145/45/47	68.6 4/4 146/46/48	69.5 4/4 148/48/50	70.3 4/4 148/48/50	71.1 2/4 149/49/51
36	68.0 3/4 147/47/50	69.0 3/4 150/50/52	70.1 4/4 151/51/54	70.7 4/4 152/52/55	71.5 4/4 152/52/55	67.6 3/4 145/45/47	68.5 4/4 147/47/49	69.5 4/4 148/48/50	70.2 4/4 148/48/50	71.0 2/4 149/49/51
38	67.9 3/4 147/47/49	69.0 3/4 150/50/53	70.0 4/4 151/51/53	70.7 4/4 152/52/55	71.4 4/4 152/52/55	67.6 3/4 146/46/48	68.5 4/4 147/47/49	69.4 4/4 148/48/50	70.1 4/4 148/48/50	70.9 2/4 148/48/50
40	67.9 3/4 146/46/49	68.9 3/4 150/50/53	70.0 4/4 151/51/54	70.6 4/4 152/52/55	71.3 4/4 152/52/54	67.4 3/4 145/45/47	68.4 4/4 147/47/49	69.3 4/4 148/48/50	70.0 4/4 148/48/49	70.8 2/4 148/48/50
42	67.8 3/4 146/46/49	68.8 3/4 150/50/52	69.9 4/4 151/51/54	70.5 4/4 152/52/55	71.3 4/4 152/52/55	67.4 3/4 145/45/47	68.3 4/4 147/47/49	69.3 4/4 148/48/50	69.9 4/4 148/48/50	70.7 4/4 148/48/50
44	67.6 3/4 146/46/48	68.7 3/4 150/50/52	69.8 4/4 151/51/54	70.4 4/4 152/52/55	71.1 4/4 152/52/54	67.2 3/4 146/46/48	68.2 4/4 147/47/49	69.1 4/4 148/48/50	69.7 4/4 148/48/50	70.5 4/4 148/48/50
46	66.5 3/4 145/45/48	67.4 3/4 148/48/51	68.5 4/4 149/49/52	69.1 4/4 151/51/53	69.9 4/4 150/50/53	66.0 3/4 145/45/47	66.9 4/4 145/45/47	67.8 4/4 146/46/48	68.5 4/4 146/46/48	69.3 4/4 147/47/48
48	65.2 3/4 145/45/48	66.2 4/4 146/46/49	67.2 4/4 148/48/50	67.8 4/4 149/49/52	68.6 4/4 149/49/52	64.7 4/4 143/43/45	65.7 4/4 143/43/45	66.5 4/4 145/45/47	67.2 4/4 144/44/46	68.1 2/4 145/45/47
* 50	64.0 3/4 144/44/47	64.9 4/4 145/45/47	65.9 4/4 147/47/49	66.5 4/4 147/47/49	67.3 4/4 147/47/50	63.5 4/4 141/41/43	64.4 4/4 142/42/44	65.2 4/4 143/43/45	66.0 4/4 143/43/45	66.8 2/4 144/44/46
* 52	62.7 4/4 142/42/45	63.7 4/4 144/44/46	64.6 4/4 146/46/48	65.2 4/4 146/46/48	66.1 4/4 146/46/49	62.3 4/4 139/39/41	63.1 4/4 141/41/43	64.0 4/4 142/42/43	64.7 4/4 142/42/44	65.5 2/4 143/43/45
* 54	61.5 4/4 141/41/43	62.4 4/4 143/43/45	63.3 4/4 144/44/46	64.0 4/4 144/44/46	64.8 4/4 146/46/48	61.0 4/4 138/38/40	61.8 4/4 140/40/42	62.7 4/4 140/40/42	63.5 4/4 141/41/42	64.3 2/4 142/42/44
	INFLUENCE OF RUNWAY CONDITION									
WET	-.4/ -1 -10/ -3/ -3 (+54) -.8/-2 -10/ 0/ 0	-.7/ -2 -8/ -1/ -1 (+54) -.7/-2 -8/ 0/ 0	.0/ -1 -4/ -1/ -1 (+54) .0/-1 -4/ 0/ 0	.0/ 0 -4/ -1/ -1 (+54) .0/ 0 -4/ 0/ 0	.0/ 0 -1/ 0/ 0 (+54) .0/ 0 -1/ 0/ 0	-.9/ -2 -9/ -2/ -2 (+54) -.9/-2 -9/ 0/ 0	-.2/ -1 -4/ 0/ 0 (+54) -.2/-1 -4/ 0/ 0	.0/ 0 -2/ 0/ 0 (+54) .0/ 0 -2/ 0/ 0	.0/ -1 0/ 0/ 0 (+54) .0/-1 0/ 0/ 0	.0/ -1 0/ 0/ 0 (+54) -.2/-1 0/ 0/ 0
D QNH HPA	INFLUENCE OF DELTA PRESSURE									
-10	-.6/ -1 0/ 0/ 0 (+54) -.6/-1 0/ 0/ 0	-.6/ -1 -1/ 0/ 0 (+54) -.6/-1 -1/ 0/ 0	-.7/ -2 0/ 0/ 0 (+54) -.7/-2 0/ 0/ 0	-.7/ -2 0/ 0/ 0 (+54) -.7/-2 0/ 0/ 0	-.9/ -2 0/ 0/ 0 (+54) -.9/-2 0/ 0/ 0	-.7/ -2 -1/ -1/ -1 (+54) -.7/-2 -1/ 0/ 0	-.8/ -2 0/ 0/ 0 (+54) -.8/-2 0/ 0/ 0	-.8/ -2 0/ 0/ 0 (+54) -.8/-2 0/ 0/ 0	-.9/ -2 -2/ -1/ -1 (+54) -.9/-2 -2/ 0/ 0	-.8/ -2 -2/ -2/ -2 (+54) -.8/-2 -2/ 0/ 0
+10	+.3/ 0 0/ +1/ +1 (+54) +.1/0 0/ +1/ +1	+.1/ 0 +1/ +1/ +1 (+54) +.1/0 +1/ +1/ +1	+.1/ 0 +1/ +1/ +1 (+54) +.1/0 +1/ +1/ +1	+.1/ 0 0/ 0/ 0 (+54) +.1/0 0/ 0/ 0	+.1/ 0 0/ 0/ 0 (+54) +.1/0 0/ 0/ 0	+.1/ 0 0/ 0/ 0 (+54) +.1/0 0/ 0/ 0	+.1/ 0 0/ 0/ 0 (+54) +.1/0 0/ 0/ 0	+.1/ 0 0/ 0/ 0 (+54) +.1/0 0/ 0/ 0	.0/ 0 0/ +1/ +1 (+54) .0/0 0/ +1/ +1	.0/ 0 0/ 0/ 0 (+54) .0/0 0/ 0/ 0

LABEL FOR INFLUENCE	MTOW(1000 KG) codes	* VMC	Tref (OAT) = 44 C	Min acc height 810 FT	Min QNH alt 1306 FT
DW (1000 KG) DTFLEX	V1min/VR/V2 (kt)	*LIMITATION	Tmax (OAT) = 50 C	Max acc height 1992 FT	Max QNH alt 2488 FT
DV1-DVR-DV2 (KT)	LIMITATION CODES				Min V1/VR/V2 = 107/13/17
(TVMC OAT C)	1=1st segment 2=2nd segment 3=runway length 4=obstacles				CHECK VMU LIMITATION
DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU				Correct. V1/VR/V2 = .2 KT/1000 KG

DETERMINATION OF MAXIMUM TAKEOFF WEIGHT AND SPEEDS

DIRECT CHART READING

The takeoff chart is computed for a given runway under a set of conditions, which are :
- OAT
- Wind
- Configuration
- QNH, air conditioning, anti ice...

Two configurations are produced on the chart. This enables the crew to select that giving the highest permissible takeoff weight. In case of equivalent performance, retain the configuration giving the lower takeoff speeds.
For a given configuration, enter the chart with the OAT and wind value to determine the maximum permissible weight. For an OAT or wind value not presented on the chart, interpolate between two consecutive temperature rows and/or two consecutive wind columns. Conservative OAT or wind values can also be considered. No extrapolation is allowed.

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

Retain the maximum takeoff weight, associated configuration and speeds from above.
For conditions different from those of the chart, apply relevant corrections.

CONSERVATIVE CORRECTIONS FOR QNH AND BLEEDS FROM FCOM 2.02.24 p 1

Corrections are given for QNH ≠ 1013 hPa, air conditioning ON, anti ice ON.
1. For the given wind and temperature conditions, read the maximum takeoff weight (choose the configuration giving the highest weight).
2. Apply the published weight correction(s) to the maximum takeoff weight (for each correction) to determine the maximum permissible takeoff weight.
3. Read the speeds associated with the maximum permissible takeoff weight by entering the chart with the retained configuration and wind value.

Example 1

DATA : OAT = 25°C
Head Wind = 10 kt
Air conditioning ON
QNH = 1013 hPa

R Use the chart from 2.02.10 p 6.
Enter the 10 kt head wind column and interpolate for 25°C, CONF 1+F,
Maximum takeoff weight (1000 kg) air conditioning OFF 71.2
Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
Maximum takeoff weight (1000 kg) air conditioning OFF 70.9

Retain CONF 1+F as takeoff configuration.
Maximum TO weight (1000 kg) air conditioning OFF 71.2
Air conditioning correction (FCOM 2.02.24 p1) . . . . . .– 2.2
Maximum permissible TO weight (1000 kg) air conditioning ON 69.0
Determine takeoff speeds for 69.0 (1000kg) in the 10kt head wind column (CONF1+F)
V1 = 151 kt, VR = 151 kt, V2 = 153 kt

CORRECTIONS FOR WET OR CONTAMINATED RUNWAYS FROM FCOM 2.04.10

(Refer to FCOM 2.04.10)

R CORRECTIONS PRODUCED ON THE RTOW CHART (SEE EXAMPLE ON 2.02.10 P 6)

A description of this correction is given on 2.02.10 p 3. The list of corrections is not exhaustive, however the most commonly used corrections are wet runway, QNH, air conditioning and/or anti ice. A maximum of three corrections can be produced on one chart.

To apply the corrections, proceed as follows :

1. Enter the chart with given OAT and wind to determine the maximum takeoff weight before correction.
2. Apply the first correction :
   If OAT is less than or equal to TVMC (line 3), apply △W correction from line 1 and △V1/△VR/△V2 corrections from line 2.
   Else, (for OAT greater than TVMC), apply △W correction from line 3 and △V1/△VR/△V2 corrections from line 4.
3. To combine a second (and third, as applicable) correction :
   If OAT is less than or equal to TVMC (line 3), apply △W correction from line 1 and △V1/△VR/△V2 corrections from line 2.
   Check that the resulting speeds are higher than the minimum speeds displayed on the RTOW chart and that V2 is higher than the VMU limited speed (FCOM 2.02.25).
   If OAT is higher than TVMC (line 3) or if the above speed check is not fulfilled, apply △W correction from line 3 and △V1/△VR/△V2 corrections from line 4. No speed check is required.

Note : – *QNH correction is given for ± 10 hPa. It is allowed to extrapolate linearly for greater QNH deviation.*
– *When using a takeoff chart with failure cases, it is not allowed to combine two failure cases.*
R – *Corrections from the chart must be applied from top to bottom, i.e. in the RTOW on 2.02.10 p 6, apply the wet correction first.*
– *If asterisk or dotted lines appear in the correction boxes, refer to more conservative corrections provided in the FCOM.*
– *No speed check is required for the first correction. However, if the first influence correction follows a conservative FCOM correction, a speed scheck is required.*

Example 2

DATA : OAT = 25°C
Head wind = 10 kt
QNH = 1028 hPa
WET runway

R Use the chart from 2.02.10 p 6.

· Enter the 10 kt head wind column and interpolate for 25°C, CONF 1+F,
max TO weight (1000 kg) 71.2

· Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
max TO weight (1000 kg) 70.9

· Retain CONF 1+F for takeoff

· Read associated speeds as V1 = 152 kt, VR = 152 kt, V2 = 155 kt

· Apply WET correction
For OAT < TVMC (54°), ΔW = ... 0.0
Intermediate weight (1000 kg) 71.2
Associated speeds,
V1 = 152 kt – 4 = 148 kt
VR = 152 kt – 1 = 151 kt
V2 = 155 kt – 1 = 154 kt
(No speed check required for first correction)

· Apply QNH correction
For OAT < TVMC (54°), ΔW = 0.1 × 15/10 = ... + 0.1
Maximum permissible takeoff weight (1000 kg) 71.3
Associated speeds,
V1 = 148 kt + 0 × 15/10 = 148 kt
VR = 151 kt + 0 × 15/10 = 151 kt
V2 = 154 kt + 0 × 15/10 = 154 kt

· Check that the speeds are higher than minimum speeds from the chart and from VMU table.

	Takeoff Configuration : 1+F			
	TOW	V1	VR	V2
TOW (RTOW)	71.2	152	152	155
FCOM correction(s)				
Intermediate value	71.2	152	152	155
WET Correction	0.0	– 4	– 1	– 1
Intermediate value	71.2	148	151	154
QNH Correction	+ 0.1	0	0	0
Final value	71.3	148	151	154

COMBINING CORRECTIONS FROM FCOM AND CHART

Proceed as follows :

1. Enter the chart with selected configuration, OAT and wind to read the maximum takeoff weight.
2. Apply corrections from FCOM to determine an intermediate weight. Interpolate associated speeds for intermediate weight in the same column (same wind and configuration).
3. Apply corrections from RTOW chart as explained above.

Example 3

DATA : OAT = 25°C
Head wind = 10 kt
Air conditioning ON
QNH = 1028 hPa
WET runway

R 1. Use the chart from 2.02.10 p 6.
Enter the 10 kt head wind column and interpolate for 25°C, CONF 1+F,
Max TO weight (1000 kg) air conditioning OFF 71.2
Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
Max TO weight (1000 kg) air conditioning OFF 70.9
Retain CONF 1+F for takeoff configuration.

2. First, apply the correction from FCOM page 2.02.24 p 1.
Max TO weight (1000 kg) air conditioning OFF 71.2
Air conditioning correction . . . . . – 2.2
Intermediate weight 69.0
Interpolate takeoff speeds for 69.0 (1000 kg) in the 10 kt head wind column,
V1 = 151 kt, VR = 151 kt, V2 = 153 kt

3. Apply WET correction
For OAT < TVMC (54°), ΔW = ... 0.0
Intermediate weight 69.0
Associated speeds,
V1 = 151 kt – 4 = 147 kt
VR = 151 kt – 1 = 150 kt
V2 = 153 kt – 1 = 152 kt
Check that the speeds are higher than minimum speeds from the chart and from VMU table.
Apply QNH correction
For OAT < TVMC (54°), ΔW = 0.1 × 15/10 = ... + 0.1
Maximum permissible takeoff weight 69.1
Associated speed,
V1 = 147 kt + 0 × 15/10 = 147 kt
VR = 150 kt + 0 × 15/10 = 150 kt
V2 = 152 kt + 0 × 15/10 = 152 kt

Check that the speeds are higher than minimum speeds from the chart and from VMU table. (It is reminded that if the speed checks are not fulfilled, the corrections must be recalculated using those provided on lines 3 and 4).
Since the speed check is fulfilled :
Max permissible takeoff weight = 69.1 (1000 kg)
V1 = 147 kt, VR = 150 kt, V2 = 152 kt.

	Takeoff Configuration : 1 + F			
	TOW	V1	VR	V2
TOW (RTOW)	71.2			
FCOM correction(s)	– 2.2			
Intermediate value	69.0	151	151	153
WET Correction	0.0	– 4	– 1	– 1
Intermediate value	69.0	147	150	152
QNH Correction	+ 0.1	0	0	0
Final value	69.1	147	150	152

EXTRAPOLATION

For a takeoff weight lower than those displayed on the chart, associated speeds are calculated as follows :

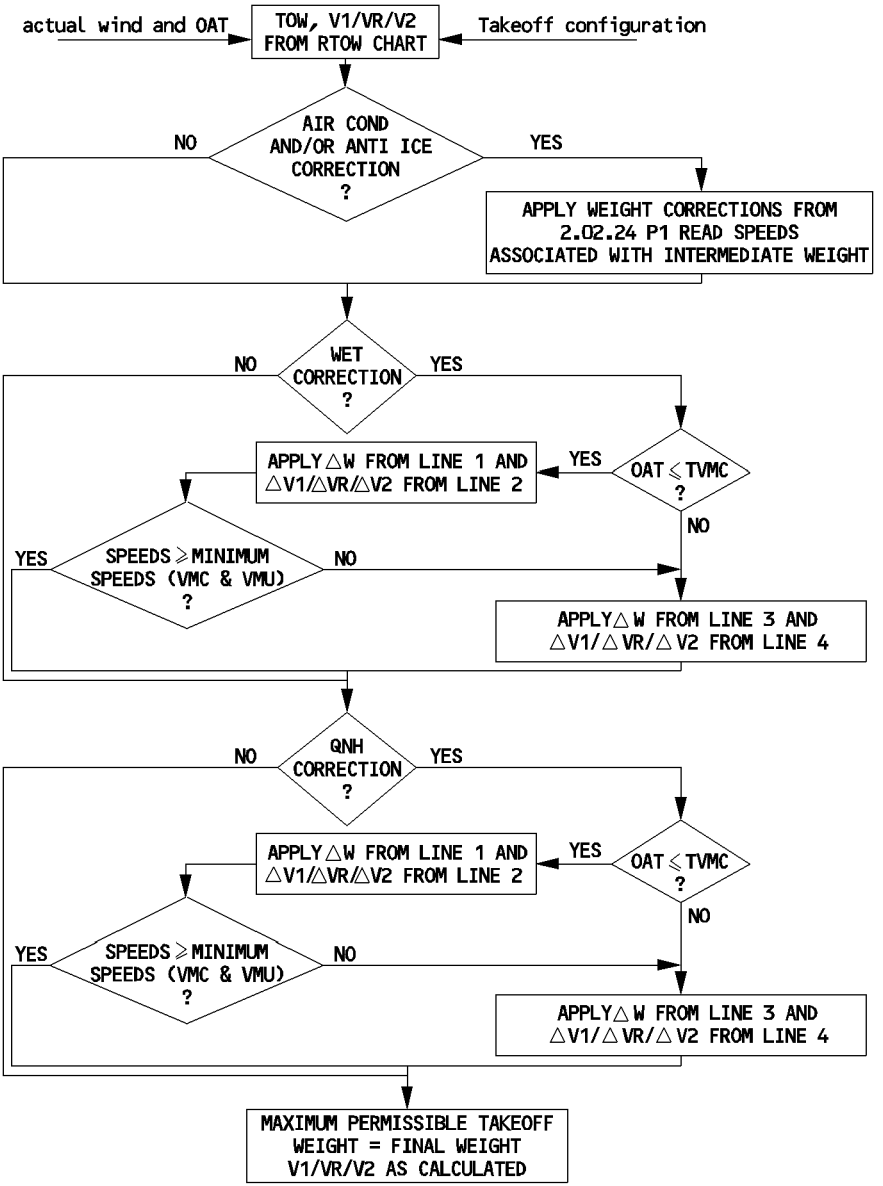
1. For given configuration and wind, note the speeds associated with the takeoff weight in the row displaying the highest permissible temperature.
2. Apply speed corrections provided at the bottom of the RTOW chart to V1, VR and V2 limited to the minimum speeds.

MAXIMUM STRUCTURAL TAKEOFF WEIGHT

The maximum structural takeoff weight is a weight limitation depending on the aircraft. This limitation is provided in the Flight Manual and in the chapter limitation of the FCOM3. Compare the maximum structural takeoff weight to the maximum permissible takeoff weight computed for given conditions and retain the lower of the two values.

SUMMARY

The following flow diagram gives the different steps to follow.



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DEFINITION OF FLEXIBLE TAKEOFF

In many cases the aircraft takes off with a weight lower than the maximum permissible takeoff weight. When this happens, it can meet the required performance (runway, second segment, obstacle,...) with a decreased thrust that is adapted to the weight : this is called FLEXIBLE TAKEOFF and the thrust is called FLEXIBLE TAKEOFF THRUST.
The use of flexible takeoff thrust saves engine life.

USE OF FLEXIBLE TAKEOFF

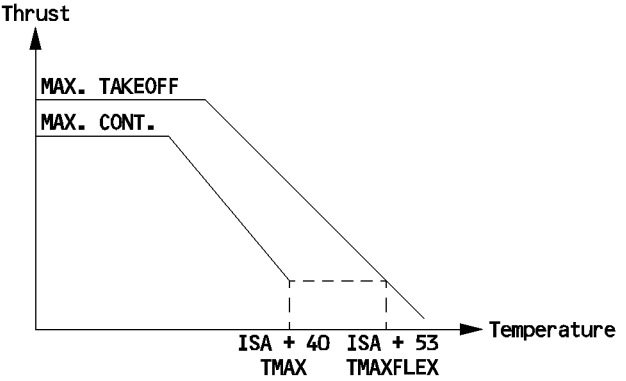
The pilot can use flexible takeoff when the actual takeoff weight is lower than the maximum permissible takeoff weight for the actual temperature. The maximum permissible takeoff weight decreases when temperature increases, so it is possible to assume a temperature at which the actual takeoff weight would be the limiting one. This temperature is called FLEXIBLE TEMPERATURE or assumed temperature and is entered in the FADEC via the MCDU PERF TO page in order to get the adapted thrust.

REQUIREMENTS

- Thrust must not be reduced by more than 25 % of the full rated takeoff thrust.
- The flexible takeoff N1 cannot be lower than the Max climb N1 at the same flight conditions.

R The FADEC takes the above two constraints into account to determine flexible N1.

- The flexible takeoff thrust cannot be lower than the Max Continuous thrust used for the final takeoff flight path computation (at ISA + 40).
  This constraint limits the maximum flexible temperature at ISA + 53 (68° C at sea level).
- The flexible temperature cannot be lower than the flat rating temperature, TREF (ISA + 30), or the actual temperature (OAT).



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- Flexible takeoff is not permitted on contaminated runways.
- The operator should check the maximum thrust (TOGA) at regular intervals in order to detect any engine deterioration, or maintain an adequate engine performance monitoring program to follow up the engine parameters.

RECOMMENDATION

· In order to extend engine life, it is recommended to use the greatest thrust reduction level.
· However, to improve the takeoff performance, the thrust can be increased by selecting a lower flexible temperature.

Using the same takeoff chart, for a given weight it is possible to :

- Select a temperature lower than the maximum determined one and keep the speeds defined at maximum temperature or,
- Move towards the left side (tailwind) of the takeoff chart while remaining within the same configuration and looking for the same actual takeoff weight at lower temperature. This produces a lower flexible temperature and, in general, lower takeoff speeds (V1/VR/V2).

Using one of the two above possibilities, check that the selected temperature is greater than the actual temperature (OAT) and greater than the flat rating temperature (TREF).

TAKEOFF PROCEDURE

Depending on environmental takeoff conditions, the following procedure is recommended.

CONDITIONS	PROCEDURE	REASON
Dry or wet well paved runway	— Use the configuration giving the maximum flex. — If equivalent flex is obtained, choose the configuration giving the lowest speeds.	Extend engine life
High altitude takeoff	— Use CONF2/CONF3	Improve comfort
Badly paved runway or Accelerate stop distance limited runway	— Use CONF2/CONF3 or — Move towards left side of the takeoff chart	Improve comfort Improve stopping distance
Windshear expected along takeoff path	— Use maximum thrust	Maintain acceleration capability
Contaminated runway	— Use maximum thrust (flex forbidden)	Improve stopping distance Decrease time on runway. Required by regulations.

DETERMINATION OF FLEXIBLE TAKEOFF TEMPERATURE AND SPEEDS

Before determining the flexible temperature, calculate the maximum permissible takeoff weight (see previous section) and ensure that the actual takeoff weight is lower than the determined maximum takeoff weight.

- Enter the RTOW chart with the wind condition and selected configuration to interpolate for the actual takeoff weight. Read the flexible temperature in the temperature column corresponding to the actual weight.
- Repeat this process for the other configuration available. Select that configuration giving the highest flexible temperature.

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

When the takeoff conditions are different from those provided on the chart, apply the associated corrections.

CONSERVATIVE CORRECTIONS FOR QNH AND BLEEDS FROM FCOM 2.02.24 P 1

Corrections are given for QNH ≠ 1013 hPa, air conditioning ON, anti ice ON.

1. For a given takeoff weight, wind condition and selected configuration, determine the flexible temperature. Retain the takeoff speeds associated with the actual weight.
2. Apply the published temperature correction. To combine two or more corrections, add the different corrections and apply to temperature value.
   (No speed corrections required).

Example 4

DATA : Actual takeoff weight = 65 000 kg
Head wind = 10 kt
Air conditioning ON
QNH = 1013 hPa

R Use the chart from 2.02.10 p 6. Determine the maximum permissible takeoff weight (see example1). The actual weight being lower than the maximum one, flexible takeoff is possible.
Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 1+F,
Flexible temperature . . . . . .52° C
Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 2,
Flexible temperature . . . . . .51° C

Retain CONF 1+F for takeoff configuration.
Takeoff speeds are V1 = 146 kt, VR = 146 kt, V2 = 148 kt
Flexible temperature with air conditioning OFF . . . . . .52° C
R Air conditioning correction (FCOM 2.02.24 p 1) . . . . . .– 5° C
R Maximum flexible temperature . . . . . .47° C

CORRECTIONS FOR WET RUNWAY FROM FCOM 2.04.10

(Refer to FCOM 2.04.10)

CORRECTIONS PRODUCED ON THE RTOW CHART (SEE EXAMPLE ON 2.02.10 P 6)

A description of this correction is given on 2.02.10 p 3. The list of corrections is not exhaustive, however the most commonly used corrections are wet runway, QNH, air conditioning and/or anti-icing. A maximum of three corrections can be produced on one chart.

To apply the correction, proceed as follows :

1. Enter the chart with wind and selected configuration. Interpolate for actual takeoff weight. Read flexible temperature associated with this weight.
2. Apply the first correction :
   If the flexible temperature is less than or equal to TVMC (line 3), apply △Tflex correction from line 1 and apply speed corrections (△V1/△VR/△V2) from line 2.
   Else, (flexible temperature greater than TVMC), apply △Tflex from line 3 and △V1/ △VR/ △V2 corrections from line 4.
   Check V2 against VMU limitation (FCOM 2.02.25). If V2 is lower than V2 limited by VMU, flexible takeoff is not possible. Set TOGA thrust and retain the speeds associated with maximum permissible takeoff weight or the speeds read in the chart of the actual weight if they are all lower.
   No speed correction is required for QNH and bleeds influence (Not applicable to maximum takeoff weight determination).
3. To combine a second and/or a third correction, proceed as per point 2.
4. Check that the final flexible temperature is :
   – higher than OAT and TREF
   – limited to TMAXFLEX
   If the check is fulfilled, retain final flexible temperature as the one to be inserted in the MCDU.
   If the check is not fulfilled, (final flexible temperature lower than OAT or TREF), no flexible takeoff is possible.
   Use TOGA thrust and retain speeds that have been calculated for the maximum permissible takeoff weight. (See 2.02.14 p 7)

Note : – QNH correction is given for ± 10 hPa. It is allowed to extrapolate linearly for greater QNH deviation.
– Corrections from the chart must be applied from top to bottom, i.e. in the RTOW on 2.02.10 p 6, apply the wet influence first.

Note : – When the flexible temperature is higher than TVMC, it is allowed to limit the flexible temperature to TVMC and apply only corrections from lines 1 and 2.
– If asterisk or dotted lines appear in the correction boxes, refer to more conservative corrections provided in the FCOM.

Example 5

DATA : Actual takeoff weight = 65 000 kg
Head wind = 10 kt
QNH = 1028 hPa
WET runway
Air conditioning OFF

R Use the chart from 2.02.10 p 6. Determine the maximum permissible takeoff weight (see example 2). The actual weight being lower than the maximum one, flexible takeoff is possible.
Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 1+F,
Flexible temperature . . . . . .52° C
Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 2,
Flexible temperature . . . . . .51° C
Retain CONF 1+F as the flexible temperature is higher.
Takeoff speeds are V1 = 146 kt, VR = 146 kt, V2 = 148 kt
Apply WET correction
For flexible temperature < TVMC (54° C), △Tflex ∓. . . . . – 0° C
Intermediate flex temperature . . . . . 52° C
Associated speeds,
V1 = 146 kt – 4 = 142 kt
VR = 146 kt – 1 = 145 kt
V2 = 148 kt – 1 = 147 kt

R Check V2 against VMU limitation on FCOM 2.02.25.
Apply QNH correction
For flex temperature < TVMC (54° C), △Tflex ∓. . . . . 0° C
Maximum flexible temperature . . . . . 52° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
Takeoff speeds are V1 = 142 kt, VR = 145 kt, V2 = 147 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	52	146	146	148
FCOM correction(s)				
Intermediate value	52	146	146	148
WET Correction	0	– 4	– 1	– 1
Intermediate value	52	142	145	147
QNH Correction	0	0	0	0
Final value	52	142	145	147

COMBINING CORRECTIONS FROM FCOM AND CHART

1. Apply corrections from FCOM (see 2.02.24 p 1).
2. Apply corrections from the RTOW chart.
   Apply speed corrections except for QNH and bleed influences.

Example 6

DATA : Actual takeoff weight = 65 000 kg
Head wind = 10 kt
Air conditioning ON
QNH = 1028 hPa
WET runway

Use the chart from 2.02.10 p 6. Determine the maximum permissible takeoff weight (see example 3). The actual weight being lower than the maximum one, flexible takeoff is possible.

· Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 1+F,
Flexible temperature . . . . . 52° C

· Enter the 10 kt head wind column and interpolate for 65 000 kg, CONF 2,
Flexible temperature . . . . . 51° C

· Retain CONF 1 + F for takeoff configuration.
Takeoff speeds are V1 = 146 kt, VR = 146 kt, V2 = 148 kt

· First, apply the correction from FCOM page 2.02.24 p 1.
Flexible temperature with air conditioning OFF . . . . . 52° C
R Air conditioning correction . . . . . – 5° C
R Intermediate flexible temperature . . . . . 47° C
No speed correction.

· Apply WET correction
For flexible temperature < TVMC (54° C), △Tflex ∓. . . . . 0° C
R Intermediate flex temperature . . . . . 47° C
Associated speeds,
V1 = 146 kt – 4 = 142 kt
VR = 146 kt – 1 = 145 kt
V2 = 148 kt – 1 = 147 kt
Check V2 against VMU limitation on FCOM 2.02.25.

· Apply QNH correction
For flexible temperature < TVMC (54° C), △Tflex ∓. . . . . 0° C
R Maximum flexible temperature . . . . . 47° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
Takeoff speeds are V1 = 142 kt, VR = 145 kt, V2 = 147 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	52	146	146	148
FCOM correction(s)	– 5	0	0	0
Intermediate value	47	146	146	148
WET Correction	0	– 4	– 1	– 1
Intermediate value	47	142	145	147
QNH Correction	0	0	0	0
Final value	47	142	145	147

FLEXIBLE TAKEOFF NOT POSSIBLE

In some cases when the actual takeoff weight is lower than the maximum permissible one but no flexible takeoff possible (that is flexible temperature lower than TREF or OAT) :

– It is mandatory to use TOGA thrust

– You can retain the speeds that have been calculated for the maximum permissible takeoff weight;

R OR

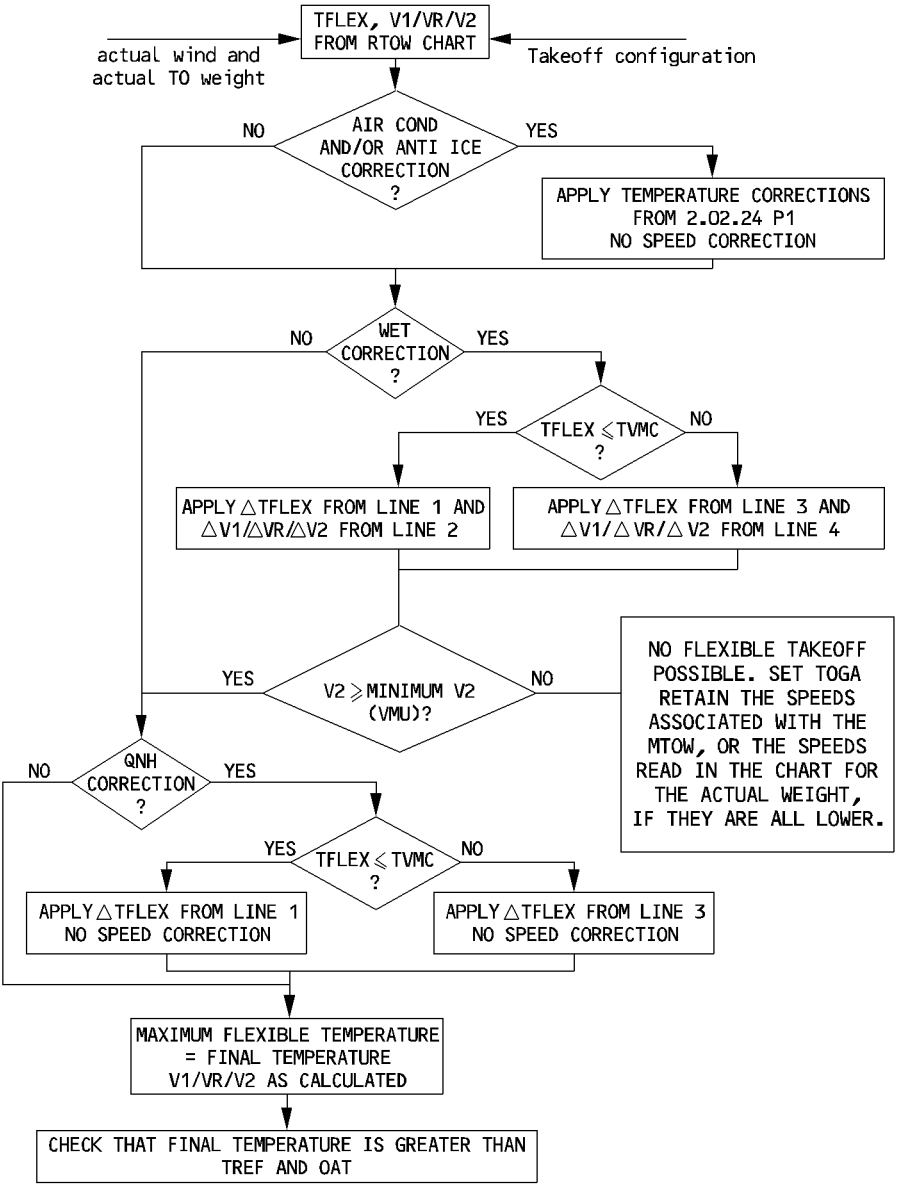
R – You can retain the speeds associated with the actual takeoff weight provided they are

R all lower than the speeds calculated for the maximum permissible takeoff weight.

SUMMARY

The flow diagram gives the different steps to follow.

R



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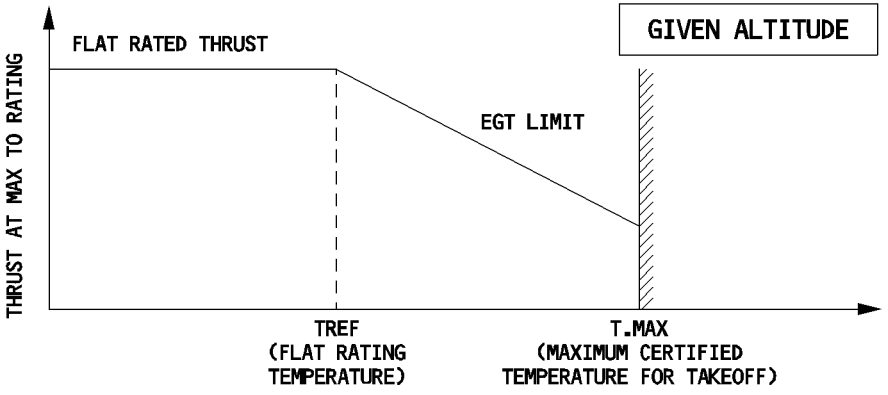
TAKEOFF PERFORMANCE

Takeoff optimization is calculated for a given runway and its obstacles and for given conditions of flap setting, temperature, wind and QNH. The calculation produces a maximum permissible takeoff weight (or a maximum takeoff temperature for an actual weight).
The takeoff thrust produced by the engine varies as follows :



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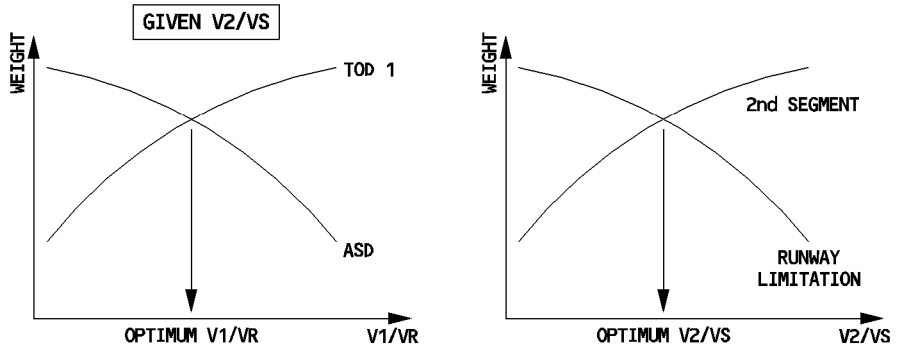
The optimization process calculates the speeds which will produce the maximum takeoff weight. To do so, it takes into account the different takeoff limitations such as TOD, ASD, TOR, second segment..., as shown on the charts below.



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LEGEND : TOD1 = TAKEOFF DISTANCE 1 ENGINE OUT,
ASD = ACCELERATE STOP DISTANCE

On a typical runway, the performance of a twin engine aircraft, is generally limited by the one engine out operation at takeoff. The optimum V2/VS and optimum V1/VR are consequently unique.

TAKEOFF CHART DESCRIPTION

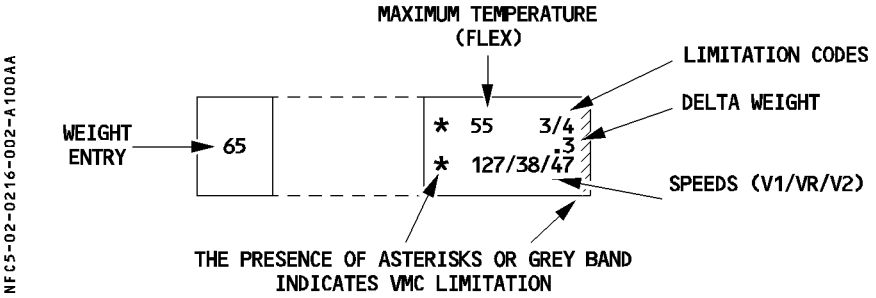
The takeoff chart (RTOW : Regulatory Takeoff Weight) is calculated for a specific aircraft version and for a particular runway specified at the top of the chart. The top of the chart also gives some information about the runway and lists the calculation assumptions.

R The chart is given for 2 different configurations and 4 wind values per configuration. This allows the crew to select the configuration that gives either :

- the highest permissible takeoff weight, or, for a given weight,
- the highest flexible temperature.

If different configurations give equivalent performance, the crew should select the configuration associated with the lowest takeoff speeds.

The left column of the chart contains weight entry. For each weight entry (and for a given configuration and wind), the chart provides the following information :



Note : The takeoff weight is the sum of the weight entry and the delta weight.

The available limitation codes are :

– First segment	: 1
– Second segment	: 2
– Runway length	: 3
– Obstacles	: 4
– Tire speed	: 5
– Brake energy	: 6
– Maximum computation weight	: 7
– Final takeoff	: 8
– VMU	: 9

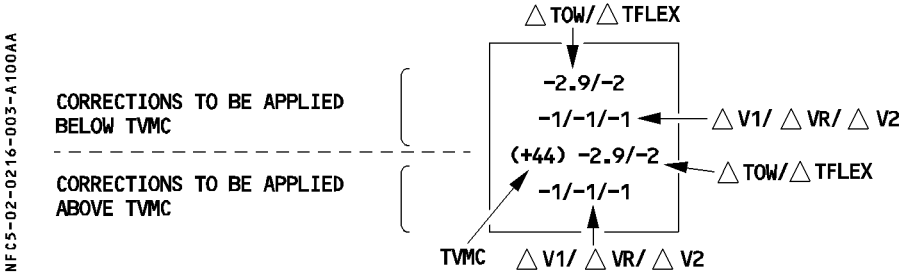
CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

Each takeoff chart is computed for a given set of conditions (air conditioning, QNH, anti ice...) specified at the top of the chart. If the actual takeoff conditions are different, the crew must apply corrections. Two types of corrections are available :

- Conservative corrections on 2.02.24 p 1 (to be used when not provided on the chart).
- Corrections (less restrictive) listed on the chart, to be applied as explained below.

DESCRIPTION OF THE CORRECTIONS ON TAKEOFF CHART

The corrections are presented on 4 lines :



TVMC is a temperature value given per column. This is a fictitious value that indicates the temperature above which the speeds are close to a VMC limitation or are VMC limited.

Note : The lower two lines may be shaded on certain chart formats.

R MINIMUM SPEED

R Minimum V1/VR/V2 due to VMC are provided on the bottom right side of the takeoff chart.
R They are only applicable in case of speed corrections.
R These speeds are conservative. They may be slightly higher than V1/VR/V2 displayed on
R the takeoff chart.

ADDITIONAL INFORMATION

ONE ENGINE OUT CLIMB PROCEDURE

The performance given in the chart is consistent with the flight path specified for the aircraft with one engine out and takes into account significant obstacles.
When the procedure to be followed is not the standard instrument departure, the chart describes a specific procedure (EOSID).
When the specified procedure requires a turn, except if otherwise stated on the RTOW chart, the turn should be performed with a maximum bank of 15° until the aircraft reaches 1500 feet or green dot.
The acceleration height (or altitude) ensures that the net flight path clears the highest obstacle by at least 35 feet when accelerating in level flight to green dot speed after an engine failure, in the most adverse conditions.

TAKEOFF ON A WET RUNWAY

Takeoff charts computed for wet runway with a 15 feet screen height and/or use of reverse thrust may produce, in some conditions, a maximum takeoff weight (or flexible temperature) higher than that obtained for a dry runway. It is thus mandatory to compare both charts (dry and wet) and retain the lower of the two weights (or flexible temperature) and the associated speeds determined for a wet runway.

Note : The crew need not compare the charts if the top of the wet runway chart specifies "DRY CHECK". (The comparison has already been inserted in the WET runway calculation).

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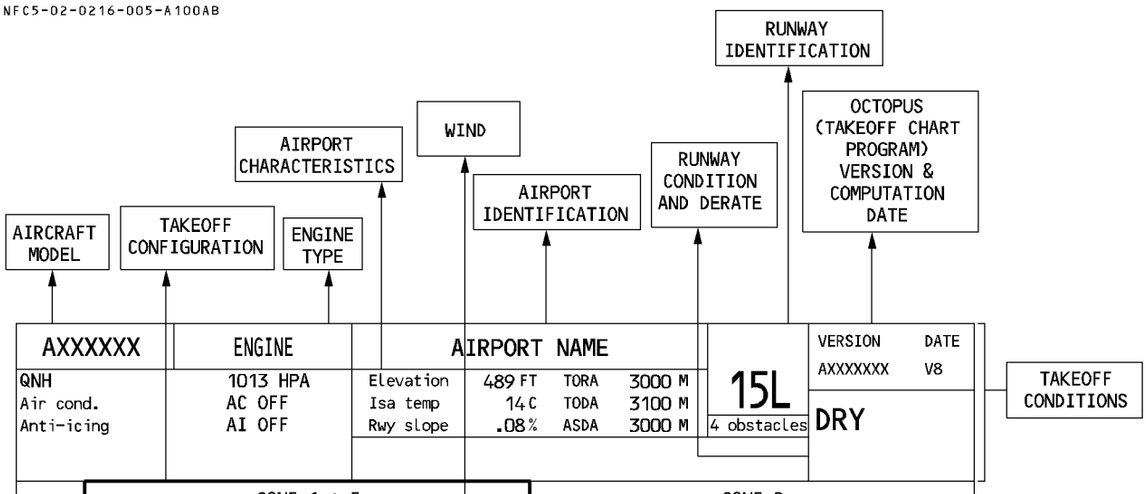


WEIGHT 1000 KG	CONF 1 + F				CONF 2			
	TAILWIND - 10 KT	TAILWIND - 5 KT	WIND 0 KT	HEADWIND 10 KT	TAILWIND - 10 KT	TAILWIND - 5 KT	WIND 0 KT	HEADWIND 10 KT
76	6 3/3 .0 148/52/55	25 3/3 .0 149/53/56	37 3/3 .0 151/54/57	38 3/3 .2 154/57/60	0 3/3 .1 150/53/56	18 3/3 .0 150/54/57	35 3/3 .0 152/56/58	37 3/3 .0 155/58/60
72	40 3/3 .2 142/46/49	42 3/3 .5 146/49/52	44 3/3 .5 150/52/55	46 3/3 .1 153/54/57	40 3/3 .1 143/47/49	42 3/3 .1 147/50/52	43 3/3 .5 151/53/55	44 3/3 .4 154/56/58
68	48 3/3 .3 141/43/46	50 3/3 .3 145/47/49	52/3/3 .2 149/50/52	53 3/3 .0 153/53/55	48 3/3 .1 142/44/46	49 3/3 .5 146/48/50	51 3/3 .1 151/52/53	51 2/3 .4 153/54/56
64	56 3/3 .3 141/42/44	58 3/7 .0 143/44/46	58 3/7 .0 140/44/46	58 3/7 .0 138/44/46	56 3/3 .1 142/43/45	57 3/3 .2 147/47/48	57 2/3 .6 149/50/51	57 2/3 .6 148/50/51
60	58 3/7 .0 118/30/33	58 3/7 .0 113/30/33	* 58 2/7 * .0 * 111/30/33	* 58 2/7 * .0 * 111/30/33	58 3/7 .0 117/30/32	* 58 3/7 * .0 * 113/31/32	* 58 2/7 * .0 * 111/31/32	* 58 2/7 * .0 * 111/31/32
56	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
52	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
48	* 58 7/7 * .0 * 111/18/22	* 58 7/7 * .0 * 111/18/22	DO NOT USE FOR OPERATIONAL PURPOSE				* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
46	* 58 7/7 * .0 * 111/18/22	* 58 7/7 * .0 * 111/18/22					* 58 7/7 * .0 * 111/18/21	* 58 7/7 * .0 * 111/18/21
40	* 58 7/7 * .0 * 112/18/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21
	GRAD1/GRAD2 (KG/C)							
	40/****	40/****	40/400	40/400	40/****	40/****	30/****	30/410
	INFLUENCE OF RUNWAY CONDITION							
WET	+.0/+0 0/+0/+0 (+54) -.4/-1 0/+0/+0	+.0/+0 -1/+0/+0 (+54) -.4/-1 -1/+0/+0	.0/-1 -1/+0/+0 (+54) -.2/-1 -1/+0/+0	-.2/-1 -1/+0/+0 (+54) -.6/-1 -1/+0/+0	+.0/+0 -1/+0/+0 (+54) -.2/-1 -1/+0/+0	+.0/+0 0/+0/+0 (+54) -.4/-1 0/+0/+0	+.0/+0 0/+0/+0 (+54) -.2/-1 0/+0/+0	-.2/-1 -1/+0/+0 (+54) -.4/-1 -1/+0/+0
D QNH HPA	INFLUENCE OF DELTA PRESSURE							
-10	-.8/-2 0/-1/-1 (+54) -.8/-2 0/+0/+0	-.9/-2 0/-1/-1 (+54) -.9/-2 0/+0/+0	-1.4/-3 0/-1/-1 (+54) -1.4/-3 0/+0/+0	-1.0/-2 -1/-1/-1 (+54) -1.0/-2 -1/+0/+0	-.8/-2 0/-1/-1 (+54) -.8/-2 0/+0/+0	-.8/-2 0/-1/-1 (+54) -.8/-2 0/+0/+0	-1.0/-2 0/0/0 (+54) -1.0/-2 0/+0/+0	-1.1/-2 -1/-1/-1 (+54) -1.1/-2 -1/+0/+0
+10	+.6/+0 +1/+0/+0 (+54) +.2/+0 +1/+0/+0	+.6/+0 +1/+0/+0 (+54) +.2/+0 +1/+0/+0	+.0/+0 +1/+1/+1 (+54) +.0/+0 +1/+1/+1	+.6/+0 +1/+1/+1 (+54) +.2/+0 +1/+1/+1	+.5/+0 +0/+0/+0 (+54) +.3/+0 +0/+0/+0	+.5/+0 +1/+0/+0 (+54) +.1/+0 +1/+0/+0	+.4/+0 +1/+1/+1 (+54) +.2/+0 +1/+1/+1	+.2/+0 +0/+1/+1 (+54) +.0/+0 +0/+1/+1

LABEL FOR INFLUENCE DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	MTOW(1000 KG) codes V1min/VR/V2(KT)	*VMC *LIMITATION	Tref (OAT) =29 C Tmax (OAT) =54 C	Min acc height 784Ft Max acc height 1965Ft	Min QNH alt 1280Ft Max QNH alt 2461Ft
	LIMITATION CODES: 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final takeoff 9=VMU			MIN V1/VR/V2 = 120/22/28 CHECK VMU LIMITATION CORRECT. V1/VR/V2 =0.2Kt/1000 Kg	

INFLUENCE CORRECTION
△WEIGHT △TFLEX
△V1/△V_R/△V2
(TVMC) △WEIGHT △TFLEX
△V1/△V_R/△V2

TAKEOFF PARAMETERS

MAX TEMPERATURE (58)

LIMITATION CODE (7-7)

DELTA WEIGHT (1000 KG) (.0)

V_1 (KT IAS) - V_R (KT IAS) - V_2 (KT IAS)
(112) (117) (122)

MINIMUM VALUES OF V1/VR/V2 TO WHICH TAKEOFF SPEEDS MUST BE LIMITED WHEN DECREMENTS ARE APPLIED

V1/VR/V2 DECREMENTS FOR WEIGHTS BELOW THE LOWEST WEIGHT OF A COLUMN

A319XXX	ENGINES	AIRPORT NAME						15L	VERSION DATE
QNH	1013.00 HPA	Elevation	489	FT	TORA	3000	M		AXXXXXXX V10
Air cond.	AC OFF	Isa temp	14	C	TODA	3100	M		
Anti-icing	AI OFF	rwy slope	.08	%	ASDA	3000	M	4 obstacles	DRY
All reversers operating									
No reversers on dry runway									

WEIGHT 1000 KG	CONF 1+F				CONF 2			
	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT
76	6 3/3 .0 148/52/55	25 3/3 .0 149/53/56	37 3/3 .0 151/54/57	38 3/3 .2 154/57/60	0 3/3 .1 150/53/56	18 3/3 .0 150/54/57	35 3/3 .0 152/56/58	37 3/3 .0 155/58/60
72	40 3/3 .2 142/46/49	42 3/3 .5 146/49/52	44 3/3 .5 150/52/55	46 3/3 .1 153/54/57	40 3/3 .1 143/47/49	42 3/3 .1 147/50/52	43 3/3 .5 151/53/55	44 3/3 .4 154/56/58
68	48 3/3 .3 141/43/46	50 3/3 .3 145/47/49	52 3/3 .2 149/50/52	53 3/3 .0 153/53/55	48 3/3 .1 142/44/46	49 3/3 .5 146/48/50	51 3/3 .1 151/52/53	51 2/3 .4 153/54/56
64	56 3/3 .3 141/42/44	58 3/7 .0 143/44/46	58 3/7 .0 140/44/46	58 3/7 .0 138/44/46	56 3/3 .1 142/43/45	57 3/3 .2 147/47/48	57 2/3 .6 149/50/51	57 2/3 .6 148/50/51
60	* 58 3/7 .0 118/30/33	* 58 3/7 .0 * 113/30/33	* 58 2/7 .0 * 111/30/33	* 58 2/7 .0 * 111/30/33	58 3/7 .0 117/30/32	* 58 3/7 .0 * 113/31/32	* 58 2/7 .0 * 111/31/32	* 58 2/7 .0 * 111/31/32
56	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/9 * .0 * 111/21/24	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
52	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/22	* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
48	* 58 7/7 * .0 * 111/18/22	* 58 7/7 * .0 * 111/18/22	DO NOT USE FOR OPERATIONAL PURPOSE				* 58 7/7 * .0 * 111/19/21	* 58 7/7 * .0 * 111/19/21
46	* 58 7/7 * .0 * 111/18/22	* 58 7/7 * .0 * 111/18/22					* 58 7/7 * .0 * 111/18/21	* 58 7/7 * .0 * 111/18/21
40	* 58 7/7 * .0 * 112/18/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/17/22	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21	* 58 7/7 * .0 * 112/18/21
	GRAD1/GRAD2 (KG/C)							
	40/****	40/****	40/ 400	40/ 400	40/****	40/****	30/****	30/ 410
	INFLUENCE OF RUNWAY CONDITION							
WET	-.5/ -2 -9/ -1/ -1 (+58)-.5/ -2 -9/ 0/ 0	-.5/ -1 -9/ -1/ -1 (+58)-.5/ -1 -9/ 0/ 0	-.5/ -1 -8/ -1/ -1 (+58)-.5/ -1 -8/ 0/ 0	-.3/ -1 -6/ 0/ 0 (+58)-.3/ -1 -6/ 0/ 0	-.7/ -2 -11/ -1/ -1 (+58)-.7/ -2 -11/ 0/ 0	-.6/ -2 -10/ -1/ -1 (+58)-.6/ -2 -10/ 0/ 0	-.4/ -1 -7/ 0/ 0 (+58)-.4/ -1 -7/ 0/ 0	-.1/ -1 -4/ 0/ 0 (+58)-.3/ -1 -4/ 0/ 0
D QNH HPA	INFLUENCE OF DELTA PRESSURE							
-10	-.9/ -2 0/ 0/ 0 (+54)-.9/ -2 0/ 0/ 0	-.5/ -1 0/ 0/ 0 (+54)-.5/ -1 0/ 0/ 0	-.6/ -2 -1/ -1/ -1 (+54)-.6/ -2 -1/ 0/ 0	-.5/ -1 -1/ -1/ -1 (+54)-.5/ -1 -1/ 0/ 0	-.5/ -1 -1/ 0/ 0 (+54)-.5/ -1 -1/ 0/ 0	-.6/ -2 -2/ -1/ -1 (+54)-.6/ -2 -2/ 0/ 0	-.6/ -2 -1/ -1/ -1 (+54)-.6/ -2 -1/ 0/ 0	-.5/ -1 -1/ 0/ 0 (+54)-.5/ -1 -1/ 0/ 0
+10	+.3/ 0 +1/ +1/ +1 (+58)+.3/ 0 +1/ +1/ +1	+.2/ 0 +1/ +1/ +1 (+58)+.2/ 0 +1/ +1/ +1	.0/ 0 0/ 0/ 0 (+58).0/ 0 0/ 0/ 0	.0/ 0 0/ +1/ +1 (+58).0/ 0 0/ +1/ +1	+.1/ 0 0/ 0/ 0 (+58)+.1/ 0 0/ 0/ 0	+.1/ 0 0/ 0/ 0 (+58)+.1/ 0 0/ 0/ 0	+.2/ 0 0/ 0/ 0 (+58)+.2/ 0 0/ 0/ 0	+.2/ 0 0/ 0/ 0 (+58).0/ 0 0/ 0/ 0

LABEL FOR INFLUENCE DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	OAT C DW CODES V1min/VR/V2 (kt) LIMITATION CODES : 1=1st segment 2=2nd segment 3=runway length 4=obstacles 5=tire speed 6=brake energy 7=max weight 8=final take-off 9=VMU	* VMC * LIMITATION Tref (OAT) = 36 C Tmax (OAT) = 54 C	Min acc height 515 FT Max acc height 1725 FT Min V1/VR/V2 = 111/16/21 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG	Min QNH alt 1011 FT Max QNH alt 2220 FT

DETERMINATION OF MAXIMUM TAKEOFF WEIGHT AND SPEEDS

GENERAL

The takeoff chart is computed for a given runway under a set of conditions, which are :
- OAT
- Wind
- Configuration
- QNH, air conditioning, anti ice...

Two configurations are produced on the chart. This enables the crew to select that giving the highest permissible takeoff weight.
In case of equivalent performance, retain the configuration giving the lower takeoff speeds.

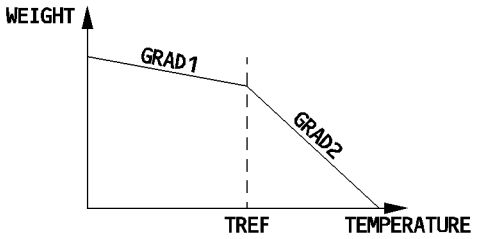
MTOW DETERMINATION

Enter the chart with the first configuration and actual wind column reading the temperature value. This temperature value stands for the OAT. Read the maximum takeoff weight corresponding to the actual OAT. Note that it is allowed to interpolate between two consecutive lines to obtain the maximum takeoff weight.
It is reminded that the takeoff weight is the sum of the weight entry and the delta weight.
Similarly determine the takeoff speeds associated with the maximum takeoff weight.

R In some cases, it may happen that the first temperature value (displayed for the highest weight entry) is higher than OAT. In this case, it is allowed to extrapolate the weight value to avoid unnecessary penalty. Use the Grad 1/Grad 2 gradients provided at the bottom of the corresponding column.

Correction to weight

Grad 1/Grad 2 are gradients provided for both sides of the flat rating temperature (TREF).
Grad 1 applies to temperatures below TREF and Grad 2 applies above TREF.
Read the lowest temperature of the column (correponding to the highest weight entry).



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- If the lowest temperature and OAT are above TREF.
  Obtain weight increment by multiplying Grad 2 by the difference in temperature between OAT and lowest temperature. Add this weight increment to the maximum takeoff weight calculated for the lowest temperature.

· If the lowest temperature and OAT are below TREF.
Obtain weight increment by multiplying Grad 1 by the difference in temperature between OAT and lowest temperature. Add this weight increment to the maximum takeoff weight calculated for the lowest temperature.
· If OAT is below TREF and lowest temperature is above TREF.
The weight increment is calculated in two steps. Step one is multiplying Grad 2 by temperature difference between lowest temperature and TREF. Step two is multiplying Grad 1 by temperature difference between TREF and OAT. Add results from step one and two to maximum takeoff weight calculated for lowest temperature.

Note : Use the weight gradients only to extrapolate above the maximum weight shown in the RTOW chart. They are not valid for interpolation between two boxes, between filled boxes or between one filled and one blank box.

– Repeat the above process for the other available configuration and retain the configuration giving the highest takeoff weight.

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

Retain the maximum takeoff weight, associated configuration and speeds from above.
For conditions different from those of the chart, apply relevant corrections.

CONSERVATIVE CORRECTIONS FOR QNH AND BLEEDS FROM FCOM 2.02.24 p 1

Corrections are given for QNH ≠ 1013 hPa, air conditioning ON, anti ice ON.
1. For the given wind and temperature conditions, determine the maximum takeoff weight (choose the configuration giving the highest weight).
2. Apply the published weight correction(s) to the maximum takeoff weight (for each correction) to determine the maximum permissible takeoff weight.
3. Read the speeds associated with the maximum permissible takeoff weight by entering the chart with the retained configuration and weight value.

Example A

DATA : OAT = 25°C
Head Wind = 10 kt
Air conditioning ON
QNH = 1013 hPa

R Use the chart from 2.02.16 p 6.
Enter the 10 kt head wind column CONF 1+F, to read for 25°C
The lowest temperature of the column is 38°C, use Grad 1/Grad 2 to extrapolate the maximum takeoff weight.
Max TO weight (1000 kg) air conditioning OFF = 76.2 + 0.4 × 2 + 0.04 × 11 = 77.4
Enter the 10 kt head wind column CONF 2, to read for 25°C
The lowest temperature of the column is 37°C, use Grad 1/Grad 2 to extrapolate the maximum takeoff weight.

Max TO weight (1000 kg) air conditioning OFF = 76.0 + 0.41 × 1 + 0.03 × 11 = 76.7
Retain CONF 1+F as takeoff configuration.
Maximum TO weight (1000 kg) air conditioning OFF 77.4
Air conditioning correction (FCOM 2.02.24 p1) . . . . . – 2.2
Maximum permissible TO weight (1000 kg) air conditioning ON 75.2
Determine takeoff speeds for 75.2 (1000kg) in the 10 kt head wind column (CONF1+F)
V1 = 154 kt, VR = 157 kt, V2 = 160 kt

CORRECTIONS FOR WET OR CONTAMINATED RUNWAYS FROM FCOM 2.04.10

(Refer to FCOM 2.04.10)

R CORRECTIONS PRODUCED ON THE RTOW CHART (SEE EXAMPLE ON 2.02.16 P 6)

A description of this correction is given on 2.02.16 p 3. The list of corrections is not exhaustive, however the most commonly used corrections are wet runway, QNH, air conditioning and/or anti ice. A maximum of three corrections can be produced on one chart.

To apply the corrections, proceed as follows :

1. Determine the maximum takeoff weight before correction for the given OAT and wind condition.
2. Apply the first correction :
   If OAT is less than or equal to TVMC (line 3), apply △W correction from line 1 and △V1/△VR/△V2 corrections from line 2.
   Else, (for OAT greater than TVMC), apply △W correction from line 3 and △V1/△VR/△V2 corrections from line 4.
3. To combine a second (and third, as applicable) correction :
   If OAT is less than or equal to TVMC (line 3), apply △W correction from line 1 and △V1/△VR/△V2 corrections from line 2.
   Check that the resulting speeds are higher than the minimum speeds displayed on the RTOW chart and that V2 is higher than the VMU limited speed (FCOM 2.02.25).
   If OAT is higher than TVMC (line 3) or if the above speed check is not fulfilled, apply △W correction from line 3 and △V1/△VR/△V2 corrections from line 4. No speed check is required.

Note : – *QNH correction is given for ± 10 hPa. It is allowed to extrapolate linearly for greater QNH deviation.*
– *When using a takeoff chart with failure cases, it is not allowed to combine two failure cases.*
R – *Corrections from the chart must be applied from top to bottom, i.e. in the RTOW on 2.02.16 p 6, apply the wet correction first.*
– *If asterisk or dotted lines appear in the correction boxes, refer to more conservative corrections provided in the FCOM.*
– *No speed check is required for the first correction. However, if the first influence correction follows a conservative FCOM correction, a speed check is required.*

Example B

DATA : OAT = 40°C
Head wind = 10 kt
QNH = 998 hPa
WET runway

R Use the chart from 2.02.16 p 6.

· Enter the 10 kt head wind column CONF 1+F, to read for 40°C
max TO weight (1000 kg) 75.2
· Enter the 10 kt head wind column CONF 2, to read for 40°C
max TO weight (1000 kg) 74.4
· Retain CONF 1+F for takeoff
· Read associated speeds as V1 = 154 kt, VR = 157 kt, V2 = 160 kt
· Apply WET correction
For OAT < TVMC (58°), ΔW = ... – 0.3
Intermediate weight (1000 kg) 74.9
Associated speeds,
V1 = 154 kt – 6 = 148 kt
VR = 157 kt – 0 = 157 kt
V2 = 160 kt – 0 = 160 kt
(No speed check required for first correction)
· Apply QNH correction
For OAT < TVMC (58°), ΔW = – 0.5 × 15/10 =. . . . . – 0.8
Maximum permissible takeoff weight (1000 kg) 74.1
Associated speeds,
V1 = 148 kt – 1 × 15/10 = 146 kt
VR = 157 kt – 1 × 15/10 = 156 kt
V2 = 160 kt – 1 × 15/10 = 159 kt
· Check that the speeds are higher than minimum speeds from the chart and from VMU table.

	Takeoff Configuration : 1+F			
	TOW	V1	VR	V2
TOW (RTOW)	75.2	154	157	160
FCOM correction(s)				
Intermediate value	75.2	154	157	160
WET Correction	– 0.3	– 6	0	0
Intermediate value	74.9	148	157	160
QNH Correction	– 0.8	– 2	– 1	– 1
Final value	74.1	146	156	159

COMBINING CORRECTIONS FROM FCOM AND CHART

Proceed as follows :

1. Determine the maximum takeoff weight by entering the chart with selected configuration, OAT and wind.
2. Apply corrections from FCOM to determine an intermediate weight. Interpolate associated speeds for intermediate weight in the same column (same wind and configuration).
3. Apply corrections from RTOW chart as explained above.

Example C

DATA : OAT = 25°C
Head wind = 10 kt
Air conditioning ON
QNH = 998 hPa
WET runway

1. Use the chart from 2.02.16 p 6.
   Enter the 10 kt head wind column CONF 1+F, to read for 25°C
   Max TO weight (1000 kg) air conditioning OFF = 76.2 + 0.4 × 2 + 0.04 × 11 = 77.4
   Enter the 10 kt head wind column CONF 2, to read for 25°C
   Max TO weight (1000 kg) air conditioning OFF = 76.0 + 0.41 × 1 + 0.03 × 11 = 76.7
   Retain CONF 1+F for takeoff configuration.
2. First, apply the correction from FCOM page 2.02.24 p 1.
   Max TO weight (1000 kg) air conditioning OFF 77.4
   Air conditioning correction . . . . . – 2,2
   Intermediate weight 75,2
   Interpolate takeoff speeds for 75,2 (1000 kg) in the 10 kt head wind column,
   V1 = 154 kt, VR = 157 kt, V2 = 160 kt
3. Apply WET correction
   For OAT < TVMC (58°), ΔW = ... – 0.3
   Intermediate weight 74,9
   Associated speeds,
   V1 = 154 kt – 6 = 148 kt
   VR = 157 kt – 0 = 157 kt
   V2 = 160 kt – 0 = 160 kt
   Apply QNH correction
   For OAT < TVMC (54°), ΔW = – 0.5 × 15/10 = ... – 0.8
   Maximum permissible takeoff weight 74,1
   Associated speed,
   V1 = 148 kt – 1 × 15/10 = 146 kt
   VR = 157 kt – 1 × 15/10 = 156 kt
   V2 = 160 kt – 1 × 15/10 = 159 kt

Check that the speeds are higher than minimum speeds from the chart and from VMU table. (It is reminded that if the speed checks are not fulfilled, the corrections must be recalculated using those provided on lines 3 and 4).
Since the speed check is fulfilled :
Max permissible takeoff weight = 74.1 (1000 kg)
V1 = 146 kt, VR = 156 kt, V2 = 159 kt.

	Takeoff Configuration : 1+F			
	TOW	V1	VR	V2
TOW (RTOW)	77.4			
FCOM correction(s)	– 2.2			
Intermediate value	75.2	154	157	160
WET Correction	– 0.3	– 6	0	0
Intermediate value	74.9	148	157	160
QNH Correction	– 0.8	– 2	– 1	– 1
Final value	74.1	146	156	159

EXTRAPOLATION

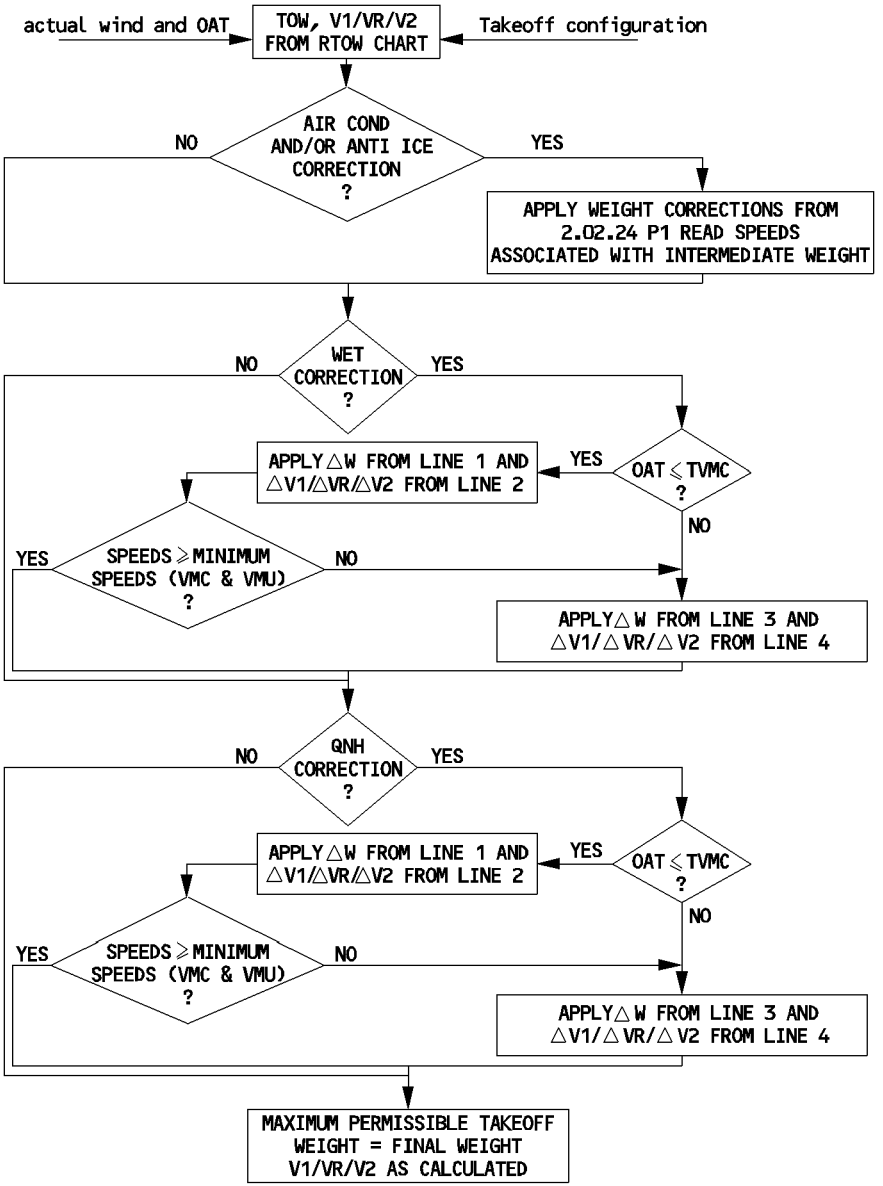
For OAT lower than the lowest temperature value of a wind column, it is possible to obtain a higher maximum permissible takeoff weight by using Grad 1/Grad 2 values. See page 1 for more details.

MAXIMUM STRUCTURAL TAKEOFF WEIGHT

The maximum structural takeoff weight is a weight limitation depending on the aircraft. This limitation is provided in the Flight Manual and in the chapter limitation of the FCOM3. Compare the maximum structural takeoff weight to the maximum permissible takeoff weight computed for given conditions and retain the lower of the two values.

SUMMARY

The following flow diagram gives the different steps to follow.



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DEFINITION OF FLEXIBLE TAKEOFF

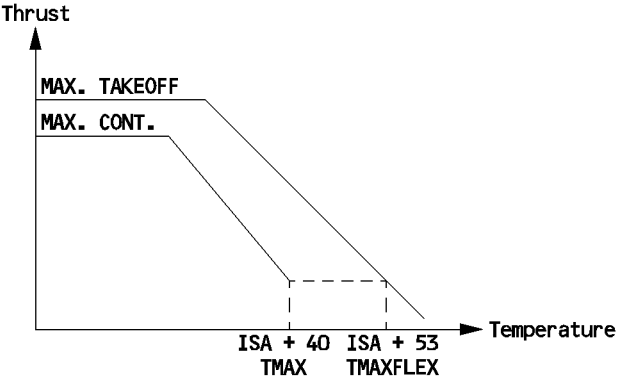
In many cases the aircraft takes off with a weight lower than the maximum permissible takeoff weight. When this happens, it can meet the required performance (runway, second segment, obstacle,...) with a decreased thrust that is adapted to the weight : this is called FLEXIBLE TAKEOFF and the thrust is called FLEXIBLE TAKEOFF THRUST.
The use of flexible takeoff thrust saves engine life.

USE OF FLEXIBLE TAKEOFF

The pilot can use flexible takeoff when the actual takeoff weight is lower than the maximum permissible takeoff weight for the actual temperature. The maximum permissible takeoff weight decreases when temperature increases, so it is possible to assume a temperature at which the actual takeoff weight would be the limiting one. This temperature is called FLEXIBLE TEMPERATURE or assumed temperature and is entered in the FADEC via the MCDU PERF TO page in order to get the adapted thrust.

REQUIREMENTS

- Thrust must not be reduced by more than 25 % of the full rated takeoff thrust.
- The flexible takeoff N1 cannot be lower than the Max climb N1 at the same flight conditions.
  The FADEC takes the above two constraints into account to determine flexible N1.
- The flexible takeoff thrust cannot be lower than the Max Continuous thrust used for the final takeoff flight path computation (at ISA + 40).
  This constraint limits the maximum flexible temperature at ISA + 53 (68° C at sea level).
- The flexible temperature cannot be lower than the flat rating temperature, TREF (ISA + 30), or the actual temperature (OAT).



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R — Flexible takeoff is not permitted on contaminated runways.
— The operator should check the maximum thrust (TOGA) at regular intervals in order to detect any engine deterioration, or maintain an adequate engine performance monitoring program to follow up the engine parameters.

RECOMMENDATION

· In order to extend engine life, it is recommended to use the greatest thrust reduction level.
· However, to improve the takeoff performance, the thrust can be increased by selecting a lower flexible temperature.

Using the same takeoff chart, for a given weight it is possible to :
— Select a temperature lower than the maximum determined one and keep the speeds defined at maximum temperature or,
— Move towards the left side of the takeoff chart (tailwind) while remaining with the same configuration and looking for the same actual takeoff weight.
This produces a lower flexible temperature and, in general, lower takeoff speeds (V1/VR/V2).

Using one of the two above possibilities, check that the selected temperature is greater than the actual temperature (OAT) and greater than the flat rating temperature (TREF).

TAKEOFF PROCEDURE

Depending on environmental takeoff conditions, the following procedure is recommended.

CONDITIONS	PROCEDURE	REASON
Dry or wet well paved runway	— Use the configuration giving the maximum flex. — If equivalent flex is obtained, choose the configuration giving the lowest speeds.	Extend engine life
High altitude takeoff	— Use CONF2/CONF3	Improve comfort
Badly paved runway or Accelerate stop distance limited runway	— Use CONF2/CONF3 or — Move towards left side of the takeoff chart	Improve comfort Improve stopping distance
Windshear expected along takeoff path	— Use maximum thrust	Maintain acceleration capability
Contaminated runway	— Use maximum thrust (flex forbidden)	Improve stopping distance Decrease time on runway. Required by regulations.

DETERMINATION OF FLEXIBLE TAKEOFF TEMPERATURE AND SPEEDS

Before determining the flexible temperature, calculate the maximum permissible takeoff weight (see previous section) and ensure that the actual takeoff weight is lower than the determined maximum takeoff weight.

- For a given configuration and wind value, enter the RTOW chart with the actual takeoff weight to read the flexible temperature and associated speeds. It is reminded that the takeoff weight is the sum of the weight entry and the delta weight displayed in each box. It is allowed to interpolate between two consecutive rows and/or columns for weight and for wind values not displayed on the chart.
- Repeat this process for the other configuration available. Select that configuration giving the highest flexible temperature.

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

When the takeoff conditions are different from those provided on the chart, apply the associated corrections.

CONSERVATIVE CORRECTIONS FOR QNH AND BLEEDS FROM FCOM 2.02.24 P 1

Corrections are given for QNH ≠ 1013 hPa, air conditioning ON, anti ice ON.

1. For a given takeoff weight, wind condition and selected configuration, read the flexible temperature. Retain the takeoff speeds associated with the actual weight.
2. Apply the published temperature correction. To combine two or more corrections, add the different corrections and apply to temperature value.
   (No speed corrections required).

Example D

DATA : Actual takeoff weight = 68 000 kg
Head wind = 10 kt
Air conditioning ON
QNH = 1013 hPa

Use the chart from 2.02.16 p 6. Determine the maximum permissible takeoff weight (see example A). The actual weight being lower than the maximum one, flexible takeoff is possible.

Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 1+F,
Flexible temperature . . . . . .53° C

Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
Flexible temperature . . . . . .51° C

Retain CONF 1+F for takeoff configuration.
Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 155 kt
Flexible temperature with air conditioning OFF . . . . . .53° C
R Air conditioning correction (FCOM 2.02.24 p 1) . . . . . .– 5° C
R Maximum flexible temperature . . . . . .48° C

CORRECTIONS FOR WET RUNWAY FROM FCOM 2.04.10

(Refer to FCOM 2.04.10)

CORRECTIONS PRODUCED ON THE RTOW CHART (SEE EXAMPLE ON 2.02.16 P 6)

A description of this correction is given on 2.02.16 p 3. The list of corrections is not exhaustive, however the most commonly used corrections are wet runway, QNH, air conditioning and/or anti-icing. A maximum of three corrections can be produced on one chart.

To apply the correction, proceed as follows :

1. Enter the chart with selected configuration, wind and actual takeoff weight to read the flexible temperature associated with this weight.
2. Apply the first correction :
   If the flexible temperature is less than or equal to TVMC (line 3), apply △Tflex correction from line 1 and apply speed corrections (△V1/△VR/△V2) from line 2.
   Else, (flexible temperature greater than TVMC), apply △Tflex from line 3 and △V1/ △VR/ △V2 corrections from line 4.
   Check V2 against VMU limitation (FCOM 2.02.25). If V2 is lower than V2 limited by VMU, flexible takeoff is not possible. Set TOGA thrust and retain the speeds associated with maximum permissible takeoff weight or the speeds read in the chart for the actual weight if they are all lower.
   No speed correction is required for QNH and bleeds influence (Not applicable to maximum takeoff weight determination).
3. To combine a second and/or a third correction, proceed as per point 2.
4. Check that the final flexible temperature is :
   – higher than OAT and TREF
   – limited to TMAXFLEX
   If the check is fulfilled, retain final flexible temperature as the one to be inserted in the MCDU.
   If the check is not fulfilled, (final flexible temperature lower than OAT or TREF), no flexible takeoff is possible.
   Use TOGA thrust and retain speeds that have been calculated for the maximum permissible takeoff weight. (See 2.02.20 p 7)

Note : – QNH correction is given for ± 10 hPa. It is allowed to extrapolate linearly for greater QNH deviation.
– Corrections from the chart must be applied from top to bottom, i.e. in the RTOW on 2.02.16 p 6, apply the wet influence first.

Note : – When the flexible temperature is higher than TVMC, it is allowed to limit the flexible temperature to TVMC and apply only corrections from lines 1 and 2.
– If asterisk or dotted lines appear in the correction boxes, refer to more conservative corrections provided in the FCOM.

Example E

DATA : Actual takeoff weight = 68 000 kg
Head wind = 10 kt
QNH = 998 hPa
WET runway
Air conditioning OFF

R Use the chart from 2.02.16 p 6. Determine the maximum permissible takeoff weight (see example B). The actual weight being lower than the maximum one, flexible takeoff is possible.
Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 1+F,
Flexible temperature . . . . . .53° C
Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
Flexible temperature . . . . . .51° C
Retain CONF 1+F as the flexible temperature is higher.
Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 155 kt
Apply WET correction
For flexible temperature < TVMC (58° C), △Tflex ∓. . . . . – 1° C
Intermediate flex temperature . . . . . 52° C
Associated speeds,
V1 = 153 kt – 6 = 147 kt
VR = 153 kt – 0 = 153 kt
V2 = 155 kt – 0 = 153 kt

R Since speed correction on V2 is 0, no V2 check against VMU limitation is necessary.
Apply QNH correction
For flex temperature < TVMC (54° C), △Tflex ∓. . . . . – 2° C
Maximum flexible temperature . . . . . 50° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
Takeoff speeds are V1 = 147 kt, VR = 153 kt, V2 = 153 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	53	153	153	155
FCOM correction(s)				
Intermediate value	53	153	153	155
WET Correction	– 1	– 6	0	0
Intermediate value	52	147	153	153
QNH Correction	– 2	0	0	0
Final value	50	147	153	153

COMBINING CORRECTIONS FROM FCOM AND CHART

1. Apply corrections from FCOM (see 2.02.24 p 1).
2. Apply corrections from the RTOW chart.
   Apply speed corrections except for QNH and bleed influences.

Example F

DATA : Actual takeoff weight = 68 000 kg
Head wind = 10 kt
Air conditioning ON
QNH = 998 hPa
WET runway

Use the chart from 2.02.16 p 6. Determine the maximum permissible takeoff weight (see example C). The actual weight being lower than the maximum one, flexible takeoff is possible.

· Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 1+F,
Flexible temperature . . . . . 53° C

· Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
Flexible temperature . . . . . 51° C

· Retain CONF 1+F for takeoff configuration.
Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 155 kt

· First, apply the correction from FCOM page 2.02.24 p 1.
Flexible temperature with air conditioning OFF . . . . . 53° C
R Air conditioning correction . . . . . – 5° C
R Intermediate flexible temperature . . . . . 48° C
No speed correction.

· Apply WET correction
For flexible temperature < TVMC (58° C), △Tflex ∓. . . . . – 1° C
R Intermediate flex temperature . . . . . 47° C
Associated speeds,
V1 = 153 kt – 6 = 147 kt
VR = 153 kt – 0 = 153 kt
V2 = 155 kt – 0 = 155 kt
Since speed correction on V2 is 0, no V2 check against VMU limitation is necessary.

· Apply QNH correction
For flexible temperature ≤ TVMC (54° C), △Tflex ∓ . . . . . – 2° C
R Maximum flexible temperature . . . . . 45° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
Takeoff speeds are V1 = 147 kt, VR = 153 kt, V2 = 155 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	53	153	153	155
FCOM correction(s)	– 5	0	0	0
Intermediate value	48	153	153	155
WET Correction	– 1	– 6	0	0
Intermediate value	47	147	153	155
QNH Correction	– 2	0	0	0
Final value	45	147	153	155

FLEXIBLE TAKEOFF NOT POSSIBLE

In some cases when the actual takeoff weight is lower than the maximum permissible one but no flexible takeoff possible (that is flexible temperature lower than TREF or OAT) :

– It is mandatory to use TOGA thrust

– You can retain the speeds that have been calculated for the maximum permissible takeoff weight;

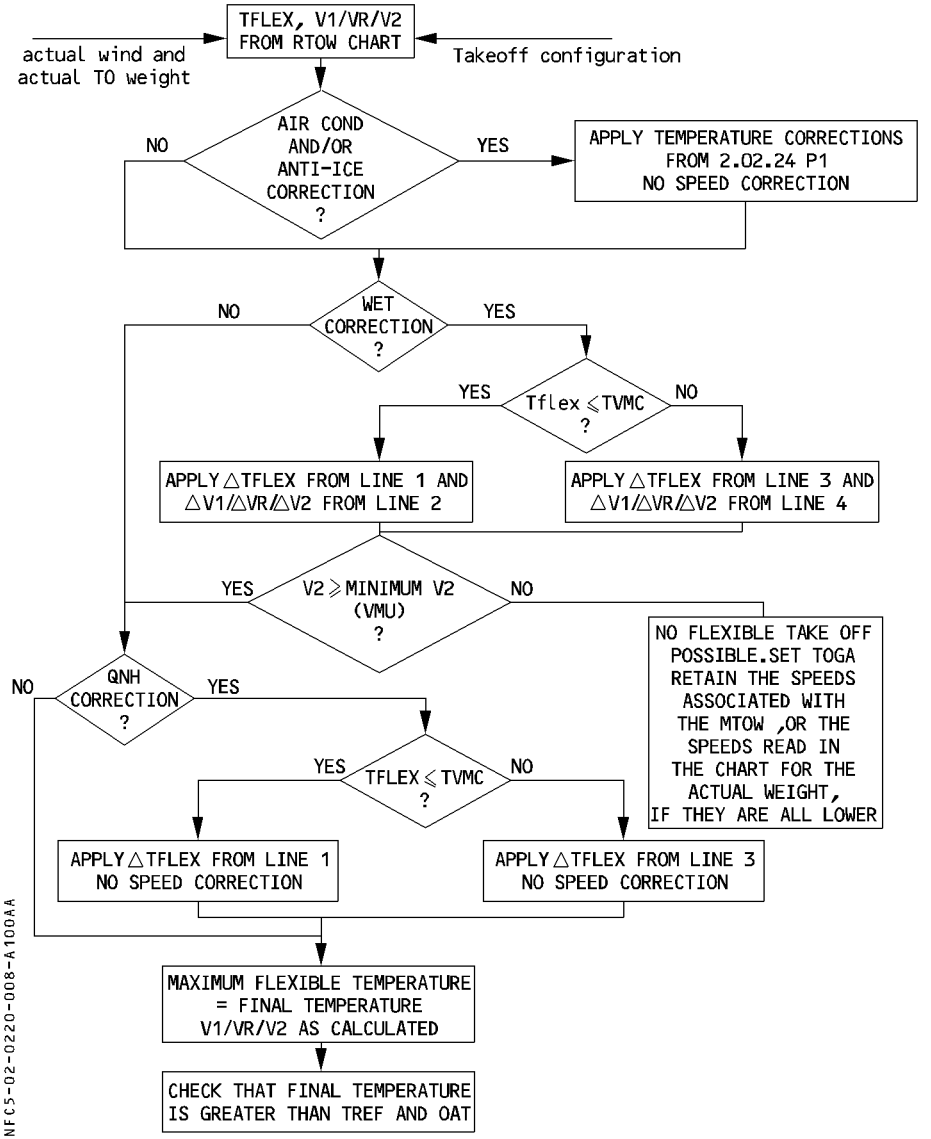
R OR

R – You can retain the speeds associated with the actual takeoff weight provided they are
R all lower than the speeds calculated for the maximum permissible takeoff weight.

SUMMARY

The flow diagram gives the different steps to follow

R



EFFECT OF QNH AND BLEEDS (up to 9200 feet)

To take into account QNH deviation and/or bleeds ON apply

CORRECTIONS ON TEMPERATURE IF FLEX TAKEOFF PERFORMED		CORRECTIONS ON WEIGHT IF TAKEOFF WITH FULL THRUST IS PERFORMED
Add 1°C/40hPa until pressure altitude equals zero. No correction for pressure altitude below 0 ft.	QNH above 1013 hPa	Add 20 kg/hPa until pressure altitude equals zero. No correction for pressure altitude below 0 ft.
Subtract 1°C/6hPa	QNH below 1013 hPa	Subtract 90 kg/hPa
Subtract 1°C	* Engine A/ICE ON	Subtract 250 kg
Subtract 2°C	* Total A/ICE ON	Subtract 750 kg
Subtract 5°C	Air Conditioning ON	Subtract 2200 kg

Compare corrected temp (CT), flat rating temp (T REF) and OAT

CT higher than OAT and CT higher than TREF	Take CT as flex temp limited to ISA + 53
Either conditions above not fulfilled	No flexible takeoff possible determine MAX TOW

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Note : — * *Corrections valid only for OAT < 10°C*
— *For high altitude operation, refer to 2.02.24 p3 (if applicable)*

EXAMPLES

R Airport geometric elevation = 450 feet

Takeoff chart data

QNH = 1013 hPa
Anti ice OFF
Air conditioning OFF

Example 1 - Full thrust takeoff

R Actual data : OAT = 5°C
QNH = 1040 hPa
Engine anti ice ON
Air conditioning OFF

R Weight read on the takeoff chart : 70000 kg
Determine the actual airport pressure altitude (1 hPa is equivalent to 28 feet according to the ISA model).
Pressure altitude = 450 – (1040 – 1013) × 28 = – 306 feet
Read in the above table the corrections for high QNH and engine anti ice ON.
QNH correction = 20 kg × (450/28) + 0 kg × (306/28) = + 320 kg
Engine anti ice correction : – 250 kg
The maximum permissible takeoff weight is 70000 + 320 – 250 = 70070 kg

Example 2 - Flexible thrust takeoff

R Actual data : OAT = 5°C
QNH = 1040 hPa
Anti ice OFF
Air conditioning ON
TOW = 65000 kg

R Flexible temperature read on the takeoff chart : TFLEX = 55°C
Read TREF on the takeoff chart or on the quick reference table.
Determine the actual airport pressure altitude (1 hPa is equivalent to 28 feet according to the ISA model).
Pressure altitude = 450 – (1040 – 1013) × 28 = – 306 feet
Read in the above table the correction for QNH and air conditioning ON :
QNH correction = 1°C/40 hPa × (450/28) + 0 = 0 °C
Air conditioning ON correction : – 5°C
New flexible temperature = 55 + 0 – 5 = 50°C
Check that the flexible temperature is above TREF and actual OAT.
Check that the flexible temperature is less than the maximum flexible temperature and retain the lower of the two.

SPEEDS LIMITED BY VMC

Takeoff speeds all have a minimum value limited by control. These minimum values are given in the tables down below.

R

Pressure altitude (ft)	–1000	0	1000	2000	3000	4000	5000	6000	8000	9200	
CONF 1 + F	112	112	111	110	109	108	108	107	104	103	V1 min
CONF 2	112	112	111	110	109	108	108	107	104	103	
CONF 3	112	112	111	110	109	108	108	107	104	103	

R

Pressure altitude (ft)	–1000	0	1000	2000	3000	4000	5000	6000	8000	9200	
CONF 1 + F	116	115	114	113	112	111	110	109	107	106	VR min
CONF 2	116	115	114	113	112	111	110	109	107	106	
CONF 3	116	115	114	113	112	111	110	109	107	106	

R

Pressure altitude (ft)	–1000	0	1000	2000	3000	4000	5000	6000	8000	9200	
CONF 1 + F	123	123	121	120	119	118	117	116	113	112	V2 min
CONF 2	123	122	121	120	119	118	117	115	113	111	
CONF 3	123	122	121	120	119	118	117	116	113	112	

V2 LIMITED BY VMU/VMCA

R The following tables, one per configuration, provide the V2 limited by minimum unstick
R speed and minimum control speed in the air.

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)										
CONFIGURATION 1+F										
PRESSURE ALTITUDE (FT)	TAKEOFF WEIGHT (1000 kg)									
	35	40	45	50	55	60	65	70	75	80
-1000	123	123	123	123	123	128	133	137	142	147
0	123	123	123	123	123	128	133	138	142	147
1000	121	121	121	121	122	128	133	138	143	148
2000	120	120	120	120	122	128	133	138	143	148
3000	119	119	119	119	123	128	133	138	143	148
4000	118	118	118	118	123	128	133	138	143	148
5000	117	117	117	117	123	128	133	138	143	148
6000	116	116	116	117	123	128	133	138	143	148
7000	115	115	115	117	123	128	133	139	143	149
8000	113	113	113	117	123	128	134	139	144	149
9000	112	112	112	117	123	128	134	139	144	149
10000	111	111	111	117	123	129	134	139	144	149
11000	109	109	111	117	123	129	134	139	144	149
12000	108	108	111	117	123	129	134	139	144	150
13000	106	106	111	118	124	129	134	140	145	150
14000	104	104	111	118	124	129	134	140	145	150

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MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)										
CONFIGURATION 2										
PRESSURE ALTITUDE (FT)	**TAKEOFF WEIGHT (1000 kg)**									
	35	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**
-1000	123	123	123	123	123	123	126	131	136	140
0	122	122	122	122	122	122	126	131	136	141
1000	121	121	121	121	121	122	126	131	136	141
2000	120	120	120	120	120	122	127	131	136	141
3000	119	119	119	119	119	122	127	131	136	141
4000	118	118	118	118	118	122	127	132	136	141
5000	117	117	117	117	117	122	127	132	136	141
6000	115	115	115	115	117	122	127	132	137	141
7000	114	114	114	114	117	122	127	132	137	142
8000	113	113	113	113	117	122	127	132	137	142
9000	112	112	112	112	117	122	127	132	137	142
10000	110	110	110	112	117	123	127	132	137	142
11000	109	109	109	112	118	123	128	132	137	142
12000	108	108	108	112	118	123	128	133	137	142
13000	106	106	106	112	118	123	128	133	138	143
14000	104	104	106	112	118	123	128	133	138	143

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MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)										
CONFIGURATION 3										
PRESSURE ALTITUDE (FT)	**TAKEOFF WEIGHT (1000 kg)**									
	35	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**
-1000	123	123	123	123	123	123	123	128	132	137
0	122	122	122	122	122	122	123	128	133	137
1000	121	121	121	121	121	121	124	128	133	137
2000	120	120	120	120	120	120	124	128	133	137
3000	119	119	119	119	119	119	124	128	133	137
4000	118	118	118	118	118	119	124	128	133	138
5000	117	117	117	117	117	119	124	129	133	138
6000	116	116	116	116	116	119	124	129	133	138
7000	115	115	115	115	115	120	124	129	133	138
8000	113	113	113	113	115	120	124	129	133	138
9000	112	112	112	112	115	120	124	129	134	138
10000	111	111	111	111	115	120	124	129	134	138
11000	109	109	109	110	115	120	125	129	134	139
12000	108	108	108	110	115	120	125	129	134	139
13000	106	106	106	110	115	120	125	130	134	139
14000	105	105	105	110	115	120	125	130	134	139

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INTRODUCTION

These tables enable the crew to quickly determine the takeoff performance at an airport for which no takeoff chart has been established. They are conservative.

USE OF TABLES

A first table gives the corrections to be applied to the runway length for wind and runway slope. Nine other tables give, for three different pressure altitudes (0, 1000 and 2000 feet) and three configurations, the maximum takeoff weight, limitation codes and associated speeds as a function of temperature and corrected runway length. TREF and TMAX are given on the top of each table. For pressure altitudes above 2000 feet, use a specific RTOW chart.

R *Note : 1. Quick reference tables are established at V1 min with air conditioning OFF and anti ice OFF*
2. Do not use quick reference tables in case of tailwind.

HOW TO PROCEED

1. 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.
2. Select the configuration as a function of this corrected runway length.
3. Enter the table(s) corresponding to the configuration and airport pressure altitude.
   As far as airport pressure altitude is concerned, two methods may be applied :
   - interpolate the takeoff performance by using the two tables enclosing the airport pressure altitude,
   - for a more conservative figure, use the table corresponding to the pressure altitude immediately above the airport pressure altitude.
4. Enter the appropriate column of the table(s) with the corrected runway length.
   Once again, two methods may be applied :
   - interpolate the takeoff performance between the two columns enclosing the corrected runway length,
   - for a more conservative figure, use the column corresponding to the shorter corrected runway length.
5. Determination of maximum takeoff weight.
   Enter the table(s) and column(s) as explained above with the actual OAT and read maximum takeoff weight, limitation codes, V1, VR and V2. If necessary interpolate weight and speeds.
6. Determination of flexible temperature.
   The determination of flexible temperature is possible only when there is no obstacle on the flight path. Enter the table(s) and column(s) with the actual takeoff weight and read the corresponding temperature as flexible temperature.
7. In case of obstacles, use the graphs from 2.02.50 to determine the corresponding weight penalty.

LIMITATION CODES

- 1 : first segment
- 2 : second segment
- 3 : runway
- 5 : tire speed
- 6 : brake energy
- 7 : maximum computation weight
- 8 : final takeoff
- 9 : VMU

Note : 1. Limitation code 4 (obstacles) does not appear in quick reference tables.
2. VMC limitation appears with an asterisk (*) in the chart.

CORRECTIONS FOR WIND AND RUNWAY SLOPE

Runway length (m)		1500	1750	2000	2250	2500	2750	3000	3250	3500
Effect of wind	per knot of head wind add (meters)	6.5	7	8	8.5	9.5	10	11	11.5	12.5
Effect of runway slope	per percent uphill slope subtract (meters)	160	215	270	325	380	435	490	545	600
	per percent downhill slope add (meters)	17	23	29	36	42	48	55	61	67

EXAMPLE

Pressure altitude : 1400 ft
Temperature : 30°C
Runway length : 2750 m
Wind : 10 kt head
Slope : 1 % up
Takeoff configuration : 1 + F

– **Determination of corrected runway length**
(Refer to 2.02.40 p2)
runway length 2750
correction for wind . . . . . .10 × 10 = + 100
correction for slope . . . . . .– 435
corrected runway length 2415

– **Determination of a conservative maximum takeoff weight :**
(Refer to 2.02.40 p6)
– Pressure altitude : 1400 ft – Use the table for 2000 ft.
– Enter the column for to 2250 m
– Read the maximum takeoff weight on the line corresponding to the temperature of
R 30°C : 69600 kg
R V1 = 133 kt, VR = 134 kt, V2 = 139 kt

– **Determination of a precise flexible temperature for the actual takeoff weight of 66000 kg :**
(Refer to 2.02.40 p5 and p6)
– Interpolate the temperature corresponding to 66000 kg for the runway length of 2415m at 1000 ft and 2000 ft pressure altitude.
Results :
R 1000 ft : 54°C, V1 = 134 kt, VR = 136 kt, V2 = 139 kt
R 2000 ft : 50°C, V1 = 133 kt, VR = 134 kt, V2 = 139 kt
– Interpolate between these two values to get the flexible temperature
R 1400 ft : 52°C, V1 = 133 kt, VR = 135 kt, V2 = 139 kt

CONFIGURATION 1+F				PRESSURE ALTITUDE = 0 FT
TREF = 45 °C TMAX = 55 °C		DRY RUNWAY SLOPE = 0 %		MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	2500	2750	3000	3250
-20	76.1 2/3 145/46/52	78.2 2/3 151/53/58	79.9 2/3 157/59/64	80.0 3/7 154/60/65	80.0 3/7 149/60/65
-10	75.4 2/3 143/44/50	77.6 2/3 149/51/56	79.3 3/6 155/57/62	79.9 3/6 155/60/65	80.0 3/7 151/60/65
0	74.7 2/3 141/43/48	76.9 2/3 147/49/54	78.7 3/6 153/55/60	79.3 3/6 153/57/63	79.8 3/6 152/59/64
10	73.9 2/3 139/41/46	76.3 2/3 145/47/53	78.0 3/6 151/53/59	78.6 3/6 150/55/61	79.2 3/6 150/58/63
20	73.0 2/3 137/39/44	75.4 2/3 143/46/51	77.2 3/6 148/51/56	77.9 3/6 148/53/59	78.4 3/6 147/56/61
30	72.2 2/3 136/37/43	74.6 2/3 142/44/49	76.4 3/6 146/49/54	77.1 3/6 145/51/57	77.7 3/6 145/54/59
40	71.5 2/3 134/36/41	74.0 2/3 140/42/47	75.8 3/6 144/47/52	76.5 3/6 143/50/55	77.1 3/6 143/52/57
45	71.1 2/3 134/35/40	73.6 2/3 139/42/46	75.4 3/6 143/47/52	76.1 3/6 142/49/54	76.7 3/6 142/51/56
47	70.2 2/3 133/35/40	72.5 2/3 139/41/46	74.5 3/6 144/47/51	75.1 3/6 143/49/54	75.7 3/6 142/51/56
49	69.2 2/3 133/34/39	71.5 2/3 138/40/45	73.4 3/6 144/46/51	74.2 3/6 144/49/54	74.7 3/6 143/51/56
51	68.3 2/3 133/34/39	70.5 2/3 138/40/45	72.4 2/3 143/46/50	73.2 3/6 145/49/53	73.7 3/6 144/51/55
53	67.3 2/3 132/33/38	69.5 2/3 138/39/44	71.3 2/3 143/45/50	72.3 3/6 145/49/53	72.8 3/6 145/51/55
55	66.4 2/3 132/33/38	68.5 2/3 137/39/43	70.2 2/3 143/45/49	71.3 3/6 146/49/53	71.8 3/6 146/51/55
57	65.5 2/3 132/32/37	67.7 2/3 137/38/43	69.3 2/3 143/44/49	70.5 3/6 147/49/53	70.9 3/6 146/50/55
59	64.7 2/3 132/32/37	66.8 2/3 137/38/42	68.3 2/3 142/43/48	69.6 3/6 147/49/53	70.0 3/6 147/51/55
61	63.9 2/3 131/32/36	65.8 2/3 137/38/42	67.4 2/3 142/43/47	68.6 2/3 147/48/53	69.1 3/6 148/51/55
63	63.0 2/3 131/31/36	64.9 2/3 136/37/41	66.4 2/3 142/43/47	67.6 2/3 147/48/52	68.2 3/6 148/50/55
65	62.1 3/3 131/31/36	64.0 2/3 136/37/41	65.4 2/3 141/42/46	66.6 2/3 146/47/51	67.3 3/6 149/50/55
67	61.1 3/3 130/30/35	63.1 2/3 136/36/40	64.5 2/3 141/42/46	65.6 2/3 146/46/51	66.5 3/6 150/51/55
68	60.7 3/3 130/30/35	62.6 2/3 136/36/40	64.0 2/3 141/41/45	65.1 2/3 146/46/50	66.0 3/6 150/50/55

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CONFIGURATION 1+F				PRESSURE ALTITUDE = 1000 FT	
TREF = 43 °C TMAX = 53 °C			DRY RUNWAY SLOPE = 0 %	MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2	
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	2500	2750	3000	3250
-20	74.8 2/3 143/44/50	76.9 2/3 149/51/56	78.6 2/3 155/57/62	79.3 3/6 156/60/65	79.7 3/6 156/62/67
-10	74.1 2/3 141/43/48	76.3 2/3 147/49/54	78.0 2/3 153/55/60	78.7 3/6 153/58/63	79.2 3/6 153/60/65
0	73.3 2/3 139/41/46	75.6 2/3 145/47/52	77.4 3/6 151/53/58	78.1 3/6 151/56/61	78.6 3/6 150/58/63
10	72.5 2/3 138/39/44	74.9 2/3 143/45/51	76.7 3/6 149/51/56	77.4 3/6 148/54/59	78.0 3/6 148/56/61
20	71.7 2/3 136/37/43	74.1 2/3 141/44/49	76.0 3/6 147/49/55	76.7 3/6 146/52/57	77.2 3/6 146/54/59
30	70.9 2/3 134/36/41	73.3 2/3 140/42/47	75.3 3/6 145/48/53	75.9 3/6 144/50/55	76.5 3/6 143/52/57
40	70.2 2/3 133/34/39	72.6 2/3 138/40/45	74.5 3/6 142/46/51	75.3 3/6 142/48/53	75.9 3/6 141/50/55
43	69.9 2/3 132/34/39	72.4 2/3 137/40/45	74.3 3/6 142/45/50	75.0 3/6 141/47/52	75.6 3/6 140/49/54
45	69.1 2/3 132/33/38	71.4 2/3 137/39/44	73.4 3/6 142/45/50	74.1 3/6 142/47/52	74.7 3/6 141/49/54
47	68.2 2/3 132/33/38	70.5 2/3 137/39/44	72.4 2/3 142/45/49	73.2 3/6 143/47/52	73.8 3/6 142/49/54
49	67.2 2/3 131/32/37	69.5 2/3 137/38/43	71.4 2/3 142/44/49	72.3 3/6 143/47/52	72.8 3/6 143/49/54
51	66.3 2/3 131/32/37	68.5 2/3 136/38/43	70.3 2/3 142/43/48	71.4 3/6 144/47/52	71.9 3/6 143/49/54
53	65.4 2/3 131/31/36	67.5 2/3 136/37/42	69.3 2/3 141/43/47	70.4 3/6 145/47/52	70.9 3/6 144/49/54
55	64.4 2/3 130/31/36	66.6 2/3 136/37/41	68.2 2/3 141/42/47	69.5 3/6 146/47/52	70.0 3/6 145/49/54
57	63.6 2/3 130/31/35	65.7 2/3 135/36/41	67.3 2/3 141/42/46	68.6 3/6 146/47/51	69.1 3/6 146/49/54
59	62.8 2/3 130/30/35	64.8 2/3 135/36/40	66.3 2/3 140/41/46	67.6 2/3 145/46/51	68.2 3/6 147/49/53
61	61.9 2/3 130/30/34	63.9 2/3 135/35/40	65.4 2/3 140/41/45	66.6 2/3 145/46/50	67.3 3/6 147/49/53
63	61.1 3/3 129/29/34	63.0 2/3 135/35/39	64.5 2/3 140/40/45	65.7 2/3 145/45/50	66.5 3/6 148/49/53
65	60.2 3/3 129/29/34	62.1 2/3 134/34/39	63.5 2/3 140/40/44	64.7 2/3 144/45/49	65.6 3/6 149/49/53
66	59.7 3/3 129/29/34	61.7 2/3 134/34/39	63.1 2/3 139/40/44	64.2 2/3 144/45/49	65.1 3/6 149/49/53

CONFIGURATION 1+F				PRESSURE ALTITUDE = 2000 FT	
TREF = 41 °C TMAX = 51 °C			DRY RUNWAY SLOPE = 0 %	MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2	
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	2250	2500	2750	3000	3250
-20	73.3 2/3 141/43/48	75.5 2/3 147/49/54	77.2 2/3 153/55/60	78.0 3/6 154/58/63	78.4 3/6 154/60/65
-10	72.6 2/3 139/41/46	74.9 2/3 145/47/52	76.6 2/3 151/53/58	77.4 3/6 151/56/61	77.9 3/6 151/58/63
0	71.9 2/3 138/39/44	74.2 2/3 143/45/50	76.0 2/3 149/51/56	76.7 3/6 149/54/59	77.3 3/6 149/56/61
10	71.1 2/3 136/37/42	73.5 2/3 141/43/48	75.3 3/6 147/49/54	76.1 3/6 147/52/57	76.7 3/6 146/54/59
20	70.3 2/3 134/36/41	72.7 2/3 139/42/47	74.7 3/6 145/48/52	75.3 3/6 144/50/55	75.9 3/6 144/52/57
30	69.6 2/3 133/34/39	71.9 2/3 138/40/45	73.9 3/6 143/46/51	74.7 3/6 142/48/53	75.3 3/6 142/50/55
40	68.9 3/9 131/32/38	71.3 2/3 136/39/43	73.3 3/6 141/44/49	73.9 3/6 140/46/51	74.6 3/6 140/48/53
41	68.8 3/9 131/32/37	71.1 2/3 136/38/43	73.2 3/6 141/44/49	73.9 3/6 140/46/51	74.5 3/6 140/48/53
43	67.9 2/3 131/32/37	70.3 2/3 136/38/43	72.3 3/6 141/43/48	73.0 3/6 141/46/51	73.7 3/6 140/48/53
45	67.0 2/3 130/31/36	69.3 2/3 135/37/42	71.3 2/3 141/43/48	72.2 3/6 141/46/51	72.7 3/6 141/48/53
47	66.1 2/3 130/31/36	68.3 2/3 135/37/42	70.3 2/3 140/42/47	71.3 3/6 142/46/50	71.8 3/6 141/48/52
49	65.2 2/3 130/30/35	67.4 2/3 135/36/41	69.2 2/3 140/42/47	70.4 3/6 143/46/50	70.8 3/6 142/48/52
51	64.3 2/3 129/30/35	66.4 2/3 135/36/41	68.2 2/3 140/41/46	69.5 3/6 144/46/50	70.0 3/6 143/48/52
53	63.4 2/3 129/29/34	65.5 2/3 134/35/40	67.2 2/3 139/41/45	68.5 3/6 144/46/50	69.0 3/6 144/48/52
55	62.5 2/3 129/29/34	64.6 2/3 134/35/39	66.2 2/3 139/40/45	67.5 2/3 144/45/50	68.1 3/6 145/48/52
57	61.6 2/3 129/29/33	63.7 2/3 134/34/39	65.2 2/3 139/40/44	66.5 2/3 144/45/49	67.2 3/6 145/48/52
59	60.8 2/3 128/28/33	62.8 2/3 133/34/38	64.3 2/3 139/39/44	65.5 2/3 143/44/48	66.3 3/6 146/48/52
61	60.0 3/3 128/28/33	61.9 2/3 133/33/38	63.4 2/3 138/39/43	64.6 2/3 143/44/48	65.5 3/6 147/48/52
63	59.1 3/3 128/28/32	61.1 2/3 133/33/37	62.5 2/3 138/38/42	63.6 2/3 143/43/47	64.6 3/6 147/48/52
64	58.7 3/3 128/28/32	60.6 2/3 133/33/37	62.0 2/3 138/38/42	63.2 2/3 142/43/47	64.1 2/3 147/47/51

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CONFIGURATION 2					PRESSURE ALTITUDE = 0 FT
TREF = 45 °C TMAX = 55 °C			DRY RUNWAY SLOPE = 0 %		MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1750	2000	2250	2500	2750
-20	71.0 2/3 132/32/37	73.8 2/3 139/40/45	76.2 2/3 145/47/52	77.8 2/3 152/54/59	79.1 2/3 158/60/65
-10	70.3 2/3 130/30/35	73.2 2/3 137/38/43	75.5 2/3 143/45/50	77.3 2/3 149/52/56	78.6 2/3 156/58/63
0	69.5 2/3 128/28/33	72.4 2/3 135/36/41	74.9 2/3 141/43/48	76.8 2/3 147/50/55	78.1 2/3 154/56/61
10	68.8 2/3 127/27/32	71.7 2/3 133/35/39	74.2 2/3 139/42/46	76.2 2/3 145/48/53	77.6 2/3 151/54/59
20	67.9 3/9 125/25/30	70.9 2/3 131/33/37	73.4 2/3 137/40/44	75.4 2/3 143/46/51	76.9 2/3 149/52/57
30	67.2 3/9 123/24/29	70.1 2/3 130/31/36	72.7 2/3 136/38/43	74.7 2/3 141/44/49	76.3 3/6 147/50/55
40	66.4 3/9 122/23/28	69.5 2/3 128/30/34	72.0 2/3 134/37/41	74.1 2/3 140/43/47	75.8 3/6 145/49/53
45	66.0 3/9 121/22/27	69.1 2/3 127/29/34	71.6 2/3 133/36/40	73.7 2/3 139/42/46	75.5 3/6 144/48/52
47	65.1 3/9 121/21/26	68.2 2/3 127/29/33	70.6 2/3 133/35/40	72.7 2/3 139/42/46	74.4 3/6 144/47/52
49	64.3 3/9 121/21/26	67.2 2/3 127/28/33	69.7 2/3 133/35/39	71.7 2/3 138/41/45	73.2 2/3 144/47/51
51	63.4 3/9 121/21/26	66.3 2/3 127/28/32	68.7 2/3 133/35/39	70.6 2/3 138/40/45	72.1 2/3 144/46/50
53	62.5 3/3 120/20/25	65.4 2/3 126/27/32	67.7 2/3 132/34/38	69.6 2/3 138/40/44	71.0 2/3 143/46/50
55	61.6 3/3 120/20/25	64.5 2/3 126/27/31	66.7 2/3 132/34/38	68.6 2/3 138/40/44	69.9 2/3 143/45/49
57	60.8 3/3 120/20/25	63.6 2/3 126/27/31	65.8 2/3 132/33/37	67.6 2/3 137/39/43	68.9 2/3 143/45/49
59	60.0 3/3 120/20/25	62.8 2/3 126/26/30	65.0 2/3 132/33/37	66.7 2/3 137/39/42	67.9 2/3 143/44/48
61	59.2 3/3 120/20/24	62.0 2/3 125/26/30	64.1 2/3 131/32/36	65.7 2/3 137/38/42	66.9 2/3 142/44/48
63	58.3 3/3 119/19/24	61.1 2/3 125/25/29	63.2 2/3 131/32/36	64.8 2/3 137/38/41	65.9 2/3 142/43/47
65	57.5 3/3 119/19/23	60.2 2/3 125/25/29	62.3 2/3 131/31/35	63.8 2/3 136/37/41	65.0 2/3 142/43/46
67	* 56.6 3/3 * 119/19/23	59.3 3/3 125/25/29	61.4 2/3 130/31/34	62.9 2/3 136/37/40	64.0 2/3 142/42/46
68	* 56.2 3/3 * 118/18/23	58.9 3/3 124/24/28	61.0 2/3 130/31/34	62.4 2/3 136/36/40	63.5 2/3 141/42/46

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CONFIGURATION 2 — **PRESSURE ALTITUDE = 1000 FT**

TREF = 43 °C
TMAX = 53 °C

DRY RUNWAY
SLOPE = 0 %

MAX TO WEIGHT(1000KG) CODES
IAS(KT) : V1 / VR / V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1750	**2000**	**2250**	**2500**	**2750**
-20	69.7 2/3 130/30/35	72.5 2/3 137/38/43	74.9 2/3 143/45/50	76.6 2/3 150/52/56	77.9 2/3 156/58/63
-10	68.9 2/3 128/28/33	71.8 2/3 135/36/41	74.2 2/3 141/43/48	76.1 2/3 147/50/54	77.4 2/3 154/56/60
0	68.2 2/3 127/27/32	71.1 2/3 133/34/39	73.6 2/3 139/41/46	75.5 2/3 145/48/52	76.9 2/3 151/54/58
10	67.4 2/3 125/25/30	70.4 2/3 131/33/37	72.9 2/3 137/40/44	74.9 2/3 143/46/50	76.4 2/3 149/52/57
20	66.6 3/9 123/23/29	69.6 2/3 130/31/36	72.1 2/3 136/38/42	74.2 2/3 141/44/49	75.8 2/3 147/50/55
30	65.8 3/9 122/22/27	68.9 2/3 128/30/34	71.4 2/3 134/36/41	73.5 2/3 140/43/47	75.1 3/6 145/48/53
40	65.1 3/9 121/21/27	68.2 2/3 126/28/33	70.8 2/3 132/35/39	72.9 2/3 138/41/45	74.6 3/6 143/47/51
43	64.8 3/9 120/21/26	68.0 2/3 126/28/32	70.5 2/3 132/34/39	72.6 2/3 137/41/45	74.4 3/6 143/46/50
45	64.0 3/9 120/20/25	67.1 2/3 126/27/32	69.6 2/3 132/34/38	71.6 2/3 137/40/44	73.3 2/3 143/46/50
47	63.2 3/9 120/20/25	66.2 2/3 126/27/31	68.6 2/3 131/33/38	70.6 2/3 137/39/44	72.3 2/3 142/45/49
49	62.4 3/9 119/19/24	65.3 2/3 125/26/31	67.6 2/3 131/33/37	69.6 2/3 137/39/43	71.2 2/3 142/45/49
51	61.5 3/9 119/19/24	64.4 2/3 125/26/30	66.7 2/3 131/33/37	68.6 2/3 136/38/42	70.1 2/3 142/44/48
53	60.6 3/3 119/19/24	63.5 2/3 125/25/30	65.7 2/3 131/32/36	67.6 2/3 136/38/42	69.0 2/3 142/44/48
55	59.7 3/3 119/19/23	62.5 2/3 125/25/29	64.8 2/3 130/32/36	66.6 2/3 136/37/41	67.9 2/3 141/43/47
57	58.9 3/3 118/18/23	61.7 2/3 124/25/29	63.9 2/3 130/31/35	65.6 2/3 136/37/41	66.9 2/3 141/43/46
59	58.1 3/3 118/18/23	60.9 2/3 124/24/28	63.0 2/3 130/31/35	64.7 2/3 135/37/40	66.0 2/3 141/42/46
61	57.3 3/3 118/18/23	60.1 2/3 124/24/28	62.2 2/3 130/30/34	63.8 2/3 135/36/40	65.0 2/3 140/42/45
63	* 56.5 3/3 * 118/18/22	59.2 3/3 124/24/28	61.3 2/3 129/30/34	62.9 2/3 135/36/39	64.0 2/3 140/41/45
65	* 55.6 3/3 * 117/17/22	58.3 3/3 123/23/27	60.4 2/3 129/29/33	62.0 2/3 134/35/39	63.1 2/3 140/41/44
66	* 55.2 3/3 * 117/17/21	57.9 3/3 123/23/27	60.0 2/3 129/29/33	61.5 2/3 134/35/38	62.6 2/3 140/40/44

CONFIGURATION 2 — **PRESSURE ALTITUDE = 2000 FT**

TREF = 41 °C
TMAX = 51 °C

DRY RUNWAY
SLOPE = 0 %

MAX TO WEIGHT(1000KG) CODES
IAS(KT) : V1 / VR / V2

TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1750	**2000**	**2250**	**2500**	**2750**
-20	68.3 3/3 129/29/34	71.2 2/3 135/36/41	73.5 2/3 141/43/48	75.2 2/3 147/50/54	76.6 2/3 154/56/60
-10	67.5 3/3 127/27/32	70.5 2/3 133/34/39	72.9 2/3 139/41/46	74.8 2/3 145/48/52	76.1 2/3 151/54/58
0	66.8 2/3 125/25/30	69.7 2/3 131/33/37	72.2 2/3 137/40/44	74.1 2/3 143/46/50	75.6 2/3 149/52/56
10	66.0 3/9 123/23/29	69.0 2/3 130/31/36	71.5 2/3 136/38/42	73.5 2/3 141/44/48	75.1 2/3 147/50/54
20	65.3 3/9 122/22/27	68.3 2/3 128/29/34	70.8 2/3 134/36/41	72.8 2/3 140/42/47	74.4 2/3 145/48/52
30	64.5 3/9 120/21/26	67.5 2/3 126/28/32	70.0 2/3 132/35/39	72.1 2/3 138/41/45	73.8 2/3 143/46/51
40	63.7 3/9 119/20/25	66.9 2/3 125/26/31	69.4 2/3 131/33/37	71.5 2/3 136/39/43	73.3 3/6 141/45/49
41	63.6 3/9 119/20/25	66.8 2/3 125/26/31	69.3 2/3 130/33/37	71.4 2/3 136/39/43	73.1 3/6 141/45/49
43	62.9 3/9 119/19/24	65.9 2/3 124/26/30	68.4 2/3 130/32/37	70.5 2/3 136/38/43	72.2 2/3 141/44/48
45	62.1 3/9 118/19/24	65.1 2/3 124/25/30	67.5 2/3 130/32/36	69.5 2/3 135/38/42	71.2 2/3 141/44/48
47	61.3 3/9 118/18/23	64.2 2/3 124/25/29	66.6 2/3 130/32/36	68.5 2/3 135/37/41	70.1 2/3 140/43/47
49	60.4 3/9 118/18/23	63.3 2/3 124/24/29	65.6 2/3 129/31/35	67.5 2/3 135/37/41	69.0 2/3 140/42/46
51	59.5 3/3 118/18/22	62.4 2/3 123/24/28	64.7 2/3 129/31/34	66.5 2/3 135/36/40	68.0 2/3 140/42/46
53	58.7 3/3 117/17/22	61.5 2/3 123/24/28	63.8 2/3 129/30/34	65.5 2/3 134/36/40	66.9 2/3 140/41/45
55	57.8 3/3 117/17/22	60.6 2/3 123/23/27	62.8 2/3 129/30/34	64.6 2/3 134/35/39	65.9 2/3 139/41/45
57	57.0 3/3 117/17/21	59.8 2/3 123/23/27	61.9 2/3 128/29/33	63.6 2/3 134/35/39	64.9 2/3 139/41/44
59	56.2 3/3 117/17/21	59.0 2/3 122/22/27	61.1 2/3 128/29/33	62.7 2/3 133/34/38	64.0 2/3 139/40/44
61	* 55.4 3/3 * 116/16/21	58.1 3/3 122/22/26	60.2 2/3 128/28/32	61.8 2/3 133/34/38	63.0 2/3 139/40/43
63	* 54.6 3/3 * 116/16/20	57.3 3/3 122/22/26	59.4 2/3 127/28/32	60.9 2/3 133/34/37	62.1 2/3 138/39/42
64	* 54.2 3/3 * 116/16/20	56.9 3/3 122/22/26	58.9 2/3 127/28/31	60.5 2/3 133/33/37	61.6 2/3 138/39/42

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CONFIGURATION 3					PRESSURE ALTITUDE = 0 FT
TREF = 45 °C TMAX = 55 °C			DRY RUNWAY SLOPE = 0 %		MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	1750	2000	2250	2500
-20	67.4 3/3 125/25/30	70.9 2/3 132/33/37	73.6 2/3 139/41/45	75.7 2/3 146/48/52	77.0 2/3 153/55/59
-10	66.7 3/3 124/24/29	70.2 2/3 130/31/35	72.9 2/3 137/39/43	75.1 2/3 144/46/50	76.6 2/3 150/53/57
0	65.9 3/3 122/22/27	69.5 2/3 128/29/34	72.2 2/3 135/37/41	74.5 2/3 142/44/48	76.1 2/3 148/51/55
10	65.2 3/3 120/20/25	68.8 2/3 127/28/32	71.6 2/3 133/35/39	73.8 2/3 140/42/46	75.6 2/3 146/49/53
20	64.4 3/3 119/19/24	68.0 2/3 125/26/31	70.8 2/3 132/34/38	73.1 2/3 138/41/45	75.0 2/3 144/47/51
30	* 63.6 3/9 * 117/17/22	67.3 2/3 124/24/29	70.0 2/3 130/32/36	72.4 2/3 136/39/43	74.2 2/3 142/45/49
40	* 62.7 3/9 * 116/17/22	66.6 2/3 122/23/28	69.4 2/3 128/31/35	71.8 2/3 134/37/41	73.7 2/3 140/44/47
45	* 62.1 3/3 * 115/17/22	66.2 2/3 121/22/27	69.0 2/3 127/30/34	71.4 2/3 134/37/40	73.3 2/3 139/43/47
47	* 61.2 3/3 * 115/17/22	65.3 2/3 121/22/27	68.1 2/3 127/29/33	70.4 2/3 133/36/40	72.3 2/3 139/42/46
49	* 60.2 3/3 * 115/17/22	64.4 2/3 121/21/26	67.1 2/3 127/29/33	69.4 2/3 133/36/39	71.2 2/3 139/42/45
51	* 59.2 3/3 * 115/17/22	63.6 2/3 121/21/26	66.2 2/3 127/28/32	68.4 2/3 133/35/39	70.1 2/3 138/41/45
53	* 58.1 3/3 * 115/17/22	62.7 2/3 120/21/25	65.3 2/3 127/28/32	67.4 2/3 133/35/38	69.1 2/3 138/41/44
55	* 57.0 3/3 * 114/17/22	61.8 2/3 120/20/25	64.3 2/3 126/28/31	66.4 2/3 132/34/38	68.1 2/3 138/40/44
57	* 55.9 3/3 * 114/17/22	61.0 2/3 120/20/24	63.5 2/3 126/27/31	65.5 2/3 132/34/37	67.2 2/3 138/40/43
59	* 54.8 3/3 * 114/17/22	60.1 3/3 120/20/24	62.6 2/3 126/27/31	64.6 2/3 132/33/37	66.2 2/3 138/39/43
61	* 53.6 3/3 * 113/17/22	59.3 3/3 119/19/24	61.8 2/3 126/26/30	63.7 2/3 132/33/36	65.2 2/3 137/39/42
63	* 52.4 3/3 * 113/18/22	58.4 3/3 119/19/24	60.9 2/3 125/26/30	62.8 2/3 131/32/36	64.3 2/3 137/38/42
65	* 51.4 3/3 * 113/18/22	* 57.6 3/3 * 119/19/23	60.1 2/3 125/25/29	61.9 2/3 131/32/35	63.3 2/3 137/38/41
67	* 50.2 3/3 * 113/18/22	* 56.7 3/3 * 119/19/23	59.2 2/3 125/25/29	61.0 2/3 131/31/35	62.3 2/3 137/37/41
68	* 49.6 3/3 * 113/18/22	* 56.3 3/3 * 118/18/23	58.8 2/3 125/25/28	60.6 2/3 131/31/34	61.8 2/3 136/37/40

CONFIGURATION 3				PRESSURE ALTITUDE = 1000 FT	
TREF = 43 °C TMAX = 53 °C			DRY RUNWAY SLOPE = 0 %	MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2	
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	1750	2000	2250	2500
-20	66.1 3/3 124/24/29	69.6 2/3 130/31/35	72.3 2/3 137/39/43	74.4 2/3 144/46/50	75.9 2/3 150/53/57
-10	65.4 3/3 122/22/27	68.9 2/3 129/29/34	71.6 2/3 135/37/41	73.8 2/3 142/44/48	75.4 2/3 148/51/55
0	64.6 3/3 120/20/25	68.2 2/3 127/27/32	70.9 2/3 133/35/39	73.2 2/3 140/42/46	74.9 2/3 146/49/53
10	63.9 3/3 119/19/24	67.5 2/3 125/26/30	70.3 2/3 132/34/38	72.5 2/3 138/40/44	74.4 2/3 144/47/51
20	63.1 3/9 117/17/22	66.7 2/3 123/24/29	69.5 2/3 130/32/36	71.8 2/3 136/39/43	73.7 2/3 142/45/49
30	* 62.3 3/9 * 116/16/21	66.0 2/3 122/23/27	68.7 2/3 128/30/34	71.1 2/3 134/37/41	73.0 2/3 140/43/47
40	* 61.3 3/3 * 114/16/21	65.3 2/3 120/21/26	68.1 2/3 127/29/33	70.5 2/3 133/36/39	72.4 2/3 138/42/45
43	* 61.0 3/3 * 114/16/21	65.1 2/3 120/21/26	67.9 2/3 126/28/32	70.3 2/3 132/35/39	72.2 2/3 138/41/45
45	* 60.0 3/3 * 114/16/21	64.2 2/3 120/20/25	67.0 2/3 126/28/32	69.3 2/3 132/35/38	71.2 2/3 138/41/44
47	* 59.0 3/3 * 114/16/21	63.4 2/3 120/20/25	66.1 2/3 126/27/31	68.4 2/3 132/34/38	70.2 2/3 137/40/44
49	* 58.0 3/3 * 113/16/21	62.5 2/3 119/20/24	65.2 2/3 125/27/31	67.4 2/3 131/34/37	69.2 2/3 137/40/43
51	* 56.9 3/3 * 113/16/21	61.7 2/3 119/19/24	64.3 2/3 125/27/31	66.4 2/3 131/33/37	68.2 2/3 137/39/43
53	* 55.7 3/3 * 113/16/21	60.7 2/3 119/19/23	63.3 2/3 125/26/30	65.4 2/3 131/33/36	67.2 2/3 136/39/42
55	* 54.6 3/3 * 113/16/21	59.9 2/3 119/19/23	62.4 2/3 125/26/30	64.5 2/3 131/32/36	66.1 2/3 136/38/42
57	* 53.4 3/3 * 112/16/21	59.0 3/3 118/18/23	61.6 2/3 124/25/29	63.6 2/3 130/32/35	65.2 2/3 136/38/41
59	* 52.3 3/3 * 112/16/21	58.2 3/3 118/18/23	60.7 2/3 124/25/29	62.7 2/3 130/31/35	64.2 2/3 136/37/40
61	* 51.2 3/3 * 112/16/21	* 57.4 3/3 * 118/18/22	59.9 2/3 124/24/28	61.8 2/3 130/31/34	63.3 2/3 135/37/40
63	* 50.1 3/3 * 112/16/21	* 56.6 3/3 * 117/17/21	59.1 2/3 124/24/28	60.9 2/3 130/30/34	62.4 2/3 135/36/39
65	* 49.0 3/3 * 112/17/21	* 55.7 3/3 * 117/17/21	58.2 2/3 123/24/27	60.1 2/3 129/30/33	61.4 2/3 135/36/39
66	* 48.4 3/3 * 111/17/21	* 55.3 3/3 * 117/17/21	57.8 2/3 123/23/27	59.6 2/3 129/30/33	60.9 2/3 135/36/39

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CONFIGURATION 3					PRESSURE ALTITUDE = 2000 FT
TREF = 41 °C TMAX = 51 °C			DRY RUNWAY SLOPE = 0 %		MAX TO WEIGHT(1000KG) CODES IAS(KT) : V1 / VR / V2
TEMP. (°C)	CORRECTED RUNWAY LENGTH (M)				
	1500	1750	2000	2250	2500
-20	64.7 3/3 122/22/27	68.2 2/3 129/29/34	70.9 2/3 135/37/41	73.1 2/3 142/44/48	74.6 2/3 148/50/55
-10	64.0 3/3 120/20/25	67.6 2/3 127/27/32	70.3 2/3 133/35/39	72.5 2/3 140/42/46	74.1 2/3 146/48/52
0	63.3 3/3 119/19/24	66.8 2/3 125/26/30	69.6 2/3 132/33/37	71.8 2/3 138/40/44	73.6 2/3 144/47/51
10	62.5 3/9 117/17/22	66.1 2/3 123/24/29	68.9 2/3 130/32/36	71.2 2/3 136/39/42	73.0 2/3 142/45/49
20	* 61.8 3/9 * 116/16/21	65.4 2/3 122/23/27	68.1 2/3 128/30/34	70.5 2/3 134/37/41	72.4 2/3 140/43/47
30	* 60.9 3/9 * 114/15/20	64.7 2/3 120/21/26	67.5 2/3 126/28/33	69.7 2/3 132/35/39	71.7 2/3 138/41/45
40	* 59.9 3/3 * 113/15/20	64.0 2/3 119/20/24	66.8 2/3 125/27/31	69.2 2/3 131/34/37	71.1 2/3 136/40/43
41	* 59.7 3/3 * 113/15/20	63.9 2/3 119/19/24	66.7 2/3 125/27/31	69.1 2/3 131/34/37	71.0 2/3 136/40/43
43	* 58.8 3/3 * 113/15/20	63.1 2/3 118/19/24	65.9 2/3 125/26/31	68.2 2/3 130/33/37	70.1 2/3 136/39/43
45	* 57.8 3/3 * 112/15/20	62.3 2/3 118/19/23	65.0 2/3 124/26/30	67.3 2/3 130/33/36	69.1 2/3 136/39/42
47	* 56.7 3/3 * 112/15/20	61.4 2/3 118/18/23	64.1 2/3 124/25/30	66.3 2/3 130/32/36	68.1 2/3 135/38/42
49	* 55.7 3/3 * 112/15/20	60.6 2/3 118/18/23	63.2 2/3 124/25/29	65.4 2/3 130/32/35	67.1 2/3 135/38/41
51	* 54.5 3/3 * 111/15/20	59.7 3/3 117/18/22	62.3 2/3 124/25/29	64.4 2/3 129/31/35	66.2 2/3 135/37/40
53	* 53.3 3/3 * 111/15/20	58.8 3/3 117/17/22	61.4 2/3 123/24/28	63.4 2/3 129/31/34	65.2 2/3 135/37/40
55	* 52.1 3/3 * 111/15/20	57.9 3/3 117/17/21	60.5 2/3 123/24/28	62.5 2/3 129/30/34	64.2 2/3 134/36/39
57	* 51.0 3/3 * 111/15/20	* 57.1 3/3 * 117/17/21	59.6 2/3 123/23/27	61.6 2/3 129/30/33	63.2 2/3 134/36/39
59	* 49.9 3/3 * 111/15/20	* 56.3 3/3 * 116/16/21	58.8 2/3 123/23/27	60.7 2/3 128/29/33	62.2 2/3 134/35/38
61	* 48.9 3/3 * 110/15/20	* 55.5 3/3 * 116/16/20	58.0 2/3 122/23/26	59.9 2/3 128/29/32	61.3 2/3 134/35/38
63	* 47.8 3/3 * 110/15/20	* 54.6 3/3 * 116/16/20	57.2 2/3 122/22/26	59.0 2/3 128/28/32	60.4 2/3 133/34/37
64	* 47.2 3/3 * 110/15/20	* 54.1 3/3 * 115/16/20	56.8 2/3 122/22/26	58.6 2/3 128/28/31	59.9 2/3 133/34/37

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INTRODUCTION

The following graphs enable the crew to quickly determine the takeoff performance out of an airport by positioning obstacles.
They must be used with the corresponding quick reference table so as to determine weight decrement and required gradient.
The net takeoff flight path and the associated weight decrement are conservative.

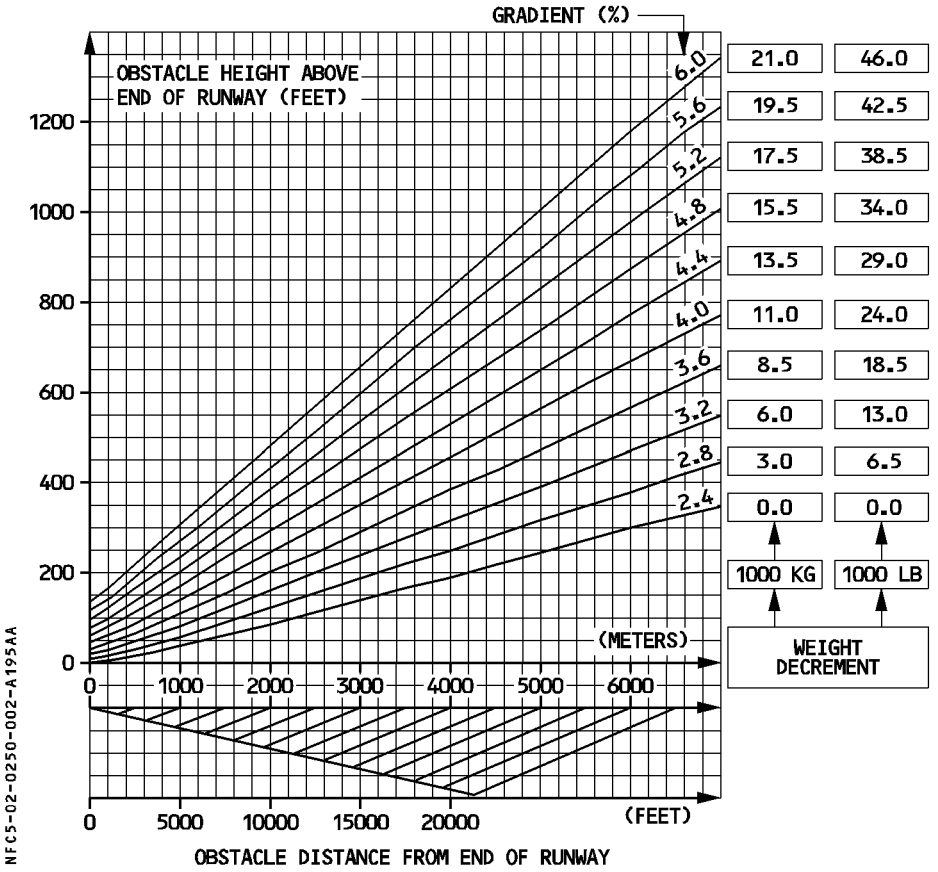
HOW TO PROCEED

1. Position the obstacle by entering its distance from end of runway and its height above the end of runway (No 35 feet margin is required as this is already included).
   In case of an ascending runway, increase the obstacle height by an additional value as indicated below each graph.
2. Read the associated weight correction. Interpolate if necessary. The second segment gradient is given for information only.

R 3. Decrease the takeoff speeds by 1 knot per 1000 kg (0.5 kt per 1000 lb) weight decrement. Limit the final speeds to the minimum values as given on 2.02.25 p1.

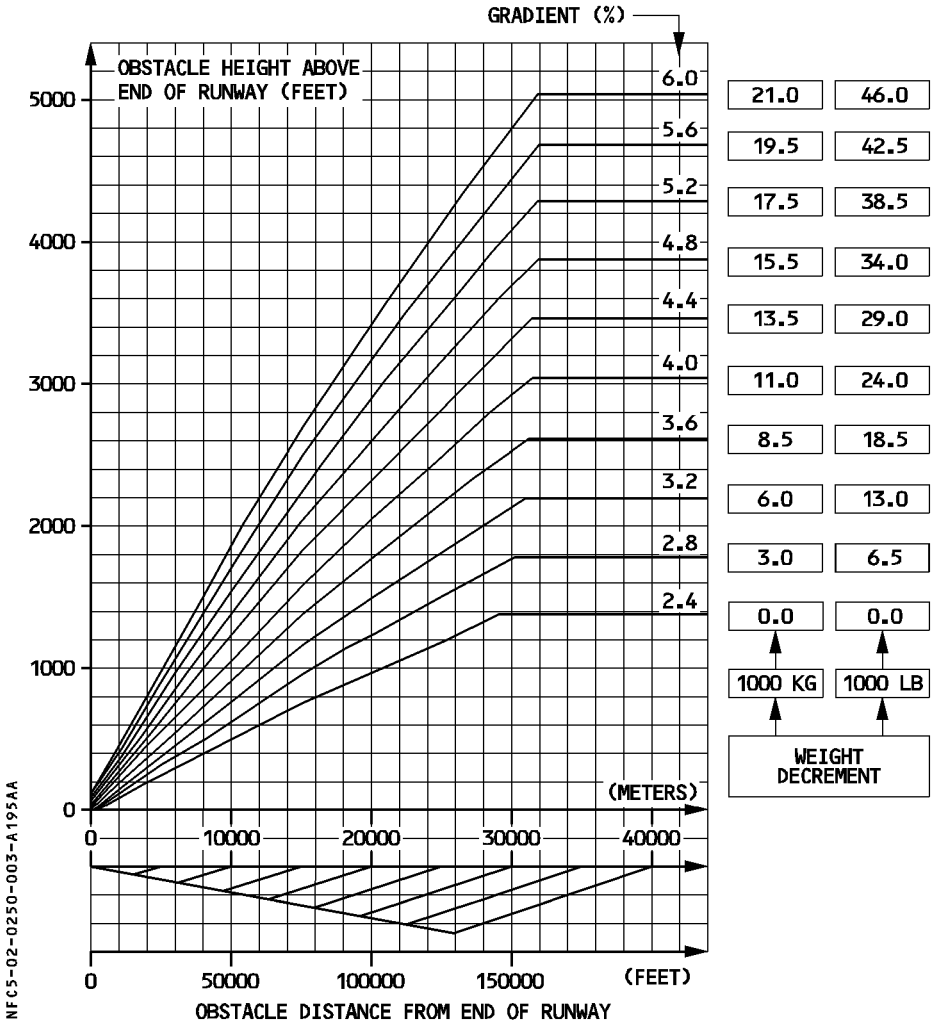
Note : In case of tailwind, do not use the obstacle clearance graphs.

CLOSE OBSTACLE CLEARANCE CONF 1 + F



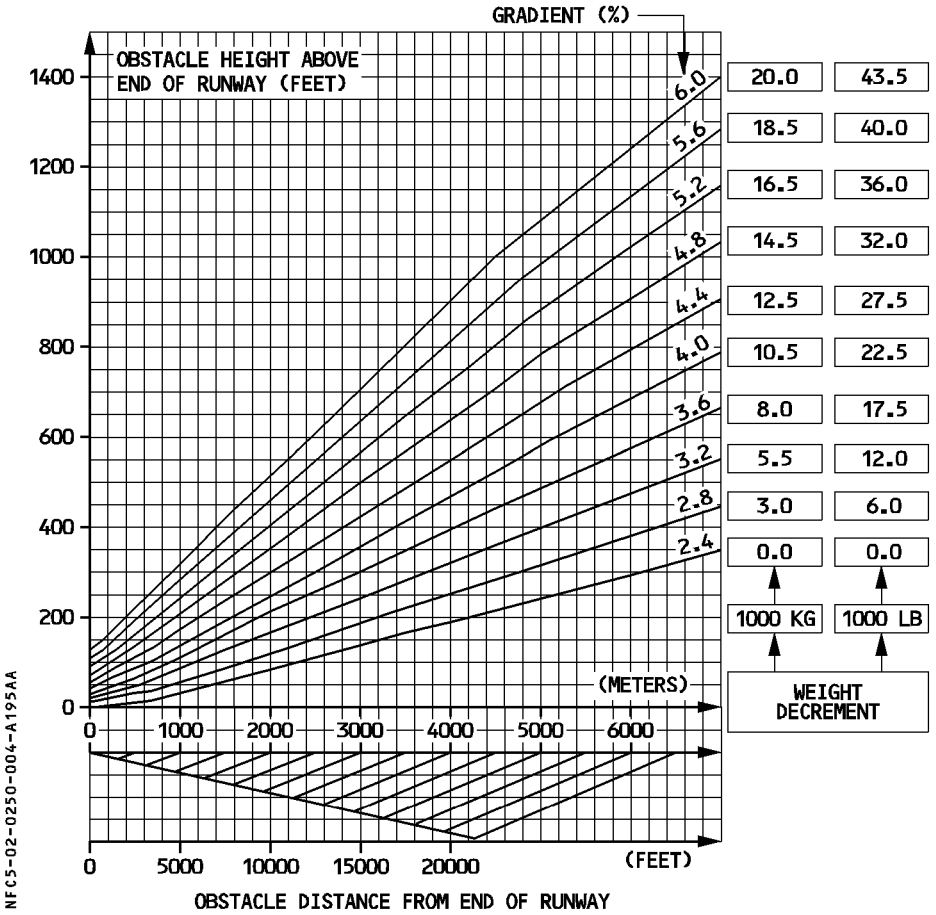
Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

REMOTE OBSTACLE CLEARANCE CONF 1 + F



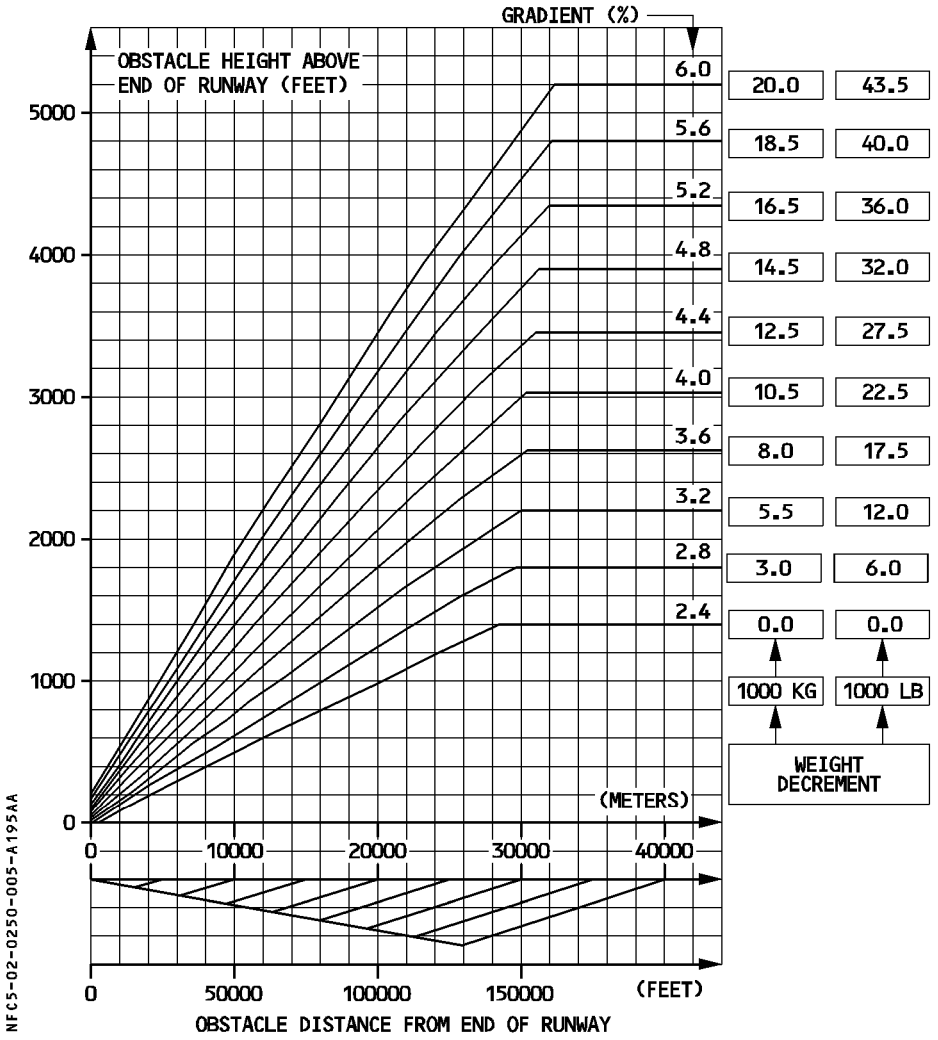
Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

CLOSE OBSTACLE CLEARANCE CONF 2



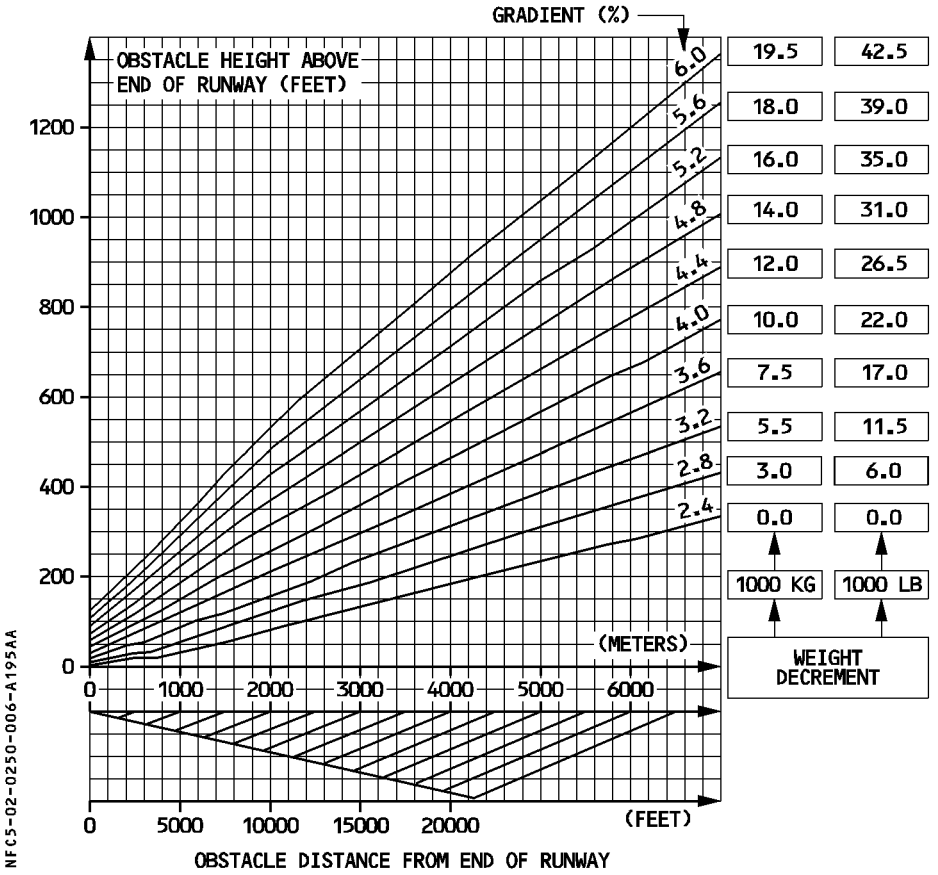
Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

REMOTE OBSTACLE CLEARANCE CONF 2



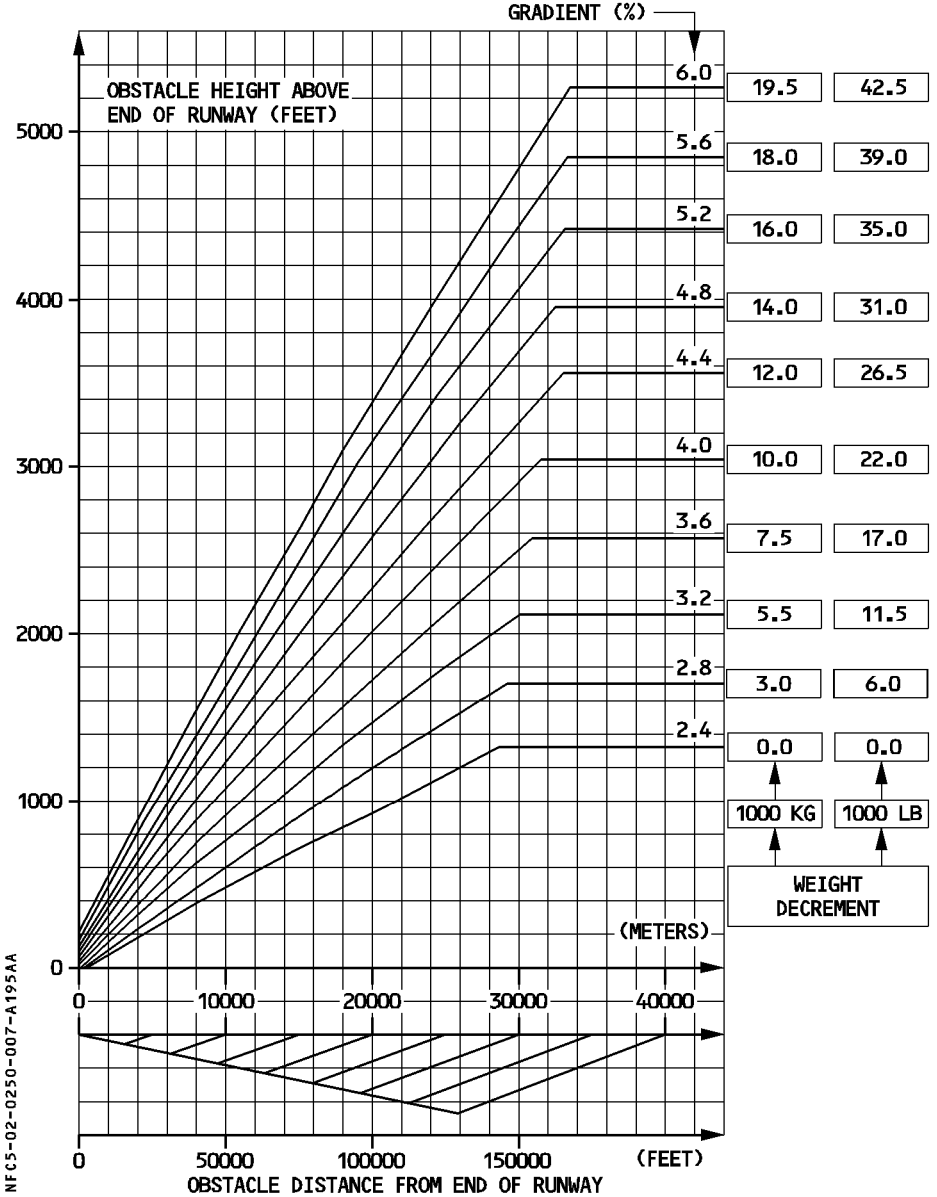
Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

CLOSE OBSTACLE CLEARANCE CONF 3



Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

REMOTE OBSTACLE CLEARANCE CONF 3



Note : In case of ascending runway, increase obstacle height by 30 feet per percent runway slope.

03.00 CONTENTS

03.10 LANDING

03.20 USE OF THE AUTOBRAKE SYSTEM

GENERAL

ACTUAL LANDING DISTANCE

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.
It assumes that :
- the approach speed is :
  - VLS (1.23 VS of the configuration) for manual landing
  - VLS + 5 kt for CAT II/CAT III automatic landing.
- the pilot applies maximum braking and the antiskid system is operating.
- the ground spoilers are operating.

It does not consider the use of reverse thrust.

REQUIRED LANDING DISTANCE

MANUAL LANDING

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.
R For JAR-OPS operators, if the surface is contaminated, the required landing distance must
R be at least the greater of the required landing distance on wet runway (see previous
R paragraph) and 115 % of the landing distance determined in accordance with approved
R contaminated landing distance data.

R AUTOMATIC LANDING

R Regulation (JAR.AWO 142) defines the required landing distance for automatic landing as the actual landing distance in automatic landing multiplied by 1.15. This distance must be
R retained for automatic landing whenever it is greater than the required landing distance in manual mode.

DISPATCH

The pilot must check before departure that the available runway length at destination is at least equal to the required landing distance for the forecasted landing weight.
In case of aircraft system failure affecting landing distance known before the dispatch, the available runway length must be at least equal to the required landing distance with failure, i.e. the required landing distance without failure multiplied by the coefficient given in the Flight Manual or the MMEL.

FAILURE IN FLIGHT

In case of an aircraft system failure occurring in flight and affecting the landing performance, the runway length to be considered for landing is the actual landing distance without failure multiplied by the landing distance coefficient associated with the failure. The coefficients are given in FCOM 3.02.80 and in the QRH.
The concept of required landing distance no longer applies.

RECOMMENDATIONS

R For most cases of abnormal landing configuration, the increased actual landing distance does not exceed the required runway length for landing in normal configuration.
However, the addition of several of these factors can very quickly lead to an overrun. Special notice should be taken of the runway condition. A slippery runway is the most common reason for overrun at landing. The combination of a slippery runway and a factor such as tailwind or an increase in approach speed should be avoided.
As far as possible, avoid the combination of any failure affecting the braking capability of the aircraft (spoilers, reversers) with landing on a contaminated runway, or prepare for it carefully by checking the available runway length against the forecasted landing distance.
During a visual approach, use all means of monitoring the flight path ; use the ILS together with available visual aids such as VASI or PAPI. Monitor the approach speed along with the wind and ground speed, especially during final approach.

ACTUAL LANDING DISTANCES

CONFIGURATION FULL

R

ACTUAL LANDING DISTANCE (METERS)												
WEIGHT (1000 KG)			40	44	48	52	56	60	64	68	72	76
RUNWAY CONDITION	DRY		750	740	750	800	830	860	900	960	1040	1130
	WET		900	900	920	990	1050	1110	1170	1240	1320	1400
	COVERED WITH	6.3 MM (1/4 INCH) WATER	1220	1240	1270	1360	1440	1530	1620	1730	1850	1940
		12.7 MM (1/2 INCH) WATER	1170	1180	1220	1300	1380	1460	1540	1630	1740	1840
		6.3 MM (1/4 INCH) SLUSH	1190	1210	1240	1320	1390	1460	1530	1630	1730	1840
		12.7 MM (1/2 INCH) SLUSH	1150	1160	1200	1270	1340	1410	1480	1570	1660	1760
		COMPACTED SNOW	1170	1180	1200	1270	1330	1380	1430	1500	1570	1630
		ICE	2510	2530	2580	2700	2800	2900	3000	3130	3260	3390

CORRECTIONS

R

	CORRECTION ON ACTUAL LANDING DISTANCE							
	dry runway	wet runway	runway covered with					
			1/4 inch water	1/2 inch water	1/4 inch slush	1/2 inch slush	compacted snow	ice
per 1000 ft above SL	+ 3 %	+ 4 %	+ 4 %	+ 3 %	+ 5 %	+ 4 %	+ 3 %	+ 4 %
per 10 kt headwind	No correction for headwind due to wind correction on approach speed							
per 10 kt tailwind	+ 20 %	+ 26 %	+ 29 %	+ 26 %	+ 27 %	+ 25 %	+ 23 %	+ 36 %
2 reversers operative	– 3 %	– 6 %	– 12 %	– 10 %	– 11 %	– 10 %	– 9 %	– 25 %
Per 5 kt speed increment (and no failure) add 8 % (all runways)								

CONFIGURATION 3

R

ACTUAL LANDING DISTANCE (METERS)											
WEIGHT (1000 KG)			40	44	48	52	56	60	64	68	72	76
RUNWAY CONDITION	DRY		750	770	810	860	900	950	1000	1090	1190	1290
	WET		920	960	1040	1120	1190	1260	1340	1420	1520	1610
	COVERED WITH	6.3 MM (1/4 INCH) WATER	1280	1330	1440	1570	1670	1780	1890	2030	2140	2280
		12.7 MM (1/2 INCH) WATER	1220	1270	1370	1480	1580	1670	1770	1890	2010	2120
		6.3 MM (1/4 INCH) SLUSH	1250	1300	1400	1490	1570	1670	1780	1890	2030	2150
		12.7 MM (1/2 INCH) SLUSH	1200	1250	1340	1430	1510	1590	1690	1800	1920	2020
		COMPACTED SNOW	1210	1250	1330	1400	1460	1530	1590	1660	1740	1810
		ICE	2840	2910	3040	3180	3290	3400	3530	3680	3830	3980

CORRECTIONS

R

	CORRECTION ON ACTUAL LANDING DISTANCE							
	dry runway	wet runway	runway covered with					
			1/4 inch water	1/2 inch water	1/4 inch slush	1/2 inch slush	compacted snow	ice
per 1000 ft above SL	+ 3 %	+ 4 %	+ 4 %	+ 4 %	+ 5 %	+ 4 %	+ 3 %	+ 4 %
per 10 kt headwind	No correction for headwind due to wind correction on approach speed							
per 10 kt tailwind	+ 19 %	+ 26 %	+ 29 %	+ 27 %	+ 28 %	+ 25 %	+ 22 %	+ 35 %
2 reversers operative	– 4 %	– 8 %	– 14 %	– 12 %	– 13 %	– 12 %	– 9 %	– 27 %
Per 5 kt speed increment (and no failure) add 8 % (all runways)								

REQUIRED LANDING DISTANCE

MANUAL LANDING

R

REQUIRED LANDING DISTANCE (METERS)										
WEIGHT (1000 KG)	**40**	**44**	**48**	**52**	**56**	**60**	**64**	**68**	**72**	**76**
CONF 3	1240	1280	1350	1430	1500	1570	1660	1810	1970	2140
CONF FULL	1240	1240	1250	1320	1380	1440	1500	1590	1730	1880

Corrections on landing distances

R Wind : per 10 kt tailwind add 20 %
No correction for headwind due to wind correction on approach speed.

R Airport elevation : per 1000 ft above sea level add 3 %.

AUTOMATIC LANDING

Determine the corrected required landing distance for manual landing from the data above.

The required landing distance for automatic landing is equal to the corrected required landing distance for manual landing except in the following case :

R — In case of landing in Conf FULL with landing weight equal to or less than 60 000 kg and with headwind at or above 10 knots, it is equal to the corrected required landing distance for manual landing increased by 90 meters.

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GENERAL

The autobrake system is designed to help the pilot in case of :
· aborted takeoff or
· landing on short runways or
· operation with low visibility weather conditions
Furthermore, it ensures a straight roll-out and optimizes the landing distance on contaminated runways provided the contamination is evenly distributed.
The following tables cover :
· dry runway
· wet runway
· runway covered with water, slush or compacted snow
· icy runway
At landing, select the braking mode according to :
· runway length
· configuration
· runway condition
A correction is necessary :
· if landing is not performed at sea level
· if reverse thrust is used
· in windy conditions
· for forward CG (A320-200 only)

MANUAL LANDING WITH AUTOBRAKE

CONFIGURATION 3

R

ACTUAL LANDING DISTANCE (METERS)								CORRECTIONS (%) ON LANDING DISTANCE		
WEIGHT (1000 KG)			40	50	60	70	80	PER 1000FT ABOVE SL	2 REV OP	PER 10KT TAIL WIND
RUNWAY CONDITION		MODE								
DRY		MED	890	1010	1160	1320	1490	+ 3	0	+19
		LOW	1440	1630	1860	2110	2360	+ 3	–4	+19
WET		MED	940	1100	1290	1500	1730	+ 4	–3	+26
		LOW	1440	1630	1860	2110	2360	+ 3	–4	+19
COVERED WITH	6.3 MM (1/4 INCH) WATER	MED	1280	1500	1780	2090	2410	+ 4	–13	+30
		LOW	1450	1660	1890	2220	2550	+ 4	–7	+26
	12.7 MM (1/2 INCH) WATER	MED	1220	1420	1670	1940	2260	+ 4	–11	+26
		LOW	1380	1580	1790	2060	2360	+ 4	–5	+23
	6.3 MM (1/4 INCH) SLUSH	MED	1250	1440	1670	1960	2260	+ 5	–12	+27
		LOW	1430	1630	1850	2090	2400	+ 5	–7	+24
	12.7 MM (1/2 INCH) SLUSH	MED	1200	1380	1590	1850	2140	+ 5	–12	+25
		LOW	1360	1560	1770	1990	2250	+ 5	–5	+22
	COMPACTED SNOW	MED	1210	1360	1530	1700	1890	+ 4	–9	+23
		LOW	1460	1640	1850	2070	2300	+ 4	–4	+21
	ICE	MED	2840	3110	3400	3750	4140	+ 4	–26	+36
		LOW	2940	3220	3520	3870	4270	+ 4	–26	+35

CONFIGURATION FULL

R

ACTUAL LANDING DISTANCE (METERS)								CORRECTIONS (%) ON LANDING DISTANCE		
WEIGHT (1000 KG)			40	50	60	70	80	PER 1000FT ABOVE SL	2 REV OP	PER 10KT TAIL WIND
RUNWAY CONDITION		MODE								
DRY		MED	890	930	1060	1200	1340	+ 3	0	+19
		LOW	1370	1460	1660	1870	2090	+ 3	–4	+20
WET		MED	920	980	1140	1310	1500	+ 4	–2	+25
		LOW	1370	1460	1660	1870	2090	+ 3	–3	+20
COVERED WITH	6.3 MM (1/4 INCH) WATER	MED	1220	1310	1530	1790	2050	+ 4	–11	+29
		LOW	1380	1480	1680	1890	2170	+ 4	–6	+25
	12.7 MM (1/2 INCH) WATER	MED	1170	1260	1460	1690	1930	+ 4	–10	+27
		LOW	1320	1420	1610	1810	2050	+ 4	–4	+22
	6.3 MM (1/4 INCH) SLUSH	MED	1190	1280	1460	1690	1940	+ 5	–11	+27
		LOW	1350	1450	1640	1840	2060	+ 5	–6	+23
	12.7 MM (1/2 INCH) SLUSH	MED	1150	1240	1410	1610	1840	+ 5	–10	+25
		LOW	1300	1390	1580	1770	1980	+ 4	–4	+22
	COMPACTED SNOW	MED	1170	1230	1380	1530	1700	+ 4	–8	+23
		LOW	1400	1470	1660	1850	2060	+ 4	–4	+21
	ICE	MED	2510	2640	2900	3200	3520	+ 4	–23	+37
		LOW	2590	2730	2990	3300	3630	+ 4	–23	+36

Note : — *Max mode is not recommended at landing*
— *Per 5 kt speed increment (and no failure) add 8 % (all runways)*
— *No correction for headwind due to wind correction on approach speed*

GENERAL

This section presents the recommendations of Airbus Industrie for operations from wet runways or from runways which are covered with contaminants such as standing water, slush or snow.

CAUTION

Take off from an icy runway is not recommended.

DEFINITIONS

DAMP : A runway is damp when the surface is not dry, but when the water on it does not give it a shiny appearance.

WET : A runway is considered as wet when the surface has a shiny appearance due to a thin layer of water. When this layer does not exceed 3 mm depth, there is no substantial risk of hydroplaning.

STANDING WATER : is caused by heavy rainfall and /or insufficient runway drainage with a depth of 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 lb/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 lb/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 lb/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 has been divided into two categories which are determined by the depth of the contaminant. For each of these categories an equivalent depth of contaminant has been defined for which the performance deterioration is the same.

1. WET RUNWAY and EQUIVALENT

   Equivalent of a wet runway is a runway covered with or less than :

   - 2 mm (0.08 inch) slush
R - 3 mm (0.12 inch) water
   - 4 mm (0.16 inch) wet snow
   - 15 mm (0.59 inch) dry snow

2. CONTAMINATED RUNWAY

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
- 50.8 mm (2 inches) dry snow is equivalent to 6.3 mm (1/4 inch) slush

Note : 1. On a damp runway no performance degradation should be considered.
2. It is not recommended to take off from a runway covered with more than 2 inches of dry snow or 1 inch of wet snow.

OPERATIONAL CONDITIONS

Performance penalties for takeoff as published in this section are computed with the following assumptions :

- The contaminant is in a layer of uniform depth and density over the entire length of the runway.
- Antiskid and spoilers are operative.
- The friction coefficient is based on studies and checked by actual tests.
- The screen height at the end of takeoff segment is 15 feet, not 35 feet.

In addition, for contaminated runways only :

- There is drag due to rolling resistance of the wheels.
- There is drag due to spray on the airframe and gears.
- Reverse thrust is used for the deceleration phase.
- Maximum thrust is used for takeoff.

Note : The net flight path clears obstacles by 15 feet instead of 35 feet.

TAKEOFF PERFORMANCE

CAUTION

R The method is based on the use of the RTOW charts established at optimum V2/VS
R and optimum V1/VR. In addition, when applying corrections for a wet runway, the
R RTOW charts should also have been established with V1 min (minimum V1 of the V1
R range). The method should not be used with takeoff charts computed for other
R conditions. All tables have been established for TOGA (and Flexible Takeoff for wet
R runways). Do not use them for Derated thrust.

Correct the determined maximum takeoff weight on dry runway to take into account QNH and bleed effects, then apply the corrections given on the following pages.

Note : 1. The results obtained with this method may be different from the influence given at the bottom of the RTOW chart.
2. On contaminated runway, in some cases, no MTOW can be determined with this method (box dashed below a given weight). A specific RTOW chart must then be computed.

TAKEOFF FROM A WET RUNWAY

1. Determine the maximum takeoff weight or flexible temperature and associated speeds
R on dry runway.
2. Two sets of tables are given depending on the use of thrust reversers and the presence of clearway. Select the table to use as applicable to your case.
The runway length in the table corresponds to the available takeoff run (TORA)
3. Apply the corrections shown in the table to the maximum takeoff weight or flexible temperature and associated speeds determined on dry runway.
4. Check that takeoff speeds are greater than the minimum values shown on the RTOW chart.
If one or more speeds are lower than these minimum values, apply the following procedure :
   - Actual TOW = maximum TOW
R · If V1 is lower than minimum V1 (V1 limited by VMCG), take this last value as V1 and further decrease weight by 3000 kg (6600 lb) per kt difference between both values. Check that VR and V2 are higher or equal to minimum values.
   · If VR or/and V2 falls below the minimum values, takeoff is not possible.
   - Actual TOW lower than maximum TOW
R · If V1 corresponding to actual TOW is lower than the minimum V1 (V1 limited by
R VMCG) :
     * If maximum TOW has a V1 equal to or above minimum V1, retain minimum V1 as V1 and decrease the flexible temperature by 4°C per knot difference between them.
     * In the rare case when the V1 corresponding to maximum TOW falls below the minimum V1, decrease maximum TOW by 3000 kg (6600 lb) per knot difference between them. Limit the actual TOW to the value found after this decrement. Take V1 equal to minimum V1 and decrease the flexible temperature by 4°C per knot difference between this last value and the V1 corresponding to the actual TOW. Check that VR and V2 are higher than or equal to the minimum values.
   · If VR or V2 corresponding to actual TOW falls below the minimum values, and if VR and V2 corresponding to maximum TOW are above the minimum values, retain the minimum speed value for VR and V2.
5. Check that V2 is above the minimum V2 value due to VMU. (refer to 2.02.25).
6. Check that the corrected flexible temperature is higher than OAT and Tref.

Note : · Do not extrapolate below the shortest runway length provided in the table.
· If no minimum speed value is available, use the conservative values provided on 2.02.25.

R DECELERATING WITHOUT REVERSE THRUST (NO CLEARWAY)

TAKEOFF CONFIGURATION	1 + F			2			3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 12000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 80000 and above
FLEX TO Temperature decrement (°C)	2	2	2	2	2	2	2	2	2
MAX TO Weight decrement (1000 kg) (1000 lb)	1.0 2.2	1.0 2.2	0.8 1.8	1.0 2.2	1.0 2.2	1.0 2.2	0.8 1.8	0.9 2.0	1.1 2.4
V1 decrement (kt)	14	15	14	13	14	15	13	13	14
VR and V2 decrement (kt)	3	4	4	2	3	4	2	2	3

R DECELERATING WITH REVERSE THRUST (NO CLEARWAY)

TAKEOFF CONFIGURATION	1 + F			2			3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 12000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 80000 and above
FLEX TO Temperature decrement (°C)	0	1	1	0	1	1	0	0	1
MAX TO Weight decrement (1000 kg) (1000 lb)	0.0 0.0	0.3 0.7	0.4 0.9	0.0 0.0	0.3 0.7	0.4 0.9	0.0 0.0	0.0 0.0	0.4 0.9
V1 decrement (kt)	9	9	10	9	9	10	9	9	9
VR and V2 decrement (kt)	0	1	2	0	1	2	0	0	1

DECELERATING WITHOUT REVERSE THRUST (WITH CLEARWAY)

TAKEOFF CONFIGURATION	1 + F			2			3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500 and above	2000 6500	2500 8000	3000 10000 and above	1750 5750	2000 6500	2500 8000 and above
FLEX TO Temperature decrement (°C)	6	5	5	6	6	4	6	6	6
MAX TO Weight decrement (1000 kg) (1000 lb)	2.5 5.5	2.1 4.6	1.7 3.7	2.5 5.5	2.5 5.5	1.8 3.9	2.1 4.6	2.4 5.2	2.2 4.8
V1 decrement (kt)	12	12	11	11	12	12	10	12	12
VR and V2 decrement (kt)	7	7	6	6	6	7	5	6	6

DECELERATING WITH REVERSE THRUST (WITH CLEARWAY)

TAKEOFF CONFIGURATION	1 + F			2			3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500 and above	2000 6500	2500 8000	3000 10000 and above	1750 5750	2000 6500	2500 8000 and above
FLEX TO Temperature decrement (°C)	4	4	2	5	4	4	5	5	4
MAX TO Weight decrement (1000 kg) (1000 lb)	1.4 3.0	1.3 2.8	0.8 1.7	1.6 3.5	1.4 3.0	1.2 2.6	1.5 3.3	1.6 3.5	1.4 3.0
V1 decrement (kt)	6	7	5	6	6	7	6	7	7
VR and V2 decrement (kt)	4	5	4	4	4	5	3	4	4

6.3 MM (1/4 INCH) WATER COVERED RUNWAY

– Determine maximum takeoff weight on dry runway.
– Apply the following weight decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1750 5700	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	15.0	12.0	9.0	6.0	14.0	14.0	13.0	14.0	14.0	11.0

– Enter the following tables with the corrected weight to determine MTOW, then determine takeoff speeds associated with actual TOW.

R

CONF 1+F

CORRECTED WEIGHT (1000 kg)	<49.1	49.1	49.3	49.3 to 70									
MTOW (1000 kg)	–	48	49.3	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	49.3	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	129	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	123	125	126	128	131	133	135	137	139	141	144	146	148
V1 (kt IAS)	112	112	113	115	118	120	122	124	126	128	131	133	135

R

CONF 2

CORRECTED WEIGHT (1000 kg)	<51.8	51.8	52	53	53 to 70								
MTOW (1000 kg)	–	48	49	53	EQUAL TO CORRECTED WEIGHT								
ACTUAL WEIGHT (1000 kg)	≤48	50	52	53	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	126	129	131	132	133	136	138	140	142	144	147	149	151
VR (kt IAS)	122	125	127	128	129	132	134	136	138	140	143	145	147
V1 (kt IAS)	112	112	112	112	113	116	118	120	122	124	127	129	131

R

CONF 3

CORRECTED WEIGHT (1000 kg)	<52.5	52.5	54	54 to 70								
MTOW (1000 kg)	–	48	54	EQUAL TO CORRECTED WEIGHT								
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	123	126	128	130	132	134	136	138	141	143	145	147
VR (kt IAS)	120	123	125	127	129	131	133	135	138	140	142	144
V1 (kt IAS)	112	112	112	112	114	116	118	120	123	125	127	129

12.7 MM (1/2 INCH) WATER COVERED RUNWAY

– Determine maximum takeoff weight on dry runway.
– Apply the following weight decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1750 5700	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	17.0	16.0	14.0	13.0	18.0	16.5	16.5	16.5	16.5	15.0

Enter the following tables with the corrected weight to determine MTOW, then determine takeoff speeds associated with actual TOW.

R

CONF 1+F

CORRECTED WEIGHT (1000 kg)	< 48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	124	127	129	132	134	136	138	140	142	145	147	149
V1 (kt IAS)	116	119	121	124	126	128	130	132	134	137	139	141

R

CONF 2

CORRECTED WEIGHT (1000 kg)	<48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	126	129	131	133	136	138	140	142	144	147	149	151
VR (kt IAS)	123	126	128	130	133	135	137	139	141	144	146	148
V1 (kt IAS)	116	119	121	123	126	128	130	132	134	137	139	141

R

CONF 3

CORRECTED WEIGHT (1000 kg)	<48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	123	126	128	130	132	134	136	138	141	143	145	147
VR (kt IAS)	120	123	125	127	129	131	133	135	138	140	142	144
V1 (kt IAS)	112	115	117	119	121	123	125	127	130	132	134	136

6.3 MM (1/4 INCH) SLUSH COVERED RUNWAY

– Determine maximum takeoff weight on dry runway.
– Apply the following weight decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1750 5700	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	13.0	10.0	7.5	6.5	14.5	12.5	10.0	13.5	12.5	11.0

– Enter the following tables with the corrected weight to determine MTOW, then determine takeoff speeds associated with actual TOW.

R

CONF 1+F

CORRECTED WEIGHT (1000 kg)	<49.1	49.1	49.3	49.3 to 70									
MTOW (1000 kg)	–	48	49.3	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	49.3	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	129	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	123	125	126	128	131	133	135	137	139	141	144	146	148
V1 (kt IAS)	112	112	113	115	118	120	122	124	126	128	131	133	135

R

CONF 2

CORRECTED WEIGHT (1000 kg)	<49.1	49.1	49.3	49.3 to 70									
MTOW (1000 kg)	–	48	49.3	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	49.3	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	126	128	129	131	133	136	138	140	142	144	147	149	151
VR (kt IAS)	122	124	125	127	129	132	134	136	138	140	143	145	147
V1 (kt IAS)	112	112	113	115	117	120	122	124	126	128	131	133	135

R

CONF 3

CORRECTED WEIGHT (1000 kg)	<51	51	52	52 to 70								
MTOW (1000 kg)	–	48	52	EQUAL TO CORRECTED WEIGHT								
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	123	126	128	130	132	134	136	138	141	143	145	147
VR (kt IAS)	120	123	125	127	129	131	133	135	138	140	142	144
V1 (kt IAS)	112	112	112	114	116	118	120	122	125	127	129	131

12.7 MM (1/2 INCH) SLUSH COVERED RUNWAY

– Determine maximum takeoff weight on dry runway.
– Apply the following weight decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1750 5750	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	16.5	15.0	13.0	13.0	17.5	16.0	14.5	17.0	16.5	14.0

– Enter the following tables with the corrected weight to determine MTOW, then determine takeoff speeds associated with actual TOW.

R

CONF 1+F

CORRECTED WEIGHT (1000 kg)	< 48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	124	127	129	132	134	136	138	140	142	145	147	149
V1 (kt IAS)	119	122	124	127	129	131	133	135	137	140	142	144

R

CONF 2

CORRECTED WEIGHT (1000 kg)	< 48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	126	129	131	133	136	138	140	142	144	147	149	151
VR (kt IAS)	123	126	128	130	133	135	137	139	141	144	146	148
V1 (kt IAS)	117	120	122	124	127	129	131	133	135	138	140	142

R

CONF 3

CORRECTED WEIGHT (1000 kg)	< 48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	123	126	128	130	132	134	136	138	141	143	145	147
VR (kt IAS)	121	124	126	128	130	132	134	136	139	141	143	145
V1 (kt IAS)	112	117	119	121	123	125	127	129	132	134	136	138

COMPACTED SNOW COVERED RUNWAY

– Determine maximum takeoff weight on dry runway.
– Apply the following weight decrement versus takeoff configuration and runway length to determine a corrected weight.

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 65000	2500 8000	3000 10000 and above	1750 5700	2000 6500	2500 8000 and above
Weight decrement (1000 kg)	8.5	4.5	4.5	4.5	11.5	6.5	4.5	9.5	8.0	5.0

– Enter the following tables with the corrected weight to determine MTOW, then determine takeoff speeds associated with actual TOW.

R

CONF 1+F

CORRECTED WEIGHT (1000 kg)	<48	48	48 to 70									
MTOW (1000 kg)	–	48	EQUAL TO CORRECTED WEIGHT									
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	122	125	127	130	132	134	136	138	140	143	145	147
V1 (kt IAS)	112	115	117	120	122	124	126	128	130	133	135	137

R

CONF 2

CORRECTED WEIGHT (1000 kg)	<50.3	50.3	51	51 to 70								
MTOW (1000 kg)	–	48	51	EQUAL TO CORRECTED WEIGHT								
ACTUAL WEIGHT (1000 kg)	≤48	50	51	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	126	129	130	131	133	136	138	140	142	144	147	149	151
VR (kt IAS)	121	124	125	126	128	131	133	135	137	139	142	144	146
V1 (kt IAS)	112	112	112	113	115	118	120	122	124	126	129	131	133

R

CONF 3

CORRECTED WEIGHT (1000 kg)	<53.3	53.3	54	55	55 to 70								
MTOW (1000 kg)	–	48	51	55	EQUAL TO CORRECTED WEIGHT								
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	55	56	58	60	62	64	66	68	70
V2 (kt IAS)	123	126	128	130	131	132	134	136	138	141	143	145	147
VR (kt IAS)	120	123	125	127	128	129	131	133	135	138	140	142	144
V1 (kt IAS)	112	112	112	112	112	113	115	117	119	122	124	126	128

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SPRAY PATTERN

There is a little chance of the engines ingesting fluid, which in any case should not jeopardize safety. The risk of ingestion is independent of the depth of the contaminant.

CROSSWIND

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 take off or to land with a crosswind component higher than :

R

Reported braking action	Reported runway friction coefficient	Maximum crosswind (kt)		Equivalent runway condition **
		Takeoff	Landing	
Good	≥ 0.4	29 *	33 *	1
Good/medium	0.39 to 0.36	29	29	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

* This is the maximum crosswind demonstrated for dry and wet runway.

** Equivalent runway condition (only valid for maximum crosswind determination)

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

R 5. Icy runway or high risk of hydroplaning

TAXIING

– FOLLOWING TAXIING PROCEDURES . . . . . CONSIDER

– Avoid high thrust settings.
– When taxiing on slippery surfaces, stay well behind preceding aircraft.
– Taxi at low speed. Note that antiskid does not operate at low taxi speeds.
– On slippery taxiways during turns with large nose wheel steering angles, noise and vibration may result from the wheels slipping sideways. Keep speed as low as possible to make a smooth turn with minimum radius. Differential power may be needed.
– If taxiing in icing conditions with precipitation on runways and taxiways contaminated with slush or snow :
· Before takeoff keep flaps/slats retracted until reaching the holding point on the takeoff runway to avoid contaminating the mechanism. Hold the BEFORE TO checklist at FLAP SETTING and finish it after extending flaps/slats.
· When taxiing in after landing, do not retract the flaps/slats to avoid damage of the structure.
After engine shutdown make a visual inspection to determine that the flap/slat mechanism is free of contamination.
· When the mechanism is clean, use the following procedure to retract the flaps/slats before the aircraft electric network is de-energized :
– Select ON the YELLOW and BLUE ELEC PUMP.
– Retract the FLAPS and monitor retraction on ECAM page.
– Select OFF the YELLOW and BLUE ELEC PUMP and resume with normal procedure.

Note : · On contaminated runways and taxiways, the radio altitude indications may fluctuate and auto call outs or GPWS warnings may be activated. Disregard them.

R *· During taxi on snowy runways, the radio altimeters may not compute any data*
R *and the ECAM warnings 'DUAL ENG FAILURE', 'ANTI ICE CAPT TAT FAULT',*
R *'ANTI ICE F/O TAT FAULT', 'L/G SHOCK ABSORBER FAULT' may be triggered.*
R *Disregard these warnings.*

TAKEOFF

– FOLLOWING TAKEOFF PROCEDURES . . . . . CONSIDER

– For contaminated runways, select MAX TO.
– Do not abort takeoff for minor deficiencies even at low speeds.
If you have to abort takeoff, maintain directional control with the rudder and small inputs to the nose wheel. If necessary, use differential braking to regain the center line when stopping distance permits.
– Do not lift the nose wheel before VR in an attempt to avoid splashing slush on the aircraft, because this produces additional aerodynamic drag.
– Rotate, lift off and retract gear and high lift devices in the normal manner.

LANDING

– FOLLOWING LANDING PROCEDURES . . . . . CONSIDER

– Avoid landing on contaminated runways if the antiskid is not functioning. The use of
R autobrake LOW or MED is recommended provided that the contamination is evenly distributed.
– Approach at the normal speed.
– Make a positive touchdown after a brief flare.
– As soon as the aircraft has touched down, lower the nose wheel onto the runway and
R select maximum reverse thrust.
Do not hold the nose wheel off the ground.
– If necessary, the maximum reverse thrust can be used until the aircraft is fully stopped.
– If the runway length is limiting, apply the brakes before lowering the nose gear onto the runway, but be prepared to apply back stick to counter the nose down pitch produced by the brakes application. (The strength of this pitching moment will depend on the brake torque attainable on the slippery runway).
– Maintain directional control with the rudder as long as possible, use nose wheel steering with care.
– When the aircraft is at taxi speed, follow the recommendations for taxiing.

Note : If there is snow, visibility may be reduced by snow blowing forward at low speeds if reversers are not cancelled.

EXAMPLES

TAKEOFF PERFORMANCE ON DRY RUNWAY

Data

Runway length : 3000 m, OAT = 36°C, no wind, CONF 1+F

– Determine maximum takeoff weight on dry runway from RTOW chart (Refer to FCOM 2.02.10 p 6)

NFC5-02-0410-014-A140AA

OAT °C	CONF 1 + F				
	TAILWIND −10 KT	TAILWIND −5 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
34.0	68.1 3/4 147/47/50	69.1 3/4 150/50/53	70.2 4/4 151/51/54	70.8 4/4 152/52/55	71.6 4/4 152/52/55
36.0	68.0 3/4 147/47/50	69.0 3/4 150/50/52	70.1 4/4 151/51/54	70.7 4/4 152/52/55	71.5 4/4 152/52/55
38.0	67.9 3/4 147/47/49	69.0 3/4 150/50/53	70.0 4/4 151/51/53	70.7 4/4 152/52/55	71.4 4/4 152/52/55

Maximum TOW = 70100 kg, V1 = 151 kt, VR = 151 kt, V2 = 154 kt.

TAKEOFF PERFORMANCE ON WET RUNWAY

With no thrust reversers operating and assuming that no clearway was used to compute the dry RTOW chart, use the table from 2.04.10 p 3.

NFC5-02-0410-014-B140AB

TAKEOFF CONFIGURATION	1+F			2			3		
RUNWAY LENGHT (m) (ft)	2500 8000	3000 10000	3500 12000 AND ABOVE	2000 6500	2500 8000	3000 10000 AND ABOVE	1500 5000	2000 6500	2500 8000 AND ABOVE
FLEX TO TEMPERATURE DECREMENT (°C)	2	2	2	2	2	2	2	2	2
MAX TO WEIGHT DECREMENT (1000 kg) (1000 lb)	1.0 2.2	1.0 2.2	0.8 1.8	1.0 2.2	1.0 2.2	1.0 2.2	0.8 1.8	0.9 2.0	1.1 2.4
V1 DECREMENT (kt)	14	15	14	13	14	15	13	13	14
VR AND V2 DECREMENT (kt)	3	4	4	2	3	4	2	2	3

· Maximum takeoff weight correction :
MTOW = 70100 – 1000 = 69100 kg, V1 = 151 – 15 = 136 kt, VR = 151 – 4 = 147 kt, V2 = 154 – 4 = 150 kt.

· Flex temperature correction :
Assuming an actual takeoff weight of 69000 kg and an initial flex temperature of 45°C.
TOW = 69000 kg ⇒ Flex temperature = 45 – 2 = 43°C
V1 = 149 – 15 = 134 kt, VR = 150 – 4 = 146 kt, V2 = 153 – 4 = 149 kt.

TAKEOFF PERFORMANCE ON RUNWAY COVERED WITH 1/2 INCH SLUSH

Data

Runway length : 3000 m, OAT = 5°C, no wind, CONF 1 + F

– Determine maximum takeoff weight on dry runway (refer to FCOM 2.02.10 p 6)

NFC5-02-0410-015-A140AB

OAT	CONF 1 + F				
	TAILWIND	TAILWIND	WIND	HEADWIND	HEADWIND
°C	– 10 kt	– 5 kt	0 kt	10 kt	20 kt
0	69.7 3/4 152/52/55	70.7 4/4 153/53/56	71.7 4/4 154/54/56	72.6 4/4 155/55/58	73.4 4/4 155/55/58
10	69.3 3/4 152/52/55	70.3 4/4 152/52/55	71.3 4/4 153/53/56	72.1 4/4 154/54/57	72.9 4/4 155/55/58

Maximum takeoff weight on dry runway = 71500 kg

– Determine a corrected weight (refer to FCOM 2.04.10 p 8)

NFC5-02-0410-015-B140AB

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RUNWAY LENGTH (m) (ft)	2500 8000	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1750 5750	2000 6500	2500 8000 and above
WEIGHT DECREMENT (1000 kg)	16.5	15.0	13.0	13.0	17.5	16.0	14.5	17.0	16.5	14.0

Corrected weight = 71500 – 15000 = 56500 kg

– Determine maximum takeoff weight and associated speeds :

NFC5-02-0410-015-C140AA

CONF 1+F													
CORRECTED WEIGHT (1000 kg)	< 48	48	48 to 70										
MTOW (1000 kg)	-	48	EQUAL TO CORRECTED WEIGHT										
ACTUAL WEIGHT (1000 kg)	≤48	50	52	54	56	58	60	62	64	66	68	70
V2 (kt IAS)	127	130	132	135	137	139	141	143	145	148	150	152
VR (kt IAS)	124	127	129	132	134	136	138	140	142	145	147	149
V1 (kt IAS)	119	122	124	127	129	131	133	135	137	140	142	144

MTOW = 56500 kg

V1 = 129 kt, VR = 135 kt, V2 = 138 kt

FERRY FLIGHT WITH NO SLATS

TO BE ISSUED LATER

GENERAL

The aircraft may fly without cabin pressurization because of an aircraft system deficiency (see MEL) or after a decompression in flight. The pilot's choice of flight level and airspeed depends on the cause of the depressurization, the distance to fly, the topographic conditions and the meteorological conditions.

OXYGEN REQUIREMENTS

CREW MEMBERS

See FAR 121.329 or JAR-OPS 1.770

PASSENGERS

For flight at cabin pressure altitudes above 10000 feet, up to and including 14000 feet, there must be enough oxygen to supply 10% of the passengers for the flight at those altitudes that lasts more than 30 minutes.
For flight at cabin pressure altitudes above 14000 feet, up to and including 15000 feet, there must be enough oxygen for 30 % of the passengers.
For flight at cabin pressure altitudes above 15000 feet, there must be enough oxygen for all passengers.

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FLIGHT PLANNING AND EXECUTION

ALTITUDE

Flight route planning should consider the above-stated restriction in cabin altitude. If cabin altitude exceeds 9550 ± 350 feet, the EXCESS CAB ALT warning on the ECAM will be activated. When above 14000 feet, the passenger oxygen masks will drop automatically. Therefore, the recommended maximum altitude for prolonged flight is FL100. The minimum altitude should be selected by respecting :

- The Minimum Safe Altitude (MSA),
- Turbulence, which is uncomfortable for passengers and,
- Low Outside Air Temperature (OAT), which can be uncomfortable for passengers when the cabin is ventilated by ram air only.

AIRSPEED

If decompression is due to structural damage, consider airspeed reduction. Use slats and flaps, as necessary, to establish low speed conditions. In addition, turbulent conditions are uncomfortable for passengers, and gust response should be minimized by reducing airspeed.

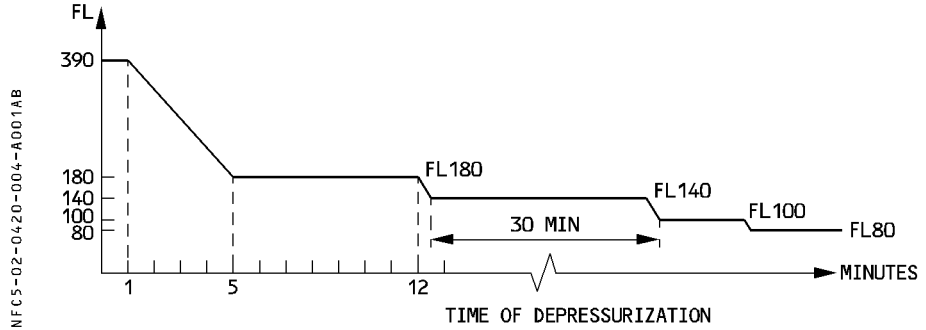
CLIMB AND DESCENT RATE

Takeoff must be performed normally, and the rate of climb must be limited to about 500 feet/minute, to ease the pressure change felt by passengers and crew.

R Likewise, the rate of descent must be limited to about 1000 feet/minute, except for the final approach which must be performed normally. Notify the ATC of any performance deficiency by a remark in the flight plan.

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.



SYSTEMS

FAILURE OCCURRING IN FLIGHT

Apply abnormal and emergency procedure required by ECAM.

FAILURE PRESENT AT DISPATCH

- **if flight with both packs inoperative**

  – PACK 1 and 2 . . . . . OFF

  – RAM AIR . . . . . ON

  Note : If the «AVIONICS SMOKE» procedure has to be applied the following flight time limitations have to be considered to protect the avionic equipment :
  At ISA + 40 : 0.5 hour
  At ISA + 30 : 1.5 hour
  At ISA + 20 : 4 hours
  At ISA + 10 and below : No limitation.

(*) 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 3.05.15 and increase fuel consumption by 6 %.

- **If both CAB PRESS systems are inoperative, or if there is structural damage :**

  – **PACK 1 and 2** . . . . . **ON**

  – **MODE SEL** . . . . . **MAN**

R – **V/S CTL** . . . . . **AS RQRD**
R Use V/S CTL to set the outflow valve opening to 50 %.

  – **OUTFLOW VALVE HALF OPEN** . . . . . **CHECK**
  The outflow valve opening is limited to 50 %, to avoid the cabin air suction effect.

  – **MAX FL** . . . . . **100 or MSA**

TAKEOFF

Limit the aircraft's rate of climb to about 500 feet/minute.

CLIMB

Note : The EXCESS CAB ALT warning may occur.
Use the ECAM CLR pushbutton to clear the warning.

DESCENT

Limit the aircraft's rate of descent to about 1000 feet/minute. Perform the final approach normally.

PERFORMANCE DATA

The following table enables the fuel consumption and the time needed from takeoff to landing to be determined in case of flight without cabin pressurization.
The table is established for :

- Takeoff
- Climb from 1500 ft at 250 kt
- Long range cruise speed at FL100
- Descent to 1500 ft at 250 kt
- Approach and landing : IMC procedure 110 kg or 240 lb (6 min)
- ISA temperature
- CG = 25 %
- Normal air conditioning
- Anti ice OFF

The table on page 8 gives the conversion from ground distance to air distance

Note : For each degree Celcius above ISA temperature apply a correction of 0.01 (kg/°C/NM) or 0.022 (lb/°C/NM).

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250 KT - CRUISE LONG RANGE - DESCENT : 250KT
IMC PROCEDURE : 110 KG (6MIN)

FL 100

NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 25.0%

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	INITIAL WEIGHT (1000KG)						
	50	**55**	**60**	**65**	**70**	**75**	**80**
220	2003 0.55	2080 0.53	2151 0.52	2219 0.51	2291 0.51	2369 0.51	2450 0.50
240	2157 1.00	2242 0.57	2318 0.55	2390 0.55	2467 0.54	2549 0.54	2635 0.54
260	2311 1.04	2404 1.01	2485 0.59	2562 0.58	2643 0.58	2729 0.57	2819 0.57
280	2464 1.09	2565 1.05	2652 1.03	2733 1.02	2819 1.01	2908 1.01	3003 1.00
300	2618 1.13	2727 1.08	2818 1.06	2904 1.05	2994 1.05	3088 1.04	3187 1.04
320	2771 1.18	2888 1.12	2985 1.10	3075 1.09	3169 1.08	3267 1.08	3370 1.07
340	2924 1.22	3048 1.16	3152 1.14	3246 1.13	3344 1.12	3446 1.11	3554 1.10
360	3076 1.27	3209 1.20	3318 1.17	3416 1.16	3519 1.15	3626 1.14	3737 1.14
380	3229 1.31	3370 1.24	3484 1.21	3587 1.20	3694 1.19	3804 1.18	3920 1.17
400	3381 1.36	3530 1.28	3650 1.25	3757 1.23	3869 1.22	3983 1.21	4103 1.20
420	3533 1.40	3689 1.33	3816 1.29	3928 1.27	4043 1.26	4162 1.25	4286 1.24
440	3684 1.45	3849 1.37	3981 1.32	4098 1.31	4218 1.29	4340 1.28	4469 1.27
460	3836 1.49	4008 1.41	4147 1.36	4268 1.34	4392 1.33	4519 1.32	4651 1.30
480	3987 1.54	4167 1.45	4312 1.40	4437 1.38	4566 1.36	4697 1.35	4834 1.34
500	4138 1.58	4326 1.49	4477 1.44	4607 1.41	4739 1.40	4875 1.39	5016 1.37
520	4288 2.03	4484 1.53	4642 1.47	4776 1.45	4913 1.43	5053 1.42	5198 1.41
540	4439 2.08	4643 1.58	4807 1.51	4946 1.49	5087 1.47	5230 1.45	5380 1.44
560	4589 2.12	4801 2.02	4971 1.55	5115 1.52	5260 1.50	5408 1.49	5562 1.47
580	4739 2.17	4958 2.06	5136 1.59	5284 1.56	5433 1.54	5585 1.52	5743 1.51
600	4889 2.21	5116 2.10	5300 2.02	5453 2.00	5606 1.57	5763 1.56	5925 1.54
620	5038 2.26	5273 2.15	5464 2.06	5621 2.03	5779 2.01	5940 1.59	6106 1.58
640	5187 2.31	5431 2.19	5628 2.10	5790 2.07	5952 2.04	6117 2.03	6287 2.01
660	5336 2.35	5588 2.23	5792 2.14	5958 2.11	6125 2.08	6294 2.06	6468 2.04
680	5485 2.40	5744 2.28	5956 2.18	6126 2.14	6297 2.12	6470 2.10	6649 2.08
700	5634 2.44	5901 2.32	6119 2.21	6294 2.18	6470 2.15	6647 2.13	6830 2.11

AIR CONDITIONING
OFF
ΔFUEL = – 3 %

ENGINE
ANTI ICE ON
ΔFUEL = + 3 %

TOTAL
ANTI ICE ON
ΔFUEL = + 5.5 %

GROUND DISTANCE/AIR DISTANCE CONVERSION

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND			WIND COMPONENTS (KT)			HEAD WIND
	+150	+100	+ 50	0	-50	-100	-150
40	29	32	36	40	46	53	64
60	44	48	53	60	68	80	95
80	58	64	71	80	91	106	127
100	73	80	89	100	114	133	159
120	88	96	107	120	137	159	191
140	102	112	125	140	160	186	223
160	117	128	142	160	183	213	255
180	131	144	160	180	205	239	286
200	146	160	178	200	228	266	318
220	160	176	196	220	251	292	350
240	175	192	214	240	274	319	382
260	190	208	231	260	297	346	414
280	204	224	249	280	320	372	445
300	219	240	267	300	342	399	477
320	233	256	285	320	365	425	509
340	248	273	303	340	388	452	541
360	263	289	320	360	411	478	573
380	277	305	338	380	434	505	604
400	292	321	356	400	457	532	636
420	306	337	374	420	479	558	668
440	321	353	392	440	502	585	700
460	335	369	409	460	525	611	732
480	350	385	427	480	548	638	764
500	365	401	445	500	571	665	795
520	379	417	463	520	593	691	827
540	394	433	481	540	616	718	859
560	408	449	498	560	639	744	891
580	423	465	516	580	662	771	923
600	438	481	534	600	685	797	954

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GENERAL

This Chapter applies to dispatch with landing gear down. However, the limitations and inflight performance also apply in case of an inflight landing gear retraction failure.
Revenue flight is permitted, with the landing gear down and the gear doors closed, in the conditions stated below.

LIMITATIONS

- Do not fly into expected icing conditions.
- Ditching with the landing gear down has not been demonstrated.

R - Disregard FM fuel predictions. Other predictions should also be disregarded (altitude,
R speed and time), except time predictions at waypoints when in cruise.

R - Do not use managed speed (except in approach) and CLB and DES autopilot modes.

- ALTITUDE ALERT is not available.

PROCEDURES

PREFLIGHT

VMO/MMO with the landing gear down is 235 knots/M.60. In the avionics compartment, on 188 VU, the VMO-MMO switch must be set to the «L/G DOWN» position.

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ABN AND EMER PROCEDURES

FLIGHT CONTROLS

Failure cases which would normally lead to ALTN law will, with L/G extended, degrade F/CTL laws down to DIRECT law.

FAILURE OF BOTH ENGINES

Follow ECAM procedures (even if some actions seem useless) unless modified by procedures below :

- If APU available : perform an assisted relight when below FL 200.
- If APU not available
  - Do not attempt an APU start (APU start inhibited in this configuration)
  - Windmilling relight can be performed as long as speed is above 300 knots (corresponding N2 above 12%).
    In this case, increase aircraft speed and disregard VMO warning.
- Flight controls are in direct laws. Use manual pitch trim as necessary (not indicated on PFD if APU GEN not available).
- In approach, set CONF 1 at or above 200 knots. Do not select flaps/slats below 200 knots.

PERFORMANCE

Consider the increase in drag to determine the takeoff weight and fuel consumption. CONF 1 + F is the recommended takeoff configuration.

Note : Takeoff with tail wind is not recommended.

Penalties on takeoff performance affect second segment gradient condition, final takeoff condition and en-route conditions. The takeoff weight to be retained is the most limiting of these three conditions.

SECOND SEGMENT GRADIENT CONDITION

The RTOW charts or the quick reference tables give the basic information for normal takeoff. To simplify, a constant weight reduction is applied whatever the limitation. This weight reduction covers the most critical case presented for flying over an obstacle.

Takeoff configuration	1 + F	2	3
Weight reduction	20 %	17 %	16 %

METHOD

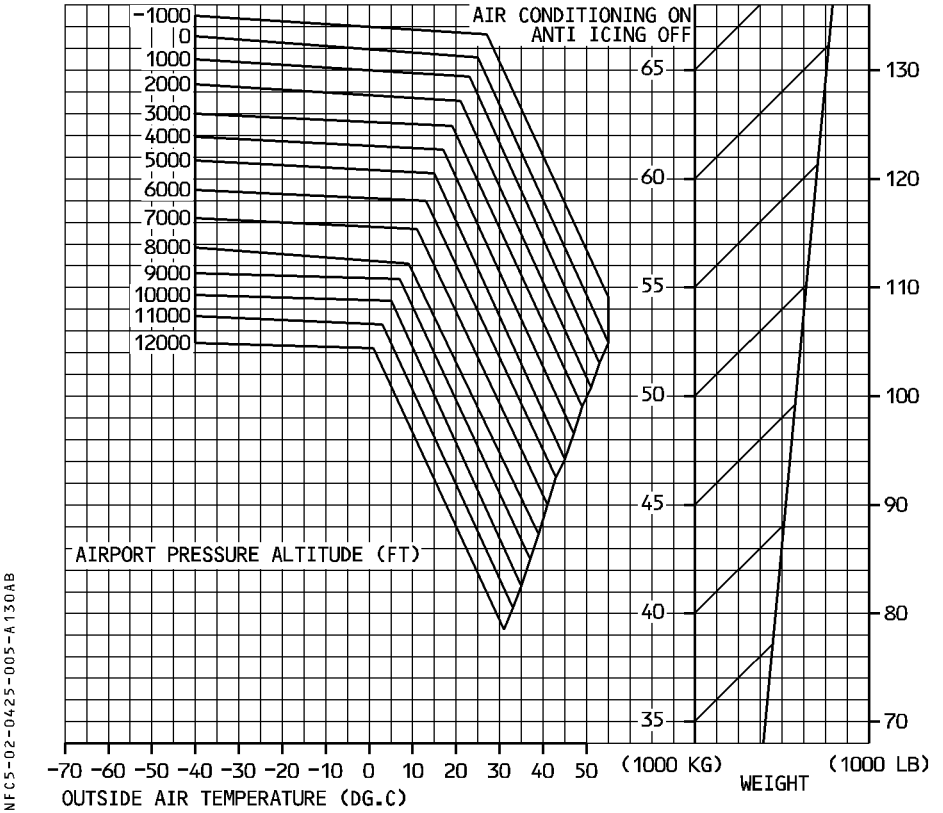
Use the RTOW chart or the quick-reference tables to define the maximum takeoff weight for the conditions on the airport (temperature, pressure, wind, runway...), then apply the above weight reduction.

FINAL TAKEOFF CONDITION

The final takeoff speed is VLS.

Use the graph below to determine the maximum takeoff weight associated with the final takeoff condition.

R



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EN ROUTE CONDITION

Retain the lowest weight according to the most limiting condition (second segment or final takeoff). Use the en route net flight path on page 11 to check that in case of engine failure the aircraft can clear the terrain on the route by 1000 feet (climbing) or 2000 feet (descending). If necessary, reduce the takeoff weight. Read the speeds corresponding to this weight in the RTOW chart or in the quick reference tables.

GO AROUND PERFORMANCE

See 3.05.35 for go-around requirements.
Further decrease the basic limiting weight by 14 %.

FLIGHT PLANNING

CLIMB

Climb at 230 kt/M.50 with both engines at maximum climb thrust. The table on page 7 gives the time, distance and fuel consumption according to takeoff weight.

CRUISE/DESCENT

The recommended cruise/descent speed is 230 kt/M.50.
The ceiling on one engine may be a limiting factor, and the choice of the route should reflect this concern.

ENGINE FAILURE

In case of engine failure, the airplane will drift down to the ceiling shown on page 12.
The thrust for drift down will be Maximum Continuous.
The drift down speed is equal to green dot speed.

HOLDING

Page 10 gives the holding parameters with slats out, this configuration being the least penalizing for holding.

R

CLIMB - 230KT/M.50 - ALL ENGINES - L/G DOWN

MAX. CLIMB THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=25.0%

FROM BRAKE RELEASE
TIME (MIN) **FUEL (KG)**
DISTANCE (NM) **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)								
	44	**48**	**52**	**56**	**60**	**64**	**68**	**72**	**76**
290	17 1337 78 277	19 1529 90 278	22 1762 105 280	26 2055 124 282	32 2450 151 284				
270	15 1229 69 275	17 1397 79 276	20 1595 91 278	23 1836 106 279	27 2145 126 281	33 2569 154 283			
250	13 1123 60 271	15 1269 68 273	17 1439 78 274	20 1639 90 276	23 1888 105 278	27 2212 126 280			
240	12 1069 56 269	14 1205 64 271	16 1362 72 272	18 1545 83 274	21 1768 96 276	25 2054 113 278	30 2441 138 280		
220	11 959 48 264	12 1077 54 266	14 1210 61 267	16 1363 70 269	18 1542 79 270	20 1763 92 272	24 2050 109 275		
200	9 845 40 258	10 945 45 259	12 1056 50 260	13 1181 57 262	15 1323 64 263	17 1493 73 264	19 1701 84 267		
180	8 722 32 247	9 803 35 249	9 892 39 250	11 991 44 251	12 1100 49 252	13 1225 55 254	15 1372 62 255	17 1547 71 257	19 1758 82 259
160	6 617 25 238	7 684 28 239	8 757 31 240	9 837 34 241	9 924 38 242	10 1022 43 243	12 1133 47 245	13 1260 53 246	14 1407 60 248
140	5 527 20 228	6 583 22 229	6 644 25 231	7 709 27 232	8 780 30 233	9 858 33 233	9 946 37 235	10 1044 41 236	11 1155 46 238
120	4 447 16 218	5 494 18 219	5 544 19 221	6 598 22 222	6 656 24 223	7 720 26 224	8 790 29 225	8 868 32 227	9 954 35 228
100	4 375 12 207	4 413 14 208	4 454 15 210	5 498 17 211	5 546 18 212	6 597 20 213	6 653 22 214	7 715 24 216	7 782 27 218
50	2 212 6 168	2 233 6 170	2 255 7 172	3 278 7 173	3 303 8 175	3 330 9 176	3 359 10 178	4 389 11 180	4 422 12 182
15	1 108 2 105	1 118 2 107	1 128 2 109	1 139 2 110	1 151 3 112	2 163 3 113	2 176 3 115	2 189 3 118	2 203 4 120

R

CRUISE - 230KT/M.50 - ALL ENGINES - L/G DOWN

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=25.0%

N1 (%)
KG/H/ENG
NM/1000KG

MACH
IAS (KT)
TAS (KT)

WEIGHT (1000KG)	FL100		FL200		FL220		FL240		FL270		FL290	
44	73.5	.417	83.0	.500	82.7	.500	82.5	.500	82.4	.500	82.5	.500
	1792	230	1787	228	1658	219	1542	210	1390	197	1305	188
	74.2	266	85.9	307	91.9	305	98.0	302	107.4	298	113.4	296
48	73.9	.417	83.3	.500	83.1	.500	83.1	.500	83.1	.500	83.4	.500
	1812	230	1812	228	1687	219	1574	210	1431	197	1355	188
	73.4	266	84.8	307	90.3	305	96.0	302	104.3	298	109.2	296
52	74.3	.417	83.7	.500	83.6	.500	83.7	.500	83.9	.500	84.3	.500
	1835	230	1841	228	1719	219	1612	210	1481	197	1411	188
	72.5	266	83.4	307	88.6	305	93.7	302	100.8	298	104.9	296
56	74.8	.417	84.2	.500	84.2	.500	84.3	.500	84.8	.500	85.5	.500
	1861	230	1873	228	1756	219	1657	210	1536	197	1484	188
	71.4	266	82.0	307	86.7	305	91.2	302	97.1	298	99.7	296
60	75.3	.417	84.7	.500	84.8	.500	85.0	.500	85.7	.500	86.8	.500
	1891	230	1909	228	1800	219	1708	210	1602	197	1573	188
	70.3	266	80.4	307	84.6	305	88.4	302	93.1	298	94.1	296
64	75.9	.417	85.2	.500	85.4	.500	85.8	.500				
	1924	230	1951	228	1850	219	1765	210				
	69.1	266	78.7	307	82.4	305	85.6	302				
68	76.5	.417	85.8	.500	86.1	.500	86.6	.500				
	1962	230	1999	228	1905	219	1828	210				
	67.8	266	76.8	307	80.0	305	82.7	302				
72	77.2	.417										
	2003	230										
	66.4	266										
76	78.0	.417										
	2046	230										
	65.0	266										

R

DESCENT - M.50/230KT - ALL ENGINES - L/G DOWN

IDLE THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=25.0%

MAXIMUM CABIN RATE OF DESCENT 350FT/MIN

WEIGHT (1000KG)	45				65				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
290	7.1	67	33	IDLE	9.2	87	42	IDLE	188
270	6.6	64	30	IDLE	8.5	83	39	IDLE	197
250	6.1	60	28	IDLE	7.9	78	36	IDLE	205
240	5.8	58	26	IDLE	7.6	76	35	IDLE	210
220	5.4	55	24	IDLE	7.0	72	32	IDLE	219
200	4.9	51	22	IDLE	6.5	67	29	IDLE	228
180	4.5	46	20	IDLE	5.9	60	26	IDLE	230
160	3.9	40	17	IDLE	5.2	53	22	IDLE	230
140	3.4	33	14	IDLE	4.5	43	19	IDLE	230
120	2.9	26	12	IDLE	3.8	34	16	IDLE	230
100	2.3	19	10	IDLE	3.0	26	13	IDLE	230
50	1.0	8	4	IDLE	1.3	11	5	IDLE	230
15	.0	0	0	IDLE	.0	0	0	IDLE	230

R

RACE TRACK HOLDING PATTERN - S SPEED - ALL ENGINES - L/G DOWN

MAX. CRUISE THRUST LIMITS
CONFIGURATION 1
NORMAL AIR CONDITIONING
ANTI-ICING OFF

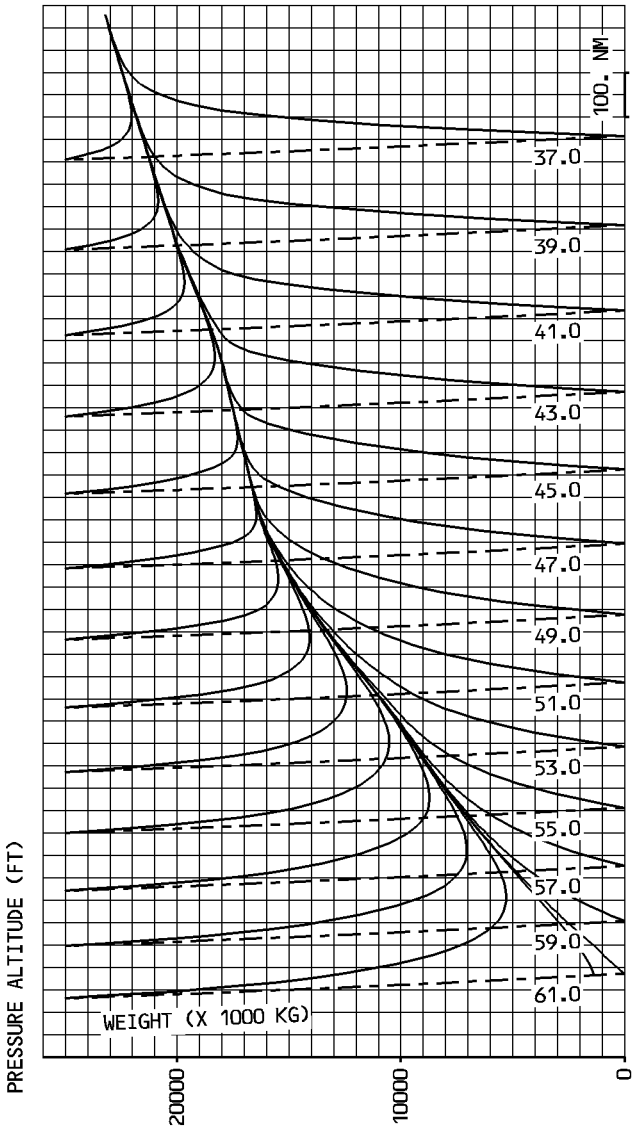
ISA
CG=25.0%

N1 (%)
FF (KG/H/ENG)

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200
44	55.2 1279	58.0 1263	61.7 1236	63.4 1230	65.2 1223	67.0 1209	68.9 1187	70.7 1166
46	56.4 1336	59.2 1318	62.9 1293	64.7 1285	66.5 1275	68.4 1255	70.1 1230	72.0 1212
48	57.6 1393	60.3 1373	64.1 1349	65.9 1340	67.8 1322	69.5 1298	71.3 1276	73.3 1261
50	58.7 1451	61.3 1428	65.3 1403	67.2 1390	69.0 1369	70.7 1342	72.6 1323	74.5 1312
52	59.8 1507	62.3 1483	66.5 1458	68.3 1438	70.1 1411	71.9 1388	73.8 1372	75.7 1364
54	60.8 1562	63.3 1538	67.7 1508	69.5 1484	71.2 1456	73.0 1435	74.9 1423	76.8 1417
56	61.8 1616	64.4 1594	68.8 1556	70.5 1527	72.2 1503	74.1 1485	76.0 1477	78.0 1473
58	62.6 1670	65.4 1649	69.8 1603	71.5 1571	73.3 1550	75.2 1536	77.1 1530	79.0 1527
60	63.6 1725	66.4 1703	70.8 1646	72.5 1619	74.3 1599	76.2 1590	78.1 1585	79.9 1584
62	64.5 1780	67.4 1757	71.7 1689	73.5 1666	75.4 1650	77.2 1643	79.1 1639	80.9 1640
64	65.4 1835	68.4 1810	72.7 1736	74.5 1714	76.3 1703	78.2 1697	80.0 1695	81.8 1697
66	66.3 1889	69.3 1859	73.6 1784	75.4 1765	77.3 1757	79.2 1753	80.9 1752	82.6 1756
68	67.2 1944	70.2 1906	74.5 1832	76.4 1817	78.2 1811	80.1 1808	81.8 1810	83.5 1817
70	68.1 2000	71.1 1953	75.4 1883	77.2 1872	79.1 1867	80.9 1866	82.6 1868	84.2 1879
72	69.0 2054	71.9 1997	76.3 1934	78.1 1926	80.0 1923	81.7 1923	83.4 1928	85.0 1941
74	69.8 2102	72.7 2042	77.1 1987	79.0 1981	80.8 1979	82.5 1981	84.1 1989	85.8 2001
76	70.6 2151	73.5 2088	78.0 2042	79.8 2038	81.6 2037	83.3 2040	84.9 2051	86.6 2068

EN ROUTE NET FLIGHT PATH - L/G DOWN - ONE ENGINE OUT		
MAX. CONTINUOUS THRUST HIGH AIR CONDITIONING ANTI ICE OFF	ISA CG = 25 %	MINIMUM ENGINE

R



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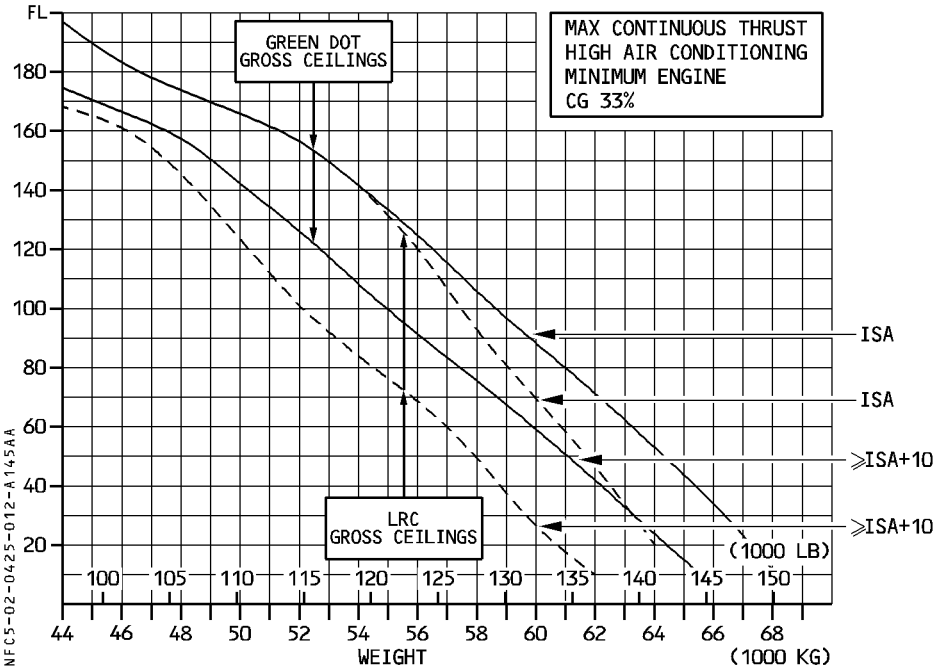
GROSS CEILINGS AT LONG RANGE AND GREEN DOT SPEEDS - ONE ENGINE OUT

R



BLEED CORRECTIONS

R

		ISA	≥ ISA + 10
LONG RANGE	ENGINE ANTI ICE ON	– 1200 FT	– 3200 FT
	TOTAL ANTI ICE ON	– 2000 FT	– 6400 FT
GREEN DOT	ENGINE ANTI ICE ON	– 300 FT	– 2000 FT
	TOTAL ANTI ICE ON	– 800 FT	– 4300 FT

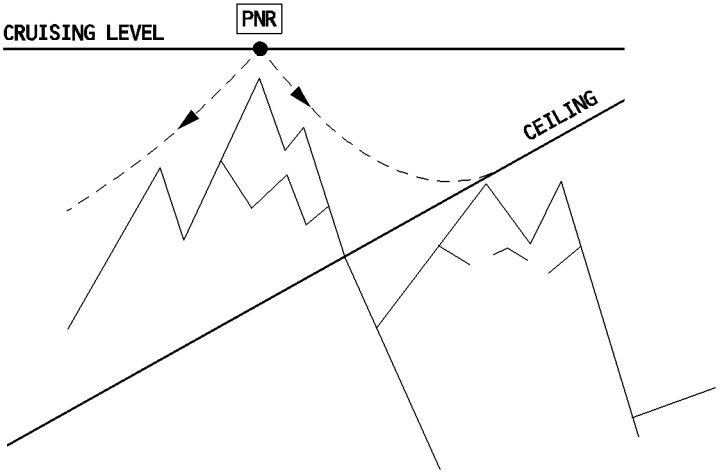
INTRODUCTION

Two failures must be taken into consideration for en route obstacle clearance over mountainous area :

- Engine failure that forces a descent to a lower cruise level
- Depressurization which, due to the passenger oxygen system, requires a descent to 10000 feet before supplementary oxygen is exhausted.

ENGINE FAILURE

If the standard strategy does not allow the aircraft to clear obstacles, the pilot must use a drift down procedure. If an engine failure occurs at any point on the route, the net flight path must clear the obstacles on the drift-down part by 2000 feet and on the climb part by 1000 feet.
If the aircraft cannot clear the en route obstacles, a point of no return (PNR) must be determined.



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If an engine failure occurs after the PNR, the aircraft must drift down on course. If the failure occurs before the PNR, the aircraft must turn back.
For en route net flight paths, refer to the Aircraft Flight Manual.

DEPRESSURIZATION

In case of depressurization, the passengers receive oxygen through individual modules. An emergency descent in accordance with a certain profile has to be performed
(Refer to 2.04.20) FLIGHT WITHOUT CABIN PRESSURIZATION

CONCLUSION

R A detailed study of each route over mountainous area must show that single-engine net
R flight path and passenger oxygen system performance allow the aircraft to clear the obstacles by 1000 feet in climb and by 2000 feet in cruise or descent.
If the aircraft in these circumstances cannot clear the obstacles on the route, a PNR must be determined and diversion procedures must be established.

GENERAL

The system design and the reliability of the engine installation of this airplane comply with
R the criteria for Extended Twin Operations (ETOPS) flights set forth in IL N° 20 (JAA) or AC
R 120-42 A (FAA) or CTC 20 (DGAC) or CAP513 (CAA UK) when the aircraft is configured, maintained and operated in accordance with the provisions of the appropriate Airbus Industrie document « Standard for Extended Range Operations » in the latest approved revision which is the Airbus CMP (Configuration, Maintenance and Procedure) document. This statement of ability does not constitute an approval to conduct Extended-Range Operations.

The section 6 of the Flight Manual refers to the approved Standard for Extended-Range Operations and the applicable limitations, procedures and performance references.

The operator is responsible for showing that he is complying with the regulation of his nation and for obtaining operational approval from his national authorities.

The airplane must be configured in accordance with the Airbus Industrie Standard for Extended-Range Operations. However, the authorities may under certain conditions allow the operator to conduct ETOPS flights with limited maximum diversion time (for example, 75 minute diversion time in a benign area of operation) without showing full compliance with these standards.

OPERATIONAL LIMITATIONS

DEFINITIONS

R For the purpose of AC 120–42A and IL N° 20 (or CAA CAP 513), Extended Range Operations are those intended to be conducted over a route that contains a point more 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 sufficiently equipped to be safely used. In particular, at the anticipated time of use, it should be available and equipped with the necessary services, including ATC, weather 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.

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 aircraft performance with one engine inoperative and the remaining engine operating at not more than MCT.
To determine the maximum distance from an adequate airport, the operator must define a diversion speed strategy as well as an aircraft reference weight for performance computation.
The same diversion speed strategy (Refer to FCOM 3.06) 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 operator establishes the ETOPS reference gross weight for each route or area of operation. This must be a representative but conservative 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 chosen so that the associated net flight path clears the enroute obstacles with the regulatory margin.
FCOM section 3.06 gives data for three speed schedules. The associated approved net flight paths are published in the section 6 of the Flight Manual.
When the diversion strategy is chosen, the maximum distance from a diversion airport, can be directly determined for different maximum diversion times, with the help of the tables provided in this section. The area of possible ETOPS operation can then be drawn on plotting charts.
Another way to determine the maximum distance to a diversion airport is to read the one-engine-inoperative cruise TAS (for the reference gross weight and at the FL for best TAS) in the cruise tables in section 3.06 taking into consideration the appropriate speed strategy and the minimum altitude for clearing possible obstacles. The maximum distance the aircraft can travel to a diversion airport is this one-engine-inoperative-TAS multiplied by the maximum allowed diversion time granted to the operator.
Operators whose authorities require that an approved one-engine-inoperative speed be published in the Flight Manual must use this approved speed.

DISPATCH CONSIDERATION

MMEL

The MMEL has been approved taking into consideration the duration of the average ETOPS flight and the maximum diversion time granted to the airframe/engine combination.
The MMEL published by Airbus Industrie and approved by the French DGAC can be used to establish the airline MEL, which must be approved by the operator's national authorities.
This MEL will probably be adapted to the airline network, environment and organization.
Other determining parameters will be :

- The maximum and the average diversion times on the route.
- The equipment of the enroute alternates.
- The navigation and communication facilities.
- The average meteorological conditions.

COMMUNICATION AND NAVIGATION FACILITIES

The aircraft communication system has provision to install three VHF transceivers and two HF radios ensuring full compliance with ETOPS requirements on any kind of route.
The aircraft navigation system meets the ETOPS requirements for en route navigation.
The aircraft has three inertial reference systems which, in conjunction with 2 FMS comply with MNPS criteria and this combination of systems is approved as the sole means of navigation for flight up to the maximum aircraft range.
See the MEL for a definition of the authorized dispatch configuration.

Note : For operation within the MNPS area, airlines must obtain approval from their national authorities.

FUEL AND OIL SUPPLY

The aircraft fuel and oil supply must be adequate to allow the aircraft to reach its destination or a planned alternate after the combined failures of an engine and pressurization or the failure of pressurization alone at the critical point on the route.
Planners must consider forecast wind and temperature conditions, as well as forecast icing conditions.
The operator must establish a routine for ETOPS critical fuel planning and compare it with the standard (non-ETOPS) fuel planning.

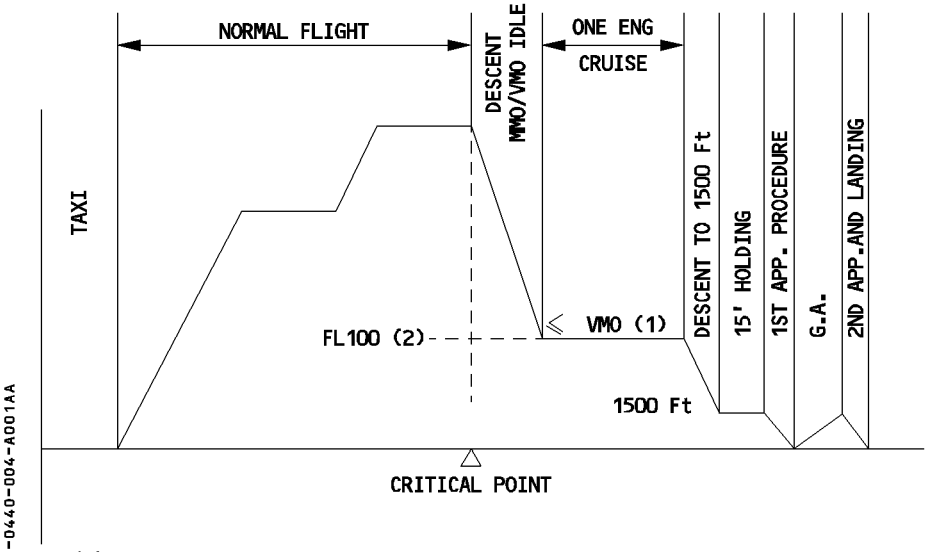
R **ELECTRICAL GENERATORS**

R Three generators are required for dispatch.

ETOPS FUEL SCENARIOS

For establishing the ETOPS critical fuel reserves, the planner must consider two diversion scenarios.

Pressurization failure + engine failure



(1) SELECTED SPEED IN DETERMINING ETOPS AREA OF OPERATION.
(2) OR ABOVE IF REQUIRED BY OBSTACLE CLEARANCE AND IF SUPPLEMENTARY OXYGEN IS AVAILABLE.

Pressurization failure

Same flight profile, but with 2 engines operating and diversion cruise set at LRC.

Fuel requirements

For each scenario, the required block fuel must be computed in accordance with the operator's ETOPS fuel policy and using the regulatory ETOPS critical fuel reserves described below.

Depending on the strategy and the one-engine-inoperative speed selected for the single-engine diversion scenario, either of these two scenarios may result in the higher fuel requirement.

The scenario resulting in the higher fuel requirement is the ETOPS critical fuel scenario, and the associated minimum block fuel requirement is the ETOPS critical fuel plan.

ETOPS CRITICAL FUEL RESERVES

For the computation of ETOPS critical fuel reserves and of the complete ETOPS critical fuel planning, the diversion fuel must include the following fuel provisions :

- fuel burn-off from the critical point to the end of descent (for example 1500 feet) at the diversion airport,
- 5 % of the above fuel burn-off as contingency fuel,
- fuel for 15 minutes of holding at 1500 feet and green dot speed,
- fuel for first (IFR) approach, a go-around and a second (VFR) approach,
- 5 % fuel mileage penalty or a demonstrated performance factor,
- effect of any Configuration Deviation List (CDL) or MEL item,
- if icing conditions are forecast :
  - effect of Nacelle Anti Icing (NAI) and Wing Anti Icing (WAI) systems,
  - effect of ice accretion on the unheated surfaces of the aircraft :

    The fuel provisions associated with the effects of NAI and WAI systems and of ice accretion on the unheated surfaces are adjusted to take into account the horizontal extent of the forecast icing areas (exposure time).

    The fuel provision factor for ice accretion on the unheated surfaces is a percentage equal to five times the forecast exposure time in hours. For example, assuming a one-hour exposure en route to and (e.g. the 15 minute holding) at the diversion airport, the fuel provision is 5 % of the fuel burned during the considered exposure time. If moderate icing is forecast, the above fuel provision is divided by two.
- If the APU is needed as a power source (MEL), its fuel consumption must be considered:

R 80 kg/h (APU GEN ON, APU BLEED OFF).

In view of our experience, Airbus Industrie recommends that the operator considers the following non mandatory fuel practices :

- Include the effect of a demonstrated performance factor, in all standard and ETOPS fuel requirement computations,
- Include a contingency fuel provision from departure to the Critical Point (CP), when computing the ETOPS critical fuel planning.

The complete ETOPS critical fuel planning for the ETOPS critical fuel scenario (from the departure to the Critical Point and then from the Critical Point to the diversion airport) must be compared with the standard fuel planning (for example, from the departure to the destination and alternate) computed in accordance with the company fuel policy and applicable operational requirements. The higher of the two fuel requirements must be considered as the minimum required block fuel for the flight.

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 critical.

WEATHER MINIMA

R Weather forecasts for en route alternates must meet the operator's applicable weather minimum requirements. If the applicable requirement is AC 120-42A or IL 20 the following applies :

An airplane cannot be dispatched unless the meteorological forecasts at en route alternate airports meet the weather minimums listed here for a period starting one hour before the earliest expected time of landing and ending one hour after the latest expected time of landing.

A. AC 120–42A dispatch weather minima (FAA)

AIRPORT EQUIPMENT	Ceiling (ft)	Visibility (m)
1 ILS/MLS	DH + 400	Greater of (3200, published minima + 1600)
2 ILS/MLS on separate runways *	DH + 200	Greater of (1600, published minima + 800)
Non precision approach	Greater of (800, MDH + 400)	Greater of (3200, published minima + 1600)
CAT II/CAT III capability with engine failure	Lower than above minima, approved on a case-by-case basis considering aircraft performance under failure conditions	

* separate runways are runways that do not touch each other.
DH : decision height
MDH : minimum descent height

R B. IL 20 dispatch weather minima (JAA)

R 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			

DIVERSION DURING EXTENDED RANGE OPERATIONS

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 requiring a diversion to the nearest airport (cases leading to a LAND ASAP message on the ECAM and/or in the QRH).
- Failure cases resulting in increased fuel consumption, exceeding the available fuel reserves.

Comments and recommendations

· Electrical generation

If one IDG fails, diversion is required in case of :

- blue hydraulic low level or
- APU no start or
- APU or APU generator inoperative or
- second IDG failure

· Fuel system

Some failure cases may lead to fuel gravity feeding which implies flight at lower altitude or to some fuel being unusable. The flight crew's evaluation of the actual situation and the fuel remaining may lead to the decision that a diversion is required.

DIVERSION PERFORMANCE DATA

FCOM section 3.06 gives three single engine descent and cruise procedures :

1. The standard strategy.
2. The obstacle strategy.
3. Fixed speed strategies (ETOPS).

For ETOPS operations, any one of the above diversion strategies can be used provided that the selected strategy and speed schedule are 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.

GUIDELINES FOR DIVERSION PROCEDURE

- Complete the related failure procedure.
- Inform ATC.
- Initiate the descent.
- Determine which enroute alternate is the most suitable (per company procedure).
- Divert to the chosen enroute alternate.
- Comply with the pre-planned diversion strategy and speed schedule, or adjust the speed schedule, as dictated by the evaluation of the actual situation.

Note : For detailed guidelines and procedures in conducting the diversion (lateral and vertical navigation), see the FMGS Pilot's Guide (FCOM Volume 4).

PROCEDURES

The SOP (FCOM 3.03) and ABN and EMER procedures (FCOM 3.02) apply. For ETOPS flights, the flight crew must complete them using the procedures given below :

COCKPIT PREPARATION

R **Fuel**

Before each flight, the flight crew must check that the fuel crossfeed valve is operating correctly :

– **FUEL X FEED . . . . . ON**
On the ECAM FUEL page check that the fuel crossfeed valve is open (indication is inline green).

– **FUEL X FEED . . . . . OFF**
Check that the fuel crossfeed valve is closed.

ABN AND EMER PROCEDURES

ELECTRICAL EMERGENCY CONFIGURATION :

In case of electrical emergency configuration, it may be better to study the STATUS on the paper checklist, after having applied ECAM actions.
The flight crew must complete the ECAM procedure using the following :

Air conditioning :

As cockpit and cabin temperature control is lost, it is recommended to open the cockpit
R door.

Fuel :

As all fuel pumps are lost, the engines are fed by gravity. Refer to 3.02.28 (Fuel gravity feed procedure).

Engine anti-ice :

Engine anti-ice valves are permanently open, although the ECAM memo ENG A. ICE is not displayed on the ECAM (except if the ENG A. ICE pushbutton is at ON).

Wing anti-ice :

If only one ENG BLEED is available, PACK 1 must be switched OFF, to avoid having both packs and wing anti-ice supplied by a single bleed source.

AVIONIC VENTILATION

Disregard the message : "MAX FLT TIME 2 HOURS", which is displayed on the ECAM in some failure cases.

BLUE HYDRAULIC LOW LEVEL

Start the APU to ensure availability of the APU generator.

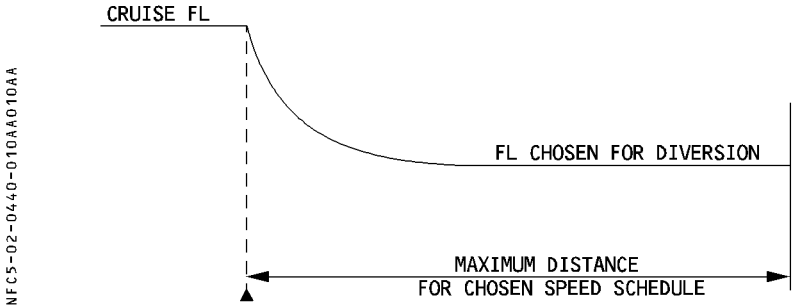
ENGINE OR IDG FAILURE

Start the APU and use the APU electrical channel.

PERFORMANCE

The two following cases result in a fuel consumption increase :
- RAT extended (Refer to ELEC EMER proc. 3.02.24).
- in electrical emergency configuration, the engine anti-ice valves are permanently open.

MAXIMUM DISTANCE (Still air) TO DIVERSION AIRPORT IN NAUTICAL MILES



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Determination of 60 minutes maximum diversion distance (JAR-OPS 1.245)

Use the distance given within the table below to decide if a route is an ETOPS one according to JAR-OPS 1.245.
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 : FL170
- Single engine diversion speed schedule : VMO/MMO

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.

Aircraft	MTOW		Distance (NM)
	(kg)	(lb)	
A319-111/112 CFM56-5B5/B6 SAC	64000 to 70000	141094 to 154322	394
	75500	166447	387
A319-111/112 CFM56-5B5/B6 DAC	64000 to 68000	141094 to 149913	403
	70000	154322	402
	75500	166447	398
A319-113/114 CFM56-5A4/A5	64000	141094	402
	68000	149913	397
	70000	154322	394
	75500	166447	386
A319-115 CFM56-5B7	64000 to 70000	141094 to 154322	410
	75500	166447	407
A319-131 IAE V2522-A5	64000 to 68000	141094 to 149913	410
	70000	154322	408
	75500	166447	405
A319-132 IAE V2524-A5	64000 to 68000	141094 to 149913	410
	70000	154322	408
	75500	166447	405
A319-133 IAE V2527M-A5	64000 to 70000	141094 to 154322	410
	75500	166447	407

MAXIMUM DISTANCE (Still air) TO DIVERSION AIRPORT IN NAUTICAL MILES (cont'd)

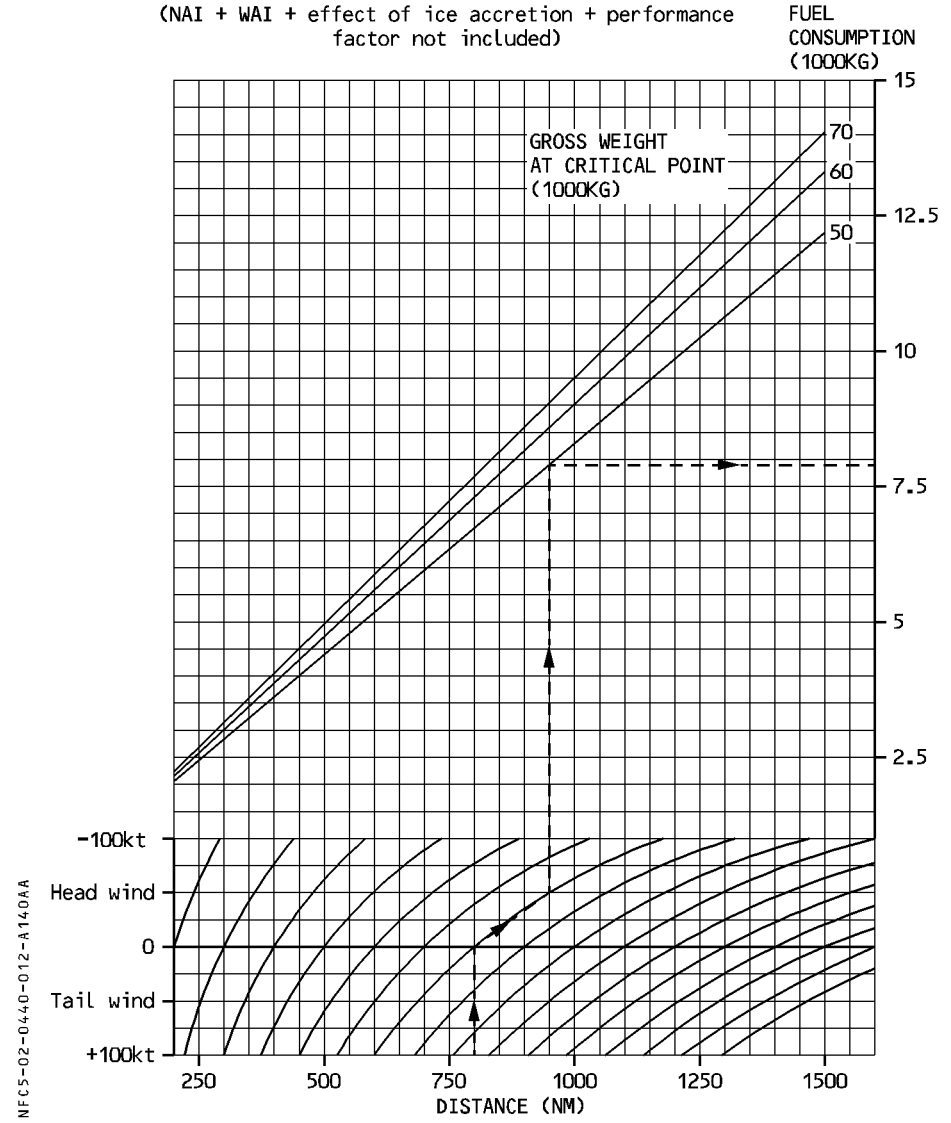
ISA							
SPEED SCHEDULE	A/C WEIGHT AT CRITICAL POINT (KG)	FL FOR DIVERSION	DIVERSION TIME (MIN)				
			60	90	120	150	180
MCT/VMO	50 000	160	409	607	806	1 005	1 205
	55 000	160	407	604	802	999	1 198
	60 000	150	406	601	797	993	1 190
	65 000	140	405	598	793	987	1 182
	70 000	130	404	596	788	981	1 175
	75 000	120	403	593	784	975	1 167
MCT/320 KT	50 000	160	409	607	806	1 005	1 205
	55 000	160	407	604	802	999	1 198
	60 000	150	406	601	797	993	1 190
	65 000	130	405	597	789	981	1 173
	70 000	110	400	587	773	960	1 146
	75 000	90	396	577	759	940	1 121

ISA + 10							
SPEED SCHEDULE	A/C WEIGHT AT CRITICAL POINT (KG)	FL FOR DIVERSION	DIVERSION TIME (MIN)				
			60	90	120	150	180
MCT/VMO	50000	160	417	619	821	1024	1227
	55000	160	415	616	817	1018	1220
	60000	160	413	612	811	1011	1211
	65000	130	414	611	809	1007	1205
	70000	110	414	609	805	1001	1198
	75000	110	412	605	799	994	1189
MCT/320KT	50000	160	418	620	822	1025	1228
	55000	160	416	617	818	1019	1221
	60000	150	415	613	813	1012	1212
	65000	140	413	609	807	1005	1203
	70000	130	411	606	801	997	1193
	75000	120	408	601	794	987	1180

R

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING ALL ENGINES-LONG RANGE CRUISE

Including: emergency descent-long range cruise at FL100
final descent 250kt-holding 15 min at FL15
IFR procedure-Go Around-2nd VFR procedure
5% allowance for wind errors
(NAI + WAI + effect of ice accretion + performance factor not included)



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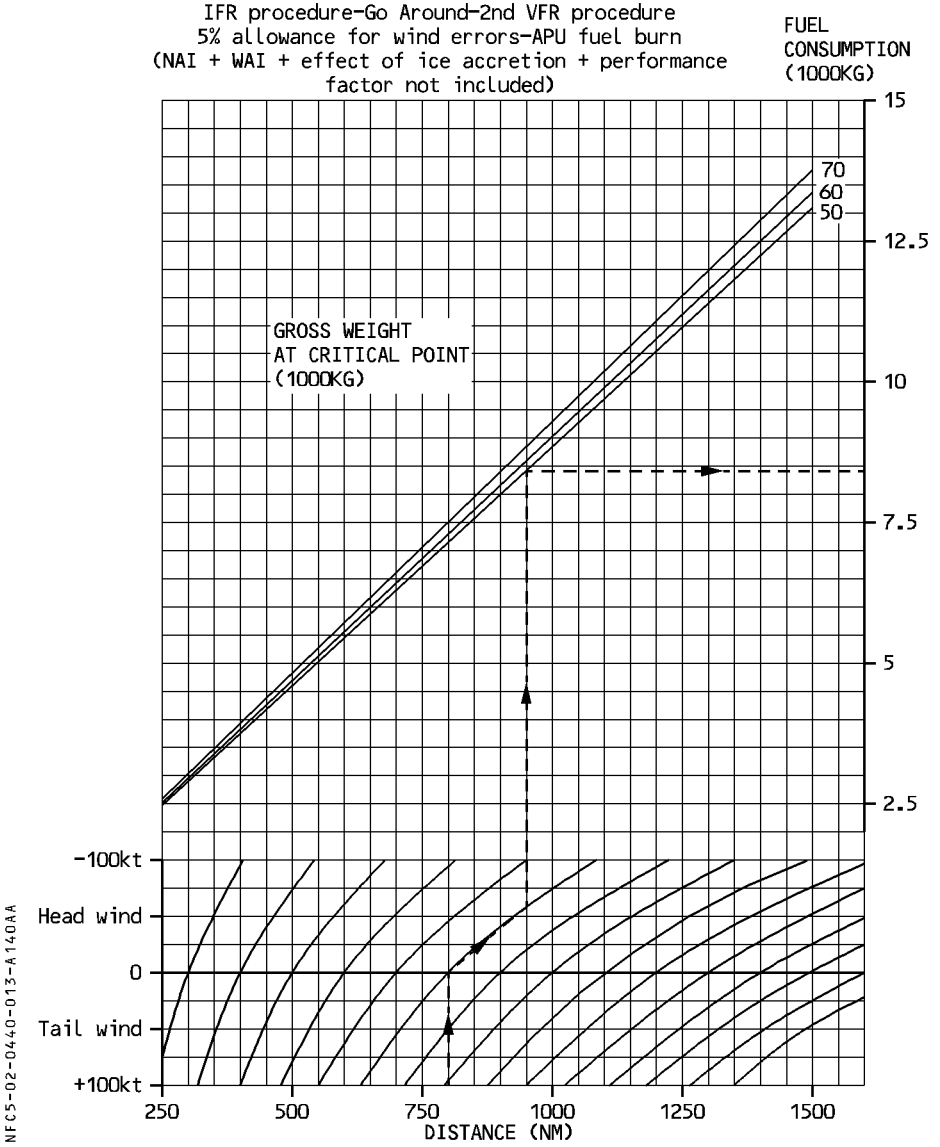
R

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING ONE ENGINE OUT-CRUISE AT 350KT

Including: emergency descent-cruise 350kt at FL100
final descent 250kt-holding 15 min at FL15
IFR procedure-Go Around-2nd VFR procedure
5% allowance for wind errors-APU fuel burn
(NAI + WAI + effect of ice accretion + performance factor not included)



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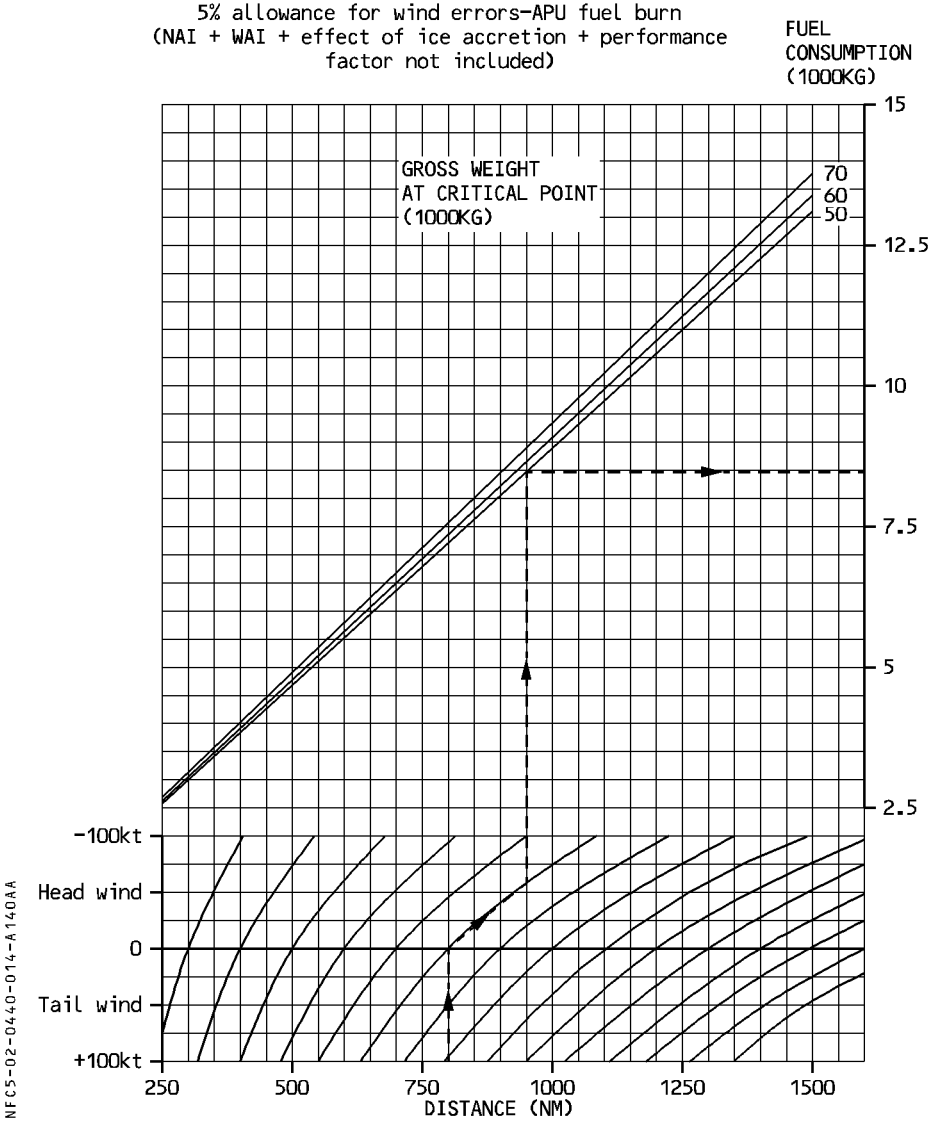
R

ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING ONE ENGINE OUT-CRUISE AT 320KT

Including: emergency descent-cruise 320kt at FL100
final descent 250kt-holding 15 min at FL15
IFR procedure-Go Around-2nd VFR procedure
5% allowance for wind errors-APU fuel burn
(NAI + WAI + effect of ice accretion + performance factor not included)



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GENERAL

This following information are issued to permit the CFM 56-5-B SAC (Single Annular Combustor) and CFM 56-5-B DAC (Double Annular Combustor) engines to be intermixed.

ENGINE PARAMETERS

The engine parameters differ significantly when the engines are at idle :
EGT : up to 250° C higher on the DAC
FUEL FLOW : up to 25 % higher on the DAC
N1 : higher on the DAC
N2 : lower on ground on the DAC, higher in flight on the DAC

CROSS BLEED ENG START

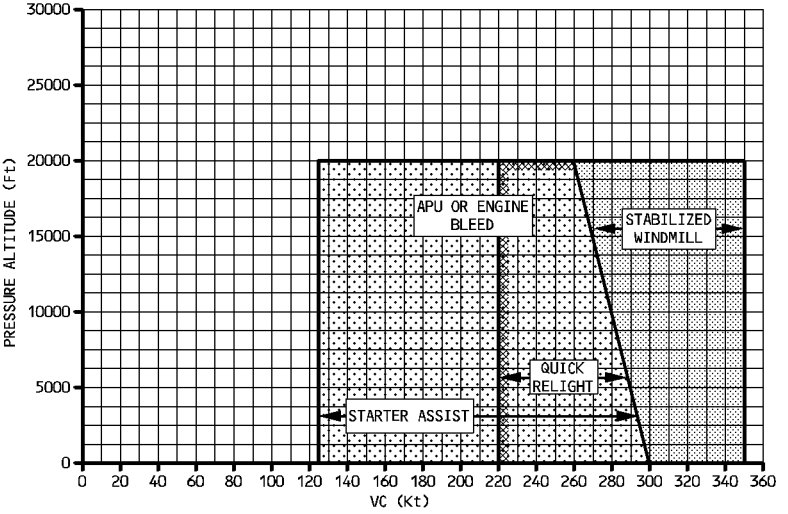
The DAC engine has an insufficient acceleration capability to sustain idle speed with a large bleed off take, when it operates with 20 injectors only. It is therefore necessary to preset a 30 % N1 on the supplying engine before lauching the start sequence.

TAKEOFF PROCEDURE

R
- The PF has to adjust engine thrust progressively in two steps :
  · step 1 : Idle to 50% N1
  brakes released when the 50% N1 is stabilized on both engines.
  · step 2 : both engines N1 to takeoff thrust.
  This procedure allows for a significantly slower acceleration from ground idle to N1 = 50 % for the double annular combustor.
- Other standard operating procedures for takeoff apply.

ENGINE RELIGHT

DAC engine relight envelop is more restrictive than SAC engine relight envelop.
Consequently, DAC engine relight procedure with the corresponding chart must be used in case of engine intermix (see chart below).



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GENERAL

Reduced Vertical Separation Minimum (RVSM) airspace is any airspace or route between FL290 and FL410 (inclusive), where aircraft are vertically separated by 1000 feet, instead of 2000 feet. The aircraft system design complies with the design criteria of the JAA Information Leaflet N° 23, and the FAA 91-RVSM Interim Guidance Material for RVSM operations.
The statement of RVSM capability is also indicated in the AFM.

OPERATIONAL APPROVAL

The above capability statement does not constitute an approval to fly RVSM. Operational approval is to be granted by the Operator's national authorities, after assessment of the airline's capability to meet RVSM requirements. The above-mentioned JAA and FAA documents also cover requirements for obtaining operational approval.

R REQUIRED EQUIPMENT/FUNCTIONS FOR RVSM

R RVSM regulations require the following equipment/functions in order to be operative :
- ADR1 + ADR2 + 2 DMC
- 1 transponder
- 1 Autopilot function
R - 1 FCU channel (for altitude target selection and OP CLB/OP DES mode engagement)
- 2 PFD
- 1 FWC (for altitude alert function)

PROCEDURES

The SOPs (FCOM 3.03) and the ABN and EMER (FCOM 3.02) procedures apply. In addition, flights in RVSM airspace must be completed by the following :

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 airframe is approved for RVSM operations.
- Reported and forecast weather on the flight route.
- 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 any defects of required equipment.
- Check, on ground, that the two primary altitude indications are within tolerances of 3.04.34 (PFD indication from onside ADR or ADR 3).

IN FLIGHT PROCEDURES

PRIOR TO RVSM AIRSPACE ENTRY

The above-listed equipment, required for RVSM, must be operating normally. Should any of this equipment fail prior entering the RVSM airspace, the crew must request new clearance, to avoid flight in this airspace. The two primary altitude indications (PFD indications from ADR1 and ADR2) should be in accordance with the instrument tolerance (3.04.34). If only two ADRs are operative, the altimeter indications on the PFD and standby altimeters should be recorded. This information may be useful in case of subsequent PFD altitude discrepancies, or the loss of both remaining ADRs.

WITHIN RVSM AIRSPACE

- Autopilot should be engaged within RVSM airspace for cruise and flight level changes.
- During cleared transitions between flight levels, the aircraft should not overshoot or undershoot the cleared flight levels by more than 150 feet.
- At intervals of approximately one hour, check that PFD altimeter indications agree in accordance with the instrument tolerance (3.04.34). The usual scan of flight deck instruments should be sufficient.
- Use the transponder and the autopilot, associated with one of the ADRs which is within tolerance.

R

POST FLIGHT

The crew must report any malfunction of the height-keeping systems, including the :
- Malfunction, or loss of any required equipment,
- Altimeter readings outside tolerances specified in 3.04.34,

and must provide sufficient details to enable maintenance to troubleshoot and repair the system.

ABN AND EMER PROCEDURES

When in RVSM airspace, the ATC will be notified of any of the following contingencies which affect the ability to maintain the cleared flight level.

- Failure of both autopilots,
- R Loss of altimeter system redundancy (only one PFD indication remaining), or excessive
- R altimeter discrepancy.
- Failure of any other equipment affecting the ability to maintain the cleared flight level, or
- Encountering greater than moderate turbulence.
- Loss of ADR1 or ADR2. If ADR1 fails, use the AP2, if ADR2 fails, use AP1.
- R If the AP is unable to maintain the assigned altitude, select the other AP.

Note : Appendix 5 of the above-mentioned JAA/FAA regulation contains detailed guidance on contingency procedures for operations in North Atlantic airspace.

If unable to notify the ATC and to obtain ATC clearance prior to deviating from the assigned cleared flight level, the crew should follow the established contingency procedure and obtain ATC clearance as soon as possible.

GENERAL

The aircraft navigation system required by regulation to fly within a Required Navigation Performance (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 on 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.

NAVIGATION SYSTEM CAPABILITY (for reference only)

European BRNAV (RNP-5) capability is shown in compliance with certification requirements of JAA AMJ 20X2.
RNP-10 capability in oceanic or remote areas is shown in compliance with paragraph 12.b (1) of FAA Notice 8400.12a.,or with paragraph 12.a., if GPS is installed and is operative.
Navigation system with GPS PRIMARY function (if GPS installed) meets certification requirements of FAA AC 20-130A and TSO C 129A in class C1 (for navigation system with multiple sensor inputs including GPS).

RNP CAPABILITY

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 MCDU PROG page the required and the estimated position accuracy are displayed and determine the HIGH/LOW accuracy indication (refer to FCOM 1.22.20).
The required accuracy can be either the default value, which is a function of the phase 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 avilable,
  - if the crosscheck 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.

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 1.2NM(1) is manually entered in MCDU.
- RNP-0.3 in approach provided a required accuracy of 0.36NM(1) is manually entered in MCDU.

Note : (1) Radial equivalent to the specified Cross Track/Along Track (XTK/ATK) accuracy

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

BRNAV IN EUROPEAN AIRSPACE

In this airspace the radio navaid coverage is assumed to support RNP-5 accuracy.
The minimum required equipment to enter BRNAV airspace is :

- One RNAV system which means :
  - One FMGC
  - One MCDU
  - One VOR for FM navigation update
  - One DME for FM navigation update
  - One IRS
- Flight Plan Data on 2 ND

PROCEDURES

Except when GPS PRIMARY is available, crosscheck periodically the FM position with navaid raw data.
The manual selection of a required accuracy on MCDU is optional.

- **If manual entry of a required accuracy is desired, use the radial equivalent to 5NM XTK/ATK accuracy that is 6.1NM.**
  When leaving the RNP-5 airspace, or when entering terminal area, revert to the default required accuracy or enter appropriate value on MCDU.

Check navigation accuracy with navaid raw data or GPS MONITOR page (if GPS installed), if one of the following MCDU or ECAM messages is displayed :
- NAV ACCUR DOWNGRAD
- FMS1/FMS2 POS DIFF
- CHECK A/C POSITION
- ECAM : FM/GPS POS DISAGREE (if GPS installed)

- **If accuracy check confirms that RNP-5 capability is lost or if both FMGC are failed : inform ATC and revert to conventional navigation.**
- **If accuracy check confirms that only one FMGC position is incorrect, resume navigation with the other FMGC.**

In IRS ONLY navigation, the BRNAV capability is kept during 2 hours independently of the estimated accuracy displayed on MCDU.

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.
For aircraft without GPS the flight time outside radio navaid coverage is limited. According to FAA Notice 8400.12A this limitation is :
- 6.2 hours since IRS ground alignment, or
- 5.7 hours since last FM radio update.

There is no limitation for aircraft fitted with GPS.
Minimum required equipment to enter a RNP-10 airspace is :
- 2 long range navigation systems, which means :
  - 2 FMGC
  - 2 MCDU
R - 1 GPS 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.

PROCEDURES

The manual selection of a required accuracy on MCDU is optional.

- **If manual entry of a required accuracy is desired, use the radial equivalent to 10NM XTK/ATK accuracy that is 12.2NM.**
- **When leaving the RNP-10 airspace, revert to the default required accuracy or enter appropriate value.**

Check navigation with POSITION MONITOR page, ISDU and GPS MONITOR page (if GPS installed), if one of the following MCDU or ECAM messages is displayed :

– FMS1/FMS2 POS DIFF
– CHECK A/C POSITION
– ECAM : FM/GPS POS DISAGREE (if GPS installed)

- **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 soon 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 MCDU.

GENERAL

The nominal runway width is 45 m. Operations on runways having a width less than 45 m requires authorization from the appropriate authorities.

INTRODUCTION

Use this flight planning chapter when no precalculated flight plan is available.
It contains the following general graphs and tables :
– Maximum and optimum cruise altitudes for M.78 and long range speed
– Optimum altitude on short stage
– Ground mile to air mile conversion for M.78 and long range speed
The integrated range method includes the following tables :
– Integrated cruise tables for M.78 for flight levels from FL290 to FL390,
– Integrated cruise tables for long range speed for flight levels from FL100 to FL390,
– Climb, step climb and descent correction tables.
These tables allow the flight planning to be done segment by segment.
Chapter 2.05.15 contains calculation tables and a comprehensive example to show how to use them.
The quick determination method is shown in chapter 2.05.40 for M.78 and long range speed.

MINIMUM RECOMMENDED FUEL REQUIREMENTS

The total fuel quantity required to fly a given sector is the sum of the following quantities:

TAXI FUEL

Quantity required for startup and taxi. Fuel calculation is based on a consumption of **10 kg/min** or **22 lb/min**
Average quantity (12 minutes) → **120 kg** or **265 lb**

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 1500 feet above destination airport.
- Approach and landing. Fuel calculation is based on a consumption of **17 kg/min** or **40 lb/min**.
  Average quantity (6 minute IFR) → **110 kg** or **240 lb**

RESERVE FUEL

This quantity includes :

"En Route" reserve fuel (contingency fuel)
· According to national regulations and company policy (generally based on a percentage of trip fuel).

Alternate fuel
· Fuel required to fly from destination to alternate airport.
It includes go-around **80 kg** or **180 lb** , climb to cruising level, cruise at long range speed, descent and approach procedure.
60 kg or 140 lb for 4 minute VFR

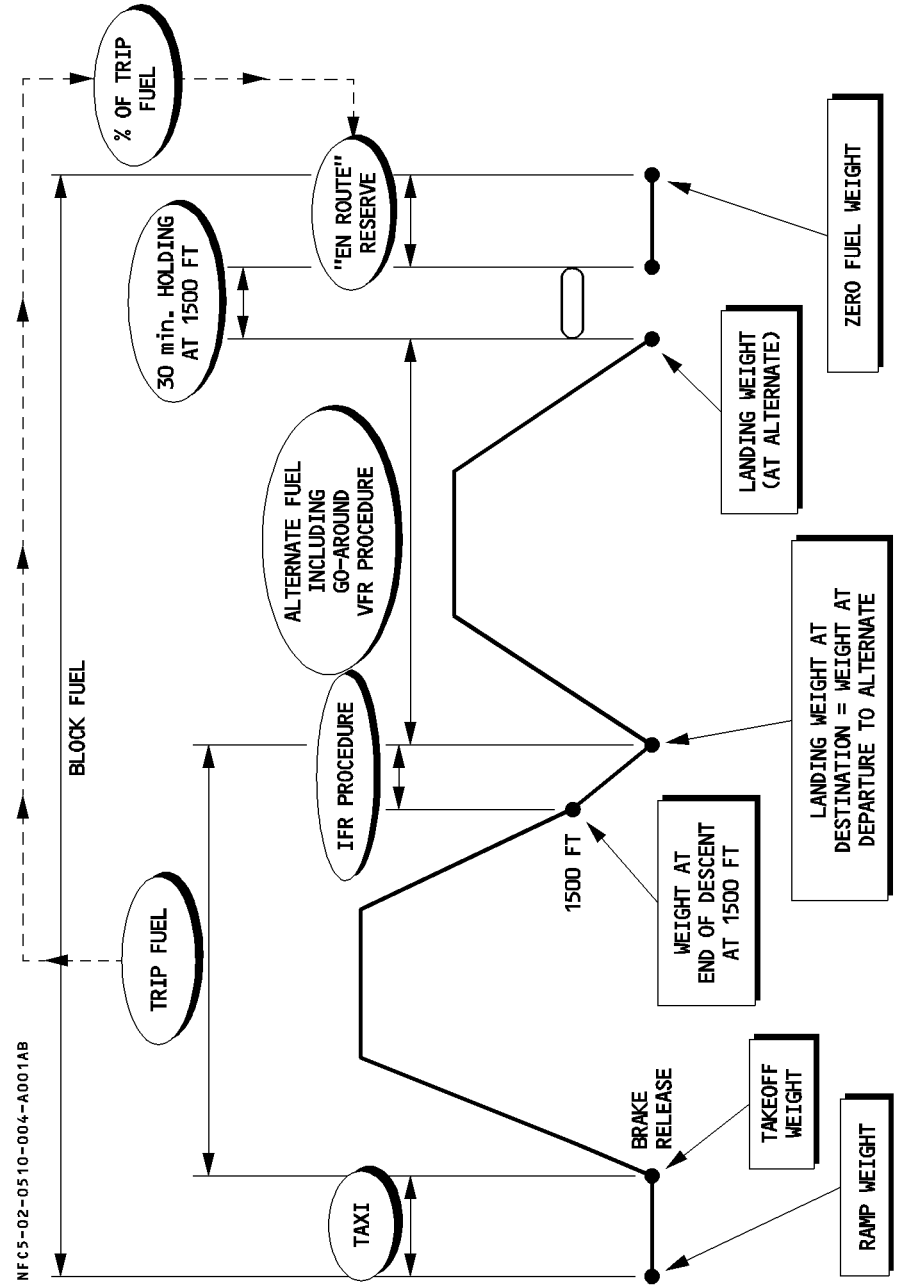
Holding Fuel
Calculation of holding fuel should take into account the altitude of the alternate and the landing weight at the alternate, using holding charts of chapter 3.05.25.
A conservative quantity corresponding to a 30 minute holding at 1500 feet above alternate airport elevation and "green dot" speed in the clean configuration is **1150 kg** or **2600 lb** .

APU FUEL

During ground operations, APU fuel consumption is about **130 Kg/h** or **290 lb/h** (Packs on, 90 KVA load on APU GEN).

FLIGHT PLAN

When no precalculated flight plan is available, flight planning can be determined by using the tables given in this chapter.
Fuel policy will be the same as for precalculated flight plan.
The graph on the following page defines the different terms used in this chapter.


% OF TRIP FUEL
"EN ROUTE" RESERVE
30 min. HOLDING AT 1500 FT
ALTERNATE FUEL INCLUDING GO-AROUND VFR PROCEDURE
IFR PROCEDURE
BLOCK FUEL
TRIP FUEL
TAXI
1500 FT
BRAKE RELEASE
ZERO FUEL WEIGHT
LANDING WEIGHT (AT ALTERNATE)
LANDING WEIGHT AT DESTINATION = WEIGHT AT DEPARTURE TO ALTERNATE
WEIGHT AT END OF DESCENT AT 1500 FT
TAKEOFF WEIGHT
RAMP WEIGHT
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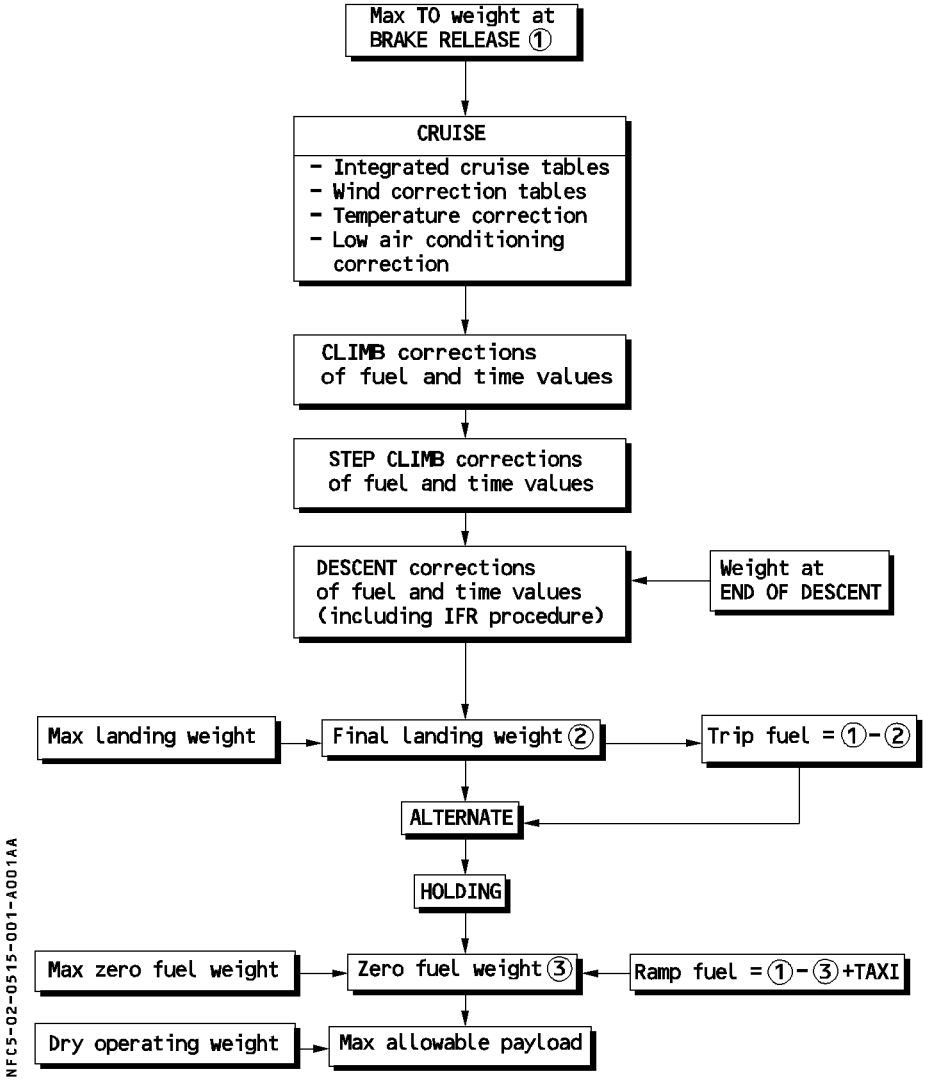
GENERAL


Max TO weight at BRAKE RELEASE ①
CRUISE
- Integrated cruise tables
- Wind correction tables
- Temperature correction
- Low air conditioning correction
CLIMB corrections of fuel and time values
STEP CLIMB corrections of fuel and time values
DESCENT corrections of fuel and time values (including IFR procedure)
Weight at END OF DESCENT
Max landing weight
Final landing weight ②
Trip fuel = ① - ②
ALTERNATE
HOLDING
Max zero fuel weight
Zero fuel weight ③
Ramp fuel = ① - ③ + TAXI
Dry operating weight
Max allowable payload
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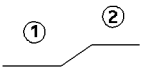
The following tables can be used for the flight planning.
The first table allows the planner to calculate fuel and time during cruise, with a possible step climb (see p 3).
The second table shows the fuel and time planning for the whole flight plan (see p 4).
At the end of the section an example shows how to use both tables for a given mission.

Note :
- *Differences in fuel consumption during step climb sections will be taken into account in the calculation table of page 4.*
- *To find optimum aircraft weight to proceed to next flight level (4000 feet step) (Refer to 2.05.20 p 2).*
- *Integrated cruise tables are established for ISA conditions only. Corrections due to differences from ISA temperature are included in the calculation table of page 4.*
- *Overhead departure weight is assumed to be equal to weight at brake release.*
- *Overhead destination weight must be entered in the calculation table of page 4.*

CALCULATION TABLE

MACHNUMBER	
INITIAL FLIGHT LEVEL:	
GROUND DISTANCE:	
WIND ('-' HEAD/'+' TAIL):	
AIR DISTANCE:	

FLIGHT PROFILE



FL:

OVERHEAD DEPARTURE
WEIGHT:
DISTANCE:
TIME:

START OF STEP CLIMB
WEIGHT:
DISTANCE:
TIME:

1

FUEL:
DISTANCE:
TIME:
REMAINING DISTANCE:

FL:

BEGIN OF FINAL CRUISE SEGMENT
WEIGHT:
DISTANCE:
TIME:

OVERHEAD DESTINATION
WEIGHT:
DISTANCE:
TIME:

2

FUEL:
DISTANCE:
TIME:
REMAINING DISTANCE:

REMAINING DISTANCE:

TOTAL VALUES	
WEIGHT OVERHEAD DEPARTURE:	
WEIGHT OVERHEAD DESTINATION:	
FUEL:	
TIME:	

NFC5-02-0515-003-A001AA

1	(1) Max TO Weight at BRAKE RELEASE ▼	▶					•	
2	WEIGHT Overhead Destination	▶					•	
3	– Temperature Correction for CRUISE	–					•	
4	+ Correction for Low Air Conditioning	+					•	
5	– CLIMB correction	–					•	
6	+ TO Altitude correction	+					•	
7	– STEP CLIMB correction	–					•	
8	= Corrected Weight Overhead Destination	=					•	
9	+ DESCENT correction (including 6 min IFR)	+					•	
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	=					•	
18	– OPERATING WEIGHT EMPTY	–					•	
19	= Max Allowable Payload	=					•	

BLOCK FUEL CALCULATION								
20	Required Fuel (1) – (3)	▶					•	
21	+ Taxi	+					•	
22	= Block Fuel	=					•	

FLIGHT TIME CALCULATION (H. MIN)								
23	Time from integrated Cruise Tables	▶				•		
24	+ CLIMB Correction	+				•		
25	+ DESCENT Correction (including 6 min IFR)	+				•		
26	= Flight Time	=				•		

Note : Line 3 : temperature correction :
0.015 (kg/°C/NM) × △ISA (°C) × air distance (NM) or
0.033 (lb/°C/NM) × △ISA (°C) × air distance (NM)

Line 6 : TO altitude correction :
0.5 (kg/1000 kg/1000 ft) × TOW (1000 kg) × airport elevation (1000 ft) or
0.5 (lb/1000 lb/1000 ft) × TOW (1000 lb) × airport elevation (1000 ft)

Line 10 : Check that landing weight at destination is lower than maximum landing weight.

Line 17 : Check that the zero fuel weight is lower than maximum zero fuel weight.

Line 22 : Check that the block fuel value is lower than maximum tank capacity.

Example

DATA
- TO weight : 72000 kg
- Ground distance to destination : 2000 NM
- Wind : – 50 kt (head wind)
- Selected initial FL : 350
- Mach number : M.78
- Temperature : ISA + 10

DETERMINATION OF CRUISE FUEL AND TIME

A : Enter the chosen flight Mach number, flight level, ground distance to be covered and forecast windspeed in the calculation table of page 7.
Calculate the air distance (see 2.05.60 P 2)
here : M.78, 50 kt head wind, 2000 NM ground distance
→ air distance : 2248 NM

CRUISE TABLE FL350

B : Read from integrated cruise table (M.78, FL350) the values for time and distance for a weight of 72000 kg (see 2.05.30 P 5) :
→ distance : 6518 NM → time : 870 min

R C : Read from 2.05.20 P 1 the value for the optimum aircraft weight to proceed to
R FL390 → 62000 kg

D : Enter integrated cruise table (M.78, FL350) and read the values for a weight of
R 62000 kg (begin of first step climb)
R → distance : 4667 NM → time : 623 min

E : Calculate the values for the first cruise segment :
R Fuel : 72000 – 62000 = 10000 kg
R Distance : 6518 – 4667 = 1851 NM
R Time : 870 – 623 = 247 min
R Remaining distance : 2248 – 1851 = 397 NM

CRUISE TABLE FL390

F : Read from integrated cruise table (M.78, FL390) the values for time and
R distance for the weight of 62000 kg (2.05.30 P 7)
R → distance : 5088 NM → time : 682 min

R G : Subtract remaining distance : 5088 – 397 = 4691 NM

H : Interpolate in integrated cruise table (M.78, FL390) the weight and time values
R corresponding to the distance of 4691 NM
R → weight : 60000 kg → time : 629 min

I : Calculate values for the second cruise segment :
R Fuel : 62000 – 60000 = 2000 kg
R Distance : 5088 – 4691 = 397 NM
R Time : 682 – 629 = 53 min

Crosscheck that remaining air distance equals zero.

J : Fill in the final table with weight overhead departure (72000 kg) and weight
R overhead destination (60000 kg).

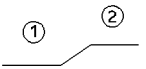
K : Calculate total values :
R Fuel : 72000 – 60000 = 12000 kg
R Time : 247 + 53 = 300 min = 5 h 00 min

R

CALCULATION TABLE

MACHNUMBER	0.78
INITIAL FLIGHT LEVEL:	350
GROUND DISTANCE:	2000 NM
WIND ('-' HEAD/'+' TAIL):	-50 KT
AIR DISTANCE:	2248 NM

FLIGHT PROFILE



FL: 350

OVERHEAD DEPARTURE	
WEIGHT:	72000 Kg
DISTANCE:	6518 NM
TIME:	870 Min

START OF STEP CLIMB	
WEIGHT:	62000 Kg
DISTANCE:	4667 NM
TIME:	623 Min

1

FUEL:	10000 Kg
DISTANCE:	1851 NM
TIME:	247 Min
REMAINING DISTANCE:	397 NM

FL: 390

BEGIN OF FINAL CRUISE SEGMENT	
WEIGHT:	62000 Kg
DISTANCE:	5088 NM
TIME:	682 Min

OVERHEAD DESTINATION	
WEIGHT:	60000 Kg
DISTANCE:	4691 NM
TIME:	629 Min

2

FUEL:	2000 Kg
DISTANCE:	397 NM
TIME:	53 Min
REMAINING DISTANCE :	0 NM

REMAINING DISTANCE: 397 NM

TOTAL VALUES	
WEIGHT OVERHEAD DEPARTURE:	72000 Kg
WEIGHT OVERHEAD DESTINATION:	60000 Kg
FUEL:	12000 Kg
TIME:	300 Min

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DATA
- TO weight : 72000 kg
- Ground distance to destination : 2000 NM
- Wind : – 50 kt (headwind)
- Selected first flight level : FL350
- M.78
- Temperature : ISA + 10 along the whole flight profile
- Airport elevation : 1500 ft
- Normal air conditioning

STEPS :

1 : Fill in Max TO weight → 72000 kg

2 : Enter the integrated cruise table corresponding to the chosen FL with TO weight at brake release point and calculate weight overhead destination. (See
R 2.05.15 P 7). Fill in → 60000 kg

3 : Apply temperature correction for given air distance :
2248 NM × 10°C × 0.015 kg/°C/NM = 337 kg (enter 400 kg into table)

4 : Correction for low air conditioning → here = 0

5 : Subtract climb correction for chosen FL (see 2.05.30 P 23) → 1000 kg

6 : Add TO altitude correction 0.5 × 72 × 1.5 = 54 kg (enter 0.1 into table)

7 : Subtract value for step climb correction : 70 kg (enter 0.1 into table)

R 8 : Calculate corrected weight overhead destination → 58600 kg

9 : Enter weight overhead destination and find descent correction (including 6min IFR) (see 2.05.30 P 24) → 100 kg

R 10 : Calculate landing weight at destination → 58700 kg

R 11 : Subtract alternate fuel, e.g. : 100 NM at FL100
R (see 2.05.50 P 2) → 961 kg
R Landing weight at alternate → 58700 – 961 = 57739 kg
R Correction due to deviation from reference landing weight at alternate (see
R 2.05.50 p 2) → 6 × (57.7 – 50) = 46.2 kg
R Corrected alternate fuel → 1008 kg

R 12 : Calculate alternate landing weight → 57600 kg

R 13 : Subtract holding fuel (Refer to 3.05.25) → 1140 kg

R 14 : Calculate weight at end of holding → 56400 kg

R 15 : Calculate trip fuel → 13300 kg

R 16 : Subtract "En Route" reserve (standard amount is 5 % of trip fuel) → 665 kg

R 17 : Calculate zero fuel weight → 55700 kg

18-19 : Subtract dry operating weight to obtain maximum allowable payload.

R 20-22 : Calculate ramp fuel (see 2.05.10 P 2 for taxi fuel).

R 23-26 : Calculate flight time (see 2.05.15 P 7, 2.05.30 P 23, 2.05.30 P 24).

R

1	(1) Max TO Weight at BRAKE RELEASE ▼	▶		7	2	•	0
2	WEIGHT Overhead Destination	▶		6	0	•	0
3	– Temperature Correction for CRUISE	–			0	•	4
4	+ Correction for Low Air Conditioning	+				•	0
5	– CLIMB correction	–			1	•	0
6	+ TO Altitude correction	+			0	•	1
7	– STEP CLIMB correction	–			0	•	1
8	= Corrected Weight Overhead Destination	=		5	8	•	6
9	+ DESCENT correction (including 6 min IFR)	+			0	•	1
10	(2) Landing Weight at Destination	=		5	8	•	7
11	– ALTERNATE Fuel	–			1	•	1
12	= ALTERNATE Landing Weight	=		5	7	•	6
13	– HOLDING	–			1	•	2
14	= Weight at END OF HOLDING	=		5	6	•	4
15	TRIP FUEL (1) – (2) 1 3 • 3	//////////////					
16	– "En Route" Reserve	–			0	•	7
17	(3) ZERO FUEL WEIGHT	=		5	5	•	7
18	– OPERATING WEIGHT EMPTY	–		4	1	•	3
19	= Max Allowable Payload	=		1	4	•	4

	BLOCK FUEL CALCULATION						
20	Required Fuel (1) – (3)	▶		1	6	•	1
21	+ Taxi	+			0	•	2
22	= Block Fuel	=		1	6	•	3

R

	FLIGHT TIME CALCULATION (H. MIN)						
23	Time from integrated Cruise Tables	▶		5	•	0	0
24	+ CLIMB Correction	+		0	•	0	5
25	+ DESCENT Correction (including 6 min IFR)	+		0	•	1	0
26	= Flight Time	=		5	•	1	5

Note : Line 3 : temperature correction :
0.015(kg/°C/NM) × △ISA (°C) × air distance (NM)

Line 6 : TO altitude correction :
0.5 (kg/1000 kg/1000 ft) × TOW (1000 kg) × airport elevation (1000 ft).

Line 10 : Check that landing weight at destination is lower than maximum landing weight.

Line 17 : Check that the zero fuel weight is lower than maximum zero fuel weight.

Line 22 : Check that the block fuel value is lower than maximum tank capacity.

OPTIMUM AND MAXIMUM ALTITUDES

DEFINITIONS

- Optimum altitude : The altitude at which the airplane covers the maximum distance per kilogram (pound) of fuel (best specific range). It depends on the actual weight and deviation from ISA.
- Maximum altitude is defined as the lower of :
  - maximum altitude at maximum cruise thrust in level flight and
  - maximum altitude at maximum climb thrust with 300 feet/minute vertical speed.

Note : Definition of the maximum altitude in the FMGC is different (Refer to FCOM 4).

CRUISE LEVEL CHARTS

These charts have been established for a center of gravity at 33 % MAC.
Maximum and optimum altitudes are given for different temperatures at long range speed and M.78.

Note : The n = 1.3 g (1.4 g) curve indicates the buffet margin.

R **OPTIMUM WEIGHT FOR 4000 FEET STEP CLIMB**

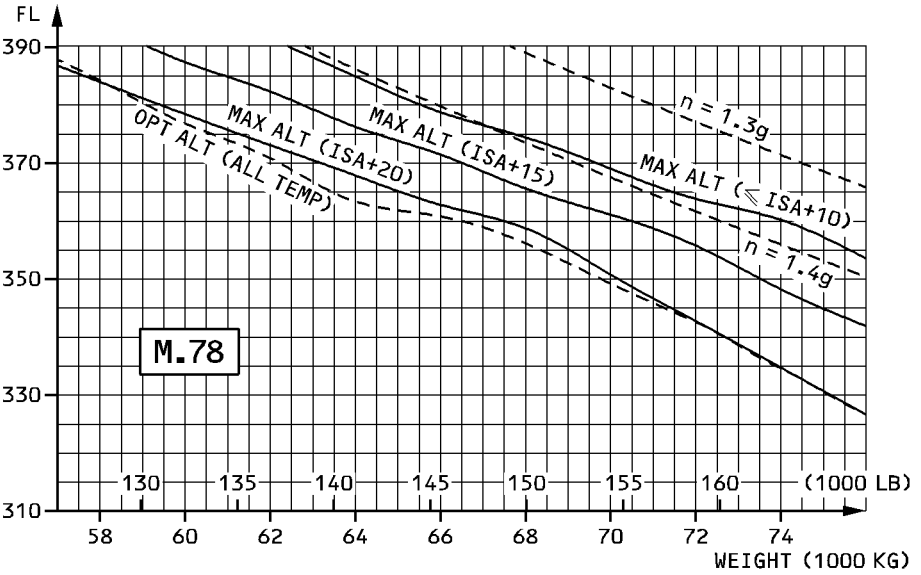
R

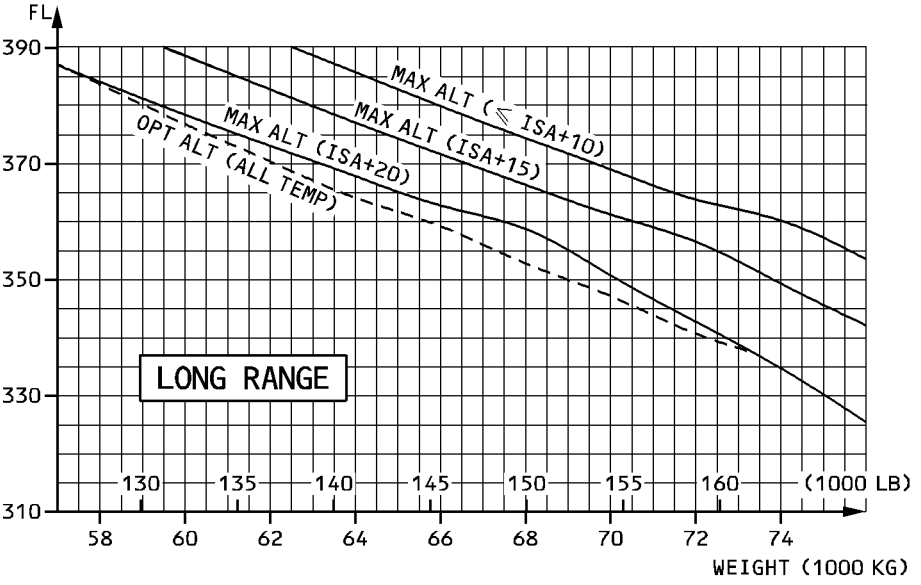
STEP CLIMB FROM/TO	WEIGHT (1000 kg/1000 lb)					
	≤ ISA + 10		ISA + 15		ISA + 20	
	LR	M.78	LR	M.78	LR	M.78
310/350	76/167	76/167	74/163	74/163	70/154	70/154
330/370	70/154	70/154	67/147	67/147	63/138	63/138
350/390	62/136	62/136	59/130	59/130	56/123	56/123

BLEED CORRECTIONS

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

R





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OPTIMUM ALTITUDE ON SHORT STAGE

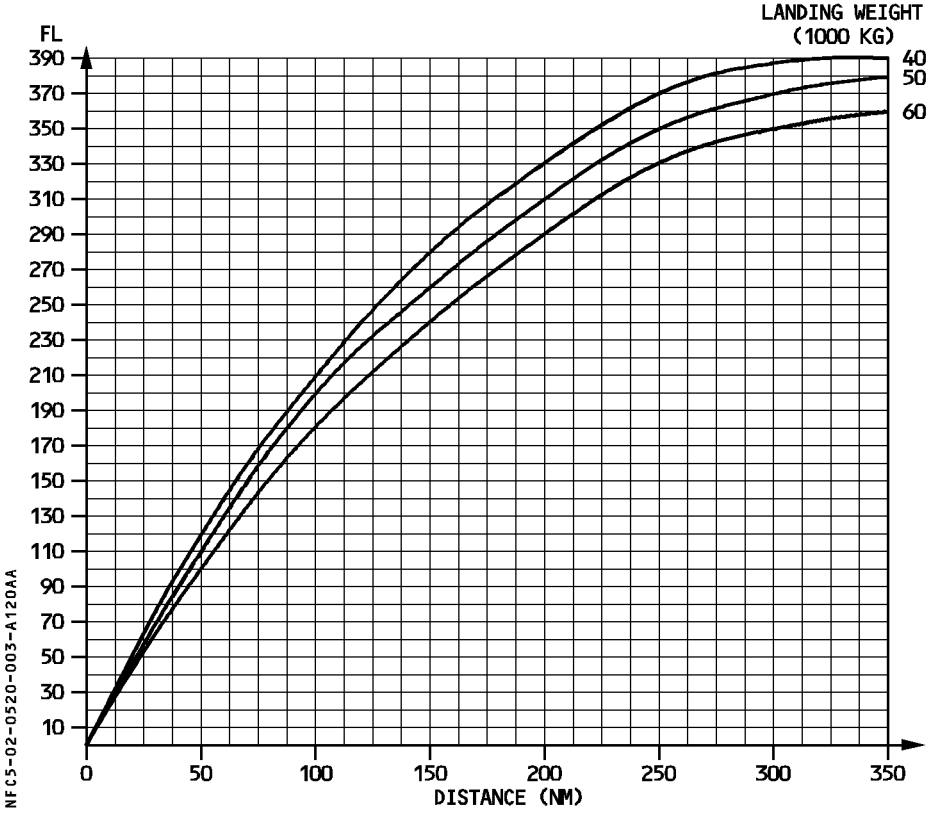
According to the air distance (from brake release point to landing), the cruise flight level is limited by the distance required to perform climb and descent. The graph determines the optimum altitude.

It includes the following profiles:

- Takeoff
- Climb: 250KT/300KT/M.78
- Long range cruise (during at least 5 minutes)
- Descent: M.78/300KT/250kt
- Approach and landing

and it is established for:

- ISA
- CG = 33 %
- Normal air conditioning
- Anti ice OFF



GENERAL

Integrated cruise tables allow the planner to calculate the cruise fuel consumption and the cruise time required to cover a given air distance.
In the tables, the difference between two gross weights represents the fuel consumption. The difference between the corresponding distances and times respectively represents the cruise distance covered and the cruise time for this fuel consumption.
Integrated cruise tables are established for M.78 at fixed levels from FL290 to FL390 and for long range speed at fixed levels from FL100 to FL390.
Corrections are given on separate tables to allow for step climbs and to take into account the climb and the descent phases.

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 462KT

DISTANCE (NM)
TIME (MIN)

M.78 FL290

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	36 5	73 9	109 14	145 19	182 24	218 28	254 33	290 38	326 42
42	363 47	399 52	435 57	471 61	507 66	543 71	579 75	615 80	651 85	687 89
44	723 94	759 99	795 103	831 108	867 113	903 117	939 122	975 127	1011 131	1046 136
46	1082 141	1118 145	1154 150	1189 155	1225 159	1261 164	1297 169	1332 173	1368 178	1403 182
48	1439 187	1475 192	1510 196	1546 201	1581 206	1617 210	1652 215	1688 219	1723 224	1759 229
50	1794 233	1829 238	1865 242	1900 247	1935 252	1971 256	2006 261	2041 265	2076 270	2111 274
52	2147 279	2182 284	2217 288	2252 293	2287 297	2322 302	2357 306	2392 311	2427 315	2462 320
54	2497 325	2532 329	2566 334	2601 338	2636 343	2671 347	2706 352	2740 356	2775 361	2810 365
56	2845 370	2879 374	2914 379	2948 383	2983 388	3018 392	3052 397	3086 401	3121 406	3155 410
58	3190 415	3224 419	3258 423	3293 428	3327 432	3361 437	3396 441	3430 446	3464 450	3498 455
60	3532 459	3566 463	3600 468	3634 472	3668 477	3702 481	3736 486	3770 490	3804 494	3838 499
62	3872 503	3905 508	3939 512	3973 516	4007 521	4040 525	4074 529	4108 534	4141 538	4175 543
64	4208 547	4242 551	4275 556	4308 560	4342 564	4375 569	4408 573	4442 577	4475 582	4508 586
66	4541 590	4574 595	4608 599	4641 603	4674 607	4707 612	4740 616	4773 620	4806 625	4838 629
68	4871 633	4904 637	4937 642	4970 646	5002 650	5035 654	5068 659	5100 663	5133 667	5166 671
70	5198 676	5231 680	5263 684	5296 688	5328 692	5360 697	5393 701	5425 705	5457 709	5489 713
72	5522 718	5554 722	5586 726	5618 730	5650 734	5682 738	5714 743	5746 747	5778 751	5809 755
74	5841 759	5873 763	5905 767	5936 772	5968 776	6000 780	6031 784	6063 788	6094 792	6126 796
76	6157 800	6189 804	6220 808	6251 812	6283 817	6314 821	6345 825	6376 829	6407 833	6438 837

LOW AIR CONDITIONING
△FUEL = – 0.6 %

ENGINE ANTI ICE ON
△FUEL = + 2.5 %

TOTAL ANTI ICE ON
△FUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 458KT

DISTANCE
(NM)
TIME (MIN)

M.78 FL310

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	39 5	78 10	117 15	156 20	195 26	234 31	273 36	312 41	351 46
42	390 51	429 56	468 61	507 66	546 72	584 77	623 82	662 87	701 92	739 97
44	778 102	817 107	855 112	894 117	933 122	971 127	1010 132	1048 137	1087 142	1125 147
46	1164 153	1202 158	1240 163	1279 168	1317 173	1355 178	1394 183	1432 188	1470 193	1508 198
48	1546 203	1584 208	1623 213	1661 218	1699 223	1737 228	1775 233	1813 238	1851 243	1888 248
50	1926 253	1964 257	2002 262	2040 267	2077 272	2115 277	2153 282	2190 287	2228 292	2266 297
52	2303 302	2341 307	2378 312	2416 317	2453 322	2491 327	2528 331	2565 336	2602 341	2640 346
54	2677 351	2714 356	2751 361	2788 366	2826 370	2863 375	2900 380	2937 385	2974 390	3010 395
56	3047 400	3084 404	3121 409	3158 414	3195 419	3231 424	3268 428	3304 433	3341 438	3378 443
58	3414 448	3451 452	3487 457	3523 462	3560 467	3596 471	3632 476	3669 481	3705 486	3741 490
60	3777 495	3813 500	3849 505	3885 509	3921 514	3957 519	3993 523	4029 528	4065 533	4101 538
62	4136 542	4172 547	4208 552	4243 556	4279 561	4315 566	4350 570	4386 575	4421 580	4456 584
64	4492 589	4527 593	4562 598	4598 603	4633 607	4668 612	4703 617	4738 621	4773 626	4808 630
66	4843 635	4878 639	4913 644	4948 649	4982 653	5017 658	5052 662	5086 667	5121 671	5156 676
68	5190 680	5225 685	5259 689	5293 694	5328 698	5362 703	5396 707	5430 712	5465 716	5499 721
70	5533 725	5567 730	5601 734	5635 739	5669 743	5702 748	5736 752	5770 756	5804 761	5837 765
72	5871 770	5904 774	5938 778	5971 783	6005 787	6038 792	6071 796	6105 800	6138 805	6171 809
74	6204 813	6237 818	6270 822	6303 826	6336 831	6369 835	6402 839	6434 844	6467 848	6500 852
76	6532 856	6565 861	6597 865	6629 869	6662 873	6694 878	6726 882	6758 886	6791 890	6823 894

LOW AIR CONDITIONING
ΔFUEL = – 0.6 %

ENGINE ANTI ICE ON
ΔFUEL = + 2.5 %

TOTAL ANTI ICE ON
ΔFUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 454KT

DISTANCE (NM)
TIME (MIN)

M.78 FL330

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	42 6	84 11	126 17	168 22	210 28	252 33	294 39	336 44	378 50
42	420 56	461 61	503 67	545 72	587 78	628 83	670 89	711 94	753 100	794 105
44	836 111	877 116	919 122	960 127	1002 132	1043 138	1084 143	1125 149	1166 154	1208 160
46	1249 165	1290 171	1331 176	1372 181	1413 187	1454 192	1495 198	1536 203	1576 208	1617 214
48	1658 219	1699 225	1739 230	1780 235	1821 241	1861 246	1902 252	1942 257	1983 262	2023 268
50	2064 273	2104 278	2144 284	2184 289	2225 294	2265 300	2305 305	2345 310	2385 315	2425 321
52	2465 326	2505 331	2545 337	2584 342	2624 347	2664 352	2704 358	2743 363	2783 368	2822 373
54	2862 379	2901 384	2941 389	2980 394	3019 399	3059 405	3098 410	3137 415	3176 420	3215 425
56	3254 430	3293 436	3332 441	3371 446	3410 451	3449 456	3488 461	3526 466	3565 471	3604 477
58	3642 482	3681 487	3719 492	3758 497	3796 502	3835 507	3873 512	3911 517	3949 522	3987 527
60	4025 532	4063 537	4101 542	4139 547	4177 552	4215 557	4253 562	4290 567	4328 572	4366 577
62	4404 582	4441 587	4478 592	4516 597	4553 602	4591 607	4628 612	4665 617	4702 622	4739 627
64	4776 632	4813 637	4850 641	4887 646	4924 651	4961 656	4997 661	5034 666	5071 671	5107 675
66	5144 680	5180 685	5216 690	5253 695	5289 700	5325 704	5361 709	5397 714	5433 719	5469 723
68	5505 728	5541 733	5577 738	5613 742	5648 747	5684 752	5719 756	5755 761	5790 766	5826 770
70	5861 775	5896 780	5931 784	5966 789	6001 794	6036 798	6071 803	6105 807	6140 812	6175 817
72	6210 821	6244 826	6278 830	6313 835	6347 839	6381 844	6416 849	6450 853	6484 858	6518 862
74	6552 867	6585 871	6619 875	6653 880	6686 884	6720 889	6753 893	6787 898	6820 902	6853 906
76	6887 911	6919 915	6952 919	6985 924	7018 928	7051 933	7084 937	7116 941	7149 945	7181 950

LOW AIR CONDITIONING
△FUEL = – 0.6 %

ENGINE ANTI ICE ON
△FUEL = + 2.5 %

TOTAL ANTI ICE ON
△FUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 450KT

DISTANCE (NM)
TIME (MIN)

M.78 FL350

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	45 6	90 12	135 18	180 24	225 30	270 36	315 42	360 48	405 54
42	450 60	495 66	539 72	584 78	629 84	673 90	718 96	762 102	807 108	851 114
44	896 120	940 125	984 131	1028 137	1072 143	1117 149	1161 155	1205 161	1249 167	1293 172
46	1337 178	1380 184	1424 190	1468 196	1512 202	1555 208	1599 213	1642 219	1686 225	1729 231
48	1773 237	1816 242	1859 248	1902 254	1946 260	1989 265	2032 271	2075 277	2118 283	2161 288
50	2203 294	2246 300	2289 305	2331 311	2374 317	2417 323	2459 328	2502 334	2544 340	2587 345
52	2629 351	2671 356	2713 362	2755 368	2798 373	2840 379	2881 385	2923 390	2965 396	3007 401
54	3049 407	3090 412	3132 418	3174 424	3215 429	3257 435	3298 440	3339 446	3380 451	3422 457
56	3463 462	3504 468	3545 473	3586 479	3627 484	3668 489	3708 495	3749 500	3789 506	3830 511
58	3871 517	3911 522	3951 527	3992 533	4032 538	4072 543	4112 549	4152 554	4192 559	4232 565
60	4272 570	4312 575	4351 581	4391 586	4431 591	4470 597	4510 602	4549 607	4588 612	4627 618
62	4667 623	4706 628	4744 633	4783 638	4822 644	4861 649	4900 654	4938 659	4977 664	5015 669
64	5054 674	5092 679	5130 685	5168 690	5206 695	5244 700	5282 705	5320 710	5357 715	5395 720
66	5433 725	5470 730	5507 735	5545 740	5582 745	5619 750	5656 755	5693 760	5730 765	5767 770
68	5804 775	5840 779	5877 784	5913 789	5950 794	5986 799	6022 804	6058 808	6094 813	6130 818
70	6166 823	6201 828	6237 832	6272 837	6308 842	6343 846	6378 851	6413 856	6448 861	6483 865
72	6518 870	6553 874	6587 879	6622 884	6656 888	6691 893	6725 897	6759 902	6793 907	6827 911
74	6861 916	6895 920	6929 925	6962 929	6996 934	7029 938	7063 943	7096 947	7129 951	7162 956
76	7195 960	7228 965	7261 969	7293 973	7326 978	7359 982	7391 986	7423 991	7456 995	7488 999

LOW AIR CONDITIONING
△FUEL = – 0.6 %

ENGINE ANTI ICE ON
△FUEL = + 2.5 %

TOTAL ANTI ICE ON
△FUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 447KT

DISTANCE (NM)
TIME (MIN)

M.78 FL370

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	48 6	96 13	145 19	193 26	241 32	289 39	337 45	385 52	433 58
42	481 64	528 71	576 77	624 84	671 90	719 96	766 103	814 109	861 115	908 122
44	956 128	1003 134	1050 141	1096 147	1143 153	1190 160	1237 166	1284 172	1331 178	1377 185
46	1424 191	1470 197	1517 203	1563 210	1609 216	1656 222	1702 228	1748 234	1794 241	1840 247
48	1886 253	1932 259	1977 265	2023 271	2069 277	2115 284	2160 290	2205 296	2251 302	2296 308
50	2341 314	2386 320	2431 326	2476 332	2521 338	2566 344	2611 350	2655 356	2700 362	2745 368
52	2789 374	2834 380	2878 386	2922 392	2966 398	3011 404	3054 410	3098 416	3142 421	3186 427
54	3230 433	3273 439	3317 445	3360 451	3404 456	3447 462	3490 468	3533 474	3576 480	3619 485
56	3662 491	3705 497	3747 503	3790 508	3833 514	3875 520	3917 525	3960 531	4002 537	4044 542
58	4086 548	4128 554	4169 559	4211 565	4253 570	4294 576	4335 581	4377 587	4418 592	4459 598
60	4500 604	4541 609	4582 614	4622 620	4663 625	4704 631	4744 636	4784 642	4824 647	4864 652
62	4905 658	4944 663	4984 668	5024 674	5063 679	5103 684	5142 690	5181 695	5220 700	5259 705
64	5298 711	5336 716	5375 721	5413 726	5452 731	5490 736	5528 741	5566 747	5604 752	5642 757
66	5680 762	5717 767	5755 772	5792 777	5830 782	5867 787	5904 792	5941 797	5977 802	6014 807
68	6051 812	6087 816	6124 821	6160 826	6196 831	6232 836	6268 841	6304 845	6340 850	6375 855
70	6411 860	6446 865	6482 869	6517 874	6552 879	6587 883	6622 888	6656 893	6691 897	6726 902
72	6760 907	6795 911								
74										
76										

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.6 %	ΔFUEL = + 2.5 %	ΔFUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%
TAS= 447KT

DISTANCE (NM)
TIME (MIN)

M.78 FL390

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
40	0 0	51 7	102 14	154 21	205 27	256 34	307 41	358 48	409 55	460 62
42	510 68	561 75	611 82	662 89	712 96	763 102	813 109	863 116	913 122	963 129
44	1013 136	1063 143	1113 149	1162 156	1212 163	1261 169	1311 176	1360 182	1409 189	1458 196
46	1508 202	1556 209	1605 215	1654 222	1703 228	1752 235	1800 241	1848 248	1897 254	1945 261
48	1993 267	2041 274	2089 280	2137 287	2185 293	2233 299	2280 306	2328 312	2375 319	2423 325
50	2470 331	2517 338	2564 344	2611 350	2658 356	2704 363	2751 369	2797 375	2844 381	2890 388
52	2936 394	2982 400	3028 406	3074 412	3120 418	3166 425	3211 431	3256 437	3301 443	3347 449
54	3392 455	3437 461	3481 467	3526 473	3571 479	3615 485	3660 491	3704 497	3748 503	3792 509
56	3836 514	3879 520	3923 526	3966 532	4009 538	4053 544	4096 549	4138 555	4181 561	4224 566
58	4266 572	4309 578	4351 583	4393 589	4435 595	4477 600	4518 606	4559 611	4601 617	4642 623
60	4684 628	4724 634	4765 639	4806 645	4847 650	4887 655	4927 661	4967 666	5007 672	5047 677
62	5088 682	5127 688	5166 693	5206 698	5245 703	5285 709	5323 714	5362 719	5400 724	5439 729
64	5477 735	5516 740	5554 745	5593 750						
66										
68										
70										
72										
74										
76										

LOW AIR CONDITIONING
△FUEL = – 0.6 %

ENGINE ANTI ICE ON
△FUEL = + 2.5 %

TOTAL ANTI ICE ON
△FUEL = + 4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL100**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	28 7	56 13	84 20	112 26	140 33	168 39	195 46	223 52	251 59	255
42	278 65	306 72	333 78	360 84	388 91	415 97	442 103	469 109	496 116	523 122	257
44	551 128	577 134	604 141	631 147	658 153	685 159	711 165	738 171	764 177	791 183	261
46	817 189	843 195	870 201	896 207	922 213	948 219	974 224	1000 230	1026 236	1052 242	265
48	1078 247	1104 253	1130 259	1155 264	1181 270	1207 276	1232 281	1258 287	1283 292	1309 298	271
50	1334 303	1359 309	1384 314	1410 319	1435 325	1460 330	1485 335	1510 340	1535 345	1560 350	280
52	1585 355	1609 360	1634 365	1659 370	1683 375	1708 380	1732 384	1757 389	1781 394	1806 398	302
54	1830 403	1855 407	1879 412	1903 417	1927 421	1952 426	1976 430	2000 435	2024 439	2048 444	318
56	2072 448	2096 453	2120 457	2144 461	2168 466	2192 470	2216 475	2240 479	2264 483	2288 488	324
58	2312 492	2335 496	2359 501	2383 505	2407 509	2430 514	2454 518	2477 522	2501 527	2525 531	329
60	2548 535	2572 539	2595 544	2619 548	2642 552	2666 556	2689 560	2712 564	2736 569	2759 573	333
62	2782 577	2806 581	2829 585	2852 589	2875 593	2898 598	2922 602	2945 606	2968 610	2991 614	338
64	3014 618	3037 622	3060 626	3083 630	3106 634	3129 638	3152 642	3175 646	3197 650	3220 654	341
66	3243 658	3266 662	3289 666	3311 670	3334 674	3357 678	3380 682	3402 686	3425 689	3447 693	345
68	3470 697	3493 701	3515 705	3538 709	3560 713	3583 717	3605 721	3628 724	3650 728	3672 732	348
70	3695 736	3717 740	3739 744	3762 747	3784 751	3806 755	3829 759	3851 762	3873 766	3895 770	351
72	3917 774	3939 778	3962 781	3984 785	4006 789	4028 793	4050 796	4072 800	4094 804	4116 807	353
74	4138 811	4160 815	4181 818	4203 822	4225 826	4247 830	4269 833	4291 837	4312 840	4334 844	356
76	4356 848	4378 851	4399 855	4421 859	4443 862	4464 866	4486 869	4507 873	4529 876	4551 880	360

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR FL120

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	29 7	58 14	87 20	116 27	145 34	174 40	203 47	232 54	260 60	257
42	289 67	318 73	346 80	374 86	403 93	431 99	459 106	487 112	515 118	544 125	262
44	572 131	599 137	627 143	655 149	683 156	711 162	738 168	766 174	793 180	820 186	268
46	848 192	875 198	902 204	929 209	957 215	984 221	1011 227	1037 232	1064 238	1091 243	277
48	1118 249	1145 254	1171 259	1198 264	1224 270	1251 275	1277 280	1304 285	1330 290	1356 295	299
50	1383 300	1409 305	1435 310	1461 315	1487 320	1513 325	1539 330	1565 335	1591 340	1617 345	314
52	1643 350	1669 355	1695 359	1720 364	1746 369	1772 374	1798 379	1823 383	1849 388	1875 393	319
54	1900 398	1926 402	1951 407	1977 412	2002 416	2028 421	2053 426	2078 430	2104 435	2129 440	324
56	2154 444	2179 449	2205 453	2230 458	2255 463	2280 467	2305 472	2330 476	2355 481	2380 485	329
58	2405 490	2430 494	2455 499	2480 503	2505 507	2530 512	2554 516	2579 521	2604 525	2628 530	334
60	2653 534	2678 538	2702 543	2727 547	2752 551	2776 556	2801 560	2825 564	2849 569	2874 573	339
62	2898 577	2923 581	2947 586	2971 590	2996 594	3020 598	3044 602	3068 607	3092 611	3117 615	343
64	3141 619	3165 623	3189 628	3213 632	3237 636	3261 640	3285 644	3309 648	3333 652	3357 656	347
66	3381 661	3404 665	3428 669	3452 673	3476 677	3500 681	3523 685	3547 689	3571 693	3594 697	350
68	3618 701	3641 705	3665 709	3689 713	3712 717	3736 721	3759 725	3782 729	3806 733	3829 737	353
70	3853 741	3876 745	3899 749	3923 752	3946 756	3969 760	3992 764	4016 768	4039 772	4062 776	357
72	4085 779	4108 783	4131 787	4154 791	4177 795	4200 798	4223 802	4246 806	4269 810	4292 813	363
74	4315 817	4338 821	4361 825	4384 828	4406 832	4429 836	4452 839	4475 843	4497 847	4520 850	369
76	4543 854	4565 857	4588 861	4611 865	4633 868	4656 872	4678 875	4701 879	4723 883	4746 886	375

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR FL150

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	31 7	61 14	92 20	123 27	154 34	184 40	214 47	244 53	275 60	269
42	305 66	335 72	365 79	395 85	425 91	455 97	484 103	514 109	544 114	573 120	288
44	603 126	632 132	661 137	691 143	720 149	749 154	779 160	808 166	837 171	866 177	308
46	895 182	924 188	953 194	982 199	1011 205	1040 210	1068 216	1097 221	1126 226	1155 232	313
48	1183 237	1212 243	1240 248	1269 253	1297 259	1326 264	1354 270	1383 275	1411 280	1439 285	317
50	1467 291	1496 296	1524 301	1552 306	1580 311	1608 317	1636 322	1664 327	1692 332	1720 337	323
52	1748 342	1775 347	1803 352	1831 358	1858 363	1886 368	1914 373	1941 378	1969 383	1996 388	327
54	2024 393	2051 397	2078 402	2106 407	2133 412	2160 417	2188 422	2215 427	2242 432	2269 436	333
56	2296 441	2323 446	2350 451	2377 455	2404 460	2431 465	2458 470	2485 474	2511 479	2538 484	339
58	2565 488	2592 493	2618 498	2645 502	2672 507	2698 512	2725 516	2751 521	2778 525	2804 530	344
60	2830 534	2857 539	2883 543	2909 548	2936 552	2962 557	2988 561	3014 566	3040 570	3066 575	348
62	3093 579	3119 584	3145 588	3171 592	3197 597	3223 601	3248 605	3274 610	3300 614	3326 618	354
64	3352 623	3377 627	3403 631	3429 636	3455 640	3480 644	3506 648	3531 652	3557 657	3582 661	360
66	3608 665	3633 669	3659 673	3684 677	3710 682	3735 686	3760 690	3785 694	3811 698	3836 702	367
68	3861 706	3886 710	3911 714	3937 718	3962 722	3987 726	4012 730	4037 734	4062 738	4087 742	373
70	4112 746	4137 750	4162 754	4187 758	4212 762	4236 766	4261 770	4286 773	4311 777	4336 781	380
72	4360 785	4385 789	4410 793	4434 796	4459 800	4484 804	4508 808	4533 811	4557 815	4582 819	387
74	4606 823	4631 826	4655 830	4680 834	4704 838	4729 841	4753 845	4777 849	4801 852	4826 856	393
76	4850 860	4874 863	4898 867	4923 871	4947 874	4971 878	4995 882	5019 885	5043 889	5067 892	397

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR FL170

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	32 6	64 13	95 19	127 25	159 31	191 37	222 44	254 50	285 56	302
42	317 62	348 68	379 74	411 80	442 86	473 92	504 98	536 104	567 110	598 116	310
44	629 122	660 128	691 134	721 140	752 146	783 151	814 157	844 163	875 169	906 175	313
46	936 180	967 186	997 192	1027 198	1058 203	1088 209	1118 215	1148 220	1179 226	1209 231	318
48	1239 237	1269 243	1299 248	1329 254	1358 259	1388 265	1418 270	1448 276	1477 281	1507 287	323
50	1537 292	1566 297	1596 303	1625 308	1655 313	1684 319	1713 324	1742 329	1772 335	1801 340	328
52	1830 345	1859 350	1888 356	1917 361	1946 366	1975 371	2004 376	2033 381	2062 386	2090 391	334
54	2119 396	2148 401	2176 407	2205 412	2234 417	2262 422	2291 426	2319 431	2347 436	2376 441	341
56	2404 446	2432 451	2460 456	2489 461	2517 465	2545 470	2573 475	2601 480	2629 485	2657 489	348
58	2685 494	2713 499	2741 503	2768 508	2796 513	2824 518	2852 522	2879 527	2907 531	2935 536	355
60	2962 541	2990 545	3017 550	3045 554	3072 559	3100 563	3127 568	3155 572	3182 577	3209 581	362
62	3236 586	3264 590	3291 594	3318 599	3345 603	3372 608	3399 612	3426 616	3453 621	3480 625	369
64	3508 629	3534 634	3561 638	3588 642	3615 647	3642 651	3669 655	3696 659	3722 663	3749 668	375
66	3776 672	3802 676	3829 680	3856 684	3882 688	3909 693	3935 697	3962 701	3988 705	4015 709	384
68	4041 713	4068 717	4094 721	4120 725	4147 729	4173 733	4199 737	4225 741	4252 745	4278 749	390
70	4304 753	4330 757	4356 761	4382 765	4408 769	4434 773	4460 777	4486 781	4512 785	4538 789	394
72	4564 793	4590 797	4616 800	4642 804	4667 808	4693 812	4719 816	4745 820	4770 824	4796 827	398
74	4822 831	4847 835	4873 839	4898 843	4924 847	4949 850	4975 854	5000 858	5026 862	5051 866	402
76	5077 869	5102 873	5127 877	5153 881	5178 884	5203 888	5229 892	5254 895	5279 899	5304 903	405

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL190**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	33 6	67 13	100 19	134 26	167 32	201 39	234 45	267 52	300 58	310
42	334 64	367 71	400 77	433 83	466 89	499 96	531 102	564 108	597 114	629 120	313
44	662 127	694 133	727 139	759 145	791 151	824 157	856 163	888 169	920 175	952 181	319
46	984 187	1016 193	1048 199	1080 205	1112 210	1144 216	1175 222	1207 228	1238 234	1270 239	324
48	1301 245	1333 251	1364 257	1395 262	1427 268	1458 274	1489 279	1520 285	1551 290	1582 296	328
50	1613 302	1644 307	1675 312	1706 318	1736 323	1767 329	1798 334	1828 340	1859 345	1889 350	336
52	1920 356	1950 361	1981 366	2011 371	2041 376	2071 382	2102 387	2132 392	2162 397	2192 402	345
54	2222 407	2252 412	2282 417	2311 422	2341 427	2371 432	2401 437	2431 442	2460 447	2490 452	355
56	2520 457	2549 462	2579 467	2608 472	2638 477	2667 481	2696 486	2726 491	2755 496	2784 501	363
58	2814 505	2843 510	2872 515	2901 519	2930 524	2959 529	2988 534	3017 538	3046 543	3075 547	369
60	3104 552	3133 557	3162 561	3191 566	3220 570	3248 575	3277 579	3306 584	3334 588	3363 593	378
62	3392 597	3420 602	3449 606	3477 611	3506 615	3534 619	3562 624	3591 628	3619 633	3648 637	385
64	3676 641	3704 646	3732 650	3760 654	3789 659	3817 663	3845 667	3873 671	3901 676	3929 680	390
66	3957 684	3985 689	4013 693	4041 697	4069 701	4096 705	4124 710	4152 714	4180 718	4207 722	394
68	4235 726	4263 731	4290 735	4318 739	4346 743	4373 747	4401 751	4428 755	4456 760	4483 764	398
70	4511 768	4538 772	4565 776	4593 780	4620 784	4647 788	4674 792	4702 796	4729 800	4756 804	402
72	4783 808	4810 812	4837 816	4864 820	4891 824	4918 828	4945 832	4972 836	4999 840	5026 844	406
74	5053 848	5079 852	5106 856	5133 860	5160 864	5187 867	5213 871	5240 875	5266 879	5293 883	410
76	5320 887	5346 891	5373 895	5399 898	5426 902	5452 906	5479 910	5505 914	5531 917	5558 921	413

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

DISTANCE (NM)
TIME (MIN)

LR FL210

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	35 7	71 13	106 20	141 27	176 34	211 40	246 47	281 54	316 60	312
42	351 67	386 73	420 80	455 86	489 93	524 99	558 106	592 112	627 118	661 125	318
44	695 131	729 138	763 144	797 150	831 156	865 163	898 169	932 175	966 181	999 187	323
46	1033 193	1066 200	1099 206	1133 212	1166 218	1199 224	1232 229	1265 235	1298 241	1331 247	329
48	1364 253	1397 259	1430 264	1463 270	1495 276	1528 281	1560 287	1593 293	1625 298	1658 304	340
50	1690 309	1722 315	1754 320	1786 325	1819 331	1851 336	1883 342	1915 347	1946 352	1978 358	354
52	2010 363	2042 368	2074 373	2105 379	2137 384	2169 389	2200 394	2232 399	2263 405	2295 410	362
54	2327 415	2358 420	2389 425	2421 430	2452 435	2483 440	2514 445	2546 450	2577 455	2608 460	369
56	2639 465	2670 470	2701 475	2732 480	2763 484	2794 489	2825 494	2855 499	2886 504	2917 509	379
58	2948 513	2978 518	3009 523	3039 528	3070 533	3101 537	3131 542	3161 547	3192 551	3222 556	384
60	3253 561	3283 565	3313 570	3343 575	3374 579	3404 584	3434 589	3464 593	3494 598	3524 602	389
62	3554 607	3584 612	3614 616	3644 621	3674 625	3704 630	3733 634	3763 639	3793 643	3823 648	394
64	3852 652	3882 657	3911 661	3941 665	3971 670	4000 674	4030 679	4059 683	4088 688	4118 692	398
66	4147 696	4176 701	4206 705	4235 709	4264 714	4293 718	4322 722	4351 727	4380 731	4410 735	403
68	4439 740	4468 744	4496 748	4525 752	4554 757	4583 761	4612 765	4641 769	4669 774	4698 778	406
70	4727 782	4756 786	4784 790	4813 794	4841 799	4870 803	4898 807	4927 811	4955 815	4984 819	410
72	5012 824	5041 828	5069 832	5097 836	5126 840	5154 844	5182 848	5210 852	5238 856	5266 860	413
74	5295 864	5323 868	5351 872	5379 877	5407 881	5435 885	5463 889	5490 893	5518 897	5546 901	415
76	5574 905	5602 909	5630 913	5657 917	5685 921	5713 925	5740 929	5768 933	5796 937	5823 941	416

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL230**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	37 7	74 14	111 21	148 28	185 35	221 42	258 48	294 55	331 62	318
42	368 69	404 76	440 82	476 89	512 96	548 102	584 109	620 116	656 122	692 129	322
44	728 135	763 142	799 148	834 154	869 161	905 167	940 173	975 179	1010 185	1045 191	331
46	1080 197	1115 203	1150 209	1184 215	1219 221	1254 227	1288 233	1323 239	1357 244	1392 250	349
48	1426 256	1460 261	1495 267	1529 273	1563 279	1597 284	1631 290	1665 295	1699 301	1733 306	360
50	1767 312	1801 317	1835 323	1869 328	1902 334	1936 339	1970 345	2003 350	2037 355	2070 361	370
52	2104 366	2137 371	2171 377	2204 382	2237 387	2271 392	2304 398	2337 403	2370 408	2403 413	377
54	2436 418	2469 424	2502 429	2535 434	2568 439	2601 444	2633 449	2666 454	2699 459	2732 464	383
56	2764 469	2797 474	2829 479	2862 484	2894 489	2927 494	2959 499	2991 504	3024 509	3056 514	388
58	3088 519	3120 524	3153 529	3185 534	3217 539	3249 544	3281 548	3313 553	3345 558	3377 563	393
60	3409 568	3440 573	3472 577	3504 582	3535 587	3567 592	3599 596	3630 601	3662 606	3693 611	398
62	3725 615	3756 620	3787 625	3819 629	3850 634	3881 639	3913 643	3944 648	3975 652	4006 657	403
64	4037 662	4068 666	4099 671	4130 675	4161 680	4192 684	4223 689	4254 693	4285 698	4315 702	406
66	4346 707	4377 711	4407 716	4438 720	4469 725	4499 729	4530 734	4560 738	4591 743	4621 747	410
68	4652 752	4682 756	4712 760	4743 765	4773 769	4803 774	4833 778	4863 782	4893 787	4924 791	412
70	4954 796	4984 800	5014 804	5044 809	5074 813	5104 817	5133 822	5163 826	5193 830	5223 835	412
72	5253 839	5282 843	5312 848	5341 852	5371 856	5401 861	5430 865	5460 869	5489 873	5518 878	413
74	5548 882	5577 886	5606 890	5635 894	5665 899	5694 903	5723 907	5752 911	5781 915	5810 920	415
76	5839 924	5868 928	5897 932	5925 936	5954 940	5983 944	6012 948	6040 952	6069 956	6097 961	419

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

DISTANCE (NM)
TIME (MIN)

LR FL250

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	39 7	77 14	116 21	155 29	193 36	231 43	269 50	308 56	346 63	321
42	384 70	422 77	460 83	497 90	535 97	573 103	610 109	647 116	685 122	722 128	340
44	759 135	796 141	833 147	870 153	907 159	945 166	981 172	1018 178	1055 184	1092 190	357
46	1128 196	1165 202	1201 208	1238 214	1274 220	1311 226	1347 231	1383 237	1420 243	1456 249	367
48	1492 255	1528 260	1564 266	1600 272	1636 278	1672 283	1708 289	1744 295	1779 300	1815 306	376
50	1851 312	1886 317	1922 323	1957 328	1993 334	2028 339	2064 345	2099 350	2134 356	2169 361	382
52	2205 367	2240 372	2275 378	2310 383	2345 388	2380 394	2415 399	2449 405	2484 410	2519 415	387
54	2554 421	2588 426	2623 431	2658 436	2692 442	2727 447	2761 452	2795 457	2830 463	2864 468	392
56	2898 473	2932 478	2967 483	3001 488	3035 493	3069 499	3103 504	3137 509	3171 514	3205 519	398
58	3238 524	3272 529	3306 534	3339 539	3373 544	3407 549	3440 554	3474 559	3507 564	3541 569	402
60	3574 574	3607 579	3641 584	3674 589	3707 594	3741 598	3774 603	3807 608	3840 613	3873 618	406
62	3906 623	3939 628	3972 632	4005 637	4037 642	4070 647	4103 652	4136 657	4168 661	4201 666	408
64	4234 671	4266 676	4299 681	4331 685	4364 690	4396 695	4428 700	4461 704	4493 709	4525 714	408
66	4558 719	4590 723	4622 728	4654 733	4686 737	4718 742	4750 747	4782 751	4813 756	4845 761	409
68	4877 765	4909 770	4940 775	4972 779	5004 784	5035 788	5067 793	5098 797	5129 802	5161 806	412
70	5192 811	5223 815	5254 820	5285 824	5316 829	5348 833	5378 838	5409 842	5440 847	5471 851	416
72	5502 855	5533 860	5563 864	5594 869	5625 873	5655 877	5686 882	5716 886	5746 890	5777 894	421
74	5807 899	5837 903	5868 907	5898 911	5928 916	5958 920	5988 924	6018 928	6048 932	6078 937	426
76	6108 941	6138 945	6167 949	6197 953	6227 957	6257 961	6286 965	6316 970	6345 974	6375 978	432

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL270**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	40 7	80 14	121 20	161 27	201 34	241 41	281 47	321 54	361 61	350
42	401 67	440 74	480 80	519 87	559 93	599 100	638 106	677 112	716 119	756 125	364
44	795 132	834 138	873 144	912 150	951 157	990 163	1029 169	1067 175	1106 181	1145 187	372
46	1183 194	1222 200	1260 206	1299 212	1337 218	1375 224	1414 230	1452 236	1490 242	1528 248	379
48	1566 254	1604 260	1642 266	1680 271	1718 277	1755 283	1793 289	1831 295	1868 301	1906 306	384
50	1943 312	1981 318	2018 324	2055 329	2093 335	2130 341	2167 346	2204 352	2241 358	2278 363	390
52	2315 369	2352 375	2389 380	2426 386	2462 391	2499 397	2536 402	2572 408	2609 413	2645 419	396
54	2682 424	2718 430	2754 435	2791 440	2827 446	2863 451	2899 457	2935 462	2971 467	3007 473	401
56	3043 478	3079 483	3115 489	3151 494	3187 499	3223 505	3258 510	3294 515	3329 521	3365 526	403
58	3400 531	3436 536	3471 542	3506 547	3542 552	3577 557	3612 563	3647 568	3683 573	3718 578	404
60	3753 583	3788 589	3823 594	3857 599	3892 604	3927 609	3962 614	3996 619	4031 625	4066 630	404
62	4100 635	4135 640	4169 645	4203 650	4238 655	4272 660	4306 665	4340 670	4374 675	4408 680	408
64	4442 685	4476 690	4510 695	4543 699	4577 704	4611 709	4644 714	4678 719	4711 724	4745 729	413
66	4778 733	4811 738	4845 743	4878 748	4911 752	4944 757	4977 762	5010 767	5043 771	5076 776	418
68	5109 781	5141 785	5174 790	5207 794	5239 799	5272 804	5305 808	5337 813	5369 817	5402 822	423
70	5434 826	5466 831	5498 835	5530 840	5563 844	5595 849	5627 853	5659 858	5690 862	5722 867	429
72	5754 871	5786 875	5817 880	5849 884	5881 888	5912 893	5944 897	5975 901	6006 906	6038 910	433
74	6069 914	6100 919	6132 923	6163 927	6194 931	6225 936	6256 940	6287 944	6318 948	6349 952	438
76	6379 957	6410 961	6441 965	6471 969	6502 973	6533 977	6563 982	6594 986	6624 990	6654 994	442

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL290**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	42 7	85 14	127 21	169 27	212 34	254 41	296 48	338 55	380 61	369
42	422 68	464 75	505 81	547 88	589 95	630 101	672 108	713 114	755 121	796 127	375
44	837 134	878 140	919 147	960 153	1001 160	1043 166	1083 172	1124 179	1165 185	1205 191	381
46	1246 198	1287 204	1327 210	1367 216	1408 223	1448 229	1488 235	1528 241	1568 247	1608 253	388
48	1648 259	1688 265	1728 271	1768 278	1808 284	1847 290	1887 296	1926 302	1966 308	2005 313	394
50	2045 319	2084 325	2123 331	2163 337	2202 343	2241 349	2280 355	2319 361	2358 366	2397 372	398
52	2436 378	2474 384	2513 390	2552 396	2590 401	2629 407	2667 413	2706 419	2744 424	2782 430	400
54	2821 436	2859 442	2897 447	2935 453	2973 459	3011 464	3049 470	3087 476	3125 481	3163 487	400
56	3201 493	3238 498	3276 504	3313 509	3351 515	3388 521	3425 526	3462 532	3499 537	3537 543	402
58	3574 548	3611 553	3647 559	3684 564	3721 570	3758 575	3794 580	3831 586	3867 591	3904 596	408
60	3940 602	3976 607	4012 612	4048 617	4085 623	4121 628	4157 633	4192 638	4228 643	4264 648	413
62	4300 654	4335 659	4371 664	4406 669	4442 674	4477 679	4513 684	4548 689	4583 694	4618 699	419
64	4653 704	4688 709	4723 714	4758 719	4793 723	4828 728	4862 733	4897 738	4932 743	4966 748	425
66	5001 753	5035 757	5069 762	5104 767	5138 772	5172 776	5206 781	5240 786	5274 790	5308 795	430
68	5342 800	5376 805	5410 809	5443 814	5477 818	5511 823	5544 828	5578 832	5611 837	5645 841	435
70	5678 846	5711 851	5744 855	5777 860	5811 864	5844 869	5877 873	5910 878	5942 882	5975 886	439
72	6008 891	6041 895	6073 900	6106 904	6139 909	6171 913	6203 917	6236 922	6268 926	6301 930	444
74	6333 935	6365 939	6397 943	6429 947	6461 952	6493 956	6525 960	6557 964	6589 969	6620 973	448
76	6652 977	6684 981	6715 985	6747 990	6778 994	6810 998	6841 1002	6872 1006	6903 1010	6935 1014	454

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL310**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	45 7	89 14	134 21	179 28	223 35	268 42	312 49	356 56	400 63	377
42	445 70	489 77	532 84	576 90	620 97	664 104	708 111	751 117	795 124	838 131	385
44	882 138	925 144	968 151	1011 157	1054 164	1097 170	1140 177	1183 183	1226 190	1269 197	392
46	1312 203	1354 209	1397 216	1439 222	1482 229	1524 235	1566 242	1608 248	1651 254	1693 261	395
48	1735 267	1777 274	1819 280	1860 286	1902 293	1944 299	1986 305	2027 311	2069 318	2110 324	396
50	2152 330	2193 336	2234 343	2275 349	2316 355	2358 361	2398 367	2439 374	2480 380	2521 386	397
52	2561 392	2602 398	2642 404	2683 410	2723 416	2763 422	2803 428	2843 434	2883 440	2923 446	401
54	2963 452	3003 457	3042 463	3082 469	3121 475	3161 481	3200 486	3239 492	3279 498	3318 504	407
56	3357 509	3396 515	3435 520	3473 526	3512 532	3551 537	3590 543	3628 548	3666 554	3705 559	413
58	3743 565	3781 570	3820 576	3858 581	3896 587	3934 592	3972 597	4009 603	4047 608	4085 613	419
60	4122 619	4160 624	4197 629	4235 635	4272 640	4309 645	4346 650	4383 655	4420 661	4457 666	426
62	4494 671	4531 676	4568 681	4605 686	4641 691	4678 696	4714 701	4751 706	4787 711	4823 716	430
64	4860 721	4896 726	4932 731	4968 736	5004 741	5040 746	5075 751	5111 756	5147 761	5182 766	436
66	5218 771	5253 775	5289 780	5324 785	5360 790	5395 795	5430 799	5465 804	5500 809	5535 814	440
68	5570 818	5605 823	5640 828	5674 832	5709 837	5744 842	5778 846	5813 851	5847 855	5881 860	445
70	5916 865	5950 869	5984 874	6018 878	6052 883	6086 887	6120 892	6154 896	6187 900	6221 905	452
72	6255 909	6288 914	6322 918	6355 923	6389 927	6422 931	6455 936	6488 940	6522 944	6555 949	456
74	6588 953	6621 957	6654 962	6687 966	6719 970	6752 974	6785 979	6817 983	6850 987	6882 991	459
76	6915 996	6947 1000	6980 1004	7012 1008	7044 1013	7076 1017	7108 1021	7140 1025	7172 1029	7204 1033	460

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR FL 330

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	47 7	94 14	141 22	188 29	235 36	282 43	328 51	375 58	421 65	388
42	468 72	514 79	560 86	607 93	653 100	699 107	745 114	791 121	837 128	882 135	391
44	928 142	974 149	1019 156	1065 163	1110 170	1156 177	1201 184	1246 191	1291 198	1336 205	392
46	1381 212	1425 218	1470 225	1515 232	1559 239	1604 246	1648 252	1692 259	1736 265	1780 272	394
48	1824 279	1868 285	1912 292	1955 298	1999 305	2042 311	2086 318	2129 324	2172 331	2215 337	400
50	2258 343	2301 350	2344 356	2386 362	2429 368	2472 375	2514 381	2556 387	2598 393	2641 399	406
52	2683 406	2725 412	2767 418	2808 424	2850 430	2892 436	2933 442	2975 448	3016 454	3058 460	413
54	3099 465	3140 471	3181 477	3222 483	3263 489	3304 495	3344 500	3385 506	3425 512	3466 518	420
56	3507 523	3547 529	3587 535	3627 540	3667 546	3707 552	3747 557	3787 563	3826 568	3866 574	425
58	3906 579	3945 585	3985 590	4024 596	4063 601	4103 607	4142 612	4181 617	4220 623	4258 628	431
60	4297 634	4336 639	4375 644	4413 649	4452 655	4490 660	4528 665	4567 670	4605 676	4643 681	436
62	4681 686	4719 691	4757 696	4795 701	4833 707	4870 712	4908 717	4945 722	4983 727	5020 732	441
64	5057 737	5094 742	5132 747	5169 752	5206 757	5243 762	5279 766	5316 771	5353 776	5389 781	448
66	5426 786	5462 791	5499 796	5535 800	5571 805	5608 810	5643 815	5679 819	5715 824	5751 829	453
68	5787 834	5823 838	5859 843	5894 848	5930 852	5965 857	6001 862	6036 866	6071 871	6106 876	455
70	6142 880	6176 885	6211 890	6246 894	6281 899	6316 903	6351 908	6385 912	6420 917	6454 921	456
72	6489 926	6523 930	6557 935	6591 939	6625 944	6660 948	6693 953	6727 957	6761 962	6795 966	457
74	6829 971	6862 975	6895 979	6929 984	6962 988	6996 992	7029 997	7062 1001	7095 1005	7128 1010	458
76	7161 1014	7194 1018	7226 1023	7259 1027	7292 1031	7324 1036	7357 1040	7389 1044	7421 1048	7453 1053	457

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR FL 350

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	50 8	99 15	149 23	198 31	248 38	297 46	346 53	395 61	444 69	388
42	493 76	542 84	590 91	639 98	687 106	736 113	784 121	831 128	879 135	927 142	390
44	975 150	1023 157	1070 164	1117 171	1165 178	1212 185	1259 192	1306 199	1352 206	1399 213	397
46	1446 220	1492 227	1539 234	1585 241	1631 248	1677 254	1723 261	1769 268	1815 275	1860 281	404
48	1906 288	1951 294	1996 301	2042 308	2087 314	2132 321	2177 327	2222 334	2266 340	2311 346	412
50	2356 353	2400 359	2444 365	2488 372	2533 378	2577 384	2621 391	2664 397	2708 403	2752 409	419
52	2796 415	2839 422	2882 428	2925 434	2969 440	3012 446	3055 452	3097 458	3140 464	3183 470	424
54	3226 476	3268 482	3310 488	3353 493	3395 499	3437 505	3479 511	3521 517	3563 522	3605 528	431
56	3647 534	3688 540	3729 545	3771 551	3812 557	3854 562	3895 568	3935 573	3976 579	4017 585	436
58	4058 590	4099 596	4139 601	4180 607	4220 612	4261 618	4301 623	4341 628	4381 634	4421 639	443
60	4461 644	4501 650	4540 655	4580 660	4620 666	4659 671	4699 676	4738 681	4777 687	4816 692	449
62	4855 697	4894 702	4933 707	4972 712	5011 718	5049 723	5088 728	5126 733	5164 738	5203 743	451
64	5241 748	5279 753	5317 758	5355 763	5393 768	5431 773	5468 778	5506 783	5543 788	5581 793	452
66	5618 798	5656 803	5693 808	5730 813	5767 818	5804 823	5840 828	5877 833	5914 837	5950 842	453
68	5987 847	6023 852	6059 857	6096 861	6132 866	6168 871	6204 876	6239 880	6275 885	6311 890	453
70	6346 895	6382 899	6417 904	6452 909	6487 913	6523 918	6557 923	6592 927	6627 932	6662 936	453
72	6696 941	6731 946	6765 950	6799 955	6834 959	6868 964	6902 968	6935 973	6969 977	7003 982	453
74	7037 986	7070 990	7104 995	7137 999	7170 1004	7204 1008	7237 1012	7269 1017	7302 1021	7335 1025	453
76	7368 1030	7400 1034	7432 1038	7465 1043	7497 1047	7529 1051	7561 1055	7594 1060	7626 1064	7658 1068	454

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL370**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	52 8	103 16	155 23	207 31	258 39	309 47	360 54	411 62	462 70	395
42	513 77	563 85	614 92	664 100	714 107	765 114	814 122	864 129	914 136	964 144	403
44	1013 151	1062 158	1112 165	1161 172	1210 179	1259 187	1307 194	1356 201	1404 208	1453 215	411
46	1501 222	1549 228	1597 235	1645 242	1693 249	1741 256	1788 263	1836 269	1883 276	1931 283	418
48	1978 289	2025 296	2071 303	2118 309	2165 316	2212 322	2258 329	2304 335	2350 342	2396 348	425
50	2443 355	2488 361	2534 367	2580 374	2625 380	2671 386	2716 392	2761 399	2806 405	2852 411	431
52	2897 417	2941 423	2986 429	3030 436	3075 442	3120 448	3164 454	3208 460	3252 466	3296 472	438
54	3340 478	3383 483	3427 489	3470 495	3514 501	3557 507	3600 513	3643 518	3686 524	3729 530	444
56	3772 536	3815 541	3857 547	3900 553	3942 558	3985 564	4027 570	4069 575	4111 581	4153 587	448
58	4195 592	4236 598	4278 603	4319 609	4361 614	4402 620	4443 625	4484 631	4525 636	4566 642	449
60	4607 647	4648 652	4688 658	4729 663	4769 669	4809 674	4849 679	4889 685	4929 690	4969 695	451
62	5009 701	5048 706	5088 711	5127 716	5166 721	5206 727	5245 732	5283 737	5322 742	5361 747	451
64	5400 753	5438 758	5476 763	5514 768	5552 773	5591 778	5628 783	5666 788	5704 793	5741 798	451
66	5779 803	5816 808	5853 813	5890 818	5927 823	5964 828	6001 833	6037 837	6074 842	6110 847	451
68	6147 852	6183 857	6219 861	6255 866	6291 871	6327 876	6362 880	6397 885	6432 890	6467 894	451
70	6502 899	6538 904	6573 908	6608 913	6643 918						452
72											
74											
76											

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0%

DISTANCE (NM)
TIME (MIN)

LR **FL390**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
40	0 0	54 8	107 16	161 23	214 31	268 39	321 47	373 54	426 62	479 69	411
42	532 77	584 84	636 92	688 99	740 107	793 114	844 121	895 129	947 136	998 143	418
44	1050 151	1100 158	1151 165	1202 172	1252 179	1303 186	1353 193	1403 200	1453 207	1503 214	427
46	1554 221	1603 228	1652 234	1702 241	1751 248	1801 255	1849 262	1898 268	1947 275	1996 282	433
48	2045 288	2093 295	2141 301	2189 308	2237 314	2285 321	2333 327	2380 334	2428 340	2475 347	441
50	2523 353	2570 359	2617 366	2663 372	2710 378	2757 384	2804 391	2850 397	2896 403	2942 409	446
52	2989 415	3034 421	3080 428	3126 434	3172 440	3217 446	3262 452	3307 458	3353 464	3398 470	449
54	3443 476	3487 482	3532 488	3576 494	3620 500	3665 506	3709 511	3752 517	3796 523	3840 529	450
56	3884 535	3927 540	3970 546	4013 552	4056 558	4100 563	4142 569	4184 575	4227 580	4269 586	450
58	4312 592	4353 597	4395 603	4437 608	4479 614	4521 619	4562 625	4603 630	4644 636	4685 641	451
60	4726 647	4766 652	4807 658	4847 663	4888 668	4928 674	4968 679	5008 684	5047 690	5087 695	451
62	5127 700	5166 705	5205 710	5243 716	5282 721	5321 726	5360 731	5399 736	5437 741		451
64											
66											
68											
70											
72											
74											
76											

LOW AIR CONDITIONING
ΔFUEL = –0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
ΔFUEL = +4.5 %

CLIMB CORRECTION

The planner must correct the values for the fuel and the time obtained from the integrated cruise tables with the numbers given in the following tables. The tables which are established for M.78 and long range speed, take into account climbing from the brake release point at 250kt/300kt/M.78.

M.78 and LONG RANGE SPEED

R

CORRECTION ON FUEL CONSUMPTION (1000 KG)									
FL	WEIGHT AT BRAKE RELEASE (1000 KG)								Time Correction
	50	54	58	62	66	70	74	78	
390	0.8	0.9	0.9	1.0	–	–	–	–	4 min
370	0.8	0.8	0.9	0.9	1.0	1.0	–	–	4 min
350	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	5 min
330	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	5 min
310	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	5 min
290	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	5 min
270	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	5 min
250	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	4 min
200	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	4 min
150	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	3 min
100	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	3 min

STEP CLIMB CORRECTION

R When the flight includes one or more step climbs (2000 feet below FL290, 4000 feet above), apply a correction of 70 kg per step climb to the fuel consumption.

DESCENT CORRECTION

Correct the fuel and time values determined in the integrated cruise tables as follows to take into account the descent down to 1500 feet followed by a 6 minute IFR approach and landing.

R

CORRECTION ON FUEL CONSUMPTION (1000 KG)								
FL	WEIGHT OVERHEAD DESTINATION (1000 KG)							Time Correction
	46	50	54	58	62	66	70	
390	0	0.1	0.1	0.2	0.2	–	–	10 min
370	0	0.1	0.1	0.1	0.2	0.2	0.3	10 min
350	0	0.1	0.1	0.1	0.2	0.2	0.2	10 min
330	0	0.1	0.1	0.1	0.2	0.2	0.2	10 min
310	0	0.1	0.1	0.1	0.1	0.2	0.2	10 min
290	0	0.1	0.1	0.1	0.1	0.2	0.2	10 min
270	0	0.1	0.1	0.1	0.1	0.2	0.2	10 min
250	0	0.1	0.1	0.1	0.1	0.1	0.2	10 min
200	0	0	0.1	0.1	0.1	0.1	0.1	9 min
150	0	0	0	0	0.1	0.1	0.1	8 min
100	0	0	0	0	0	0	0	8 min

INTRODUCTION

The following flight planning tables allow the planner to determine trip fuel consumption and trip time required to cover a given air distance :
These tables are established for :
- Takeoff
- Climb profile 250kt/300kt/M.78
- Cruise Mach number M.78/LR
- Descent profile M.78/300kt/250kt
- Approach and landing 110 kg – 6 minute IFR
- ISA
- CG = 33 %
- Normal air conditioning
- Anti ice OFF

They are based upon a reference landing weight of 50 000 kg

Note : 1. In the tables, the asterisk (*) means that a step climb of 4000 ft must be flown to reach the corresponding FL.
2. To obtain a flight plan at optimum cruise level, the highest flight level desired within the flight has to be selected in the table.
3. For each degree Celcius above ISA temperature apply fuel correction 0.015 (kg/°C/NM) × △ISA (°C) × Air Distance (NM).

CORRECTION FOR DEVIATION FROM REFERENCE LANDING WEIGHT

The fuel consumption must be corrected when the actual landing weight is different from the reference landing weight.
If it is lower (or greater) than the reference landing weight, subtract (or add) the value given in the correction part of the table per 1000 kg below (or above) the reference landing weight.

EXAMPLE

The following is an example of a complete flight plan based on the assumptions :
- Zero fuel weight : 55 000 kg = landing weight at alternate airport
- Cruise M.78 at FL370
- Ground distance from departure to destination : 1800 NM
- Average wind during flight : - 40 kt (headwind)
- ISA conditions
- "En route" reserve : 5 %
- Ground distance from destination to alternate : 200 NM, no wind at FL200

To calculate the flight plan, a reverse calculation is needed, i.e. start with the landing weight at alternate (the schematic on 2.05.10 p 4 gives an overview of the calculation to be performed).

1. Alternate fuel and time
   – From 2.05.50 p2 ;
   Alternate time = 40 min
R Alternate fuel : 1 519 + 10 × (55 – 50) = 1 569 kg
2. Holding fuel and time
   – A 30 min holding is assumed at 1500 ft. Read from 3.05.25 p2, holding fuel = 1 243 kg
R 3. At destination, the landing weight = 55 000 + 1 569 + 1 243 = 57 812 kg
4. Evaluation of the air distance between departure and destination.
   – The "Ground distance/Air distance" conversion table from 2.05.60 p2 shows that the corresponding air distance is : 1 975 NM.
5. Trip fuel and time
   – Enter air distance and flight level 370 (see table on 2.05.40 p5), read the corresponding values of fuel consumption and time, for the reference landing weight and without deviation from ISA.
R Fuel = 9 840 kg
R Time = 4 h 36 min
   – Correction for landing weight
R △ fuel consumption = 116 × (57.812 – 50) = 907 kg
R – Trip reserves (5 %) = 0.05 × (9 840 + 907) = 538 kg
R 6. Taxi fuel = 120 kg (2.05.10 p 2)
7. Total fuel on board (Block fuel) :
R 9 840 + 907 + 538 + 1 243 + 1 569 + 120 = 14 217 kg

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
200	1559 0.38	1540 0.38	1527 0.38	1520 0.38	1518 0.38		11	14	15
225	1703 0.41	1674 0.41	1653 0.41	1639 0.41	1631 0.41	1632 0.41	12	15	16
250	1847 0.44	1809 0.44	1780 0.45	1758 0.45	1745 0.45	1740 0.45	12	15	18
275	1990 0.48	1943 0.48	1906 0.48	1878 0.48	1858 0.48	1849 0.48	13	16	19
300	2134 0.51	2078 0.51	2032 0.51	1997 0.51	1971 0.51	1958 0.51	13	17	20
325	2278 0.54	2213 0.54	2159 0.54	2116 0.55	2085 0.55	2067 0.55	14	17	21
350	2422 0.57	2347 0.58	2286 0.58	2236 0.58	2198 0.58	2176 0.58	15	18	22
375	2566 1.01	2482 1.01	2413 1.01	2356 1.01	2312 1.02	2286 1.02	15	19	23
400	2710 1.04	2617 1.04	2539 1.04	2475 1.05	2426 1.05	2395 1.05	16	20	24
425	2854 1.07	2752 1.07	2666 1.08	2595 1.08	2540 1.08	2505 1.08	16	20	26
450	2999 1.10	2887 1.11	2794 1.11	2715 1.11	2654 1.12	2614 1.12	17	21	27
475	3143 1.14	3023 1.14	2921 1.14	2835 1.15	2768 1.15	2724 1.15	17	22	28
500	3287 1.17	3158 1.17	3048 1.18	2956 1.18	2883 1.18	2834 1.18	18	23	29
525	3432 1.20	3293 1.21	3175 1.21	3076 1.21	2997 1.22	2945 1.22	18	24	30
550	3576 1.23	3429 1.24	3303 1.24	3196 1.25	3112 1.25	3055 1.25	19	24	31
575	3721 1.27	3564 1.27	3430 1.28	3316 1.28	3226 1.28	3165 1.28	19	25	33
600	3865 1.30	3700 1.30	3558 1.31	3437 1.31	3341 1.32	3276 1.32	20	26	34
625	4010 1.33	3835 1.34	3685 1.34	3558 1.35	3456 1.35	3386 1.35	21	27	35
650	4155 1.36	3971 1.37	3813 1.38	3678 1.38	3571 1.38	3497 1.38	21	27	36
675	4300 1.40	4107 1.40	3941 1.41	3799 1.41	3686 1.42	3608 1.42	22	28	37
700	4445 1.43	4243 1.44	4069 1.44	3920 1.45	3801 1.45	3719 1.45	22	29	39
725	4590 1.46	4378 1.47	4196 1.48	4041 1.48	3916 1.49	3830 1.49	23	30	40
750	4735 1.49	4515 1.50	4325 1.51	4162 1.52	4031 1.52	3942 1.52	23	31	41
775	4880 1.53	4651 1.53	4453 1.54	4283 1.55	4147 1.55	4053 1.55	24	31	42
800	5025 1.56	4787 1.57	4581 1.57	4404 1.58	4262 1.59	4165 1.59	25	32	44
825	5171 1.59	4923 2.00	4709 2.01	4525 2.02	4378 2.02	4276 2.02	25	33	45

LOW AIR CONDITIONING
ΔFUEL = – 0.5 %

ENGINE ANTI ICE ON
ΔFUEL = + 3 %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
825	5171 1.59	4923 2.00	4709 2.01	4525 2.02	4378 2.02	4276 2.02	25	33	45
850	5316 2.03	5060 2.03	4838 2.04	4647 2.05	4494 2.05	4388 2.05	26	34	46
875	5462 2.06	5196 2.07	4966 2.07	4768 2.08	4610 2.09	4500 2.09	26	35	48
900	5607 2.09	5333 2.10	5095 2.11	4890 2.12	4726 2.12	4612 2.12	27	35	49
925	5753 2.12	5469 2.13	5224 2.14	5011 2.15	4842 2.15	4725 2.15	28	36	50
950	5899 2.16	5606 2.16	5353 2.17	5133 2.18	4958 2.19	4837 2.19	28	37	52
975	6045 2.19	5743 2.20	5482 2.21	5256 2.22	5075 2.22	4950 2.22	29	38	53
1000	6191 2.22	5880 2.23	5611 2.24	5378 2.25	5191 2.25	5062 2.25	29	39	54
1025	6337 2.25	6017 2.26	5740 2.27	5500 2.28	5308 2.29	5175 2.29	30	40	56
1050	6483 2.29	6154 2.30	5870 2.31	5623 2.32	5425 2.32	5289 2.32	31	40	57
1075	6629 2.32	6292 2.33	5999 2.34	5745 2.35	5542 2.36	5402 2.36	31	41	58
1100	6775 2.35	6429 2.36	6129 2.37	5868 2.38	5659 2.39	5516 2.39	32	42	60
1125	6921 2.38	6566 2.39	6258 2.41	5991 2.42	5777 2.42	5630 2.42	33	43	61
1150	7068 2.42	6704 2.43	6388 2.44	6113 2.45	5894 2.46	5744 2.46	33	44	62
1175	7214 2.45	6841 2.46	6518 2.47	6236 2.48	6012 2.49	5858 2.49	34	45	64
1200	7361 2.48	6979 2.49	6648 2.50	6360 2.52	6129 2.52	5973 2.52	35	45	65
1225	7507 2.51	7116 2.53	6778 2.54	6483 2.55	6247 2.56	6087 2.56	35	46	67
1250	7654 2.55	7254 2.56	6908 2.57	6606 2.58	6365 2.59	6202 2.59	36	47	68
1275	7801 2.58	7392 2.59	7038 3.00	6729 3.02	6483 3.02	6317 3.02	37	48	70
1300	7947 3.01	7530 3.02	7168 3.04	6853 3.05	6601 3.06	6432 3.06	37	49	71
1325	8094 3.04	7668 3.06	7299 3.07	6976 3.08	6719 3.09	6547 3.09	38	50	73
1350	8241 3.08	7806 3.09	7429 3.10	7100 3.12	6838 3.13	6662 3.12	39	51	74
1375	8388 3.11	7944 3.12	7560 3.14	7224 3.15	6956 3.16	6778 3.16	39	52	76
1400	8535 3.14	8083 3.16	7691 3.17	7348 3.18	7075 3.19	6893 3.19	40	53	77
1425	8683 3.17	8221 3.19	7821 3.20	7472 3.22	7194 3.23	7009 3.23	41	54	79
1450	8830 3.21	8360 3.22	7952 3.24	7596 3.25	7313 3.26	7125 3.26	41	54	80

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 3 %	ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1450	8830 3.21	8360 3.22	7952 3.24	7596 3.25	7313 3.26	7125 3.26	41	54	80
1475	8977 3.24	8498 3.25	8083 3.27	7720 3.28	7432 3.29	7241 3.29	42	55	82
1500	9125 3.27	8637 3.29	8214 3.30	7845 3.32	7551 3.33	7357 3.33	43	56	84
1525	9272 3.30	8776 3.32	8346 3.34	7969 3.35	7670 3.36	7474 3.36	43	57	85
1550	9420 3.34	8914 3.35	8477 3.37	8094 3.38	7789 3.39	7591 3.39	44	58	87
1575	9568 3.37	9053 3.39	8609 3.40	8218 3.42	7909 3.43	7707 3.43	45	59	88
1600	9715 3.40	9192 3.42	8740 3.44	8343 3.45	8028 3.46	7824 3.46	45	60	90
1625	9863 3.44	9332 3.45	8872 3.47	8468 3.49	8148 3.49	7941 3.49	46	61	92
1650	10011 3.47	9471 3.48	9004 3.50	8593 3.52	8268 3.53	8059 3.53	47	62	93
1675	10159 3.50	9610 3.52	9135 3.53	8718 3.55	8388 3.56	8176 3.56	47	63	94
1700	10307 3.53	9749 3.55	9267 3.57	8844 3.59	8509 4.00	8294 4.00	48	64	96
1725	10455 3.57	9889 3.58	9399 4.00	8969 4.02	8629 4.03	8412 4.03	49	65	98
1750	10603 4.00	10028 4.02	9532 4.03	9095 4.05	8750 4.06	8530 4.06	50	66	100
1775	10752 4.03	10168 4.05	9664 4.07	9220 4.09	8870 4.10	8649 4.10	50	67	101
1800	10900 4.06	10308 4.08	9796 4.10	9346 4.12	8991 4.13	8767 4.13	51	68	103
1825	11049 4.10	10447 4.11	9929 4.13	9472 4.15	9112 4.16	8886 4.16	52	69	105
1850	11197 4.13	10587 4.15	10061 4.17	9598 4.19	9233 4.20	9005 4.20	52	70	107
1875	11346 4.16	10727 4.18	10194 4.20	9724 4.22	9354 4.23	9124 4.23	53	71	109
1900	11495 4.19	10867 4.21	10327 4.23	9850 4.25	9476 4.26	9243 4.26	54	72	110
1925	11644 4.23	11007 4.25	10459 4.27	9976 4.29	9597 4.30	9363 4.30	55	73	112
1950	11793 4.26	11148 4.28	10592 4.30	10103 4.32	9719 4.33	9482 4.33	55	74	114
1975	11943 4.29	11289 4.31	10725 4.33	10229 4.35	9840 4.36	9602 4.36	56	75	116
2000	12092 4.32	11429 4.34	10859 4.37	10356 4.39	9962 4.40	9722 4.40	57	76	118
2025	12241 4.36	11570 4.38	10992 4.40	10483 4.42	10084 4.43	9842 4.43	58	77	120
2050	12391 4.39	11711 4.41	11125 4.43	10610 4.45	10206 4.47	9963 4.47	58	78	121
2075	12540 4.42	11852 4.44	11259 4.46	10737 4.49	10329 4.50	10083 4.50	59	79	123

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 3 %	ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2075	12540 4.42	11852 4.44	11259 4.46	10737 4.49	10329 4.50	10083 4.50	59	79	123
2100	12690 4.45	11994 4.48	11392 4.50	10864 4.52	10451 4.53	10204 4.53	60	80	125
2125	12840 4.49	12135 4.51	11526 4.53	10991 4.55	10573 4.57	10325 4.57	61	81	127
2150	12989 4.52	12276 4.54	11660 4.56	11118 4.59	10696 5.00	10446 5.00	61	82	129
2175	13139 4.55	12418 4.57	11794 5.00	11246 5.02	10819 5.03	10567 5.03	62	83	131
2200	13289 4.58	12559 5.01	11928 5.03	11374 5.05	10942 5.07	10688 5.07	63	85	133
2225	13439 5.02	12701 5.04	12062 5.06	11502 5.09	11065 5.10	10810 5.10	64	86	134
2250	13589 5.05	12843 5.07	12196 5.10	11630 5.12	11188 5.13	10932 5.13	64	87	136
2275	13740 5.08	12985 5.11	12330 5.13	11758 5.15	11312 5.17	11054 5.17	65	88	138
2300	13890 5.12	13127 5.14	12464 5.16	11886 5.19	11436 5.20	11176 5.20	66	89	140
2325	14040 5.15	13269 5.17	12599 5.20	12015 5.22	11561 5.24	11299 5.24	67	90	142
2350	14191 5.18	13411 5.20	12734 5.23	12143 5.25	11685 5.27	11422 5.27	68	91	144
2375	14341 5.21	13553 5.24	12868 5.26	12272 5.29	11810 5.30	11546 5.30	68	92	146
2400	14492 5.25	13696 5.27	13003 5.30	12401 5.32	11935 5.34	11671 5.34	69	93	148
2425	14643 5.28	13838 5.30	13138 5.33	12530 5.36	12061 5.37	11796 5.37	70	95	150
2450	14794 5.31	13981 5.34	13273 5.36	12659 5.39	12186 5.40	11921 5.40	71	96	152
2475	14945 5.34	14124 5.37	13408 5.40	12788 5.42	12312 5.44	12046 5.44	72	97	154
2500	15096 5.38	14267 5.40	13543 5.43	12918 5.46	12437 5.47	12172 5.47	73	98	156
2525	15247 5.41	14410 5.43	13679 5.46	13047 5.49	12563 5.50	12298 5.50	73	99	158
2550	15399 5.44	14553 5.47	13814 5.49	13177 5.52	12689 5.54	12424 5.54	74	100	160
2575	15550 5.47	14696 5.50	13949 5.53	13306 5.56	12815 5.57	12550 5.57	75	102	162
2600	15701 5.51	14839 5.53	14085 5.56	13436 5.59	12942 6.00	12677 6.00	76	103	164
2625	15853 5.54	14983 5.57	14221 5.59	13566 6.02	13068 6.04	12804 6.04	77	104	166
2650	16005 5.57	15126 6.00	14357 6.03	13696 6.06	13195 6.07	12931 6.07	78	105	168
2675	16156 6.00	15270 6.03	14493 6.06	13827 6.09	13322 6.11	13058 6.11	79	107	170
2700	16308 6.04	15414 6.06	14629 6.09	13957 6.12	13449 6.14	13185 6.14	79	108	172

LOW AIR CONDITIONING
ΔFUEL = – 0.5 %

ENGINE ANTI ICE ON
ΔFUEL = + 3 %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2700	16308 6.04	15414 6.06	14629 6.09	13957 6.12	13449 6.14	13185 6.14	79	108	172
2725	16460 6.07	15557 6.10	14765 6.13	14087 6.16	13576 6.17	13313 6.17	80	109	174
2750	16612 6.10	15701 6.13	14902 6.16	14218 6.19	13703 6.21	13441 6.21	81	110	176
2775	16764 6.13	15845 6.16	15038 6.19	14349 6.22	13831 6.24	13570 6.24	82	112	179
2800	16916 6.17	15989 6.20	15175 6.23	14480 6.26	13959 6.27	13698 6.27	83	113	181
2825	17068 6.20	16134 6.23	15312 6.26	14611 6.29	14087 6.31	13820 6.31*	84	114	183
2850	17221 6.23	16278 6.26	15448 6.29	14743 6.32	14215 6.34	13951 6.34*	85	115	185
2875	17374 6.26	16423 6.29	15585 6.33	14874 6.36	14343 6.37	14082 6.38*	85	117	187
2900	17527 6.30	16567 6.33	15722 6.36	15005 6.39	14472 6.41	14213 6.41*	86	118	189
2925	17680 6.33	16712 6.36	15860 6.39	15137 6.42	14601 6.44	14345 6.44*	87	119	192
2950	17833 6.36	16856 6.39	15997 6.43	15269 6.46	14730 6.48	14477 6.48*	88	121	194
2975	17987 6.40	17001 6.43	16134 6.46	15401 6.49	14859 6.51	14609 6.51*	89	122	196
3000	18140 6.43	17146 6.46	16272 6.49	15533 6.52	14989 6.54	14741 6.54*	90	123	198
3025	18294 6.46	17292 6.49	16409 6.52	15665 6.56	15118 6.58	14873 6.58*	91	125	201
3050	18447 6.49	17437 6.53	16547 6.56	15798 6.59	15248 7.01	15006 7.01*	92	126	203
3075	18601 6.53	17583 6.56	16685 6.59	15930 7.02	15378 7.04	15138 7.04*	93	127	205
3100	18755 6.56	17729 6.59	16823 7.02	16063 7.06	15508 7.08	15271 7.08*	93	129	208

LOW AIR CONDITIONING
ΔFUEL = – 0.5 %

ENGINE ANTI ICE ON
ΔFUEL = + 3 %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
200	1521 0.39	1516 0.39	1514 0.39	1515 0.38	1517 0.38		14	15	15
225	1650 0.43	1639 0.43	1633 0.42	1630 0.42	1629 0.42	1631 0.41	15	17	17
250	1780 0.47	1762 0.47	1752 0.46	1745 0.45	1740 0.45	1740 0.45	16	18	19
275	1909 0.51	1886 0.50	1871 0.50	1860 0.49	1852 0.48	1848 0.48	17	19	20
300	2039 0.54	2010 0.54	1990 0.53	1975 0.53	1963 0.52	1957 0.51	18	20	22
325	2169 0.58	2133 0.58	2110 0.57	2090 0.56	2075 0.55	2066 0.55	19	22	23
350	2298 1.02	2257 1.02	2229 1.01	2205 1.00	2187 0.59	2175 0.58	20	23	24
375	2428 1.06	2382 1.05	2349 1.04	2321 1.03	2299 1.02	2284 1.02	21	24	26
400	2559 1.09	2506 1.09	2469 1.08	2437 1.07	2412 1.06	2394 1.05	22	26	27
425	2689 1.13	2630 1.13	2589 1.12	2553 1.11	2524 1.09	2503 1.08	23	27	29
450	2819 1.17	2755 1.17	2709 1.15	2669 1.14	2637 1.13	2613 1.12	24	28	30
475	2950 1.21	2879 1.21	2829 1.19	2785 1.18	2750 1.16	2723 1.15	26	29	32
500	3080 1.25	3004 1.24	2950 1.23	2902 1.21	2863 1.20	2833 1.18	27	31	33
525	3211 1.28	3129 1.28	3071 1.26	3018 1.25	2976 1.23	2943 1.22	28	32	34
550	3342 1.32	3254 1.32	3191 1.30	3135 1.28	3089 1.27	3053 1.25	29	33	36
575	3473 1.36	3379 1.36	3312 1.34	3252 1.32	3203 1.30	3163 1.29	30	35	37
600	3604 1.40	3505 1.39	3433 1.37	3369 1.35	3316 1.33	3274 1.32	31	36	39
625	3735 1.43	3630 1.43	3555 1.41	3486 1.39	3430 1.37	3384 1.35	32	37	40
650	3867 1.47	3756 1.47	3676 1.45	3603 1.43	3544 1.40	3495 1.39	33	39	42
675	3998 1.51	3881 1.51	3798 1.48	3721 1.46	3658 1.44	3606 1.42	34	40	43
700	4130 1.55	4007 1.54	3919 1.52	3838 1.50	3772 1.47	3717 1.45	36	41	45
725	4261 1.58	4133 1.58	4041 1.56	3956 1.53	3886 1.51	3829 1.49	37	43	46
750	4393 2.02	4259 2.02	4163 1.59	4074 1.57	4001 1.54	3940 1.52	38	44	48
775	4525 2.06	4386 2.06	4286 2.03	4192 2.00	4116 1.57	4052 1.55	39	45	49
800	4657 2.10	4512 2.09	4408 2.06	4310 2.04	4230 2.01	4164 1.59	40	47	51
825	4790 2.13	4639 2.13	4530 2.10	4429 2.07	4345 2.04	4275 2.02	41	48	52

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.4 %	ΔFUEL = + 3. %	ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
825	4790 2.13	4639 2.13	4530 2.10	4429 2.07	4345 2.04	4275 2.02	41	48	52
850	4922 2.17	4765 2.17	4653 2.14	4547 2.11	4461 2.08	4388 2.05	42	49	54
875	5054 2.21	4892 2.21	4776 2.17	4666 2.14	4576 2.11	4500 2.09	44	51	56
900	5187 2.25	5020 2.24	4899 2.21	4785 2.18	4691 2.14	4612 2.12	45	52	57
925	5320 2.28	5147 2.28	5022 2.24	4904 2.21	4807 2.18	4725 2.15	46	53	59
950	5453 2.32	5275 2.32	5145 2.28	5023 2.25	4923 2.21	4837 2.19	47	55	60
975	5586 2.36	5403 2.36	5269 2.32	5143 2.28	5039 2.25	4950 2.22	48	56	62
1000	5719 2.40	5531 2.39	5392 2.35	5262 2.32	5155 2.28	5063 2.25	49	58	63
1025	5852 2.44	5659 2.43	5516 2.39	5382 2.35	5271 2.31	5177 2.29	51	59	65
1050	5985 2.47	5787 2.47	5640 2.42	5502 2.39	5388 2.35	5290 2.32	52	60	66
1075	6119 2.51	5916 2.50	5764 2.46	5622 2.42	5504 2.38	5404 2.35	53	62	68
1100	6252 2.55	6044 2.54	5888 2.50	5742 2.46	5621 2.41	5518 2.39	54	63	70
1125	6386 2.59	6173 2.58	6012 2.53	5862 2.49	5738 2.45	5633 2.42	55	64	71
1150	6520 3.02	6302 3.01	6136 2.57	5982 2.53	5855 2.48	5747 2.46	57	66	73
1175	6654 3.06	6431 3.05	6261 3.00	6103 2.56	5973 2.52	5862 2.49	58	67	74
1200	6788 3.10	6561 3.09	6386 3.04	6224 3.00	6090 2.55	5976 2.52	59	69	76
1225	6922 3.14	6690 3.12	6510 3.07	6345 3.03	6208 2.58	6091 2.56	60	70	78
1250	7057 3.17	6820 3.16	6635 3.11	6466 3.07	6325 3.02	6207 2.59	62	71	79
1275	7191 3.21	6950 3.20	6761 3.15	6587 3.10	6443 3.05	6322 3.02	63	73	81
1300	7326 3.25	7080 3.23	6886 3.18	6708 3.14	6561 3.08	6437 3.06	64	74	82
1325	7461 3.29	7210 3.27	7011 3.22	6830 3.17	6679 3.12	6553 3.09	65	76	84
1350	7596 3.32	7340 3.31	7137 3.25	6952 3.21	6798 3.15	6669 3.12	67	77	86
1375	7731 3.36	7471 3.34	7263 3.29	7073 3.24	6916 3.18	6785 3.16	68	78	87
1400	7866 3.40	7601 3.38	7389 3.32	7195 3.27	7035 3.22	6901 3.19	69	80	89
1425	8001 3.44	7732 3.42	7515 3.36	7318 3.31	7154 3.25	7017 3.22	70	81	91
1450	8136 3.48	7863 3.45	7641 3.39	7440 3.34	7273 3.29	7134 3.26	72	83	92

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.4 %	ΔFUEL = + 3 %	ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1450	8136 3.48	7863 3.45	7641 3.39	7440 3.34	7273 3.29	7134 3.26	72	83	92
1475	8272 3.51	7994 3.49	7768 3.43	7562 3.38	7392 3.32	7251 3.29	73	84	94
1500	8408 3.55	8126 3.52	7894 3.46	7685 3.41	7512 3.35	7368 3.32	74	85	96
1525	8543 3.59	8257 3.56	8021 3.50	7808 3.45	7631 3.39	7485 3.36	76	87	98
1550	8679 4.03	8389 4.00	8148 3.53	7931 3.48	7751 3.42	7602 3.39	77	88	99
1575	8816 4.06	8521 4.03	8275 3.57	8054 3.52	7871 3.45	7720 3.42	78	90	101
1600	8952 4.10	8653 4.07	8402 4.01	8177 3.55	7991 3.49	7837 3.46	80	91	103
1625	9088 4.14	8786 4.11	8530 4.04	8301 3.58	8111 3.52	7955 3.49	81	92	105
1650	9225 4.18	8918 4.14	8657 4.08	8425 4.02	8232 3.55	8073 3.52	82	94	106
1675	9361 4.21	9051 4.18	8785 4.11	8549 4.05	8352 3.59	8192 3.56	84	95	108
1700	9498 4.25	9184 4.21	8913 4.15	8673 4.09	8473 4.02	8310 3.59	85	97	110
1725	9635 4.29	9317 4.25	9041 4.18	8797 4.12	8594 4.05	8429 4.02	86	98	112
1750	9772 4.33	9450 4.28	9169 4.22	8921 4.15	8716 4.08	8548 4.06	88	100	113
1775	9909 4.36	9584 4.32	9298 4.25	9046 4.19	8837 4.12	8668 4.09	89	101	115
1800	10047 4.40	9717 4.36	9426 4.28	9171 4.22	8959 4.15	8787 4.12	90	103	117
1825	10184 4.44	9851 4.39	9555 4.32	9296 4.26	9080 4.18	8907 4.16	92	104	119
1850	10322 4.48	9985 4.43	9684 4.35	9421 4.29	9202 4.22	9027 4.19	93	105	121
1875	10459 4.51	10119 4.46	9813 4.39	9546 4.32	9324 4.25	9147 4.22	95	107	123
1900	10597 4.55	10253 4.50	9943 4.42	9672 4.36	9447 4.28	9267 4.26	96	108	125
1925	10735 4.59	10388 4.54	10072 4.46	9797 4.39	9569 4.32	9387 4.29	97	110	127
1950	10873 5.03	10523 4.57	10202 4.49	9923 4.43	9692 4.35	9508 4.32	99	111	128
1975	11012 5.06	10658 5.01	10331 4.53	10049 4.46	9815 4.38	9629 4.36	100	113	130
2000	11151 5.10	10793 5.04	10461 4.56	10175 4.49	9938 4.41	9750 4.39	101	114	132
2025	11291 5.14	10928 5.08	10592 5.00	10302 4.53	10061 4.45	9871 4.42	103	116	134
2050	11431 5.17	11063 5.11	10722 5.03	10428 4.56	10184 4.48	9993 4.46	104	117	136
2075	11571 5.21	11198 5.15	10852 5.07	10555 4.59	10308 4.51	10114 4.49	106	119	138

LOW AIR CONDITIONING
ΔFUEL = – 0.4 %

ENGINE ANTI ICE ON
ΔFUEL = + 3. %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2075	11571 5.21	11198 5.15	10852 5.07	10555 4.59	10308 4.51	10114 4.49	106	119	138
2100	11711 5.25	11334 5.18	10983 5.10	10682 5.03	10432 4.55	10236 4.52	107	120	140
2125	11851 5.28	11469 5.22	11114 5.14	10809 5.06	10556 4.58	10358 4.56	109	122	142
2150	11992 5.32	11605 5.25	11245 5.17	10936 5.10	10680 5.01	10481 4.59	110	123	144
2175	12132 5.36	11741 5.29	11376 5.20	11063 5.13	10804 5.04	10603 5.02	112	125	146
2200	12273 5.39	11877 5.32	11508 5.24	11191 5.16	10929 5.08	10726 5.05	113	126	148
2225	12414 5.43	12013 5.36	11640 5.27	11319 5.20	11053 5.11	10849 5.09	114	128	150
2250	12555 5.47	12149 5.40	11772 5.31	11447 5.23	11178 5.14	10972 5.12	116	129	152
2275	12697 5.50	12286 5.43	11904 5.34	11575 5.26	11303 5.17	11095 5.15	117	131	154
2300	12838 5.54	12423 5.47	12036 5.38	11703 5.30	11428 5.21	11219 5.19	119	132	156
2325	12980 5.58	12560 5.50	12168 5.41	11832 5.33	11553 5.24	11343 5.22	120	134	158
2350	13122 6.01	12697 5.54	12301 5.44	11960 5.36	11678 5.27	11468 5.25	122	135	160
2375	13264 6.05	12834 5.57	12434 5.48	12089 5.40	11804 5.31	11593 5.29	123	137	162
2400	13406 6.09	12971 6.01	12567 5.51	12218 5.43	11929 5.34	11718 5.32	125	138	164
2425	13549 6.12	13109 6.04	12700 5.55	12347 5.46	12055 5.38	11843 5.35	126	140	166
2450	13691 6.16	13247 6.07	12833 5.58	12476 5.50	12180 5.41	11969 5.39	128	141	168
2475	13834 6.19	13385 6.11	12967 6.02	12606 5.53	12306 5.44	12095 5.42	129	143	170
2500	13977 6.23	13523 6.14	13101 6.05	12736 5.56	12432 5.48	12221 5.45	131	144	172
2525	14120 6.27	13662 6.18	13235 6.08	12866 6.00	12559 5.51	12348 5.49	132	146	174
2550	14264 6.30	13800 6.21	13369 6.12	12996 6.03	12685 5.54	12474 5.52	134	148	176
2575	14407 6.34	13939 6.25	13503 6.15	13126 6.06	12812 5.58	12601 5.56	135	149	178
2600	14551 6.38	14078 6.28	13638 6.19	13257 6.09	12939 6.01	12729 5.59	137	151	180
2625	14695 6.41	14217 6.32	13772 6.22	13387 6.13	13066 6.04	12856 6.02	138	152	182
2650	14839 6.45	14356 6.35	13907 6.25	13518 6.16	13193 6.08	12984 6.06	140	154	184
2675	14983 6.48	14496 6.39	14042 6.29	13649 6.19	13320 6.11	13111 6.09	141	155	186
2700	15128 6.52	14636 6.42	14178 6.32	13780 6.23	13448 6.14	13240 6.12	143	157	189

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.4 %	ΔFUEL = + 3 %	ΔFUEL = + 5.5 %

R

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. LANDING WEIGHT = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2700	15128 6.52	14636 6.42	14178 6.32	13780 6.23	13448 6.14	13240 6.12	143	157	189
2725	15273 6.56	14776 6.46	14313 6.35	13912 6.26	13576 6.18	13368 6.16	144	158	191
2750	15418 6.59	14916 6.49	14449 6.39	14044 6.29	13704 6.21	13497 6.19	146	160	193
2775	15563 7.03	15057 6.52	14585 6.42	14175 6.32	13832 6.24	13626 6.22	147	161	195
2800	15708 7.06	15197 6.56	14722 6.46	14308 6.36	13960 6.28	13755 6.26	149	163	197
2825	15854 7.10	15338 6.59	14858 6.49	14440 6.39	14088 6.31	13886 6.29*	151	165	199
2850	15999 7.14	15479 7.03	14995 6.52	14573 6.42	14217 6.34	14017 6.32*	152	166	201
2875	16145 7.17	15620 7.06	15131 6.56	14705 6.45	14346 6.38	14148 6.36*	154	168	204
2900	16291 7.21	15761 7.10	15268 6.59	14838 6.49	14476 6.41	14280 6.39*	155	169	206
2925	16437 7.24	15903 7.13	15406 7.02	14972 6.52	14605 6.44	14412 6.42*	157	171	208
2950	16584 7.28	16045 7.16	15543 7.06	15105 6.55	14735 6.48	14544 6.46*	159	172	210
2975	16730 7.31	16187 7.20	15681 7.09	15239 6.58	14865 6.51	14676 6.49*	160	174	213
3000	16877 7.35	16329 7.23	15818 7.12	15372 7.02	14995 6.54	14808 6.52*	162	176	215
3025	17024 7.39	16471 7.27	15956 7.16	15506 7.05	15125 6.58	14941 6.56*	163	177	217
3050	17172 7.42	16614 7.30	16095 7.19	15641 7.08	15255 7.01	15074 6.59*	165	179	220
3075	17319 7.46	16757 7.33	16233 7.22	15775 7.11	15386 7.04	15207 7.02*	166	181	222
3100	17468 7.49	16900 7.37	16372 7.26	15910 7.15	15517 7.08	15340 7.06*	168	182	224

LOW AIR CONDITIONING
ΔFUEL = – 0.4 %

ENGINE ANTI ICE ON
ΔFUEL = + 3 %

TOTAL ANTI ICE ON
ΔFUEL = + 5.5 %

GENERAL

The alternate planning tables allow the flight crew to determine the fuel consumption and time required to cover a given air distance from go-around at destination airport to landing at alternate airport.
These tables are established for :
- Go-around : 80 kg or 180 lb
- Climb profile : 250kt/300kt/M.78
- Long Range Speed
- Descent profile : M.78/300kt/250kt
- Approach and landing at alternate airport : 60 kg or 140 lb (4 minutes)
- ISA
- CG = 33 %
- Normal air conditioning
- Anti ice OFF

Note : 1. In the tables, the asterisk (*) means that a step climb of 4000 feet must be flown to reach the corresponding flight level.
2. The flight level shown on the top of each column is the final flight level.
3. For each degree Celsius above ISA temperature apply a fuel correction of 0.015 (kg/°C/NM) × △ISA (°C) × Air Distance (NM)
or 0.033 (lb/°C/NM) ×△ISA (°C) × Air Distance (NM)

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The alternate planning tables are based on a reference landing weight at alternate.
The fuel consumption must be corrected when the actual weight is different from the reference weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference weight.

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 80 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 60 KG (4MIN)

REF. LDG WT AT ALTERNATE = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	120	140	160	180	200	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL120	FL140 FL160	FL180 FL200
20									
40	483 0.12						2		
60	642 0.16	615 0.16	611 0.16	612 0.16			3	3	
80	801 0.20	768 0.20	757 0.20	751 0.19	749 0.19	751 0.19	5	4	4
100	961 0.25	921 0.24	903 0.23	891 0.23	883 0.23	879 0.22	6	5	5
120	1120 0.29	1075 0.28	1050 0.27	1030 0.27	1016 0.26	1006 0.26	8	6	6
140	1280 0.33	1228 0.32	1196 0.31	1170 0.30	1149 0.30	1134 0.29	9	7	7
160	1441 0.37	1382 0.35	1343 0.35	1310 0.34	1283 0.34	1262 0.33	10	8	8
180	1601 0.41	1536 0.39	1490 0.38	1450 0.38	1417 0.37	1390 0.36	11	9	9
200	1762 0.45	1690 0.43	1637 0.42	1590 0.41	1551 0.41	1519 0.40	13	10	10
220	1923 0.49	1845 0.47	1784 0.46	1731 0.45	1685 0.44	1647 0.43	14	11	11
240	2084 0.53	1999 0.51	1931 0.50	1871 0.49	1819 0.48	1776 0.47	15	12	12
260	2246 0.57	2154 0.54	2078 0.53	2012 0.52	1953 0.52	1904 0.50	17	13	13
280	2407 1.01	2309 0.58	2226 0.57	2153 0.56	2088 0.55	2033 0.53	18	14	14
300	2569 1.05	2464 1.02	2374 1.01	2293 1.00	2223 0.59	2162 0.57	19	15	15
320	2732 1.09	2619 1.06	2522 1.04	2435 1.03	2357 1.02	2291 1.00	20	16	16
340	2894 1.13	2774 1.10	2670 1.08	2576 1.07	2492 1.06	2420 1.04	22	17	17
360	3057 1.17	2930 1.13	2818 1.12	2717 1.11	2627 1.09	2550 1.07	23	18	18
380	3220 1.21	3086 1.17	2966 1.16	2859 1.14	2762 1.13	2679 1.11	24	19	19
400	3384 1.25	3242 1.21	3115 1.19	3001 1.18	2898 1.17	2809 1.14	25	20	20
420	3548 1.28	3398 1.25	3263 1.23	3142 1.22	3033 1.20	2939 1.17	27	21	21
440	3712 1.32	3554 1.28	3412 1.27	3284 1.25	3169 1.24	3069 1.21	28	22	22
460	3876 1.36	3710 1.32	3561 1.30	3426 1.29	3305 1.27	3199 1.24	29	23	23
480	4040 1.40	3867 1.36	3710 1.34	3569 1.33	3440 1.31	3329 1.27	30	24	24
500	4205 1.44	4024 1.39	3859 1.38	3711 1.36	3576 1.34	3460 1.31	31	25	25

LOW AIR CONDITIONING
ΔFUEL = – 0.5 %

ENGINE ANTI ICE ON
ΔFUEL = + 3.5 %

TOTAL ANTI ICE ON
ΔFUEL = + 6.5 %

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 80 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 60 KG (4MIN)

REF. LDG WT AT ALTERNATE=50000KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 230	270	310	350	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL230 FL270	FL310 FL350	FL390
100	880 0.22					6		
120	999 0.25	1005 0.24				7		
140	1119 0.28	1113 0.28				8		
160	1238 0.32	1221 0.31	1226 0.30			9	10	
180	1358 0.35	1330 0.34	1324 0.33	1332 0.32		9	11	
200	1477 0.38	1438 0.37	1422 0.36	1423 0.35		10	12	
220	1597 0.41	1546 0.40	1521 0.39	1515 0.38		11	13	
240	1717 0.44	1655 0.43	1619 0.42	1606 0.41	1608 0.40	12	14	14
260	1836 0.48	1763 0.46	1718 0.45	1698 0.44	1695 0.43	12	15	16
280	1956 0.51	1872 0.49	1817 0.48	1790 0.47	1782 0.46	13	16	17
300	2076 0.54	1980 0.52	1915 0.51	1882 0.50	1869 0.48	14	17	18
320	2197 0.57	2089 0.55	2014 0.54	1974 0.52	1955 0.51	15	18	19
340	2317 1.01	2198 0.58	2113 0.57	2066 0.55	2042 0.54	16	19	20
360	2437 1.04	2307 1.01	2212 1.00	2158 0.58	2130 0.57	16	20	22
380	2558 1.07	2416 1.04	2311 1.03	2251 1.01	2217 0.59	17	21	23
400	2678 1.10	2525 1.07	2410 1.06	2343 1.04	2304 1.02	18	22	24
420	2799 1.13	2635 1.10	2510 1.09	2436 1.07	2392 1.05	19	23	25
440	2920 1.16	2744 1.14	2609 1.12	2528 1.10	2479 1.07	20	24	26
460	3041 1.20	2853 1.17	2708 1.15	2621 1.12	2567 1.10	20	25	28
480	3162 1.23	2963 1.20	2808 1.18	2714 1.15	2654 1.13	21	26	29
500	3283 1.26	3073 1.23	2908 1.21	2807 1.18	2742 1.15	22	27	30

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 3.5 %	ΔFUEL = + 6.5 %

GENERAL

R The ground distance/air distance conversion tables show the air distance for a given ground distance due to the influence of the wind.
The tables are given for:
- M.78
- Long range speed.

M.78

R

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND			WIND COMPONENTS (KT)			HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	10	11	13	15
20	15	16	18	20	23	26	30
30	22	25	27	30	34	39	45
40	30	33	36	40	45	51	60
50	37	41	45	50	56	64	75
100	75	82	90	100	113	129	150
200	150	164	180	200	225	257	300
300	225	245	270	300	338	386	450
400	300	327	360	400	450	514	600
500	375	409	450	500	563	643	750
1000	750	818	900	1000	1125	1286	1501
1500	1125	1227	1350	1500	1688	1929	2251
2000	1500	1636	1800	2000	2248	2572	3001
2500	1875	2045	2250	2500	2813	3215	3752
3000	2250	2454	2700	3000	3375	3858	4502
3500	2624	2863	3150	3500	3938	4501	5252
4000	2999	3272	3600	4000	4500	5144	6003
4500	3374	3681	4050	4500	5063	5787	6753
5000	3749	4090	4500	5000	5626	6430	7503

FLIP23 A320211 M565A1PIP 3410 03301.000011 0250300 .7800 .00000 0 0300350 0 0 77 64 43 61 18590 FCOM-N0--03--50--002--001

LONG RANGE SPEED UP TO FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	10	12	14	17
20	14	16	18	20	23	27	34
30	21	24	26	30	35	41	51
40	28	31	35	40	46	55	68
50	36	39	44	50	58	69	84
100	71	79	88	100	116	137	169
200	142	157	176	200	232	275	338
300	213	236	264	300	347	412	507
400	284	314	352	400	463	550	676
500	355	393	440	500	579	687	845
1000	710	786	880	1000	1158	1374	1690
1500	1065	1179	1320	1500	1736	2061	2535
2000	1420	1572	1760	2000	2315	2748	3380
2500	1775	1965	2201	2500	2894	3435	4225
3000	2130	2358	2641	3000	3473	4122	5070
3500	2485	2751	3081	3500	4051	4809	5915
4000	2840	3144	3521	4000	4630	5496	6760
4500	3195	3537	3961	4500	5209	6183	7605
5000	3550	3930	4401	5000	5788	6870	8450

FLIP23 A319–114 CFM56–5A5 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 70 61 40 57 18590 FCOM-N0–03–50–003–210

LONG RANGE SPEED ABOVE FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND			WIND COMPONENTS (KT)			HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	10	11	13	15
20	15	16	18	20	23	26	30
30	22	25	27	30	34	39	45
40	30	33	36	40	45	51	60
50	37	41	45	50	56	64	75
100	75	82	90	100	113	129	150
200	150	164	180	200	225	257	300
300	225	245	270	300	338	386	450
400	300	327	360	400	450	514	600
500	375	409	450	500	563	643	750
1000	750	818	900	1000	1125	1286	1500
1500	1125	1227	1350	1500	1688	1929	2251
2000	1500	1636	1800	2000	2250	2572	3001
2500	1875	2045	2250	2500	2813	3215	3751
3000	2250	2454	2700	3000	3375	3858	4501
3500	2625	2863	3150	3500	3938	4501	5252
4000	3000	3272	3600	4000	4500	5144	6002
4500	3375	3681	4050	4500	5063	5787	6752
5000	3749	4090	4500	5000	5625	6430	7502

FLIP23 A319–114 CFM56–5A5 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 70 61 40 57 18590 FCOM-N0–03–50–004–210

FUEL TANKERING

GENERAL

Fuel tankering graphs allow to determine the optimum fuel quantity to be tankered as a function of the fuel price ratio between departure and destination airports. The following pages present for one flight level per page the optimum aircraft takeoff weight depending on the fuel price ratio (departure fuel price divided by destination fuel price) and on the air distance to fly.

The computed optimum takeoff weight is based on the additional fuel consumption needed for the transport of the extra (tankered) fuel and it is the weight at which the maximum profit can be achieved. The quantity of extra fuel that can be loaded is calculated as the difference between the optimum takeoff weight (including extra fuel) and the planned takeoff weight (without fuel tankering).

The graphs are established for :

- FL290, 310, 330, 350, 370, 390
- Air distances from 250 to 2500 NM
- Flight profile :
  Climb : 250KT/300KT/M.78
  Cruise : M.78
  Descent : M.78/300KT/250KT

Note : 1. If necessary, step climbs are performed to reach the indicated flight levels.
2. The crew/operator has to verify that the found aircraft weight complies with basic aircraft limitations (e.g. max fuel capacity) as well as with mission dependent restrictions (e.g. MLW at destination).

EXAMPLES

1. Fuel price ratio = 0.944

Cruising Altitude = FL310
Planned TOW = 68 000 kg (mission weight without fuel tankering)
Air Distance = 1750 NM

Enter graph on page 2.05.70 P.4.

For the given air distance, the optimum fuel tankering weight is 65 000 kg, which is lower than the planned takeoff weight → no fuel tankering recommended.

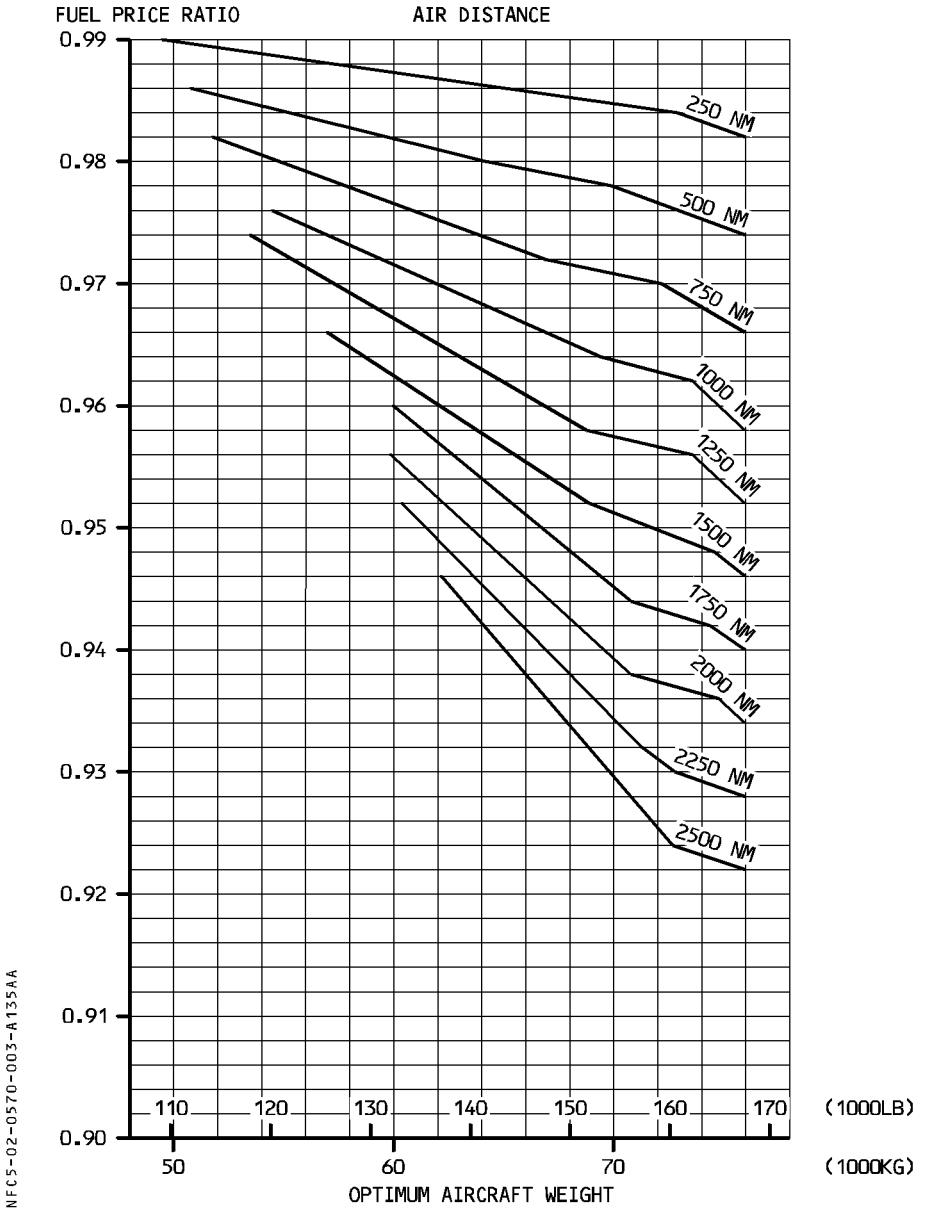
2. Fuel price ratio = 0.930

Cruising Altitude = FL350
Planned TOW = 60 000 kg (mission weight without fuel tankering)
Air Distance = 1250 NM
Enter graph on page 2.05.70 P6.
For the given air distance, the optimum fuel tankering weight is 69 500 kg, which is 9500 kg higher than the planned takeoff weight → optimum quantity of extra fuel is 9500 kg.
Check :
a) new TOW less than or equal to MTOW from departure airport ;
b) total fuel to be loaded less than or equal to maximum fuel capacity ;
c) MLW at destination

3. Fuel price ratio = 0.902

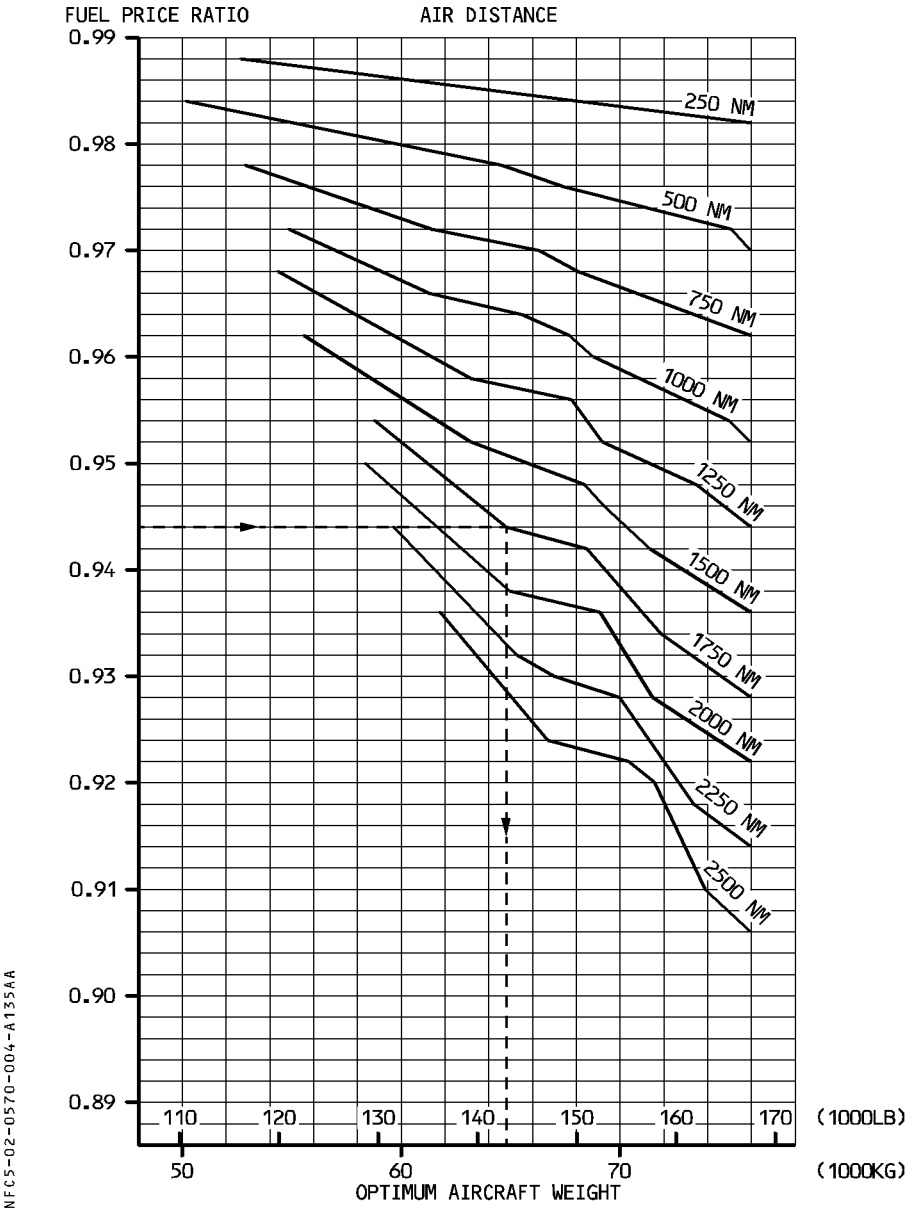
Cruising Altitude = FL390
Planned TOW = 60 000 kg (mission weight without fuel tankering)
Air Distance = 1375 NM
Enter graph on page 2.05.70 P8.
Interpolate for the air distance of 1375 NM between 1250 NM and 1 500 NM.
For the given air distance, the optimum fuel tankering weight is 63 500 kg, which is 3500 kg higher than the planned takeoff weight → optimum quantity of extra fuel is 3500 kg.
Check :
a) new TOW less than or equal to MTOW from departure airport ;
b) total fuel to be loaded less than or equal to maximum fuel capacity ;
c) MLW at destination

FL290



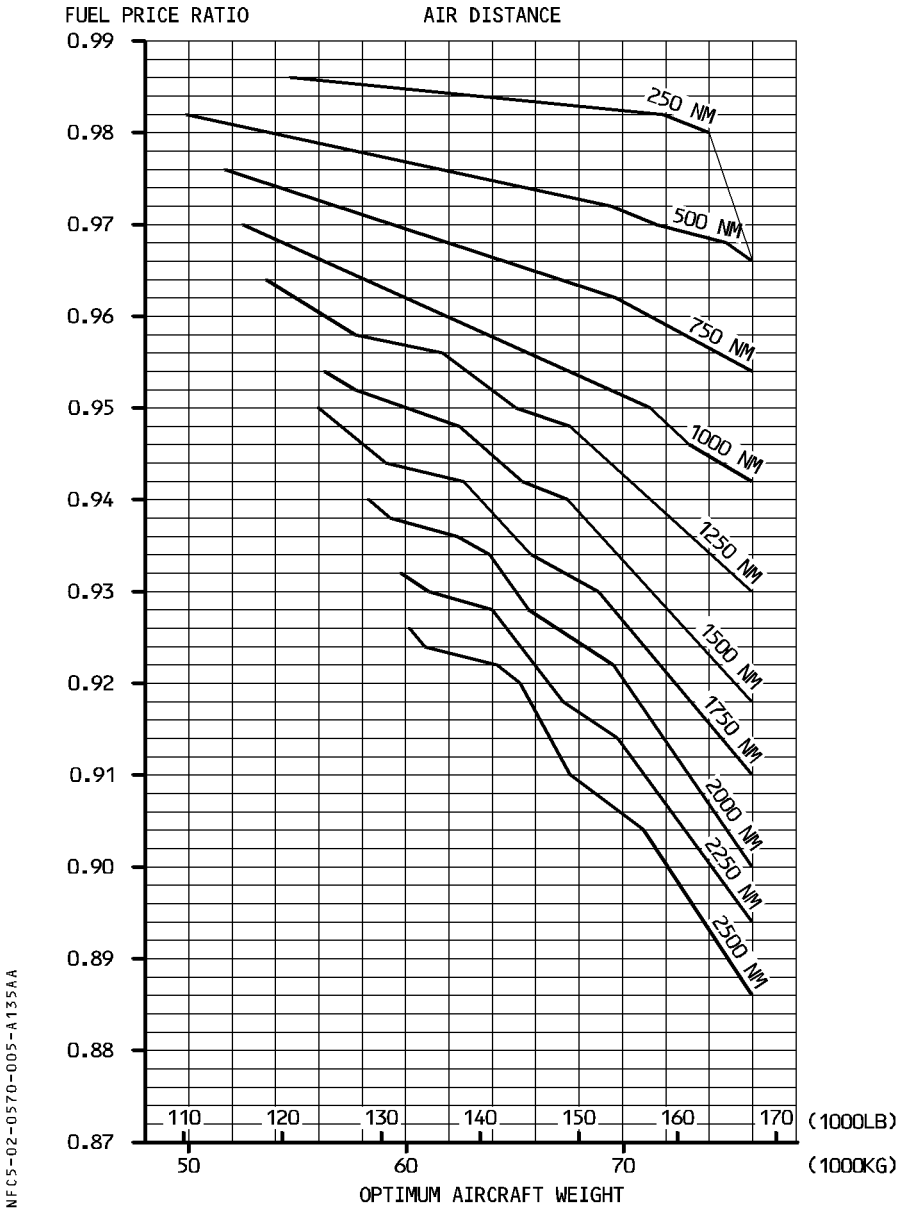
NFCS-02-0570-003-A135AA

FL310



NFC5-02-0570-004-A135AA

FL330



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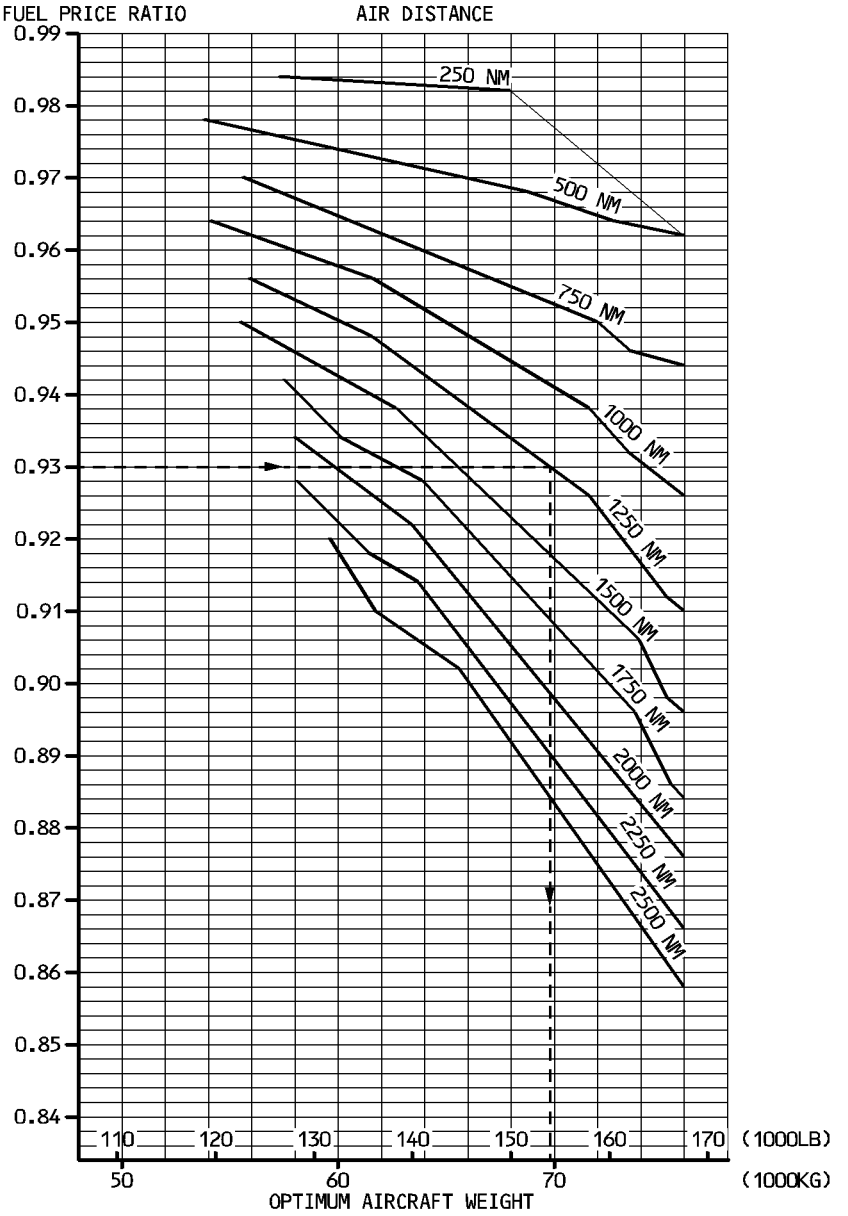
FL350



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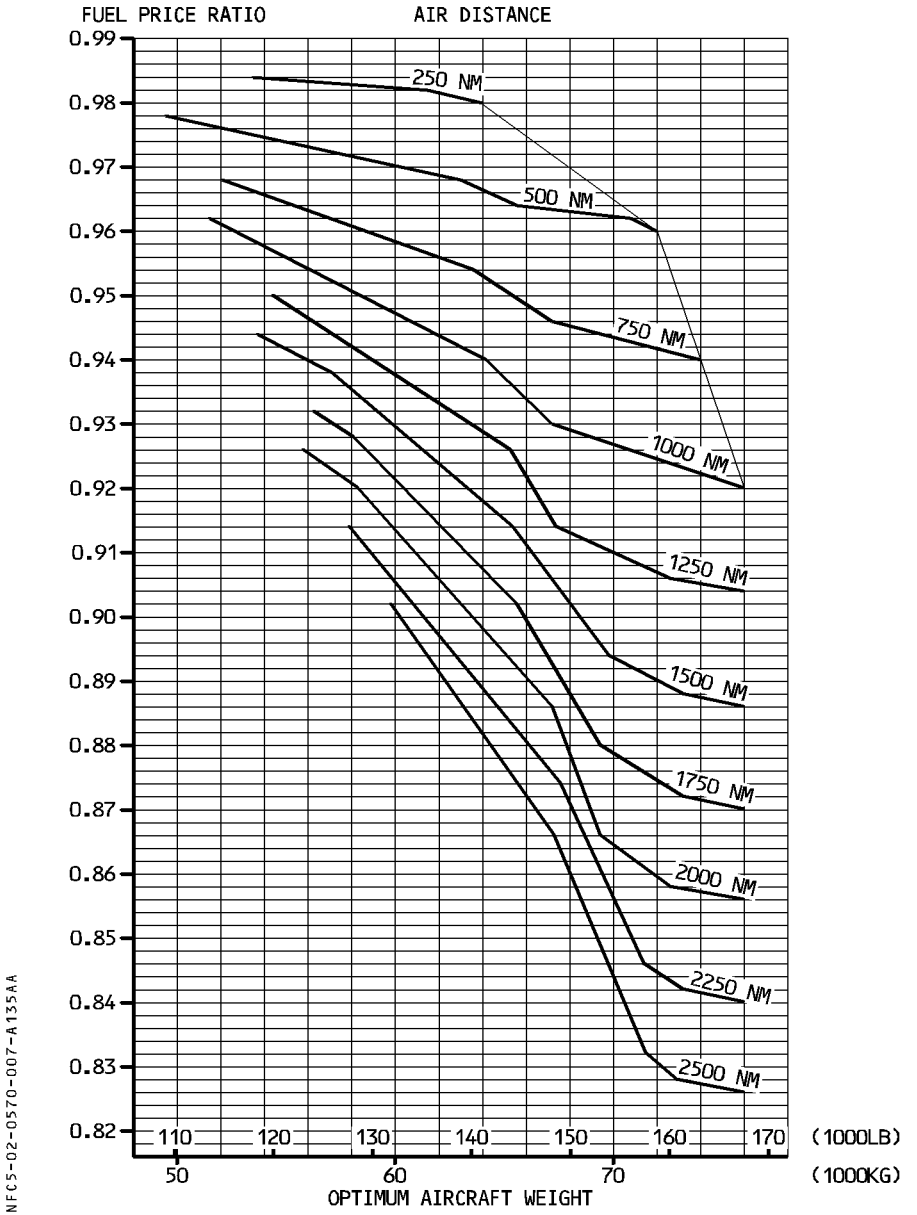
FL370



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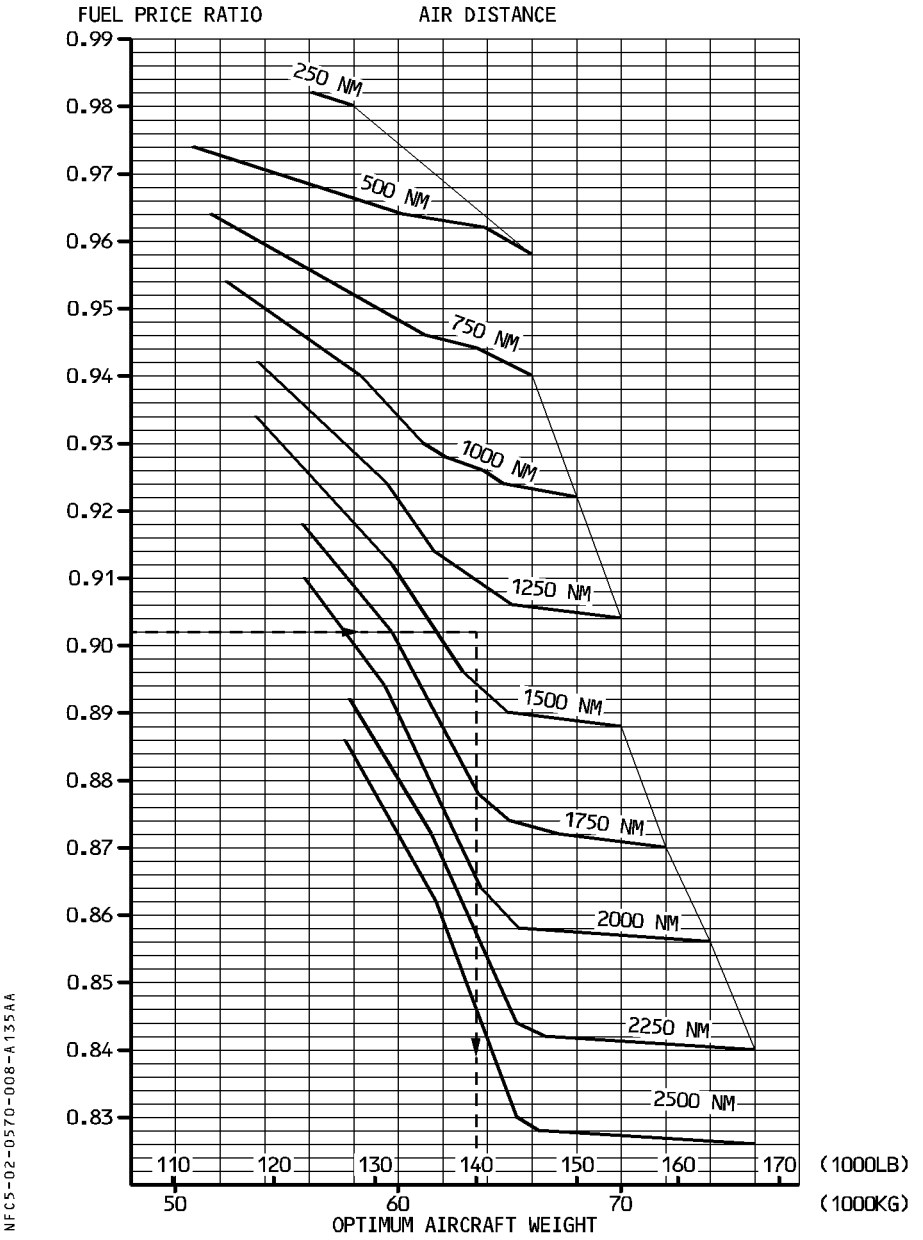
FL390



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