Flight Crew Operating Manual

FCOM

A320

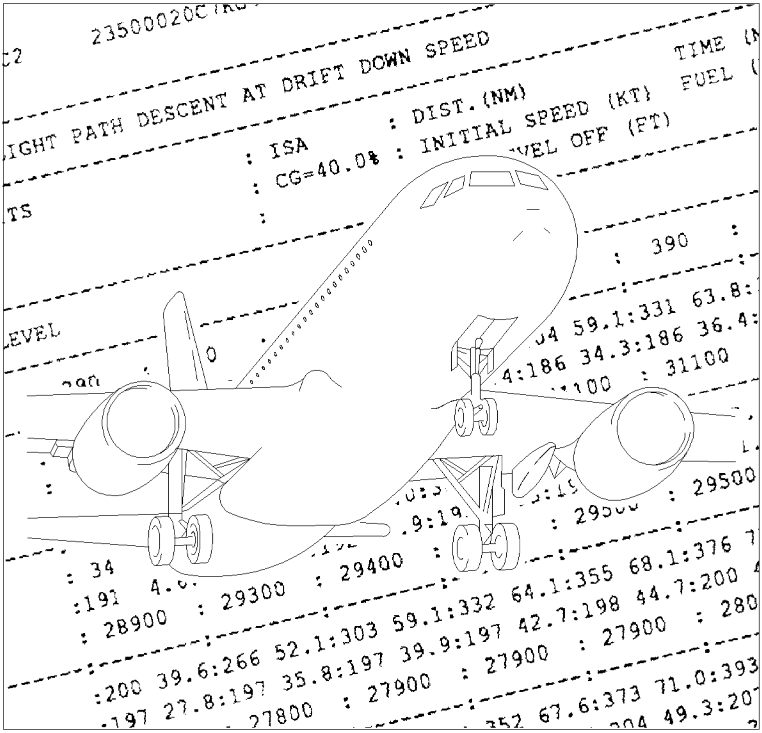
Volume 2

Customer Services

AIRBUS

A318/A319/A320/A321

FLIGHT CREW OPERATING MANUAL



FLIGHT PREPARATION

2

AIRBUS®

00.00 CONTENTS

FOREWORD

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

COMMENTS — QUESTIONS — SUGGESTIONS

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

R

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

FOR TECHNICAL OR PROCEDURAL CONTENT

AIRBUS - BP N°33
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX - FRANCE
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ATTN. Technical Documentation Services - SDC
EMAIL : sb.reporting@airbus.com

FOR PRINTING AND DISTRIBUTION

NFC5-02-0010-001-A001AA

CONTENT

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

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

USE

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

R **DEFINITION OF A WARNING, CAUTION AND NOTE**

R The following are the official definitions of warnings, cautions and notes taken directly from
R the JAR 25 / CS-25 and applicable to Airbus flight operational documentation :
R "WARNING: An operating procedure, technique, etc. that may result in personal injury
R or loss of life if not followed."
R "CAUTION : An operating procedure, technique, etc. that may result in damage to
R equipment if not followed."
R "NOTE : An operating procedure, technique, etc. considered essential to
R emphasize. Information contained in notes may also be safety related."

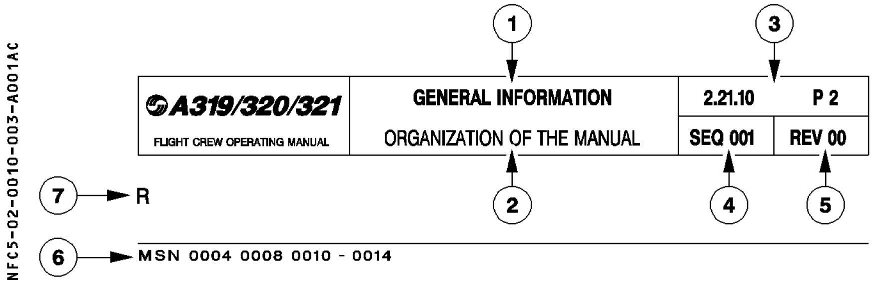
COMPLEMENTARY INFORMATION

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
R	0001	Mod : 33374 = (33374+34862+37809)
R	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)
R	0006	Mod : 20057 = (20057+33374+34862)
R	0007	Mod : (20057+33374) = (20057+33374+34862+37809)
	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)
R	0011	Mod : (20024+20167) = (20024+20167+37331+37332)
R	0012	Mod : (20024+20167+34456) = (20024+20167+37226) = (20024+20167+28378+34456) = (20024+20167+34456+37331+37332) = (20024+20167+37226+37331+37332)
	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 = B8 = (Mod : 28160+CFM 56-5-B4)
	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 : (22013+36310) = (22013+25800+36310)
R	0022	Mod : (20024+20167+28378) = (20024+20167+33973) = (20024+20167+28378+37331+37332) = (20024+20167+33973+37331+37332)
	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)
R	0027	Mod : (20024+20167+28238+32635) = (20024+20167+28238+32635+37331+37332)
R	0028	Mod : (20040+20065+20106+20107+21103+22013+30422) = (20040+20065+20106+20107+21103+22013+25453+30422)
	0029	STD = Mod : 22802 = (20586+22802)
	0030	Mod : 22013 = (22013+22802) = (20586+22013+22802)
	0031	Mod : 20024 = (20024+22802) = (20024+20586+22802)
R	0032	Mod : (23124+25615) = (25615+28009) = (23124+38140) = (28009+38140)
R	0036	Mod : (20268+26965) = (20268+31106)
R	0037	Mod : 31896 = 31897 = 32401 = 32402 = 32475 = 32929 = 35119 = (31896+32402) = (31897+32401) = (31896+32332+32475) = (31897+32333+32929) = (31896+32332+35119)
R	0038	Mod : 31896 = 31897 = 32401 = 32402 = 32475 = 32929 = 35119 = (31896+32402) = (31897+31401) = (31896+32332+32475) = (31897+32333+32929) = (31896+32332+35119)
	0041	Mod : 22461 = 23408 = (22461+23408)

	CODE	DESIGNATION
	0042	Mod : (20268+22013) = (20268+22013+25141)
	0043	Mod : (20268+25714) = (20268+25714+26131)
	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)
	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)
R	0054	Mod : (32401+33323) = (32402+33323) = (32475+33323) = (32929+33323)
R	0055	STD = Mod : (20139+22129) = (20139+22129+28160+28917)
	0056	Mod : 20139 = (20139+28160+28917)
R	0057	Mod : (20024+28378+31286) = (20024+31286+37226)
R	0058	Mod : 22461 = 23408 = (22461+23408)
R	0059	Mod : (27620+30020+33323+35542) = (27620+30020+33323+37285+35542)
R	0060	Mod : (20268+28722+56-5-B4) = (20268+28722+36297+56-5-B5) = (20268+28722+36311+56-5-B6) = (20268+28722+36885+56-5-B6)
R	0061	Mod : 33323 = (27620+33323+33497) = (33323+34809+37588) = (27620+33323+33497+34809+37588)
R	0062	Mod : (27620+33323) = (27620+33323+37285) = (27620+33323+37285+33497) = (27620+33323+34809+37588) = (27620+33323+34809+37588+37285) = (27620+33323+34809+37588+37285+33497)
R	0063	Mod : (27620+33323+34809) = (27620+33323+34313) = (27620+33323+37285+34809) = (27620+33323+37285+34313) = (27620+33323+33497+37285+34809) = (27620+33323+33497+37285+34313)
R	0064	Mod : (33323+34809) = (33323+34313) = (27620+33323+33497+34809) = (27620+33323+33497+34313)
R	0065	Mod : (33323+32401+34809) = (33323+32402+34313) = (33323+32929+34809) = (33323+32475+34313) = (33323+32401+34809+31426) = (33323+32402+34313+31426) = (33323+32929+34809+31426) = (33323+32475+34313+31426)
R	0066	Mod : 33323 = (32401+33323+37588) = (32929+33323+37588) = (32401+33323+35651) = (33323+32401+34809+37588) = (33323+32929+34809+37588)
	0067	Mod : (20268+24044+28721+31607) = (20268+24044+28960+31607)
	0068	Mod : (20268+25647) = (20268+ACA)
	0069	Mod :26723 = 27410 = 27639 = 27763 = 30277 = 30835 = 30836
	0070	Mod : 20268 = (20268+25800) = (20268+24404+35404) = (20268+27727+35404) = (20268+24404+25800+35404) = (20268+24404+27727+35404) = (20268+25800+27727+35404) = (20268+24404+25800+27727+35404)
	0071	Mod : 20268 = (20268+25800) = (20268+24404+25502) = (20268+24404+35404) = (20268+27727+35404) = (20268+24404+25502+25800) = (20268+24404+25800+35404) = (20268+24404+27727+35404) = (20268+25800+27727+35404) = (20268+24404+25800+27727+35404)

	CODE	DESIGNATION
	0072	STD = Mod : 25800 = (24404+35404) = (27727+35404) = (24404+27727+35404) = (24404+25800+35404) = (25800+27727+35404) = (24404+25800+27727+35404)
	0073	STD = Mod : 24404 = 24405 = (24404+25502) = (24405+25501) = (24404+35404) = (27727+35404) = (24404+25502+25800) = (24405+25501+25800) = (24404+27727+35404) = (24404+25800+35404) = (25800+27727+35404) = (24404+25800+27727+35404)
R R R	0074	Mod : (33323+31426) = (32401+33323+37588+31426) = (32401+33323+35651+31426) = (32929+33323+37588+31426) = (33323+32401+34809+31426+37588) = (33323+32929+34809+31426+37588)
	0075	Mod : (20268+24044+25647) = (20268+24044+ACA) = (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)
	0079	Mod : 20268 = (20268+25647)
	0080	Mod : (20268+25647) = (ACA = CMM) = (20268+25647+ACA = CMM)
	0081	STD = Mod : 24105 = 27773 = (24105+27773) = (24105+27773+28471)
	0082	Mod : (20268+24044+25647) = (20268+24044+ACA) = (20268+24044+25647+ACA) = (20268+24044+25647+28960+ACA)
	0083	Mod : (20024+20167+22013+30422) = (20024+20167+22013+25453+30422)
	0084	Mod : (20024+25453) = (20024+20164+25453) = (20024+20586+25453)
R R R	0085	Mod : (27620+33323+37285+33497) = (27620+33323+34809+37588) = (27620+33323+34809+37588+37285) = (27620+33323+34809+37588+37285+33497)
	0086	Mod : (20024+22013+25453) = (20024+22013+30422) = (20024+22013+25453+30422)
	0087	Mod : (20024+22013+25453+31286) = (20024+22013+30422+31286) = (20024+22013+25453+30422+31286)
R R	0088	Mod : (20268+32121/56-5-B4) = (20268+32121+36297/56-5-B5) = (20268+32121+36311/56-5-B6) = (20268+32121+36885/56-5-B5)
R R	0089	Mod : (33323+34809) = (33323+34313) = (27620+33323+33497+34809) = (27620+33323+33497+34313)
	0090	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+26965+35040) = (20268+27773+35040)
	0091	Mod : 22013 = (22013+32656) = (22013+34221) = (22013+34221+32656)
	0092	Mod : (24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) = (26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) = (26965+32239) = (26965+32311) = (27773+32150) = (27773+32238) = (27773+32239) = (27773+32311) = (26965+35040) = (27773+35040)
	0093	Mod : 25530 = (25530+25800) = (25800+27727) = (25530+25800+27727)
	0094	Mod : (24946+25615+26965) = (24946+25615+27773) = (25615+25951+26965) = (25615+25951+27773) = (25615+26760+26965) = (25615+26760+27773) = (25615+26965+32150) = (25615+26965+32238) = (25615+26965+32239) = (25615+26965+32311) = (25615+27773+32150) = (25615+27773+32238) = (25615+27773+32239) = (25615+27773+32311) = (25615+26965+35040) = (25615+27773+35040)

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+26965+35040) = (20268+27773+35040) = (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)
0096	Mod : (20024+20164+20586) = (20024+20164+37565)
0097	Mod : (20268+26965) or (20268+31106)
0098	Mod : (20268+25647+26965) = (20268+25647+31106) = (20268+26965+ACA = MXA) = (20268+31106+ACA = MXA)
0099	Mod : (20268+25647+26965) = (20268+25647+31106)
0100	Mod : (20024+20167+22013) = (20024+20167+20586+22013) = (20024+20167+22013+37565)
0101	Mod : (20024+20586+28238) = (20024+28238+37565)
0102	Mod : (22461+27773+32311) = (22461+27773+32150) = (22461+27773+24946) = (22461+27773+26760) = (22461+27773+32238) = (22461+27773+25951) = (22461+27773+32239) = (22461+26965+32311) = (22461+26965+32150) = (22461+26965+24946) = (22461+26965+26760) = (22461+26965+32238) = (22461+26965+25951) = (22461+26965+32239) = 22461+26965+35040) = (22461+27773+35040) = (23408+27773+32311) = (23408+27773+32150) = (23408+27773+24946) = (23408+27773+26760) = (23408+27773+32238) = (23408+27773+25951) = (23408+27773+32239) = (23408+26965+32311) = (23408+26965+32150) = (23408+26965+24946) = (23408+26965+26760) = (23408+26965+32238) = (23408+26965+25951) = (23408+26965+32239) = (23408+26965+35040) = (23408+27773+35040) = (22461+23408+27773+32311) = (22461+23408+27773+32150) = (22461+23408+27773+24946) = (22461+23408+27773+26760) = (22461+23408+27773+32238) = (22461+23408+27773+25951) = (22461+23408+27773+32239) = (22461+23408+26965+32311) = (22461+23408+26965+32150) = (22461+23408+26965+24946) = (22461+23408+26965+26760) = (22461+23408+26965+32238) = (22461+23408+26965+25951) = (22461+23408+26965+32239) = (22461+23408+26965+35040) = (22461+23408+27773+35040)
0103	Mod : (20268+25647+CFM 56-5-B6) = (ACA = MXA+CFM 56-5-B6)
0104	Mod : (20024+20167+21120+22013) = (20024+20167+20586+21120+22013)
0105	Mod : (20268+24946+25647+27773) = (20268+25647+27773+32311) = (20268+25647+27773+32150) = (20268+25647+26760+27773) = (20268+25647+27773+32238) = (20268+25647+27773+32239) = (20268+25647+25951+27773) = (20268+24946+25647+26965) = (20268+25647+26965+32311) = (20268+25647+26965+32150) = (20268+25647+26760+26965) = (20268+25647+26965+32238) = (20268+25647+26965+32239) = (20268+25647+25951+26965) = (20268+25647+26965+35040) = (20268+25647+27773+35040) = (20268+24946+27773+ACA) = (20268+27773+32311+ACA) = (20268+27773+32150+ACA) = (20268+26760+27773+ACA) = (20268+27773+32238+ACA) =(20268+27773+32239+ACA) = (20268+25951+27773+ACA) = (20268+24946+26965+ACA) = (20268+26965+32311+ACA) = (20268+26965+32150+ACA) = (20268+26760+26965+ACA) = (20268+26965+32238+ACA) = (20268+26965+32239+ACA) = (20268+25951+26965+ACA) = (20268+26965+35040+ACA) = (20268+27773+35040+ACA)

CODE	DESIGNATION
0106	Mod : (20268+22461+27773+32311) = (20268+22461+27773+32150) = (20268+22461+27773+24946) = (20268+22461+27773+26760) = (20268+22461+27773+32238) = (20268+22461+27773+25951) = (20268+22461+27773+32239) = (20268+22461+26965+32311) = (20268+22461+26965+32150) = (20268+22461+26965+24946) = (20268+22461+26965+26760) = (20268+22461+26965+32238) = (20268+22461+26965+25951) = (20268+22461+26965+32239) = (20268+22461+26965+35040) = (20268+22461+27773+35040) = (20268+23408+27773+32311) = (20268+23408+27773+32150) = (20268+23408+27773+24946) = (20268+23408+27773+26760) = (20268+23408+27773+32238) = (20268+23408+27773+25951) = (20268+23408+27773+32239) = (20268+23408+26965+32311) = (20268+23408+26965+32150) = (20268+23408+26965+24946) = (20268+23408+26965+26760) = (20268+23408+26965+32238) = (20268+23408+26965+25951) = (20268+23408+26965+32239) = (20268+23408+26965+35040) = (20268+23408+27773+35040) = (20268+22461+23408+27773+32311) = (20268+22461+23408+27773+32150) = (20268+22461+23408+27773+24946) = (20268+22461+23408+27773+26760) = (20268+22461+23408+27773+32238) = (20268+22461+23408+27773+25951) = (20268+22461+23408+26965+32311) = (20268+22461+23408+26965+32150) = (20268+22461+23408+26965+24946) = (20268+22461+23408+26965+26760) = (20268+22461+23408+26965+32238) = (20268+22461+23408+26965+25951) = (20268+22461+23408+26965+32239) = (20268+22461+23408+26965+35040) = (20268+22461+23408+27773+35040)
0107	Mod : (24946+25647+27773) = (25647+27773+32311) = (25647+27773+32150) = (25647+26760+27773) = (25647+27773+32238) = (25647+27773+32239) = (25647+25951+27773) = (24946+25647+26965) = (25647+26965+32311) = (25647+26965+32150) = (25647+26760+26965) = (25647+26965+32238) = (25647+26965+32239) = (25647+25951+26965) = (25647+26965+35040) = (25647+27773+35040) = (24946+27773+ACA) = (27773+32311+ACA) = (27773+32150+ACA) = (26760+27773+ACA) = (27773+32238+ACA) =(27773+32239+ACA) = (25951+27773+ACA) = (24946+26965+ACA) = (26965+32311+ACA) = (26965+32150+ACA) = (26760+26965+ACA) = (26965+32238+ACA) = (26965+32239+ACA) = (25951+26965+ACA) = (26965+35040+ACA) = (27773+35040+ACA)
0108	Mod : (24946+25647+26965) = (24946+25647+27773) = (25647+25951+26965) = (25647+26760+26965) = (25647+25951+27773) = (25647+26760+27773) = (25647+26965+32150) = (25647+26965+32238) = (25647+26965+32239) = (25647+26965+32311) = (25647+27773+32150) = (25647+27773+32238) = (25647+27773+32239) = (25647+27773+32311) = (25647+26965+35040) = (25647+27773+35040) = (24946+26965+ACA) = (24946+27773+ACA) = (25951+26965+ACA) = (26760+26965+ACA) = (25951+27773+ACA) = (26760+27773+ACA) = (26965+32150+ACA) = (26965+32238+ACA) = (26965+32239+ACA) = (26965+32311+ACA) = (27773+32150+ACA) = (27773+32238+ACA) = (27773+32239+ACA) = (27773+32311+ACA) = (26965+35040+ACA) = (27773+35040+ACA)
0109	Mod : (20268+25647) = ACA = (20268+25647+ACA)
0110	Mod : (20268+25647) = ACA = MXA = (20268+ACA = MXA) = (20268+25647+ACA = MXA)
0112	Mod : 34456 = (20024+34456) = (20024+37226) = (20024+20164+34456) = (20024+20586+34456)
0113	Mod : 20268 = (20268+25800) = (20268+25530+26505) = (20268+25530+25800+26505)
0114	STD = Mod : 25800 = (25530+26505) = (25530+25800+26505)
0115	Mod : (20268+31106+33323) = (20268+26965+33323)
0116	Mod : (20268+25647+31106) = (20268+25647+26965)
0118	Mod : (20268+32619) = (20268+33239) = (20268+32619+33239)

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0119	Mod : (20268+28342+32619) = (20268+28342+33239) = (20268+28342+32619+33239)
0120	"Mod: (24946+26965+20268+32619) = (24946+27773+20268+32619) = (25951+26965+20268+32619) = (25951+27773+20268+32619) = (26760+26965+20268+32619) = (26760+27773+20268+32619) = (26965+32150+20268+32619) = (26965+32238+20268+32619) = (26965+32239+20268+32619) = (26965+32311+20268+32619) = (26965+35040+20268+32619) = (27773+35040+20268+32619 = (27773+32150+20268+32619) = (27773+32238+20268+32619) = (27773+32239+20268+32619) = (27773+32311+20268+32619) = (24946+26965+20268+33239) = (24946+27773+20268+33239) = (25951+26965+20268+33239) = (25951+27773+20268+33239) = (26760+26965+20268+33239) = (26760+27773+20268+33239) = (26965+32150+20268+33239) = (26965+32238+20268+33239) = (26965+32239+20268+33239) = (26965+32311+20268+33239) = (27773+32150+20268+33239) = (27773+32238+20268+33239) = (27773+32239+20268+33239) = (27773+32311+20268+33239) = (24946+26965+20268+32619+33239) = (24946+27773+20268+32619+33239) = (25951+26965+20268+32619+33239) = (25951+27773+20268+32619+33239) = (26760+26965+20268+32619+33239) = (26760+27773+20268+32619+33239) = (26965+32150+20268+32619+33239) = (26965+32238+20268+32619+33239) = " (26965+32239+20268+32619+33239) = (26965+32311+20268+32619+33239) = (27773+32150+20268+32619+33239) = (27773+32238+20268+32619+33239) = (27773+32239+20268+32619+33239) = (27773+32311+20268+32619+33239) = (ACA + 20268+25647+27773+32311) = (ACA + 20268+25647+27773+32150) = (ACA + 20268+25647+27773+24946) = (ACA + 20268+25647+27773+26760) = (ACA + 20268+25647+27773+32238) = (ACA + 20268+25647+27773+32239) = (ACA + 20268+25647+27773+25951) = (ACA + 20268+25647+26965+32311) = (ACA + 20268+25647+26965+32150) = (ACA + 20268+25647+26965+24946) = (ACA + 20268+25647+26965+26760) = (ACA + 20268+25647+26965+32238) = (ACA + 20268+25647+26965+32239) = (ACA + 20268+25647+26965+25951) = (ACA+20268+25647+26965+35040) = (ACA+20268+25647+27773+35040)
0121	Mod : (20024+28378) = (20024+33973) = (20024+20164+33973) = (20024+20164+20586+28378)
0122	Mod : 25453 = 28378 = 30422 = 33973 = 34456 = 37226
0123	Mod : (20024+28378) = (20024+33973) = (20024+34456) = (20024+37226)
0124	Mod : (20268+26965) = (20268+31106)
0125	Mod : (20268+28342+31106) = (20268+28342+26965)
0126	Mod : (20024+22013) = (22013+24024+32115+32622)
0127	Mod : (20024+30422) = (20024+20164+30422) = (20024+20586+30422) = (20024+25453+30422) = (20024+20164+25453+30422) = (20024+20586+25453+30422) = (20024+25453+30422+32255)
0129	Mod: (20268+24946+26965+33323) = (20268+24946+27773+33323) = (20268+25951+26965+33323) = (20268+25951+27773+33323) = (20268+26760+26965+33323) = (20268+26760+27773+33323) = (20268+26965+32150+33323) = (20268+26965+32238+33323) = (20268+26965+32239+33323) = (20268+26965+32311+33323) = (20268+27773+32150+33323) = (20268+27773+32238+33323) = (20268+27773+32239+33323) = (20268+27773+32311+33323) = (20268+26965+35040+33323) = (20268+27773+35040+33323)
0130	Mod: (24946+26965+33323) = (24946+27773+33323) = (25951+26965+33323) = (25951+27773+33323) = (26760+26965+33323) = (26760+27773+33323) = (26965+32150+33323) = (26965+32238+33323) = (26965+32239+33323) = (26965+32311+33323) = (27773+32150+33323) = (27773+32238+33323) = (27773+32239+33323) = (27773+32311+33323) = (26965+35040+33323) = (27773+35040+33323)
0131	Mod: (20268+28342+31106) = (202268+26965+28342)

	CODE	DESIGNATION
	0132	Mod: (20268+31106) = (20268+26965)
	0133	Mod: (20268+24946+26965+25647) = (20268+24946+27773+25647) = (20268+25951+26965+25647) = (20268+25951+27773+25647) = (20268+26760+26965+25647) = (20268+26760+27773+25647) = (20268+26965+32150+25647) = (20268+26965+32238+25647) = (20268+26965+32239+25647) = (20268+26965+32311+25647) = (20268+27773+32150+25647) = (20268+27773+32238+25647) = (20268+27773+32239+25647) = (20268+27773+32311+25647) = (20268+26965+35040+25647) = (20268+27773+35040+25647)
	0134	Mod : 22013 = 24105 = (24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) = (26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) = (26965+32239) = (26965+32311) = (26965+35040) = (27773+35040) = (27773+32150) = (27773+32238) = (27773+32239) = (27773+32311)
	0135	Mod : (32401+33323+31426) = (32402+33323+31426) = (32475+33323+31426) = (32929+33323+31426)
	0136	Mod : (24946+26965+20268+32656) = (24946+27773+20268+32656) = (25951+26965+20268+32656) = (25951+27773+20268+32656) = (26760+26965+20268+32656) = (26760+27773+20268+32656) = (26965+32150+20268+32656) = (26965+32238+20268+32656) = (26965+32239+20268+32656) = (26965+32311+20268+32656) = (26965+35040+20268+32656) = (27773+35040+20268+32656) = (27773+32150+20268+32656) = (27773+32238+20268+32656) = (27773+32239+20268+32656) = (27773+32311+20268+32656)
	0137	Mod : (21103+21897+21898+22013) = (21103+21897+22013)
	0138	Mod : (21103+22013+25453+30422) = (21103+22013+30422)
	0139	Mod : (20040+20065+20106+20107) = (20040+20065+20106)
R	0140	Mod : 36310 = (25800+36310)
R	0141	Mod : (20040+20065+20106+21103) = (20040+20065+20106+20107+21105)
	0142	Mod : (21103+30243) = (21103+30243+33223)
	0143	Mod : 21103 = (20107+21103)
	0144	Mod : (21103+24105+28238) = (21103+24105+28238+32635)
	0145	Mod : (20040+20065+21103+24105+24821+26372) = (20040+20065+21103+24105+24821+25940)
	0146	Mod : (21103+22013+25453) = (21103+21897+22013+25453) = (20040+20065+21103+21897+21898+22013+25453)
	0147	Mod : 25453 = 28378 = 28378 = 30422 = 33973 = 34456 = 37226
	0148	Mod : (22013+36310) = (22013+36310+25800)
	0149	Mod : (20268+36310) = (20268+25800+36310)
	0150	Mod : (21103+22013+25453+25940) = (21103+21897+21898+22013+25453+25940)
	0151	Mod : (20040+20065+21103+22013+25453+25940) = (21103+21897+21898+22013+25453+25940)
	0153	Mod : (21103+24105+28238+32457) = (21103+24105+28238+32457+32635)
	0154	Mod : (20040+20065+21103+24105+24821) = (21897+21898+21103+24105+24821) = (21103+21897+21898+24105+24821+26638+26639)
R R R R	0155	Mod : 36311 = 36297 = 36885 = (25800+36311) = (25800+36297) = (25800+36885) = (25530+26505+36311) = (25530+26505+36297) = (25530+26505+36885) = (25800+25530+26505+36297) = (25800+25530+26505+36311) = (25800+25530+26505+36885)
R	0156	Mod : (20024+20167+21120+22013) = (L+20024+20167+21120+22013+22802)
R R	0157	Mod :(21103+28378) = (21103+25714+26131) = (21103+25714+26131+28330+28335+28378)

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	0158	Mod : (20268+31106) = (20268+26965)
	0159	Mod : 22013 = 24105 = (27773+32311) = (27773+32150) = (27773+24946) = (27773+26760) = (27773+32238) = (27773+32239) = (26965+32311) = (26965+32150) = (26965+24946) = (26965+26760) = (26965+32238) = (26965+32239) = (26965+35040) = (27773+35040)
	0160	Mod : (20268+24044+31701) = (20268+24044+34818)
	0161	Mod : (20268+24946+26965+33171) = (20268+24946+27773+33171) = (20268+25951+26965+33171) = (20268+25951+27773+33171) = (20268+26760+26965+33171) = (20268+26760+27773+33171) = (20268+26965+32150+33171) = (20268+26965+32238+33171) = (20268+26965+32239+33171) = (20268+26965+32311+33171) = (20268+27773+32150+33171) = (20268+27773+32238+33171) = (20268+27773+32239+33171) = (20268+27773+32311+33171) = (20268+26965+35040+33171) = (20268+27773+35040+33171)
	0162	Mod : (20268+32656) = (20268+26342+34221)
	0163	Mod : 20268 = (20268+28342+34221)
R	0167	Mod : (21103+25714+26131+28330+28335+28378)
R	0168	Mod : (20040+20065+21103+24105) = (21103+21897+21898+24105) = (21103+24105+26638+26639) = (21103+24105+28319+28322) = (21103+21897+21898+24105+26638+26639)
	0169	Mod : (21897+22013+25453) = (22013+25453+25905) = (22013+25453+25907) = (22013+25453+21898)
	0170	Mod : (22013+25453+25905+30422) = (22013+25453+25907+30422) = (22013+25905+30422) = (22013+25907+30422)
	0171	Mod : (20268+26965+28342) = (20268+28342+31106) = (20268+28342)
	0173	Mod : STD = 26925 = (30397+33865)
R	0174	Mod : (21103+24105+37226) = (21103+24105+28319+28322+37226)
R	0175	Mod : 20268 = (20268+25800) = (20268+24404) = (20268+24404+25502) = (20268+24404+25800) = (20268+25800+27727) = (20268+24404+25502+25800) = (20268+24404+25800+27727)
	0176	Mod : (20268+24946+26965+34041) = (20268+24946+27773+34041) = (20268+25951+26965+34041) = (20268+25951+27773+34041) = (20268+26760+26965+34041) = (20268+26760+27773+34041) = (20268+26965+32150+34041) = (20268+26965+32238+34041) = (20268+26965+32239+34041) = (20268+26965+32311+34041) = (20268+27773+32150+34041) = (20268+27773+32238+34041) = (20268+27773+32239+34041) = (20268+27773+32311+34041) = (20268+26965+35040+34041) = (20268+27773+35040+34041)
	0177	Mod : (21103+34456) = (20040+20065+21103+34456)
	0178	Mod : (21103+24105+28319+28322+31687) = (21103+24105+31687)
	0179	Mod : (21103+21897+21898) = (20106+20107+21103+21897+21898) = (21103+28330)
	0180	Mod : (20040+20065+21103+28378) = (20040+20065+21103+28378+34456)
	0183	Mod : (24105+30020) = (20268+24105+30020)
	0184	Mod : (23871+24946+26965) = (23871+24946+27773) = (23871+25951+26965) = (23871+25951+27773) = (23871+26760+26965) = (23871+26760+27773) = (23871+26965+32150) = (23871+26965+32238) = (23871+26965+32239) = (23871+26965+32311) = (23871+27773+32150) = (23871+27773+32238) = (23871+27773+32239) = (23871+27773+32311) = (23871+26965+35040) = (23871+27773+35040)

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0185	Mod : 22013 = 24105 = (MXA+24105) = (((24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) = (26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) = (26965+32239) = (26965+32311) = (27773+32150) = (27773+32238) = (27773+32239) = (27773+32311) = (26965+35040) = (27773+35040))+56-5-a1)
0186	Mod : 20268 = (20268+26346+N:US)
0187	Mod : 20268 = (20268+26346+22129) = (20268+26346+N:US)
0188	Mod : 22013 = 24105 = (20268+22013) = (20268+24105) = (24946+26965+Eng:56-5A1) = (24946+27773+Eng:56-5A1) = (25951+26965+Eng:56-5A1) = (25951+27773+Eng:56-5A1) = (26760+26965+Eng:56-5A1) = (26760+27773+Eng:56-5A1) = (26965+32150+Eng:56-5A1) = (26965+32238+Eng:56-5A1) = (26965+32239+Eng:56-5A1) = (26965+32311+Eng:56-5A1) = (27773+32150+Eng:56-5A1) = (27773+32238+Eng:56-5A1) = (27773+32239+Eng:56-5A1) = (27773+32311+Eng:56-5A1) = (26965+35040+Eng:56-5A1) = (27773+35040+Eng:56-5A1)
0189	Mod : 22013 = 24105 = (24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) = (26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) = (26965+32239) = (26965+32311) = (27773+32150) = (27773+32238) = (27773+32239) = (27773+32311) = (26965+35040) = (27773+35040)
0190	Mod : 22013 = 24105 = (24946+26965+Eng:56-5A1) = (24946+27773+Eng:56-5A1) = (25951+26965+Eng:56-5A1) = (25951+27773+Eng:56-5A1) = (26760+26965+Eng:56-5A1) = (26760+27773+Eng:56-5A1) = (26965+32150+Eng:56-5A1) = (26965+32238+Eng:56-5A1) = (26965+32239+Eng:56-5A1) = (26965+32311+Eng:56-5A1) = (27773+32150+Eng:56-5A1) = (27773+32238+Eng:56-5A1) = (27773+32239+Eng:56-5A1) = (27773+32311+Eng:56-5A1) = (26965+35040+Eng:56-5A1) = (27773+35040+Eng:56-5A1)
0191	Mod : (22013+25647) = (24105+25647) = (24946+25647+26965) = (24946+25647+27773) = (25647+25951+26965) = (25647+26760+26965) = (25647+25951+27773) = (25647+26760+27773) = (25647+26965+32150) = (25647+26965+32238) = (25647+26965+32239) = (25647+26965+32311) = (25647+27773+32150) = (25647+27773+32238) = (25647+27773+32239) = (25647+27773+32311) = (25647+27773+35040) = (25647+26965+35040) = (24946+26965+ACA) = (24946+27773+ACA) = (25951+26965+ACA) = (26760+26965+ACA) = (25951+27773+ACA) = (26760+27773+ACA) = (26965+32150+ACA) = (26965+32238+ACA) = (26965+32239+ACA) = (26965+32311+ACA) = (27773+32150+ACA) = (27773+32238+ACA) = (27773+32239+ACA) = (27773+32311+ACA) = (27773+35040+ACA) = (26965+35040+ACA)
0192	Mod : 22013 = 24105 = (24946+26965) = (24946+27773) = (25951+26965) = (25951+27773) = (26760+26965) = (26760+27773) = (26965+32150) = (26965+32238) = (26965+32239) = (26965+32311) = (27773+32150) = (27773+32238) = (27773+32239) = (27773+32311) = (27773+35040) = (26965+35040)
0193	Mod : 28685 = 28686 = (27714+28685+31528) = (27714+28685) = (27714+28686) = (27714+28686+31039)
0194	Mod : 31528 = 31039 = 25910 = 27714 = (28685+34506) = (28686+34506) = (27714+28685+31528+34506)
R R 0195	Mod : (27714+36998) = (31039+36998) = (31528+36998) = (27714+35165+36998) = (31039+35165+36998) = (31528+35165+36998)
R 0196	Mod : (27714+35165) = (35165+31039) = (35165+31528)
0198	Mod : (23779+25910) = (23779+27714) = (23779+25910+28685+34506) = (23779+27714+28685+34506) = (23779+27714+28686+34506)

CODE	DESIGNATION
0199	Mod : (23779+31039) = (23779+31528) = (23779+27714+31039) = (23779+27714+31528) = (23779+27714+28685+31528+34506)
0200	Mod : 25910 = 27714 = (25910+28685+34506) = (27714+28685+34506) = (27714+28686+34506)
0201	Mod : 31039 = 31528 = (27714+31039) = (27714+31528) = (27714+28685+31528+34506)
0202	Mod : 25453 = 28238 = 28378 = 30422 = 33973 = 34456
0203	STD = Mod : (31896+32332) = (31897+32333)
R 0204	Mod : (30397+33323) = (27620+30397+33323+33497)
R 0205	Mod : (25615+23124) = (25615+28009)
0206	Mod : (21103+28378+33223) = (21103+25714+26131+33223)
R 0207	Mod : (27620+30397+33323) = (27620+30397+33323+37285)
R 0208	Mod : (25615+32619) = (25615+33239)
R 0209	Mod : (27620+30020+30397+33323) = (27620+30020+30397+33323+37285)
R 0210	Mod : (27620+30020+30397+33323+35542) = (27620+30020+30397+33323+37285+35542)
R 0211	Mod : (30397+33323+34097+34126) = (27620+30397+33323+33497+34097+34126)
R 0212	Mod : (27620+30397+33323+34097+34126) = (27620+30397+33323+34097+34126+37285)
0213	Mod : (20268+34221) = (20268+34221+32656)
0214	Mod : (24105+34221) = (24105+34221+32656)
0215	Mod : (20268+36310) = (20268+25800+36310) = (20268+24404+25502+36310) = (20268+24404+25502+25800+36310)
0216	"Mod : (20268+36297) = (20268+24946+26965+36297) = (20268+24946+27773+36297) = (20268+25951+26965+36297) = (20268+25951+27773+36297) = (20268+26760+26965+36297) = (20268+26760+27773+36297) = (20268+26965+32150+36297) = (20268+26965+32238+36297) = (20268+26965+32239+36297) = (20268+26965+32311+36297) = (20268+27773+32150+36297) = (20268+27773+32238+36297) = (20268+27773+32239+36297) = (20268+27773+32311+36297) = (20268+26965+35040+36297) = (20268+27773+35040+36297)"
R 0217	Mod : (28177+30020+30397+34097+34126)
R 0218	Mod : (30020+30397+34097+34126+35542)
0219	Mod : (20268+36311) = (20268+36297)
R 0220	Mod : (27620+30020+30397+33323+34097+34126) = (27620+30020+30397+33323+34097+34126+37285)
R 0221	Mod : (28177+30020+30397+34097+34126+35542)
R 0222	Mod : (27620+30020+30397+33323+34097+34126+35542) = (27620+30020+30397+33323+34097+34126+37285+35542)

CODE	DESIGNATION
0223	Mod : 36750 = (24946+25615+26965+36750) = (24946+25615+27773+36750) = (25615+25951+26965+36750) = (25615+25951+27773+36750) = (25615+26760+26965+36750) = (25615+26760+27773+36750) = (25615+26965+32150+36750) = (25615+26965+32238+36750) = (25615+26965+32239+36750) = (25615+26965+32311+36750) = (25615+27773+32150+36750) = (25615+27773+32238+36750) = (25615+27773+32239+36750) = (25615+27773+32311+36750) = (25615+26965+35040+36750) = (25615+27773+35040+36750)
0224	Mod : 26750 = (24946+26965+36750) = (24946+27773+36750) = (25951+26965+36750) = (25951+27773+36750) = (26760+26965+36750) = (26760+27773+36750) = (26965+32150+36750) = (26965+32238+36750) = (26965+32239+36750) = (26965+32311+36750) = (27773+32150+36750) = (27773+32238+36750) = (27773+32239+36750) = (27773+32311+36750) = (26965+35040+36750) = (27773+35040+36750)
0225	Mod : (20268+36311) = (20268+36297) = (20268+25800+36311) = (20268+25800+36297) = (20268+25530+26505+36311) = (20268+25530+26505+36297) = (20268+25800+25530+26505+36311) = (20268+25800+25530+26505+36297)
0226	Mod : (31528+30397) = (31039+30397) = (25910+30397) = (27714+30397) = (28685+34506+30397) = (28686+34506+30397) = (27714+30397+31528) = (25910+27714+30397) = (25910+27714+30397+31039) = (27714+28685+30797+34506) = (27714+28685+30397+31528) = (27714+28685+31528+34506+30397) = (25910+27714+28685+30397+34506)
0229	Mod : (20268+34818) = (20268+31701)
0230	Mod : (20268+36311) = (20268+36297) = (20268+36885) = (20268+24946+26965+36311) = (20268+24946+27773+36311) = (20268+25951+26965+36311) = (20268+25951+27773+36311) = (20268+26760+26965+36311) = (20268+26760+27773+36311) = (20268+26965+32150+36311) = (20268+26965+32238+36311) = (20268+26965+32239+36311) = (20268+26965+32311+36311) = (20268+27773+32150+36311) = (20268+27773+32238+36311) = (20268+27773+32239+36311) = (20268+27773+32311+36311) = (20268+26965+35040+36311) = (20268+27773+35040+36311) = (20268+24946+26965+36297) = (20268+24946+27773+36297) = (20268+25951+26965+36297) = (20268+25951+27773+36297) = (20268+26760+26965+36297) = (20268+26760+27773+36297) = (20268+26965+32150+36297) = (20268+26965+32238+36297) = (20268+26965+32239+36297) = (20268+26965+32311+36297) = (20268+27773+32150+36297) = (20268+27773+32238+36297) = (20268+27773+32239+36297) = (20268+27773+32311+36297) = (20268+26965+35040+36297) = (20268+27773+35040+36297) = (20268+24946+26965+36885) = (20268+24946+27773+36885) = (20268+25951+26965+36885) = (20268+25951+27773+36885) = (20268+26760+26965+36885) = (20268+26760+27773+36885) = (20268+26965+32150+36885) = (20268+26965+32238+36885) = (20268+26965+32239+36885) = (20268+26965+32311+36885) = (20268+27773+32150+36885) = (20268+27773+32238+36885) = (20268+27773+32239+36885) = (20268+27773+32311+36885) = (20268+26965+35040+36885) = (20268+27773+35040+36885

CODE	DESIGNATION
0231	Mod : (20268+36311) = (20268+36885) = (20268+24946+26965+36311) = (20268+24946+27773+36311) = (20268+25951+26965+36311) = (20268+25951+27773+36311) = (20268+26760+26965+36311) = (20268+26760+27773+36311) = (20268+26965+32150+36311) = (20268+26965+32238+36311) = (20268+26965+32239+36311) = (20268+26965+32311+36311) = (20268+27773+32150+36311) = (20268+27773+32238+36311) = (20268+27773+32239+36311) = (20268+27773+32311+36311) = (20268+26965+35040+36311) = (20268+27773+35040+36311) = (20268+24946+26965+36885) = (20268+24946+27773+36885) = (20268+25951+26965+36885) = (20268+25951+27773+36885) = (20268+26760+26965+36885) = (20268+26760+27773+36885) = (20268+26965+32150+36885) = (20268+26965+32238+36885) = (20268+26965+32239+36885) = (20268+26965+32311+36885) = (20268+27773+32150+36885) = (20268+27773+32238+36885) = (20268+27773+32239+36885) = (20268+27773+32311+36885) = (20268+26965+35040+36885) = (20268+27773+35040+36885)
0232	Mod : (20268+36297) = (20268+36311) = (20268+36885)
0233	Mod : 30397 = (27714+28685+30397+31528)
0234	"Mod : (20268+36311) = (20268+36297) = (20268+36885) = (20268+25800+36311) = (20268+25800+36297) = (20268+25800+36885) = (20268+25530+26505+36311) = (20268+25530+26505+36297) = (20268+25530+26505+36885) = (20268+25800+25530+26505+36297) = (20268+25800+25530+26505+36311) = (20268+25800+25530+26505+36885) "
0235	Mod : (20268+36311) = (20268+36885) = (20268+36311/US) = (20268+36885/US)
0236	Mod : (27620+30020+33323) = (27620+30020+33323+37285)
0237	Mod : (27620+33323) = (27620+33323+37285)
0250	Mod : 20164 = 32255 = (20164+30961) = (20164+24373+30961)
R 0251	Mod : (27714+30397+36998) = (30397+31039+36998) = (30397+31528+36998) = (27714+30397+35165+36998) = (30397+31039+35165+36998) = (30397+31528+35165+36998)
R 0252	Mod : (21103+24105+28319+28322+37226)
R 0253	56-5-B4 = (25800+56-5-B4) = (36297+ 56-5-B5) = (36311+ 56-5-B6) = (36885+56-5-B6) = (25800+36297+ 56-5-B5) = (25800+36311+56-5-B6) = (25800+36885+56-5-B6)
R 0254	Mod : (20024+20167) = (20024+20167+21120+23869)
R 0255	Mod : (20024+20167+28238) = (20024+20167+28238+32635+35649) = (20024+20167+28238+37331+37332) = (20024+20167+28238+32635+35649+37331+37332)
R 0256	Mod : (20024+20167+34456) = (20024+20167+28378+34456) = (20024+20167+34456+37331) = (20024+20167+37226+37331)
0257	Mod : (20024+20167+28378+37331) = (20024+20167+33973+37331)
0258	Mod : (20024+20167+28238+37331) = (20024+20167+28238+32635+35649+37331)
0259	Mod : (20024+20167+28238+32635+37331)
0260	Mod : (20040+20065+20106+20107+21103+22013+25453)
0261	Mod : 26723 = 27410 = 27639 = 27763 = 30277 = 30835 = 30836 = 37985
0262	Mod : (25615+26018+26645) = (26018+26645+38140) = (23108+25615+26018+26645)

CODE	DESIGNATION
0263	Mod : (25615+26018) = (26018+38140) = (23108+25615+26018)
0264	Mod : 25615 = 38140 = (23108+25615)
0381	Mod : (20268+36297) = (20268+24946+26965+36297) = (20268+24946+27773+36297) = (20268+25951+26965+36297) = (20268+25951+27773+36297) = (20268+26760+26965+36297) = (20268+26760+27773+36297) = (20268+26965+32150+36297) = (20268+26965+32238+36297) = (20268+26965+32239+36297) = (20268+26965+32311+36297) = (20268+27773+32150+36297) = (20268+27773+32238+36297) = (20268+27773+32239+36297) = (20268+27773+32311+36297) = (20268+26965+35040+36297) = (20268+27773+35040+36297)

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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	

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N°	ISSUE DATE	
29	MAR 01	
30	SEP 01	
31	APR 02	
32	SEP 02	
33	MAR 03	
34	NOV 03	
35	JUL 04	
36	MAR 05	
37	DEC 05	
38	SEP 06	
39	MAY 07	
40	SEP 08	

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

LIST OF EFFECTIVE TEMPORARY REVISIONS

M	TR NO	-DATE--	-----------TITLE------------	-----EFFECTIVITY-----
	689-1A	DEC2008	RNP-4 OPERATIONS	ALL

SUBJECT : RNP-4 OPERATIONS

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

VALIDITY : All A320 Family Operators.

FILING INSTRUCTIONS

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

TR N° 689-1, Page 1 of 5, following 2.00.36.
TR N° 689-1, Page 2 of 5, facing 2.04.00 Page 2.
TR N° 689-1, Page 3 of 5, facing 2.04.51 Page 1.
TR N° 689-1, Page 4 of 5, facing 2.04.51 Page 3.
TR N° 689-1, Page 5 of 5, facing 2.04.51 Page 4.

This Temporary Revision has been issued after normal revision N° 40
Do not remove it until instructed to do so.

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

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

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

MSN	REGISTRATION
0009	S1.6UPT2HO

V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA / REASONS OF CHANGE
2	04	00	002	102	REV040	36998=35165+36998
						- INCORPORATION OF MOD 36998
2	04	51	006	100	REV040	36998=35165+36998
						- INCORPORATION OF MOD 36998
2	04	51	007	100	REV040	36998
						- INCORPORATION OF MOD 36998
2	04	51	008	100	REV040	36998
						- INCORPORATION OF MOD 36998

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	2	00	00	001	001	REV021	CONTENTS	ALL
	2	00	10	001	001	REV038	ORGANIZATION OF THE MANUAL	ALL
	2	00	10	002	001	REV040	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
	2	00	20	001	001	REV040	LIST OF CODES	ALL
	2	00	20	002	001	REV040	LIST OF CODES	
	2	00	20	003	001	REV040	LIST OF CODES	ALL
	2	00	20	004	001	REV040	LIST OF CODES	
	2	00	20	005	001	REV040	LIST OF CODES	ALL
	2	00	20	006	001	REV040	LIST OF CODES	
	2	00	20	007	001	REV040	LIST OF CODES	ALL
	2	00	20	008	001	REV040	LIST OF CODES	
	2	00	20	009	001	REV040	LIST OF CODES	ALL
	2	00	20	010	001	REV040	LIST OF CODES	
	2	00	20	011	001	REV040	LIST OF CODES	ALL
	2	00	20	012	001	REV040	LIST OF CODES	
	2	00	20	013	001	REV040	LIST OF CODES	ALL
	2	00	30	001	001	REV028	LIST OF NORMAL REVISIONS	ALL
	2	00	30	002	001	REV040	LIST OF NORMAL REVISIONS	
	2	00	35	001	001	REV022	RECORD OF TEMPORARY REVISION	ALL
	2	00	36	001	001	REV040	LIST OF EFFECTIVE TR	ALL
	2	00	70	001	001	REV040	CROSS REFERENCE TABLE	ALL
	2	00	75	001	001	REV040	HIGHLIGHTS	ALL
	2	00	80	001	001	REV040	LIST OF EFFECTIVE PAGES	ALL
	2	00	85	001	001	REV040	LIST OF MODIFICATIONS	ALL
	2	01	00	001	001	REV039		ALL
	2	01	10	001	001	REV031		ALL
	2	01	20	001	001	REV021		ALL
	2	01	20	002	002	REV035	STD = M:(20040+20065)	
	2	01	20	003	100	REV020	MOD:21329	ALL
	2	01	20	004	001	REV020		
	2	01	20	005	001	REV020		ALL
	2	01	20	006	001	REV020		

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	2	01	30	001	200	REV038	CODE 0011	ALL
	2	01	30	002	100	REV020	MOD:20024	
	2	01	30	003	102	REV040	31286	ALL
	2	01	30	004	001	REV020		
	2	01	30	005	100	REV020	MOD:20024	ALL
	2	01	30	006	001	REV021		
	2	01	30	007	205	REV040	20024+31286	ALL
	2	01	30	007A	001	REV038		ALL
	2	01	30	008	205	REV040	20024+31286	ALL
	2	01	30	009	100	REV040	20024	ALL
	2	01	30	010	200	REV024	CODE 0024	
	2	01	30	010A	001	REV033		ALL
	2	01	30	011	100	REV033	M:20024=20024+32115+32622	ALL
	2	01	30	011A	001	REV033	STD=32115+32622	ALL
	2	01	30	012	100	REV033	20024	ALL
	2	01	30	013	001	REV033	CODE 0029	ALL
	2	01	30	014	001	REV033	CODE 0029	
	2	01	30	015	001	REV033	CODE 0029	ALL
	2	01	30	016	001	REV033	CODE 0029	
	2	01	30	017	001	REV033	CODE 0029	ALL
	2	01	30	018	001	REV033	CODE 0029	
	2	01	30	019	001	REV033	CODE 0029	ALL
	2	01	30	020	100	REV033	CODE 0031	
	2	01	30	021	100	REV033	CODE 0031	ALL
	2	01	40	001	001	REV028		ALL
	2	01	40	002	110	REV028	M:20268	
	2	01	40	003	100	REV028	MOD:20268	ALL
	2	01	40	004	110	REV035	MOD 20268	
	2	01	40	005	110	REV035	MOD 20268	ALL
	2	01	40	006	001	REV030		
	2	02	00	001	100	REV025	CODE 0189	ALL
	2	02	00	002	001	REV035		
	2	02	05	001	001	REV022		ALL
	2	02	10	001	001	REV022		ALL
	2	02	10	002	100	REV025	CODE 0189	
	2	02	10	003	370	REV034	COD90/2500/2527/27E/B4/A1/A3	ALL
	2	02	10	004	100	REV025	CODE 0189	

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	2	02	10	005	100	REV025	CODE 0189	ALL
	2	02	10	006	270	REV034	COD92/2527/2500/27E/A1/A3/B4	
	2	02	12	001	270	REV037	C0092/V2500/27/27E/A1/A3/B4	ALL
	2	02	12	002	280	REV037	CODE 0092/CFM 56-5-B4	
	2	02	12	003	270	REV037	COD92/2500/2527/27E/B4/A1/A3	ALL
	2	02	12	004	280	REV037	CODE 0092/CFM 56-5-B4	
	2	02	12	005	280	REV037	CODE 0092/CFM 56-5-B4	ALL
	2	02	12	006	100	REV022	CODE 0189	
	2	02	14	001	090	REV025	CFM 56-5-B4	ALL
	2	02	14	002	100	REV038	CODE 0192	
	2	02	14	003	370	REV037	CODE0090/V25/27/27E/B4/A1/A3	ALL
	2	02	14	004	280	REV034	CODE 0092/CFM 56-5-B4	
	2	02	14	005	270	REV040	CODE0092/V25/27/27E/B4/A1/A3	ALL
	2	02	14	006	280	REV034	CODE 0092/CFM 56-5-B4	
	2	02	14	007	280	REV034	CODE 0092/CFM 56-5-B4	ALL
	2	02	14	008	100	REV033	CODE 0192	
	2	02	16	001	001	REV022		ALL
	2	02	16	002	100	REV023	CODE 0189	
	2	02	16	003	370	REV034	0090/V2500/2527/27E/B4/A1/A3	ALL
	2	02	16	004	100	REV025	CODE 0198	
	2	02	16	005	100	REV037	CODE 0189	ALL
	2	02	16	006	270	REV034	0092 V2527/27E/2500/A1/A3/B4	
	2	02	18	001	100	REV025	CODE 0189	ALL
	2	02	18	002	270	REV034	0092 V2527/27E/2500/A1/A3/B4	
	2	02	18	003	255	REV034	CODE 0092/B4	ALL
	2	02	18	004	270	REV037	0092 V2527/27E/2500/A1/A3/B4	
	2	02	18	005	255	REV037	CODE 0092/B4	ALL
	2	02	18	006	255	REV034	CODE 0092/B4	
	2	02	18	007	100	REV022	CODE 0189	ALL
	2	02	20	001	040	REV025	CFM 56-5-B4	ALL
	2	02	20	002	100	REV038	CODE 0192	
	2	02	20	003	270	REV034	C:0092/V2500/27/27E/A1/A3/B4	ALL
	2	02	20	004	255	REV034	CODE 0092/B4	
	2	02	20	005	270	REV036	C:0092/V2500/27/27E/A1/A3/B4	ALL
	2	02	20	006	255	REV037	CODE 0092/B4	
	2	02	20	007	255	REV034	CODE 0092/B4	ALL
	2	02	20	008	100	REV033	CODE 0189	
	2	02	24	001	245	REV040	CODE 0092/56-5-B4	ALL
	2	02	24	002	245	REV034	CODE 0092/56-5-B4	

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	2	02	25	001	350	REV038	CODE 0090/56-5-B4	ALL
	2	02	25	002	350	REV038	CODE 0090/56-5-B4	
	2	02	25	003	350	REV038	CODE 0090/56-5-B4	ALL
	2	02	25	004	350	REV038	CODE 0090/56-5-B4	
	2	02	40	001	360	REV037	CODE 0090 (IAE/CFM)	ALL
	2	02	40	002	260	REV037	CODE 0092 (IAE/CFM)	
	2	02	40	003	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	004	300	REV034	CODE:0090/56-5-B4	
	2	02	40	005	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	006	300	REV034	CODE:0090/56-5-B4	
	2	02	40	007	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	008	300	REV034	CODE:0090/56-5-B4	
	2	02	40	009	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	010	001	REV020		
	2	02	40	011	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	012	300	REV034	CODE:0090/56-5-B4	
	2	02	40	013	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	40	014	001	REV020		
	2	02	50	001	001	REV032		ALL
	2	02	50	002	300	REV034	CODE:0090/56-5-B4	
	2	02	50	003	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	50	004	300	REV034	CODE:0090/56-5-B4	
	2	02	50	005	300	REV034	CODE:0090/56-5-B4	ALL
	2	02	50	006	300	REV034	CODE:0090/56-5-B4	
	2	02	50	007	300	REV034	CODE:0090/56-5-B4	ALL
	2	03	00	001	001	REV031		ALL
	2	03	10	001	001	REV026	CODE 0081	ALL
	2	03	10	002	001	REV026		
	2	03	10	003	305	REV034	CODE 0090 CFM ENG: 56-5-B4	ALL
	2	03	10	004	305	REV034	CODE 0090 CFM ENG: 56-5-B4	
	2	03	10	005	305	REV034	CODE 0090 CFM ENG: 56-5-B4	ALL
	2	03	10	006	001	REV032		
	2	03	20	001	001	REV033		ALL
	2	03	20	002	305	REV034	CODE 0090 CFM ENG: 56-5-B4	
	2	04	00	001	001	REV039		ALL
	2	04	00	002	102	REV040	36998=35165+36998	
	2	04	10	001	001	REV040		ALL
	2	04	10	002	001	REV037		
	2	04	10	002A	340	REV037	C:90/V2527/27E/2500/B4/A1/A3	ALL

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2	04	10	004	348	REV034	CODE:0090/56-5-B4	
2	04	10	005	348	REV038	CODE:0090/56-5-B4	ALL
2	04	10	006	348	REV038	CODE:0090/56-5-B4	
2	04	10	007	348	REV038	CODE:0090/56-5-B4	ALL
2	04	10	008	348	REV038	CODE:0090/56-5-B4	
2	04	10	009	348	REV038	CODE:0090/56-5-B4	ALL
2	04	10	010	001	REV022		
2	04	10	011	001	REV021		ALL
2	04	10	012	001	REV038		
2	04	10	013	001	REV038		ALL
2	04	10	014	348	REV034	CODE:0090/56-5-B4	
2	04	10	015	348	REV038	CODE:0090/56-5-B4	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	REV036		
2	04	20	005	100	REV040	34673	ALL
2	04	20	005A	100	REV040	34673	ALL
2	04	20	006	030	REV027	CODE 0253	ALL
2	04	20	007	170	REV028	CODE 0048 CFM 56-5-B4	ALL
2	04	20	008	001	REV036		
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	REV037	CODE 0015	ALL
2	04	25	004	200	REV034	CODE 0092/CFM56-5-B4	
2	04	25	005	450	REV035	CODE 0120/56-5-B4	ALL
2	04	25	006	215	REV040	CODE 0092/CFM 56-5-B4	
2	04	25	007	140	REV023	CODE 0048 CFM 56-5-B4	ALL
2	04	25	008	140	REV026	CODE 0048 CFM 56-5-B4	
2	04	25	009	170	REV023	CODE 0048 CFM 56-5-B4	ALL
2	04	25	010	140	REV031	CODE 0048 CFM 56-5-B4	
2	04	25	011	140	REV023	MOD:20268 CFM 56-5-B4	ALL
2	04	25	012	140	REV031	20268 CFM 56-5-B4	
2	04	35	001	001	REV020		ALL
2	04	35	002	001	REV021		

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	2	04	40	003	001	REV021		ALL
	2	04	40	004	001	REV020		
	2	04	40	004A	001	REV040		ALL
	2	04	40	005	001	REV021		ALL
	2	04	40	005A	001	REV040		ALL
	2	04	40	006	001	REV040		ALL
	2	04	40	007	001	REV040		ALL
	2	04	40	008	001	REV038		
	2	04	40	009	110	REV037	26249	ALL
	2	04	40	010	145	REV040	CODE 0001/CFM/PW	
	2	04	40	010A	010	REV031	CFM/PW	ALL
	2	04	40	010B	001	REV038		ALL
	2	04	40	011	140	REV031	CODE 0048 CFM 56-5-B4	ALL
	2	04	40	012	065	REV025	CODE 0009 CFM 56-5-B4	
	2	04	40	013	065	REV025	CODE 0009/56-5-B4	ALL
	2	04	40	014	065	REV025	CODE 0009/56-5-B4	
	2	04	45	001	025	REV040	B1/B2/B3/B4/B5/B6/B7/B8/B9	ALL
	2	04	45	002	025	REV040	B1/B2/B3/B4/B5/B6/B7/B8/B9	
	2	04	45	003	025	REV040	B1/B2/B4/B5/B6/B7/B8/B9	ALL
	2	04	45	004	025	REV040	B1/B2/B3/B4/B5/B6/B7/B8/B9	
	2	04	51	001	103	REV038	CODE 0037	ALL
	2	04	51	002	001	REV038		
	2	04	51	003	103	REV038	CODE 0038	ALL
	2	04	51	004	103	REV038	CODE 0038	
	2	04	51	005	001	REV040		ALL
	2	04	51	006	100	REV040	36998=35165+36998	
	2	04	51	007	100	REV040	36998	ALL
	2	04	51	008	100	REV040	36998	
	2	04	60	001	001	REV035	STD=26925=(33865+30397)/CODE	ALL
	2	05	00	001	001	REV021		ALL
	2	05	10	001	120	REV024	M:25800/56-5-B1 TO B9	ALL
	2	05	10	002	001	REV021		
	2	05	10	003	001	REV020		ALL
	2	05	10	004	001	REV021		

M V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
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2	05	15	001	001	REV020		ALL
2	05	15	002	020	REV024	CODE 0073/CFM	
2	05	15	003	001	REV020		ALL
2	05	15	004	001	REV022		
2	05	15	005	180	REV031	CODE 0048/CFM 56-5-B4	ALL
2	05	15	006	180	REV031	CODE 0048/CFM 56-5-B4	
2	05	15	007	180	REV031	CODE 0048 CFM 56-5-B4	ALL
2	05	15	008	140	REV031	CODE 0048 CFM 56-5-B4	
2	05	15	009	140	REV031	CODE 0048 CFM 56-5-B4	ALL
2	05	20	001	140	REV031	CODE 0048/CFM 56-5-B4	ALL
2	05	20	002	170	REV034	CODE:0048 CFM 56-5-B4 T=L	
2	05	20	003	001	REV022		ALL
2	05	30	001	120	REV024	M:25800/56-5-B1 TO B9	ALL
2	05	30	002	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	003	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	004	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	005	180	REV026	CODE 0048 CFM 56-5-B4	ALL
2	05	30	006	180	REV026	CODE 0048 CFM 56-5-B4	
2	05	30	007	180	REV026	CODE 0048 CFM 56-5-B4	ALL
2	05	30	008	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	009	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	010	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	011	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	012	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	013	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	014	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	015	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	016	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	017	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	018	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	30	019	180	REV023	CODE 0048 CFM 56-5-B4	ALL
2	05	30	020	180	REV026	CODE 0048 CFM 56-5-B4	
2	05	30	021	180	REV026	CODE 0048 CFM 56-5-B4	ALL
2	05	30	022	180	REV030	CODE 0048 CFM 56-5-B4	
2	05	30	023	180	REV023	CODE 0048/56-5-B4	ALL
2	05	30	024	180	REV023	CODE 0048 CFM 56-5-B4	
2	05	40	001	130	REV024	M:25800/CFM 56-5-B4	ALL
2	05	40	002	180	REV023	CODE 0048/56-5-B4	

M	V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	EFFECTIVITY
	2	05	40	003	180	REV023	CODE 0048 CFM 56-5-B4	ALL
	2	05	40	004	180	REV023	CODE 0048 CFM 56-5-B4	
	2	05	40	005	180	REV023	CODE 0048 CFM 56-5-B4	ALL
	2	05	40	006	180	REV023	CODE 0048 CFM 56-5-B4	
	2	05	40	007	180	REV023	CODE 0048 CFM 56-5-B4	ALL
	2	05	40	008	180	REV023	CODE 0048 CFM 56-5-B4	
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	2	05	60	001	001	REV021		ALL
	2	05	60	002	001	REV023		
	2	05	60	003	001	REV022		ALL
	2	05	60	004	001	REV021		
	2	05	70	001	030	REV021	CFM 56-5-B4	ALL
	2	05	70	002	030	REV022	CFM 56-5-B4	
	2	05	70	003	030	REV021	CFM 56-5-B4	ALL
	2	05	70	004	030	REV021	CFM 56-5-B4	
	2	05	70	005	030	REV021	CFM 56-5-B4	ALL
	2	05	70	006	030	REV021	CFM 56-5-B4	
	2	05	70	007	030	REV021	CFM 56-5-B4	ALL
	2	05	70	008	030	REV021	CFM 56-5-B4	

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M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	031	20024	....	FUEL- INSTALL A CENTRE TANK SYSTEM-	ALL
.	036	20167	....	STRUCTURE - REINFORCE STRUCTURE TO ALLOW MTOW 72T-MLW 63T-MZFW 59T DESIGN WEIGHTS	ALL
.	036	20268	....	WINGS-WING TIP FENCES-INTRODUCE WING TIPS INCLUDING FENCES-	ALL
.	036	21329	....	DOORS-CARGO COMPT DOORS-MODIFY LOCKING INDICATION	ALL
.	036	23124	....	AIR CONDITIONING - PRESSURIZATION CONTROL - IMPROVE CONTROLLER TO ENABLE USE OF EXTERNAL MODE	ALL
.	036	23779	....	MINOR IMPROVEMENTS INTRODUCED FROM A/C 508 (ST2) TO A/C 521 (ST2)	ALL
.	031	24251	....	POWER PLANT - A320 - CFM 56 - INSTALL DERATED ENGINES CFM 56-B4	ALL
.	036	24373	....	FUEL - TANK LEVEL SENSING - INTRODUCE MODIFIED LOW FUEL PRESSURE WARNING CONTROL	ALL
.	036	24946	....	LANDING GEAR - MLG - MESSIER - INTRODUCE BRAKES P/N C202253	ALL
.	036	25800	....	POWER PLANT-GENERAL-INTRODUCE CFM56-5B/P	ALL
.	036	26018	....	INDICATING/RECORDING SYSTEMS-DISPLAY MANAGEMENT COMPUTER (DMC)-INTRODCUE DMC V32 STD	ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	036	26249	....	AIR CONDITIONING-FLOW CONTROL AND INDICATING INTRODUCE MODIFIED AIR CONDITIONING FLOW CONTROL ALL
.	036	26645	....	AUTO-FLIGHT-FAC INTRODUCE FAC STD BAM 0513 ALL
.	036	26910	....	FLIGHT CONTROL -ELAC SYSTEM- INTRODUCE E.L.A.C. WITH ENHANCED RELAYS ALL
.	040	26925	....	LANDING GEAR-ALTERNATE BRAKING- INTRODUCE MODIFIED ALTERNATE BRAKING SYSTEM ALL
.	037	26965	....	LANDING GEAR-WHEELS AND BRAKES- INTRODUCE BSCU COMMON STD ALL
.	036	27276	....	FLIGHT CONTROLS-ELAC SYSTEM-INTRODUCE ELAC SOFTWARE "L80" ALL
.	036	27620	....	NAVIGATION-STANDBY DATA : ALTITUDE AND HEADING - INSTALL INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS) ALL
.	036	27773	....	LANDING GEAR-NORMAL BRAKING- INTRODUCE STD 8 BSCU (TWIN VERSION) ALL
.	037	28009	....	AIR CONDITIONING-PRESSURE CONTROL AND MONITORING-INTRODUCE PRESSURE CONTROLLER P/N 9022-15702-10 ALL
.	036	28160	....	ELEC PWR-AC EMERGENCY GENERATION- ACTIVATE A319/A321 ELECTRICAL EMERGENCY CONFIGURATION ON A320 A/C ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	036	30961	....	FUEL - MAIN FUEL PUMP SYSTEM - ADAPT PUMP CONTROL LATCH FOR FLIGHT DECK REFUEL CAPABILITY	ALL
.	036	31106	....	LANDING GEAR - NORMAL BRAKING - INTRODUCE STD 9 BSCU (TWIN VERSION)	ALL
.	040	31286	....	COMMUNICATIONS-HF SYSTEM-ACTIVATE DATA LINK FUNCTION FOR HFDR1	ALL
.	036	31395	....	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC STD L81	ALL
.	039	31426	....	NAVIGATIONS-EGPWS-ACTIVATE GEOMETRIC ALTITUDE FUNCTION IN THE EGPWS	ALL
.	040	31896	....	AUTOFLIGHT-FMGC-INSTALL FMGC CFM C13042AA01 (EQUIPPED WITH FMS2) HONEYWELL	ALL
.	040	32619	....	ENGINE FUEL AND CONTROL - FADEC SYSTEM INTRODUCE NEW FADEC SOFTWARE "5BK" ON SAC CFM56-5B ENGINES	ALL
.	040	33239	....	ENGINE FUEL AND CONTROL - FADEC SYSTEM - INSTALL "5BL" STANDARD ECU SOFTWARE FOR CFM56-5B ENGINES (A318 CAPABLE)	ALL
.	039	33374	....	INDICATING RECORDING SYSTEM - FLIGHT WARNING COMPUTER (FWC) - INSTALL FWC STANDARD H2F2	ALL
.	040	34673	....	AIR CONDITIONING - PRESSURE CONTROL AND MONITORING - INSTALL RPCU AND WIRING PROVISIONS FOR RPWS	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
N	040	36998	....	NAVIGATION - GENERAL - INSTALL P/B IN THE COCKPIT ACTIVATING LOGICS OF LAT DEV SCALE DISPLAY	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)**
The total weight of an aircraft ready for a specific type of operation excluding all usable fuel and traffic load.
Operational Empty Weight plus items specific to the type of flight i.e. catering, 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 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

If the aircraft is in full bulk configuration, or if the Cargo Loading System (CLS) is installed,
R the maximum load for each compartment is as follows :

- **Forward**
  Compartment 1 : 3 402 kg (7 500 lb)
- **Aft**
  Compartment 4 : 4 536 kg (10 000 lb)
- **Bulk**
  Compartment 5 : 1 497 kg (3 300 lb)

If the CLS is installed, 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	3	4
Full size	LD3-46W	2K2	H	1134	2500	3	4
60.4 × 61.5 in		2K3	K	1134	2500	3	4
60.4 × 61.5 in		2K3	X	1134	2500	3	4

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 ground service panel

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

– **LEVER OF ELECTRICAL MANUAL SELECTOR VALVE . . . . CLOSE**

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 ground service panel

– **LEVER OF ELECTRICAL MANUAL SELECTOR VALVE . . . . OPEN**

HAND PUMP CLOSING

On ground service panel

– **LEVER OF ELECTRICAL MANUAL SELECTOR VALVE . . . . CLOSE**

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 ground service panel

– **LEVER OF ELECTRICAL MANUAL SELECTOR VALVE . . . . OPEN**

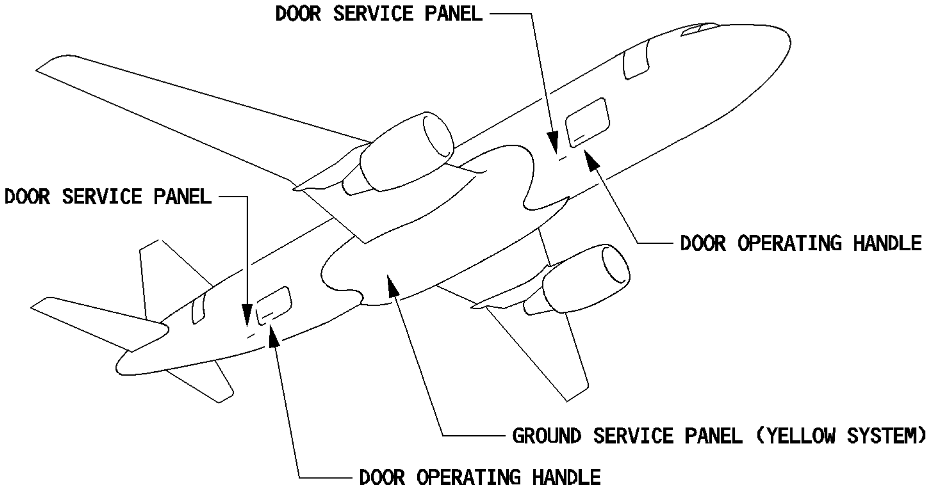
On door

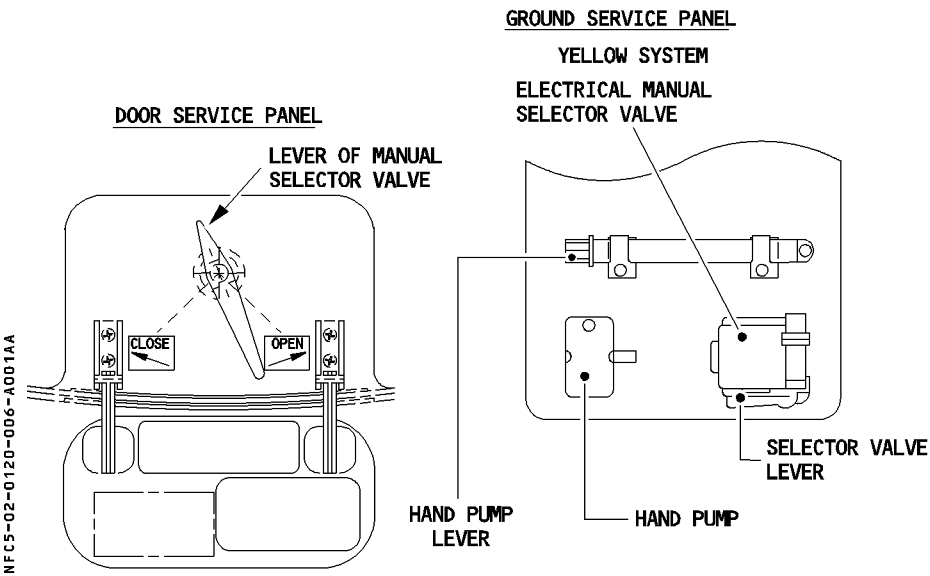
– **DOOR . . . . LOCK**
Lock the operating handle as for normal operation.

On door service panel and ground service panel

– **ACCESS DOORS . . . . CLOSE**

LOCATION OF SERVICE PANELS



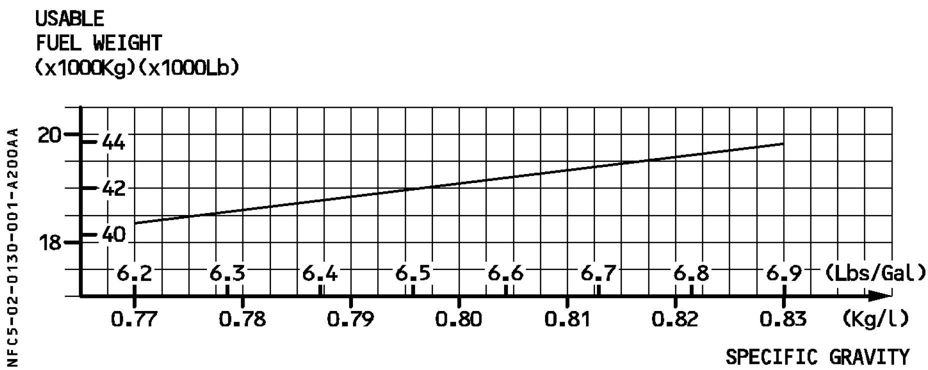


GENERAL INFORMATION

USABLE FUEL VOLUME

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

USABLE FUEL WEIGHT

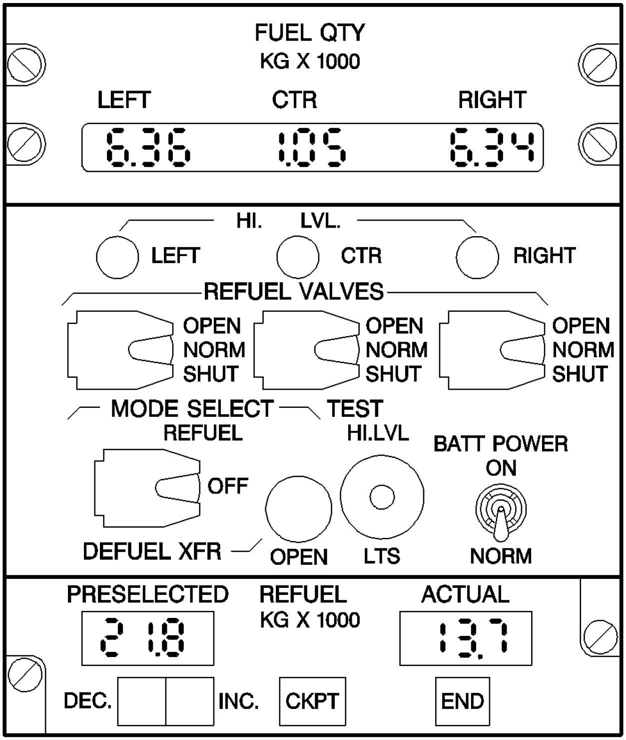


REFUELING

- During automatic refueling, fuel goes into the center tank and outer cell of wing tanks
R simultaneously. When the outer cell of wing tank is full, fuel overflows into the inner cell. 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 – Electrical transients (caused by switching among the APU, the external and the engine
R electrical supply) during automatic refueling may stop the process. If the automatic
R refueling process is stopped, it is necessary to re-enter the Preselected Fuel Quantity.

REFUELING CONTROL PANEL



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REFUELING

PREPARATION

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

– **SAFETY PRECAUTIONS** . . . . **APPLY**

R During refueling operations, ensure that :
R – No HF transmission (including HF transmission via the HF DATA LINK pb) is
R performed
R – The aircraft is properly bonded to the tanker
R – The tanker and the aircraft are properly grounded. If suitable ground is not available,
R the aircraft can be bonded to the tanker only. Always connect the ground cable to the
R parking ground point (or to the tanker) before connecting it to the aircraft. In the cockpit, check that the PARK BRK is ON and that the ACCU PRESS has sufficient pressure. Do not refuel, if a fire or engine overheat warning is displayed. During refueling, do not operate the external lighting.

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** . . . . **HI.LVL**
HI LVL lights change state if the high level sensors and their circuits are serviceable.

AUTOMATIC REFUELING

– **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.**

INTENTIONALLY LEFT BLANK

DEFUELING

Note : Defueling by suction is not possible.

– ACCESS PLATFORM . . . . IN POSITION

– SAFETY PRECAUTIONS . . . . APPLY

R During defueling operations, ensure that :
R – No HF transmission (including HF transmission via the HF DATA LINK pb) is
R performed
R – The aircraft is properly bonded to the tanker
R – The tanker and the aircraft are properly grounded. If suitable ground is not available,
R the aircraft can be bonded to the tanker only. Always connect the ground cable to the
R parking ground point (or to the tanker) before connecting it to the aircraft. In the cockpit, check that the PARK BRK is ON and that the ACCU PRESS has sufficient pressure. Do not defuel, if a fire or engine overheat warning is displayed. During defueling, do not operate the external lighting.

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 . . . . NORM

– 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**
Disembark all passengers.
R During refueling operations, ensure that :
R – No HF transmission (including HF transmission via the HF DATA LINK pb) is
R performed
R – The aircraft is properly bonded to the tanker
R – The tanker and the aircraft are properly grounded. If suitable ground is not available,
R the aircraft can be bonded to the tanker only. Always connect the ground cable to the
R parking ground point (or to the tanker) before connecting it to the aircraft. Refer to Aircraft Maintenance Manual (AMM) 12–11–28 PB 301 for more detailed safety procedures.

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 the refuel control panel) . . . . Check OFF**

– **FUEL/XFR VALVE 1/WING/L C/B (A10 on 49VU) and FUEL/XFR VALVE 2/WING/L C/B (M22 on 121VU) . . . . PULL for a minimum of 5 sec then PUSH**
The refuel control panel door must be closed when the C/B's are being pulled.

– **FUEL/XFR VALVE 1/WING/R C/B (A11 on 49VU) and FUEL/XFR VALVE 2/WING/R C/B (M23 on 121VU) . . . . PULL for a minimum of 5 sec then PUSH**
Intercell transfer valves will stay open until the next refuel selection.

– **FUEL/XFR VALVE 1/WING/L and R C/B's (A10 and A11 on 49VU), and FUEL/XFR VALVE 2/WING/L and R C/B's (M22 and M23 on 121 VU) . . . . PULL**
The refuel control panel door must be closed when the C/B's are being pulled. Then it could be opened for subsequent procedures.

RH WING REFUELING PROCEDURE

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

***– REFUELING . . . . START**

● **If the center tank is to be refueled :**

– GROUND FUEL TRANSFER PROCEDURE . . . . APPLY

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

***– REFUELING . . . . STOP**

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

LH WING REFUELING PROCEDURE

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

– FUEL/XFR VALVE 1/WING/L and R C/B's (A10 and A11 on 49VU) and FUEL/XFR VALVE 2/WING/L and R C/B's (M22 and M23 on 121VU) . . . . PUSH

– 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**

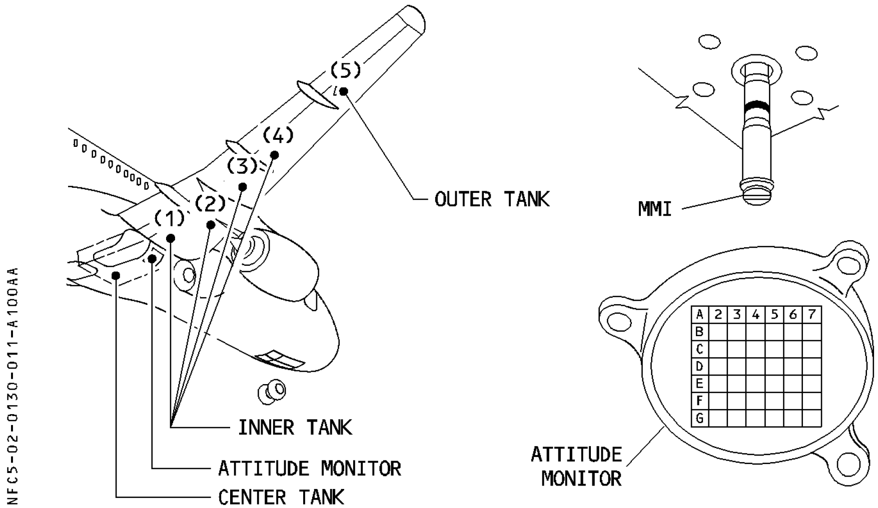
    Note : The T.O MEMO does not appear automatically since one engine is kept running.

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							MMI READING	LITERS ATTITUDE MONITOR READING						
		A* LEFT WING				G RIGHT WING				A RIGHT WING				G LEFT WING		
		1	2	3	4	5	6	7		1	2	3	4	5	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 N°	MMI READING	LITERS ATTITUDE READING A LEFT WING				G RIGHT WING			MMI READING	LITERS ATTITUDE READING A RIGHT WING				G LEFT WING		
		1	2	3	4	5	6	7		1	2	3	4	5	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

MMI N°	MMI READING	LITERS ATTITUDE MONITOR READING B*	LEFT WING			F	RIGHT WING		MMI READING	LITERS ATTITUDE MONITOR READING B	RIGHT WING			F	LEFT WING	
		1	2	3	4	5	6	7		1	2	3	4	5	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							MMI READING	LITERS ATTITUDE MONITOR READING						
		B LEFT WING				F	RIGHT WING			B RIGHT WING				F	LEFT WING	
		1	2	3	4	5	6	7		1	2	3	4	5	6	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

MMI N°	MMI READING	LITERS ATTITUDE MONITOR READING C* LEFT WING				E RIGHT WING			MMI READING	LITERS ATTITUDE MONITOR READING C RIGHT WING				E LEFT WING		
		1	2	3	4	5	6	7		1	2	3	4	5	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	350	350	350	16	350	350	350	350	350	350	350
	18	400	400	400	400	400	400	400	18	400	400	400	400	400	400	400
	20	450	450	450	450	450	450	450	20	450	450	450	450	450	450	450
	22	550	550	550	550	500	500	500	22	500	500	500	500	500	500	500
	24	600	600	600	600	600	600	600	24	600	600	600	600	600	550	550
	26	700	700	700	700	650	650	650	26	650	650	650	650	650	650	650
	28	750	750	750	750	750	750	750	28	750	750	750	750	750	700	700
	30	850	850	850	850	850	850	850	30	800	800	800	800	800	800	800
	32	950	950	950	950	950	950	950	32	900	900	900	900	900	900	900
	34	1050	1050	1050	1050	1050	1050	1050	34	1000	1000	1000	1000	1000	1000	1000
	36	1200	1150	1150	1150	1150	1150	1150	36	1100	1100	1100	1100	1100	1100	1100
	38	1300	1300	1300	1250	1250	1250	1250	38	1200	1200	1200	1200	1200	1200	1200
	40	1400	1400	1400	1400	1400	1400	1400	40	1300	1300	1300	1300	1300	1300	1300
	42	1500	1500	1500	1500	1500	1500	1500	42	1400	1400	1400	1400	1400	1400	1400
	44	1600	1600	1600	1600	1600	1600	1600	44	1550	1550	1500	1500	1500	1500	1500
	46	1750	1750	1750	1750	1750	1750	1750	46	1650	1650	1650	1650	1650	1650	1650
	48	1850	1850	1850	1850	1900	1900	1900	48	1800	1750	1750	1750	1750	1750	1800
	50	2000	2000	2000	2000	2000	2000	2050	50	1900	1900	1900	1900	1900	1900	1900
	52	2150	2150	2150	2150	2150	2150	2200	52	2000	2000	2000	2000	2000	2000	2050
	54	2300	2300	2300	2300	2300	2300	2350	54	2150	2150	2150	2150	2150	2150	2200
	56	2450	2500	2500	2500	2500	2500	2500	56	2300	2300	2300	2300	2300	2300	2350
	58	2600	2650	2650	2650	2650	2650	2700	58	2450	2450	2450	2450	2450	2500	2500
	60	2800	2800	2800	2800	2850	2850	2850	60	2600	2600	2600	2600	2600	2650	2650
	62	2900	2950	2950	2950	2950	2950	3000	62	2750	2750	2750	2750	2800	2800	2800
	63	2950	3000	3000	3000	3050	3050	3100	63	2800	2800	2800	2800	2850	2850	2850
	MAX	3250	3250	3300	3350	3350	3350	3400	MAX	3100	3100	3100	3100	3100	3100	3100

* GRID SQUARE LETTER
** GRID SQUARE NUMBER

MMI N°	MMI READING	LITERS ATTITUDE READING C LEFT WING 1	2	3	4	E RIGHT WING 5	6	7	MMI READING	LITERS ATTITUDE MONITOR READING C RIGHT WING 1	2	3	4	E LEFT WING 5	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	MMI READING	LITERS ATTITUDE MONITOR READING D BOTH WINGS 1	2	3	4	5	6	7**	MMI N°
1	2	50	50	50	50	50	50	50	18	3950	3900	3900	3850	3850	3850	3800	2
	4	100	100	100	100	100	100	100	20	4100	4100	4050	4050	4050	4000	4000	
	6	100	100	100	100	100	100	100	22	4200	4200	4150	4150	4150	4150	4150	
	8	150	150	150	150	150	150	150	24	4350	4350	4350	4300	4300	4300	4300	
	10	200	200	200	200	200	200	200	26	4500	4500	4500	4500	4500	4500	4500	
	12	250	250	250	250	250	250	250	28	4650	4650	4650	4650	4650	4700	4700	
	14	300	300	300	300	300	300	300	30	4800	4800	4800	4850	4850	4850	4900	
	16	350	350	350	350	360	350	350	32	4950	4950	5000	5000	5000	5050	5100	
	18	400	400	400	400	400	400	400	MAX								
	20	450	450	450	450	450	450	450									
	22	500	500	500	500	500	500	500	2	4800	4800	4800	4800	4750	4750	4600	3
	24	600	600	600	600	600	600	600	4	5000	5000	5000	5000	4950	4900	4850	
	26	650	650	650	650	650	650	650	6	5100	5150	5150	5100	5100	5100	5050	
	28	750	750	750	750	750	750	750	8	5250	5250	5250	5250	5250	5200	5200	
	30	850	850	850	850	850	850	850	10	5350	5350	5350	5400	5400	5350	5350	
	32	950	950	950	950	950	950	950	12	5450	5500	5500	5500	5500	5500	5500	
	34	1050	1050	1050	1050	1050	1000	1000	14	5600	5600	5600	5600	5600	5600	5600	
	36	1150	1150	1150	1150	1150	1100	1100	16	5700	5700	5700	5750	5750	5750	5750	
	38	1250	1250	1250	1250	1250	1250	1250	18	5800	5800	5850	5850	5850	5900	5900	
	40	1350	1350	1350	1350	1350	1350	1350	20	5900	5900	5950	5950	5950	6000	6000	
	42	1450	1450	1450	1450	1450	1450	1450	MAX								
	44	1550	1550	1550	1550	1550	1550	1550									
	46	1700	1700	1700	1700	1700	1700	1700	2	5900	5850	5800	5800	5800	5800	5800	4
	48	1800	1800	1800	1800	1800	1800	1800	4	6000	5950	5950	5950	5950	5950	5950	
	50	1950	1950	1950	1950	1950	1950	1950	6	6100	6100	6050	6050	6050	6050	6050	
	52	2100	2100	2100	2100	2100	2100	2100	8	6200	6200	6200	6200	6200	6200	6200	
	54	2250	2250	2250	2250	2250	2250	2250	10	6300	6300	6300	6300	6300	6300	6300	
	56	2400	2400	2400	2400	2400	2400	2400	12	6400	6400	6400	6400	6400	6400	6400	
	58	2550	2550	2550	2550	2550	2600	2600	14	6500	6500	6500	6500	6500	6500	6500	
	60	2700	2700	2700	2700	2700	2750	2750	16	6600	6600	6600	6600	6600	6600	6600	
	62	2850	2850	2850	2850	2850	2900	2900	18	6750	6750	6770	6800	6800	6810	6820	
	63	2900	2900	2900	2900	2900	2950	2950	MAX								
	MAX	3050	3050	3100	3100	3100	3150	3150									
2	2	2550	2550	2500	2500	2450	2450	2450	2	700	700	700	650	650	650	600	5
	4	2750	2700	2700	2700	2650	2650	2600	4	750	750	750	700	700	700	650	
	6	2900	2900	2850	2850	2850	2800	2800	6	800	800	750	750	750	750	700	
	8	3000	3000	2950	2950	2950	2950	2900	8	800	800	800	800	800	750	750	
	10	3200	3150	3150	3150	3150	3100	3050	10	850	800	800	800	800	800	800	
	12	3350	3350	3350	3350	3300	3300	3250	12	850	850	850	850	850	850	850	
	14	3550	3550	3550	3500	3500	3450	3450	14	850	850	850	850	850	850	850	
	16	3750	3750	3700	3700	3650	3650	3600	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 = 42500 kg and CG = 27 % (H-arm = 18.93 m)
R Deviation or adjustment = + 100 kg in zone F
R Cargo = 5500 kg with the following distribution :
R cargo 1 = 2000 kg ; cargo 3 = 1500 kg ; cargo 4 = 1500 kg ; cargo 5 = 500 kg
R Passengers = 145 pax with the following distribution :
R cabin OA = 50 ; cabin OB = 55 ; cabin OC = 40
R Fuel = 13000 kg

DESCRIPTION

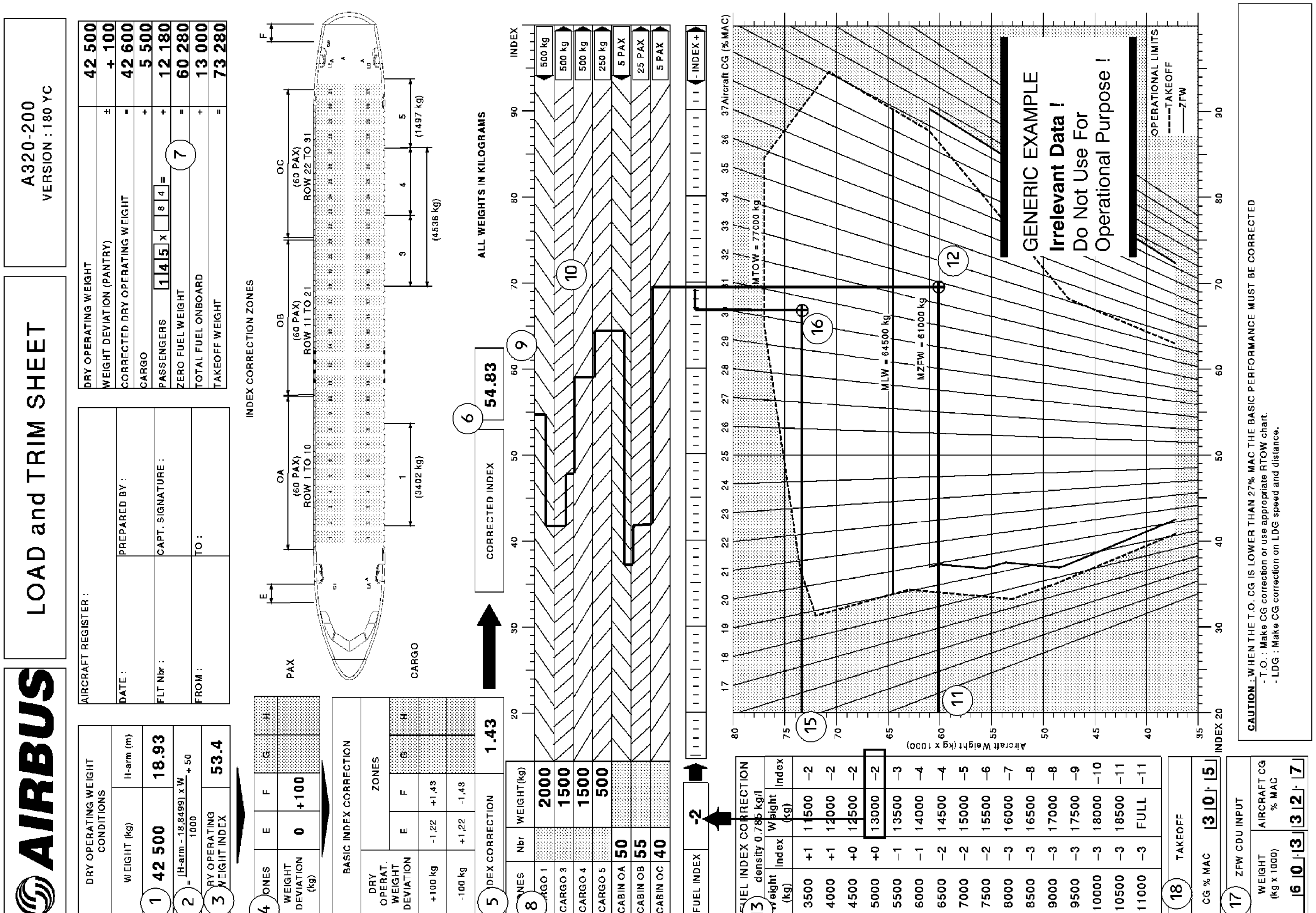
R a) Enter Master data in (1).
R b) Compute Dry Operating Weight Index using the formula indicated in (2) and report in (3).
R c) Dry Operating Index = 53.4.
R d) Enter weight deviation or adjustment in (4) and read corresponding index variation in
R (5) : + 1.43.
R e) Calculate corrected index and report in (6) : 54.83.
R f) Enter master data in table (7) and determine Zero Fuel Weight : 60280 kg and Takeoff
R Weight : 73280 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 : – 2 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 : 32.7 % and fill in table (17).
R o) Read takeoff CG position : 30.5 % 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.

Note : When referring to CG lower than 27 %, an operational margin is taken into account. It is the reason why performance at forward CG (lower than 25 %) must be used for operational CG lower than 27 %.

R



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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 :
R *$I = W \times (\text{H-arm} - 18.85)/1000 + K$ or $I = [(CG - 25) \times W \times 0.000042] + K$*
R *(Weight in kg, H-arm 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 :*
R *I=W×(H-arm−18.85)/1000+K or I=[(CG−25)×W×0.000042]+K*
R *(Weight in kg, H-arm in m)*

Inner Tanks		Outer Tanks		Center Tank	
Weight	Index	Weight	Index	Weight	Index
500	− 1	250	1	500	− 1
1000	− 1	500	1	1000	− 1
1500	− 2	FULL	2	1500	− 2
2000	− 2			2000	− 3
2500	− 2			2500	− 3
3000	− 3			3000	− 4
3500	− 3			3500	− 5
4000	− 3			4000	− 6
4500	− 3			4500	− 7
5000	− 3			5000	− 7
FULL	− 2			5500	− 8
				6000	− 9
				FULL	− 10

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02.00 CONTENTS

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)

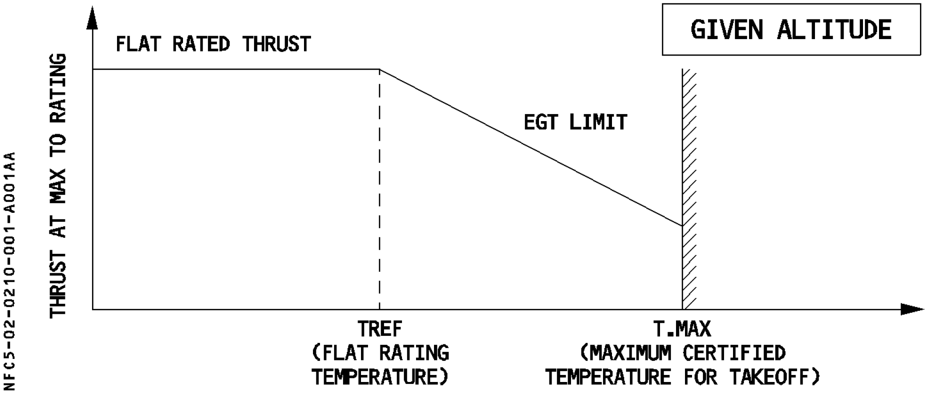
— weight entry (weight provided in the left column).

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.

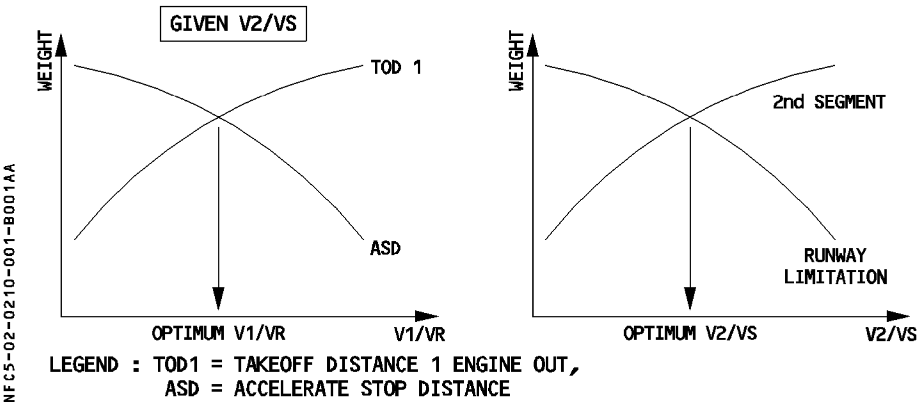
The airline may request Airbus to delete anyone set of sections from the customized FCOM.

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 :



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.

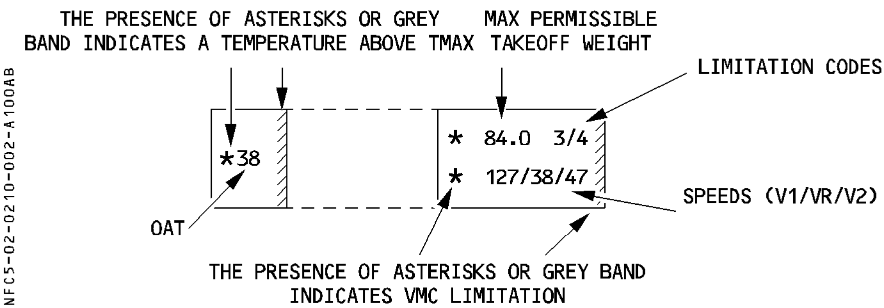


On a typical runway, the performance of a twin engine aircraft, is generally limited by the one engine out operation at takeoff. The optimum V2/VS and optimum V1/VR are consequently unique.

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

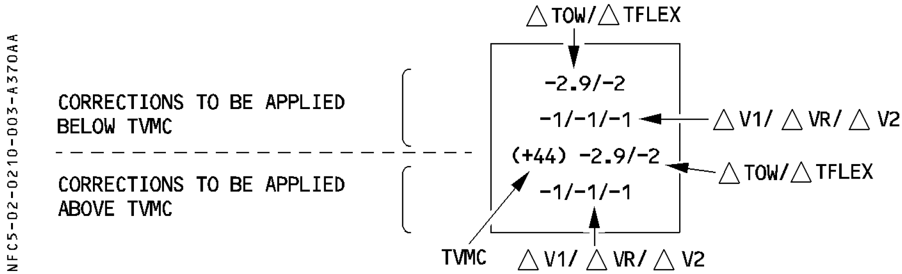
CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

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.

Note : If the RTOW chart is based on the CG being at 25 %, the crew can find the takeoff performance at a more forward CG by decreasing the takeoff weight by 1000 kg (2200 lb) and increasing V1, VR and V2 by 1 knot.

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.

MINIMUM SPEED

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

FLEX TEMPERATURE INDICATOR

On the temperature entry chart, the temperature column may display asterisks or have a 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).*

RTOW CHARTS – COMPLEMENTARY INFORMATION

NFC5-02-0210-005-A100AB

AIRCRAFT MODEL — TAKEOFF CONFIGURATION — ENGINE TYPE — AIRPORT CHARACTERISTICS — WIND — AIRPORT IDENTIFICATION — RUNWAY CONDITION AND DERATE — RUNWAY IDENTIFICATION — OCTOPUS (TAKEOFF CHART PROGRAM) VERSION & COMPUTATION DATE — TAKEOFF CONDITIONS

AXXXXXX	ENGINE	AIRPORT NAME			15L	VERSION AXXXXXXX	DATE V8
QNH Air conditioning Anti-icing	1013 HPA AC OFF AI OFF	Elevation Isa temp Rwy slope	489 FT 14 C .08 %	TORA 3000 M TODA 3100 M ASDA 3000 M	4 obstacles	DRY	

OAT °C	CONF 1 + F TAILWIND − 10.0 KT	CONF 1 + F TAILWIND − 5.0 KT	CONF 1 + F WIND 0 KT	CONF 1 + F HEADWIND + 10.0 KT	CONF 1 + F HEADWIND + 20.0 KT	CONF 2 TAILWIND − 10.0 KT	CONF 2 TAILWIND − 5.0 KT	CONF 2 WIND 0 KT	CONF 2 HEADWIND + 10.0 KT	CONF 2 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)	*VMC *LIMITATION	Tref (OAT) =29 C Tmax (OAT) =50 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 = .1Kt/1000 Kg	

MINIMUM & MAXIMUM ACC. HEIGHT AND ALT.

INFLUENCE CORRECTION
ΔWEIGHT ΔTFLEX
ΔV1/ΔV_R/ΔV2
(TVMC) ΔWEIGHT ΔTFLEX
ΔV1/ΔV_R/ΔV2

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

R

A320XXX	ENGINES	AIRPORT NAME						15L	VERSION DATE AXXXXXXX **V20
QNH	1013.25 HPA	Elevation	489	FT	TORA	3000	M		
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 C	CONF 1+F TAILWIND –10 KT	CONF 1+F TAILWIND –5 KT	CONF 1+F WIND 0 KT	CONF 1+F HEADWIND 10 KT	CONF 1+F HEADWIND 20 KT	CONF 2 TAILWIND –10 KT	CONF 2 TAILWIND –5 KT	CONF 2 WIND 0 KT	CONF 2 HEADWIND 10 KT	CONF 2 HEADWIND 20 KT
–20	80.2 4/6 156/56/58	82.0 4/6 162/62/64	83.6 3/4 167/67/69	84.8 3/4 170/70/72	85.8 3/4 173/73/75	80.4 4/6 154/54/59	81.9 3/4 159/59/64	83.4 3/4 164/64/69	84.4 3/4 167/67/72	85.2 2/4 169/69/74
–10	79.5 4/6 153/56/58	81.3 4/6 159/59/62	83.1 4/6 164/64/66	84.3 3/4 167/67/69	85.3 3/4 171/71/72	79.7 4/6 151/52/57	81.4 4/6 156/56/62	82.9 3/4 161/61/66	84.0 3/4 164/64/69	84.9 3/4 167/67/72
0	78.8 4/6 151/54/57	80.6 4/6 156/57/59	82.5 4/6 162/62/64	83.7 3/4 165/65/67	84.7 3/4 168/68/70	79.0 4/6 149/51/56	80.8 4/6 154/54/60	82.4 3/4 159/59/64	83.5 3/4 162/62/67	84.5 3/4 165/65/70
10	78.2 4/6 148/53/55	80.0 4/6 154/57/59	81.8 4/6 159/60/62	83.1 4/6 163/63/65	84.2 3/4 166/66/67	78.4 4/6 147/50/54	80.2 4/6 152/52/58	81.9 3/4 156/56/62	83.0 3/4 159/59/65	83.9 3/4 162/63/68
20	77.6 4/6 146/51/53	79.3 4/6 151/55/57	81.1 4/6 157/57/60	82.5 4/6 160/60/62	83.6 4/6 163/63/65	77.7 4/6 145/48/52	79.5 4/6 150/51/56	81.3 4/6 154/54/60	82.4 3/4 157/57/63	83.4 3/4 160/61/66
30	76.9 4/6 144/50/52	78.7 4/6 149/54/56	80.5 4/6 154/57/60	81.8 4/6 158/58/60	83.0 4/6 161/61/63	77.1 4/6 143/46/50	78.9 4/6 148/50/55	80.7 4/6 153/53/58	81.9 3/4 155/56/61	82.9 3/4 158/59/64
32	76.8 4/6 144/50/52	78.6 4/6 149/53/55	80.4 4/6 154/56/58	81.7 4/6 157/58/60	82.9 4/6 161/61/63	77.0 4/6 142/45/50	78.7 4/6 147/50/55	80.6 4/6 152/53/58	81.8 4/6 155/55/60	82.8 3/4 157/59/64
34	76.7 4/6 143/50/52	78.4 4/6 148/53/55	80.2 4/6 154/56/58	81.5 4/6 157/57/60	82.8 4/6 160/60/62	76.9 4/6 142/45/50	78.6 4/6 147/50/55	80.5 4/6 152/52/57	81.7 4/6 154/55/60	82.7 3/4 157/58/64
36	76.6 4/6 143/49/52	78.4 4/6 148/52/54	80.1 4/6 153/56/58	81.4 4/6 156/57/59	82.7 4/6 160/60/62	76.8 4/6 141/45/50	78.5 4/6 146/50/55	80.3 4/6 151/52/57	81.6 4/6 154/55/60	82.6 3/4 157/58/63
38	76.5 4/6 142/49/52	78.3 4/6 147/52/54	80.0 4/6 153/56/58	81.3 4/6 156/58/60	82.6 4/6 159/60/62	76.7 4/6 141/45/50	78.4 4/6 146/48/53	80.2 4/6 151/52/57	81.5 4/6 154/54/59	82.5 3/4 156/58/63
40	76.4 4/6 142/49/52	78.2 4/6 147/52/54	79.9 4/6 152/56/58	81.2 4/6 156/58/60	82.5 4/6 159/59/61	76.6 4/6 141/45/50	78.3 4/6 146/48/53	80.1 4/6 150/51/56	81.4 4/6 153/54/59	82.4 3/4 156/57/63
42	76.3 4/6 142/49/51	78.0 4/6 147/52/54	**DO NOT USE FOR OPERATIONAL PURPOSE**						81.3 4/6 153/54/59	82.3 3/4 156/57/62
44	76.1 4/6 142/49/51	77.9 4/6 146/51/53							81.1 4/6 153/53/58	82.1 3/4 155/57/62
46	75.5 4/6 142/48/51	77.2 4/6 147/51/53	78.9 4/6 152/55/57	80.2 4/6 155/56/58	80.7 2/4 154/56/58	75.7 4/6 141/45/49	77.3 4/6 145/47/52	79.1 4/6 150/50/55	80.3 3/4 152/53/58	80.7 2/4 152/55/60
48	74.5 4/6 143/48/50	76.2 4/6 148/50/52	77.9 4/6 153/53/55	79.1 4/6 155/56/57	79.3 2/4 153/55/57	74.7 4/6 141/44/48	76.4 4/6 146/47/51	78.0 3/4 150/50/55	79.1 3/4 152/53/57	79.5 4/8 155/58/63
50	73.6 4/6 143/47/49	75.3 4/6 148/49/51	76.9 4/6 153/53/55	77.9 4/8 154/54/56	77.9 2/4 151/54/55	73.8 4/6 142/42/46	75.4 4/6 146/47/51	76.9 3/4 150/50/54	78.0 3/4 152/52/57	78.0 2/4 149/52/57
52	72.7 4/6 144/46/48	74.4 4/6 149/49/51	75.8 3/4 153/53/54	76.3 2/4 152/52/53	76.3 2/4 147/52/53	72.9 4/6 142/44/48	74.3 3/4 146/46/50	75.8 3/4 150/50/54	76.4 2/4 150/50/55	76.4 2/4 146/50/55
54	71.8 4/6 145/46/47	73.3 3/4 149/49/51	74.8 3/4 152/52/54	75.0 2/4 150/50/52	75.0 2/4 145/50/52	71.9 3/4 142/43/47	73.3 3/4 146/46/50	74.7 3/4 149/49/54	75.1 2/4 148/49/54	75.1 2/4 144/49/54
	INFLUENCE OF RUNWAY CONDITION									
WET	–2.0/ -5 –169/ –1/-1 (+54) –2.0/ -5 –16/0/0	–1.5/ -4 –15/-2/-2 (+54) –1.5/ -4 –15/0/ 0	–1.2/ -3 –13/ -4/ -4 (+54) –1.3/ -3 –13/ 0/0	–1.1/ -2 –11/ -3/-3 (+54) –1.1/ -2 –11/ 0/0	–1.8/ -2 –10/-2/–2 (+54) -0.8/ -2 –10/ 0/0	–0.9/ -4 –14/ 0/ (+54) –0.9/ -4 –14/ 0/0	–1.5/ -4 –13/ 0/ (+54) –1.5/ -4 –13/ 0/0	–1.2/ -3 –12/ -2/ -2 (+54) –1.3/ -3 –11/ 0/0	–1.2/ -2 –10/ -1/ -1 (+54) –1.2/ -2 –10/ 0/0	–1.5/ -3 –4/ -2/ -2 (+54) –1.5/ -3 –4/ 0/0
D QNH HPA	**INFLUENCE OF DELTA PRESSURE**									
–10.0	–0.8/ -2 0/ 0/ (+54) –0.8/ -2 0/ 0/	–0.7/ -2 0/ 0/ (+54) –0.7/ -2 0/ 0/	–0.7/ -2 0/ 0/ (+54) –0.7/ -2 0/ 0/	–1.3/ -3 –1/ 0/ (+54) –1.3/ -3 –1/ 0/	–0.7/ -2 0/ 0/ (+54) –0.7/ -2 0/ 0/	–0.7/ -2 0/ 0/ (+54) –0.7/ -2 0/ 0/	–1.2/ -3 0/ 0/ (+54) –1.2/ -3 0/ 0/	–0.8/ -2 –1/ -1/ -2 (+54) –0.8/ -2 –1/ 0/	–0.8/ -2 –1/ 0/ (+54) –0.8/ -2 –1/ 0/	–0.8/ -2 –1/ -1/ -1 (+54) –0.8/ -2 –1/ 0/
+10.0	+0.2/ 0 0/ 0/ (+54) +0.2/ 0 0/ 0/	+0.2/ 0 0/ 0/ (+54) +0.2/ 0 0/ 0/	0.0/ 0 0/ 0/ (+54) 0.0/ 0 0/ 0/	+0.2/ 0 0/ 0/ (+54) +0.2/ 0 0/ 0/	+0.2/ 0 +1/ +1/ +1 (+54) +0.2/ 0 +1/ +1/ +1	+0.2/ 0 0/ +1/ +1 (+54) +0.2/ 0 0/ +1/ +1	+0.2/ 0 0/ 0/ (+54) +0.2/ 0 0/ 0/	+0.2/ 0 0/ 0/ (+54) +0.2/ 0 0/ 0/	+0.2/ 0 +1/ +1/ +1 (+54) +0.2/ 0 +1/ +1/ +1	+0.2/ 0 +1/ +1/ +1 (+54) +0.2/ 0 +1/ +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) = 44 C Tmax (OAT) = 54 C	Min acc height 464 FT Max acc height 1917 FT	Min QNH alt 953 FT Max QNH alt 2406 FT
	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				Min V1/VR/V2 = 108/114/117 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 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
Use the chart from 2.02.10 p 6.
Enter the 10 kt head wind column and interpolate for 25°C, CONF 1+F,
R Maximum takeoff weight (1000 kg) air conditioning OFF 82.1
Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
R Maximum takeoff weight (1000 kg) air conditioning OFF 82.1

Retain CONF 2 as takeoff configuration.

R Maximum TO weight (1000 kg) air conditioning OFF 82.1
Air conditioning correction (FCOM 2.02.24 p1) . . . . – 2.2
R Maximum permissible TO weight (1000 kg) air conditioning ON 79.9
Determine takeoff speeds for 79.9 (1000 kg) in the 10 kt head wind column (CONF 2)
V1 = 152 kt, VR = 153kt, V2 = 158 kt

CORRECTIONS FOR WET OR CONTAMINATED RUNWAYS 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 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.*
- *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 check is required.*

Example 2

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

Use the chart from 2.02.10 p 6.

- Enter the 10 kt head wind column and interpolate for 25°C, CONF 1+F,
R max TO weight (1000 kg) 82.1
- Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
R max TO weight (1000 kg) 82.1
- Retain CONF 2 for takeoff as the speeds are lower.
- Read associated speeds as V1 = 156 kt, VR = 157 kt, V2 = 162 kt
- Apply WET correction
R For OAT < TVMC (54°C), △W =.................................– 1.2
R Intermediate weight (1000 kg) 80.9
Associated speeds,
R V1 = 156 kt – 10 = 146 kt
R VR = 157 kt – 1 = 156 kt
R V2 = 162 kt – 1 = 161 kt
(No speed check required for first correction)
- Apply QNH correction
For OAT < TVMC (54°C), △W = 0.2 × 15/10 = ... + 0.3
R Maximum permissible takeoff weight (1000 kg) 81.2
Associated speeds,
R V1 = 146 kt + 1 × 15/10 = 147 kt
R VR = 156 kt + 1 × 15/10 = 158 kt
R V2 = 161 kt + 1 × 15/10 = 163 kt
- Check that the speeds are higher than minimum speeds from the chart and from VMU table.

R

	Takeoff Configuration : 2			
	TOW	V1	VR	V2
TOW (RTOW)	82.1	156	157	162
FCOM correction(s)				
Intermediate value	82.1	156	157	162
WET Correction	– 1.2	– 10	– 1	– 1
Intermediate value	80.9	146	156	161
QNH Correction	+ 0.3	+ 1	+ 2	+ 2
Final value	81.2	147	158	163

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

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,
R Max TO weight (1000 kg) air conditioning OFF 82.1
Enter the 10 kt head wind column and interpolate for 25°C, CONF 2,
R Max TO weight (1000 kg) air conditioning OFF 82.1
Retain CONF 2 for takeoff configuration.
2. First, apply the correction from FCOM page 2.02.24 p 1.
R Max TO weight (1000 kg) air conditioning OFF 82.1
Air conditioning correction . . . .– 2.2
R Intermediate weight 79.9
R Interpolate takeoff speeds for 79.9 (1000 kg) in the 10 kt head wind column,
V1 = 152 kt, VR = 153 kt, V2 = 158 kt
3. Apply WET correction
R For OAT < TVMC (54°C), ΔW = ...– 1.2
R Intermediate weight 78.7
Associated speeds,
R V1 = 152 kt – 10 = 142 kt
VR = 153 kt – 1 = 152 kt
V2 = 158 kt – 1 = 157 kt
Check that the speeds are higher than minimum speeds from the chart and from VMU table
Apply QNH correction
For OAT < TVMC (54°C), ΔW = 0.2 × 15/10 =. + 0.3
R Maximum permissible takeoff weight 79.0
Associated speed,
R V1 = 142 kt + 1 × 15/10 = 143 kt
R VR = 152 kt + 1 × 15/10 = 154 kt
R V2 = 157 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 :

R Max permissible takeoff weight = 79.0 (1000 kg)

R V1 = 143 kt, VR = 154 kt, V2 = 159 kt.

R

	Takeoff Configuration : 2			
	TOW	V1	VR	V2
TOW (RTOW)	82.1			
FCOM correction(s)	– 2.2			
Intermediate value	79.9	152	153	158
WET Correction	– 1.2	– 10	– 1	– 1
Intermediate value	78.7	142	152	157
QNH Correction	+ 0.3	+ 1	+ 2	+ 2
Final value	79.0	143	154	159

EXTRAPOLATION

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

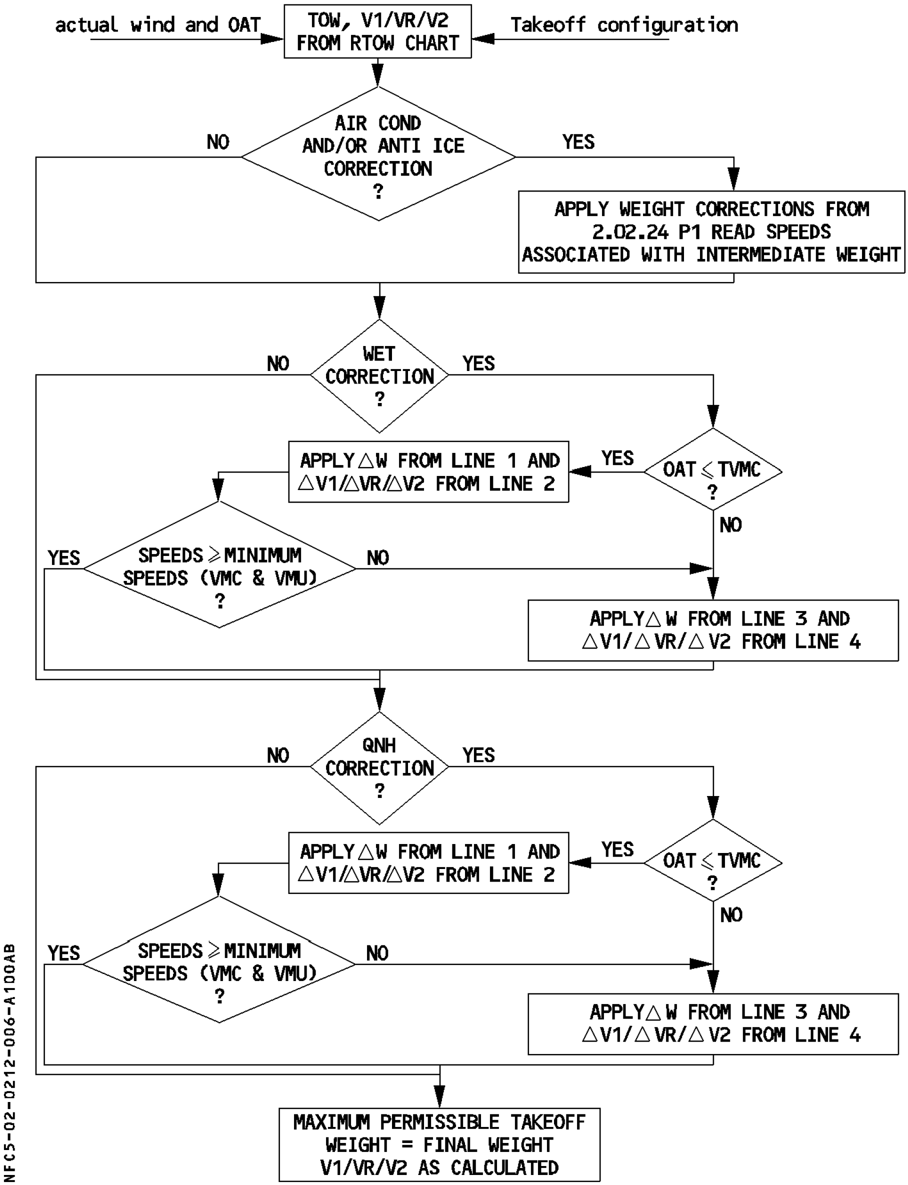
1. For given configuration and wind, note the speeds associated with the takeoff weight in the row displaying the highest permissible temperature.
2. Apply speed corrections provided at the bottom of the RTOW chart to V1, VR and V2 limited to the minimum speeds.

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.



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.

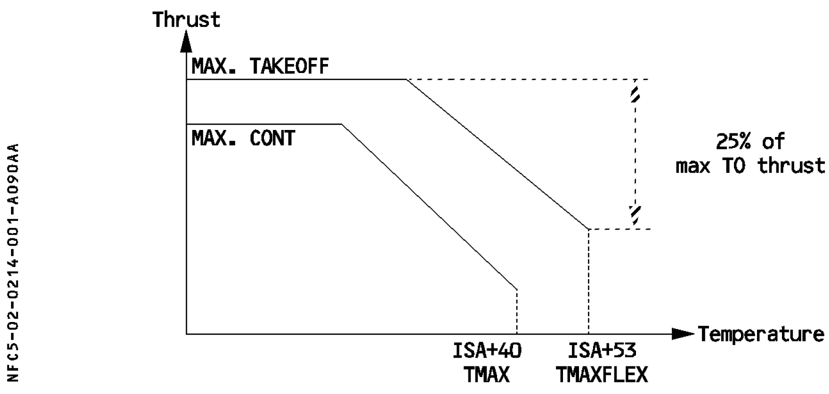
USE OF FLEXIBLE TAKEOFF

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 above two constraints also limit the maximum flexible temperature at ISA + 53 (68°C at sea level).
- The flexible takeoff thrust cannot be lower than the Max Continuous thrust used for the final takeoff flight path computation (at ISA + 40).

R - The flexible temperature cannot be lower than the flat rating temperature, TREF* (ISA
R + 29 up to 2000 feet), or the actual temperature (OAT).



R *Note : *TREF being a function of pressure altitude, read it on the takeoff chart.*

— 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

R · In order to extend engine life and save maintenance costs, it is recommended to use
R flexible thrust reduction.

· 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.

R

CONDITIONS	PROCEDURE	REASON
Dry or wet well paved runway	— Use the flap setting giving the highest flexible temperature. — When flexible temperature difference between two flap settings is low, use the highest flap setting.	Extend engine life and save maintenance costs.
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.

Note : If the RTOW chart is based on the CG being at 25 %, the crew can determine the flexible temperature at a more forward CG by decreasing the flexible temperature by 2°C. V1, VR and V2 must be increased by 1 knot.

CONSERVATIVE CORRECTIONS FOR QNH AND BLEEDS FROM FCOM 2.02.24 P 1

Corrections are given for QNH $\neq$ 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 2

DATA : Actual takeoff weight = 76 000 kg
Head wind = 10 kt
Air conditioning ON
QNH = 1013 hPa

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 76 000 kg, CONF 1 + F,
Flexible temperature . . . . .52° C
Enter the 10 kt head wind column and interpolate for 76 000 kg, CONF 2,
Flexible temperature . . . . .52° C

Retain CONF 2 for takeoff configuration.
Takeoff speeds are V1 = 150 kt, VR = 150 kt, V2 = 155 kt
Flexible temperature with air conditioning OFF . . . . .52° C
Air conditioning correction (FCOM 2.02.24 p 1) . . . . – 7° C
Maximum flexible temperature . . . . .45° 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.
   <u>No speed correction is required for QNH and bleeds influence</u> (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)

<u>Note</u> :
- *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 = 76 000 kg
Head wind = 10 kt
QNH = 1028 hPa
WET runway
Air conditioning OFF

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 76 000 kg, CONF 1+F,
Flexible temperature . . . . 52° C
Enter the 10 kt head wind column and interpolate for 76 000 kg, CONF 2,
Flexible temperature . . . . 52° C
Equivalent performance is obtained from the two different configurations.
Retain CONF 2 as the speeds are lower.
R Takeoff speeds are V1 = 149 kt, VR = 150 kt, V2 = 155 kt
Apply WET correction
For flexible temperature < TVMC (54° C), △Tflex =. . . . . – 2° C
Intermediate flex temperature . . . . 50° C
Associated speeds,
R V1 = 149 kt – 10 = 139 kt
VR = 150 kt – 1 = 149 kt
V2 = 155 kt – 1 = 154 kt
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 . . . . 50° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
R Takeoff speeds are V1 = 139 kt, VR = 149 kt, V2 = 154 kt
R

	Takeoff Configuration : 2			
	Tflex	V1	VR	V2
Chart temperature	52	149	150	155
FCOM correction(s)				
Intermediate value	52	149	150	155
WET Correction	– 2	- 10	– 1	– 1
Intermediate value	50	139	149	154
QNH Correction	0	0	0	0
Final value	50	139	149	154

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 = 76 000 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 76 000 kg, CONF 1+F,
  Flexible temperature . . . . 52° C
· Enter the 10 kt head wind column and interpolate for 76 000 kg, CONF 2,
  Flexible temperature . . . . 52° C
· Retain CONF 2 for takeoff configuration.
  Takeoff speeds are V1 = 150 kt, VR = 150 kt, V2 = 155 kt
· First, apply the correction from FCOM page 2.02.24 p 1.
  Flexible temperature with air conditioning OFF . . . . 52° C
  Air conditioning correction . . . . – 7° C
  Intermediate flexible temperature . . . . 45° C
  No speed correction.
· Apply WET correction
  For flexible temperature < TVMC (54° C), △Tflex ≑. . . . . – 1
  Intermediate flex temperature . . . . 44° C
  Associated speeds,
  V1 = 150 kt – 5 = 145 kt
  VR = 150 kt – 1 = 149 kt
  V2 = 155 kt – 1 = 154 kt
  Check V2 against VMU limitation on FCOM 2.02.25.
· Apply QNH correction
  For flexible temperature < TVMC (54° C), △Tflex ≑. . . . . 0° C
  Maximum flexible temperature . . . . 44° C
  Check that OAT/TREF < flex temperature ≤ TMAXFLEX
  No speed correction.
  Takeoff speeds are V1 = 145 kt, VR = 149 kt, V2 = 154 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	52	150	150	155
FCOM correction(s)	– 7	0	0	0
Intermediate value	45	150	150	155
WET Correction	– 1	– 5	– 1	– 1
Intermediate value	44	145	149	154
QNH Correction	0	0	0	0
Final value	44	145	149	154

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;

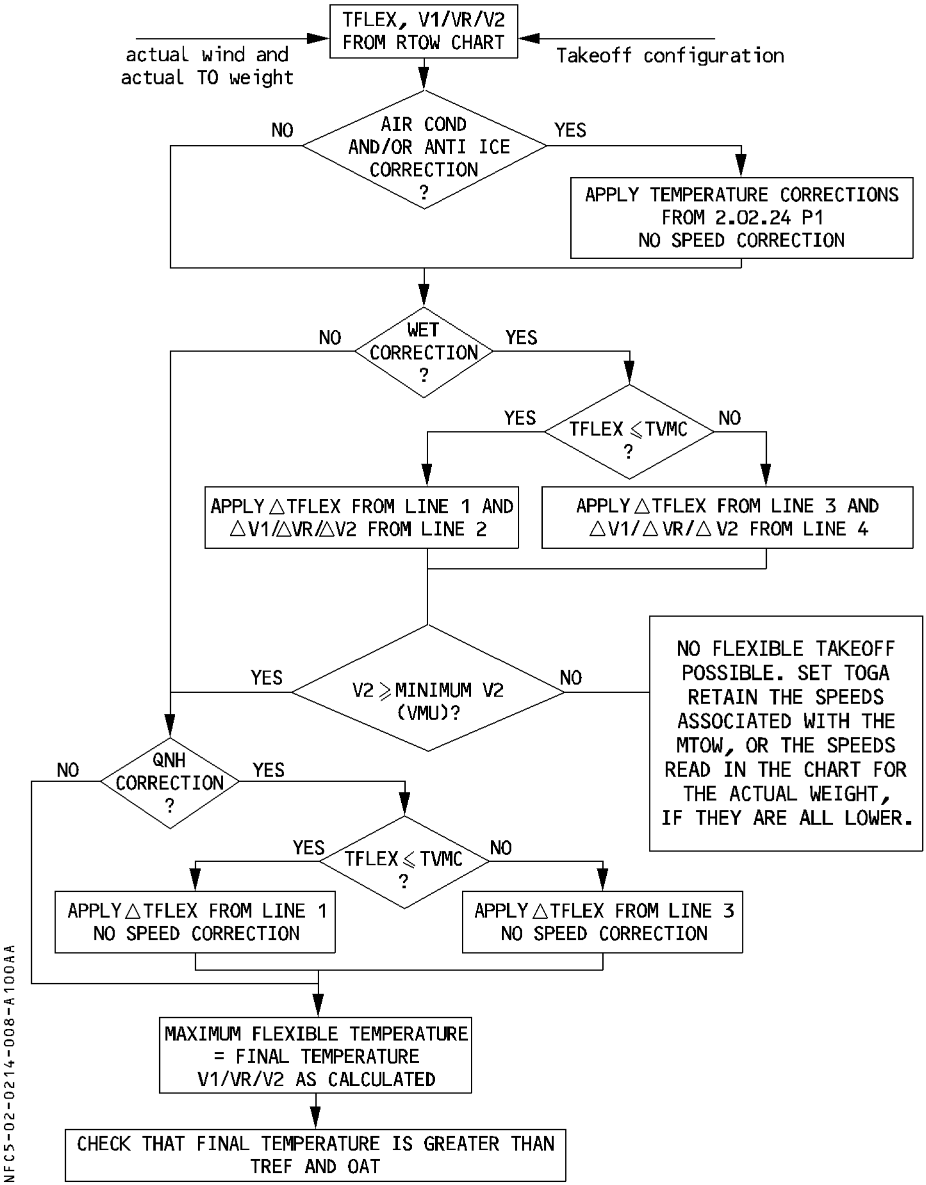
OR

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

SUMMARY

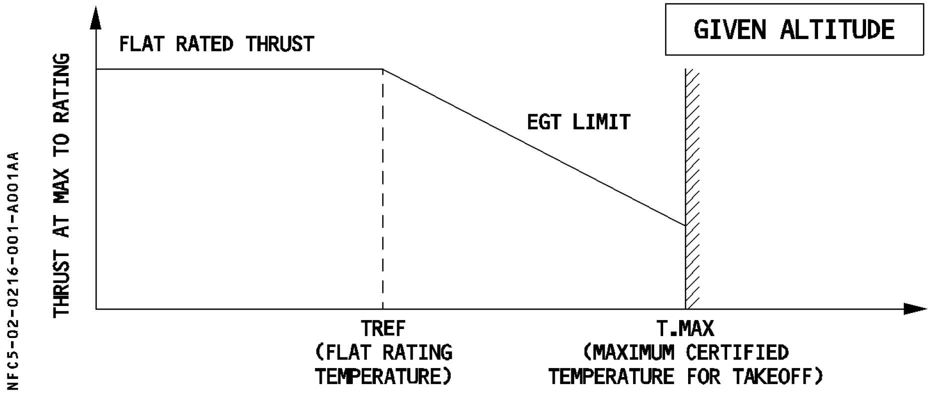
The flow diagram gives the different steps to follow.

R

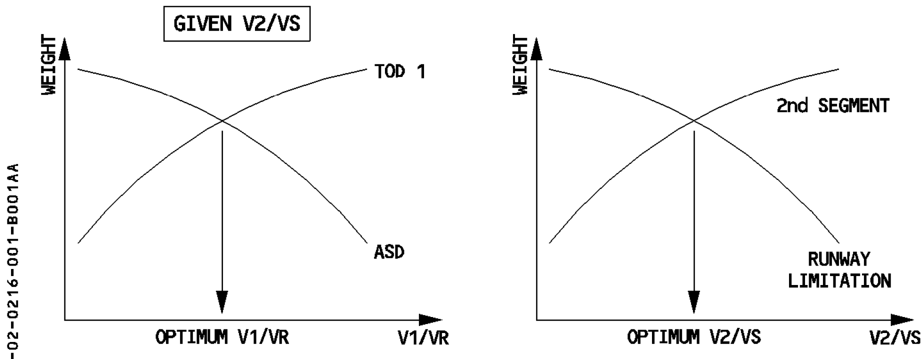


TAKEOFF PERFORMANCE

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 :



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.



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

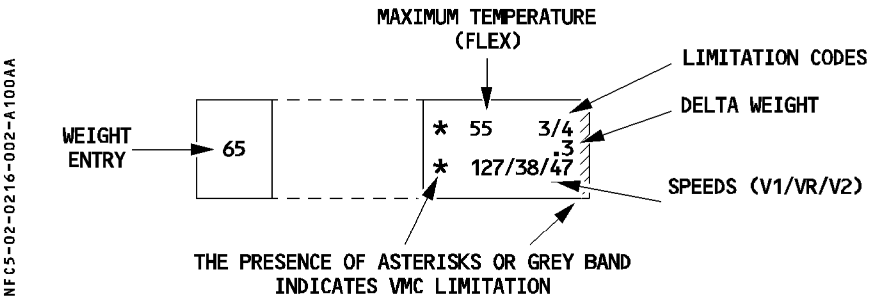
On a typical runway, the performance of a twin engine aircraft, is generally limited by the one engine out operation at takeoff. The optimum V2/VS and optimum V1/VR are consequently unique.

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

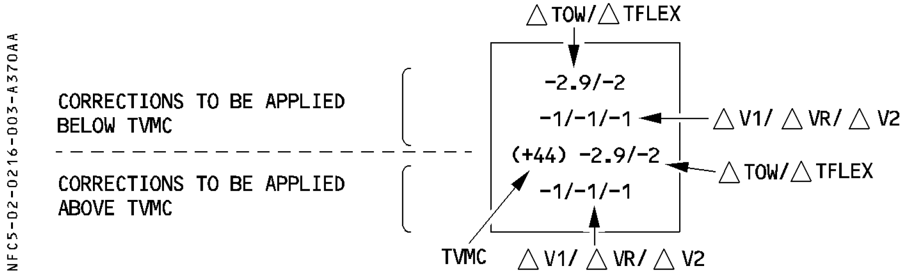
CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

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.

Note : If the RTOW chart is based on the CG being at 25 %, the crew can find the takeoff performance at a more forward CG by decreasing the takeoff weight by 1000 kg (2200 lb) and increasing V1, VR and V2 by 1 knot.

R **DESCRIPTION OF THE CORRECTIONS ON TAKEOFF CHART**

R The corrections are presented on 4 lines :
R



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

R *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).*

NFC5-02-0216-005-A100AB

AIRCRAFT MODEL — TAKEOFF CONFIGURATION — ENGINE TYPE — AIRPORT CHARACTERISTICS — WIND — AIRPORT IDENTIFICATION — RUNWAY CONDITION AND DERATE — RUNWAY IDENTIFICATION — OCTOPUS (TAKEOFF CHART PROGRAM) VERSION & COMPUTATION DATE — TAKEOFF CONDITIONS

AXXXXXX	ENGINE	AIRPORT NAME		15L	VERSION AXXXXXXX	DATE V8
QNH Air cond. Anti-icing	1013 HPA AC OFF AI OFF	Elevation 489 FT Isa temp 14 C Rwy slope .08 %	TORA 3000 M TODA 3100 M ASDA 3000 M	4 obstacles	DRY	

WEIGHT 1000 KG	CONF 1 + F TAILWIND - 10 KT	CONF 1 + F TAILWIND - 5 KT	CONF 1 + F WIND 0 KT	CONF 1 + F HEADWIND 10 KT	CONF 2 TAILWIND - 10 KT	CONF 2 TAILWIND - 5 KT	CONF 2 WIND 0 KT	CONF 2 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	MTOW(1000 KG) codes	*VMC	Tref (OAT) =29 C	Min acc height 784Ft	Min QNH alt 1280Ft
DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT) (TVMC OAT C) DW (1000 KG) DTFLEX DV1-DVR-DV2 (KT)	V1min/VR/V2(KT)	*LIMITATION	Tmax (OAT) =54 C	Max acc height 1965Ft	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 = 111/17/21 CHECK VMU LIMITATION CORRECT. V1/VR/V2 = 1 Kt/1000 Kg	

GRAD1/GRAD2

MINIMUM & MAXIMUM ACC. HEIGHT AND ALT.

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

R

A320XXX	ENGINES	AIRPORT NAME				15L	VERSION DATE
QNH	1013.25 HPA	Elevation	489 FT	TORA	3000 M		AXXXXXXX **V20
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
80	–18 4/6 0.0 155/56/58	9 4/6 0.0 154/57/59	37 4/6 0.0 153/55/57	45 4/6 0.6 155/56/58	–15 4/6 0.0 153/53/58	12 4/6 0.0 151/52/57	40 4/6 0.1 150/51/56	46 3/4 0.3 152/53/58
76	44 4/6 0.1 141/49/51	48 4/6 0.2 148/50/52	51 3/4 0.4 153/53/55	52 2/4 0.3 152/52/53	44 4/6 0.3 140/45/49	48 4/6 0.4 146/47/51	51 3/4 0.4 150/50/54	52 2/4 0.4 150/50/55
72	53 4/6 0.3 145/46/48	56 3/4 0.2 148/48/50	59 3/4 0.0 152/52/53	60 3/4 0.4 154/54/55	53 3/4 0.4 142/43/47	56 3/4 0.2 146/46/50	58 3/4 0.5 149/49/53	60 3/4 0.3 151/51/55
68	61 3/4 0.3 144/44/45	63 3/4 0.5 148/48/49	65 3/4 0.6 151/51/52	67 3/4 0.3 153/53/54	61 3/4 0.3 142/42/45	63 3/4 0.5 145/45/48	65 3/4 0.4 148/48/52	66 4/4 0.6 149/49/53
64	68 3/4 0.5 143/43/44	69 3/4 1.1 147/47/48	69 3/4 2.2 151/51/52	69 3/4 3.0 153/53/54	68 3/4 0.6 141/41/44	69 3/4 1.0 144/44/47	69 4/4 2.0 147/47/50	69 4/4 2.7 147/47/50
60	69 3/4 4.0 143/43/44	* 69 7/9 * 0.0 * 114/32/33	* 69 7/9 * 0.0 * 114/32/33	* 69 7/9 * 0.0 * 114/32/33	69 3/4 4.0 141/41/44	* 69 7/9 * 0.0 * 112/26/29	* 69 7/9 * 0.0 * 112/26/29	* 69 7/9 * 0.0 * 112/26/29
56	* 69 7/9 * 0.0 * 114/27/29	* 69 7/9 * 0.0 * 114/27/29	**DO NOT USE FOR OPERATIONAL PURPOSE**				* 69 7/9 * 0.0 * 112/21/24	* 69 7/9 * 0.0 * 112/21/24
52	* 69 7/9 * 0.0 * 114/22/24	* 69 7/9 * 0.0 * 114/22/24					* 69 7/7 * 0.0 * 112/19/22	* 69 7/7 * 0.0 * 112/19/22
48	* 69 7/7 * 0.0 * 115/20/22	* 69 7/7 * 0.0 * 115/20/22	* 69 7/7 * 0.0 * 115/20/22	* 69 7/7 * 0.0 * 115/20/22	* 69 7/7 * 0.0 * 113/18/22	* 69 7/7 * 0.0 * 113/18/22	* 69 7/7 * 0.0 * 113/18/22	* 69 7/7 * 0.0 * 113/18/22
	GRAD1/GRAD2 (KG/C)							
	50/****	50/****	60/****	60/ 460	50/****	50/****	60/****	50/ 470
	INFLUENCE OF RUNWAY CONDITION							
WET	–1.4/ -3 –11/ -1/ -1 (+69) –1.4/ -3 –11/ 0/ 0	–1.1/ -3 –10/ -1/ -1 (+69) –1.1/ -3 –10/ 0/ 0	–0.7/ -2 –9/ -2/ -2 (+69) –0.7/ -2 –9/ 0/ 0	–0.7/ -2 –8/ -2/ -2 (+69) –0.7/ -2 –8/ 0/ 0	–1.3/ -3 –10/ 0/ 0 (+69) –1.3/ -3 –10/ 0/ 0	–1.3/ -3 –9/ -4/ -4 (+69) –1.3/ -3 –9/ 0/ 0	–0.4/ -1 –7/ -2/ -2 (+69) –0.4/ -1 –7/ 0/ 0	–0.2/ -1 –5/ 0/ 0 (+69) –0.2/ -1 –5/ 0/ 0
D QNH HPA	**INFLUENCE OF DELTA PRESSURE**							
–10.0	–0.8/ -2 0/ 0/ -1 (+61) –0.8/ -2 0/ 0/ 0	–1.2/ -3 0/ 0/ -1 (+61) –1.2/ -3 0/ 0/ 0	–0.7/ -2 –1/ -1/ -1 (+61) –0.7/ -2 –1/ 0/ 0	–0.7/ -2 –1/ -1/ -1 (+61) –0.7/ -2 –1/ 0/ 0	–0.7/ -2 0/ 0/ 0 (+61) –0.7/ -2 0/ 0/ 0	–0.7/ -2 0/ 0/ -1 (+61) –0.7/ -2 0/ 0/ 0	–0.7/ -2 0/ 0/ -1 (+61) –0.7/ -2 0/ 0/ 0	–0.7/ -2 0/ 0/ -1 (+61) –0.7/ -2 0/ 0/ 0
+10.0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	0.0/ 0 0/ 0/ 0 (+69) 0.0/ 0 0/ 0/ 0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	+0.2/ 0 0/ 0/ 0 (+69) +0.2/ 0 0/ 0/ 0	+0.2/ 0 +1/ +1/ +1 (+69) +0.2/ 0 +1/ +1/ +1

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)	* VMC *LIMITATION	Tref (OAT) = 44 C Tmax (OAT) = 54 C	Min acc height 515 FT Min QNH alt 1004 FT Max acc height 1934 FT Max QNH alt 2423 FT
	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			Min V1/VR/V2 = 115/20/22 CHECK VMU LIMITATION Correct. V1/VR/V2 = 1.0 KT/1000 KG

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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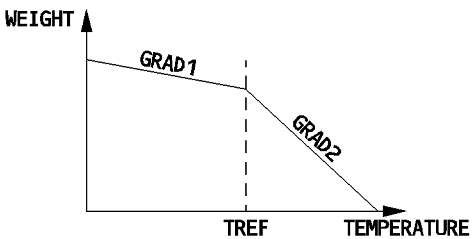


· If the lowest temperature and OAT are above TREF.
Obtain weight increment by multiplying Grad 2 by the difference in temperature between OAT and lowest temperature. Add this weight increment to the maximum takeoff weight calculated for the lowest temperature.

- 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.

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

CORRECTIONS DUE TO DIFFERENT TAKEOFF CONDITIONS

R 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.

R 1. For the given wind and temperature conditions, determine the maximum takeoff weight
R (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

Use the chart from 2.02.16 p 6.
R Enter the 10 kt head wind column CONF 1+F, to read for 25°C
R The lowest temperature of the column is 45°C, use Grad 1/Grad 2 to extrapolate the
R maximum takeoff weight.
R Max TO weight (1000 kg) air conditioning OFF = 80.6 + 0.46 × 1 + 0.06 × 19 =
R 82.2
R Enter the 10 kt head wind column CONF 2, to read for 25°C
R The lowest temperature of the column is 46°C, use Grad 1/Grad 2 to extrapolate the
R maximum takeoff weight.

Max TO weight (1000 kg) air conditioning OFF = 80.3 + 0.47 × 2 + 0.05 × 19 = 82.2
Retain CONF 1+F as takeoff configuration.
Maximum TO weight (1000 kg) air conditioning OFF 82.2
Air conditioning correction (FCOM 2.02.24 p1) . . . . – 2.2
Maximum permissible TO weight (1000 kg) air conditioning ON 80.0
Determine takeoff speeds for 80.0 (1000kg) in the 10 kt head wind column (CONF1+F)
V1 = 155 kt, VR = 156 kt, V2 = 158 kt

CORRECTIONS FOR WET OR CONTAMINATED RUNWAYS 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 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.*
- *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 = 45°C
Head wind = 10 kt
QNH = 998 hPa
WET runway

Use the chart from 2.02.16 p 6.

· Enter the 10 kt head wind column CONF 1+F, to read for 45°C max TO weight (1000 kg) 80.6
· Enter the 10 kt head wind column CONF 2, to read for 45°C max TO weight (1000 kg) 80.3
· Retain CONF 1+F for takeoff
· Read associated speeds as V1 = 155 kt, VR = 156 kt, V2 = 158 kt
· Apply WET correction
For OAT < TVMC (69°C), ΔW =. . . . . – 0.7
Intermediate weight (1000 kg) 79.9
Associated speeds,
V1 = 155 kt – 8 = 147 kt
VR = 156 kt – 2 = 154 kt
V2 = 158 kt – 2 = 156 kt
(No speed check required for first correction)
· Apply QNH correction
R For OAT < TVMC (61°C), ΔW = – 0.7 × 15/10 ≑. . . . . – 1
Maximum permissible takeoff weight (1000 kg) 78.9
Associated speeds,
V1 = 147 kt – 1 × 15/10 = 145 kt
VR = 154 kt – 1 × 15/10 = 153 kt
V2 = 156 kt – 1 × 15/10 = 155 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)	80.6	155	156	158
FCOM correction(s)				
Intermediate value	80.6	155	156	158
WET Correction	– 0.7	– 8	– 2	– 2
Intermediate value	79.9	147	154	156
QNH Correction	– 1	– 2	– 1	– 1
Final value	78.9	145	153	155

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 = 80.6 + 0.46 × 1 + 0.06 × 19 = 82.2
   Enter the 10 kt head wind column CONF 2, to read for 25°C
   Max TO weight (1000 kg) air conditioning OFF = 80.3 + 0.47 × 2 + 0.05 × 19 = 82.2
   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 82.2
   Air conditioning correction . . . . – 2.2
   Intermediate weight 80.0
   Interpolate takeoff speeds for 80.0 (1000 kg) in the 10 kt head wind column,
   V1 = 155 kt, VR = 156 kt, V2 = 158 kt
3. Apply WET correction
   For OAT < TVMC (69°C), ΔW ≒ . . . . – 0.7
   Intermediate weight 79.3
   Associated speeds,
   V1 = 155 kt – 8 = 147 kt
   VR = 156 kt – 2 = 154 kt
   V2 = 158 kt – 2 = 156 kt
   Apply QNH correction
R For OAT < TVMC (61°C), ΔW = – 0.7 × 15/10 ≒ . . . . – 1
   Maximum permissible takeoff weight 78.3
   Associated speed,
R V1 = 147 kt – 1 × 15/10 = 145 kt
   VR = 154 kt – 1 × 15/10 = 153 kt
   V2 = 156 kt – 1 × 15/10 = 155 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 = 78.3 (1000 kg)
V1 = 145 kt, VR = 153 kt, V2 = 155 kt.

	Takeoff Configuration : 1+F			
	TOW	V1	VR	V2
TOW (RTOW)	82.2			
FCOM correction(s)	– 2.2			
Intermediate value	80.0	155	156	158
WET Correction	– 0.7	– 8	– 2	– 2
Intermediate value	79.3	147	154	156
QNH Correction	– 1	– 2	– 1	– 1
Final value	78.3	145	153	155

EXTRAPOLATION

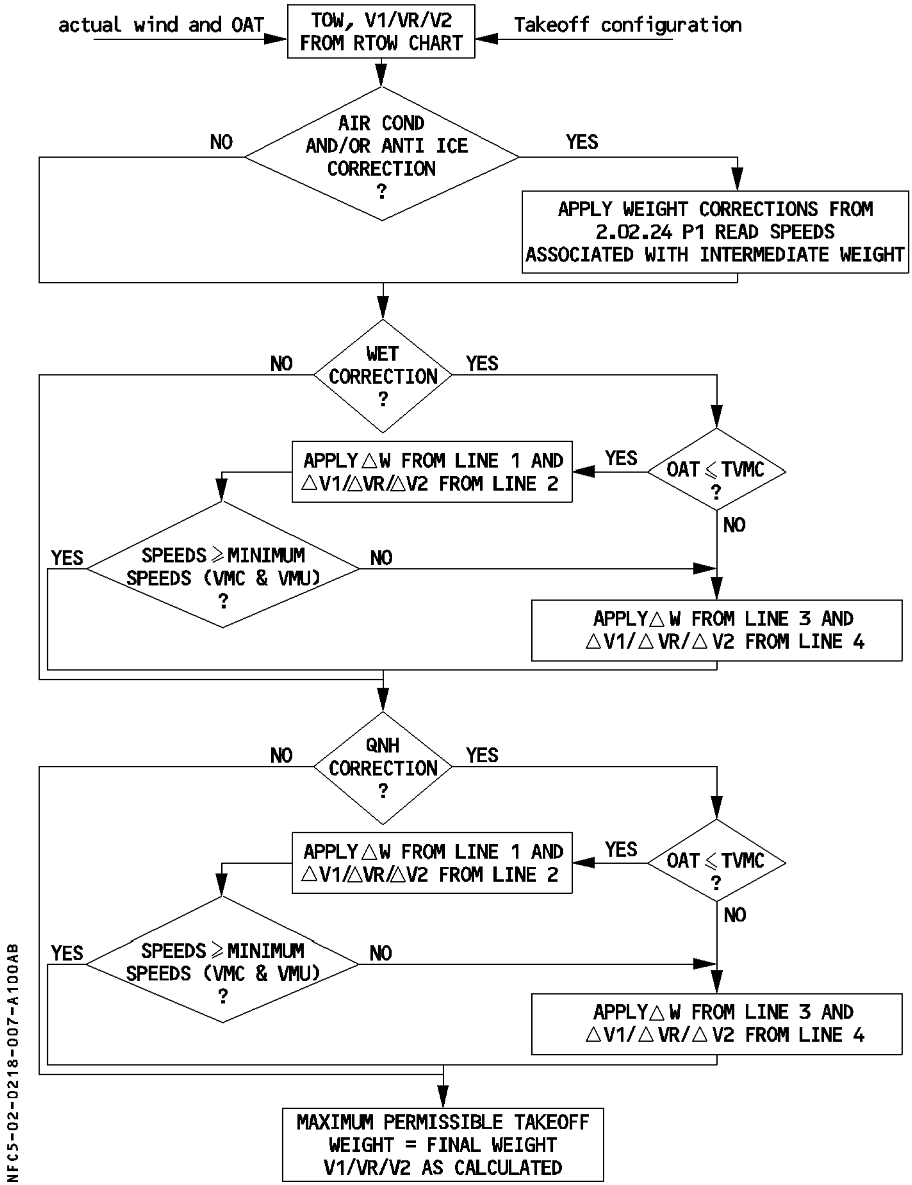
For OAT lower than the lowest temperature value of a wind column, it is possible to obtain a higher maximum permissible takeoff weight by using Grad 1/Grad 2 values. See page 1 for more details.

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.



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.

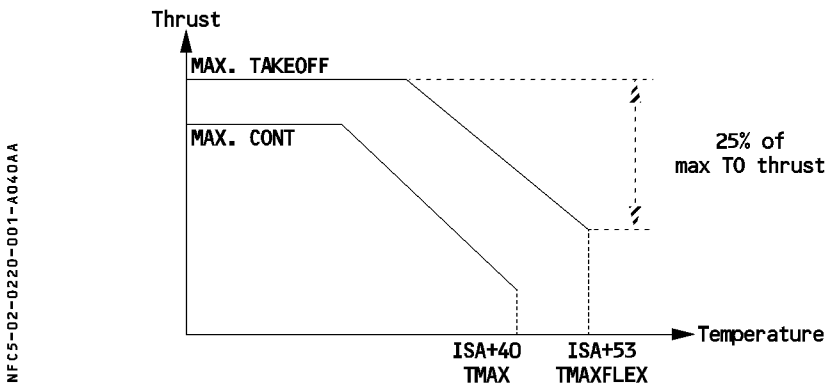
USE OF FLEXIBLE TAKEOFF

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 above two constraints also limit the maximum flexible temperature at ISA + 53 (68°C at sea level).
- The flexible takeoff thrust cannot be lower than the Max Continuous thrust used for the final takeoff flight path computation (at ISA + 40).

R – The flexible temperature cannot be lower than the flat rating temperature, TREF* (ISA
R + 29 up to 2000 feet), or the actual temperature (OAT).



R *Note : *TREF being a function of pressure altitude, read it on the takeoff chart.*

- 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

R · In order to extend engine life and save maintenance costs, it is recommended to use
R flexible thrust reduction.

· 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.

R

CONDITIONS	PROCEDURE	REASON
Dry or wet well paved runway	— Use the flap setting giving the highest flexible temperature. — When flexible temperature difference between two flap settings is low, use the highest flap setting.	Extend engine life and save maintenance costs.
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.

R *Note : If the RTOW chart is based on the CG being at 25 %, the crew can determine the*
R *flexible temperature at a more forward CG by decreasing the flexible temperature*
R *by 2°C. V1, VR and V2 must be increased by 1 knot.*

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 . . . . .67° C
Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
Flexible temperature . . . . .66° C

Retain CONF 1+F for takeoff configuration.
Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 154 kt
Flexible temperature with air conditioning OFF . . . . .67° C
Air conditioning correction (FCOM 2.02.24 p 1) . . . .– 7° C
Maximum flexible temperature . . . . .60° 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.
   <u>No speed correction is required for QNH and bleeds influence</u> (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)

<u>Note</u> : – 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

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 . . . . .67° C
Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
Flexible temperature . . . . .66° C
Retain CONF 1+F as the flexible temperature is higher.
Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 154 kt
Apply WET correction
For flexible temperature < TVMC (69° C), ΔTflex =. . . . . – 2° C
Intermediate flex temperature . . . . 65 ° C
Associated speeds,
V1 = 153 kt – 8 = 145 kt
VR = 153 kt – 2 = 151 kt
V2 = 154 kt – 2 = 152 kt
Check V2 against VMU limitation in FCOM 2.02.25.
Apply QNH correction
R For flex temperature ≥ TVMC (61° C), ΔTflex = ... – 3° C
Maximum flexible temperature . . . . 62° C
Check that OAT/TREF < flex temperature ≤ TMAXFLEX
No speed correction.
Takeoff speeds are V1 = 145 kt, VR = 151 kt, V2 = 152 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	67	153	153	154
FCOM correction(s)				
Intermediate value	67	153	153	154
WET Correction	– 2	– 8	– 2	– 2
Intermediate value	65	145	151	152
QNH Correction	– 3	0	0	0
Final value	62	145	151	152

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 . . . . 67° C
· Enter the 10 kt head wind column and interpolate for 68 000 kg, CONF 2,
  Flexible temperature . . . . 66° C
· Retain CONF 1+F for takeoff configuration.
  Takeoff speeds are V1 = 153 kt, VR = 153 kt, V2 = 154 kt
· First, apply the correction from FCOM page 2.02.24 p 1.
  Flexible temperature with air conditioning OFF . . . . 67° C
  Air conditioning correction . . . . – 7° C
  Intermediate flexible temperature . . . . 60° C
  No speed correction.
· Apply WET correction
  For flexible temperature < TVMC (69° C), △Tflex =. . . . . – 2° C
  Intermediate flex temperature . . . . 58° C
  Associated speeds,
  V1 = 153 kt – 8 = 145 kt
  VR = 153 kt – 2 = 151 kt
  V2 = 154 kt – 2 = 152 kt
R Check V2 against VMU limitation in FCOM 2.02.25.
· Apply QNH correction
R For flexible temperature < TVMC (61° C), △Tflex =. . . . . – 3° C
  Maximum flexible temperature . . . . 55° C
  Check that OAT/TREF < flex temperature ≤ TMAXFLEX
  No speed correction.
  Takeoff speeds are V1 = 145 kt, VR = 151 kt, V2 = 152 kt

	Takeoff Configuration : 1 + F			
	Tflex	V1	VR	V2
Chart temperature	67	153	153	154
FCOM correction(s)	– 7	0	0	0
Intermediate value	60	153	153	154
WET Correction	– 2	– 8	– 2	– 2
Intermediate value	58	145	151	152
QNH Correction	– 3	0	0	0
Final value	55	145	151	152

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 ;

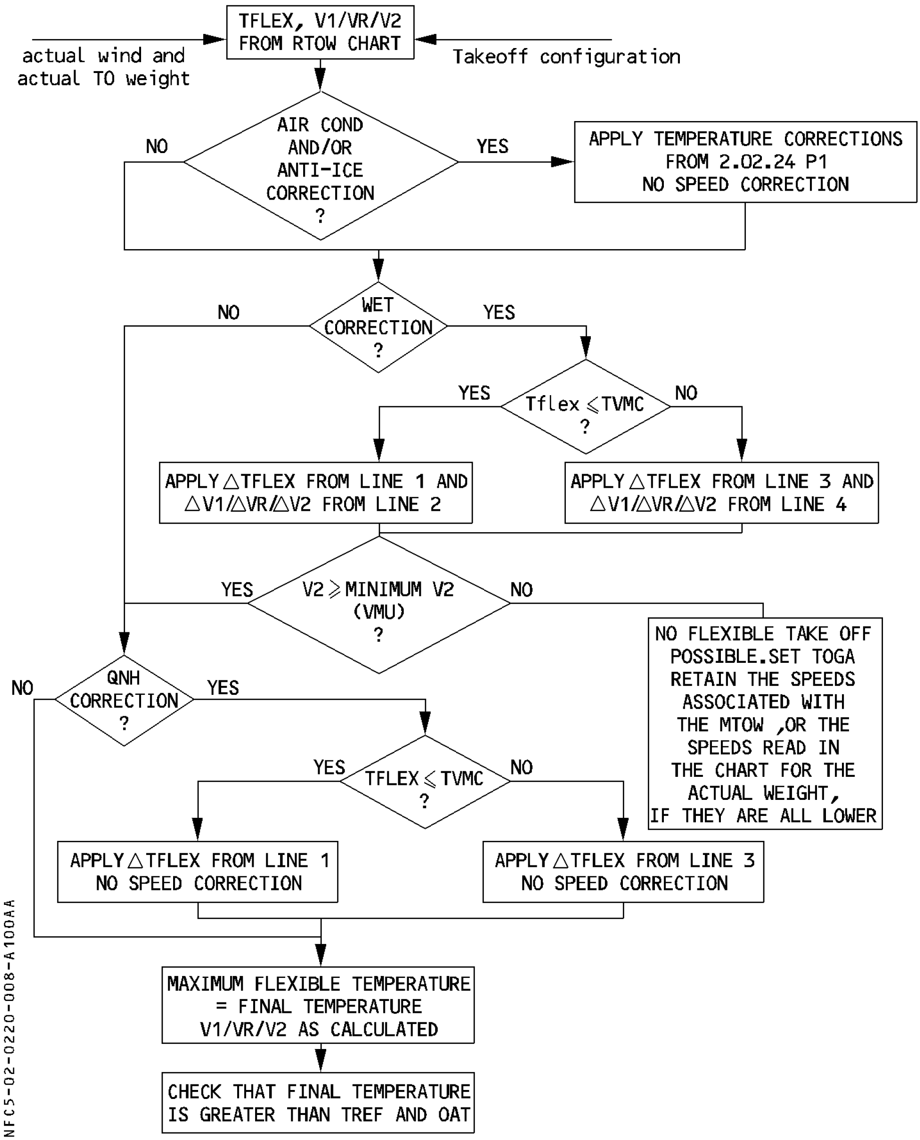
OR

- You can retain the speeds associated with the actual takeoff weight provided they are 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)

R

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
No correction except if actual pressure altitude is between 2000 ft and 4000 ft: subtract 1°C/3hPa	QNH above 1013 hPa	No correction except if actual pressure altitude is between 2000 ft and 4000 ft: subtract 40 kg/hPa
Subtract 1°C/2hPa	QNH below 1013 hPa	Subtract 140 kg/hPa
Subtract 5°C	Engine A/ICE ON *	Subtract 300 kg
Subtract 11°C	Total A/ICE ON *	OAT ⩽ ISA + 5 Subtract 950 kg OAT > ISA + 5 Subtract 1650 kg
Subtract 7°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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<u>*Note*</u> *: – * Corrections valid only for OAT < 10°C*
– For high altitude operation, refer to 2.02.24 p 3 (if applicable)

<u>EXAMPLES</u>
Airport geometric elevation = 450 feet

<u>Takeoff chart data</u>
QNH = 1013 hPa
Anti ice OFF
Air conditioning OFF

Example 1 - Full thrust takeoff

Actual data : OAT = 5°C
QNH = 1040 hPa
Engine anti ice ON
Air conditioning OFF
Weight read on the takeoff chart : 73 000 kg
Read in the above table the corrections for high QNH and engine anti ice ON.
QNH correction : none
Engine anti ice correction : - 300 kg
The maximum permissible takeoff weight is 73000 + 0 – 300 = 72700 kg

Example 2 - Flexible thrust takeoff

Actual data : OAT = 5°C
QNH = 1040 hPa
Anti ice OFF
Air conditioning ON
TOW = 65000 kg
Flexible temperature read on the takeoff chart : TFLEX = 55°C
Read TREF on the takeoff chart or on the quick reference table.
Read in the above table the correction for QNH and air conditioning ON :
QNH correction = none
Air conditioning ON correction : – 7°C
New flexible temperature = 55 – 7 = 48°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)	–2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9200	14100	
CONF 1 + F	117	115	114	113	112	112	111	110	109	108	106	100	V1 min
CONF 2	115	113	112	111	111	110	109	108	107	106	104	100	
CONF 3	114	112	111	110	110	110	109	108	107	105	104	100	

R

Pressure altitude (ft)	–2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9200	14100	
CONF 1 + F	121	119	118	116	116	116	115	114	113	111	110	102	VR min
CONF 2	119	117	116	115	114	114	113	112	111	109	108	100	
CONF 3	118	116	115	114	114	114	113	112	110	109	107	100	

R

Pressure altitude (ft)	–2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9200	14100	
CONF 1 + F	124	121	120	119	119	119	118	117	115	114	112	104	V2 min
CONF 2	123	121	120	119	119	119	117	116	115	114	112	103	
CONF 3	123	121	120	119	119	118	117	116	115	114	112	103	

V2 LIMITED BY VMU/VMCA

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

R

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)								
CONFIGURATION 1+F								
PRESSURE ALTITUDE (FT)	**TAKEOFF WEIGHT (1000 KG)**							
	45	**50**	**55**	**60**	**65**	**70**	**75**	**80**
–2000	124	124	130	135	140	145	150	155
0	121	124	130	135	140	145	150	155
1000	120	124	130	135	140	145	151	155
2000	119	124	129	135	140	146	151	155
3000	119	124	130	135	140	146	151	156
4000	119	124	130	135	141	146	151	156
5000	119	124	130	135	141	146	151	156
6000	119	124	130	135	141	146	152	156
7000	119	124	130	136	141	146	152	156
8000	118	124	130	136	141	147	152	157
9000	118	124	130	136	141	147	152	157
10000	118	124	130	136	141	147	152	157
11000	118	124	130	136	142	147	153	157
12000	118	124	130	136	142	147	153	158
13000	118	124	130	136	142	148	153	158
14100	118	124	130	136	142	148	153	158

R

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)								
CONFIGURATION 2								
PRESSURE ALTITUDE (FT)	**TAKEOFF WEIGHT (1000 KG)**							
	45	**50**	**55**	**60**	**65**	**70**	**75**	**80**
–2000	123	123	124	129	134	139	144	149
0	121	121	124	129	134	140	145	149
1000	120	120	124	129	135	140	145	149
2000	119	119	124	129	135	140	145	149
3000	119	119	124	129	135	140	145	150
4000	119	119	124	130	135	140	145	150
5000	117	119	124	130	135	140	146	150
6000	116	119	124	130	135	141	146	150
7000	115	119	124	130	135	141	146	150
8000	114	119	124	130	136	141	146	151
9000	113	119	124	130	136	141	146	151
10000	113	119	125	130	136	141	147	151
11000	113	119	125	130	136	141	147	151
12000	113	119	125	131	136	142	147	152
13000	113	119	125	131	136	142	147	152
14100	113	119	125	131	137	142	147	152

R

MINIMUM V2 LIMITED BY VMU/VMCA (KT IAS)								
CONFIGURATION 3								
PRESSURE ALTITUDE (FT)	**TAKEOFF WEIGHT (1000 KG)**							
	45	**50**	**55**	**60**	**65**	**70**	**75**	**80**
–2000	123	123	123	124	129	134	139	143
0	121	121	121	124	129	135	140	144
1000	120	120	120	124	129	135	140	144
2000	119	119	119	124	130	135	140	144
3000	119	119	119	124	130	135	140	144
4000	118	118	119	124	130	135	140	144
5000	117	117	119	125	130	135	140	144
6000	116	116	120	125	130	135	140	145
7000	115	115	120	125	130	136	141	145
8000	114	114	119	125	130	136	141	145
9000	112	114	120	125	131	136	141	145
10000	110	114	120	125	131	136	141	145
11000	109	114	120	125	131	136	141	145
12000	109	114	120	126	131	137	142	146
13000	108	114	120	126	131	137	142	146
14100	109	115	120	126	132	137	142	146

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.

Note : *1. Quick reference tables are established for the forward CG envelope (less than 25%) 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 corresponding to 2250 m
– Read the maximum takeoff weight on the line corresponding to the temperature of 30°C : 71300 kg
V1 = 139 kt, VR = 146 kt, V2 = 148 kt

– **Determination of a precise flexible temperature for the actual takeoff weight of 64000 kg :**
(Refer to 2.02.40 p5 and p6)
– Interpolate the temperature corresponding to 64000 kg for the runway length of 2415 m at 1000 ft and 2000 ft pressure altitude.
Results :
1000 ft : 61°C, V1 = 138 kt, VR = 139 kt, V2 = 140 kt
2000 ft : 57°C, V1 = 137 kt, VR = 139 kt, V2 = 140 kt
– Interpolate between these two values to get the flexible temperature
1400 ft : 59°C, V1 = 137 kt, VR = 139 kt, V2 = 140 kt

CONFIGURATION 1+F			PRESSURE ALTITUDE = 0 FT		FWD CG
TREF = 44 °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	80.4 3/9 150/53/55	82.9 3/6 155/57/59	83.8 3/6 154/59/61	84.5 3/6 154/62/64	85.1 3/6 153/64/66
−10	79.4 3/9 148/52/54	82.2 3/6 153/55/57	83.0 3/6 152/57/59	83.8 3/6 151/60/62	84.5 3/6 151/62/64
0	78.4 3/9 147/51/53	81.3 3/6 151/54/56	82.4 3/6 150/55/57	83.1 3/6 149/58/60	83.9 3/6 148/60/62
10	77.3 3/9 145/50/52	80.2 3/6 149/53/55	81.5 3/6 148/54/56	82.5 3/6 147/56/58	83.2 3/6 146/58/60
20	76.0 3/9 143/49/51	79.2 3/6 147/52/54	80.5 3/6 146/53/55	81.6 3/6 145/54/56	82.4 3/6 144/57/58
30	74.8 3/9 142/48/50	78.1 3/6 145/51/53	79.5 3/6 144/52/54	80.6 3/6 143/53/55	81.7 3/6 142/55/57
40	73.6 3/9 141/47/49	77.1 3/6 144/50/51	78.5 3/6 142/51/53	79.7 3/6 141/52/54	80.9 3/6 140/54/55
44	73.1 3/9 140/47/49	76.6 3/6 143/49/51	78.1 3/6 142/51/52	79.3 3/6 140/52/54	80.5 3/6 139/53/55
46	72.1 3/9 140/46/48	75.7 3/6 144/49/51	77.2 3/6 142/50/52	78.3 3/6 141/51/53	79.4 3/6 140/52/54
48	71.1 3/9 140/45/47	74.6 3/6 144/48/50	76.2 3/6 143/49/51	77.4 3/6 142/50/52	78.1 3/6 141/52/54
50	70.2 3/9 139/44/46	73.4 3/9 144/48/49	75.2 3/6 144/49/50	76.2 3/6 143/50/51	76.9 3/6 142/52/54
52	69.2 3/9 139/43/45	72.3 3/9 143/47/48	74.2 3/6 145/48/50	75.0 3/6 144/50/51	75.6 3/6 143/52/53
54	68.2 3/9 139/42/44	71.2 3/9 143/46/47	73.2 3/6 146/48/49	73.8 3/6 145/50/51	74.4 3/6 145/52/53
55	67.8 3/9 138/42/43	70.6 3/9 143/45/47	72.6 3/6 146/48/49	73.2 3/6 146/50/51	73.7 3/6 145/52/53
57	66.8 3/9 138/41/42	69.5 3/9 143/44/45	71.3 3/6 147/48/49	71.9 3/6 147/50/51	72.4 3/6 146/52/53
59	65.8 3/9 138/40/41	68.3 3/9 142/43/44	70.0 2/3 147/47/48	70.7 3/6 148/50/51	71.1 3/6 148/52/53
61	64.8 3/9 137/39/40	67.2 3/9 142/42/43	68.7 2/3 147/47/48	69.5 3/6 149/51/51	69.9 3/6 149/52/53
63	63.8 3/9 137/38/39	65.9 3/3 142/42/43	67.3 3/3 147/47/48	68.3 3/6 151/51/51	68.7 3/6 150/52/53
65	62.9 3/9 137/37/38	64.6 3/3 142/42/43	65.9 3/3 146/46/47	66.9 3/3 150/50/51	67.5 3/6 151/52/53
67	61.6 3/9 136/36/37	63.3 3/3 141/41/42	64.5 3/3 145/45/45	65.5 3/3 149/49/50	66.1 3/6 153/53/53
68	61.0 3/9 135/35/36	62.6 3/3 140/40/41	63.8 3/3 145/45/45	64.7 2/3 148/48/48	65.4 2/3 151/51/52

CONFIGURATION 1+F	PRESSURE ALTITUDE = 1000 FT		FWD CG		
TREF = 42 °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	78.9 3/9 148/51/54	81.6 3/6 154/55/57	82.5 3/6 153/58/60	83.2 3/6 152/60/62	83.8 3/6 152/63/64
−10	77.9 3/9 147/50/52	80.8 3/6 151/54/56	81.8 3/6 150/56/57	82.6 3/6 150/58/60	83.2 3/6 149/61/62
0	76.7 3/9 145/49/51	79.9 3/6 149/53/55	81.0 3/6 148/54/56	81.9 3/6 147/56/58	82.6 3/6 147/59/60
10	75.5 3/9 143/49/51	78.9 3/6 148/52/53	80.0 3/6 146/53/55	81.2 3/6 145/54/56	81.9 3/6 145/57/59
20	74.2 3/9 142/48/50	77.8 3/6 146/50/52	79.1 3/6 145/52/54	80.2 3/6 143/53/55	81.2 3/6 143/55/57
30	73.0 3/9 141/47/49	76.6 3/6 144/49/51	78.0 3/6 143/51/53	79.1 3/6 141/52/54	80.3 3/6 141/53/55
40	71.9 3/9 139/46/48	75.4 3/6 143/49/51	77.0 3/6 141/50/52	78.3 3/6 140/51/53	79.5 3/6 139/52/54
42	71.6 3/9 139/46/48	75.2 3/6 142/49/51	76.7 3/6 141/50/51	78.1 3/6 140/51/53	79.3 3/6 138/52/54
44	70.7 3/9 139/45/47	74.2 3/6 143/48/50	75.8 3/6 142/49/51	77.1 3/6 140/50/52	78.2 3/6 139/51/53
46	69.8 3/9 138/44/46	73.1 3/9 143/48/49	74.8 3/6 142/49/50	76.1 3/6 141/49/51	77.0 3/6 140/51/52
48	68.9 3/9 138/43/45	72.0 3/9 142/47/48	73.9 3/6 143/48/50	75.0 3/6 142/49/50	75.8 3/6 141/51/52
50	67.9 3/9 138/42/44	71.0 3/9 142/46/47	73.0 3/6 144/48/49	74.0 3/6 143/49/50	74.6 3/6 142/51/52
52	67.0 3/9 137/41/43	69.9 3/9 142/45/46	72.0 3/6 145/47/48	72.8 3/6 144/49/50	73.3 3/6 143/51/52
53	66.5 3/9 137/41/42	69.4 3/9 142/44/45	71.6 3/6 145/47/48	72.2 3/6 145/49/50	72.7 3/6 144/51/52
55	65.6 3/9 137/40/41	68.3 3/9 141/43/44	70.3 3/6 146/46/47	70.9 3/6 146/49/50	71.4 3/6 145/51/52
57	64.6 3/9 137/39/40	67.2 3/9 141/42/43	68.9 2/3 146/46/47	69.7 3/6 147/49/50	70.1 3/6 147/51/52
59	63.6 3/9 136/38/39	66.0 3/9 141/41/42	67.5 2/3 145/45/46	68.4 3/6 148/49/50	68.8 3/6 148/51/52
61	62.7 3/9 136/37/38	64.8 3/3 140/40/41	66.2 3/3 145/45/46	67.2 3/6 149/49/50	67.6 3/6 149/51/52
63	61.7 3/9 135/36/37	63.5 3/3 140/40/41	64.8 3/3 145/45/45	65.8 3/3 149/49/49	66.4 3/6 150/51/52
65	60.6 3/9 135/35/36	62.2 3/3 140/40/40	63.5 3/3 143/43/44	64.4 3/3 148/48/48	65.1 2/3 151/51/51
66	60.0 3/9 134/34/35	61.6 3/3 139/39/40	62.8 3/3 142/43/43	63.7 2/3 147/47/47	64.4 2/3 150/50/50

CONFIGURATION 1+F			**PRESSURE ALTITUDE = 2000 FT**		**FWD CG**
TREF = 40 °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	77.3 3/9 147/50/52	80.2 3/6 152/53/55	81.2 3/6 151/56/58	81.9 3/6 151/58/60	82.5 3/6 150/61/62
−10	76.1 3/9 145/49/51	79.3 3/6 150/52/54	80.5 3/6 149/54/55	81.3 3/6 148/56/58	81.9 3/6 148/59/60
0	74.9 3/9 143/48/51	78.3 3/6 148/51/53	79.6 3/6 147/53/54	80.6 3/6 146/54/56	81.3 3/6 145/57/58
10	73.6 3/9 142/48/50	77.3 3/6 146/50/52	78.6 3/6 145/52/53	79.7 3/6 144/53/55	80.6 3/6 143/55/56
20	72.4 3/9 141/47/49	76.2 3/6 145/49/51	77.6 3/6 143/51/52	78.7 3/6 142/52/54	79.8 3/6 141/53/55
30	71.3 3/9 139/46/48	74.9 3/6 143/49/51	76.5 3/6 142/50/51	77.8 3/6 140/51/53	78.9 3/6 139/52/54
40	70.3 3/9 138/45/47	73.7 3/6 142/48/50	75.3 3/6 140/49/51	76.8 3/6 139/50/52	78.0 3/6 138/51/53
42	69.4 3/9 138/44/46	72.7 3/6 142/47/49	74.4 3/6 141/49/50	75.8 3/6 140/49/51	76.8 3/6 138/50/52
44	68.4 3/9 137/43/45	71.6 3/9 141/46/48	73.4 3/6 142/48/50	74.7 3/6 140/49/50	75.8 3/6 139/50/51
46	67.5 3/9 137/42/44	70.6 3/9 141/45/47	72.6 3/6 142/48/49	73.7 3/6 141/48/50	74.6 3/6 140/50/51
48	66.6 3/9 136/41/43	69.6 3/9 141/44/46	71.7 3/6 143/47/48	72.7 3/6 142/48/49	73.4 3/6 141/50/51
50	65.7 3/9 136/40/42	68.6 3/9 140/43/45	70.9 3/6 144/46/47	71.7 3/6 143/48/49	72.2 3/6 143/50/51
51	65.3 3/9 136/40/41	68.1 3/9 140/43/44	70.4 3/6 144/46/47	71.1 3/6 144/48/49	71.6 3/6 143/50/51
52	64.8 3/9 136/39/41	67.6 3/9 140/42/44	69.8 3/6 144/45/46	70.5 3/6 144/48/49	71.0 3/6 144/50/51
54	63.9 3/9 135/38/39	66.5 3/9 140/41/42	68.5 2/3 144/45/46	69.3 3/6 145/48/49	69.7 3/6 145/50/51
56	62.9 3/9 135/37/38	65.4 3/9 139/40/41	67.1 2/3 144/44/45	68.0 3/6 147/48/49	68.4 3/6 146/50/51
58	61.9 3/9 135/36/37	64.3 3/9 139/39/40	65.7 2/3 144/44/45	66.8 3/6 148/48/49	67.2 3/6 148/50/51
60	61.0 3/9 134/35/36	63.0 3/3 139/39/40	64.4 3/3 143/43/44	65.4 2/3 147/47/48	66.0 3/6 149/50/50
62	60.0 3/9 134/34/35	61.8 3/3 138/38/39	63.1 3/3 142/42/43	64.0 2/3 146/46/47	64.8 3/6 150/50/50
64	58.9 3/9 133/33/34	60.5 3/3 137/37/38	61.8 2/3 141/41/42	62.7 2/3 145/45/46	63.4 2/3 149/49/49

CONFIGURATION 2			PRESSURE ALTITUDE = 0 FT		FWD CG
TREF = 44 °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	74.3 3/9 136/40/44	78.5 3/9 141/43/47	81.3 2/3 147/48/52	83.2 3/6 152/54/59	84.0 3/6 152/57/62
−10	73.1 3/9 135/39/43	77.5 3/9 140/42/46	80.6 2/3 145/46/50	82.6 3/6 150/52/57	83.4 3/6 150/55/60
0	71.9 3/9 133/38/43	76.5 3/9 138/41/45	79.9 3/9 143/44/49	82.0 3/6 148/50/55	82.7 3/6 148/53/58
10	70.9 3/9 132/37/41	75.3 3/9 136/40/45	79.0 3/9 141/43/48	81.3 3/6 146/48/53	82.0 3/6 145/51/56
20	69.8 3/9 130/36/40	74.1 3/9 135/40/44	78.0 3/9 140/43/47	80.4 3/6 144/47/51	81.3 3/6 144/49/54
30	68.7 3/9 129/35/39	72.9 3/9 134/39/43	77.0 3/9 138/42/46	79.7 3/6 142/45/49	80.5 3/6 142/47/52
40	67.7 3/9 128/34/38	71.8 3/9 133/38/42	75.9 3/9 137/41/45	78.9 3/6 140/44/48	79.8 3/6 140/46/50
44	67.3 3/9 127/33/38	71.4 3/9 132/38/42	75.5 3/9 136/41/45	78.5 3/6 140/43/47	79.5 3/6 139/45/49
46	66.5 3/9 127/32/37	70.5 3/9 132/37/41	74.3 3/9 136/40/44	77.5 3/6 141/43/47	78.3 3/6 140/45/49
48	65.6 3/9 127/32/36	69.6 3/9 131/36/40	73.2 3/9 136/40/44	76.1 3/9 140/42/46	77.1 3/6 141/45/49
50	64.8 3/9 126/31/35	68.6 3/9 131/35/39	72.1 3/9 136/39/43	74.8 3/9 140/42/46	75.9 3/6 142/45/49
52	63.9 3/9 126/30/34	67.7 3/9 131/34/38	71.0 3/9 136/38/42	73.5 2/3 140/41/45	74.7 3/6 143/46/49
54	63.1 3/9 126/29/33	66.7 3/9 131/34/37	69.9 3/9 135/37/40	72.2 2/3 140/41/44	73.5 3/6 144/46/49
55	62.6 3/9 126/29/33	66.2 3/9 130/33/37	69.4 3/9 135/37/40	71.5 2/3 140/41/44	72.9 3/6 144/46/49
57	61.7 3/9 125/28/32	65.3 3/9 130/32/36	68.2 3/9 135/35/39	70.1 2/3 140/40/44	71.5 2/3 144/45/49
59	60.8 3/9 125/27/31	64.2 3/9 130/31/34	67.0 3/9 135/35/38	68.7 2/3 140/40/43	70.0 2/3 144/45/48
61	60.0 3/9 125/26/30	63.3 3/9 130/30/33	65.7 3/3 135/35/38	67.4 2/3 140/40/42	68.7 2/3 144/44/48
63	59.1 3/9 124/26/29	62.4 3/9 129/29/32	64.5 3/3 134/34/37	66.1 3/3 140/40/42	67.3 2/3 144/44/47
65	58.2 3/9 124/25/28	61.2 3/9 129/29/32	63.3 3/3 134/34/37	64.7 3/3 139/39/42	65.9 2/3 143/43/45
67	57.3 3/9 123/24/27	60.0 3/9 128/28/30	62.0 3/3 133/33/36	63.4 3/3 138/38/41	64.5 2/3 142/42/44
68	56.9 3/9 123/24/27	59.5 3/3 128/28/30	61.3 3/3 132/32/35	62.7 3/3 137/37/40	63.8 2/3 141/41/44

CONFIGURATION 2			PRESSURE ALTITUDE = 1000 FT		FWD CG
TREF = 42 °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	72.6 3/9 135/39/43	77.0 3/9 140/42/46	79.9 2/3 145/46/50	81.9 3/6 150/52/57	82.8 3/6 151/55/60
−10	71.5 3/9 133/38/42	75.9 3/9 138/41/45	79.2 3/9 143/44/48	81.3 3/6 148/50/55	82.1 3/6 148/53/58
0	70.4 3/9 132/37/41	74.8 3/9 137/40/45	78.4 3/9 141/43/47	80.6 3/6 147/49/53	81.4 3/6 146/51/56
10	69.3 3/9 130/35/40	73.6 3/9 135/40/44	77.5 3/9 140/42/46	79.9 3/6 145/47/51	80.8 3/6 144/49/54
20	68.2 3/9 129/34/39	72.4 3/9 134/39/43	76.4 3/9 138/42/46	79.2 3/6 143/45/49	80.0 3/6 142/48/52
30	67.2 3/9 128/33/38	71.3 3/9 132/38/42	75.3 3/9 137/41/45	78.4 3/6 141/43/47	79.2 3/6 140/46/50
40	66.2 3/9 126/32/37	70.3 3/9 131/37/41	74.2 3/9 136/40/44	77.5 3/6 139/42/46	78.6 3/6 138/44/48
42	66.0 3/9 126/32/36	70.1 3/9 131/37/41	73.9 3/9 135/40/44	77.3 3/6 139/42/46	78.4 3/6 138/44/48
44	65.2 3/9 126/31/36	69.2 3/9 131/36/40	72.8 3/9 135/40/43	76.2 3/6 139/42/45	77.1 3/6 139/44/48
46	64.4 3/9 125/30/35	68.3 3/9 130/35/39	71.8 3/9 135/39/43	74.9 3/9 139/41/45	75.9 3/6 140/44/48
48	63.5 3/9 125/30/34	67.4 3/9 130/34/38	70.8 3/9 135/38/41	73.6 3/9 139/41/44	74.8 3/6 141/44/48
50	62.7 3/9 125/29/33	66.4 3/9 130/33/37	69.7 3/9 134/37/40	72.4 3/9 139/40/43	73.6 3/6 142/44/48
52	61.9 3/9 125/28/32	65.5 3/9 129/32/36	68.7 3/9 134/36/39	71.0 2/3 139/40/43	72.5 3/6 143/44/48
53	61.4 3/9 124/28/31	65.0 3/9 129/32/35	68.2 3/9 134/35/39	70.4 2/3 139/39/43	71.8 3/6 143/45/48
55	60.6 3/9 124/27/31	64.1 3/9 129/31/34	67.1 3/9 134/34/38	69.0 2/3 138/39/42	70.4 2/3 143/44/47
57	59.7 3/9 124/26/30	63.1 3/9 129/30/33	65.9 3/9 133/33/36	67.7 2/3 138/39/41	69.0 2/3 143/44/47
59	58.8 3/9 123/25/29	62.2 3/9 128/29/32	64.6 3/3 133/33/36	66.3 2/3 138/38/41	67.6 2/3 143/43/46
61	57.9 3/9 123/25/28	61.2 3/9 128/28/31	63.4 3/3 133/33/36	65.0 3/3 138/38/41	66.3 2/3 142/42/45
63	57.1 3/9 123/24/27	60.2 3/9 127/27/30	62.2 3/3 133/33/36	63.7 3/3 138/38/40	64.9 2/3 142/42/44
65	56.2 3/9 122/23/26	59.0 3/9 126/26/29	61.0 3/3 132/32/35	62.4 3/3 137/37/39	63.5 2/3 140/40/43
66	55.8 3/9 122/22/25	58.4 3/9 126/26/29	60.3 3/3 131/31/33	61.7 3/3 136/36/39	62.8 2/3 140/40/42

CONFIGURATION 2		PRESSURE ALTITUDE = 2000 FT			FWD CG
TREF = 40 °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	71.0 3/9 133/37/42	75.3 3/9 138/41/45	78.5 3/9 143/44/48	80.6 2/3 149/50/55	81.5 3/6 149/53/58
−10	69.9 3/9 132/36/41	74.2 3/9 137/40/44	77.7 3/9 141/43/47	79.9 2/3 147/48/53	80.9 3/6 147/51/56
0	68.8 3/9 130/35/40	73.0 3/9 135/40/44	76.8 3/9 140/42/46	79.2 3/6 145/47/51	80.2 3/6 145/49/54
10	67.8 3/9 129/34/38	71.9 3/9 134/39/43	75.8 3/9 138/41/45	78.5 3/6 143/45/49	79.5 3/6 143/48/52
20	66.7 3/9 127/33/37	70.8 3/9 132/38/42	74.7 3/9 137/41/45	77.8 3/6 141/43/47	78.7 3/6 141/46/50
30	65.7 3/9 126/32/36	69.7 3/9 131/36/41	73.5 3/9 136/40/44	76.9 3/6 140/42/46	77.9 3/6 139/44/48
40	64.7 3/9 125/31/35	68.7 3/9 130/35/39	72.4 3/9 134/39/43	76.0 3/6 138/42/46	77.2 3/6 137/43/47
42	63.9 3/9 125/30/34	67.9 3/9 129/35/39	71.4 3/9 134/39/42	74.7 3/9 138/41/45	76.0 3/6 138/43/47
44	63.1 3/9 124/29/33	67.0 3/9 129/34/38	70.4 3/9 134/38/41	73.5 3/9 138/41/44	74.8 3/6 139/43/47
46	62.3 3/9 124/29/33	66.0 3/9 129/33/37	69.4 3/9 133/37/40	72.3 3/9 138/40/43	73.7 3/6 140/43/47
48	61.4 3/9 124/28/32	65.2 3/9 129/32/36	68.4 3/9 133/36/39	71.1 3/9 137/39/42	72.5 3/6 141/43/47
50	60.6 3/9 123/27/31	64.2 3/9 128/31/35	67.4 3/9 133/35/38	69.9 3/9 137/38/41	71.4 3/6 142/43/47
51	60.2 3/9 123/27/30	63.8 3/9 128/31/34	66.9 3/9 133/34/38	69.2 2/3 137/38/41	70.7 3/6 142/43/46
52	59.8 3/9 123/26/30	63.3 3/9 128/30/34	66.4 3/9 132/34/37	68.6 2/3 137/38/41	70.0 2/3 142/43/46
54	58.9 3/9 123/25/29	62.4 3/9 128/30/33	65.3 3/9 132/33/36	67.3 2/3 137/37/40	68.6 2/3 142/42/46
56	58.1 3/9 122/25/28	61.5 3/9 127/29/32	64.2 3/9 132/32/35	65.9 2/3 137/37/40	67.2 2/3 142/42/45
58	57.2 3/9 122/24/27	60.5 3/9 127/28/31	62.9 3/3 132/32/35	64.6 2/3 137/37/39	65.8 2/3 141/41/44
60	56.3 3/9 121/23/26	59.5 3/9 127/27/30	61.6 3/3 132/32/34	63.2 3/3 136/36/39	64.4 2/3 141/41/43
62	55.5 3/9 121/22/25	58.5 3/9 126/26/28	60.5 3/3 131/31/33	62.0 3/3 136/36/38	63.1 2/3 140/40/42
64	54.6 3/9 121/21/24	57.4 3/9 125/25/27	59.3 3/3 130/30/33	60.7 3/3 135/35/37	61.8 2/3 139/39/41

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CONFIGURATION 3		PRESSURE ALTITUDE = 0 FT		FWD CG
TREF = 44 °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	71.2 3/3 129/31/37	76.1 3/3 134/35/40	79.3 2/3 141/41/45	81.6 2/3 147/49/52	83.4 2/3 154/55/58
−10	70.2 3/3 127/30/36	75.1 3/3 133/35/39	78.6 2/3 139/39/43	81.0 2/3 145/47/50	82.8 3/6 151/53/56
0	69.1 3/3 126/29/34	73.9 3/3 131/34/39	77.9 2/3 137/37/41	80.4 2/3 143/45/48	82.2 3/6 149/51/55
10	68.1 3/3 124/28/33	72.8 3/3 130/33/38	77.1 3/3 135/36/41	79.7 2/3 141/43/46	81.6 3/6 147/50/53
20	67.0 3/3 123/27/32	71.7 3/3 128/32/37	76.1 3/3 133/35/40	78.9 2/3 139/41/45	80.9 3/6 145/48/51
30	66.0 3/3 122/26/31	70.7 3/3 127/31/36	75.0 3/3 132/35/39	78.1 2/3 137/39/43	80.2 3/6 143/46/49
40	65.0 3/3 120/25/30	69.7 3/3 126/30/35	73.9 3/3 131/34/39	77.5 2/3 135/37/42	79.5 3/6 140/44/47
44	64.6 3/3 120/25/30	69.3 3/3 125/30/35	73.4 3/3 130/34/39	77.2 2/3 135/37/41	79.2 3/6 140/43/47
46	63.8 3/3 120/24/29	68.4 3/3 125/29/34	72.4 3/3 130/33/38	75.9 2/3 135/36/40	77.9 3/6 140/43/46
48	63.0 3/3 119/23/28	67.5 3/3 125/28/33	71.3 3/3 130/32/37	74.5 2/3 135/36/40	76.5 2/3 140/42/46
50	62.2 3/3 119/22/27	66.6 3/3 124/28/32	70.3 3/3 130/32/36	73.1 2/3 135/36/40	75.1 2/3 140/42/45
52	61.3 3/3 119/22/26	65.7 3/3 124/27/31	69.2 3/3 129/31/35	71.7 2/3 135/35/39	73.6 2/3 140/42/45
54	60.5 3/3 118/21/25	64.7 3/3 124/26/30	68.1 3/3 129/30/33	70.4 2/3 134/35/39	72.1 2/3 140/41/45
55	60.0 3/3 118/21/25	64.2 3/3 124/25/29	67.5 3/3 129/29/33	69.8 2/3 134/35/38	71.4 2/3 140/41/44
57	59.2 3/3 118/20/24	63.3 3/3 124/24/28	66.2 3/3 129/29/33	68.5 2/3 134/34/38	70.0 2/3 140/40/44
59	58.3 3/3 117/19/23	62.3 3/3 123/24/27	64.9 3/3 129/29/32	67.1 3/3 134/34/38	68.6 2/3 140/40/43
61	57.4 3/3 117/18/22	61.2 3/3 123/23/26	63.7 3/3 129/29/32	65.8 3/3 134/34/38	67.3 2/3 139/39/43
63	* 56.5 3/3 * 116/17/21	60.1 3/3 122/22/25	62.5 3/3 129/29/32	64.5 3/3 134/34/37	65.9 2/3 139/39/42
65	* 55.4 3/3 * 116/17/21	58.9 3/3 120/20/24	61.3 3/3 128/28/31	63.2 3/3 133/33/36	64.6 2/3 138/38/41
67	* 54.1 3/3 * 116/17/21	57.8 3/3 120/20/23	60.1 3/3 127/27/30	61.9 3/3 132/32/35	63.2 3/3 137/37/40
68	* 53.5 3/3 * 116/17/21	57.2 3/3 120/20/23	59.5 3/3 126/26/29	61.3 3/3 131/31/34	62.5 2/3 136/36/39

CONFIGURATION 3		PRESSURE ALTITUDE = 1000 FT		FWD CG
TREF = 42 °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	69.7 3/3 127/30/35	74.5 3/3 133/34/39	78.0 2/3 139/39/43	80.3 2/3 145/47/50	82.1 2/3 151/53/56
−10	68.7 3/3 126/29/34	73.4 3/3 131/34/39	77.3 2/3 137/37/41	79.7 2/3 143/45/48	81.5 2/3 149/51/54
0	67.6 3/3 124/28/33	72.3 3/3 130/33/38	76.4 3/3 135/36/40	79.0 2/3 141/43/46	80.9 2/3 147/49/53
10	66.6 3/3 123/27/32	71.2 3/3 128/32/37	75.5 3/3 133/35/40	78.3 2/3 139/41/45	80.3 3/6 145/48/51
20	65.5 3/3 122/26/31	70.2 3/3 127/31/36	74.3 3/3 132/35/39	77.5 2/3 137/39/43	79.6 3/6 143/46/49
30	64.5 3/3 120/25/30	69.2 3/3 126/30/35	73.3 3/3 131/34/39	76.8 2/3 135/37/41	78.9 3/6 141/44/47
40	63.6 3/3 119/24/29	68.2 3/3 124/29/34	72.3 3/3 129/33/38	76.1 3/3 134/36/40	78.2 3/6 139/42/46
42	63.4 3/3 119/24/29	68.0 3/3 124/29/34	72.1 3/3 129/33/38	75.9 3/3 133/36/40	78.1 3/6 139/42/45
44	62.6 3/3 118/23/28	67.1 3/3 124/28/33	71.0 3/3 129/32/37	74.5 3/3 133/35/39	76.7 2/3 139/41/45
46	61.7 3/3 118/22/27	66.2 3/3 124/27/32	70.0 3/3 129/31/36	73.2 2/3 133/34/39	75.3 2/3 138/41/44
48	60.9 3/3 118/21/26	65.3 3/3 123/26/31	69.0 3/3 128/30/35	71.9 2/3 133/34/38	73.8 2/3 138/41/44
50	60.1 3/3 117/21/25	64.4 3/3 123/26/30	68.0 3/3 128/30/33	70.6 2/3 133/34/38	72.4 2/3 138/40/44
52	59.2 3/3 117/20/24	63.5 3/3 123/25/29	66.9 3/3 128/29/32	69.3 2/3 133/33/37	71.0 2/3 138/40/43
53	58.9 3/3 117/20/24	63.1 3/3 123/24/28	66.4 3/3 128/28/32	68.7 2/3 133/33/37	70.3 2/3 138/39/43
55	58.0 3/3 117/19/23	62.1 3/3 122/23/27	65.2 3/3 128/28/31	67.4 2/3 133/33/36	68.9 2/3 138/39/42
57	57.1 3/3 116/18/22	61.1 3/3 122/23/26	63.9 3/3 128/28/31	66.1 3/3 133/33/36	67.6 2/3 138/38/42
59	56.2 3/3 116/17/21	60.1 3/3 122/22/25	62.6 3/3 127/27/31	64.7 3/3 133/33/36	66.2 2/3 138/38/41
61	* 55.3 3/3 * 115/16/20	59.0 3/3 121/21/24	61.4 3/3 127/27/30	63.4 3/3 132/32/36	64.9 2/3 137/37/40
63	* 54.2 3/3 * 115/16/20	57.9 3/3 119/19/23	60.2 3/3 126/26/29	62.2 3/3 132/32/35	63.5 3/3 137/37/40
65	* 52.9 3/3 * 114/16/20	56.8 3/3 118/18/21	59.1 3/3 125/25/28	60.9 3/3 131/31/33	62.2 3/3 136/36/39
66	* 52.3 3/3 * 114/16/20	56.2 3/3 118/18/21	58.5 3/3 125/25/28	60.3 3/3 130/30/33	61.5 3/3 135/35/38

CONFIGURATION 3		PRESSURE ALTITUDE = 2000 FT		FWD CG
TREF = 40 °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	68.2 3/3 126/29/34	72.7 3/3 132/34/38	76.5 3/3 137/37/41	79.0 2/3 143/44/48	80.8 2/3 149/51/54
−10	67.1 3/3 124/28/33	71.7 3/3 130/33/37	75.8 3/3 135/36/40	78.3 2/3 141/42/46	80.2 2/3 147/49/52
0	66.1 3/3 123/27/32	70.7 3/3 128/32/36	74.8 3/3 134/35/40	77.6 2/3 139/40/44	79.6 2/3 145/47/50
10	65.1 3/3 122/25/31	69.7 3/3 127/31/35	73.8 3/3 132/35/39	76.9 2/3 137/38/43	78.9 2/3 143/45/49
20	64.1 3/3 120/24/29	68.6 3/3 126/30/34	72.7 3/3 131/34/38	76.1 2/3 135/37/41	78.2 3/6 141/44/47
30	63.1 3/3 119/23/28	67.6 3/3 124/29/33	71.6 3/3 129/33/37	75.3 3/3 134/36/40	77.5 3/6 139/42/45
40	62.1 3/3 118/22/27	66.7 3/3 123/28/32	70.7 3/3 128/32/36	74.4 3/3 132/35/39	76.8 3/6 137/40/44
42	61.3 3/3 117/22/26	65.8 3/3 123/27/31	69.7 3/3 128/31/35	73.1 3/3 132/34/39	75.4 2/3 137/40/43
44	60.5 3/3 117/21/26	64.9 3/3 122/26/30	68.7 3/3 127/30/34	71.8 3/3 132/34/38	73.9 2/3 137/39/43
46	59.7 3/3 117/20/25	64.1 3/3 122/25/29	67.7 3/3 127/29/33	70.7 2/3 132/33/37	72.5 2/3 137/39/43
48	58.9 3/3 116/20/24	63.2 3/3 122/24/28	66.7 3/3 127/28/32	69.4 2/3 132/32/36	71.2 2/3 137/39/42
50	58.0 3/3 116/19/23	62.3 3/3 122/24/28	65.7 3/3 127/28/31	68.2 2/3 132/32/36	69.8 2/3 137/38/42
51	57.6 3/3 116/18/22	61.8 3/3 121/23/27	65.2 3/3 126/27/31	67.5 2/3 132/32/35	69.2 2/3 137/38/41
52	57.2 3/3 115/18/22	61.4 3/3 121/23/27	64.7 3/3 126/27/30	66.9 2/3 132/32/35	68.5 2/3 137/38/41
54	56.4 3/3 115/17/21	60.5 3/3 121/22/26	63.5 3/3 126/26/30	65.6 2/3 132/32/35	67.2 2/3 137/37/41
56	* 55.5 3/3 * 114/16/20	59.5 3/3 121/21/25	62.2 3/3 126/26/29	64.3 3/3 131/31/35	65.8 2/3 137/37/40
58	* 54.6 3/3 * 114/15/19	58.5 3/3 120/20/23	60.9 3/3 126/26/29	63.0 3/3 131/31/34	64.4 2/3 136/36/39
60	* 53.6 3/3 * 113/15/18	57.3 3/3 119/19/22	59.7 3/3 125/25/28	61.6 3/3 130/30/33	63.1 2/3 135/35/38
62	* 52.3 3/3 * 113/15/18	56.3 3/3 118/18/21	58.6 3/3 124/24/27	60.4 3/3 129/29/32	61.8 2/3 134/34/37
64	* 51.1 3/3 * 113/15/18	55.2 3/3 117/17/20	57.4 3/3 123/23/26	59.2 3/3 128/28/31	60.5 2/3 134/34/36

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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.

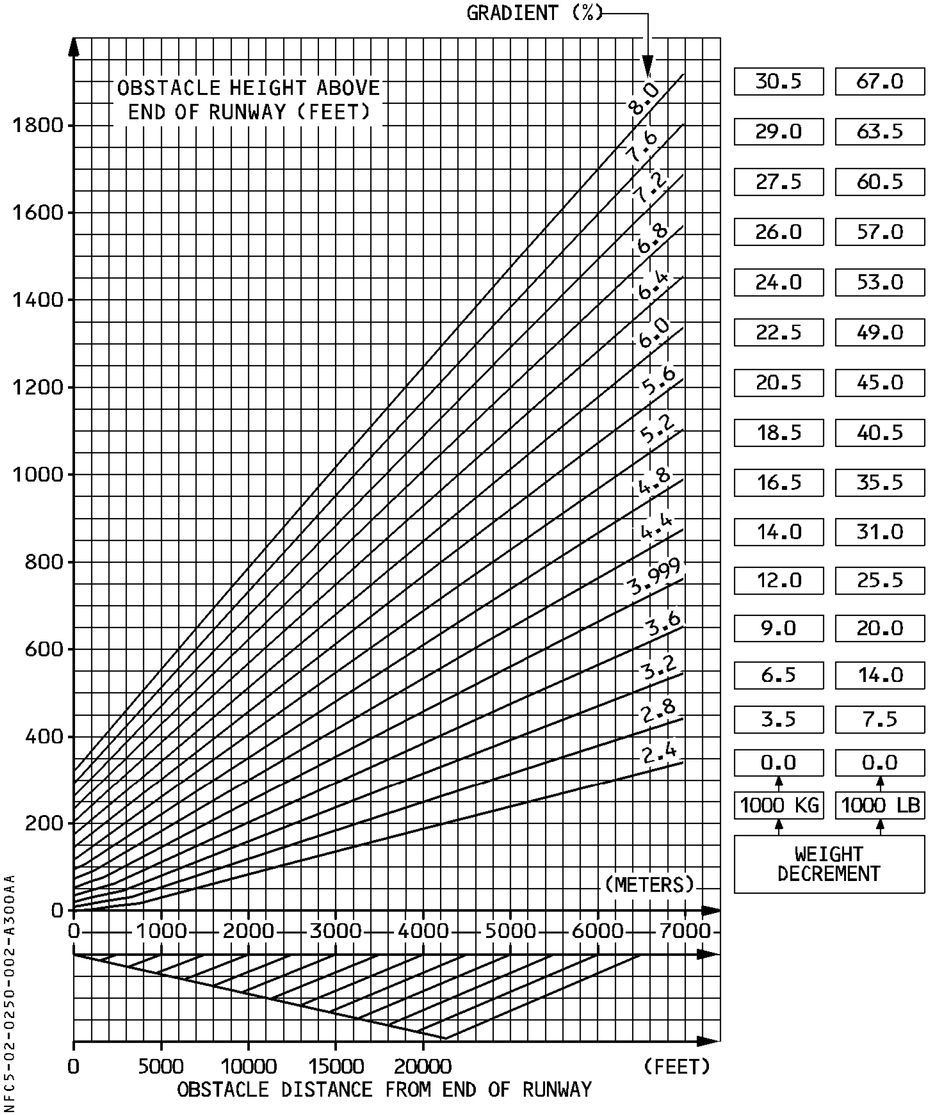
HOW TO PROCEED

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.

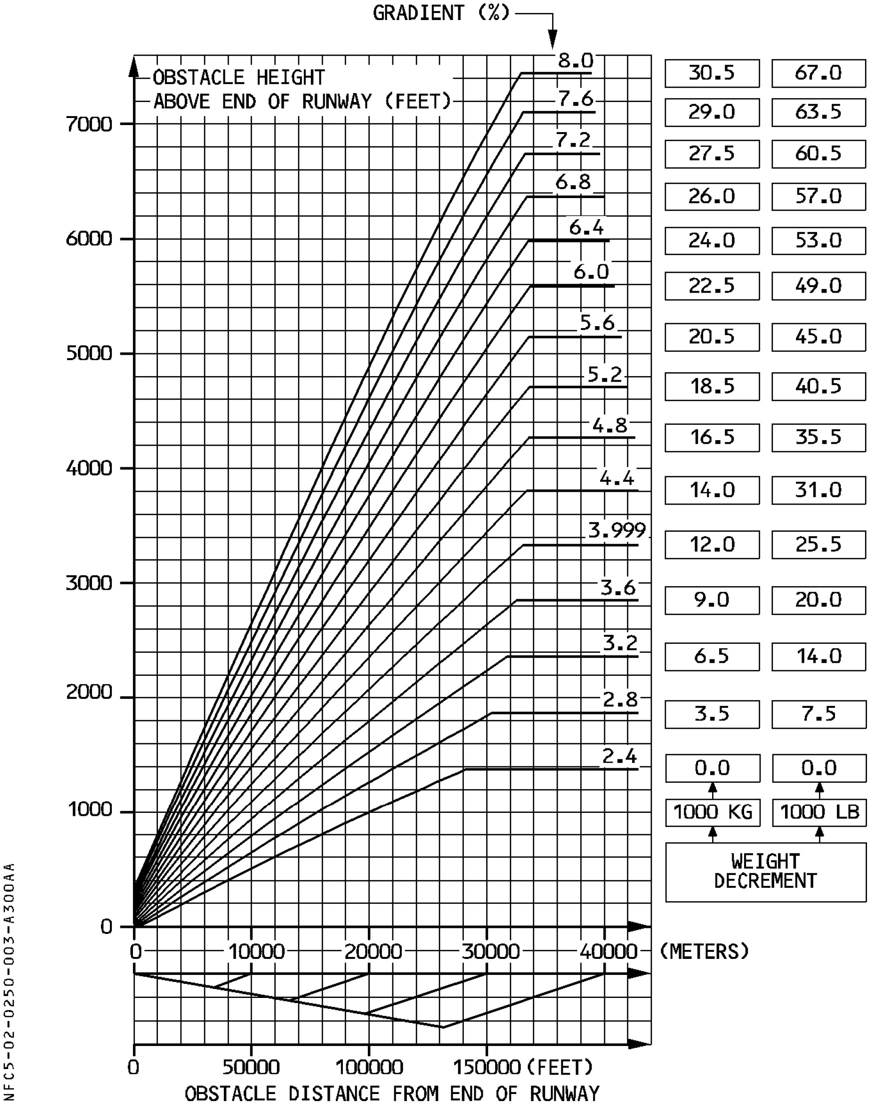
   Note : In case of tailwind, do not use the obstacle clearance graphs.

CLOSE OBSTACLE CLEARANCE CONF 1 + F



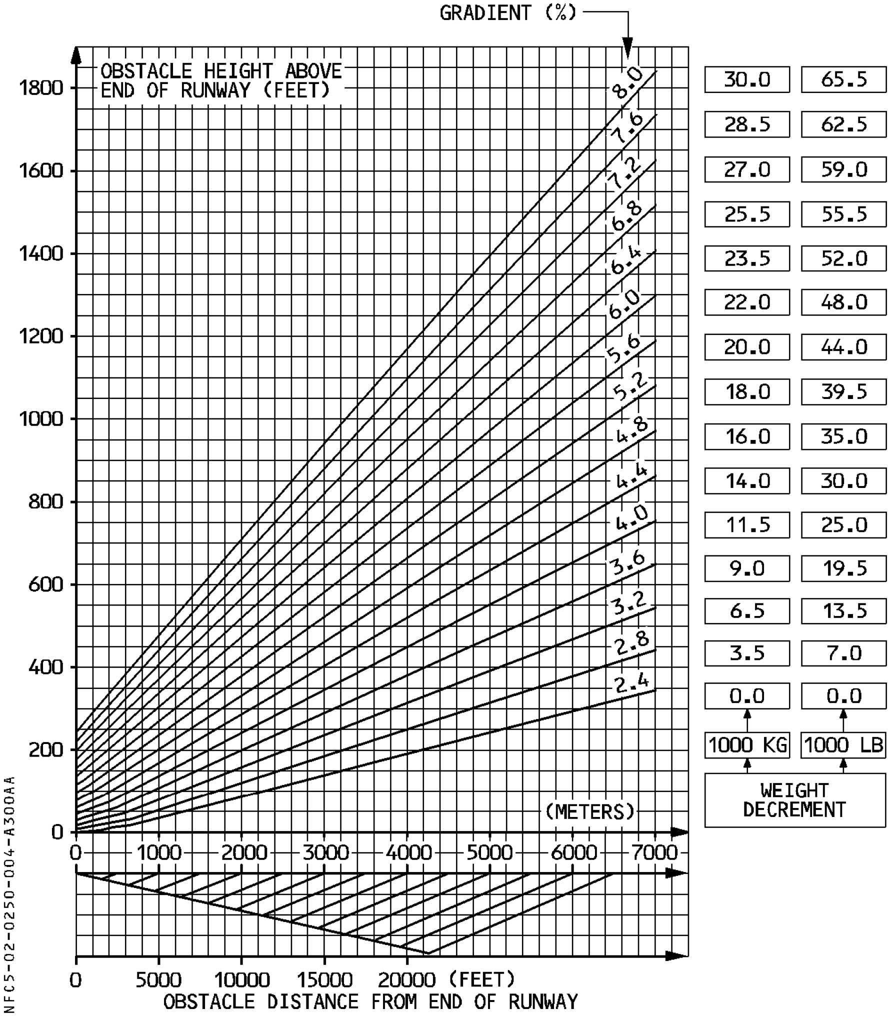
<u>Note</u>: *In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.*

REMOTE OBSTACLE CLEARANCE CONF 1 + F



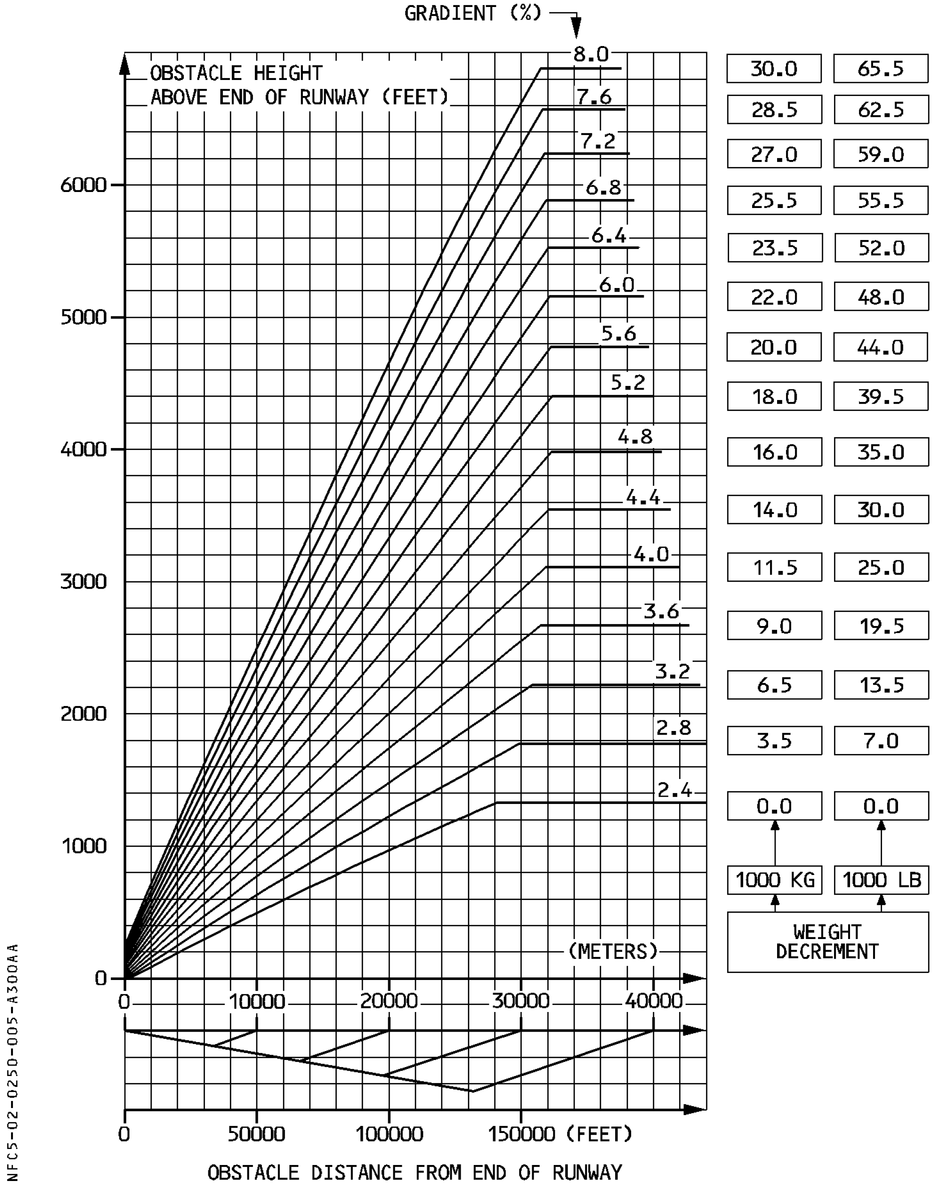
Note : *In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.*

CLOSE OBSTACLE CLEARANCE CONF 2



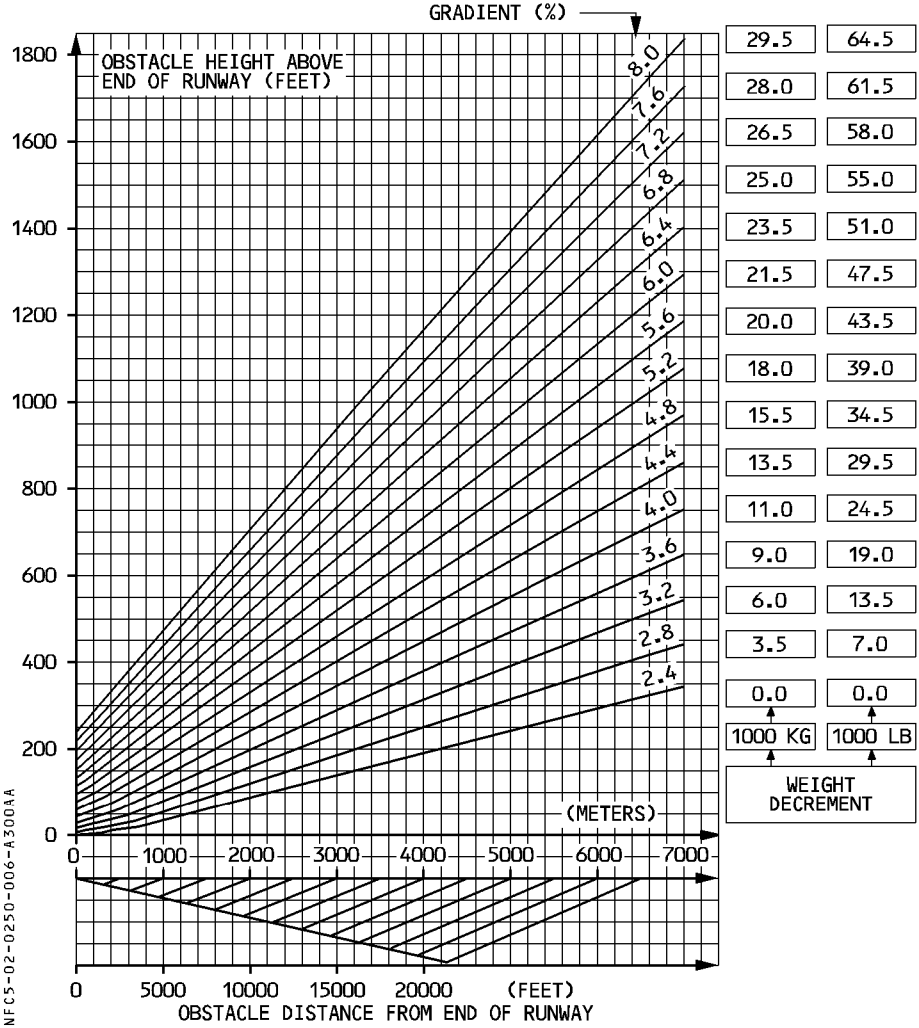
Note : In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.

REMOTE OBSTACLE CLEARANCE CONF 2



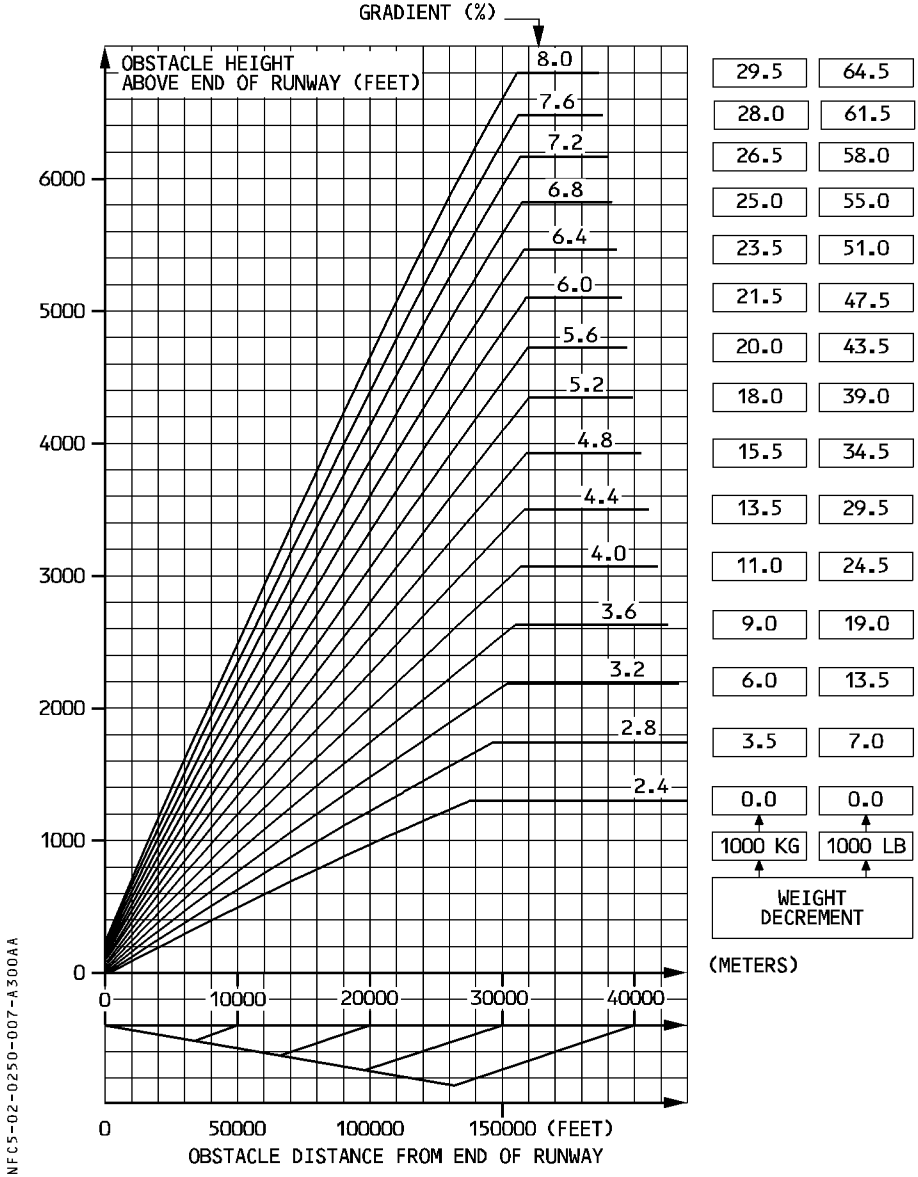
Note : In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.

CLOSE OBSTACLE CLEARANCE CONF 3



Note : In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.

REMOTE OBSTACLE CLEARANCE CONF 3



Note : In case of ascending runway, increase obstacle height by 50 feet per percent runway slope.

03.00 CONTENTS

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

For most cases of abnormal landing configuration, the increased actual landing distance
R 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

ACTUAL LANDING DISTANCE (METERS)											
WEIGHT (1000 KG)			46	50	54	58	62	66	70	74	78
RUNWAY CONDITION	DRY		700	730	770	800	840	910	990	1080	1170
	WET		920	980	1040	1110	1180	1240	1320	1390	1460
	COVERED WITH	6.3 MM (1/4 INCH) WATER	1220	1300	1380	1480	1590	1700	1810	1930	2020
		12.7 MM (1/2 INCH) WATER	1190	1260	1340	1430	1530	1630	1730	1840	1930
		6.3 MM (1/4 INCH) SLUSH	1180	1260	1340	1420	1500	1580	1670	1770	1860
		12.7 MM (1/2 INCH) SLUSH	1150	1220	1300	1370	1450	1530	1610	1700	1780
		COMPACTED SNOW	1190	1270	1340	1410	1480	1550	1620	1700	1750
		ICE	2570	2690	2820	2950	3090	3230	3370	3510	3620

CORRECTIONS

	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 %	+ 3 %	+ 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	+ 18 %	+ 21 %	+ 23 %	+ 21 %	+ 22 %	+ 20 %	+ 18 %	+ 31 %
forward C.G.	+ 2 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %
2 reversers operative	–3 %	–8 %	–10 %	–10 %	–9 %	–8 %	–8 %	–24 %
Per 5 kt speed increment (and no failure) add 8% (all runways)								

CONFIGURATION 3

ACTUAL LANDING DISTANCE (METERS)											
WEIGHT (1000 KG)			46	50	54	58	62	66	70	74	78
RUNWAY CONDITION	DRY		750	780	820	860	910	1000	1100	1200	1290
	WET		1020	1090	1160	1240	1320	1400	1480	1570	1650
	COVERED WITH	6.3 MM (1/4 INCH) WATER	1340	1430	1540	1660	1790	1930	2060	2200	2310
		12.7 MM (1/2 INCH) WATER	1300	1380	1480	1590	1710	1830	1950	2080	2180
		6.3 MM (1/4 INCH) SLUSH	1300	1390	1470	1560	1650	1760	1890	2010	2110
		12.7 MM (1/2 INCH) SLUSH	1250	1340	1420	1500	1590	1690	1800	1910	2000
		COMPACTED SNOW	1300	1380	1460	1540	1620	1700	1780	1850	1910
		ICE	2970	3110	3260	3410	3560	3720	3880	4040	4170

CORRECTIONS

	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 %	+ 5 %	+ 3 %	+ 4 %
per 10 kt headwind	No correction for headwind due to wind correction on approach speed							
per 10 kt tailwind	+ 18 %	+ 21 %	+ 24 %	+ 21 %	+ 22 %	+ 20 %	+ 17 %	+ 29 %
forward C.G.	+ 2 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %	+ 3 %
2 reversers operative	–3 %	–9 %	–12 %	–11 %	–11 %	–10 %	–9 %	–26 %
Per 5 kt speed increment (and no failure) add 8% (all runways)								

REQUIRED LANDING DISTANCE

MANUAL LANDING

REQUIRED LANDING DISTANCE (METERS)									
WEIGHT (1000 KG)	**46**	**50**	**54**	**58**	**62**	**66**	**70**	**74**	**78**
CONF 3	1250	1300	1360	1430	1520	1670	1830	1990	2140
CONF FULL	1170	1220	1270	1330	1390	1510	1650	1800	1940

Corrections on landing distances

Wind : per 10 kt tailwind add 19 %
no correction for headwind due to wind correction on approach speed.
Airport elevation : per 1000 ft above sea level add 3 %.
Forward CG : add 2 %

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 :
- In case of landing in Conf 3 with landing weight equal to or less than 65000 kg, it is equal to the corrected required landing distance for manual landing increased by 125 meters.
- In case of landing in Conf FULL with landing weight equal to or less than 65000 kg, it is equal to the corrected required landing distance for manual landing increased by 70 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

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	FWD CG
RUNWAY CONDITION	MODE									
DRY	MED	970	1080	1230	1390	1540	+ 3	0	+ 16	+ 2
DRY	LOW	1430	1620	1860	2110	2360	+ 3	0	+ 18	+ 2
WET	MED	1010	1150	1340	1540	1740	+ 4	–4	+ 21	+ 3
WET	LOW	1430	1620	1860	2110	2360	+ 3	–0	+ 18	+ 2
COVERED WITH 6.3 MM (1/4 INCH) WATER	MED	1280	1470	1750	2080	2400	+ 4	–12	+ 23	+ 3
COVERED WITH 6.3 MM (1/4 INCH) WATER	LOW	1420	1620	1880	2200	2520	+ 4	–2	+ 19	+ 2
COVERED WITH 12.7 MM (1/2 INCH) WATER	MED	1240	1420	1670	1970	2260	+ 4	–11	+ 21	+ 3
COVERED WITH 12.7 MM (1/2 INCH) WATER	LOW	1390	1590	1840	2130	2420	+ 4	–1	+ 17	+ 2
COVERED WITH 6.3 MM (1/4 INCH) SLUSH	MED	1240	1420	1640	1900	2190	+ 5	–10	+ 22	+ 3
COVERED WITH 6.3 MM (1/4 INCH) SLUSH	LOW	1380	1570	1820	2070	2340	+ 5	0	+ 17	+ 2
COVERED WITH 12.7 MM (1/2 INCH) SLUSH	MED	1200	1370	1580	1810	2070	+ 5	–10	+ 20	+ 3
COVERED WITH 12.7 MM (1/2 INCH) SLUSH	LOW	1350	1550	1790	2030	2280	+ 4	0	+ 16	+ 2
COVERED WITH COMPACTED SNOW	MED	1270	1430	1620	1820	2010	+ 4	–9	+ 17	+ 3
COVERED WITH COMPACTED SNOW	LOW	1420	1610	1860	2110	2340	+ 4	0	+ 17	+ 2
COVERED WITH ICE	MED	2850	3130	3510	3900	4270	+ 4	–25	+ 32	+ 4
COVERED WITH ICE	LOW	2890	3170	3540	3940	4310	+ 4	–25	+ 31	+ 3

CONFIGURATION FULL

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	FWD CG
RUNWAY CONDITION	MODE									
DRY	MED	950	1010	1150	1290	1430	+ 3	0	+ 16	+ 2
DRY	LOW	1390	1490	1710	1950	2170	+ 3	0	+ 18	+ 2
WET	MED	960	1040	1200	1380	1550	+ 4	0	+ 20	+ 3
WET	LOW	1390	1490	1710	1950	2170	+ 3	0	+ 18	+ 2
COVERED WITH 6.3 MM (1/4 INCH) WATER	MED	1230	1340	1550	1830	2100	+ 4	–10	+ 23	+ 3
COVERED WITH 6.3 MM (1/4 INCH) WATER	LOW	1390	1500	1740	1990	2250	+ 4	–1	+ 18	+ 2
COVERED WITH 12.7 MM (1/2 INCH) WATER	MED	1190	1290	1490	1750	2000	+ 4	–9	+ 21	+ 3
COVERED WITH 12.7 MM (1/2 INCH) WATER	LOW	1360	1480	1710	1940	2190	+ 4	0	+ 16	+ 2
COVERED WITH 6.3 MM (1/4 INCH) SLUSH	MED	1190	1290	1490	1700	1930	+ 5	–9	+ 21	+ 3
COVERED WITH 6.3 MM (1/4 INCH) SLUSH	LOW	1350	1460	1690	1920	2140	+ 4	0	+ 16	+ 2
COVERED WITH 12.7 MM (1/2 INCH) SLUSH	MED	1150	1250	1440	1640	1850	+ 5	–8	+ 19	+ 3
COVERED WITH 12.7 MM (1/2 INCH) SLUSH	LOW	1320	1430	1660	1880	2100	+ 4	0	+ 16	+ 2
COVERED WITH COMPACTED SNOW	MED	1210	1300	1490	1670	1830	+ 4	–8	+ 18	+ 3
COVERED WITH COMPACTED SNOW	LOW	1380	1490	1720	1950	2170	+ 4	0	+ 18	+ 2
COVERED WITH ICE	MED	2530	2710	3040	3390	3710	+ 4	–23	+ 33	+ 3
COVERED WITH ICE	LOW	2560	2740	3070	3420	3710	+ 4	–23	+ 33	+ 3

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

04.00 CONTENTS

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NO CHANGE

04.51 RNP

NO CHANGE

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 :

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

2. CONTAMINATED RUNWAY

R An 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
- R 25.4 mm (1 inch) wet snow is equivalent to 12.7 mm (1/2 inch) slush
- 50.8 mm (2 inches) dry snow is equivalent to 6.3 mm (1/4 inch) slush
- R 101.6 mm (4 inches) dry snow is equivalent to 12.7 mm (1/2 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 4 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

The method is based on the use of the RTOW charts established at optimum V2/VS and optimum V1/VR. In addition, when applying corrections for a wet runway, the RTOW charts should also have been established with V1 min (minimum V1 of the V1 range). The method should not be used with takeoff charts computed for other conditions. All tables have been established for TOGA (and Flexible Takeoff for wet 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.*
R 3. *The published corrections are valid for charts calculated with forward CG and*
R *basic CG.*

TAKEOFF FROM A WET RUNWAY

1. Determine the maximum takeoff weight or flexible temperature and associated speeds 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
     · 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
     · If V1 corresponding to actual TOW is lower than the minimum V1 (V1 limited by 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.

<u>*Note*</u> *: · 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.

NO THRUST REVERSERS OPERATIVE (NO 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)	8	5	3	8	6	2	6	6	2
MAX TO Weight decrement (1000 kg) (1000 lb)	2.6 5.8	2.0 4.5	1.3 2.9	2.5 5.6	2.2 4.9	0.7 1.6	2.1 4.7	2.1 4.7	0.7 1.6
V1 decrement (kt)	15	14	14	16	14	14	14	15	13
VR and V2 decrement (kt)	2	1	1	2	1	2	1	2	0

ALL THRUST REVERSERS OPERATIVE (NO 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)	3	2	0	3	1	0	2	1	1
MAX TO Weight decrement (1000 kg) (1000 lb)	1.0 2.3	0.6 1.4	0.0 0.0	0.8 1.8	0.3 0.7	0.0 0.0	0.6 1.4	0.2 0.5	0.1 0.3
V1 decrement (kt)	9	9	9	10	8	9	10	9	8
VR and V2 decrement (kt)	0	0	0	0	0	0	0	0	0

NO THRUST REVERSERS OPERATIVE (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)	15	9	9	14	11	4	15	12	5
MAX TO Weight decrement (1000 kg) (1000 lb)	5.4 12.0	4.1 9.1	3.8 8.4	4.6 10.2	4.2 9.3	1.6 3.6	4.5 10.0	4.5 10.0	2.2 4.9
V1 decrement (kt)	14	15	15	14	14	15	13	13	14
VR and V2 decrement (kt)	4	3	6	4	4	6	3	4	5

ALL THRUST REVERSERS OPERATIVE (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)	11	5	2	10	8	3	11	9	3
MAX TO Weight decrement (1000 kg) (1000 lb)	3.9 8.6	2.3 5.1	0.9 2.0	3.3 7.3	3.1 6.9	1.0 2.3	3.3 7.3	3.3 7.3	1.3 2.5
V1 decrement (kt)	9	10	12	9	9	10	8	9	9
VR and V2 decrement (kt)	3	2	3	3	3	4	2	2	4

TAKEOFF FROM A 6.3 MM (1/4 INCH) WATER COVERED RUNWAY

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

R

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RWY 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 (1000 kg) With clearway	12.8	11.7	9.8	9.8	13.9	13.2	11.4	14.9	14.5	13.1
Without clearway	10.5	10.1	9.0	9.0	11.1	11.1	10.4	11.4	11.8	11.8

- 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)	<55.2	55.2	56	58	58 to 78													
	MTOW (1000 kg)	–	46.7	50	58	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<46.7	46.7	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	126	129	131	134	136	138	141	143	145	148	150	152	155	157	159	161
	VR (kt IAS)	121	121	123	126	128	131	133	135	138	140	142	145	147	149	152	154	156	158
	V1 (kt IAS)	117	117	117	117	117	117	117	117	120	122	124	127	129	131	134	136	138	140

R

CONF 2	CORRECTED WEIGHT (1000 kg)	<56.8	56.8	58	59	59 to 78													
	MTOW (1000 kg)	–	48.7	55	59	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48.7	48.7	50	52	54	56	58	59	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	125	125	127	129	132	134	137	138	139	141	143	146	148	150	153	155	157	159
	VR (kt IAS)	119	119	121	123	126	128	131	132	133	135	137	140	142	144	147	149	151	153
	V1 (kt IAS)	115	115	115	115	115	115	115	115	116	118	120	123	125	127	130	132	134	136

R

CONF 3	CORRECTED WEIGHT (1000 kg)	<57.8	57.8	58	60	60 to 78												
	MTOW (1000 kg)	–	48	49	60	EQUAL TO CORRECTED WEIGHT												
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	123	123	126	128	131	133	135	138	140	142	145	147	149	151	153	155	157
	VR (kt IAS)	118	118	121	123	126	128	130	133	135	137	140	142	144	146	148	150	152
	V1 (kt IAS)	114	114	114	114	114	114	114	114	116	118	121	123	125	127	129	131	133

TAKEOFF FROM A 12.7 MM (1/2 INCH) WATER COVERED RUNWAY

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

R

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RWY 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 (1000 kg) With clearway	16.7	15.7	12.9	10.4	17.3	16.6	15.5	17.5	17.5	16.3
Without clearway	14.4	14.1	12.0	9.6	13.3	14.5	14.5	14.0	14.8	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)	<51.4	51.4	52	52.7	52.7 to 78														
	MTOW (1000 kg)	–	46.7	49	52.7	EQUAL TO CORRECTED WEIGHT														
	ACTUAL WEIGHT (1000 kg)	<46.7	46.7	48	50	52	52.7	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	126	129	131	132	134	136	138	141	143	145	148	150	152	155	157	159	161
	VR (kt IAS)	122	122	124	127	129	130	132	134	136	139	141	143	146	148	150	153	155	157	159
	V1 (kt IAS)	117	117	117	117	117	117	119	121	123	126	128	130	133	135	137	140	142	144	146

R

CONF 2	CORRECTED WEIGHT (1000 kg)	<52.9	52.9	54	54 to 78													
	MTOW (1000 kg)	–	48	54	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	127	129	132	134	137	139	141	143	146	148	150	153	155	157	159
	VR (kt IAS)	119	119	122	124	127	129	132	134	136	138	141	143	145	148	150	152	154
	V1 (kt IAS)	115	115	115	115	115	117	120	122	124	126	129	131	133	136	138	140	142

R

CONF 3	CORRECTED WEIGHT (1000 kg)	<54	54	56	56 to 78													
	MTOW (1000 kg)	–	48	56	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	123	123	126	128	131	133	135	138	140	142	145	147	149	151	153	155	157
	VR (kt IAS)	118	118	121	123	126	128	130	133	135	137	140	142	144	146	148	150	152
	V1 (kt IAS)	114	114	114	114	114	114	116	119	121	123	126	128	130	132	134	136	138

TAKEOFF FROM A 6.3 MM (1/4 INCH) SLUSH COVERED RUNWAY

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

R

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RWY 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 (1000 kg) With clearway	13.2	11.8	9.8	9.8	14.5	13.8	11.6	15.2	15.2	13.9
Without clearway	10.9	10.2	9.0	9.0	11.7	11.7	10.6	11.5	12.5	12.6

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)	<53.2	53.2	54	55	55 to 78														
	MTOW (1000 kg)	–	46.7	51	55	EQUAL TO CORRECTED WEIGHT														
	ACTUAL WEIGHT (1000 kg)	<46.7	46.7	48	50	52	54	55	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	126	129	131	134	135	136	138	141	143	145	148	150	152	155	157	159	161
	VR (kt IAS)	122	122	124	127	129	132	133	134	136	139	141	143	146	148	150	153	155	157	159
	V1 (kt IAS)	117	117	117	117	117	117	117	118	120	123	125	127	130	132	134	137	139	141	143

R

CONF 2	CORRECTED WEIGHT (1000 kg)	<54.8	54.8	56	56.7	56.7 to 78													
	MTOW (1000 kg)	–	48	53	56.7	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	56.7	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	127	129	132	134	135	137	139	141	143	146	148	150	153	155	157	159
	VR (kt IAS)	119	119	122	124	127	129	130	132	134	136	138	141	143	145	148	150	152	154
	V1 (kt IAS)	115	115	115	115	115	115	115	117	119	121	123	126	128	130	133	135	137	139

R

CONF 3	CORRECTED WEIGHT (1000 kg)	<56.3	56.3	58	58.7	58.7 to 78													
	MTOW (1000 kg)	–	48	55	58.7	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	58.7	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	123	123	126	128	131	133	135	136	138	140	142	145	147	149	151	153	155	157
	VR (kt IAS)	118	118	121	123	126	128	130	131	133	135	137	140	142	144	146	148	150	152
	V1 (kt IAS)	114	114	114	114	114	114	114	114	116	118	120	123	125	127	129	131	133	135

TAKEOFF FROM A 12.7 MM (1/2 INCH) SLUSH COVERED RUNWAY

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

R

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RWY 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 (1000 kg) With clearway	18.9	18.9	16.3	15.4	18.7	18.7	17.9	18.9	18.4	18.3
△WEIGHT (1000 kg) Without clearway	17.3	17.3	15.4	14.6	14.7	16.6	16.9	15.4	15.7	17.0

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)	<47.8	47.8	48	48 to 78														
	MTOW (1000 kg)	–	46.7	48	EQUAL TO CORRECTED WEIGHT														
	ACTUAL WEIGHT (1000 kg)	<46.7	46.7	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	126	129	131	134	136	138	141	143	145	148	150	152	155	157	159	161
	VR (kt IAS)	123	123	125	128	130	133	135	137	140	142	144	147	149	151	154	156	158	160
	V1 (kt IAS)	117	117	117	120	122	125	127	129	132	134	136	139	141	143	146	148	150	152

R

CONF 2	CORRECTED WEIGHT (1000 kg)	<49.5	49.5	50	50 to 78														
	MTOW (1000 kg)	–	47	50	EQUAL TO CORRECTED WEIGHT														
	ACTUAL WEIGHT (1000 kg)	<47	47	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	123	123	124	127	129	132	134	137	139	141	143	146	148	150	153	155	157	159
	VR (kt IAS)	119	119	120	123	125	128	130	133	135	137	139	142	144	146	149	151	153	155
	V1 (kt IAS)	115	115	115	115	117	120	122	125	127	129	131	134	136	138	141	143	145	147

R

CONF 3	CORRECTED WEIGHT (1000 kg)	<51	51	52	52 to 78													
	MTOW (1000 kg)	–	48	52	EQUAL TO CORRECTED WEIGHT													
	ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	123	123	126	128	131	133	135	138	140	142	145	147	149	151	153	155	157
	VR (kt IAS)	119	119	122	124	127	129	131	134	136	138	141	143	145	147	149	151	153
	V1 (kt IAS)	114	114	114	114	117	119	121	124	126	128	131	133	135	137	139	141	143

TAKEOFF FROM A COMPACTED SNOW COVERED RUNWAY

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

R

TAKEOFF CONFIGURATION	CONF 1 + F				CONF 2			CONF 3		
RWY 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 (1000 kg) With clearway	8.6	8.5	8.5	9.8	10.5	7.4	5.6	13.1	10.3	8.2
Without clearway	6.3	6.3	7.4	9.0	7.7	5.3	4.6	9.6	7.6	6.9

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)	<52.7	52.7	54	54 to 78														
MTOW (1000 kg)	–	46.7	54	EQUAL TO CORRECTED WEIGHT														
ACTUAL WEIGHT (1000 kg)	<46.7	46.7	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
V2 (kt IAS)	124	124	126	129	131	134	136	138	141	143	145	148	150	152	155	157	159	161
VR (kt IAS)	123	123	125	128	130	133	135	137	140	142	144	147	149	151	154	156	158	160
V1 (kt IAS)	117	117	117	117	117	117	119	121	124	126	128	131	133	135	138	140	142	144

R

CONF 2																		
CORRECTED WEIGHT (1000 kg)	<54.8	54.8	56	56.7	56.7 to 78													
MTOW (1000 kg)	–	48	53	56.7	EQUAL TO CORRECTED WEIGHT													
ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	56.7	58	60	62	64	66	68	70	72	74	76	78
V2 (kt IAS)	124	124	127	129	132	134	135	137	139	141	143	146	148	150	153	155	157	159
VR (kt IAS)	119	119	122	124	127	129	130	132	134	136	138	141	143	145	148	150	152	154
V1 (kt IAS)	115	115	115	115	115	115	115	117	119	121	123	126	128	130	133	135	137	139

R

CONF 3																		
CORRECTED WEIGHT (1000 kg)	<56.3	56.3	58	58.7	58.7 to 78													
MTOW (1000 kg)	–	48	55	58.7	EQUAL TO CORRECTED WEIGHT													
ACTUAL WEIGHT (1000 kg)	<48	48	50	52	54	56	58	58.7	60	62	64	66	68	70	72	74	76	78
V2 (kt IAS)	123	123	126	128	131	133	135	136	138	140	142	145	147	149	151	153	155	157
VR (kt IAS)	119	119	122	124	127	129	131	132	134	136	138	141	143	145	147	149	151	153
V1 (kt IAS)	114	114	114	114	114	114	114	114	116	118	120	123	125	127	129	131	133	135

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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 :

R * Set the YELLOW ELEC PUMP to ON
R * Check that the BLUE ELEC PUMP is in the AUTO position
R * Set the BLUE PUMP OVRD to ON
R * Retract the FLAPS and monitor retraction on ECAM page.
R * Select off the YELLOW ELEC PUMP and BLUE PUMP OVRD and resume with
R 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.*
– *During taxi on snowy runways, the radio altimeters may not compute any data and the ECAM warnings 'DUAL ENG FAILURE', 'ANTI ICE CAPT TAT FAULT', 'ANTI ICE F/O TAT FAULT', 'L/G SHOCK ABSORBER FAULT' may be triggered. Disregard these warnings.*

R **TAKEOFF**

R **– FOLLOWING TAKEOFF PROCEDURES . . . . CONSIDER**
R – For contaminated runways, select MAX TO.
R – Do not abort takeoff for minor deficiencies even at low speeds.
R If you have to abort takeoff, maintain directional control with the rudder and small
R inputs to the nose wheel. If necessary, use differential braking to regain the center
R line when stopping distance permits.
R – Do not lift the nose wheel before VR in an attempt to avoid splashing slush on the
R aircraft, because this produces additional aerodynamic drag.
R – 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 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 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-A348AA

OAT °C	CONF 1 + F				
	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
34.0	76.7 4/6 143/50/52	78.4 4/6 148/53/55	80.2 4/6 154/56/58	81.5 4/6 157/57/60	82.8 4/6 160/60/62
36.0	76.5 4/6 143/49/52	78.4 4/6 148/52/54	80.1 4/6 153/56/58	81.4 4/6 156/57/59	82.7 4/6 160/60/62

Maximum TOW = 80100 kg, V1 = 153 kt, VR = 156 kt, V2 = 158 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 lower table from 2.04.10 p 3.

NFC5-02-0410-014-B348AA

TAKEOFF CONFIGURATION	CONF 1+F			CONF 2			CONF 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)	8	5	3	8	6	2	6	6	2
MAX TO WEIGHT DECREMENT (1000 kg) (1000 lb)	2.6 5.8	2.0 4.5	1.3 2.9	2.5 5.6	2.2 4.9	0.7 1.6	2.1 4.5	2.1 4.7	0.7 1.6
V1 DECREMENT (kt)	15	14	14	16	14	14	14	15	13
VR AND V2 DECREMENT (kt)	2	1	1	2	1	2	1	2	0

· Maximum takeoff weight correction :
MTOW = 80100 – 2000 = 78100 kg, V1 = 153 – 14 = 139 kt, VR = 156 – 1= 155 kt, V2 = 158 – 1= 157 kt.

· Flex temperature correction :
Assuming an actual takeoff weight of 78400 kg and an initial flex temperature of 47°C
TOW = 78400 kg ⇒ Flex temperature = 47 – 5 = 42°C
V1 = 152 – 14 = 138 kt, VR = 154 – 1= 153 kt, V2 = 156 – 1= 155 kt.

Check the resulting speeds against the minimum speeds as per procedure 2.04.10 p2a.

TAKEOFF PERFORMANCE ON RUNWAY COVERED WITH 1/2 INCH SLUSH

Data

Runway length 3000 m (no clearway), OAT = 5°C, 5 kt tailwind, CONF 1+F

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

NFC5-02-0410-015-A348AA

OAT °C	CONF 1 + F				
	TAILWIND -10 KT	TAILWIND -5 KT	WIND 0 KT	HEADWIND 10 KT	HEADWIND 20 KT
0.0	78.8 4/6 151/54/57	80.6 4/6 156/57/59	82.5 4/6 162/62/64	83.7 3/4 165/65/67	84.7 3/4 168/68/70
10.0	78.2 4/6 148/53/55	80.0 4/6 154/57/59	81.8 4/6 159/60/62	83.1 4/6 163/63/65	84.2 3/4 166/66/67

Maximum takeoff weight on dry runway = 80300 kg

– Determine a corrected weight (Refer to FCOM 2.04.10 p 8). As no clearway, use the correction displayed on the second line (without clearway).

R

NFC5-02-0410-015-B348AA

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 (1000 kg) With clearway Without clearway	18.9 17.3	18.9 17.3	16.3 15.4	15.4 14.6	18.7 14.7	18.7 16.6	17.9 16.9	18.9 15.4	18.4 15.7	18.3 17.0

Corrected weight = 80300 – 17300 = 63000 kg

– Determine maximum takeoff weight and associated speeds :

R

NFC5-02-0410-015-C348AA

CONF 1+F	CORRECTED WEIGHT (1000 kg)	<47.8	47.8	48	48 to 78														
	MTOW (1000 kg)	-	46.7	48	EQUAL TO CORRECTED WEIGHT														
	ACTUAL WEIGHT (1000 kg)	<46.7	47.3	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
	V2 (kt IAS)	124	124	126	129	131	134	136	138	141	143	145	148	150	152	155	157	159	161
	VR (kt IAS)	123	123	125	128	130	133	135	137	140	142	144	147	149	151	154	156	158	160
	V1 (kt IAS)	117	117	117	120	122	125	127	129	132	134	136	139	141	143	146	148	150	152

MTOW = 63000 kg

V1 = 135 kt, VR = 143 kt, V2 = 144 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

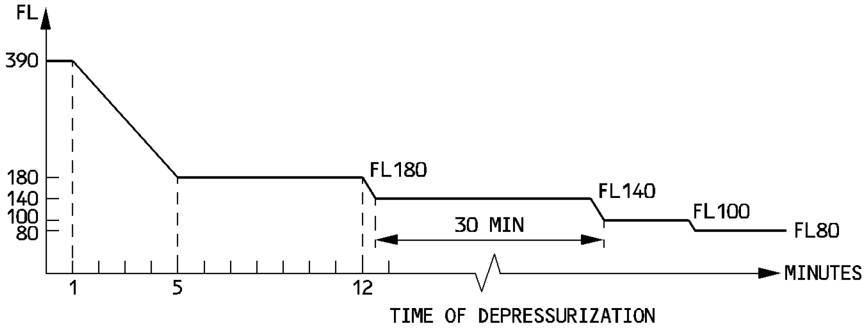
If decompression is due to structural damage, consider airspeed reduction. Use slats and flaps, as necessary, to establish low speed conditions. In addition, turbulent conditions are uncomfortable for passengers, and gust response should be minimized by reducing airspeed.

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 the event of depressurization, oxygen is supplied to passengers through an individual mask. The capacity of the units is such that the aircraft must descend and remain below the following profile.



NFC5-02-0420-004-A001AB

SYSTEMS

FAILURE OCCURRING IN FLIGHT

Apply the abnormal and emergency procedures 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.

– **MAX FL . . . . 100 or MSA**
Between FL 80 and FL 150, oxygen must be provided for 2 % of the passengers. This is provided by the portable oxygen system. When it is no longer available, descend to FL 80. For performance at FL 80/250 knots : 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 :**
TEST OF THE MANUAL OPERATION OF THE OUTFLOW VALVE ON GROUND :

– **PACK 1 and 2 . . . . OFF**

– **OUTFLOW VALVE FULLY OPEN . . . . CHECK**
Check that the outflow valve is fully open on the CAB PRESS page

– **RPCU C/B (X23 ON 122VU) . . . . PULL**

– **MODE SEL . . . . MAN**

– **MAN V/S CTL . . . . DN**
Check that the outflow valve closes on the CAB PRESS page

– **MAN V/S CTL . . . . UP**
Check that the outflow valve opens on the CAB PRESS page

– **MODE SEL . . . . AUTO**

– **RPCU C/B (X23 ON 122VU) . . . . PUSH**

– **PACK 1 and 2 . . . . ON**

– **MAX FL . . . . 100 or MSA**
Between FL 80 and FL 150, oxygen must be provided for 2 % of the passengers. This is provided by the portable oxygen system. When it is no longer available, descend to FL 80. For performance at FL 80/250 knots : Use data for FL 100/LRC given in 3.05.15, and increase fuel consumption by 6 %.

TAKEOFF

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

● **If both CAB PRESS systems one inoperative, or if there is structural damage :**

● **WHEN IN CLEAN CONFIGURATION :**

– **MODE SEL . . . . MAN**

– **V/S CTL . . . . AS RQRD**
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 prevent the cabin air suction effect.

CLIMB

<u>Note</u> : *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 120 kg or 260 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
R Following tables have been calculated using databases for CFM 56–5–B /P. If the engines
R fitted on the aircraft are not /P, the fuel consumption has to be increased by 3 %.

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 : 120 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	1895 0.55	1968 0.53	2040 0.52	2110 0.51	2183 0.51	2257 0.50	2336 0.50
240	2039 0.59	2119 0.57	2197 0.55	2271 0.55	2348 0.54	2426 0.54	2509 0.54
260	2183 1.04	2270 1.01	2353 0.59	2432 0.58	2513 0.58	2595 0.57	2682 0.57
280	2326 1.08	2420 1.05	2509 1.03	2593 1.02	2678 1.01	2763 1.01	2854 1.01
300	2470 1.13	2571 1.09	2665 1.07	2753 1.05	2842 1.04	2932 1.04	3026 1.04
320	2613 1.17	2721 1.13	2821 1.10	2914 1.09	3007 1.08	3100 1.07	3199 1.07
340	2756 1.21	2871 1.17	2977 1.14	3074 1.12	3171 1.11	3269 1.11	3371 1.11
360	2899 1.26	3020 1.21	3133 1.18	3234 1.16	3336 1.15	3437 1.14	3543 1.14
380	3042 1.30	3170 1.25	3288 1.21	3394 1.20	3500 1.18	3605 1.18	3715 1.17
400	3185 1.35	3319 1.30	3444 1.25	3554 1.23	3664 1.22	3773 1.21	3886 1.21
420	3327 1.39	3468 1.34	3599 1.29	3713 1.27	3828 1.25	3941 1.24	4058 1.24
440	3469 1.44	3616 1.38	3754 1.33	3873 1.30	3992 1.29	4108 1.28	4229 1.28
460	3611 1.48	3765 1.42	3909 1.36	4032 1.34	4155 1.32	4276 1.31	4400 1.31
480	3753 1.53	3913 1.46	4064 1.40	4192 1.38	4319 1.36	4443 1.35	4572 1.34
500	3895 1.57	4061 1.50	4219 1.44	4351 1.41	4482 1.39	4611 1.38	4743 1.38
520	4036 2.01	4209 1.55	4373 1.48	4510 1.45	4645 1.43	4778 1.41	4913 1.41
540	4177 2.06	4357 1.59	4528 1.52	4668 1.48	4808 1.46	4945 1.45	5084 1.45
560	4318 2.10	4505 2.03	4682 1.55	4827 1.52	4971 1.50	5112 1.48	5255 1.48
580	4459 2.15	4652 2.07	4836 1.59	4986 1.56	5134 1.53	5279 1.52	5425 1.51
600	4600 2.19	4799 2.12	4990 2.03	5144 1.59	5297 1.57	5446 1.55	5595 1.55
620	4741 2.24	4946 2.16	5144 2.07	5302 2.03	5460 2.00	5612 1.58	5766 1.58
640	4881 2.28	5093 2.20	5298 2.11	5460 2.07	5622 2.04	5779 2.02	5936 2.01
660	5021 2.33	5240 2.25	5451 2.14	5618 2.10	5784 2.07	5945 2.05	6106 2.05
680	5161 2.37	5386 2.29	5605 2.18	5776 2.14	5946 2.11	6112 2.09	6275 2.08
700	5301 2.42	5532 2.34	5758 2.22	5934 2.18	6108 2.14	6278 2.12	6445 2.12

AIR CONDITIONING OFF	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 2.5 %	△FUEL = + 5 %	△FUEL = + 9 %

GROUND DISTANCE/AIR DISTANCE CONVERSION

R

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+150	+100	+ 50	0	–50	–100	–150
40	27	30	35	**40**	48	59	76
60	41	46	52	**60**	71	88	115
80	54	61	69	**80**	95	117	153
100	68	76	86	**100**	119	146	191
120	81	91	104	**120**	143	176	229
140	95	106	121	**140**	166	205	267
160	108	121	138	**160**	190	234	305
180	122	137	155	**180**	214	264	344
200	135	152	173	**200**	238	293	382
220	149	167	190	**220**	261	322	420
240	163	182	207	**240**	285	352	458
260	176	197	224	**260**	309	381	496
280	190	213	242	**280**	333	410	534
300	203	228	259	**300**	357	439	573
320	217	243	276	**320**	380	469	611
340	230	258	293	**340**	404	498	649
360	244	273	311	**360**	428	527	687
380	257	288	328	**380**	452	557	725
400	271	304	345	**400**	475	586	763
420	285	319	362	**420**	499	615	802
440	298	334	380	**440**	523	645	840
460	312	349	397	**460**	547	674	878
480	325	364	414	**480**	571	703	916
500	339	380	432	**500**	594	732	954
520	352	395	449	**520**	618	762	992
540	366	410	466	**540**	642	791	1031
560	379	425	483	**560**	666	820	1069
580	393	440	501	**580**	689	850	1107
600	406	455	518	**600**	713	879	1145

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 degrade F/CTL laws down to DIRECT law, if the landing gear is extended.

FAILURE OF BOTH ENGINES

R When both engines are failed, to ease the handling of all the different ECAM procedures
R resulting from this all engine flame out situation, it is recommended to use the ENG DUAL
R FAILURE QRH paper procedure, and if time permits, to clear the ECAM.
R Follow all the steps of the QRH paper procedure, except those that are modified by the
R procedure below :

- If the APU is not available :
  - Attempt an APU start
  - If APU start is unsuccessful, a windmilling relight can be performed, as long as the speed is above 300 knots (corresponding N2 above 12%).
    In this case, increase the aircraft speed and disregard the VMO warning.
- If the APU is available : Perform an assisted relight, when below FL 200.
- Flight controls are in direct law. 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	22 %	19 %	19 %

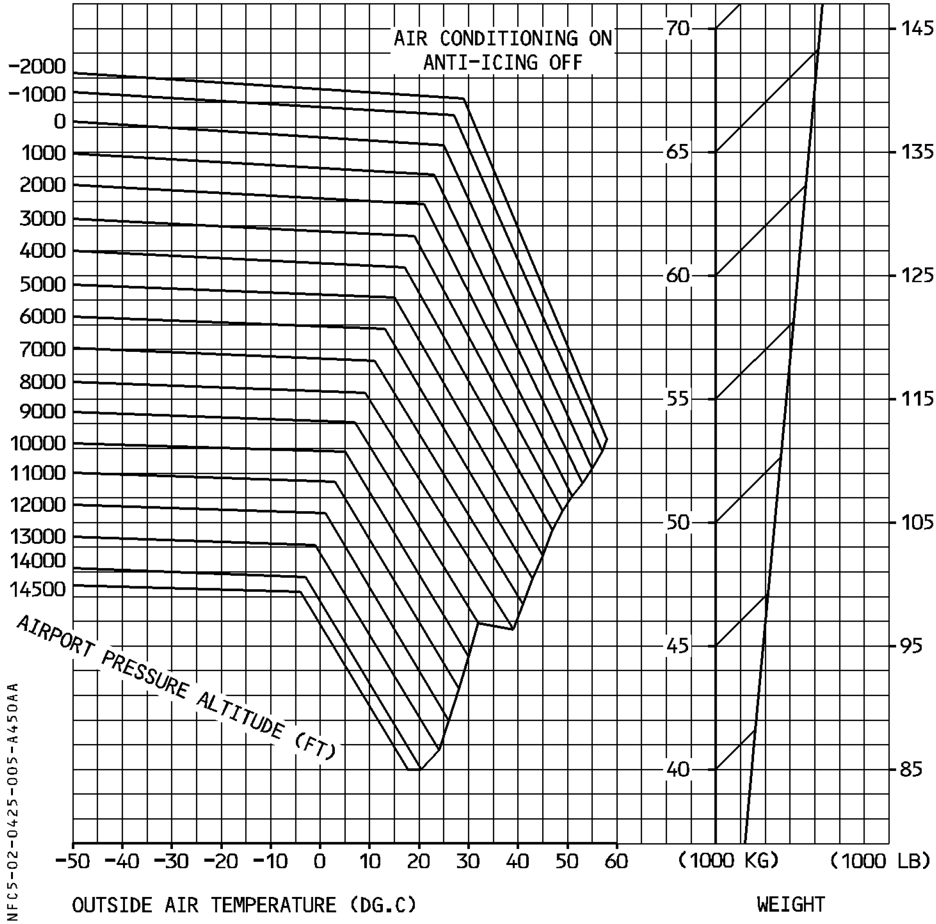
METHOD

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. This graph is established for 25 % CG location.
In case of forward CG the weight must be decreased by 400 kg (900 lb).



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 15 %.

FLIGHT PLANNING

R *Note :* *The performance tables are established at ISA. For each degree Celsius above ISA*
R *temperature and per NM of air distance apply a fuel correction of 0.05 kg/°C/NM*
R *(0.11 lb/°C/NM).*

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. CLIMG THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF				ISA CG=25.0%		**FROM BRAKE RELEASE** **TIME (MIN) FUEL (KG)** **DISTANCE (NM) TAS (KT)**			
	WEIGHT AT BRAKE RELEASE (1000KG)								
FL	**50**	**52**	**54**	**56**	**58**	**60**	**62**	**64**	**66**
290	21 1651	23 1778	25 1921	27 2085	30 2277	33 2507			
	98 279	106 280	116 281	127 282	140 283	156 284			
270	18 1500	20 1607	21 1725	23 1858	25 2009	27 2183	30 2389		
	85 277	92 278	99 279	108 279	117 280	129 281	143 282		
250	16 1356	17 1447	19 1546	20 1655	21 1778	23 1915	25 2073	28 2257	31 2475
	74 274	79 275	85 275	92 276	99 277	107 278	117 279	129 280	143 282
240	15 1285	16 1369	17 1459	18 1559	20 1669	21 1792	23 1932	25 2091	27 2277
	68 272	73 273	78 273	84 274	91 275	98 276	106 277	116 278	128 279
220	13 1143	14 1214	15 1289	16 1371	17 1461	18 1559	19 1668	21 1790	22 1928
	58 267	62 268	66 268	70 269	75 270	81 271	87 272	94 273	102 274
200	11 999	12 1057	12 1119	13 1185	14 1256	15 1333	16 1417	17 1509	18 1610
	48 260	51 260	54 261	57 262	61 263	65 263	69 264	74 265	80 266
180	9 845	9 892	10 940	11 992	11 1047	12 1105	12 1167	13 1233	14 1304
	37 250	40 250	42 251	44 251	47 252	50 253	53 253	56 254	59 255
160	7 718	8 756	8 795	9 837	9 880	10 926	10 975	11 1026	11 1080
	29 240	31 240	33 241	35 241	37 242	38 242	41 243	43 244	45 244
140	6 611	6 642	7 675	7 709	7 744	8 781	8 820	9 861	9 904
	23 230	25 231	26 231	27 232	29 232	30 233	32 233	34 234	35 234
120	5 517	5 543	6 570	6 598	6 627	6 657	7 689	7 722	7 756
	19 220	20 221	21 221	22 222	23 222	24 223	25 223	26 224	28 224
100	4 432	4 454	5 475	5 498	5 522	5 546	5 572	6 598	6 626
	14 209	15 210	16 211	17 211	18 212	18 212	19 213	20 213	21 214
50	2 243	2 254	2 266	3 278	3 290	3 303	3 317	3 330	3 344
	6 171	7 172	7 173	7 173	8 174	8 175	9 175	9 176	9 177
15	1 123	1 128	1 133	1 139	1 145	1 151	1 157	2 163	2 170
	2 108	2 109	2 110	2 110	3 111	3 112	3 113	3 113	3 114

11.0-08F0A320–214 CFM56–5B4/P SA21101000C5KG250 0 018590 0 0 2 1.0 500.0 300.00 1 02230.000 .500.000 0 FCOM-N0–02–04–25–007–140

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**	
48	73.9	.417	83.4	.500	83.2	.500	83.2	.500	83.3	.500	83.5	.500
	1768	230	1810	228	1687	219	1577	210	1435	197	1359	188
	75.2	266	84.8	307	90.3	305	95.8	302	104.0	298	108.9	296
50	74.2	.417	83.6	.500	83.5	.500	83.5	.500	83.6	.500	84.0	.500
	1781	230	1825	228	1704	219	1596	210	1459	197	1387	188
	74.6	266	84.1	307	89.4	305	94.7	302	102.3	298	106.7	296
52	74.4	.417	83.8	.500	83.7	.500	83.8	.500	84.0	.500	84.5	.500
	1795	230	1841	228	1722	219	1616	210	1485	197	1417	188
	74.1	266	83.4	307	88.5	305	93.5	302	100.5	298	104.4	296
54	74.6	.417	84.0	.500	84.0	.500	84.1	.500	84.5	.500	85.1	.500
	1810	230	1857	228	1741	219	1638	210	1513	197	1454	188
	73.4	266	82.7	307	87.5	305	92.3	302	98.6	298	101.7	296
56	74.9	.417	84.3	.500	84.3	.500	84.4	.500	84.9	.500	85.7	.500
	1826	230	1875	228	1761	219	1662	210	1543	197	1497	188
	72.8	266	81.9	307	86.5	305	90.9	302	96.7	298	98.9	296
58	75.1	.417	84.5	.500	84.6	.500	84.8	.500	85.4	.500	86.3	.500
	1843	230	1894	228	1782	219	1687	210	1574	197	1541	188
	72.1	266	81.1	307	85.5	305	89.6	302	94.8	298	96.0	296
60	75.4	.417	84.8	.500	84.9	.500	85.1	.500	86.0	.500		
	1861	230	1914	228	1805	219	1714	210	1616	197		
	71.5	266	80.2	307	84.4	305	88.2	302	92.3	298		
62	75.7	.417	85.1	.500	85.2	.500	85.5	.500	86.6	.500		
	1879	230	1935	228	1829	219	1742	210	1660	197		
	70.8	266	79.4	307	83.3	305	86.8	302	89.9	298		
64	76.0	.417	85.3	.500	85.5	.500	85.9	.500				
	1898	230	1957	228	1856	219	1772	210				
	70.0	266	78.5	307	82.1	305	85.3	302				
66	76.3	.417	85.6	.500	85.9	.500	86.3	.500				
	1918	230	1981	228	1883	219	1804	210				
	69.3	266	77.5	307	80.9	305	83.7	302				
68	76.6	.417	85.9	.500	86.2	.500						
	1939	230	2005	228	1912	219						
	68.6	266	76.6	307	79.7	305						

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				55				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
290	7.1	67	33	IDLE	8.2	77	38	IDLE	188
270	6.6	63	30	IDLE	7.6	74	35	IDLE	197
250	6.1	60	28	IDLE	7.1	70	32	IDLE	205
240	5.8	58	26	IDLE	6.8	68	31	IDLE	210
220	5.4	55	24	IDLE	6.3	64	28	IDLE	219
200	4.9	51	22	IDLE	5.8	60	26	IDLE	228
180	4.5	47	20	IDLE	5.2	55	23	IDLE	230
160	4.0	41	17	IDLE	4.6	48	20	IDLE	230
140	3.4	34	15	IDLE	4.0	40	17	IDLE	230
120	2.9	28	12	IDLE	3.4	32	14	IDLE	230
100	2.3	21	10	IDLE	2.7	25	11	IDLE	230
50	1.0	9	4	IDLE	1.2	10	5	IDLE	230
15	.0	0	0	IDLE	.0	0	0	IDLE	230

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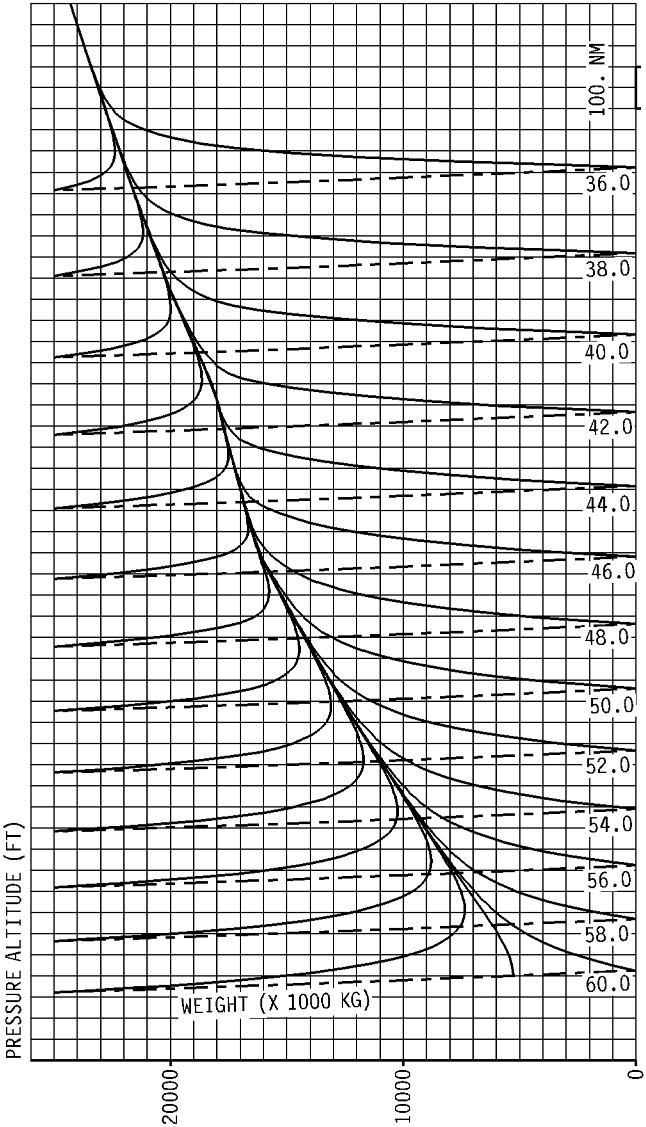
R

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**
46	56.3 1248	59.1 1223	62.9 1206	64.7 1202	66.5 1198	68.3 1194	70.1 1192	71.9 1187
48	57.4 1297	60.3 1274	64.1 1260	66.0 1255	67.8 1251	69.5 1248	71.3 1243	73.2 1239
50	58.6 1347	61.3 1327	65.3 1313	67.2 1308	69.0 1304	70.7 1300	72.5 1296	74.4 1293
52	59.7 1398	62.3 1380	66.6 1366	68.3 1361	70.1 1357	71.8 1353	73.7 1348	75.5 1347
54	60.8 1449	63.3 1434	67.7 1419	69.5 1415	71.1 1410	72.9 1405	74.8 1402	76.7 1402
56	61.7 1501	64.3 1488	68.8 1472	70.5 1467	72.2 1463	74.0 1458	75.9 1457	77.8 1457
58	62.6 1554	65.4 1541	69.8 1525	71.5 1520	73.2 1516	75.1 1512	77.0 1512	78.9 1514
60	63.5 1607	66.4 1594	70.8 1578	72.4 1573	74.2 1569	76.1 1567	78.0 1568	79.8 1571
62	64.4 1659	67.4 1645	71.7 1631	73.4 1626	75.2 1622	77.1 1622	79.0 1624	80.8 1627
64	65.3 1713	68.4 1699	72.6 1684	74.4 1680	76.2 1677	78.1 1678	79.9 1681	81.7 1684
66	66.3 1766	69.3 1753	73.5 1738	75.3 1734	77.1 1733	79.1 1735	80.8 1738	82.6 1743
68	67.2 1819	70.2 1806	74.4 1792	76.2 1789	78.1 1789	80.0 1792	81.7 1796	83.4 1804
70	68.1 1872	71.1 1859	75.3 1847	77.1 1845	79.0 1846	80.8 1850	82.6 1854	84.2 1865
72	69.0 1926	71.9 1913	76.2 1901	78.0 1901	79.9 1904	81.6 1908	83.3 1914	85.0 1928
74	69.8 1981	72.7 1967	77.0 1957	78.9 1958	80.7 1962	82.4 1966	84.1 1975	85.7 1990
76	70.6 2033	73.4 2021	77.8 2013	79.7 2015	81.5 2019	83.2 2024	84.8 2036	
78	71.4 2085	74.2 2075	78.6 2069	80.5 2073	82.2 2077	83.9 2084	85.5 2099	

EN ROUTE NET FLIGHT PATH - L/G DOWN - ONE ENGINE OUT		
MAX. CONTINUOUS THRUST HIGH AIR CONDITIONING ANTI ICE OFF	ISA CG = 23 %	MINIMUM ENGINE

R



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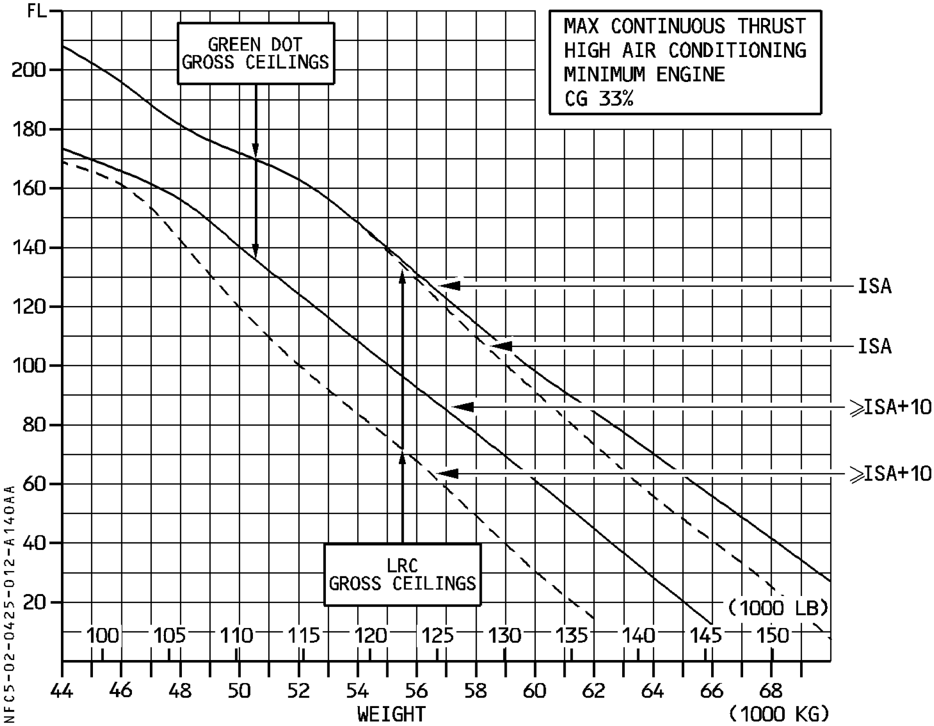
GROSS CEILINGS AT LONG RANGE AND GREEN DOT SPEEDS - ONE ENGINE OUT

R



BLEED CORRECTIONS

R

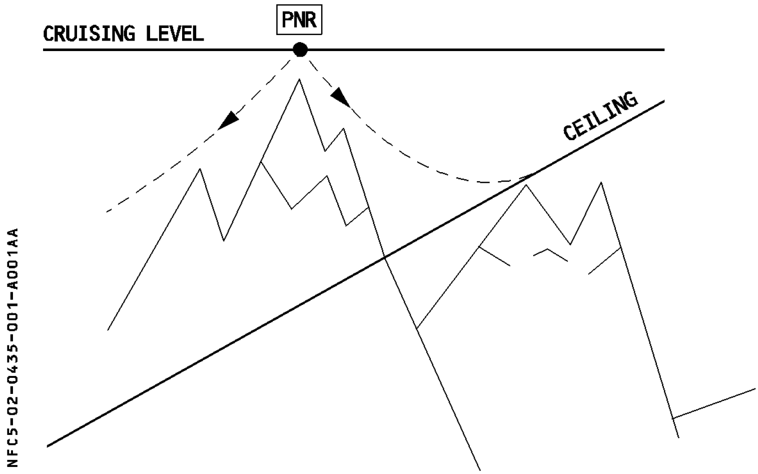
		ISA	≥ ISA + 10
LONG RANGE	ENGINE ANTI ICE ON	– 500 FT	– 2800 FT
	TOTAL ANTI ICE ON	– 1300 FT	– 4600 FT
GREEN DOT	ENGINE ANTI ICE ON	– 200 FT	– 1700 FT
	TOTAL ANTI ICE ON	– 1200 FT	– 3500 FT

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.



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 aircraft comply with the criteria for Extended Twin Operations (ETOPS) flights set forth in AMC 20-6 (EASA) or
R AC 120-42 A (FAA) or FAR 25-1535 (FAA) 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.
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 operator may amend this chapter, as needed.
The aircraft 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 JAR-OPS 1-245 and FAR 121-161 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.

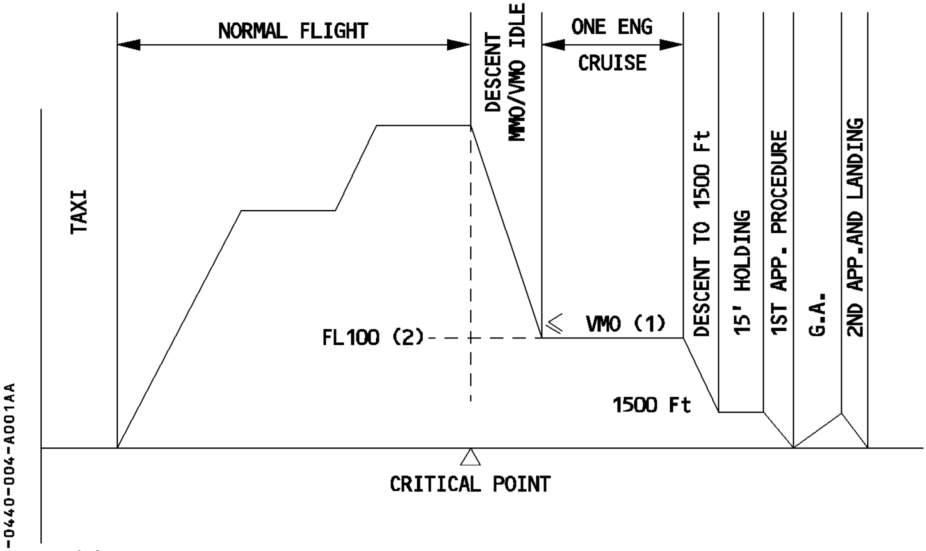
ELECTRICAL GENERATORS

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.

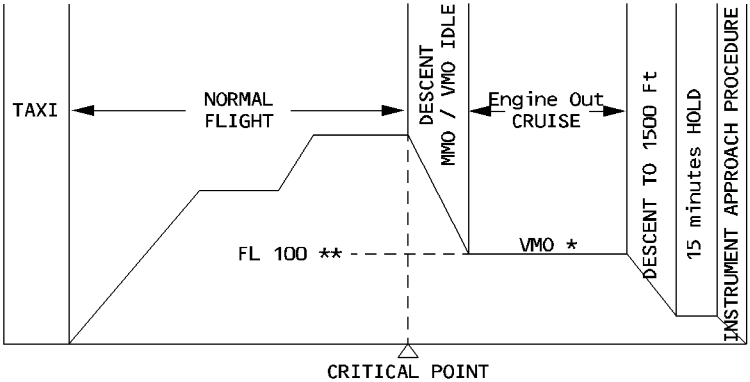
Pressurization failure
Same flight profile, but with 2 engines operating and diversion cruise set at LRC.

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.

FAA ETOPS FUEL SCENARIOS

For establishing the ETOPS critical fuel reserves, the operator must consider three diversion scenarios.

1. **Pressurization Failure + Engine Failure**



* SELECTED SPEED IN DETERMINING ETOPS AREA OF OPERATIONS
** OR ABOVE, IF REQUIRED BY OBSTACLE CLEARANCE, AND IF SUPPLEMENTARY OXYGEN IS AVAILABLE

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2. **Pressurization Failure**
   Same Flight Profile as above, but all engines operating and Diversion Cruise Speed* set to LRC.

3. **Engine Failure**
   Same Flight Profile as above, but standard descent speed and Diversion Cruise at the FL** appropriate to gross engine out ceiling at the selected ETOPS diversion speed.

FAA FUEL REQUIREMENTS

For the first two scenarios, involving depressurization, the required block fuel must be calculated in accordance with the operator's ETOPS fuel policy and using the regulatory ETOPS critical fuel reserves described on the page 5a.
Depending on the strategy and the one-engine-inoperative speed selected for the single-engine diversion strategy, 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.
It is not necessary to calculate the 3rd scenario (engine failure), as this scenario is never critical, due to the higher diversion flight level.

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: 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.

FAA ETOPS CRITICAL FUEL RESERVES

For the computation of the 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 at the alternate airport
· Fuel for 15 minutes of holding at 1500 feet and green dot speed at the alternate
· Fuel for an instrument approach and landing
· Fuel to account for errors in wind forecasting (5 % wind or 5 % fuel)
· Fuel to account for aircraft deterioration (demonstrated performance factor or 5 %)
· Fuel to account for any Configuration Deviation List (CDL) or MEL item
· Fuel to account for Icing Effects (if forecast) for the critical mission
· Fuel to account for APU use (if APU is a required power source)

Wind Errors

A 5 % wind speed factor (i.e. an increment to headwind or a decrement to tailwind) on the actual forecast wind should be used to account for potential errors. However if the operator is not using the actual forecast wind based on a wind model acceptable to the certification authorities then 5 % of the fuel for the critical scenario is required as a reserve fuel.

Icing

The most critical scenario must be compensated for the greater of :

(A) The effect of airframe icing during 10 % of the time during which icing is forecast, including ice accumulation on unproptected surfaces, and the fuel used by engine and wing anti-ice during this period.

(B) Fuel for engine and wing anti-ice for the entire time during which icing is forecast.

The effect of ice accretion on unprotected surfaces is equal in percentage to three times the exposure time in hours. For example, assuming a two-hour exposure time, the fuel provision is $3 \times 2 = 6$ % of the fuel burned during the considered exposure time. If moderate icing is forecast, the above fuel provision is divided by two.

Note : The ETOPS icing fuel reserve is always limited by (B).

Unless a reliable icing forecast is available, icing may be presumed to occur when the Total Air Temperature (TAT) is less than +10° C, or if the outside air temperature is between 0° C and –20° C with a relative humidity of 55 % or more.

APU

Fuel consumption of 80 kg/hr or 176 lb/hr (APU GEN ON, APU BLEED OFF).

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

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

R The operator must compare the entire ETOPS critical fuel planning for the ETOPS critical fuel
R scenario with the standard fuel planning computed in accordance with the company fuel
R policy and applicable operational requirements. The higher of the two fuel requirements
R 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

Weather forecasts for en route alternates must meet the operator's applicable weather
R minimun requirements. If the applicable requirement is AC 120-42A or AC 120-42B or AMC 20-6, the following applies :
An airplane cannot be dispatched unless the meteorological forecasts at en route alternate
R airports meet the weather minimums listed here for the applicable time window which is
R based on the earliest expected time of landing and the latest expected time of landing, with
R or without an additional margin as required by applicable regulation.

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 which do not touch each other.
DH : decision height
MDH : minimum descent height

R B. AC 120-42B dispatch weather minima
R

AIRPORT EQUIPMENT	Ceiling (ft)	Visibility (m)
1 ILS/MLS and Non precision approach	DH + 400	Published minima + 1600 m
2 ILS/MLS on different suitable runways	DH + 200	Published minima + 800 m
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	

R C. AMC 20–6 dispatch weather minima (EASA)

The operator must use either table 1 or table 2, but not a combination of both.

R 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 availabile 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, a diversion is required in case of :
— Blue hydraulic circuit low level, low air pressure or overheat, 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.

· Hydraulic system :
If low level, low air pressure or overheat on blue hydraulic circuit, a diversion is required in case of :
— One IDG failure, or
— APU no start, or
— APU/APU GEN failure.

· APU :
If APU/APU GEN fails, a diversion is required in case of :
— Blue hydraulic circuit low level, low air pressure or overheat, or
— One IDG failure.

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

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 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.

BLUE HYDRAULIC LOW LEVEL

Start the APU to ensure availability of the APU generator.

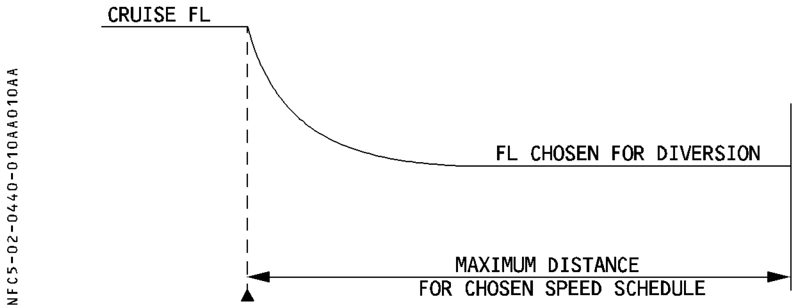
ENGINE OR IDG FAILURE

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



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 (kg)	MTOW (lb)	Distance (NM)
A320-111 CFM56-5A1	66000	145504	393
	68000	149913	390
A320-211/212 CFM56-5A1/A3	66000 to 67000	145504 to 147708	391
	68000 to 70000	149913 to 154322	388
	71500	157629	385
	73500	162038	382
	75500	166447	379
	77000	169754	376
A320-214 CFM56-5B4	70000	154322	406
	71500	157629	406
	73500 to 77000	162038 to 169754	397
A320–231 IAE V2500-A1	66000 to 68000	149913 to 154322	414
	70000 to 71500	154322 to 157629	411
	73500	162038	408
	75500	166447	405
	77000	169754	403
A320-232/233 IAE V2527-A5/ IAE V2527E-A5	70000	154322	410
	71500	157629	409
	73500	162038	407
	75500 to 78000	166447 to 171959	403

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

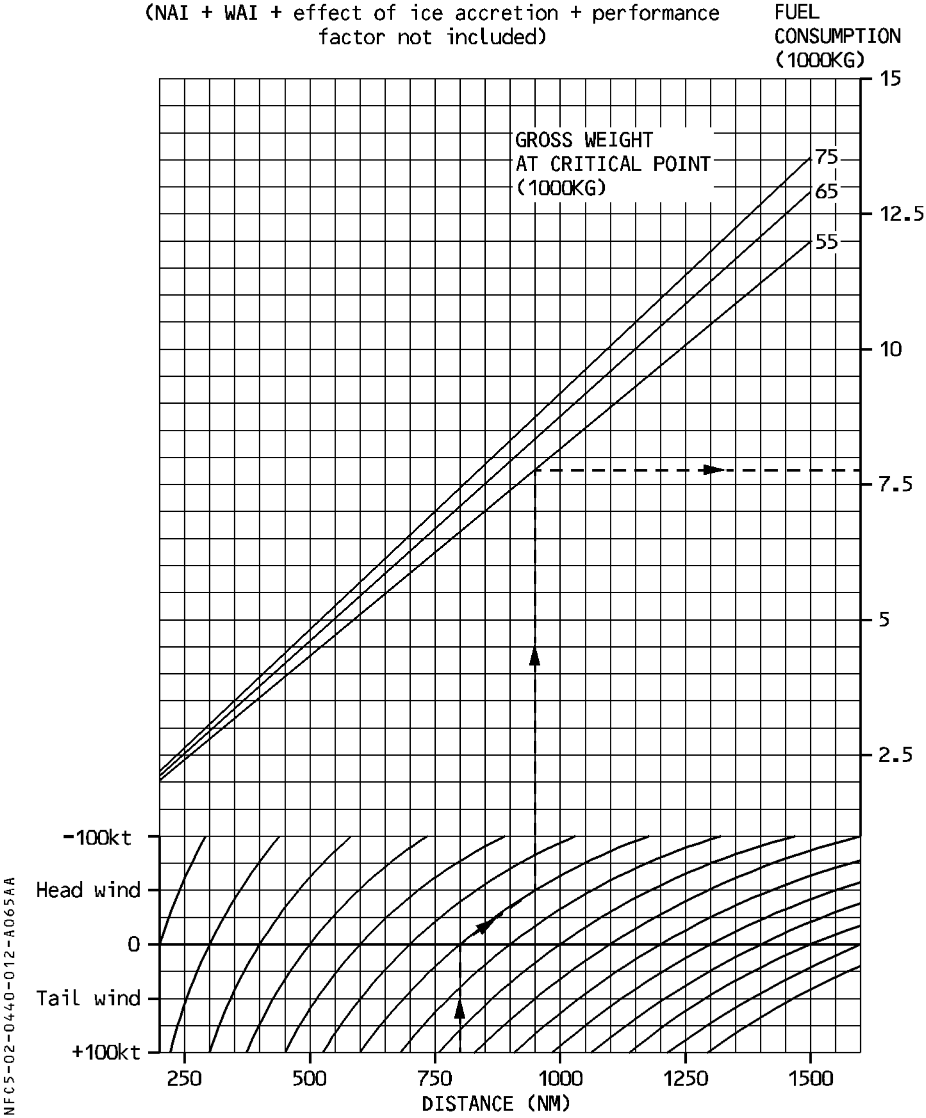
ISA							
SPEED SCHEDULE	A/C WEIGHT AT CRITICAL POINT (KG)	FL FOR DIVERSION	DIVERSION TIME (MIN)				
			60	90	120	150	180
MCT/VMO	50 000	160	414	616	818	–	–
	55 000	160	413	614	815	1017	1219
	60 000	160	412	612	812	1012	1213
	65 000	160	410	608	807	1007	1206
	70 000	160	408	605	802	1000	1198
	75 000	160	405	600	795	992	1188
MCT/320 KT	50 000	160	412	613	814	–	–
	55 000	160	412	613	814	1015	1215
	60 000	160	412	612	812	1012	1213
	65 000	160	410	608	807	1007	1206
	70 000	160	408	605	802	1000	1198
	75 000	160	405	600	795	992	1188

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	422	628	–	–	–
	55000	160	422	626	831	1036	1242
	60000	160	420	624	827	1032	1236
	65000	160	418	620	823	1026	1229
	70000	160	416	616	817	1019	1221
	75000	160	413	611	811	1010	1211
MCT/320KT	50000	170	421	626	831	–	–
	55000	160	421	626	830	1035	1239
	60000	160	420	624	827	1032	1236
	65000	160	418	620	823	1026	1229
	70000	160	416	617	818	1019	1221
	75000	160	413	612	811	1011	1211

R

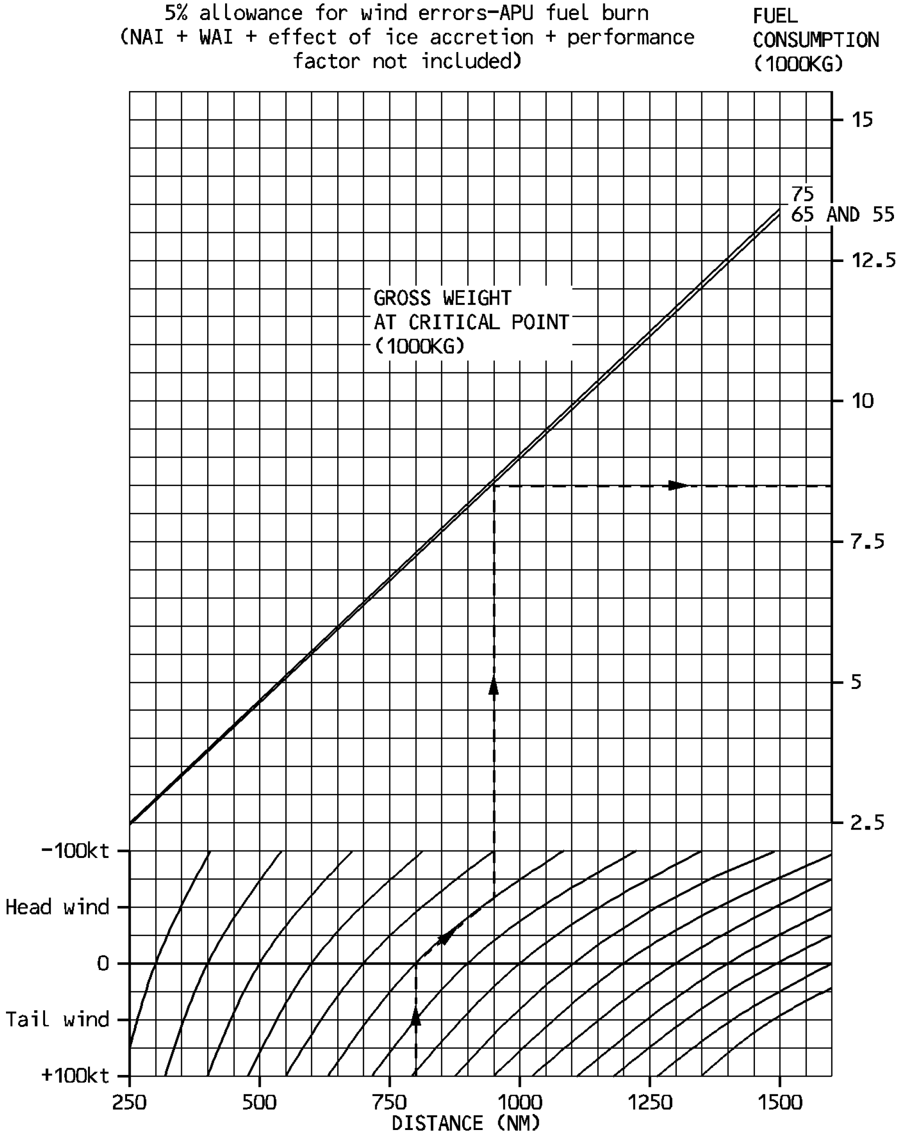
ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING
ALL ENGINES-LONG RANGE CRUISE

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)



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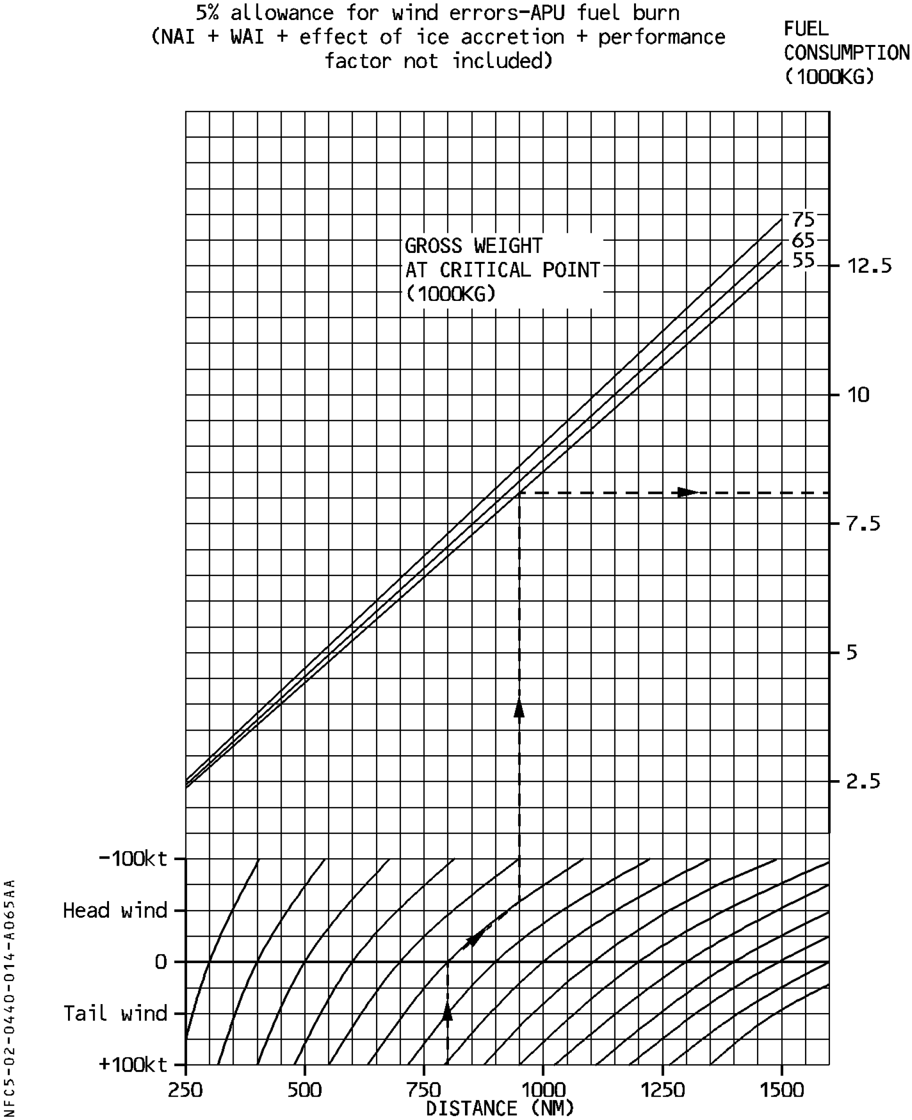
ETOPS FUEL REQUIREMENT FROM CRITICAL POINT TO LANDING ONE ENGINE OUT-CRUISE AT 320KT

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)



R **ENGINE INTERMIX TYPE 1**

GENERAL

R The following information provides the conditions and procedures necessary in order to
R temporarily operate an A318/A319/A320/A321 aircraft when a CFM56–5B Single Annular
R Combustor (SAC) engine is intermixed with a CFM56–5B Double Annular Combustor (DAC)
R engine.
R This engine intermix configuration is indicated in the cockpit with the following placard :
R "CAUTION : ENGINE INTERMIX TYPE 1".

ENGINE PARAMETERS

Engine parameters differ significantly, when the engines are at idle :
EGT : Up to 250° C higher on the DAC engine.
FUEL FLOW : Up to 25 % higher on the DAC engine.
N1 : Higher on the DAC engine.
N2 : Lower on ground on the DAC engine, higher in flight on the DAC engine.

CROSSBLEED ENG START

The DAC engine has insufficient acceleration capability to sustain idle speed with a large bleed offtake, when it operates with only 20 injectors. Therefore, it is necessary to preset a 30 % N1 on the supplying engine before launching the start sequence.

TAKEOFF PROCEDURE

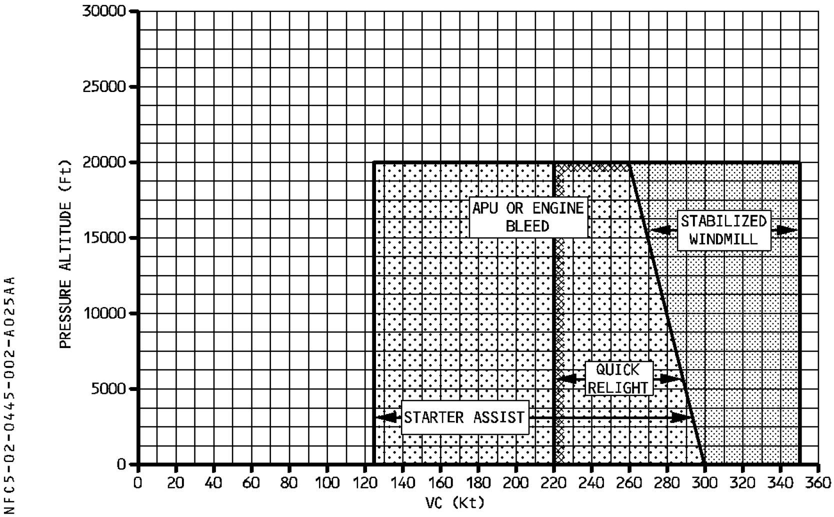
– The PF must progressively adjust engine thrust in two steps :
  · Step 1 : Idle to 50 % N1.
    Brakes released, when the 50 % N1 is stabilized on both engines.
  · Step 2 : Both engines N1 to takeoff thrust.
  This procedure enables a significantly slower acceleration from ground idle to N1 = 50 % for the double annular combustor.
– Other standard operative procedures apply for takeoff.

ENGINE RESPONSE

In flight, when the aircraft is in clean configuration, the DAC engine may accelerate from idle more slowly than the SAC engine. This is particularly evident, if the acceleration follows a deceleration. There is no significant effect on aircraft handling. This difference in engine response disappears when the slats are extended.

ENGINE RELIGHT

R The DAC engine relight envelope is more restrictive than the SAC engine relight envelope.
R Therefore, in the case of an engine intermix, the flight crew must use the DAC engine
R relight procedure with the corresponding chart (see chart below).



ENGINE INTERMIX TYPE 2

GENERAL

The following information provides the conditions and procedures necessary in order to temporarily operate an A318/A319/A320/A321 aircraft when a CFM 56–5B/P SAC (Single Annular Combustor) engine is intermixed with a CFM56–5B/3 TI (Tech Insertion) engine. This engine intermix configuration is indicated in the cockpit with the following placard : "CAUTION : ENGINE INTERMIX TYPE 2".

ENGINE PARAMETERS

In the case of only one operative pack configuration (only one pack OFF) :

N1 : At idle up to 9 % higher on the CFM56-5B/3 TI engine, on ground or in flight in clean configuration.

N2 : At idle up to 11 % higher on the CFM56-5B/3 TI engine, on ground or in flight in clean configuration.

TAKEOFF PROCEDURE

In the case of only one operative pack configuration, due to the difference in N2 at idle between engines, the following takeoff procedure is recommended :

– The PF progressively adjusts engine thrust in two steps :
  · Step 1 : From idle to about 50 % N1 on brakes.
  · Step 2 : From both engines at similar N1 to takeoff thrust after brakes release.
– Other standard operative procedures apply for takeoff.

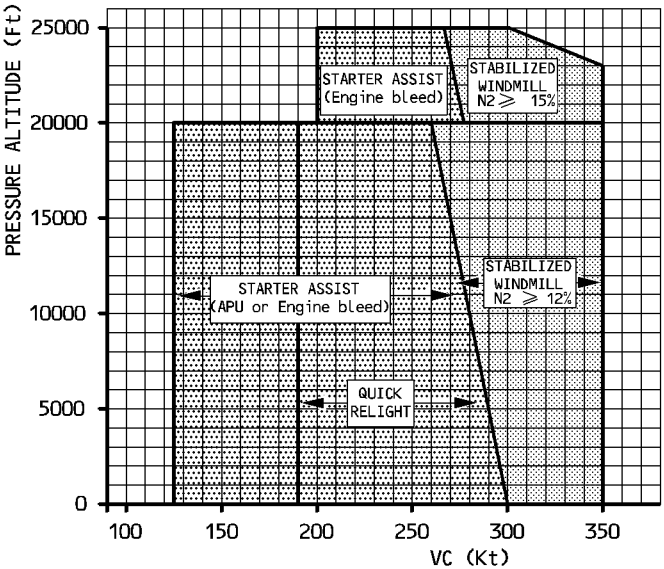
ENGINE RESPONSE

In the case of only one operative pack configuration, due to the difference in N2 at idle between engines, the CFM56–5B/3 TI engine may accelerate from idle to high thrust faster than the CFM56–5B/P SAC engine when the aircraft is on ground or in flight in clean configuration. There is no significant effect on aircraft handling.
The difference in engine response disappears in flight when the slats are extended.

Note : Depending on the FADEC standard, the flight crew may observe a different deceleration between the two engines (CFM56–5B/P engine is faster to decelerate) when the aircraft is above FL100 and in unsymmetrical bleed configuration or with the APU BLEED ON.

ENGINE RELIGHT

For the CFM56-5B/3 TI engine, the maximum altitude for the engine relight envelope is reduced, compared to the CFM56–5B/P SAC engine. Therefore, in the case of an engine intermix, the flight crew must use the following engine relight envelope :



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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 %.
An RNP value can be associated with an airspace, a route, a SID, a STAR, a RNAV approach, or an RNAV missed approach procedure.
Depending on the RNP value, and on 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) and P-RNAV (RNP-1) capability meets the certification requirements of JAA TGL 2 and TGL 10. Terminal and en-route RNAV operations comply with the certification requirements of the FAA Advisory Circular 90-100.
R RNP-4 capability in oceanic or remote areas complies with FAA Notice 8400.33.
RNP-10 capability in oceanic or remote areas complies with paragraph 12.b (1) of FAA Notice 8400.12a., or with paragraph 12.a. or 12.b (5), if GPS is installed and is operative.
Navigation system with the GPS PRIMARY function (if GPS installed) meets the 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

NO CHANGE

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 %.
An RNP value can be associated with an airspace, a route, a SID, a STAR, a RNAV approach or a RNAV missed approach procedure.
Depending on the RNP value, and on 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) and P-RNAV (RNP-1) capability meets the certification
R requirements of JAA TGL 2 and TGL 10. Terminal and en-route RNAV operations comply
R with the certification requirements of the FAA Advisory Circular 90-100.
RNP-10 capability in oceanic or remote areas complies with paragraph 12.b (1) of FAA Notice 8400.12a., or with paragraph 12.a. or 12.b (5), if GPS is installed and is operative.
Navigation system with the GPS PRIMARY function (if GPS installed) meets the 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. Obviously, this is 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 a default value, which is either a function of the flight phase, or a navigation database procedure value, or a value manually entered by the crew.
When flying in an 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 to be fulfilled.
- When LOW is displayed, the RNP requirement is estimated not fulfilled. In this case :
  - The crew crosschecks navigation with raw data, if available,
  - If the crosscheck is negative, or if raw data is unavailable, the crew informs the ATC.

When leaving the RNP environment, the crew will clear the manually-entered required accuracy.

Without GPS PRIMARY function

RNP accuracy criteria are met, provided radio navaid coverage supports it for :

- RNP-1 en route and in the terminal area, provided a required accuracy of 1NM(1) is checked, or manually entered in the MCDU.
- RNP-0.3 in approach, provided a required accuracy of 0.3NM(1) is checked, or manually entered in the MCDU.

Note : (1) It is possible to enter the radial equivalent to the specified Crosstrack (XTK) accuracy, that is the RNP multiplied by 1.2, the EPE being an estimated radial position error.

With the GPS PRIMARY function

RNP requirements are met, provided GPS PRIMARY is available, for :

- RNP-1 en route
- RNP-0.5 in the terminal areas, provided the AP or FD in NAV mode is used.
- RNP-0.3 in approach, provided the AP or FD in NAV mode is used.

BRNAV IN EUROPEAN AIRSPACE

In this airspace, 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
  - R · One VOR or one GPS receiver for FM navigation update
  - R · One DME or one GPS receiver for FM navigation update
  - · One IRS
- Flight Plan Data on two NDs.

PROCEDURES

When GPS PRIMARY is not available, periodically crosscheck the FM position with navaid raw data.
Manual selection of a required accuracy on the MCDU is optional.

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

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NO CHANGE

R **RNP-4 OR 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.
R The minimum required equipment to enter a RNP-4/RNP-10 airspace is :
R — Two long range navigation systems, which mean :
R · Two FMGC (or 1 FMGC + 1 BACK UP NAV)
R · Two MCDU
R · For RNP-10, one GPS if required by flight time outside radio navaid coverage. For
R aircraft without GPS the flight time outside radio navaid coverage is limited. According
R to FAA Notice 8400.12A, this limitation is :
R ∗ 6.2 hours since IRS ground alignment, or
R ∗ 5.7 hours since last FM radio update.
R There is no limitation for aircraft fitted with GPS.
R For RNP-4, two GPS are required.
R · Two IRS
R Refer also to Regional Supplementary Procedures of ICAO Doc 7030 for specific
R requirements in a particular airspace.

PROCEDURES

R The manual selection of a required accuracy on MCDU is optional.
R — If a manual entry of a required accuracy is desired, the flight crew must manually enter:
R · For RNP-10, enter 10NM or use the radial equivalent to 10NM XTK accuracy that is
R 12.2NM.
R · For RNP-4, enter 4NM or use the radial equivalent to 4NM XTK accuracy that is 4.9NM.

- If one of the following MCDU or ECAM messages is displayed, check navigation accuracy with the navaid raw data, or with the GPS MONITOR page (if GPS installed):
  · NAV ACCUR DOWNGRAD
  · FMS1/FMS2 POS DIFF
  · CHECK IRS 1(2)(3)/FM POSITION
  · ECAM : FM/GPS POS DISAGREE (if GPS installed)
- If the accuracy check confirms that RNP-5 capability is lost, or if both FMGCs have failed : Inform the ATC, and revert to conventional navigation.
- If the accuracy check confirms that only one FMGC position is incorrect, resume navigation with the other FMGC.

In inertial navigation, BRNAV capability is maintained for 2 hours, independently of the estimated accuracy displayed on the 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, 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 the last the FM radio update.

There is no limitation for aircraft fitted with the GPS.
Minimum required equipment to enter RNP-10 airspace is :
- Two long range navigation systems, which means :
  · Two FMGC
  · Two MCDU
  · One GPS required by flight time outside radio navaid coverage
  · Two IRS

Also refer to the Regional Supplementary Procedures (ICAO Doc 7030) for specific requirements in a particular airspace.

PROCEDURES

Manual selection of a required accuracy on the MCDU is optional.
- If manual entry of a required accuracy is desired, enter 10NM or use the radial equivalent to 10NM XTK accuracy, that is 12.2NM.

When leaving RNP-10 airspace, revert to the default required accuracy or enter the appropriate value.

— If one of the following MCDU or ECAM messages is displayed, check navigation with
R POSITION MONITOR page, ISDU or IRS 1(2)(3) pages, and GPS MONITOR page (if GPS installed) :
  · FMS1/FMS2 POS DIFF
  · CHECK IRS 1(2)(3)/FM POSITION
  · ECAM : FM/GPS POS DISAGREE (if GPS installed)
— Use the AP, with the navigation system checked correct.
— If unable to determine which system is correct, inform the ATC, and look for navaid raw data confirmation as soon as possible.

In inertial navigation, the RNP-10 capability is maintained for 5.7 hours, since the last radio update (according to FAA Notice 8400.12A), independently of the estimated accuracy displayed on the MCDU.

R **P-RNAV/RNP-1 TERMINAL PROCEDURES**

R For terminal procedures requiring P-RNAV or RNP-1 capability, the flight crew can assume
R that the radio navaid coverage supports the RNP-1 accuracy. Otherwise, the procedure may
R specify that GPS equipment is required (refer to the published procedure chart). The
R minimum equipment required to fly a P-RNAV or RNP-1 procedure is :
R — One RNAV system, which includes :
R   · One FMGC
R   · One MCDU
R   · One GPS receiver, or one VOR and one DME, for FM navigation update*
R   · One IRS, and
R   · One FD in NAV mode.
R — Flight Plan data displayed on both NDs.
R *GPS may be required for RNP-1 terminal procedures.
R For terminal procedures with legs below the MSA, or with legs that may not have sufficient
R radar coverage, two RNAV systems may be mandated by the procedure chart.

R **PROCEDURES**

R The terminal procedure (RNAV SID, RNAV STAR, RNAV TRANSITION, ...) must be loaded
R from the FM navigation database and checked for reasonableness, by comparing the
R waypoints, tracks, distances and altitude constraints (displayed on the F-PLN page), with
R the procedure chart.
R The flight crew must not modify the procedure, that is loaded from the navigation database,
R unless instructed to do so by the ATC (DIR TO, radar vectoring, insertion of waypoints
R loaded from the navigation database).

R When leaving RNP airspace, revert to the default required accuracy or enter the appropriate value.

NO CHANGE

In inertial navigation, the RNP-10 capability is maintained for 5.7 hours, since the last radio update (according to FAA Notice 8400.12A), independently of the estimated accuracy displayed on the MCDU.

R For RNP-4 with GPS PRIMARY LOST, the RNP-4 capability is maintained until NAV ACCUR
R DOWNGRAD appears.

P-RNAV/RNP-1 TERMINAL PROCEDURES

NO CHANGE

- **If GPS is required for the P-RNAV/RNP-1 procedure :**
  - Before starting the departure/approach procedure, check that GPS PRIMARY is available (GPS PRIMARY displayed on the MCDU PROG page).
  - If GPS PRIMARY is not available before starting the procedure, inform the ATC, and request another departure/arrival procedure that does not require GPS.
  - If GPS PRIMARY is lost while flying the procedure, inform the ATC of this loss of capability, and follow ATC instructions.

- **If GPS is NOT required for the P-RNAV/RNP-1 procedure :**
  - Check that GPS PRIMARY is available (GPS PRIMARY displayed on the MCDU PROG page).

  IF GPS PRIMARY is not available :
  - Crosscheck the FM position with the navaid raw data, before starting the procedure.
  - Check or enter RNP-1 in the REQUIRED field of the MCDU PROG page, and check that HIGH accuracy is available. When completing the terminal procedure, revert to the default value or enter the appropriate value on the MCDU PROG page.

  If one of the following messages appears, while flying the procedure :
  - "NAV ACCUR DOWNGRAD" (on MCDU and ND) on both sides, or
R - "FMS1/FMS2 POS DIFF" (on MCDU), or
R - "CHECK IRS 1(2)(3)/FM POSITION" (on MCDU), or
R - "NAV FM/GPS POS DISAGREE" (on ECAM, if GPS installed)

  Then :
  - Inform the ATC of the loss of P-RNAV/RNP-1 capability, and follow ATC instructions.

  Note : *If the "NAV ACCUR DOWNGRAD" message is displayed on one side only, navigation may be continued using the other FMGC.*

RNP AR OPERATIONS

GENERAL

For RNP AR (SAAAR or equivalent) operations, the flight crews should refer to the specific procedures published by the airline.
The airline must obtain an operational approval and the flight crews must be qualified for this type of operations. To obtain this operational approval the airline should refer to the AFM and the associated Airworthiness Compliance Document (ACD). The approved RNP values are given in the AFM and the ACD.
The main procedure steps for RNP AR have been introduced in the SOP of FCOM Volume 3 and in the paragraph below. This does not relieve the airline from the need to provide the flight crews with tailored procedures when required.

REQUIRED EQUIPMENT

2 FMGC (2 FM required for RNAV approach)
2 MCDU
2 FD
1 AP, but 2 AP if RNP 0.3 or less is required in go around or departure
4 EFIS DU with 2 L/DEV and 2 V/DEV displays and RNP P/B
2 GPS (MMR) (2 GPS required for RNAV approach)
3 IRS (2 IRS for a departure)
EGPWS if obstacles
FCU with both channels

PROCEDURES

The availability of GPS PRIMARY for the estimated time of operation must be verified with an appropriate GPS prediction tool prior to dispatch.
Prior starting an RNP AR instrument procedures, check that :
- OAT and wind, as applicable, are within limits,
- The nearby navaids are deselected as necessary to avoid VORDME radio update if GPS PRIMARY is lost.
- The FMS lateral and vertical F-PLN extracted from the navigation database is in agreement with the instrument procedure chart.
- Two GPS sensors are in NAV on GPS MONITOR page
- The correct RNP value is displayed on MCDU with HIGH accuracy,
- GPS PRIMARY is available,
- Select the RNP P/B to ON, to get L/DEV indication on PFD.

For operations with RNP<0.3 NM, one AP must be engaged.
If obstacles, EGPWS TERRAIN display must be selected on both ND unless weather radar monitoring is required on one side.
Airspeed and configuration must be adapted for the radii of turns in the procedure.

Departure :

Before takeoff check that NAV is armed.
When NAV is indicated active on FMA and at 100 ft select AP ON.
Monitor lateral deviation using the L/DEV on PFD.
Callout must be performed when L/DEV 1/2 RNP or 1 dot is reached.
If L/DEV increases towards 1 RNP or 2 dots, take over manually using FD and the L/DEV indication to fly back on the intended flight plan and reengage AP as applicable.

Approach :

Verify altimeters after IAF but before the point where FINAL APP will activate and check that the difference between both indications is less than 75 ft.
The FINAL APP mode must activate before the FAF or any earlier defined waypoint indicated on the approach chart.
Monitor the L/DEV and V/DEV indications on PFD.
Callouts must be performed when
– V/DEV ±50 ft is reached or
– L/DEV reaches 1/2 RNP or 1 dot.
Go around must be initiated if
– V/DEV –75 ft is reached or if
– L/DEV reaches 1 RNP or 2 dots.

Go Around :

With this standard of FMGC, GA TRACK mode will automatically activate at Go Around initiation. Therefore the PF must immediately reengage the NAV mode to remain on the FMS flight plan. This is essential if the go around is initiated during a turn.

Abnormal operations :

Detailed information is given in the ACD for the airline to develop contingency procedures adapted to each operation.
The flight crews must be trained to conduct departure or missed approach procedures with systems failures to ensure a safe extraction.
For approach, the following aply :
The RNP AR approach procedure should be continued in case of single failure of :
– GPS (MMR)
– FMGS
– EFIS DU
– MCDU
– AP (autopilot)

The RNP AR approach procedure must be discontinued in case of :
- Dual loss of GPS PRIMARY
- Dual NAV ACCUR DOWNGRAD
- FM/GPS POSITION DISAGREE
- FMS1/FMS2 POS DIFF
- Dual loss of FMGC or dual loss of FINAL APP mode
- Dual AP failure if the RNP<0.3
- Loss of EGPWS TERRAIN if obstacles or TERRAIN inconsistencies
- NAV ALT DISCREPANCY

Engine failure :

With this aircraft definition, if one engine fails in approach with NAV or FINAL APP mode, the AP must be disconnected, therefore :
- If RNP<0.3 a Go Around must be performed
- If RNP=0.3, the approach can be continued with FD

In case of engine failure during departure or a missed approach procedure, the flight crew must take into consideration the bank angle limitation when flying at a speed lower than the maneuvering speed. Turns in the procedure may require bank angle higher than 15°.
Flying with one engine inoperative affects the aircraft lateral performance. The crew should be trained and instructed to disconnect AP should the aircraft deviate from the intended track.
This training must consider turning and straight legs as appropriate.

GENERAL

A standard runway is 45 meters wide. Operations on runways less than 45 meters wide require authorization from the Airworthiness Authorities.

05.00 CONTENTS

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 **11.5 kg/min** or **25 lb/min**
Average quantity (12 minutes) → **140 kg** or **300 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 **20 kg/min** or **45 lb/min**.
  Average quantity (6 minute IFR) → **120 kg** or **270 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 **100 kg** or **220 lb** , climb to cruising level, cruise at long range speed, descent and approach procedure.
80 kg or 180 lb for 4 minute VFR

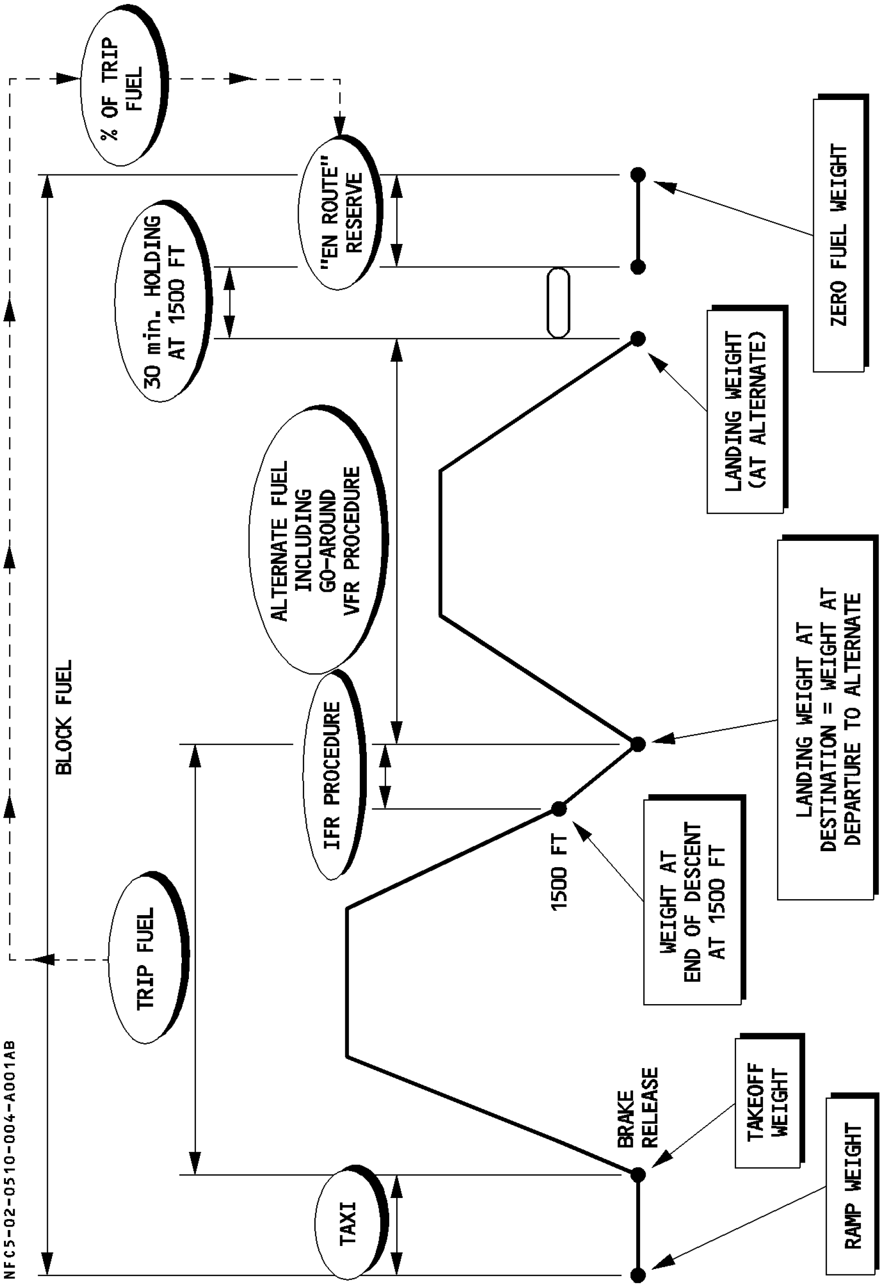
Holding Fuel
Calculation of holding fuel should take into account the altitude of the alternate and the landing weight at the alternate, using holding charts of chapter 3.05.25.
A conservative quantity corresponding to a 30 minute holding at 1500 feet above alternate airport elevation at "green dot" speed in the clean configuration is
1200 kg or **2700 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
ZERO FUEL WEIGHT
LANDING WEIGHT (AT ALTERNATE)
ALTERNATE FUEL INCLUDING GO-AROUND VFR PROCEDURE
BLOCK FUEL
IFR PROCEDURE
LANDING WEIGHT AT DESTINATION = WEIGHT AT DEPARTURE TO ALTERNATE
1500 FT
WEIGHT AT END OF DESCENT AT 1500 FT
TRIP FUEL
BRAKE RELEASE
TAKEOFF WEIGHT
RAMP WEIGHT
TAXI
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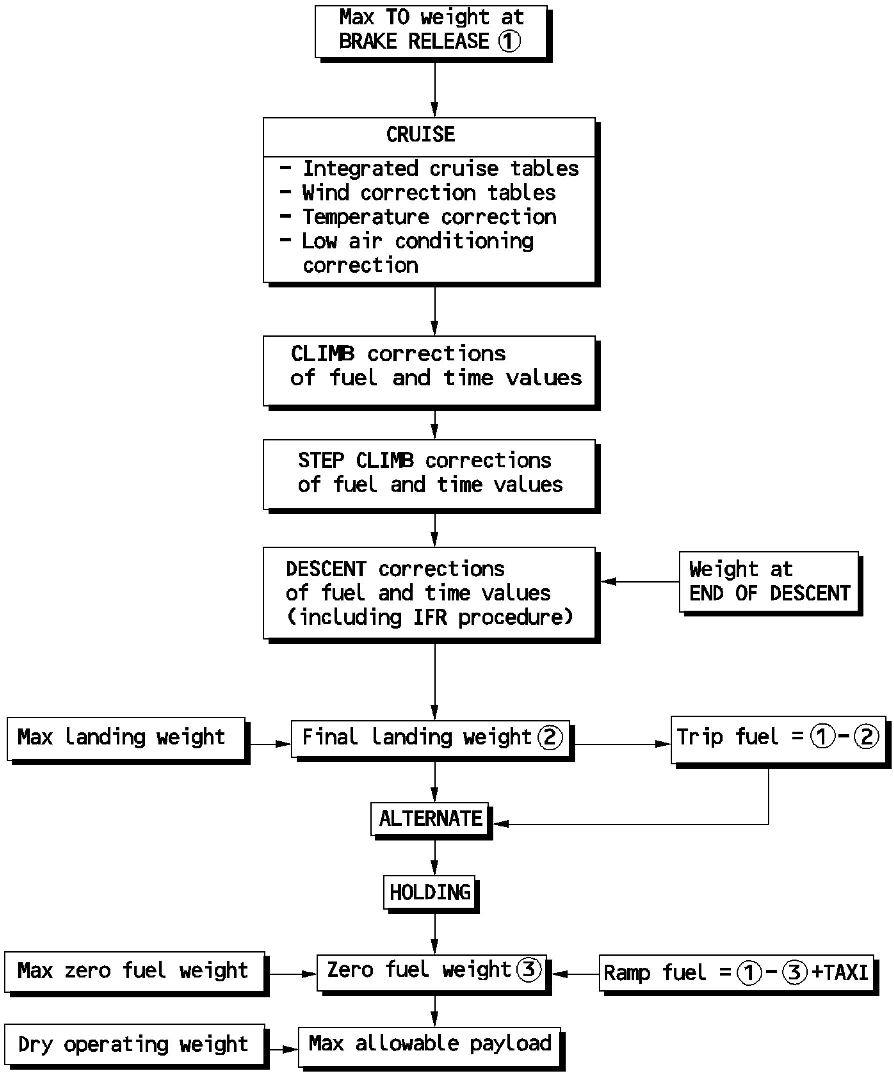
GENERAL



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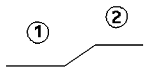
The following tables can be used for the flight planning.
The first table allows the planner to calculate fuel and time during cruise, with a possible step climb (see p 3).
The second table shows the fuel and time planning for the whole flight plan (see p 4).
At the end of the section an example shows how to use both tables for a given mission.
Following tables have been calculated using databases for CFM 56–5–B /P SAC. If the engines fitted on the aircraft are not /P, the fuel consumption has to be increased by 3 %.

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 : 5599 NM → time : 747 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 : 3759 NM → time : 502 min

E : Calculate the values for the first cruise segment :

R	Fuel	: 72000 – 62000 = 10000 kg
R	Distance	: 5599 – 3759 = 1840 NM
R	Time	: 747 – 502 = 245 min
R	Remaining distance	: 2248 – 1840 = 408 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 : 4050 NM → time : 543 min

R G : Subtract remaining distance : 4050 – 408 = 3642 NM

H : Interpolate in integrated cruise table (M.78, FL390) the weight and time values corresponding to the distance of 3642 NM
→ weight : 60000 kg → time : 489 min

I : Calculate values for the second cruise segment :
R Fuel : 62000 – 60000 = 2000 kg
R Distance : 4050 – 3642 = 408 NM
R Time : 543 – 489 = 54 min
Crosscheck that remaining air distance equals zero.

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

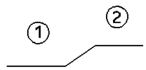
K : Calculate total values :
Fuel : 72000 – 60000 = 12000 kg
R Time : 245 + 54 = 299 min = 4 h 59 min

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:	5599 NM
TIME:	747 Min

START OF STEP CLIMB	
WEIGHT:	62000 Kg
DISTANCE:	3759 NM
TIME:	502 Min

1

FUEL:	10000 Kg
DISTANCE:	1840 NM
TIME:	245 Min
REMAINING DISTANCE:	408 NM

FL: 390

BEGIN OF FINAL CRUISE SEGMENT	
WEIGHT:	62000 Kg
DISTANCE:	4050 NM
TIME:	543 Min

OVERHEAD DESTINATION	
WEIGHT:	60000 Kg
DISTANCE:	3642 NM
TIME:	489 Min

2

FUEL:	2000 Kg
DISTANCE:	408 NM
TIME:	54 Min
REMAINING DISTANCE :	0 NM

REMAINING DISTANCE: 408 NM

TOTAL VALUES	
WEIGHT OVERHEAD DEPARTURE:	72000 Kg
WEIGHT OVERHEAD DESTINATION:	60000 Kg
FUEL:	12000 Kg
TIME:	299 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 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 : 50 kg (enter 0.1 into table)
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) → 200 kg
10 : Calculate landing weight at destination → 58800 kg
R 11 : Subtract alternate fuel, e.g. : 100 NM at FL100
R (see 2.05.50 P 2) → 986 kg
R Landing weight at alternate → 58800 – 986 = 57814 kg
R Correction due to deviation from reference landing weight at alternate (see
R 2.05.50 p 2) → 6 × (57.8 – 55) = 16.8 kg
R Corrected alternate fuel → 1003 kg
12 : Calculate alternate landing weight → 57800 kg
R 13 : Subtract holding fuel (Refer to 3.05.25) → 1094 kg
R 14 : Calculate weight at end of holding → 56700 kg
15 : Calculate trip fuel → 13200 kg
16 : Subtract "En Route" reserve (standard amount is 5 % of trip fuel) → 660 kg
R 17 : Calculate zero fuel weight → 56000 kg
18-19 : Subtract dry operating weight to obtain maximum allowable payload.
R 20-22 : Calculate ramp fue (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	•	2
10	(2) Landing Weight at Destination		=		5	8	•	8
11	– ALTERNATE Fuel		–			1	•	0
12	= ALTERNATE Landing Weight		=		5	7	•	8
13	– HOLDING		–			1	•	1
14	= Weight at END OF HOLDING		=		5	6	•	7
15	TRIP FUEL (1) – (2)	1 3 • 2	//////////////					
16	– "En Route" Reserve		–			0	•	7
17	(3) ZERO FUEL WEIGHT		=		5	6	•	0
18	– OPERATING WEIGHT EMPTY		–		4	1	•	3
19	= Max Allowable Payload		=		1	4	•	7

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	▶		4	•	9	9
24	+ CLIMB Correction	+		0	•	0	5
25	+ DESCENT Correction (including 6 min IFR)	+		0	•	1	0
26	= Flight Time	=		5	•	1	4

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.

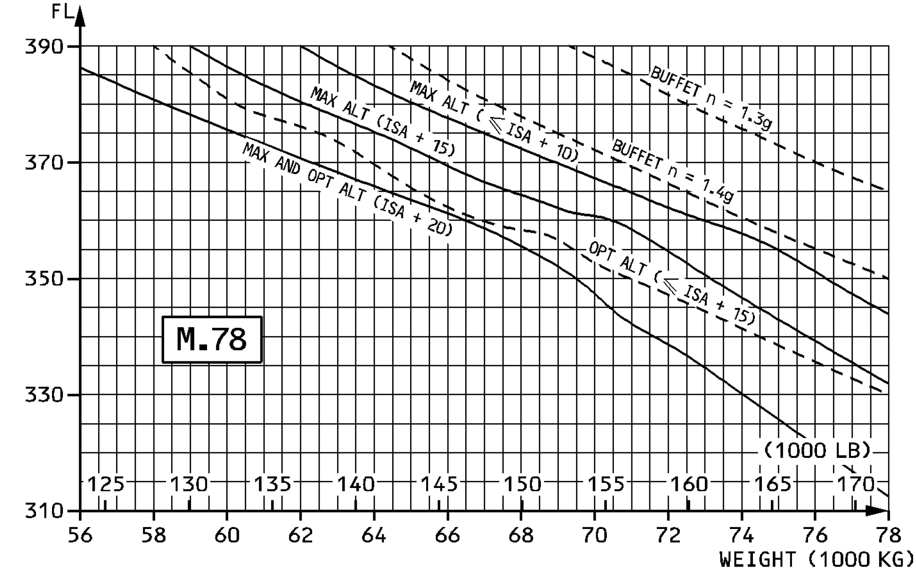
R
OPTIMUM WEIGHT FOR 4000 FEET STEP CLIMB
R

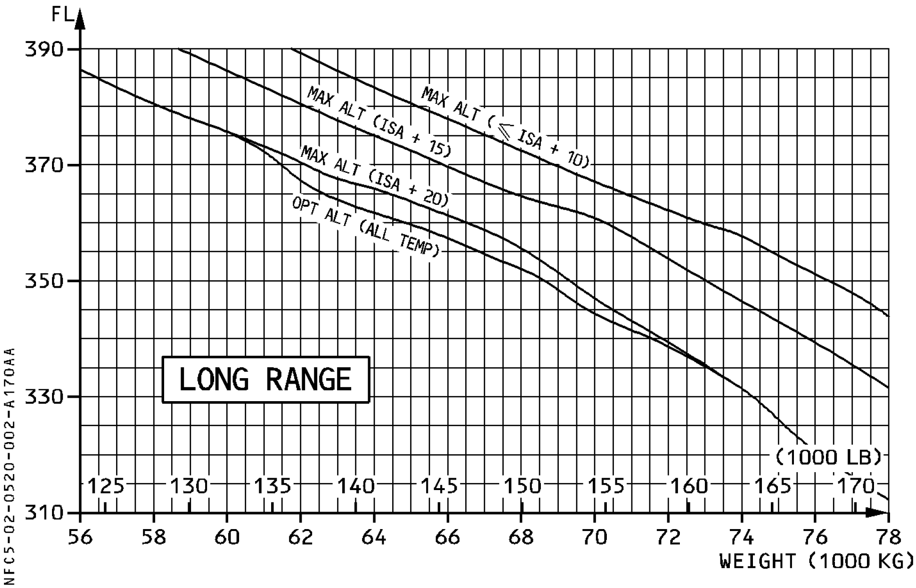
STEP CLIMB FROM/TO	WEIGHT (1000 kg/1000 lb)					
	≤ ISA + 10		ISA + 15		ISA + 20	
	LR	M.78	LR	M.78	LR	M.78
310/350	76/167	76/167	73/160	73/160	69/152	69/152
330/370	69/152	69/152	66/145	66/145	62/136	62/136
350/390	62/136	62/136	59/130	59/130	55/121	55/121

BLEED CORRECTIONS

	ENGINE ANTI ICE	TOTAL ANTI ICE
ISA	Max Alt. : – 200 ft Opt Alt. : – 200 ft	Max Alt. : – 500 ft Opt Alt. : – 300 ft
ISA + 10	Max Alt. : – 1500 ft Opt Alt. : – 400 ft	Max Alt. : – 4200 ft Opt Alt. : – 3100 ft
ISA + 15	Max Alt. : – 3500 ft Opt Alt. : – 3500 ft	Max. Alt. : – 4800 ft Opt Alt. : – 4300 ft
ISA + 20	Max Alt. : – 5300 ft Opt Alt. : – 3800 ft	Max Alt. : – 6500 ft Opt Alt. : – 6200 ft

R


FL
390
370
350
330
310
BUFFET n = 1.3g
BUFFET n = 1.4g
MAX ALT (≤ ISA + 10)
MAX ALT (ISA + 15)
MAX AND OPT ALT (ISA + 20)
OPT ALT (≤ ISA + 15)
M.78
(1000 LB)
125
130
135
140
145
150
155
160
165
170
56
58
60
62
64
66
68
70
72
74
76
78
WEIGHT (1000 KG)


FL
390
370
350
330
310
MAX ALT (≤ ISA + 10)
MAX ALT (ISA + 15)
MAX ALT (ISA + 20)
OPT ALT (ALL TEMP)
LONG RANGE
(1000 LB)
125
130
135
140
145
150
155
160
165
170
56
58
60
62
64
66
68
70
72
74
76
78
WEIGHT (1000 KG)
NFC5-02-0520-002-A170AA

OPTIMUM ALTITUDE ON SHORT STAGE

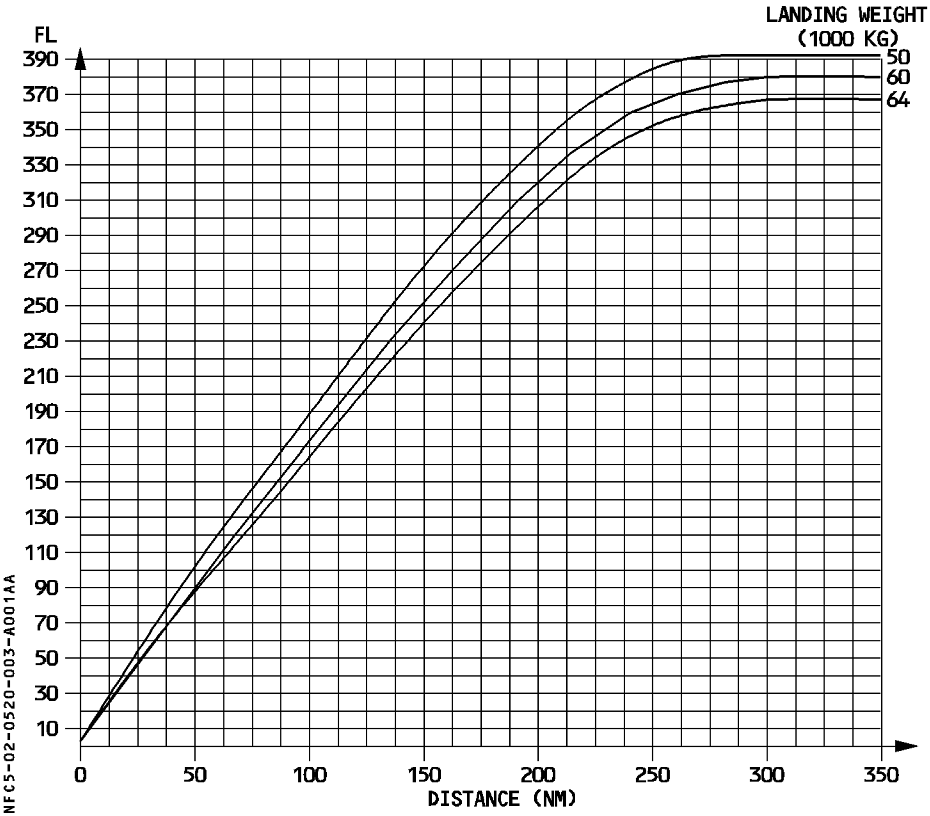
According to the air distance (from brake release point to landing), the cruise flight level is limited by the distance required to perform climb and descent. The graph determines the optimum altitude.

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**
44	0 0	36 5	72 9	108 14	144 19	180 23	216 28	252 33	288 37	323 42
46	359 47	395 51	431 56	467 61	502 65	538 70	574 75	610 79	645 84	681 88
48	717 93	752 98	788 102	823 107	859 112	894 116	930 121	965 125	1001 130	1036 135
50	1072 139	1107 144	1142 148	1178 153	1213 158	1248 162	1283 167	1319 171	1354 176	1389 181
52	1424 185	1459 190	1494 194	1529 199	1564 203	1599 208	1634 212	1669 217	1704 221	1739 226
54	1774 231	1809 235	1844 240	1878 244	1913 249	1948 253	1983 258	2017 262	2052 267	2087 271
56	2121 276	2156 280	2190 285	2225 289	2259 294	2294 298	2328 303	2363 307	2397 312	2432 316
58	2466 320	2500 325	2534 329	2569 334	2603 338	2637 343	2671 347	2705 352	2740 356	2774 360
60	2808 365	2842 369	2876 374	2910 378	2944 383	2978 387	3011 391	3045 396	3079 400	3113 405
62	3147 409	3180 413	3214 418	3248 422	3281 426	3315 431	3348 435	3382 440	3415 444	3449 448
64	3482 453	3516 457	3549 461	3582 466	3616 470	3649 474	3682 479	3715 483	3749 487	3782 491
66	3815 496	3848 500	3881 504	3914 509	3947 513	3980 517	4013 522	4046 526	4078 530	4111 534
68	4144 539	4177 543	4209 547	4242 551	4275 556	4307 560	4340 564	4372 568	4405 573	4438 577
70	4470 581	4502 585	4535 589	4567 594	4599 598	4632 602	4664 606	4696 610	4728 614	4760 619
72	4792 623	4824 627	4856 631	4888 635	4920 639	4952 644	4984 648	5016 652	5047 656	5079 660
74	5111 664	5143 668	5174 672	5206 677	5237 681	5269 685	5300 689	5332 693	5363 697	5394 701
76	5426 705	5457 709	5488 713	5519 717	5551 721	5582 725	5613 729	5644 733	5675 738	5706 742
LOW AIR CONDITIONING △FUEL = − 0.5 %			**ENGINE ANTI ICE ON** △FUEL = + 2 %				**TOTAL ANTI ICE ON** △FUEL = + 4.5 %		

11.0 -08F0A320-214 CFM56-5B4/P SA22100000C5KG330 0 018590 0 0 1 1.0 .0 .00 02901 . 780 .000 .000 0 FCOM-N0-02–05–30-002-180

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
44	0 0	39 5	77 10	116 15	155 20	193 25	232 30	270 35	309 40	347 46
46	386 51	424 56	462 61	501 66	539 71	577 76	615 81	654 86	692 91	730 96
48	768 101	806 106	844 111	882 116	920 121	958 126	996 131	1034 136	1072 140	1110 145
50	1147 150	1185 155	1223 160	1260 165	1298 170	1336 175	1373 180	1411 185	1449 190	1486 195
52	1524 200	1561 205	1598 210	1636 214	1673 219	1711 224	1748 229	1785 234	1822 239	1859 244
54	1897 249	1934 254	1971 258	2008 263	2045 268	2082 273	2119 278	2156 283	2193 287	2230 292
56	2266 297	2303 302	2340 307	2377 312	2413 316	2450 321	2486 326	2523 331	2559 336	2596 340
58	2632 345	2669 350	2705 355	2741 359	2778 364	2814 369	2850 374	2886 378	2922 383	2958 388
60	2995 393	3031 397	3066 402	3102 407	3138 411	3174 416	3210 421	3246 426	3281 430	3317 435
62	3353 440	3388 444	3424 449	3460 454	3495 458	3531 463	3566 467	3601 472	3637 477	3672 481
64	3707 486	3742 491	3778 495	3813 500	3848 504	3883 509	3918 514	3953 518	3988 523	4023 527
66	4058 532	4092 536	4127 541	4162 546	4196 550	4231 555	4265 559	4300 564	4334 568	4369 573
68	4403 577	4438 582	4472 586	4506 591	4540 595	4574 600	4608 604	4642 609	4677 613	4711 618
70	4745 622	4778 626	4812 631	4846 635	4880 640	4913 644	4947 649	4980 653	5014 657	5048 662
72	5081 666	5114 670	5148 675	5181 679	5214 684	5248 688	5281 692	5314 697	5347 701	5380 705
74	5413 710	5445 714	5478 718	5511 722	5544 727	5576 731	5609 735	5641 740	5674 744	5706 748
76	5739 752	5771 757	5803 761	5836 765	5868 769	5900 773	5932 778	5964 782	5996 786	6028 790

LOW AIR CONDITIONING △FUEL = – 0.5 %	**ENGINE ANTI ICE ON** △FUEL = + 2 %	**TOTAL ANTI ICE ON** △FUEL = + 4.5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22100000C5KG330 0 018590 0 0 1 1.0 .0 .00 03101 . 780 .000 .000 0 FCOM-N0-02–05–30-003-180

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**
44	0	41	83	124	165	207	248	289	330	371
	0	5	11	16	22	27	33	38	44	49
46	412	453	494	535	576	617	658	698	739	780
	55	60	65	71	76	82	87	92	98	103
48	821	861	902	942	983	1024	1064	1104	1145	1185
	109	114	119	125	130	135	141	146	151	157
50	1225	1266	1306	1346	1386	1426	1466	1506	1546	1586
	162	167	173	178	183	189	194	199	204	210
52	1626	1666	1705	1745	1785	1824	1864	1903	1943	1982
	215	220	226	231	236	241	247	252	257	262
54	2022	2061	2100	2140	2179	2218	2257	2296	2335	2374
	267	273	278	283	288	293	299	304	309	314
56	2413	2452	2491	2530	2569	2607	2646	2685	2723	2762
	319	324	329	335	340	345	350	355	360	365
58	2800	2839	2877	2915	2953	2992	3030	3068	3106	3144
	370	375	380	386	391	396	401	406	411	416
60	3182	3220	3258	3295	3333	3371	3409	3446	3484	3521
	421	426	431	436	441	446	451	456	461	466
62	3559	3596	3633	3671	3708	3745	3782	3819	3856	3893
	471	476	481	485	490	495	500	505	510	515
64	3930	3967	4004	4040	4077	4114	4150	4187	4223	4259
	520	525	529	534	539	544	549	554	559	563
66	4296	4332	4368	4404	4440	4476	4512	4548	4584	4620
	568	573	578	582	587	592	597	602	606	611
68	4656	4691	4727	4762	4798	4833	4868	4903	4939	4974
	616	620	625	630	635	639	644	649	653	658
70	5009	5044	5079	5114	5148	5183	5218	5252	5287	5321
	662	667	672	676	681	686	690	695	699	704
72	5356	5390	5424	5458	5492	5527	5560	5594	5628	5662
	708	713	717	722	726	731	735	740	744	749
74	5696	5729	5763	5796	5830	5863	5896	5929	5962	5995
	753	758	762	767	771	775	780	784	789	793
76	6028	6061	6094	6126	6159	6192	6224	6256	6289	6321
	797	802	806	810	815	819	823	827	832	836

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2 %	△FUEL = + 4.5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22100000C5KG330 0 018590 0 0 1 1.0 .0 .00 03301 . 780 .000 .000 0 FCOM-N0-02–05–30-004-180

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
44	0	44	88	132	177	221	265	308	352	396
	0	6	12	18	24	29	35	41	47	53
46	440	484	527	571	615	658	702	745	789	832
	59	65	70	76	82	88	94	99	105	111
48	875	918	962	1005	1048	1091	1134	1177	1219	1262
	117	123	128	134	140	146	151	157	163	168
50	1305	1348	1390	1433	1475	1518	1560	1602	1645	1687
	174	180	186	191	197	203	208	214	219	225
52	1729	1771	1813	1855	1897	1939	1981	2023	2065	2106
	231	236	242	248	253	259	264	270	276	281
54	2148	2189	2231	2272	2314	2355	2396	2437	2478	2519
	287	292	298	303	309	314	320	325	331	336
56	2560	2601	2642	2683	2724	2764	2805	2845	2886	2926
	342	347	353	358	363	369	374	380	385	390
58	2967	3007	3047	3087	3127	3167	3207	3247	3287	3326
	396	401	407	412	417	423	428	433	439	444
60	3366	3406	3445	3484	3524	3563	3602	3641	3680	3719
	449	454	460	465	470	476	481	486	491	496
62	3759	3797	3836	3875	3913	3952	3990	4029	4067	4105
	502	507	512	517	522	527	532	538	543	548
64	4143	4181	4219	4257	4295	4333	4370	4408	4445	4483
	553	558	563	568	573	578	583	588	593	598
66	4520	4557	4595	4632	4669	4706	4742	4779	4816	4852
	603	608	613	618	623	628	633	638	643	648
68	4889	4925	4961	4998	5034	5070	5106	5141	5177	5213
	652	657	662	667	672	677	681	686	691	696
70	5248	5284	5319	5354	5389	5425	5459	5494	5529	5564
	700	705	710	715	719	724	729	733	738	742
72	5599	5633	5667	5702	5736	5770	5804	5838	5872	5906
	747	752	756	761	765	770	775	779	784	788
74	5940	5973	6006	6040	6073	6107	6139	6172	6205	6238
	793	797	802	806	810	815	819	824	828	832
76	6271	6304	6336	6369	6401	6434	6466	6498	6530	6562
	837	841	846	850	854	859	863	867	871	876

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
$\triangle$FUEL = – 0.5 %	$\triangle$FUEL = + 2 %	$\triangle$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**
44	0 0	47 6	94 13	141 19	188 25	234 31	281 38	327 44	374 50	421 56
46	467 63	513 69	560 75	606 81	652 87	698 94	744 100	790 106	836 112	882 118
48	928 124	973 131	1019 137	1065 143	1110 149	1156 155	1201 161	1246 167	1291 173	1336 179
50	1382 185	1426 191	1471 197	1516 203	1561 209	1606 215	1650 221	1694 227	1739 233	1783 239
52	1828 245	1872 251	1916 257	1960 263	2004 269	2048 275	2092 281	2135 286	2179 292	2223 298
54	2266 304	2309 310	2353 316	2396 321	2439 327	2482 333	2525 339	2568 344	2611 350	2653 356
56	2696 362	2739 367	2781 373	2823 379	2866 384	2908 390	2950 396	2992 401	3034 407	3076 412
58	3118 418	3159 424	3200 429	3242 435	3283 440	3325 446	3366 451	3407 457	3448 462	3489 468
60	3530 473	3570 479	3610 484	3651 490	3691 495	3732 500	3772 506	3811 511	3851 517	3891 522
62	3931 527	3971 532	4010 538	4049 543	4089 548	4128 554	4167 559	4205 564	4244 569	4283 574
64	4322 580	4360 585	4398 590	4436 595	4475 600	4513 605	4551 610	4588 615	4626 620	4664 625
66	4701 631	4739 635	4776 640	4813 645	4850 650	4887 655	4924 660	4960 665	4997 670	5033 675
68	5070 680	5106 685	5142 690	5177 694	5213 699	5249 704	5285 709	5321 714	5356 718	5392 723
70	5428 728	5463 733	5498 737	5532 742	5567 747	5602 751	5637 756	5672 761		
72										
74										
76										
LOW AIR CONDITIONING △FUEL = – 0.5 %			**ENGINE ANTI ICE ON** △FUEL = + 2 %				**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 FL390

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
44	0 0	49 7	99 13	148 20	198 27	247 33	296 40	345 46	394 53	444 59
46	493 66	541 73	590 79	638 86	687 92	735 99	784 105	832 112	880 118	928 124
48	976 131	1024 137	1071 144	1119 150	1167 156	1214 163	1262 169	1309 176	1356 182	1403 188
50	1450 194	1497 201	1544 207	1590 213	1637 220	1683 226	1730 232	1776 238	1822 244	1868 251
52	1914 257	1960 263	2005 269	2051 275	2096 281	2142 287	2187 293	2232 299	2277 305	2322 311
54	2367 317	2411 323	2456 329	2500 335	2545 341	2589 347	2633 353	2676 359	2720 365	2764 371
56	2808 377	2851 382	2894 388	2937 394	2980 400	3023 405	3066 411	3108 417	3150 423	3193 428
58	3235 434	3277 440	3319 445	3361 451	3402 456	3444 462	3485 467	3526 473	3568 478	3609 484
60	3650 489	3690 495	3731 500	3771 506	3812 511	3852 517	3892 522	3931 527	3971 533	4010 538
62	4050 543	4090 548	4129 554	4169 559	4207 564	4245 569	4284 575	4323 580	4362 585	4401 590
64										
66										
68										
70										
72										
74										
76										

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2 %	△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)
44	0 0	29 6	57 13	86 19	115 26	143 32	172 38	200 45	229 51	257 57	268
46	285 64	314 70	342 76	370 82	398 89	426 95	454 101	482 107	510 113	538 119	271
48	566 125	593 131	621 137	649 143	676 149	704 155	731 161	759 167	786 173	813 179	275
50	841 185	868 191	895 196	922 202	949 208	976 214	1003 219	1030 225	1057 231	1084 236	280
52	1111 242	1137 247	1164 253	1190 258	1217 264	1244 269	1270 274	1296 280	1323 285	1349 290	287
54	1376 295	1402 300	1428 305	1454 310	1480 315	1506 320	1532 325	1558 330	1584 335	1610 340	308
56	1636 345	1662 350	1687 355	1713 359	1739 364	1765 369	1790 374	1816 378	1841 383	1867 388	320
58	1893 392	1918 397	1943 402	1969 406	1994 411	2020 416	2045 420	2070 425	2095 429	2121 434	327
60	2146 439	2171 443	2196 448	2221 452	2247 457	2272 461	2297 466	2322 470	2347 474	2372 479	333
62	2397 483	2421 488	2446 492	2471 497	2496 501	2521 505	2546 510	2570 514	2595 518	2620 523	338
64	2644 527	2669 531	2694 536	2718 540	2743 544	2767 548	2792 553	2816 557	2841 561	2865 565	343
66	2889 570	2914 574	2938 578	2962 582	2987 586	3011 590	3035 595	3059 599	3084 603	3108 607	348
68	3132 611	3156 615	3180 619	3204 624	3228 628	3253 632	3276 636	3300 640	3324 644	3348 648	351
70	3372 652	3396 656	3420 660	3444 664	3468 668	3492 672	3515 676	3539 680	3563 684	3587 688	354
72	3610 692	3634 696	3658 700	3681 704	3705 708	3729 712	3752 716	3776 720	3799 724	3823 728	355
74	3846 732	3870 736	3893 740	3916 744	3940 748	3963 752	3987 756	4010 760	4033 764	4056 768	356
76	4080 771	4103 775	4126 779	4149 783	4173 787	4196 791	4219 795	4242 799	4265 803	4288 806	357
LOW AIR CONDITIONING ΔFUEL = – 0.5 %				**ENGINE ANTI ICE ON** ΔFUEL = + 2.5 %				**TOTAL ANTI ICE ON** ΔFUEL = + 5 %			

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 01001 . 990.000 .000 0 FCOM-N0-02–05–30-008-180

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)
44	0	30	60	90	119	149	179	208	238	267	272
	0	7	13	20	26	33	39	46	52	58	
46	297	326	356	385	414	443	472	501	530	559	277
	65	71	78	84	90	96	103	109	115	121	
48	588	617	645	674	703	731	760	788	817	845	284
	127	133	139	145	151	157	162	168	174	179	
50	873	902	930	958	986	1014	1042	1070	1098	1126	305
	185	190	196	201	207	212	218	223	228	234	
52	1153	1181	1209	1236	1264	1292	1319	1347	1374	1402	316
	239	244	249	255	260	265	270	275	280	286	
54	1429	1456	1484	1511	1538	1566	1593	1620	1647	1674	323
	291	296	301	306	311	316	321	326	331	336	
56	1701	1728	1755	1782	1809	1836	1863	1889	1916	1943	328
	341	346	351	356	360	365	370	375	380	385	
58	1970	1996	2023	2050	2076	2103	2129	2156	2182	2209	335
	389	394	399	404	408	413	418	422	427	432	
60	2235	2261	2288	2314	2340	2366	2393	2419	2445	2471	341
	437	441	446	450	455	460	464	469	473	478	
62	2497	2523	2549	2575	2601	2627	2653	2679	2705	2730	347
	482	487	491	496	500	505	509	514	518	522	
64	2756	2782	2808	2833	2859	2885	2910	2936	2962	2987	350
	527	531	536	540	544	549	553	558	562	566	
66	3013	3038	3064	3089	3114	3140	3165	3191	3216	3241	352
	571	575	579	584	588	592	597	601	605	609	
68	3267	3292	3317	3342	3367	3393	3418	3443	3468	3493	353
	614	618	622	627	631	635	639	644	648	652	
70	3518	3543	3568	3593	3618	3643	3667	3692	3717	3742	354
	656	661	665	669	673	678	682	686	690	694	
72	3767	3791	3816	3841	3866	3890	3915	3939	3964	3989	354
	699	703	707	711	715	719	724	728	732	736	
74	4013	4038	4062	4087	4111	4135	4160	4184	4208	4233	355
	740	744	749	753	757	761	765	769	773	777	
76	4257	4281	4305	4329	4354	4378	4402	4426	4450	4474	357
	781	785	789	794	798	802	806	810	814	818	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 01201 . 990 .000 .000 0 FCOM-N0-02–05–30-009-180

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)
44	0	32	63	95	126	158	189	221	252	283	299
	0	6	13	19	25	31	37	44	50	56	
46	314	345	376	407	438	469	500	531	562	593	310
	62	68	74	80	86	92	98	103	109	115	
48	623	654	684	715	746	776	806	837	867	897	315
	121	127	133	139	144	150	156	161	167	173	
50	928	958	988	1018	1048	1078	1108	1138	1168	1198	321
	179	184	190	195	201	207	212	218	223	229	
52	1227	1257	1287	1316	1346	1376	1405	1434	1464	1493	327
	234	239	245	250	256	261	266	272	277	282	
54	1523	1552	1581	1610	1640	1669	1698	1727	1756	1785	336
	287	293	298	303	308	313	319	324	329	334	
56	1814	1843	1871	1900	1929	1958	1986	2015	2044	2072	344
	339	344	349	354	359	364	369	374	379	384	
58	2101	2129	2158	2186	2215	2243	2272	2300	2328	2356	348
	389	394	398	403	408	413	418	423	428	433	
60	2385	2413	2441	2469	2497	2525	2553	2581	2609	2637	349
	438	442	447	452	457	462	467	471	476	481	
62	2665	2693	2721	2749	2777	2805	2832	2860	2888	2915	349
	486	491	495	500	505	510	514	519	524	529	
64	2943	2970	2998	3026	3053	3081	3108	3135	3163	3190	350
	533	538	543	548	552	557	562	566	571	576	
66	3217	3245	3272	3299	3326	3353	3380	3407	3434	3461	351
	580	585	590	594	599	604	608	613	617	622	
68	3488	3515	3542	3569	3596	3623	3649	3676	3702	3729	354
	627	631	636	640	645	649	654	658	663	667	
70	3756	3782	3809	3835	3862	3888	3914	3940	3967	3993	358
	672	676	680	685	689	694	698	702	707	711	
72	4019	4045	4071	4098	4124	4150	4176	4201	4227	4253	361
	716	720	724	729	733	737	741	746	750	754	
74	4279	4305	4331	4356	4382	4408	4433	4459	4485	4510	365
	759	763	767	771	775	780	784	788	792	796	
76	4536	4561	4587	4612	4637	4663	4688	4713	4738	4764	369
	800	805	809	813	817	821	825	829	833	837	

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 01501 . 990 .000 .000 0 FCOM-N0-02–05–30-0010-180

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)
44	0	33	66	99	132	165	198	231	264	296	311
	0	6	13	19	25	32	38	44	51	57	
46	329	362	394	427	459	492	524	556	588	621	317
	63	69	75	81	88	94	100	106	112	118	
48	653	685	717	749	781	813	845	876	908	940	322
	124	130	136	142	148	153	159	165	171	177	
50	971	1003	1034	1066	1097	1129	1160	1191	1222	1254	330
	182	188	194	199	205	211	216	222	227	233	
52	1285	1316	1347	1378	1409	1440	1470	1501	1532	1563	339
	239	244	249	255	260	266	271	277	282	287	
54	1593	1624	1655	1685	1716	1746	1776	1807	1837	1868	345
	293	298	303	309	314	319	324	330	335	340	
56	1898	1928	1958	1988	2019	2049	2079	2109	2139	2169	346
	345	351	356	361	366	372	377	382	387	392	
58	2199	2228	2258	2288	2318	2348	2377	2407	2437	2466	347
	397	403	408	413	418	423	428	434	439	444	
60	2496	2525	2555	2584	2614	2643	2672	2702	2731	2760	348
	449	454	459	464	469	474	479	484	489	494	
62	2789	2818	2847	2876	2905	2934	2963	2992	3021	3050	350
	499	504	509	514	519	524	529	534	539	544	
64	3078	3107	3136	3164	3193	3221	3250	3278	3306	3335	354
	549	553	558	563	568	573	578	582	587	592	
66	3363	3391	3419	3448	3476	3504	3532	3560	3588	3616	358
	597	601	606	611	615	620	625	629	634	639	
68	3644	3671	3699	3727	3755	3783	3810	3838	3865	3893	362
	643	648	653	657	662	666	671	675	680	684	
70	3920	3948	3975	4002	4030	4057	4084	4111	4139	4166	366
	689	693	698	702	707	711	716	720	725	729	
72	4193	4220	4247	4274	4301	4328	4355	4381	4408	4435	370
	733	738	742	747	751	755	760	764	768	772	
74	4462	4488	4515	4542	4568	4595	4621	4648	4674	4700	376
	777	781	785	789	794	798	802	806	810	814	
76	4727	4753	4779	4806	4832	4858	4884	4910	4936	4962	383
	819	823	827	831	835	839	843	847	851	855	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 01701 . 990 .000 .000 0 FCOM-N0-02–05–30-0011-180

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)
44	0	35	69	104	139	173	207	242	276	310	317
	0	7	13	20	26	33	39	45	52	58	
46	345	379	413	447	481	515	548	582	616	650	324
	65	71	77	83	90	96	102	108	114	120	
48	683	717	750	784	817	850	884	917	950	983	334
	126	132	138	144	150	156	162	168	174	180	
50	1016	1049	1082	1115	1148	1180	1213	1246	1278	1311	341
	185	191	197	203	208	214	220	226	231	237	
52	1344	1376	1408	1441	1473	1506	1538	1570	1602	1635	343
	243	248	254	260	265	271	277	282	288	294	
54	1667	1699	1731	1763	1795	1827	1859	1890	1922	1954	344
	299	305	310	316	321	327	333	338	344	349	
56	1986	2017	2049	2080	2112	2144	2175	2206	2237	2269	345
	355	360	366	371	377	382	387	393	398	404	
58	2300	2331	2362	2393	2424	2455	2486	2517	2547	2578	349
	409	414	420	425	430	436	441	446	451	457	
60	2609	2640	2670	2701	2731	2762	2792	2822	2853	2883	354
	462	467	472	477	482	488	493	498	503	508	
62	2913	2943	2973	3003	3033	3063	3093	3123	3153	3183	358
	513	518	523	528	533	538	543	548	553	558	
64	3213	3242	3272	3301	3331	3361	3390	3419	3449	3478	362
	563	568	573	578	583	587	592	597	602	607	
66	3507	3536	3566	3595	3624	3653	3682	3711	3740	3769	367
	611	616	621	626	630	635	640	645	649	654	
68	3798	3826	3855	3884	3912	3941	3970	3998	4027	4055	373
	659	663	668	672	677	682	686	691	695	700	
70	4084	4112	4140	4169	4197	4225	4253	4281	4309	4337	380
	704	709	713	717	722	726	731	735	739	744	
72	4365	4393	4421	4449	4477	4505	4533	4560	4588	4616	388
	748	752	757	761	765	770	774	778	782	786	
74	4643	4671	4698	4726	4753	4781	4808	4835	4862	4890	396
	791	795	799	803	807	811	815	819	824	828	
76	4917	4944	4971	4998	5025	5053	5079	5106	5133	5160	404
	832	836	840	844	848	852	856	860	864	868	

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 01901 . 990 .000 .000 0 FCOM-N0-02–05–30-0012-180

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)
44	0	36	72	109	145	181	217	253	289	324	325
	0	7	13	20	26	33	40	46	52	59	
46	360	396	431	467	502	538	573	608	644	679	336
	65	72	78	84	91	97	103	109	116	122	
48	714	749	784	819	854	889	923	958	993	1027	340
	128	134	140	146	153	159	165	171	177	183	
50	1062	1097	1131	1165	1200	1234	1269	1303	1337	1371	341
	189	195	201	207	213	220	225	231	237	243	
52	1405	1439	1473	1507	1541	1575	1608	1642	1675	1709	344
	249	255	261	267	273	279	285	290	296	302	
54	1742	1776	1809	1842	1875	1909	1942	1975	2008	2041	348
	308	314	319	325	331	336	342	348	353	359	
56	2074	2106	2139	2172	2204	2237	2270	2302	2334	2367	353
	365	370	376	381	387	392	398	403	409	414	
58	2399	2431	2464	2496	2528	2560	2592	2624	2656	2688	357
	420	425	430	436	441	447	452	457	462	468	
60	2720	2751	2783	2814	2846	2878	2909	2940	2972	3003	362
	473	478	483	489	494	499	504	509	515	520	
62	3034	3066	3097	3128	3159	3190	3221	3252	3283	3314	367
	525	530	535	540	545	550	555	560	565	570	
64	3344	3375	3406	3436	3467	3497	3528	3558	3589	3619	376
	575	580	585	589	594	599	604	609	613	618	
66	3649	3679	3710	3740	3770	3800	3830	3860	3890	3920	385
	623	628	632	637	642	646	651	656	660	665	
68	3950	3979	4009	4039	4068	4098	4127	4157	4186	4216	393
	669	674	678	683	687	692	696	701	705	709	
70	4245	4274	4304	4333	4362	4391	4420	4449	4478	4507	401
	714	718	723	727	731	736	740	744	749	753	
72	4536	4565	4594	4623	4652	4681	4709	4738	4767	4795	407
	757	761	766	770	774	778	783	787	791	795	
74	4824	4853	4881	4910	4938	4967	4995	5023	5051	5080	409
	799	804	808	812	816	820	824	829	833	837	
76	5108	5136	5164	5193	5221	5249	5277	5305	5333	5361	411
	841	845	849	853	857	861	866	870	874	878	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 02101 . 990 .000 .000 0 FCOM-N0-02–05–30-013-180

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)
44	0 0	38 7	76 13	113 20	151 27	189 34	226 40	264 47	301 54	339 60	336
46	376 67	414 74	451 80	488 87	525 93	562 100	599 106	636 113	673 119	710 126	338
48	746 132	783 139	819 145	856 152	892 158	929 164	965 171	1001 177	1037 183	1073 189	342
50	1109 196	1145 202	1181 208	1217 214	1253 220	1288 227	1324 233	1359 239	1395 245	1430 251	347
52	1466 257	1501 263	1536 269	1571 275	1606 281	1641 287	1676 293	1711 299	1746 304	1781 310	351
54	1815 316	1850 322	1884 328	1919 334	1953 339	1988 345	2022 351	2056 357	2091 362	2125 368	357
56	2159 374	2193 379	2227 385	2261 390	2294 396	2328 402	2362 407	2396 412	2429 418	2463 423	362
58	2496 429	2530 434	2563 440	2596 445	2630 450	2663 456	2696 461	2729 466	2762 472	2795 477	370
60	2828 482	2861 487	2893 492	2926 498	2959 503	2992 508	3024 513	3057 518	3089 523	3121 528	379
62	3154 533	3186 538	3218 543	3250 548	3283 553	3315 558	3347 563	3379 568	3411 572	3442 577	389
64	3474 582	3506 587	3538 592	3569 596	3601 601	3633 606	3664 611	3696 615	3727 620	3758 625	397
66	3790 629	3821 634	3852 639	3884 643	3915 648	3946 653	3977 657	4008 662	4039 666	4070 671	404
68	4101 675	4132 680	4163 685	4193 689	4224 694	4255 698	4286 703	4316 707	4347 712	4377 716	406
70	4408 721	4438 725	4469 730	4499 734	4529 739	4560 743	4590 747	4620 752	4650 756	4681 761	408
72	4711 765	4741 770	4771 774	4801 778	4831 783	4861 787	4890 791	4920 796	4950 800	4980 804	409
74	5010 809	5039 813	5069 817	5098 822	5128 826	5157 830	5186 834	5216 839	5245 843	5274 847	413
76	5304 851	5333 856	5362 860	5391 864	5420 868	5449 872	5478 876	5507 880	5536 885	5565 889	417

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 02301 . 990 .000 .000 0 FCOM-N0-02–05–30-014-180

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)
44	0	39	79	118	158	197	236	275	314	353	339
	0	7	14	21	28	35	42	48	55	62	
46	392	431	470	508	547	586	624	662	700	739	344
	69	76	82	89	96	103	109	116	122	129	
48	777	815	853	891	928	966	1004	1041	1079	1116	349
	136	142	149	155	161	168	174	181	187	193	
50	1154	1191	1228	1265	1302	1340	1376	1413	1450	1487	355
	200	206	212	219	225	231	237	243	249	256	
52	1523	1560	1596	1633	1669	1706	1742	1778	1814	1850	361
	262	268	274	280	286	292	298	304	309	315	
54	1886	1922	1958	1993	2029	2065	2100	2136	2171	2207	370
	321	327	333	338	344	350	356	361	367	372	
56	2242	2277	2312	2347	2382	2417	2452	2487	2522	2556	381
	378	384	389	395	400	406	411	416	422	427	
58	2591	2626	2660	2695	2729	2764	2798	2832	2866	2900	391
	432	438	443	448	453	459	464	469	474	479	
60	2935	2968	3002	3036	3070	3104	3138	3171	3205	3239	399
	484	490	495	500	505	510	515	520	525	530	
62	3272	3306	3339	3373	3406	3439	3473	3506	3539	3572	402
	535	540	545	550	555	560	565	570	575	580	
64	3605	3638	3671	3704	3737	3770	3803	3836	3868	3901	404
	585	590	594	599	604	609	614	619	624	629	
66	3934	3966	3999	4031	4064	4096	4128	4160	4193	4225	405
	633	638	643	648	653	657	662	667	672	676	
68	4257	4289	4321	4353	4385	4417	4448	4480	4512	4543	409
	681	686	690	695	700	704	709	714	718	723	
70	4575	4606	4638	4669	4701	4732	4763	4794	4825	4857	414
	727	732	737	741	746	750	755	759	764	768	
72	4888	4919	4950	4980	5011	5042	5073	5104	5134	5165	419
	773	777	781	786	790	795	799	803	808	812	
74	5196	5226	5256	5287	5317	5348	5378	5408	5438	5468	423
	816	821	825	829	834	838	842	846	851	855	
76	5498	5528	5558	5588	5618	5648	5678	5707	5737	5767	428
	859	863	867	872	876	880	884	888	892	896	

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0-08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 02501 . 990 .000 .000 0 FCOM-N0-02–05–30-015-180

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)**
44	0	41	82	123	164	205	245	286	327	367	347
	0	7	14	21	28	35	42	49	56	63	
46	408	448	488	528	568	608	648	688	727	767	353
	70	77	83	90	97	104	110	117	124	130	
48	807	846	885	925	964	1003	1042	1081	1120	1159	360
	137	144	150	157	163	170	176	182	189	195	
50	1198	1236	1275	1313	1352	1390	1428	1467	1505	1543	370
	201	208	214	220	226	232	238	244	250	256	
52	1581	1619	1656	1694	1732	1770	1807	1844	1882	1919	382
	262	268	274	280	286	292	298	303	309	315	
54	1957	1994	2031	2068	2105	2142	2178	2215	2252	2289	392
	321	326	332	338	343	349	354	360	366	371	
56	2325	2362	2398	2435	2471	2508	2544	2580	2616	2652	397
	377	382	388	393	399	404	410	415	420	426	
58	2688	2724	2760	2796	2832	2868	2903	2939	2974	3010	400
	431	437	442	447	453	458	464	469	474	480	
60	3046	3081	3116	3152	3187	3222	3257	3292	3327	3362	401
	485	490	495	501	506	511	516	522	527	532	
62	3397	3432	3466	3501	3536	3570	3605	3639	3674	3708	405
	537	542	547	553	558	563	568	573	578	583	
64	3742	3776	3810	3844	3879	3913	3946	3980	4014	4048	410
	588	593	598	603	608	613	618	623	628	632	
66	4081	4115	4148	4182	4215	4249	4282	4315	4348	4381	415
	637	642	647	652	657	661	666	671	676	680	
68	4415	4447	4480	4513	4546	4579	4612	4644	4677	4709	420
	685	690	694	699	704	709	713	718	722	727	
70	4742	4774	4807	4839	4871	4904	4936	4968	5000	5032	426
	732	736	741	745	750	754	759	763	768	772	
72	5064	5096	5128	5159	5191	5223	5255	5286	5318	5349	431
	777	781	786	790	794	799	803	807	812	816	
74	5381	5412	5443	5474	5506	5537	5568	5599	5630	5661	435
	821	825	829	833	838	842	846	851	855	859	
76	5692	5723	5753	5784	5815	5846	5876	5907	5937	5968	440
	863	867	872	876	880	884	888	892	897	901	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 02701 . 990 .000 .000 0 FCOM-N0-02–05–30-016-180

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)
44	0	43	85	128	170	213	255	297	339	381	358
	0	7	14	21	28	35	42	49	56	63	
46	423	465	506	548	590	631	672	714	755	796	370
	70	77	83	90	97	103	110	116	123	129	
48	837	878	919	959	1000	1041	1081	1122	1162	1202	382
	136	142	149	155	161	168	174	180	186	192	
50	1243	1282	1322	1362	1402	1442	1482	1521	1561	1601	392
	199	205	211	217	223	229	235	241	247	253	
52	1640	1680	1719	1758	1797	1837	1876	1915	1953	1992	394
	259	265	271	277	283	289	295	301	307	313	
54	2031	2070	2109	2147	2186	2224	2263	2301	2339	2377	396
	319	325	330	336	342	348	354	359	365	371	
56	2416	2454	2491	2529	2567	2605	2643	2680	2718	2755	400
	377	382	388	394	399	405	411	416	422	427	
58	2793	2830	2867	2904	2941	2978	3015	3052	3089	3126	406
	433	438	444	449	455	460	466	471	476	482	
60	3162	3199	3235	3272	3308	3344	3381	3417	3453	3489	411
	487	493	498	503	508	514	519	524	529	535	
62	3525	3561	3596	3632	3668	3704	3739	3775	3810	3845	416
	540	545	550	555	560	566	571	576	581	586	
64	3881	3916	3951	3986	4021	4056	4091	4126	4161	4195	422
	591	596	601	606	611	616	621	625	630	635	
66	4230	4265	4299	4334	4368	4403	4437	4471	4505	4539	428
	640	645	650	655	659	664	669	674	678	683	
68	4573	4607	4641	4675	4709	4742	4776	4809	4843	4876	432
	688	693	697	702	707	711	716	721	725	730	
70	4910	4943	4976	5010	5043	5076	5109	5142	5175	5208	437
	734	739	744	748	753	757	762	766	771	775	
72	5241	5273	5306	5339	5371	5404	5436	5469	5501	5533	442
	780	784	788	793	797	802	806	810	815	819	
74	5566	5598	5630	5662	5694	5726	5758	5790	5822	5853	446
	824	828	832	836	841	845	849	854	858	862	
76	5885	5917	5948	5980	6011	6043	6074	6105	6136	6168	450
	866	870	875	879	883	887	891	896	900	904	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 –08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 02901 . 990 .000 .000 0 FCOM-N0-02–05–30-0017-180

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)
44	0	44	88	132	177	221	264	308	352	395	380
	0	7	14	21	28	35	41	48	55	62	
46	439	482	526	569	612	655	698	741	784	827	389
	68	75	82	88	95	102	108	115	121	128	
48	870	912	954	997	1039	1082	1124	1166	1208	1250	392
	134	141	147	154	160	167	173	180	186	193	
50	1292	1334	1375	1417	1459	1500	1542	1583	1624	1665	394
	199	205	212	218	224	231	237	243	249	256	
52	1706	1747	1788	1829	1869	1910	1951	1991	2031	2072	399
	262	268	274	280	286	292	298	304	310	316	
54	2112	2152	2192	2232	2272	2311	2351	2390	2430	2469	405
	322	328	334	340	346	352	358	363	369	375	
56	2509	2548	2587	2626	2665	2704	2743	2782	2821	2859	410
	381	386	392	398	404	409	415	420	426	432	
58	2898	2936	2975	3013	3051	3090	3128	3165	3203	3241	417
	437	443	448	454	459	465	470	475	481	486	
60	3279	3317	3354	3392	3429	3467	3504	3541	3579	3616	423
	492	497	502	508	513	518	523	529	534	539	
62	3653	3690	3727	3763	3800	3837	3873	3910	3946	3983	428
	544	549	555	560	565	570	575	580	585	590	
64	4019	4055	4091	4127	4163	4200	4235	4271	4307	4342	434
	595	600	605	610	615	620	625	630	635	640	
66	4378	4414	4449	4484	4520	4555	4590	4625	4660	4696	439
	645	650	654	659	664	669	674	678	683	688	
68	4731	4765	4800	4835	4870	4904	4939	4973	5007	5042	443
	693	697	702	707	711	716	721	725	730	735	
70	5076	5110	5144	5178	5212	5247	5280	5314	5348	5381	448
	739	744	748	753	757	762	766	771	775	780	
72	5415	5449	5482	5515	5549	5582	5615	5649	5682	5715	452
	784	789	793	798	802	807	811	815	820	824	
74	5748	5781	5814	5846	5879	5912	5944	5977	6009	6042	455
	828	833	837	841	846	850	854	858	863	867	
76	6074	6107	6139	6171	6203	6235	6267	6299	6331	6363	458
	871	875	880	884	888	892	897	901	905	909	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
∆FUEL = – 0.5 %	∆FUEL = + 2.5 %	∆FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 03101 . 990 .000 .000 0 FCOM-N0-02–05–30-018-180

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**DISTANCE (NM)** **TIME (MIN)**	**LR FL330**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
44	0	46	92	138	184	230	276	322	367	413	388
	0	7	14	21	28	36	43	50	57	64	
46	458	503	548	594	639	684	728	773	817	862	391
	71	78	84	91	98	105	112	119	125	132	
48	906	950	994	1038	1082	1126	1170	1214	1257	1301	398
	139	145	152	159	165	172	178	185	191	198	
50	1344	1387	1430	1473	1516	1559	1602	1644	1687	1730	404
	204	211	217	223	230	236	242	249	255	261	
52	1772	1814	1856	1898	1940	1983	2024	2066	2107	2149	410
	267	274	280	286	292	298	304	310	316	322	
54	2191	2232	2273	2314	2355	2397	2437	2478	2519	2559	418
	328	334	340	346	352	358	363	369	375	381	
56	2600	2640	2681	2721	2761	2802	2841	2881	2921	2961	423
	387	392	398	404	409	415	421	426	432	437	
58	3001	3040	3080	3119	3159	3198	3237	3276	3315	3354	429
	443	448	454	459	465	470	476	481	487	492	
60	3393	3432	3470	3509	3547	3586	3624	3663	3701	3739	434
	497	503	508	513	519	524	529	535	540	545	
62	3777	3815	3853	3891	3928	3966	4004	4041	4079	4116	439
	550	555	561	566	571	576	581	586	591	596	
64	4153	4190	4227	4264	4301	4338	4375	4412	4448	4485	444
	601	606	611	616	621	626	631	636	641	646	
66	4522	4558	4594	4630	4667	4703	4739	4775	4811	4847	449
	651	656	661	665	670	675	680	685	689	694	
68	4883	4918	4954	4989	5025	5060	5095	5131	5166	5201	452
	699	704	708	713	718	723	727	732	737	741	
70	5236	5271	5306	5341	5375	5410	5445	5479	5514	5548	454
	746	750	755	760	764	769	773	778	782	787	
72	5582	5616	5651	5685	5719	5753	5786	5820	5854	5887	456
	792	796	800	805	809	814	818	823	827	832	
74	5921	5954	5988	6021	6054	6088	6120	6153	6186	6219	456
	836	840	845	849	854	858	862	867	871	875	
76	6252	6284	6317	6349	6382	6414	6446	6479	6511	6543	457
	880	884	888	892	897	901	905	909	914	918	

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0 -08F0A320-214 CFM56-5B4/P SA22200000C5KG330 0 018590 0 0 1 1.0 .0 .00 03301 . 990 .000 .000 0 FCOM-N0-02–05–30-019-180

R

INTEGRATED CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**DISTANCE (NM)** **TIME (MIN)**	**LR FL350**

WEIGHT (1000KG)	0	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	TAS (KT)
44	0 0	48 7	96 14	143 22	191 29	239 36	286 43	333 50	380 57	428 64	395
46	475 72	521 78	568 85	615 92	661 99	708 106	754 113	800 120	846 127	892 133	401
48	938 140	983 147	1029 153	1074 160	1120 167	1165 173	1210 180	1255 186	1300 193	1345 199	409
50	1390 206	1435 212	1479 219	1523 225	1568 231	1612 238	1656 244	1700 250	1744 257	1788 263	416
52	1832 269	1875 275	1918 281	1962 287	2005 294	2048 300	2091 306	2134 312	2177 318	2220 324	423
54	2263 330	2305 336	2347 342	2390 347	2432 353	2474 359	2516 365	2558 371	2600 377	2642 382	429
56	2684 388	2725 394	2767 400	2808 405	2850 411	2891 417	2932 422	2973 428	3014 434	3055 439	434
58	3096 445	3136 450	3177 456	3217 461	3258 467	3298 472	3338 478	3378 483	3418 489	3458 494	440
60	3498 499	3538 505	3578 510	3617 515	3657 521	3696 526	3735 531	3775 537	3814 542	3853 547	444
62	3892 552	3931 558	3969 563	4008 568	4047 573	4086 578	4124 583	4162 588	4200 594	4239 599	448
64	4277 604	4315 609	4353 614	4391 619	4428 624	4466 629	4504 634	4541 639	4578 644	4616 649	450
66	4653 654	4690 659	4727 664	4764 669	4801 673	4838 678	4874 683	4911 688	4947 693	4984 698	452
68	5020 703	5056 707	5092 712	5128 717	5164 722	5200 726	5236 731	5271 736	5307 741	5342 745	452
70	5378 750	5413 755	5448 759	5483 764	5518 769	5553 773	5587 778	5622 782	5657 787	5691 791	453
72	5726 796	5760 800	5794 805	5828 809	5862 814	5896 818	5930 823	5963 827	5997 832	6030 836	454
74	6064 841	6097 845	6130 849	6163 854	6196 858	6229 862	6262 867	6295 871	6327 875	6359 880	455
76	6392 884	6424 888	6457 892	6489 897	6522 901						455

LOW AIR CONDITIONING ΔFUEL = – 0.5 %	**ENGINE ANTI ICE ON** ΔFUEL = + 2.5 %	**TOTAL ANTI ICE ON** ΔFUEL = + 5 %

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)
44	0 0	49 7	99 14	148 22	197 29	247 36	296 43	344 50	393 57	442 64	408
46	491 71	539 78	587 85	635 92	683 99	731 106	778 113	826 120	873 126	921 133	415
48	968 140	1015 146	1062 153	1109 160	1156 166	1203 173	1249 179	1295 186	1341 192	1388 199	423
50	1434 205	1479 212	1525 218	1571 224	1617 231	1662 237	1707 243	1753 250	1798 256	1843 262	430
52	1888 268	1933 274	1977 281	2022 287	2066 293	2111 299	2155 305	2199 311	2243 317	2287 323	435
54	2331 329	2374 335	2418 341	2461 347	2505 353	2548 359	2591 364	2634 370	2677 376	2720 382	441
56	2763 388	2805 393	2848 399	2890 405	2933 410	2975 416	3017 422	3059 427	3101 433	3143 439	445
58	3185 444	3226 450	3267 455	3309 461	3350 466	3391 472	3432 477	3473 483	3514 488	3555 494	448
60	3596 499	3636 505	3676 510	3716 515	3757 521	3797 526	3837 531	3876 537	3916 542	3956 547	450
62	3996 553	4035 558	4074 563	4113 568	4152 574	4191 579	4230 584	4268 589	4307 594	4346 599	450
64	4384 604	4422 609	4460 614	4498 620	4536 625	4574 630	4611 635	4649 640	4686 645	4724 649	451
66	4761 654	4798 659	4835 664	4872 669	4909 674	4945 679	4981 684	5018 688	5054 693	5090 698	452
68	5126 703	5162 708	5198 712	5234 717	5270 722	5305 727	5341 731	5376 736	5411 741	5446 745	453
70	5481 750										453
72											
74											
76											

LOW AIR CONDITIONING △FUEL = – 0.5 %	**ENGINE ANTI ICE ON** △FUEL = + 2.5 %	**TOTAL ANTI ICE ON** △FUEL = + 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)
44	0 0	51 7	102 14	152 21	203 29	254 36	304 43	354 50	404 57	454 64	425
46	505 71	554 78	603 84	653 91	702 98	752 105	800 112	849 118	898 125	947 132	431
48	996 138	1044 145	1092 152	1140 158	1188 165	1236 171	1283 178	1331 184	1378 191	1426 197	437
50	1473 204	1520 210	1567 216	1614 223	1661 229	1707 235	1754 242	1800 248	1846 254	1892 260	442
52	1938 266	1984 273	2029 279	2075 285	2121 291	2166 297	2211 303	2256 309	2301 315	2346 321	446
54	2391 327	2435 333	2479 339	2524 345	2568 351	2612 357	2656 362	2699 368	2743 374	2786 380	449
56	2830 386	2873 391	2916 397	2959 403	3002 409	3045 414	3087 420	3129 426	3171 431	3213 437	449
58	3256 442	3297 448	3339 453	3380 459	3422 465	3463 470	3504 475	3545 481	3586 486	3627 492	451
60	3667 497	3707 502	3747 508	3787 513	3827 518	3867 524	3907 529	3947 534	3986 539	4025 545	452
62	4064 550	4103 555	4142 560	4182 565	4221 571						452
64											
66											
68											
70											
72											
74											
76											

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 2.5 %	△FUEL = + 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

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	0.8	0.9	0.9	–	–	–	–	4 min
370	0.8	0.8	0.9	0.9	0.9	1.0	–	–	4 min
350	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	5 min
330	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	5 min
310	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	5 min
290	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	5 min
270	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	5 min
250	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	5 min
200	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	5 min
150	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	4 min
100	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	3 min

STEP CLIMB CORRECTION

When the flight includes one or more step climbs (2000 feet below FL290, 4000 feet above), apply a correction of 50 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.

CORRECTION ON FUEL CONSUMPTION (1000 KG)								
FL	WEIGHT OVERHEAD DESTINATION (1000 KG)							Time Correction
	46	50	54	58	62	66	70	
390	0.1	0.1	0.2	0.2	0.2	0.3	–	10 min
370	0.1	0.1	0.1	0.2	0.2	0.3	0.3	10 min
350	0.1	0.1	0.1	0.2	0.2	0.2	0.3	10 min
330	0.1	0.1	0.1	0.2	0.2	0.2	0.3	10 min
310	0.1	0.1	0.1	0.2	0.2	0.2	0.3	10 min
290	0.1	0.1	0.1	0.2	0.2	0.2	0.2	10 min
270	0.1	0.1	0.1	0.1	0.2	0.2	0.2	10 min
250	0.1	0.1	0.1	0.1	0.2	0.2	0.2	10 min
200	0	0.1	0.1	0.1	0.1	0.1	0.2	10 min
150	0	0	0.1	0.1	0.1	0.1	0.1	9 min
100	0	0	0	0	0	0.1	0.1	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 120 kg – 6 minute IFR
- ISA
- CG = 33 %
- Normal air conditioning
- Anti ice OFF

They are based upon a reference landing weight of 55 000 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 : 60 000 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 p 2 ;
     Alternate time = 40 min
     Alternate fuel : 1 559 + 11 × (60 – 55) = 1 614 kg
2. Holding fuel and time
   – A 30 min holding is assumed at 1500 ft. Read from 3.05.25 p 2, holding fuel = 1 300 kg
3. At destination, the landing weight = 60 000 + 1 614 + 1 300 = 62 914 kg
4. Evaluation of the air distance between departure and destination.
   – The "Ground distance/Air distance" conversion table from 2.05.60 p 2 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 p 5), read the corresponding values of fuel consumption and time, for the reference landing weight and without deviation from ISA.
     Fuel = 10 478 kg
     Time = 4 h 37 min
   – Correction for landing weight
     △ fuel consumption = 146 × (62.914 – 55) = 1 155 kg
   – Trip reserves (5 %) = 0.05 × (10 478 + 1 155) = 582 kg
6. Taxi fuel = 140 kg (2.05.10 p 2)
7. Total fuel on board (Block fuel) :
   10 478 + 1 155 + 582 + 1 300 + 1 614 + 140 = 15 269 kg

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	1628 0.38	1616 0.38	1610 0.38	1610 0.38			13	15	
225	1775 0.42	1754 0.42	1741 0.42	1734 0.42	1734 0.42		13	16	17
250	1921 0.45	1892 0.45	1871 0.45	1858 0.45	1853 0.45	1855 0.45	14	17	19
275	2068 0.48	2030 0.48	2002 0.48	1982 0.48	1972 0.49	1972 0.49	15	18	21
300	2215 0.51	2168 0.52	2132 0.52	2107 0.52	2092 0.52	2089 0.52	15	19	22
325	2361 0.55	2306 0.55	2263 0.55	2231 0.55	2211 0.55	2206 0.55	16	19	24
350	2508 0.58	2444 0.58	2394 0.58	2355 0.58	2331 0.59	2324 0.59	16	20	25
375	2655 1.01	2583 1.01	2525 1.02	2480 1.02	2451 1.02	2441 1.02	17	21	27
400	2802 1.04	2721 1.05	2656 1.05	2605 1.05	2571 1.05	2559 1.05	18	22	28
425	2950 1.08	2860 1.08	2787 1.08	2730 1.09	2691 1.09	2677 1.09	18	23	29
450	3097 1.11	2998 1.11	2918 1.12	2855 1.12	2811 1.12	2795 1.12	19	24	31
475	3244 1.14	3137 1.15	3050 1.15	2980 1.15	2932 1.15	2913 1.15	20	25	32
500	3391 1.17	3276 1.18	3181 1.18	3105 1.19	3052 1.19	3032 1.19	20	26	34
525	3539 1.21	3415 1.21	3312 1.21	3230 1.22	3173 1.22	3151 1.22	21	27	36
550	3687 1.24	3554 1.24	3444 1.25	3355 1.25	3294 1.25	3269 1.25	22	28	37
575	3834 1.27	3693 1.28	3576 1.28	3481 1.29	3415 1.29	3389 1.29	22	29	39
600	3982 1.30	3832 1.31	3708 1.31	3607 1.32	3536 1.32	3508 1.32	23	30	41
625	4130 1.34	3971 1.34	3840 1.35	3732 1.35	3657 1.36	3627 1.36	24	31	42
650	4278 1.37	4111 1.38	3972 1.38	3858 1.39	3779 1.39	3747 1.39	25	32	44
675	4426 1.40	4250 1.41	4104 1.41	3984 1.42	3900 1.42	3867 1.42	25	33	46
700	4574 1.43	4390 1.44	4236 1.45	4110 1.45	4022 1.46	3987 1.46	26	34	48
725	4722 1.47	4530 1.47	4369 1.48	4237 1.49	4144 1.49	4107 1.49	27	35	49
750	4870 1.50	4670 1.51	4501 1.51	4363 1.52	4267 1.52	4228 1.52	27	36	51
775	5019 1.53	4810 1.54	4634 1.55	4490 1.55	4389 1.56	4349 1.56	28	37	53
800	5167 1.57	4950 1.57	4767 1.58	4617 1.59	4512 1.59	4471 1.59	29	38	55
825	5316 2.00	5090 2.01	4900 2.01	4744 2.02	4634 2.02	4592 2.02	29	39	56

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = + 2 %	△FUEL = + 4.5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7800 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-003-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE = M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
825	5316 2.00	5090 2.01	4900 2.01	4744 2.02	4634 2.02	4592 2.02	29	39	56
850	5464 2.03	5231 2.04	5033 2.05	4871 2.05	4757 2.06	4714 2.06	30	40	58
875	5613 2.06	5371 2.07	5166 2.08	4998 2.09	4880 2.09	4836 2.09	31	41	60
900	5762 2.10	5512 2.10	5299 2.11	5125 2.12	5004 2.13	4958 2.13	32	42	62
925	5911 2.13	5652 2.14	5433 2.15	5253 2.15	5127 2.16	5080 2.16	32	43	63
950	6060 2.16	5793 2.17	5566 2.18	5380 2.19	5251 2.19	5203 2.19	33	44	65
975	6209 2.19	5934 2.20	5700 2.21	5508 2.22	5374 2.23	5326 2.23	34	45	67
1000	6358 2.23	6075 2.24	5833 2.24	5636 2.25	5498 2.26	5449 2.26	35	46	69
1025	6507 2.26	6216 2.27	5967 2.28	5763 2.29	5622 2.29	5572 2.29	35	47	71
1050	6657 2.29	6357 2.30	6101 2.31	5892 2.32	5746 2.33	5695 2.33	36	48	73
1075	6806 2.32	6498 2.33	6235 2.34	6020 2.35	5871 2.36	5819 2.36	37	49	74
1100	6955 2.36	6639 2.37	6369 2.38	6148 2.39	5995 2.39	5943 2.39	38	50	76
1125	7105 2.39	6781 2.40	6503 2.41	6276 2.42	6120 2.43	6067 2.43	38	51	78
1150	7255 2.42	6923 2.43	6638 2.44	6405 2.45	6245 2.46	6191 2.46	39	52	80
1175	7405 2.45	7064 2.47	6772 2.48	6534 2.49	6370 2.49	6316 2.49	40	53	82
1200	7555 2.49	7206 2.50	6907 2.51	6662 2.52	6495 2.53	6441 2.53	41	55	84
1225	7705 2.52	7348 2.53	7041 2.54	6791 2.56	6621 2.56	6566 2.56	41	56	86
1250	7855 2.55	7490 2.56	7176 2.58	6921 2.59	6746 3.00	6691 3.00	42	57	87
1275	8005 2.58	7632 3.00	7311 3.01	7050 3.02	6872 3.03	6817 3.03	43	58	89
1300	8155 3.02	7775 3.03	7446 3.04	7179 3.06	6998 3.06	6943 3.06	44	59	91
1325	8305 3.05	7917 3.06	7582 3.08	7309 3.09	7124 3.10	7069 3.10	45	60	93
1350	8456 3.08	8059 3.10	7717 3.11	7439 3.12	7251 3.13	7195 3.13	45	61	95
1375	8606 3.12	8202 3.13	7852 3.14	7569 3.16	7377 3.16	7322 3.16	46	63	97
1400	8757 3.15	8345 3.16	7988 3.18	7699 3.19	7504 3.20	7449 3.20	47	64	99
1425	8908 3.18	8488 3.19	8124 3.21	7829 3.22	7631 3.23	7576 3.23	48	65	101
1450	9059 3.21	8630 3.23	8259 3.24	7959 3.26	7758 3.26	7704 3.26	49	66	103

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2 %	△FUEL = + 4.5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7800 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-004-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	9059 3.21	8630 3.23	8259 3.24	7959 3.26	7758 3.26	7704 3.26	49	66	103
1475	9210 3.25	8773 3.26	8395 3.27	8089 3.29	7885 3.30	7832 3.30	49	67	105
1500	9361 3.28	8917 3.29	8531 3.31	8220 3.32	8013 3.33	7944 3.33*	50	68	107
1525	9512 3.31	9060 3.33	8668 3.34	8351 3.36	8141 3.37	8074 3.37*	51	70	109
1550	9664 3.34	9203 3.36	8804 3.37	8481 3.39	8268 3.40	8205 3.40*	52	71	111
1575	9815 3.38	9347 3.39	8940 3.41	8612 3.42	8396 3.43	8336 3.43*	53	72	113
1600	9967 3.41	9490 3.42	9077 3.44	8744 3.46	8525 3.47	8467 3.47*	53	73	115
1625	10119 3.44	9634 3.46	9214 3.47	8875 3.49	8653 3.50	8598 3.50*	54	74	117
1650	10271 3.47	9778 3.49	9351 3.51	9006 3.52	8782 3.53	8730 3.53*	55	76	119
1675	10423 3.51	9922 3.52	9488 3.54	9138 3.56	8910 3.57	8862 3.57*	56	77	121
1700	10575 3.54	10066 3.56	9625 3.57	9270 3.59	9039 4.00	8993 4.00*	57	78	123
1725	10727 3.57	10210 3.59	9762 4.01	9402 4.02	9168 4.03	9125 4.03*	58	79	125
1750	10880 4.00	10354 4.02	9900 4.04	9534 4.06	9298 4.07	9257 4.07*	59	81	127
1775	11032 4.04	10499 4.05	10038 4.07	9667 4.09	9427 4.10	9390 4.10*	59	82	129
1800	11185 4.07	10643 4.09	10176 4.11	9800 4.12	9558 4.13	9522 4.13*	60	83	131
1825	11337 4.10	10788 4.12	10314 4.14	9933 4.16	9689 4.17	9655 4.17*	61	84	133
1850	11490 4.13	10932 4.15	10452 4.17	10066 4.19	9820 4.20	9788 4.20*	62	86	135
1875	11643 4.17	11077 4.19	10590 4.21	10199 4.22	9951 4.24	9921 4.23*	63	87	137
1900	11796 4.20	11222 4.22	10729 4.24	10333 4.26	10082 4.27	10054 4.27*	64	88	139
1925	11949 4.23	11367 4.25	10867 4.27	10466 4.29	10214 4.30	10188 4.30*	65	90	141
1950	12102 4.26	11512 4.28	11006 4.30	10600 4.33	10346 4.34	10321 4.33*	66	91	144
1975	12255 4.30	11658 4.32	11145 4.34	10734 4.36	10478 4.37	10455 4.37*	66	92	146
2000	12408 4.33	11803 4.35	11283 4.37	10868 4.39	10610 4.40	10589 4.40*	67	94	148
2025	12562 4.36	11948 4.38	11423 4.40	11002 4.43	10742 4.44	10723 4.44*	68	95	150
2050	12716 4.40	12094 4.42	11562 4.44	11137 4.46	10875 4.47	10858 4.47*	69	97	152
2075	12869 4.43	12240 4.45	11701 4.47	11271 4.49	11008 4.50	10992 4.50*	70	98	155

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = + 2 %	△FUEL = + 4.5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7800 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-005-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	12869 4.43	12240 4.45	11701 4.47	11271 4.49	11008 4.50	10992 4.50*	70	98	155
2100	13023 4.46	12386 4.48	11840 4.50	11406 4.53	11141 4.54	11127 4.54*	71	99	157
2125	13177 4.49	12532 4.51	11980 4.54	11541 4.56	11275 4.57	11262 4.57*	72	101	159
2150	13331 4.53	12678 4.55	12120 4.57	11676 4.59	11408 5.01	11397 5.00*	73	102	161
2175	13485 4.56	12824 4.58	12260 5.00	11811 5.03	11542 5.04	11532 5.04*	74	104	163
2200	13640 4.59	12970 5.01	12400 5.04	11947 5.06	11676 5.07	11667 5.07*	75	105	165
2225	13794 5.02	13117 5.05	12540 5.07	12082 5.09	11810 5.11	11803 5.10*	76	107	168
2250	13948 5.06	13264 5.08	12680 5.10	12218 5.13	11945 5.14	11939 5.14*	77	108	170
2275	14103 5.09	13410 5.11	12821 5.14	12354 5.16	12080 5.17	12074 5.17*	78	109	172
2300	14258 5.12	13557 5.14	12962 5.17	12490 5.19	12214 5.21	12210 5.20*	79	111	174
2325	14412 5.15	13704 5.18	13102 5.20	12627 5.23	12350 5.24	12347 5.24*	80	112	177
2350	14567 5.19	13851 5.21	13243 5.24	12764 5.26	12485 5.27	12483 5.27*	81	114	179
2375	14723 5.22	13998 5.24	13384 5.27	12900 5.29	12621 5.31	12620 5.30*	81	115	181
2400	14878 5.25	14146 5.28	13526 5.30	13037 5.33	12758 5.34	12757 5.34*	82	117	183
2425	15034 5.28	14293 5.31	13667 5.33	13174 5.36	12894 5.37	12894 5.37*	83	119	186
2450	15190 5.32	14441 5.34	13808 5.37	13312 5.39	13031 5.41	13032 5.40*	84	120	188
2475	15346 5.35	14588 5.37	13950 5.40	13449 5.43	13168 5.44	13169 5.44*	85	122	190
2500	15502 5.38	14736 5.41	14092 5.43	13587 5.46	13305 5.48	13307 5.47*	86	123	192
2525	15658 5.41	14884 5.44	14234 5.47	13725 5.49	13442 5.51	13445 5.50*	87	125	195
2550	15815 5.45	15033 5.47	14376 5.50	13863 5.53	13580 5.54	13584 5.54*	88	126	197
2575	15971 5.48	15181 5.51	14518 5.53	14001 5.56	13718 5.58	13722 5.57*	89	128	199
2600	16128 5.51	15330 5.54	14660 5.57	14139 5.59	13856 6.01	13861 6.00*	90	129	201
2625	16284 5.55	15479 5.57	14803 6.00	14278 6.03	13994 6.04	14000 6.04*	91	131	204
2650	16441 5.58	15628 6.00	14946 6.03	14416 6.06	14133 6.08	14139 6.07*	92	133	206
2675	16598 6.01	15777 6.04	15089 6.07	14555 6.09	14271 6.11	14279 6.10*	93	134	209
2700	16755 6.04	15926 6.07	15232 6.10	14694 6.13	14410 6.14	14418 6.14*	94	136	211

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 4.5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7800 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-006-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	16755 6.04	15926 6.07	15232 6.10	14694 6.13	14410 6.14	14418 6.14*	94	136	211
2725	16912 6.08	16076 6.10	15375 6.13	14833 6.16	14550 6.18	14558 6.17*	95	137	214
2750	17070 6.11	16225 6.14	15519 6.17	14973 6.20	14689 6.21	14698 6.20*	96	139	216
2775	17227 6.14	16375 6.17	15663 6.20	15113 6.23	14829 6.25	14838 6.24*	97	141	218
2800	17385 6.17	16525 6.20	15807 6.23	15254 6.26	14969 6.28	14979 6.27*	99	142	220
2825	17542 6.21	16675 6.24	15951 6.27	15395 6.30	15109 6.31	15119 6.31*	100	144	222
2850	17700 6.24	16825 6.27	16095 6.30	15535 6.33	15251 6.35	15260 6.34*	101	146	225
2875	17858 6.27	16975 6.30	16240 6.33	15677 6.36	15393 6.38	15402 6.37*	102	148	227
2900	18016 6.30	17125 6.33	16384 6.36	15818 6.40	15535 6.41	15543 6.41*	103	150	229
2925	18175 6.34	17275 6.37	16529 6.40	15960 6.43	15675 6.45*	15685 6.44*	104	151	231
2950	18333 6.37	17426 6.40	16674 6.43	16101 6.46	15820 6.48*	15827 6.47*	105	153	234
2975	18492 6.40	17577 6.43	16819 6.46	16243 6.50	15964 6.52*	15969 6.51*	106	155	236
3000	18650 6.43	17727 6.47	16964 6.50	16385 6.53	16109 6.55*	16112 6.54*	107	157	238
3025	18809 6.47	17878 6.50	17109 6.53	16528 6.56	16255 6.58*	16254 6.57*	108	159	240
3050	18968 6.50	18030 6.53	17255 6.56	16670 7.00	16400 7.01*	16397 7.01*	109	161	243
3075	19127 6.53	18181 6.56	17401 7.00	16813 7.03	16545 7.05*	16540 7.04*	110	162	245
3100	19286 6.56	18333 7.00	17546 7.03	16956 7.06	16691 7.08*	16683 7.07*	111	164	247

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2 %	△FUEL = + 4.5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7800 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-007-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	1599 0.39	1602 0.39	1605 0.39	1609 0.38			15	16	
225	1732 0.43	1731 0.43	1730 0.42	1731 0.42	1733 0.42		16	17	18
250	1865 0.47	1860 0.46	1855 0.46	1852 0.45	1852 0.45	1855 0.45	18	19	20
275	1998 0.51	1989 0.50	1980 0.49	1974 0.49	1971 0.49	1973 0.48	19	20	21
300	2132 0.54	2118 0.54	2105 0.53	2096 0.52	2090 0.52	2090 0.52	20	21	23
325	2265 0.58	2247 0.57	2231 0.56	2218 0.56	2209 0.55	2208 0.55	22	23	25
350	2399 1.02	2377 1.01	2357 1.00	2341 0.59	2329 0.59	2325 0.59	23	24	26
375	2532 1.06	2507 1.05	2483 1.04	2463 1.03	2448 1.02	2443 1.02	24	26	28
400	2666 1.09	2637 1.08	2609 1.07	2586 1.06	2568 1.06	2562 1.05	25	27	30
425	2801 1.13	2767 1.12	2735 1.11	2708 1.10	2688 1.09	2680 1.09	27	28	31
450	2935 1.17	2897 1.16	2861 1.14	2831 1.13	2808 1.12	2798 1.12	28	30	33
475	3069 1.21	3027 1.19	2988 1.18	2954 1.17	2928 1.16	2917 1.15	29	31	35
500	3204 1.24	3158 1.23	3114 1.21	3078 1.20	3048 1.19	3036 1.19	31	33	37
525	3339 1.28	3289 1.26	3241 1.25	3201 1.23	3169 1.22	3155 1.22	32	34	38
550	3474 1.32	3420 1.30	3368 1.28	3325 1.27	3290 1.26	3275 1.25	33	36	40
575	3609 1.36	3551 1.34	3496 1.32	3448 1.30	3411 1.29	3394 1.29	35	37	42
600	3744 1.39	3682 1.37	3623 1.35	3572 1.34	3532 1.32	3514 1.32	36	38	44
625	3880 1.43	3813 1.41	3750 1.39	3696 1.37	3653 1.36	3634 1.35	38	40	46
650	4016 1.47	3945 1.45	3878 1.42	3821 1.41	3774 1.39	3754 1.39	39	41	48
675	4152 1.50	4076 1.48	4006 1.46	3945 1.44	3896 1.43	3875 1.42	40	43	49
700	4288 1.54	4208 1.52	4134 1.49	4070 1.47	4018 1.46	3996 1.45	42	44	51
725	4424 1.58	4340 1.55	4262 1.53	4194 1.51	4140 1.49	4117 1.49	43	46	53
750	4561 2.02	4473 1.59	4391 1.56	4319 1.54	4262 1.53	4238 1.52	44	47	55
775	4697 2.05	4605 2.03	4520 2.00	4445 1.58	4385 1.56	4360 1.55	46	48	57
800	4834 2.09	4738 2.06	4648 2.03	4570 2.01	4507 1.59	4482 1.59	47	50	59
825	4971 2.13	4870 2.10	4777 2.07	4696 2.05	4630 2.03	4604 2.02	48	51	60

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

FLIP23D A320–214 CFM56-5B4/P SA3420 03301.000011 0250300 .7801 .00200 120 0300350 55 0 100100 40100 18590 FCOM-02-05-40-008-180

FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	4971 2.13	4870 2.10	4777 2.07	4696 2.05	4630 2.03	4604 2.02	48	51	60
850	5108 2.16	5003 2.13	4907 2.10	4821 2.08	4753 2.06	4726 2.05	50	53	62
875	5246 2.20	5137 2.17	5036 2.14	4947 2.11	4876 2.09	4849 2.09	51	54	64
900	5383 2.24	5270 2.21	5166 2.17	5073 2.15	5000 2.13	4971 2.12	53	56	66
925	5521 2.27	5403 2.24	5295 2.21	5200 2.18	5123 2.16	5094 2.15	54	57	68
950	5659 2.31	5537 2.28	5425 2.24	5326 2.22	5247 2.20	5218 2.19	55	59	70
975	5797 2.35	5671 2.31	5555 2.28	5453 2.25	5371 2.23	5341 2.22	57	60	72
1000	5936 2.38	5805 2.35	5686 2.31	5580 2.28	5495 2.26	5465 2.25	58	62	74
1025	6074 2.42	5939 2.38	5816 2.35	5707 2.32	5620 2.30	5589 2.29	60	63	75
1050	6213 2.46	6073 2.42	5947 2.38	5834 2.35	5744 2.33	5713 2.32	61	65	77
1075	6352 2.49	6207 2.46	6077 2.42	5961 2.39	5869 2.36	5837 2.35	62	66	79
1100	6491 2.53	6342 2.49	6208 2.45	6089 2.42	5994 2.40	5962 2.39	64	67	81
1125	6630 2.57	6477 2.53	6340 2.49	6217 2.45	6119 2.43	6087 2.42	65	69	83
1150	6770 3.00	6612 2.56	6471 2.52	6345 2.49	6244 2.46	6212 2.45	67	70	85
1175	6910 3.04	6747 3.00	6603 2.56	6473 2.52	6370 2.50	6337 2.49	68	72	87
1200	7049 3.08	6883 3.03	6734 2.59	6601 2.55	6495 2.53	6463 2.52	69	73	89
1225	7190 3.11	7018 3.07	6866 3.02	6729 2.59	6621 2.56	6589 2.55	71	75	91
1250	7330 3.15	7154 3.10	6999 3.06	6858 3.02	6747 3.00	6715 2.59	72	76	93
1275	7470 3.18	7290 3.14	7131 3.09	6987 3.06	6874 3.03	6841 3.02	74	78	95
1300	7611 3.22	7426 3.18	7264 3.13	7116 3.09	7000 3.06	6968 3.05	75	79	97
1325	7752 3.26	7562 3.21	7396 3.16	7246 3.12	7127 3.10	7095 3.09	77	81	99
1350	7893 3.29	7699 3.25	7529 3.20	7375 3.16	7254 3.13	7223 3.12	78	83	101
1375	8035 3.33	7836 3.28	7663 3.23	7505 3.19	7381 3.16	7350 3.15	80	84	103
1400	8176 3.37	7973 3.32	7796 3.26	7635 3.22	7509 3.20	7478 3.19	81	86	105
1425	8318 3.40	8110 3.35	7930 3.30	7765 3.26	7637 3.23	7606 3.22	82	87	107
1450	8460 3.44	8247 3.39	8063 3.33	7896 3.29	7764 3.26	7735 3.25	84	89	109

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	8460 3.44	8247 3.39	8063 3.33	7896 3.29	7764 3.26	7735 3.25	84	89	109
1475	8602 3.47	8384 3.42	8197 3.37	8026 3.32	7892 3.30	7863 3.29	85	90	111
1500	8744 3.51	8522 3.46	8332 3.40	8157 3.36	8021 3.33	7990 3.32*	87	92	113
1525	8887 3.55	8660 3.49	8466 3.43	8288 3.39	8149 3.36	8121 3.35*	88	93	115
1550	9029 3.58	8798 3.53	8600 3.47	8419 3.42	8278 3.40	8251 3.39*	90	95	117
1575	9172 4.02	8936 3.56	8735 3.50	8550 3.46	8407 3.43	8400 3.42*	91	96	119
1600	9315 4.05	9075 4.00	8870 3.54	8682 3.49	8536 3.46	8513 3.45*	93	98	121
1625	9458 4.09	9213 4.03	9005 3.57	8813 3.52	8665 3.50	8644 3.49*	94	100	123
1650	9601 4.12	9352 4.07	9141 4.00	8945 3.56	8795 3.53	8775 3.52*	96	101	125
1675	9745 4.16	9491 4.10	9276 4.04	9078 3.59	8924 3.56	8907 3.55*	97	103	127
1700	9888 4.20	9630 4.14	9411 4.07	9210 4.02	9054 3.59	9039 3.59*	99	104	129
1725	10032 4.23	9770 4.17	9546 4.11	9342 4.06	9185 4.03	9170 4.02*	100	106	131
1750	10176 4.27	9910 4.21	9682 4.14	9474 4.09	9315 4.06	9303 4.05*	102	108	133
1775	10321 4.30	10050 4.24	9818 4.17	9607 4.12	9446 4.09	9435 4.09*	103	109	135
1800	10465 4.34	10190 4.27	9954 4.21	9740 4.16	9577 4.13	9567 4.12*	105	111	138
1825	10610 4.37	10330 4.31	10090 4.24	9873 4.19	9708 4.16	9700 4.15*	106	113	140
1850	10755 4.41	10470 4.34	10226 4.28	10006 4.22	9840 4.19	9833 4.19*	108	114	142
1875	10900 4.45	10611 4.38	10363 4.31	10140 4.26	9972 4.23	9966 4.22*	109	116	144
1900	11045 4.48	10752 4.41	10500 4.34	10273 4.29	10105 4.26	10100 4.26*	111	118	146
1925	11191 4.52	10893 4.45	10637 4.38	10407 4.32	10237 4.29	10233 4.29*	112	119	148
1950	11337 4.55	11034 4.48	10774 4.41	10541 4.36	10370 4.33	10367 4.32*	114	121	151
1975	11483 4.59	11176 4.52	10911 4.45	10675 4.39	10503 4.36	10501 4.36*	115	123	153
2000	11629 5.02	11318 4.55	11049 4.48	10810 4.42	10636 4.39	10635 4.39*	117	124	155
2025	11775 5.06	11460 4.58	11187 4.51	10944 4.46	10769 4.43	10769 4.42*	118	126	157
2050	11922 5.09	11602 5.02	11325 4.55	11079 4.49	10903 4.46	10904 4.46*	120	128	159
2075	12068 5.13	11744 5.05	11463 4.58	11214 4.52	11037 4.49	11039 4.49*	121	129	162

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	12068 5.13	11744 5.05	11463 4.58	11214 4.52	11037 4.49	11039 4.49*	121	129	162
2100	12215 5.16	11887 5.09	11601 5.01	11349 4.56	11171 4.53	11174 4.52*	123	131	164
2125	12363 5.20	12029 5.12	11739 5.05	11485 4.59	11306 4.56	11309 4.56*	124	133	166
2150	12510 5.23	12172 5.16	11878 5.08	11620 5.02	11440 4.59	11444 4.59*	126	134	168
2175	12658 5.27	12315 5.19	12017 5.11	11756 5.06	11575 5.03	11579 5.02*	127	136	170
2200	12806 5.30	12459 5.22	12156 5.15	11892 5.09	11710 5.06	11715 5.06*	129	138	173
2225	12954 5.34	12603 5.26	12295 5.18	12028 5.12	11846 5.09	11851 5.09*	130	139	175
2250	13102 5.37	12746 5.29	12435 5.22	12165 5.16	11981 5.13	11987 5.12*	132	141	177
2275	13251 5.41	12891 5.33	12575 5.25	12301 5.19	12117 5.16	12124 5.16*	134	143	179
2300	13400 5.44	13035 5.36	12715 5.28	12438 5.22	12253 5.19	12260 5.19*	135	145	181
2325	13549 5.48	13179 5.39	12855 5.32	12576 5.25	12390 5.23	12397 5.22*	137	146	184
2350	13698 5.51	13324 5.43	12996 5.35	12713 5.29	12527 5.26	12534 5.26*	138	148	186
2375	13848 5.55	13469 5.46	13136 5.38	12851 5.32	12664 5.29	12672 5.29*	140	150	188
2400	13997 5.58	13614 5.50	13277 5.42	12989 5.35	12801 5.33	12809 5.32*	141	152	190
2425	14147 6.02	13760 5.53	13418 5.45	13127 5.39	12939 5.36	12947 5.36*	143	153	193
2450	14297 6.05	13906 5.56	13559 5.48	13265 5.42	13077 5.39	13085 5.39*	144	155	195
2475	14448 6.09	14051 6.00	13701 5.52	13404 5.45	13215 5.43	13223 5.42*	146	157	197
2500	14598 6.12	14197 6.03	13842 5.55	13542 5.49	13354 5.46	13362 5.45*	148	159	199
2525	14748 6.16	14344 6.06	13984 5.58	13681 5.52	13492 5.49	13500 5.49*	149	161	201
2550	14898 6.19	14490 6.10	14126 6.02	13820 5.55	13631 5.53	13639 5.52*	151	162	204
2575	15048 6.22	14637 6.13	14269 6.05	13960 5.58	13770 5.56	13778 5.55*	152	164	206
2600	15199 6.26	14784 6.17	14411 6.08	14099 6.02	13910 5.59	13917 5.59*	154	166	208
2625	15350 6.29	14931 6.20	14554 6.11	14239 6.05	14050 6.03	14057 6.02*	156	168	211
2650	15501 6.33	15078 6.23	14697 6.15	14379 6.08	14190 6.06	14197 6.05*	157	170	213
2675	15652 6.36	15225 6.27	14840 6.18	14519 6.11	14330 6.09	14337 6.09*	159	171	215
2700	15804 6.40	15373 6.30	14984 6.21	14660 6.15	14471 6.13	14477 6.12*	160	173	217

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.5 %	ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

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FLIGHT PLANNING FROM BRAKE RELEASE TO LANDING
CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. LANDING WEIGHT = 55000 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	15804 6.40	15373 6.30	14984 6.21	14660 6.15	14471 6.13	14477 6.12*	160	173	217
2725	15955 6.43	15521 6.33	15127 6.25	14801 6.18	14612 6.16	14618 6.15*	162	175	220
2750	16107 6.47	15669 6.37	15272 6.28	14941 6.21	14753 6.19	14758 6.19*	164	177	222
2775	16260 6.50	15818 6.40	15416 6.31	15082 6.25	14894 6.23	14899 6.22*	165	179	224
2800	16412 6.53	15966 6.43	15561 6.35	15224 6.28	15036 6.26	15041 6.25*	167	181	226
2825	16564 6.57	16115 6.47	15706 6.38	15366 6.31	15178 6.29	15182 6.29*	169	183	229
2850	16717 7.00	16264 6.50	15851 6.41	15508 6.34	15321 6.33	15324 6.32*	170	184	231
2875	16870 7.04	16413 6.53	15996 6.44	15650 6.38	15470 6.36*	15466 6.35*	172	186	233
2900	17023 7.07	16563 6.57	16142 6.48	15792 6.41	15614 6.39*	15609 6.39*	174	188	235
2925	17177 7.10	16713 7.00	16288 6.51	15935 6.44	15758 6.43*	15751 6.42*	175	190	238
2950	17330 7.14	16863 7.03	16434 6.54	16078 6.48	15903 6.46*	15894 6.45*	177	192	240
2975	17484 7.17	17013 7.07	16580 6.57	16221 6.51	16048 6.49*	16037 6.49*	179	194	242
3000	17638 7.21	17163 7.10	16726 7.01	16364 6.54	16193 6.53*	16181 6.52*	180	196	245
3025	17792 7.24	17314 7.13	16873 7.04	16508 6.58	16338 6.56*	16324 6.55*	182	198	247
3050	17947 7.27	17465 7.16	17020 7.07	16652 7.01	16483 6.59*	16468 6.59*	184	200	249
3075	18102 7.31	17616 7.20	17167 7.10	16796 7.04	16629 7.03*	16612 7.02*	185	202	252
3100	18257 7.34	17767 7.23	17315 7.14	16940 7.07	16775 7.06*	16756 7.05*	187	204	254

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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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 : 100 kg or 220 lb
- Climb profile : 250kt/300kt/M.78
- Long Range Speed
- Descent profile : M.78/300kt/250kt
- Approach and landing at alternate airport : 80 kg or 180 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) × ΔISA (°C) × Air Distance (NM) or 0.033 (lb/°C/NM) ×ΔISA (°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.

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 100 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 80 KG (4MIN)

REF. LDG. WT AT ALTERNATE = 55000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	**120**	**140**	**160**	**180**	**200**	**FL100 FL120**	**FL140 FL160**	**FL180 FL200**
20									
40	522 0.12						2		
60	676 0.16	659 0.16	660 0.16				3	4	
80	831 0.19	807 0.20	802 0.20	801 0.19	805 0.19		5	5	5
100	986 0.23	955 0.23	943 0.23	937 0.23	934 0.23	937 0.22	6	5	6
120	1140 0.27	1103 0.27	1085 0.27	1072 0.26	1064 0.26	1061 0.26	7	6	7
140	1296 0.31	1251 0.31	1227 0.30	1208 0.30	1193 0.30	1185 0.29	8	7	8
160	1451 0.34	1400 0.34	1369 0.34	1344 0.33	1323 0.33	1309 0.33	9	8	9
180	1606 0.38	1548 0.38	1511 0.37	1480 0.37	1452 0.36	1434 0.36	10	9	10
200	1762 0.42	1697 0.42	1653 0.41	1616 0.40	1582 0.40	1559 0.40	11	10	11
220	1918 0.46	1846 0.45	1796 0.44	1752 0.44	1712 0.43	1684 0.43	12	11	12
240	2074 0.49	1995 0.49	1938 0.48	1889 0.47	1842 0.47	1809 0.46	13	12	12
260	2231 0.53	2144 0.53	2081 0.51	2025 0.51	1972 0.50	1934 0.50	14	13	13
280	2387 0.57	2294 0.56	2224 0.55	2162 0.54	2103 0.54	2059 0.53	15	14	14
300	2544 1.00	2443 1.00	2367 0.59	2299 0.57	2233 0.57	2184 0.57	16	15	15
320	2701 1.04	2593 1.04	2510 1.02	2436 1.01	2364 1.01	2310 1.00	17	16	16
340	2858 1.08	2743 1.07	2653 1.06	2573 1.04	2494 1.04	2435 1.04	18	16	17
360	3014 1.12	2893 1.11	2796 1.09	2710 1.08	2625 1.08	2561 1.07	19	17	18
380	3171 1.15	3043 1.14	2940 1.13	2847 1.11	2756 1.11	2687 1.11	20	18	19
400	3329 1.19	3193 1.18	3084 1.16	2984 1.15	2886 1.15	2813 1.14	21	19	20
420	3486 1.23	3343 1.22	3227 1.20	3122 1.18	3018 1.18	2939 1.17	22	20	21
440	3643 1.26	3494 1.25	3371 1.23	3259 1.22	3149 1.22	3065 1.21	23	21	22
460	3801 1.30	3644 1.29	3515 1.27	3397 1.25	3280 1.25	3192 1.24	24	22	23
480	3959 1.34	3795 1.32	3659 1.30	3534 1.28	3412 1.29	3318 1.28	25	23	24
500	4117 1.37	3946 1.36	3803 1.34	3672 1.32	3543 1.32	3445 1.31	26	24	25

LOW AIR CONDITIONING △FUEL = – 0.5 %	**ENGINE ANTI ICE ON** △FUEL = + 3 %	**TOTAL ANTI ICE ON** △FUEL = + 6.5 %

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ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 100 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 80 KG (4MIN)

REF. LANDING WEIGHT = 55000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 230	270	310	350	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) **FL230 FL270**	**FL310 FL350**	**FL390**
100								0
120	1065 0.25					7		0
140	1183 0.29	1193 0.28				9		0
160	1301 0.32	1303 0.31	1319 0.30			10	10	0
180	1419 0.35	1413 0.34	1422 0.33			11	12	0
200	1538 0.38	1523 0.37	1524 0.36	1531 0.35		12	13	0
220	1656 0.42	1633 0.40	1627 0.39	1628 0.38		13	14	0
240	1775 0.45	1744 0.43	1730 0.42	1724 0.41		14	15	0
260	1893 0.48	1854 0.46	1832 0.45	1822 0.44	1822 0.43	15	16	17
280	2012 0.52	1965 0.49	1935 0.48	1919 0.46	1915 0.46	16	17	18
300	2131 0.55	2076 0.52	2038 0.51	2016 0.49	2009 0.49	17	18	20
320	2250 0.58	2186 0.55	2142 0.54	2113 0.52	2103 0.51	18	19	21
340	2369 1.02	2297 0.58	2245 0.56	2211 0.55	2196 0.54	19	21	23
360	2489 1.05	2408 1.01	2348 0.59	2308 0.58	2290 0.57	20	22	24
380	2608 1.08	2519 1.04	2452 1.02	2406 1.00	2385 0.59	21	23	26
400	2728 1.12	2630 1.07	2555 1.05	2504 1.03	2479 1.02	22	24	27
420	2847 1.15	2742 1.10	2659 1.08	2602 1.06	2573 1.05	23	25	27
440	2967 1.18	2853 1.13	2763 1.11	2700 1.09	2668 1.07	24	26	28
460	3087 1.21	2965 1.16	2867 1.14	2798 1.11	2762 1.10	25	27	30
480	3207 1.25	3076 1.19	2971 1.17	2896 1.14	2857 1.13	26	28	31
500	3327 1.28	3188 1.22	3075 1.20	2994 1.17	2952 1.16	27	29	32

LOW AIR CONDITIONING △FUEL = – 0.5 %	**ENGINE ANTI ICE ON** △FUEL = + 3 %	**TOTAL ANTI ICE ON** △FUEL = + 5 %

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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

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R **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**	11	13	16
20	15	16	18	**20**	23	27	32
30	22	24	27	**30**	34	40	48
40	29	32	36	**40**	46	53	64
50	36	40	45	**50**	57	66	79
100	73	80	89	**100**	114	133	159
200	146	160	178	**200**	228	266	318
300	219	241	267	**300**	342	398	477
400	292	321	356	**400**	456	531	635
500	365	401	445	**500**	570	664	794
1000	730	802	890	**1000**	1141	1328	1589
1500	1094	1203	1335	**1500**	1711	1992	2383
2000	1459	1604	1780	**2000**	2282	2656	3177
2500	1824	2005	2225	**2500**	2852	3320	3971
3000	2189	2406	2670	**3000**	3423	3984	4766
3500	2554	2807	3115	**3500**	3993	4648	5560
4000	2919	3208	3560	**4000**	4564	5312	6354
4500	3283	3609	4005	**4500**	5134	5976	7149
5000	3648	4010	4450	**5000**	5705	6640	7943

FLIP23 A320211 M565A1PIP 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 77 64 43 61 18590 FCOM-N0–03–50–003–001

LONG RANGE SPEED ABOVE FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	8	8	9	**10**	11	13	15
20	15	16	18	**20**	22	26	30
30	23	25	27	**30**	34	38	45
40	30	33	36	**40**	45	51	60
50	38	41	45	**50**	56	64	75
100	75	82	90	**100**	112	128	149
200	150	164	180	**200**	225	256	299
300	226	246	270	**300**	337	385	448
400	301	328	360	**400**	449	513	597
500	376	410	450	**500**	562	641	746
1000	752	820	901	**1000**	1124	1282	1493
1500	1128	1230	1351	**1500**	1685	1923	2239
2000	1504	1639	1802	**2000**	2247	2564	2985
2500	1880	2049	2252	**2500**	2809	3205	3731
3000	2256	2459	2703	**3000**	3371	3846	4478
3500	2632	2869	3153	**3500**	3933	4487	5224
4000	3008	3279	3604	**4000**	4494	5128	5970
4500	3383	3689	4054	**4500**	5056	5769	6716
5000	3759	4098	4505	**5000**	5618	6410	7463

FLIP23 A320211 M565A1PIP 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 77 64 43 61 18590 FCOM-N0–03–50–004–001

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 :

R Climb : 250KT/300KT/M.78
Cruise : M.78
R 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

R **1. Fuel price ratio = 0.942**
Cruising Altitude = FL310
Planned TOW = 64 000 kg (mission weight without fuel tankering)
R Air Distance = 2250 NM
Enter graph on page 2.05.70 P.4.
For the given air distance, the optimum fuel tankering weight is 60 000 kg, which is lower than the planned takeoff weight → no fuel tankering recommended.

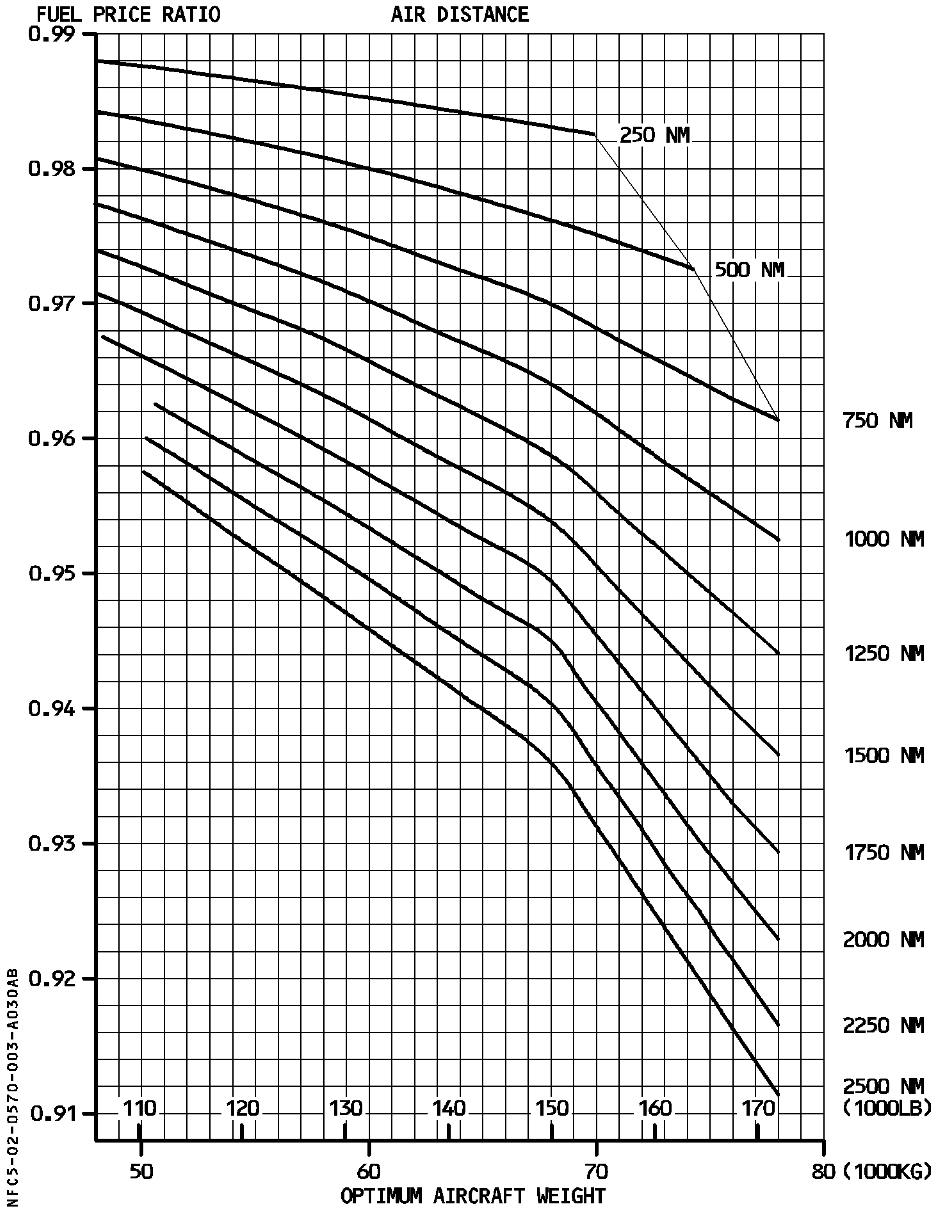
2. Fuel price ratio = 0.914

Cruising Altitude = FL350
Planned TOW = 62 000 kg (mission weight without fuel tankering)
Air Distance = 1500 NM
Enter graph on page 2.05.70 P6.
For the given air distance, the optimum fuel tankering weight is 70 000 kg, which is 8000 kg higher than the planned takeoff weight → optimum quantity of extra fuel is 8000 kg.
Check :
R 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

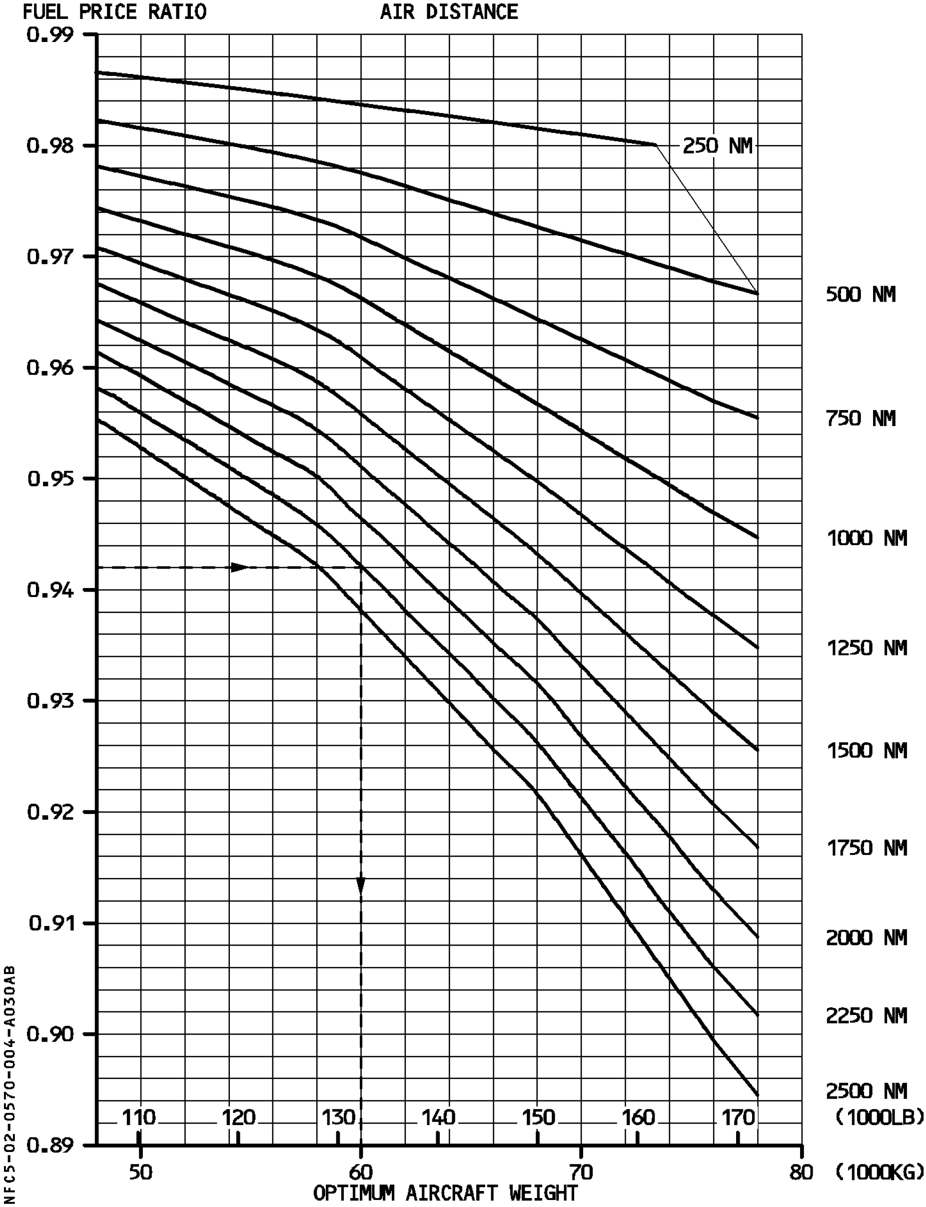
Cruising Altitude = FL390
Planned TOW = 56 000 kg (mission weight without fuel tankering)
Air Distance = 1375 NM
Enter graph on page 2.05.70 P8.
Interpolate for the air distance of 1375 NM between the borderline and 1500 NM.
For the given air distance, the optimum fuel tankering weight is 60 000 kg, which is 4000 kg higher than the planned takeoff weight → optimum quantity of extra fuel is 4000 kg.
Check :
R a) new TOW less than or equal to MTOW from departure airport ;
R b) total fuel to be loaded less than or equal to maximum fuel capacity ;
c) MLW at destination

FL290

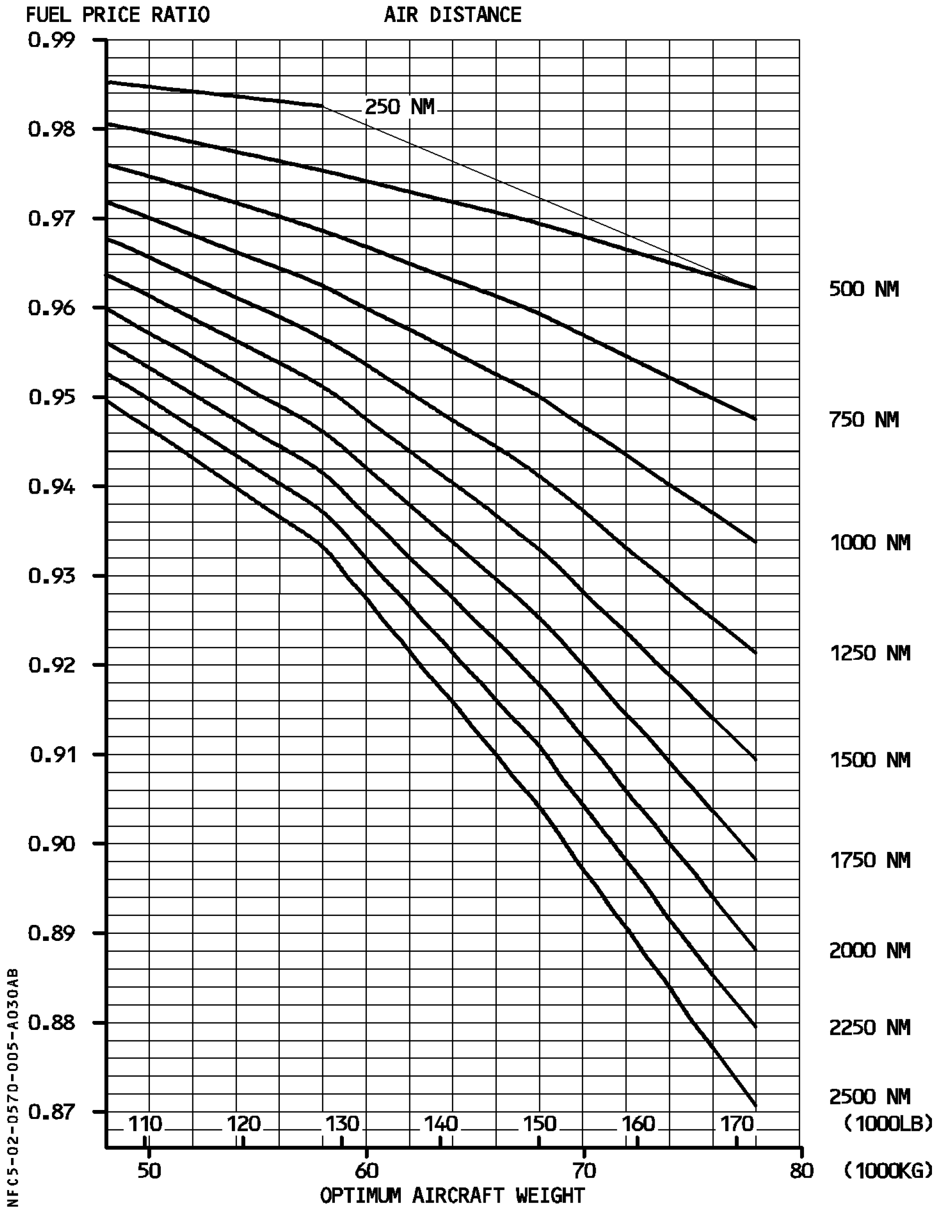


FUEL PRICE RATIO
AIR DISTANCE
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
250 NM
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-003-A030AB

FL310


FUEL PRICE RATIO
AIR DISTANCE
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
250 NM
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-004-A030AB

FL330


FUEL PRICE RATIO
AIR DISTANCE
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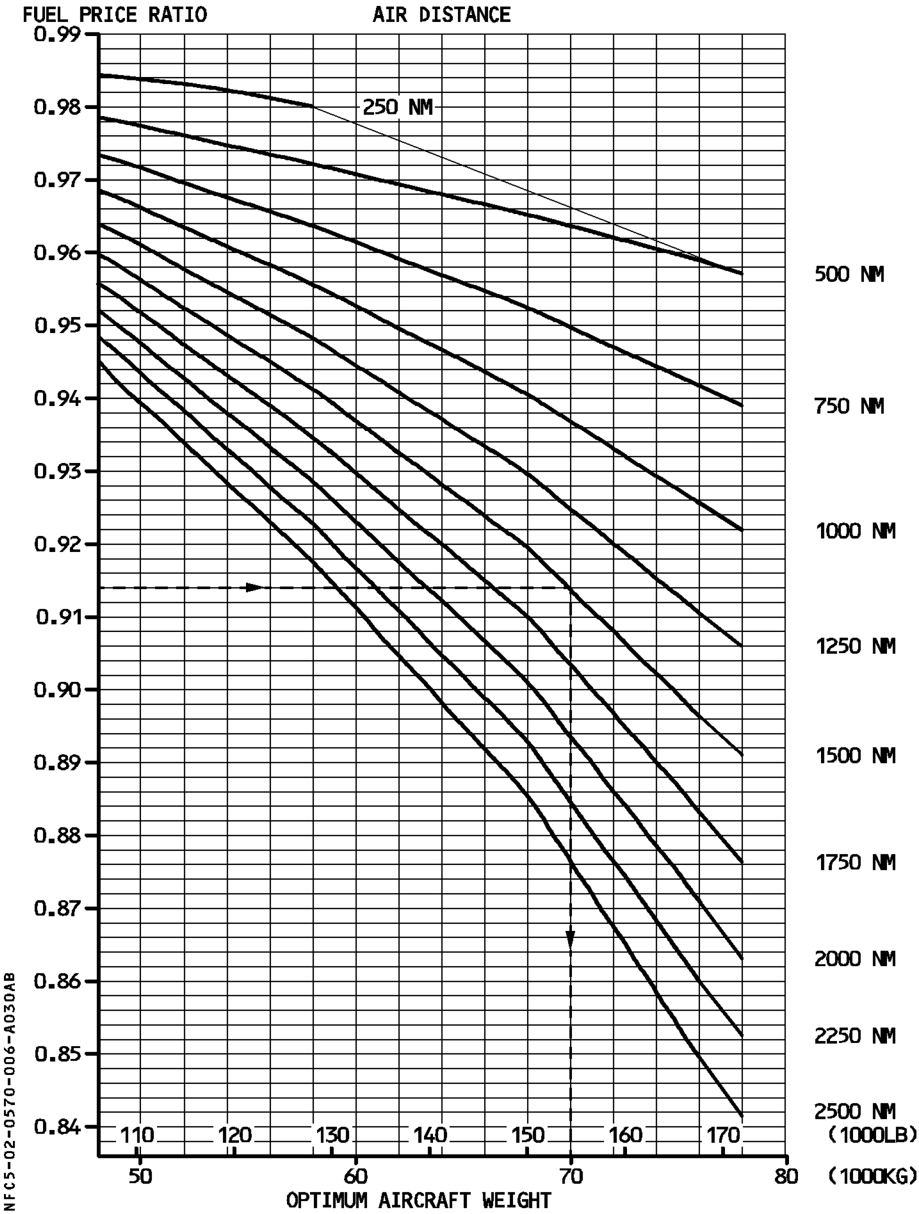
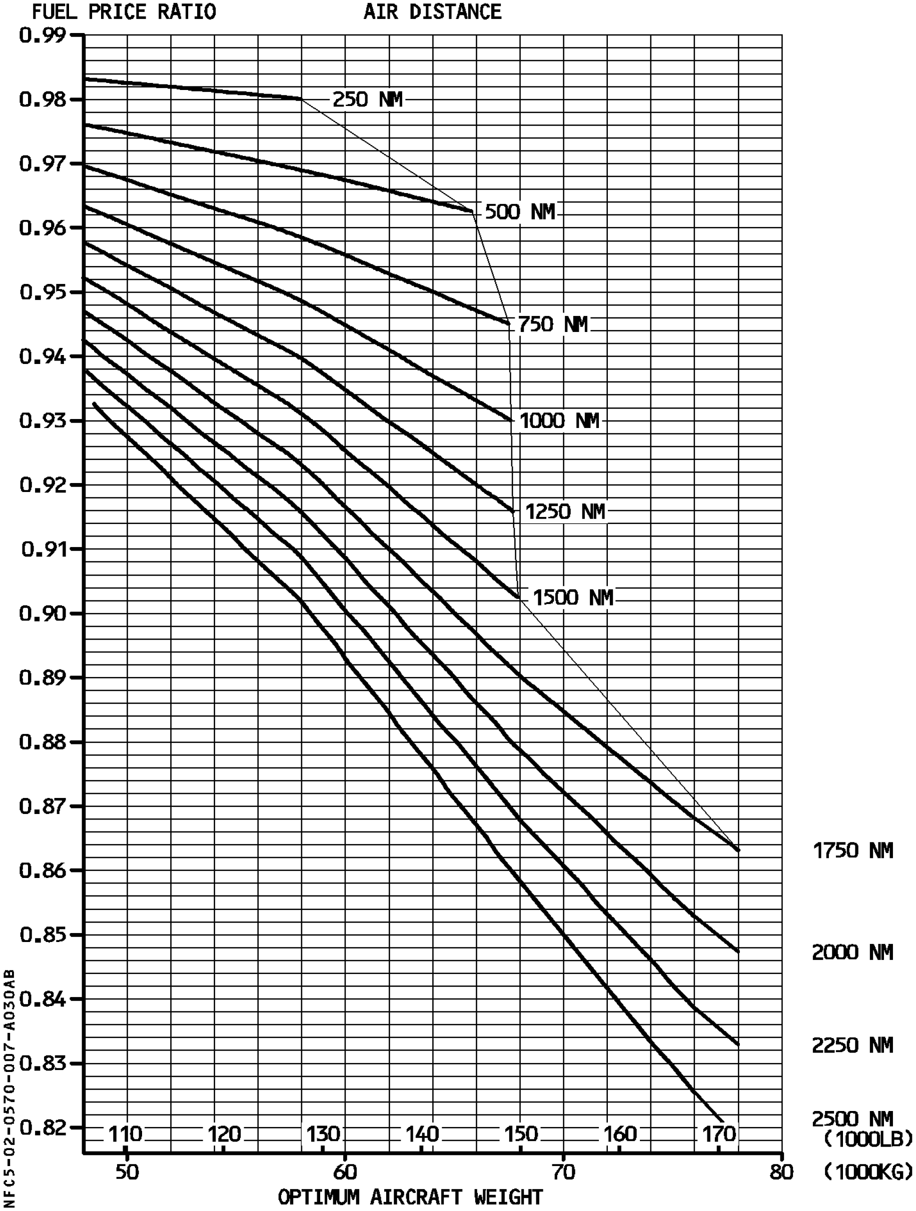
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
0.88
0.87
250 NM
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-005-A030AB

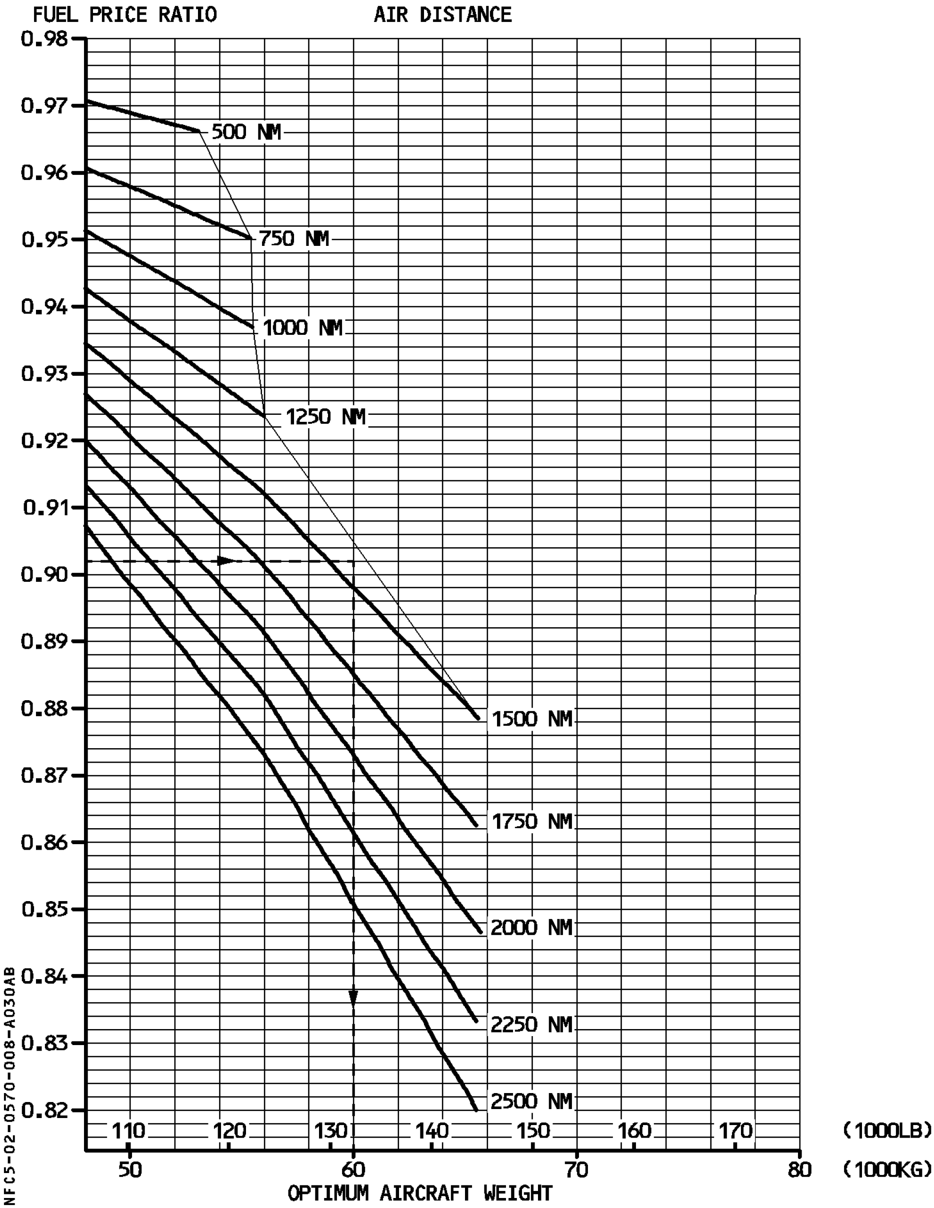
FL350


FUEL PRICE RATIO
AIR DISTANCE
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
0.88
0.87
0.86
0.85
0.84
250 NM
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-006-A030AB

FL370


FUEL PRICE RATIO
AIR DISTANCE
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
0.88
0.87
0.86
0.85
0.84
0.83
0.82
250 NM
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-007-A030AB

FL390


FUEL PRICE RATIO
AIR DISTANCE
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
0.88
0.87
0.86
0.85
0.84
0.83
0.82
500 NM
750 NM
1000 NM
1250 NM
1500 NM
1750 NM
2000 NM
2250 NM
2500 NM
110
120
130
140
150
160
170
(1000LB)
50
60
70
80
(1000KG)
OPTIMUM AIRCRAFT WEIGHT
NFC5-02-0570-008-A030AB