INTERFLUG
BETRIEB
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Flugbetriebsdokumentation

Flugzeug-Handbuch A 310

FZH-310

Das FZH-310 /Teil 2 ist ein von Airbus Industrie genehmigter und in den Abschnitten

- 02 PROCEDURES & TECHNIQUES
- 03 NORMAL PROCEDURES

im Betriebsteil Flugbetrieb der INTERFLUG bearbeiteter Nachdruck des Teils 2 (PROCEDURES AND PERFORMANCE) des Original-FLIGHT CREW OPERATING MANUAL (FCOM) des Flugzeugtyps A310. Es unterliegt dem Änderungsdienst und ist nur für den internen Gebrauch bei INTERFLUG bestimmt.
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Flugkapitän Materna
Betriebsteilleiter

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Airbus Industrie
FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT FITTED WITH GE ENGINES	BULLETIN/ ISSUE N° 05/01 DATE MAR 18/83

SUBJECT : POWER MANAGEMENT CONTROL (PMC)

The PMC is a limited authority digital electronic engine trim control which improves thrust management by increasing thrust setting accuracy.

It permits to visualize the steady state of N1 linked to the TLA position and trims the engine to obtain
actual N1 = N1 command.

THRUST MANAGEMENT

1. Thrust setting general logic

Throttle position loop : (see fig. 1).
The TCC computes the N1 limit (see part 2.).
It displays it on the TRP and commands the N1 limit index on the N1 indicators . The PMC computes the N1 command (see part 3.), according to the TLA (Thrust Lever Angle).
It displays the N1 command on the indicator (via the COMMAND needle) and sends it to the TCC. When the auto-throttle is engaged, it commands the throttles to obtain N1 COMMAND = N1 LIMIT (or TARGET N1 for a flex take off).

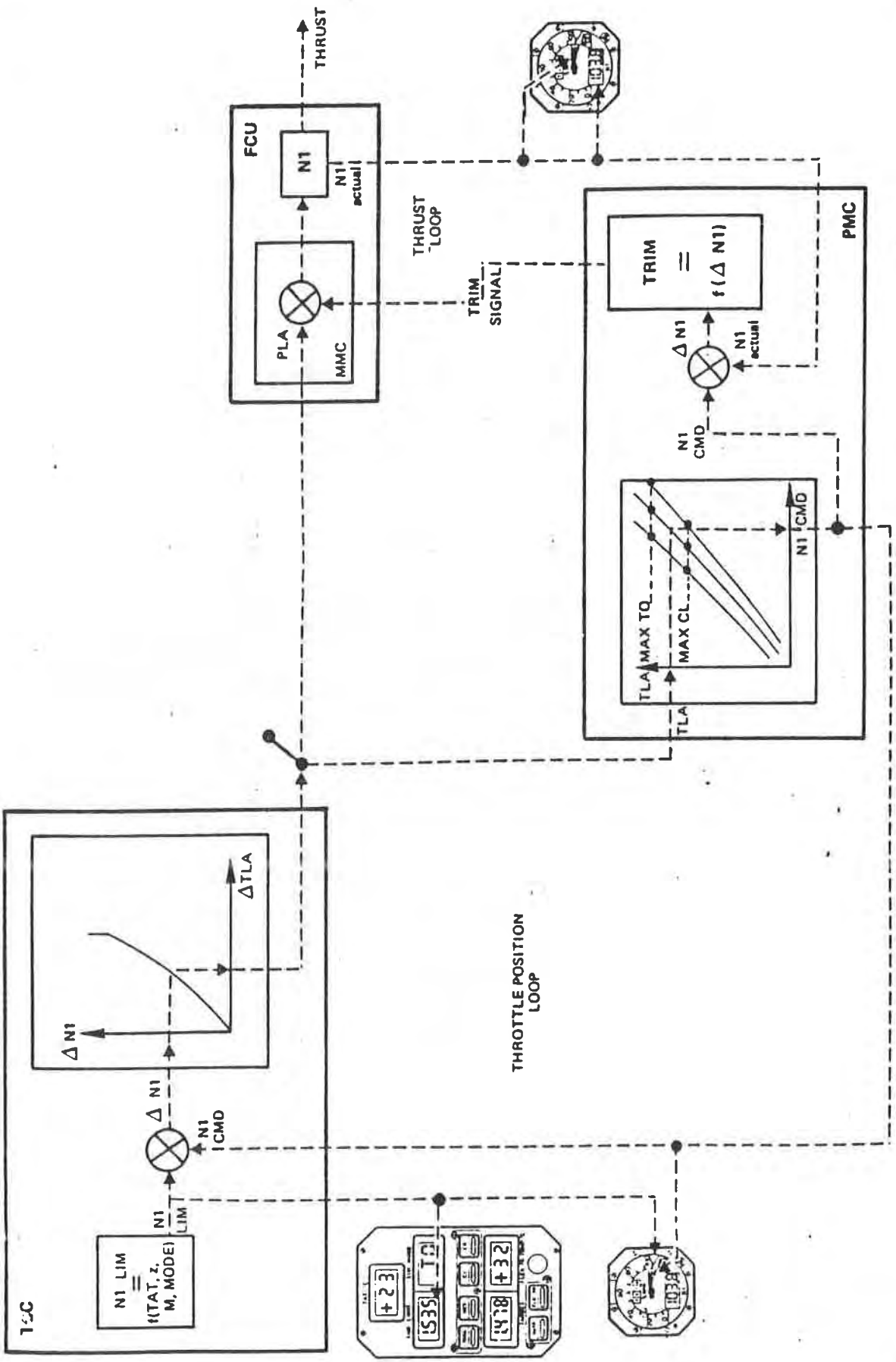
When all bleeds are selected off, MAX CONT (or MAX TO in the case of Mach $<$ 0.47 and altitude $<$ 14200 ft) rating is obtained for a throttle position closed to the full forward position, and MAX CL rating is obtained for another fixed position. These positions do not depend on external conditions, which dispenses the crew from adjusting the throttles during a flight phase.

Thrust loop :
Owing to the trim signal, the actual value of N1 is maintained equal to the command value.
The actual value is displayed on the indicator via the actual N1 needle and the actual N1 counter.

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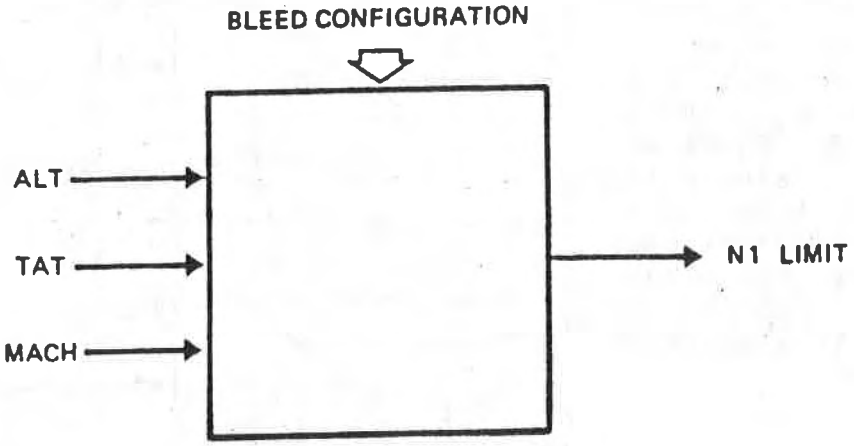
Fig. 1 THRUST SETTING GENERAL LOGIC



2. N1 limit calculation by TCC

For each mode which can be selected on the TRP, the TCC has :
- a basic function N1K = f(TT2)
- a N1K correction function, varying with altitude

and
- a function giving the flat rating value, according to altitude

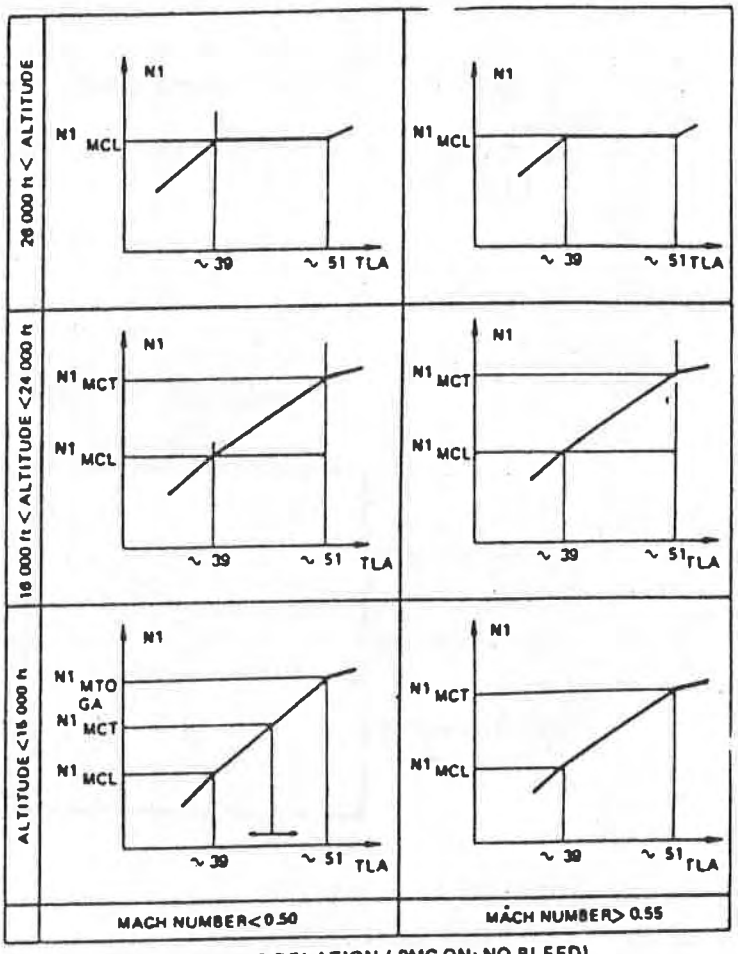


Note : Bleed air correction is a polynomial function of altitude. Its coefficients are defined for each of the following configurations :
- air conditioning
- wing anti ice on 2 engines
- wing anti ice on 1 engine
- engine anti ice

3. N1 command calculation by PMC

The PMC receives TLA information, and depending on the altitude and the mach number, as shown on this schematic (valid with no bleed) computes the corresponding maximum rating.

When the TLA is one of the two fixed values (∼39 or ∼51), the PMC computes the corresponding rating (MAX TO, MAX CLIMB or MAX CONT), using the same functions and the same logic as the TCC, except bleed air correction which is not taken into account by the PMC.



TLA - RATINGS RELATION (PMC ON; NO BLEED)

When the TLA is not one of the two fixed values, the rating is calculated by means of an interpolation.

Note : Above TLA-Max rating relations are valid with PMC ON and no bleeds. For all the other conditions (bleeds ON with PMC ON or OFF, bleeds OFF with PMC OFF and FLEX TO with or without bleeds) Max thrust rating will be established at a different throttle position (less than full forward (∼51°) for TO/GA and MCT).

OPERATION WITH TCC OFF

The pilot reads the N1 LIMIT in tables which are in the FCOM (V2).
He manually sets the N1 LIMIT index on the indicator. If the PMC is available, the pilot sets the throttle to obtain N1 COMMAND = N1 LIMIT (or N1 TARGET for flex TO) and the PMC ensures that ACTUAL N1 = N1 COMMAND.

Note : Different tables are given for the two cases : PMC on and PMC off, because of the two following points :

1) A natural trend of the engine is to reduce ratings. Normally it is corrected by the PMC. When the PMC is not operating, this trend is taken into account for N1 LIMIT computation by the TCC. So, this point has also to be considered in the tables.

2) The correction due to wing anti ice depends on PMC operation.
At lift off, the wing anti ice begins operation.
. if PMC is off, the hydromechanical regulation, for a fixed throttle position, ensures a constant EGT (with an N1 diminution)
. if PMC is on, for a fixed throttle position, it will keep a constant N1 value, which involves an overtemperature. So in this case, a correction must be applied for N1 limit calculation.

OPERATION WITH PMC OFF (or PMC failure)

The PMC incorporates self-test features.
If a failure is detected, the trim value is frozen by a solenoid and the crew is advised by the ENG TRIM FAULT light and CRT display.

If it is necessary to deactivate the PMC system, extreme care should be taken to ensure that engine operating limits are not exceeded. The throttles setting must reduced before the PMC system is switched off. Crew action should be delayed to a non critical phase of flight.

When the PMC is off the hydromechanical control ensures thrust management and thrust setting is made in a conventional way.

Note : Some more critical failures may involve the loss of the digital actual N1 indication.

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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AVV-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT	BULLETIN/ ISSUE N° 08/02 DATE MAR 84

SUBJECT : AERODYNAMIC DESIGN AND FLYING QUALITIES

A - AERODYNAMIC DESIGN

1. GENERAL

The A 310 is a medium range aircraft whose wing aerodynamic design has been optimized for both high speed and low speed.

The A 310 uses the same wide-body cross-section selected for the A 300. The well proven layout for wing moveable surfaces, tailplane position and engine location has also been retained. But in front of these points of similarity, there are also significant aerodynamic differences between the two aircraft which are :

- an all-new wing, to take advantage of the latest advances in aerodynamics,
- a new rear fuselage permitting an increase in setting capacity without increasing fuselage length
- a new tailplane of reduced area
- new engines

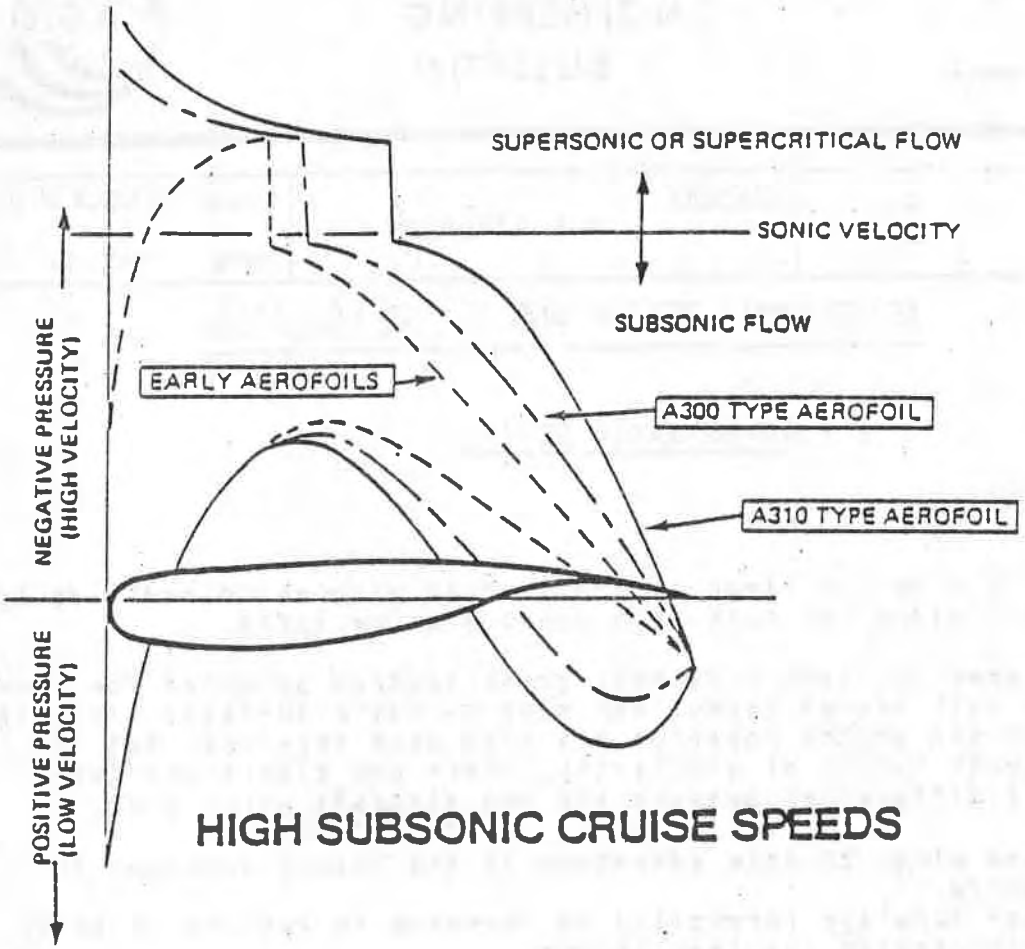
2. WING DESIGN

2.1 High speed design

Compared to the A 300, the supercritical flow and rear loading characteristics of the A 310 have been significantly improved with a particular attention being paid to delay as much as possible the onset of the buffet and to avoid pitch up at high angles of attack.

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HIGH SUBSONIC CRUISE SPEEDS

All interference aspects have been carefully treated, (wing/ fuselage junction, nacelle/pylon/wing interference, flap support fairing/wing interference...)

The results have been :

- an increase in design lift coefficient of about 20% relative to the A 300
- an increase in wing thickness for same drag relative to the A 300 particularly on the inboard wing, which allows more fuel capacity
- a reduction in wing area of 16% relative to the A 300 while retaining adequate volume for fuel stowage
- an increase of 14% in aspect ratio, thus maintaining the span within 2% of the A 300 as improving induced drag and hence fuel efficiency.

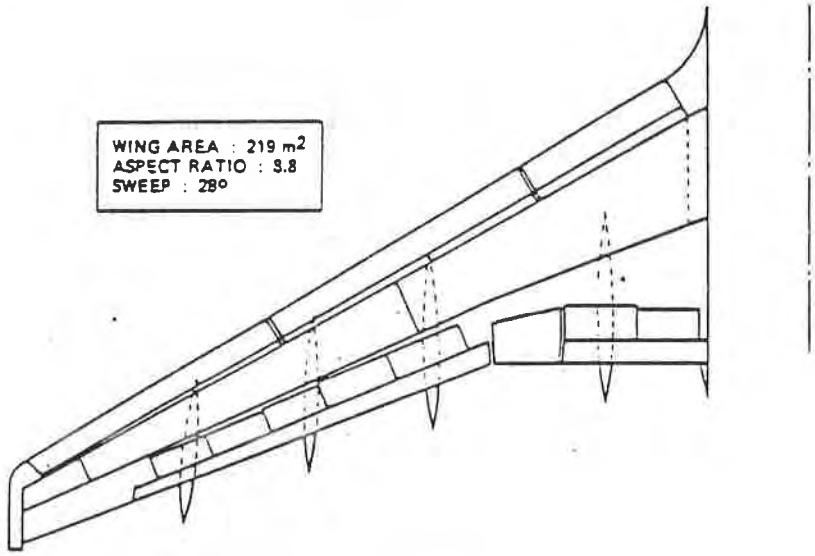
2.2 Low speed design

To achieve the A 300 field performance requirements, very efficient high lift devices were needed.

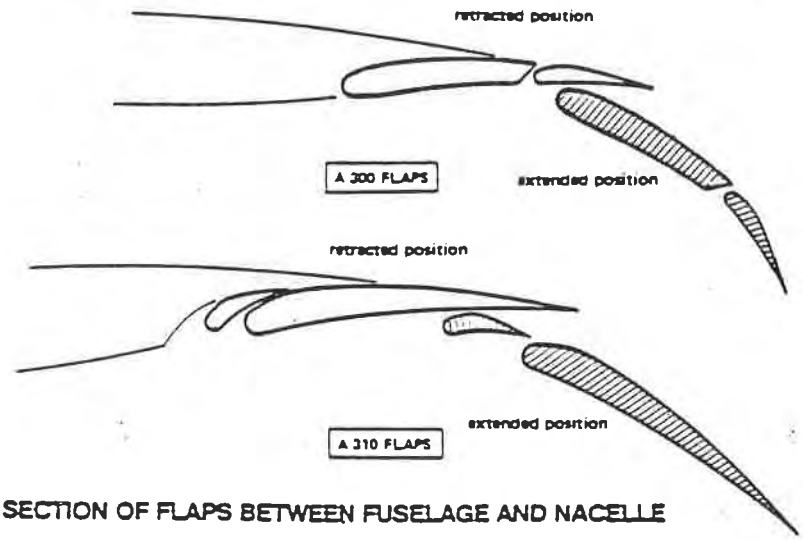
Full span leading edge slats associated with tabbed fowler flaps at the trailing edge were finally selected. This track mounted system permitted both take-off and landing configurations to be aerodynamically optimized. The system was proved in extensive wind tunnel tests guided by theoretical methods.

A similar approach has been used to optimize A 310 high lift devices and all the experiences gathered on A 300 has been used to improve the system.

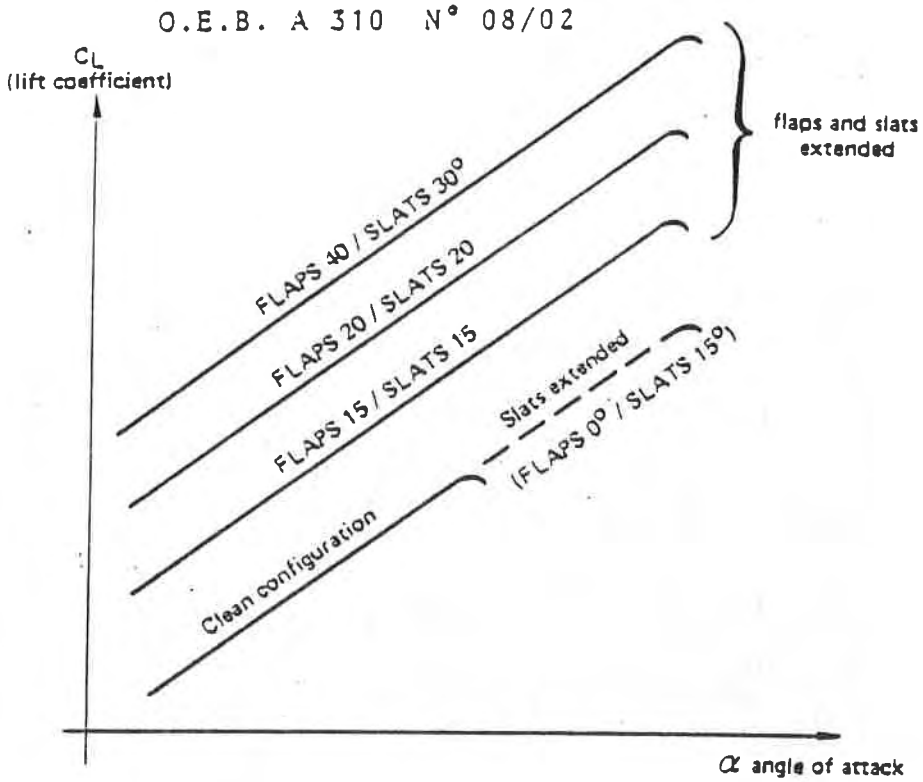
The flap tabs were replaced by a forward expanding vane. This solution offered a cleaner cruise configuration than the tabbed flap when combined with the advanced airfoil. Early wind tunnel tests showed that the vane on the outboard flap could be deleted with a substantial saving in weight and complexity.



A310 WING



SECTION OF FLAPS BETWEEN FUSELAGE AND NACELLE



Slats improve the air flow at high angle of attack and allow to increase the maximum lift coefficient. Flaps act on the camber of the wing and allow to increase lift coefficient at a given angle of attack.

3. FLIGHT CONTROLS

3.1 Primary flight controls

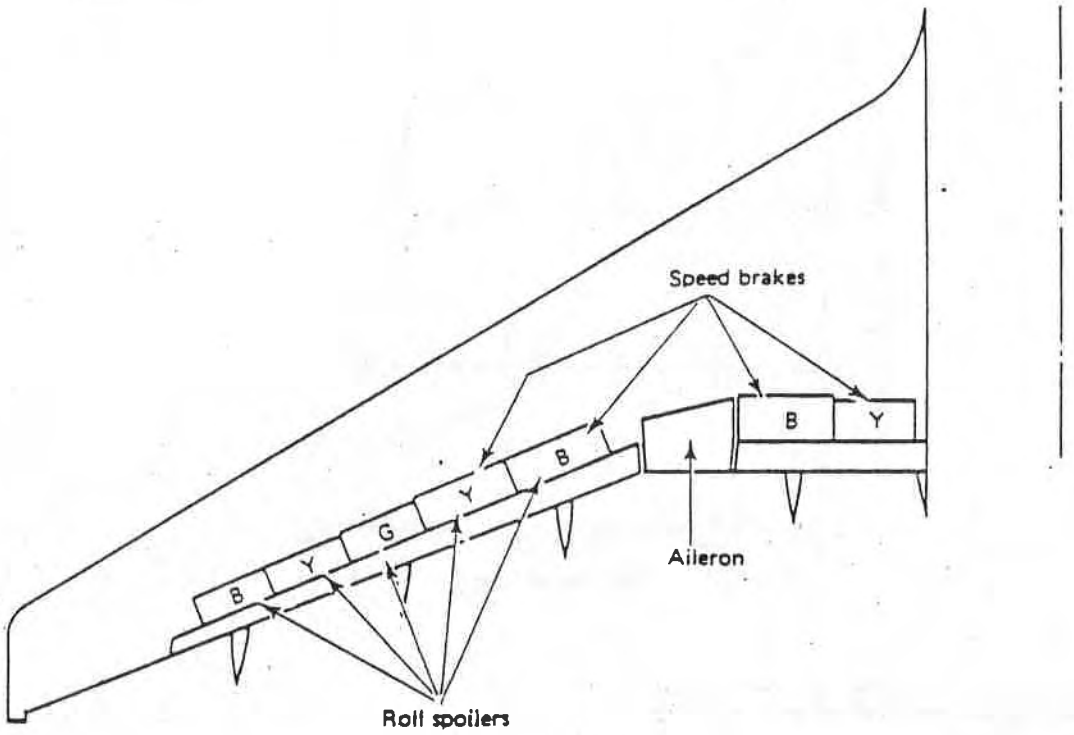
3.1.1 Pitch

Mechanical control of the two elevators which are hinged on the trimmable horizontal stabilizer.

The two elevator control channels can be uncoupled up to Vc : 195 kt for jamming on one control linkage occuring during take off.

- Hydraulic actuation is achieved by three mechanical input servocontrols per elevator.
- The maximum deflections of the elevators are :
  + 15° (pitch down)
  - 30° (pitch up)
- The pitch artificial feel system creates a stiffness on the control column which is a variable with the flight conditions.

3.1.2 Roll



Roll control on each wing is achieved by means of an inner aileron and 5 spoilers (N°3 to 7).

The inner aileron is controlled by means of a mechanical linkage.

The spoilers are controlled by electrical signals.

Each inner aileron is operated by 3 servocontrols, each powered by a different hydraulic system.

Each spoiler surface is actuated by one hydraulic actuator.

The artificial feel system is independent from the flight conditions.

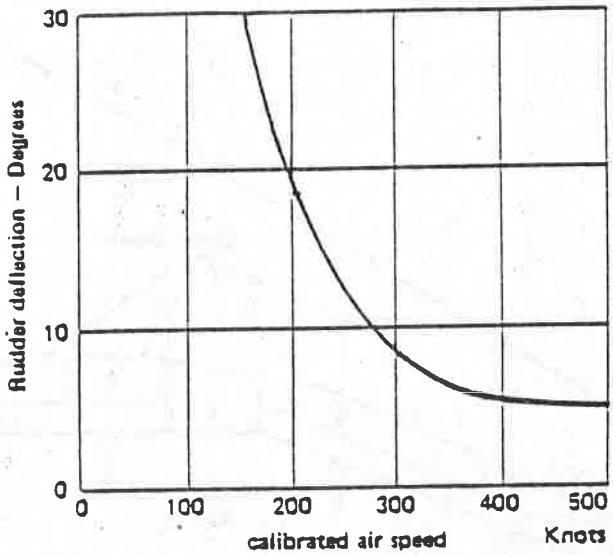
3.1.3 Yaw

The rudder surface is controlled by single mechanical linkage up to the artificial feel unit.

Hydraulic actuation is achieved by three servocontrols each powered by a different hydraulic system.

At high speeds a variable stop lever control system limits the rudder travel according to A/C speed (Vc).

The law of maximum rudder deflection versus Vc to be achieved so as not to exceed the structural limitation is :



3.2 Secondary flight controls

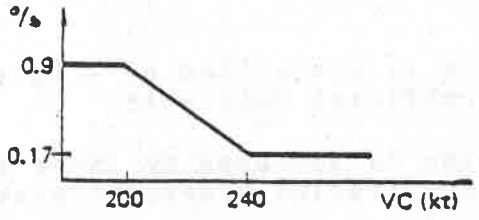
3.2.1 Trims

. Pitch
Pitch trim control is achieved by a trimmable horizontal stabilizer (THS). The THS is driven by an actuator which includes two hydraulic systems. The trim control is :

. mechanical
. electrical (including : - manual trim
- auto trim
- Mach and Vc trim
- angle of attack trim)

The pilots can override the electrical control using the mechanical control, by applying a sufficiently large force on the trim control wheels.

In electrical mode, the rotation speed of the pilot trim are :



Trimmable horizontal stabilizer authorities :

+ 3° (pitch down)
- 14° (pitch up)

. Yaw
The trim control is electrically signaled

Main characteristics :
- low speed : 1.2 rudder deflection per second
- reset action for rudder deflection
- authority : +/- 21° of rudder deflection or variable stop lever control system values.

. Roll

The trim control is electrically signalled in the range of +/- 7° of the aileron.

3.2.2 Slats and Flaps

Five slat/flap settings are proposed, with 5 gates on the slat/flap control lever.

SLAT/FLAP CONFIGURATIONS

SLATS	FLAPS	FLIGHT PHASE
0	0	CRUISE
15	0	TAKE OFF
15	15	TAKE OFF
20	20	APPROACH
30	40	LANDING

3.2.3 Speed brakes

Four electrically signalled surfaces (1 to 4) are used on each wing for this function.

Maximum deflections : outer airbrakes : 45°
inner airbrakes : 45° x 0.45

3.2.4 Ground spoilers

Use of all moving surfaces (1 to 7) on the ground up to a deflection of 50°.

B - FLYING QUALITIES

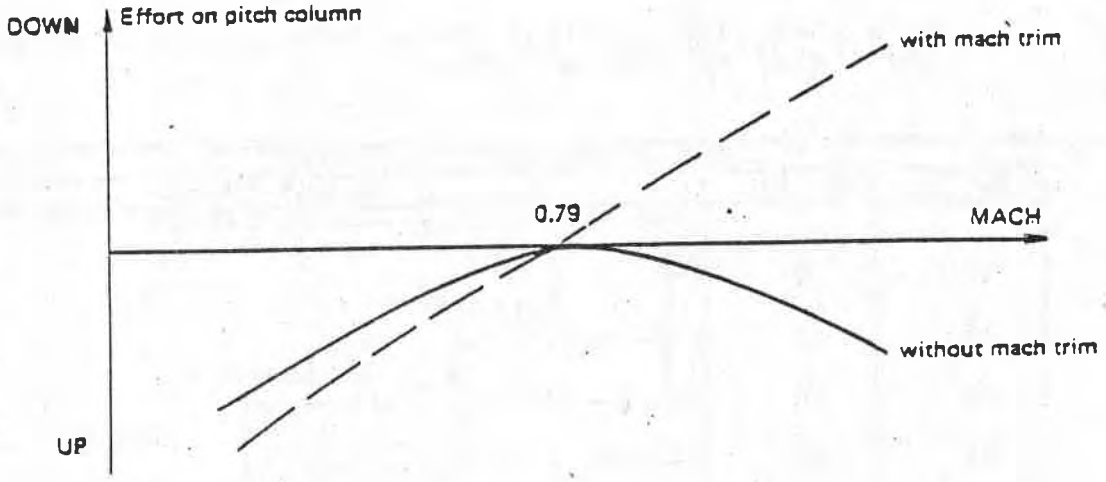
1. LONGITUDINAL CHARACTERISTICS

1.1 Longitudinal static stability

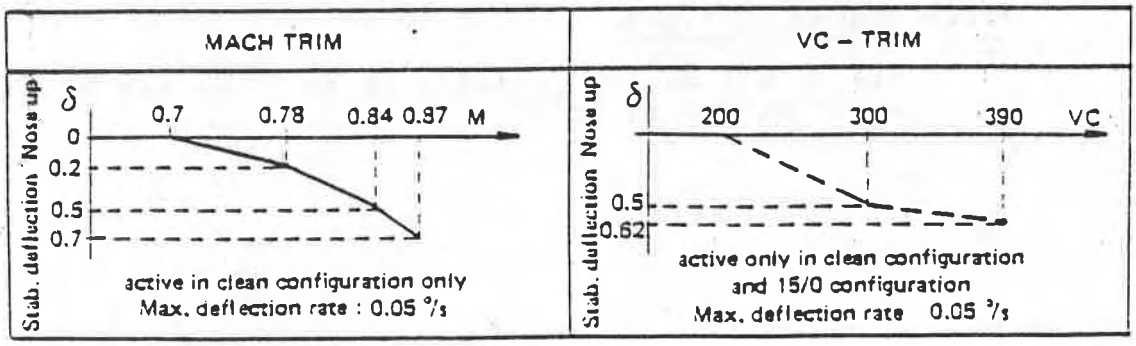
Speed stability

The concept of relaxed stability, already introduced in the A 300, has been extended on the A 310. Nevertheless without any longitudinal stability augmentation aids the airplane has still good handling qualities and is authorized to fly with a small flight envelope restriction at Mach 0.78.

In order to comply with the airworthiness requirements which demand a positive slope of the law stick force versus speed and a mean gradient of 1 pound per 6 knots, the A 310 has been equipped with a Mach trim and a speed (vc) trim.



The Mach Trim works beyond 0.7 Mach number and the Vc-trim is operative above 200 kt. The mixing of these two laws allows to comply with the regulation at aft cg while providing comfortable handling qualities at forward cg as in the descent at constant speed.



Without aids the A 310 recovering the natural static stability below 0.79 Mach number the Airworthiness Authorities authorise to dispatch the airplane through the MMEL with only one Pitch Trim, without any limitation, and limit the flight envelope to 0.78 Mach number in case of double failure.

1.2 Longitudinal dynamic stability

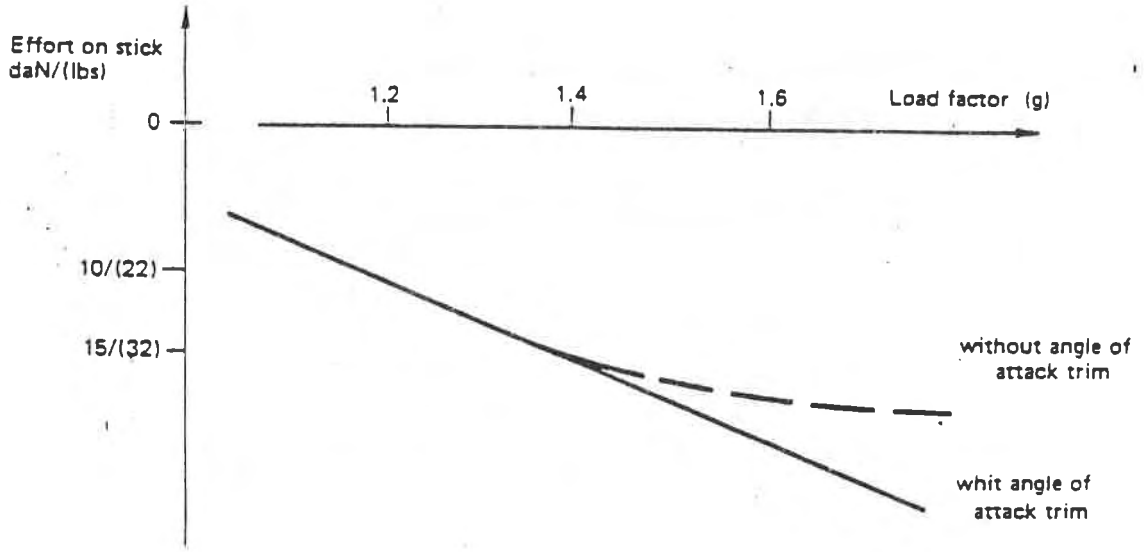
In the whole flight envelope, any quick input on the pitch control leads to an aperiodic response of the airplane. The angle of attack oscillation is strongly damped.

The period (about 80 seconds in clean configuration) and the damping of the phugoid mode are such that they do not affect the handling.

1.3 Manoeuvrability : longitudinal control

In all configurations the longitudinal manoeuvrability is satisfactory. Any transition from a flight condition to another can be performed very easily with one hand. The laws of the artificial feel have been optimized in order to have an effort per g between 10 daN/25 lb and 20 daN/50 lb within the whole flight envelope and within the cg limits.

Stability in manoeuver :
In clean configuration, at high Mach number and high altitude without augmentation system, the stick force may slightly decrease at load factors beyond 1.4 g. This phenomenum even though not affecting the normal handling manoeuvers, is couteracted by an angle of attack trim which introduces a tailplane pitch down deflection when the angle of attack increases and consequently increases the effort on the stick during manoeuver



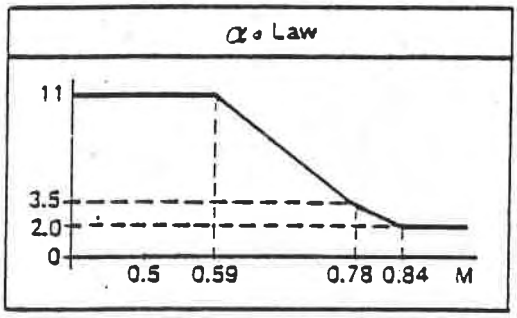
Angle of attack trim is active in clean configuration with the following law :

$$\delta_{q_T} = 0.45\ (\alpha - \alpha_o)$$

where α is the actual angle of attack

R It is inhibited when the auto pilot is engaged or air-
R brakes are extended.

α_o is as follows :



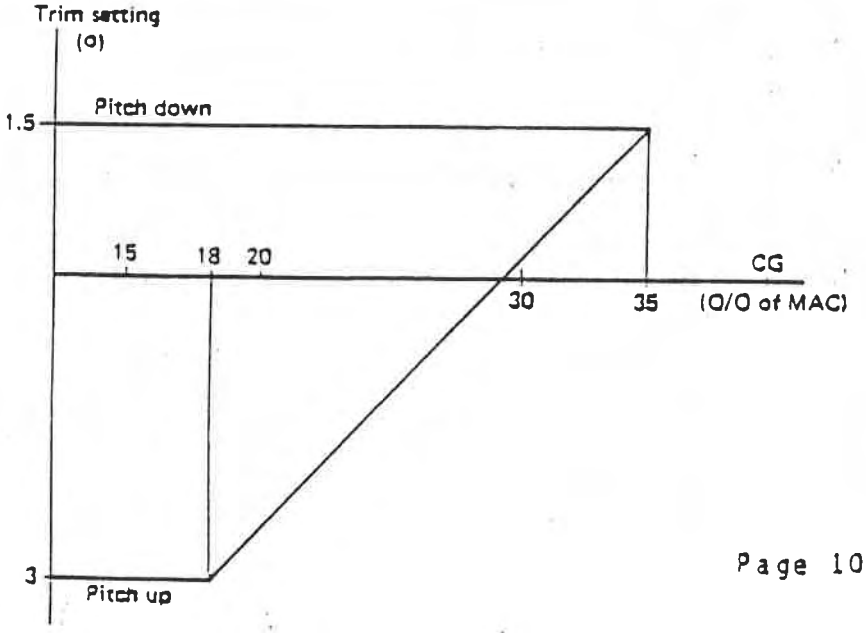
The angle of attack trim has an other function which is to counter excessive angle of attack at low speed (α greater than 21° in 20°/20° and 30°/40° configuration) by initia-
R ting a 4° nose down deflection of the stabiliser at the
R max.rate of 0.4 °/s.

1.4 Take off out of trim

The take off trim range has been selected to have the airplane trimmed for the second segment climb at about 1.3 Vs all engines operative.

One law, trim setting versus cg position, only is retained whatever the take off configuration (S15/F0, S15/F15 or S20/F20).

The elevator efficiency and the pitch artificial feel allow to take off with the maximum out of trim corresponding to the take off trim range without exceptional piloting skill and effort.



1.5 Configuration change

1.5.1 Landing gear manoeuver

The longitudinal pitching moment associated with landing gear extension and retraction requires a control force not more than 10 daN (25 lb).

1.5.2 Speedbrake manoeuver

The trim change due to the speedbrake extension is very small in pitch up.

- Speedbrake extended the handling qualities are such that there is no limitation for their use.
- The deceleration rate between 300 kt and 250 kt at constant altitude is :
  1.6 kt/s (0.084 g) with speedbrake extended
  0.77 kt/s(0.04 g) with speedbrake retracted

1.5.3 Slat/flap extension and retraction

The change in slat and flap configuration either in extension or in retraction induces a pitch moment which is easily controlable (effort less than 12 daN (28 lb)).

2. LATERAL CHARACTERISTICS

2.1 Roll manoeuvrability

Using the digital technology, the laws of the spoilers have been optimized for each airplane configuration.

Time to bank to 30°

CONDITION	SLATS/FLAPS	SPEED/GEAR	TIME TO BANK 30° (s)	
			PILOT ACTION ON RUDDER PEDALS	NO PILOT ACTION ON RUDDER PEDALS
LANDING ONE ENGINE OUT	30/40	1.3Vs GD	2.2	2.4
APPROACH ONE ENGINE OUT	20/20	1.3Vs GU	2.5	2.6
APPROACH ONE ENGINE OUT	20/20	1.3Vs GD	2.6	2.8
TAKE OFF ONE ENGINE OUT	15/15	1.4Vs GU	2.7	2.7
TAKE OFF ONE ENGINE OUT	15/0	1.4Vs GU	2.7	3.0

2.2 Lateral control one engine inoperative

The directional procedure for take off with one engine failure is to use sufficient rudder to hold a constant heading whilst maintaining the control wheel at about neutral.

Example for take off configuration 15°/15° - Gear up. 1.4Vs

	NO RUDDER (TOW=130T)
BANK ANGLE	0°
WHEEL DEFLEC.	53,5 %
WHEEL FORCE	9 LB

STANDARD PERFORMANCE HANDLING

CONTROL WHEEL AT NEUTRAL* - CONSTANT HEADING

TOW	138,6 T	130 T
RUDDER DEFLECTION	15° 50% STILL AVAILABLE	16,5° 48% STILL AVAILABLE
RUDDER FORCE	45 LB	58 LB
SIDE SLIP	3.7°	4°
BANK ANGLE	0.4°	0.4°

*This procedure allows 100 % control wheel availability and about 50 % of rudder leading to an outstanding maneuvering capability.

Example for LANDING CONFIGURATION 30°/40° Gear down 1.3Vs

	NO RUDDER
BANK ANGLE	0°
WHEEL DEFLEC.	51 %
WHEEL FORCE	8,5 LB

STANDARD PERFORMANCE HANDLING

CONTROL WHEEL AT NEUTRAL* - CONSTANT HEADING

RUDDER DEFLECTION	11° 63 % STILL AVAILABLE
RUDDER FORCE	38 LB
SIDE SLIP	1,8°
BANK ANGLE	0,6°

*This procedure allows 100 % control wheel availability and about 40 % of rudder leading to an outstanding maneuvering capability.

2.3 Directional and lateral stability

2.3.1 Dutch roll

Without yaw damper, the lateral dynamic stability is positive in the whole flight envelope (period between 4 and 5 seconds and damping ratio between 0.03 and 0.08 in clean configuration ; period of about 6 seconds and damping ratio between 0.03 and 0.06 in other configurations). However to improve the passengers comfort and allow an easier handling at high altitude, the A 310 is provided with two yaw dampers.
Note that it is possible to dispatch the aircraft with the two yaw dampers inoperative without any restriction.

2.3.2 Steady sideslip/cross wind capability

The A 310 presents a yaw and roll positive static stability in all conditions : the aircraft has a tendency to recover from a sideslip with the roll control free, while maintaining the heading constant by means of rudder. The yaw and roll control movements and forces are proportional to sideslip angle.

From flight test results and after readjustment of the theoretical results for aircraft identification the cross wind capability theoretically assessed for the A 310 is :

R 37 kt for take off and landing

3. STALL CHARACTERISTICS

Whatever the configuration may be, the lateral and longitudinal controllability is always assured by the main controls with small displacements.

Longitudinal static stability is always positive even at rear center of gravity location and with engine thrust.

The aircraft behaviour is good up to and during the stall which is characterized by buffet and natural nose down. Furthermore, in order to increase this nose down in approach and landing configurations, an α -trim protection system has been installed for the very high incidence range ($\alpha > 21°$).

In addition aural warning and stick shakers, initiated by an angle of attack signal, provide in all configuration a margin to the stalling speed of about 10%.

Recovery by lowering pitch control is immediate and easy and no secondary stall tendency has been noticed.

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OPERATIONS ENGINEERING BULLETIN

A 310

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SUBJECT : AFS BEHAVIOUR FOLLOWING CUT OFF (GREATER THAN 5 SECONDS) OF THE TOTAL ELECTRICAL NETWORK OF THE AIRCRAFT

REASON FOR USE :

A misunderstanding of the behaviour of the AFS computers after electrical network cut off greater than 5 seconds (and this occurs every day before the first flight of the day) has caused some useless removal of these computers.

DESCRIPTION OF THE PHENOMENON

1 - AFS COMPUTER TEST PROGRESS

After an electrical network cut off (greater than 5 seconds) on ground, all the AFS computers perform automatically some self tests.

These tests are activated by a power up detector and verify that the safety devices are operating correctly (voters, comparators, hardware delays, power channels, hardware circuits involved in the disconnection logics and software circuits elements).

During completion of these tests, the AFS computers are not in position to accept any system engagement. Consequently, after each power supply cut off and particularly during daily A/C power setting, it is mandatory to await until completion of these tests before trying to engage any AP, ATS, Pitch Trim or Yaw damper lever.

2- END OF TESTS DETECTION

these tests may require up to five minutes. The end of these tests is detected, by the following cockpit symptoms :

For the FCC 1 (2) : Appearance of FD1 (2) engagement indication on FMA.

For the FAC 1 (2) : Disappearance of "SPD LIM" red flag on CAPT (F/O) PFD.

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For the TCC : Selection of TO mode on TRP.
If A/C is fitted with 2 TCC's, note that presence of this indication means end of tests for at least one TCC. To ensure that both TCC's have completed their tests, it is possible to monitor through FMS that TCC1 and TCC2 failure indication have disappeared on SENSOR STATUS page (for a SPERRY FMS) or on DATA SENSORS page (for SMITHS FMS).

These different symptoms mean that the AFS computers are energized. It is possible at this time to engage any AFS lever (PITCH TRIM, YAW DAMPER , ATS or AP).

3 - AUTOMATIC POWER SUPPLY CUT OFF (OF THE AFS COMPUTERS)

12.5 sec after the end of these tests, in order that the AFS computers do not remain energized without any necessity, an automatic cut off of the AFS computer energization occurs.

This of course does not cut the total network of the A/C.

NOTE : The automatic cut off occurs only if no AFS lever (PITCH TRIM, YAW DAMPER or ATS is engaged).

As soon as this automatic cut off has occurred :
- FD1 and FD2 indication on FMA's disappear again
- "SPD LIM" red flag on PFD's appears again
- TO indication on TRP disappears again.

When the crew wants to energize again the AFS computers (for COCKPIT PREPARATION) he has to engage a PITCH TRIM lever first. Then he can engage any YAW DAMPER, ATS or AP lever provided engagement conditions of these systems are met.

AIRBUS INDUSTRIE RECOMMENDATIONS TO THE CREW

- If COCKPIT PREPARATION is done just after A/C power setting (first flight of the day), it may be necessary to await until end of AFS self tests (5 min maximum) to engage any AFS system.

- After occurence of an automatic AFS power supply cut-off, it is mandatory to engage first TRIM 1 or 2 (in order to restore power supply to other AFS computers) before engaging any other AFS system (YAW DAMPER, ATS or AP).

NOTE : ATS or YAW DAMPER can however be engaged, even if both TRIM are inoperative when one engine is running.

Airbus Industrie
FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by A1/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT FITTED WITH G.E. ENGINES	BULLETIN/ ISSUE N° 21/1 DATE August 30/83

SUBJECT : OIL QUANTITY VARIATION

REASON FOR ISSUE :

The purpose of this bulletin is to explain oil quantity indication variations that occur due to characteristics of the lubrication system.

DISCUSSION :

Before engine start, 18 quarts on the cockpit gauge corresponds to a full tank while a zero cockpit gauge indication corresponds to approximately 6 quarts remaining in the tank.

When the engine is running, the tank oil quantity and cockpit indications will decrease due to additional distribution of oil within the lube system (i.e., sumps, gearboxes and supply and scavenge lines). The magnitude of the quantity decrease, commonly referred to as "gulping," varies with rotor speed. High "gulping" is associated with high N1 and N2. During takeoff, aircraft acceleration on the runway and aircraft rotation will transiently increase "gulping". Oil temperature (thermal expansion), aeration and aircraft pitch attitude will also influence "gulping".

Indicated oil quantity will increase or decrease with power changes as shown in the following table. The lack of any indicated oil "gulping", i.e., no change in indicated quantity with engine speed changes, implies an instrumentation problem.

TYPICAL OIL "GULPING"

Operational Mode	Change from Pre-Start Quantity +/- 2, qts
Ground idle	5
Takeoff	10
Climb	8/10
Cruise	6
Descent	5
Ground idle	5
Shutdown	0

All engines will not have identical "gulping" characteristics.

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RECOMMENDATIONS :

During takeoff/early climb if oil "gulping" to or near zero occurs monitor oil temperature and pressure. If indicated quantity does not recover after reducing power a loss of oil or indicator error should be suspected. Normal engine operation can be conducted without oil quantity indication as long as oil pressure and temperature are satisfactory.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY	BULLETIN/ ISSUE N° 28/1
		ALL GE ENGINES	DATE 12/12/83

SUBJECT : ENGINE TRIM SYSTEM FAILURE DURING TAKE-OFF

The engine trim fault warning on ECAM and associated single chime are inhibited from take-off power setting to 1000 ft, based on the assumption that in the normal "fail fix" mode, thrust excursions would not exceed +/- 5 % (about +/- 2 % N1). The local ENG TRIM FAULT light on the overhead panel is not inhibited during that phase of flight.

NOTE : The PMC electronically modulates or "down trims" the N2 scheduled by the Main Engine Control (MEC) to regulate fan speed (N1) to a value computed by the PMC. "Fail fix" mode is activated by some PMC faults : in these cases "down trim" will remain constant for all subsequently selected throttle lever settings.

In service experience has shown that certain types of PMC faults activate "fail fix" mode but may allow thrust changes greater than +/- 5 %. The probability of occurence is such that it can be considered that these faults affect only one engine at a time.

PROCEDURES :

We recall below the existing FCOM procedures :
- Check take-off N1 is set prior to reaching 100 Kt (FCOM 2.02.13 page 1) and interrupt the take-off if this condition is not achieved.
- Above 100 Kt PNF monitors engine instruments.

In case of significant loss of thrust :
- Before V1 : the take-off should be aborted
- After V1 : Continue the take-off and, depending on amount of thrust lost, consider following flight pattern for engine failure at take-off.
  When circumstances permit carry out the ENG TRIM FAULT procedure as displayed on ECAM when above 1000 Ft.

.../...

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NOTES :

1) In case of ENG TRIM FAULT light local warning activation associated with an increase of N1 on one engine, apply ENG OVER LIMIT procedure as displayed by ECAM (inhibited between 70 Kt and lift off) or FCOM 2.05.10 page 5.
2) Do not switch OFF ENG TRIM before throttles reduction.

Refer to GE OEB N° 508 for any information concerning the various types of PMC system faults.

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FLIGHT DIVISION
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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/E-VO	File FCOM 2.19	VALIDITY ALL AIRCRAFT FITTED WITH (PM S5063 OR MOD 6523) AND WITHOUT MOD 4941	BULLETIN/ISSUE N° 29/3 DATE 15 JUN 1988

R

SUBJECT : ATS SWITCHING IN FLIGHT

REASON FOR ISSUE

R For Aircraft fitted with 2 TCC's (MP S5063 or MOD 6523), as long as

Mod 4941 (batch B of AFS) is not embodied, arming both autothrottles at the same time is forbidden in any flight phase.

However, a switching from ATS1 to ATS2 may be attempted in flight in order to check operation of the opposite ATS.

The purpose of this bulletin is to explain the procedure allowing such a transfer without loss of A/THR function.

R PROCEDURE : Before Mod 4941 embodiment

With ATS1 armed, A/THR function engaged, MCT or CL or CR mode engaged on TRP :

- Arm ATS 2
- Select another thrust mode on the selection keyboard of the TRP (except FLX TO) : this causes TCC 2 to synchronize with this mode.
- Press the key corresponding to the previous selected mode.
- Disarm ATS 1.

R Note : After Mod 4941 embodiment

Both ATSs can be armed at the same time. The above procedure is therefore useless.

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FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT	BULLETIN/ ISSUE N° 32/3
			DATE DECEMBER 84

SUBJECT : CIRCUIT BREAKER USE IN FLIGHT

As a general rule crew actions by C/B operation in flight must be restricted to the C/B's listed in this OEB or to one resetting attempt in case of tripped C/B's.

Before any action is taken the consequences must be considered and fully understood (refer to OEB 07).

This OEB provide some information for understanding before operating any C/B.

1 - DIGITAL COMPUTERS REINITIALIZATION

Digital computers abnormal behaviour may be stopped in some cases by interrupting the power supply of its processing part for a short time (approx. 10 sec.).

Generally, and in particular for the AFS computers, this may be achieved with the normal cockpit controls (engagement levers, push buttons) by selecting the related control OFF then ON.

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

The following C/B list indicates which C/B may be used for this purpose.

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SYSTEMS	CIRCUIT BREAKER / LOCATION	
FMS	FMS - SYS1 SUPPLY	21 VU - J11
	FMS - SYS2 SUPPLY	21 VU - J14
FLT CTL	ARTF FEEL-FLC1-26VAC.ESS	21 VU - J02
	ARTF FEEL-FLC2.26VAC	21 VU - J04
FLT INS	ADS - ADC2 - 115V AC -	21 VU - E10
	ADS - F/O ALTM & VSI -	21 VU - E11
	NAVIGATION - CAPT EFIS SGU1.	21 VU - F04
	NAVIGATION - F/O EFIS SGU2.	21 VU - F11
	NAVIGATION - EFIS SGU3.	21 VU - F06
R	ECAM - WLDP -	21 VU - B08 - B09
R	FWC 1 -	21 VU - B06 - B07
R	FWC 2 -	21 VU - A07 - A08
COM	VHF 1	22 VU - B16
	VHF 2	21 VU - D07
	VHF 3	21 VU - D08
	HF 1	21 VU - D03
NAV	ADF 1	21 VU - D01
	ADF 2	21 VU - D14
	VOR 1	21 VU - C02
	VOR 2	21 VU - C13
	ILS 1	21 VU - C03
	ILS 2	21 VU - C12
	RAD ALTM 1	21 VU - C05
	RAD ALTM 2	21 VU - C10
	DME 1	21 VU - C04
	DME 2	21 VU - C11
GPWS	RAD ALTM 1	21 VU - C05
CAB PRESS	CAB PRESS SYS 1 115V AC	22 VU - B18
ANTI-ICE **	WINDOW HEAT L REG and WARN	126 VU - H85
	WINDOW HEAT R REG and WARN	126 VU - H90

* GPWS FAULT may be cleared by cycling associated radio altimeter circuit breaker.

** If conditions permit, cycling window heat circuit breaker may solve some faults.

2 - CIRCUIT BREAKER TRIPPING :

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

However, if time permits one reset may be attempted. If unsuccessful, a second attempt must not be made.

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FLIGHT DIVISION
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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT FITTED WITH MOD 5099 AND 5429	BULLETIN/ ISSUE N° 43/1 DATE JUNE 84

SUBJECT: COMPATIBILITY PROBLEM BETWEEN "OP++ STANDARD" FMS AND "BATCH B" FCC.

Reason for issue :

For aircraft fitted with ""OP++ standard" FMS (mod 5099), "Batch C" TCC (mod 5429) and "Batch B" FCC (MP S5893) there is no altitude capture if, for any abnormal reason, PROFILE mode remains armed.

Explanation :

Due to a logical condition within "Batch B" FCC, ALT ACQ mode does not engage as long as PROFILE mode is armed.

Conditions for PROFILE engagement when armed are :

- Altitude greater than THR RED ALT
- Weights initialisation completed (on INIT page B)
- CRZ FL defined (predetermined with CO RTE or manually inserted by the crew)

Note also that, in case of a FCU altitude lower than THR RED ALT, PALT mode should engage to capture the FCU selected altitude.

Consequently, if for any reason PROF does not engage in "PALT", the FCU selected altitude will not be captured and altitude alert warning will, then, be activated. In addition, message "INITIALIZE WEIGHTS" will be shown on CDU display if appropriate.

RECOMMENDATION

"PROFILE ARMED" condition will be deleted within next "Batch C" FCC. In the meantime, it is recommended to disarm PROFILE so that ALT ACQ can be engaged and to take corrective actions for PROF engagement as appropriate.

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BP N° 33, 31707 Blagnac Cedex, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/FV DD	File FCOM 2.15	VALIDITY ALL AIRCRAFT WITH MOD 5429 WITHOUT MOD 3791, MOD 5757 AND MOD 6789	BULLETIN/ISSUE N° 43/2 DATE AUG. 89

SUBJECT :

COMPATIBILITY PROBLEM BETWEEN "OP++ STANDARD" FMS AND "BATCH B" FCC.

Reason for issue :

For aircraft fitted with "OP++ standard" FMS (mod 5099), "Batch C" TCC (mod 5429) and "Batch B" FCC (MP S5893) there is no altitude capture if, for any abnormal reason, PROFILE mode remains armed.

Explanation :

Due to a logical condition within "Batch B" FCC, ALT ACQ mode does not engage as long as PROFILE mode is armed.

Conditions for PROFILE engagement when armed are :

- Altitude greater than THR RED ALT,
- Weight initialisation completed (on INIT page B),
- CRZ FL defined (predetermined with CO RTE or manually inserted by the crew).

Note also that, in case of a FCU altitude lower than THR RED ALT, PALT mode should engage to capture the FCU selected altitude.

Consequently, if for any reason PROF does not engage in "PALT", the FCU selected altitude will not be captured and altitude alert warning will, then, be activated. In addition, message "INITIALIZE WEIGHTS" will be shown on CDU display if appropriate.

RECOMMENDATION

"PROFILE ARMED" condition will be deleted within next "Batch C" FCC. In the meantime, it is recommended to disarm PROFILE so that ALT ACQ can be engaged to take corrective actions for PROF engagement as appropriate.

Techn. Dokumentationsstelle
Ordnungsnr.: A 310-57 bj
Eingang: 10.8.89
Exemplarnr. 515

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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT.	BULLETIN/ ISSUE N° 52/1 DATE DECEMBER 84

SUBJECT : AUTOPILOT ENGAGEMENT

REASONS FOR ISSUE :

Questions from A310 operators :

- Why do A/P sometimes fail to engage in flight ?
- Is it permissible to recycle FCC's CB's in flight when such a failure occurs ?

CAUSES :

Frequent causes of this problem are the crew engaging the pitch trim or starting the APU while the AFS computers self test is in progress.

EXPLANATION :

Self test begins, on ground, at DC power up (electrical ground power or APU generator connexion) and requires about 4 minutes.

Energizing AFS computers (PITCH TRIM lever at ON) or making electrical transients (APU start) when the AFS computers self test is not completed can cause the self test to fail and subsequent engagement of one or both A/P's will not be possible.

Pulling FAC and/or FCC CB's, when on ground, will reinitialize a new self test sequence.

PROCEDURE :

To avoid A/P failing to engage in flight after take-off, we recommend the following precautions as a complement to AI NORMAL PROCEDURES (FCOM chapter 2-03).

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1) PRELIMINARY COCKPIT PREPARATION :

To avoid AFS computers self test fail, do not start APU within 4 minutes (completion of self test) of switching the EXT PWR to ON.

NOTE : It may be necessary to instruct ground crew on this subject.

2) COCKPIT PREPARATION :

Wait until the end of the AFS computers self test (4 minutes after electrical power application from ground power or in event of no ground power available from the APU GEN) before engaging any AFS lever (PITCH TRIM - YAW DAMPER, ATS or A/P).

3) AFTER START :

It is possible to ensure engagement status by selecting each A/P to ON (CWS) for 5 seconds.

Note : If unsuccessfull FAC and/or FCC 28V DC C/B's may be recycled, 20 sec off and 4 min on before attempting to reengage any TRIM, YAW DAMPER, or A/P.

4) IN FLIGHT :

Do not recycle AFS C/B's in flight. (This does not restart the self test which can only be made on the ground, but there is a chance of failing the watchdog monitor of a computer and in addition the computer is forced into a test good condition, as a result a genuinely faulty computer could be used with the risk of an active failure).

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY All aircraft without mod. 3791 embodied	BULLETIN/ ISSUE N° 58/01 DATE APRIL 85

SUBJECT : SPERRY FMS WITH OP++ STANDARD INCORPORATED - USE OF PROFILE MODE WITH OF ALTITUDE CAPTURE OR HOLD

In relation with PROFILE mode engaged some abnormal aircraft behaviours have been found out :

- FCU selected altitude not maintained
- Level-off performed at non selected FCU altitude
- No level-off performed at preselected FCU altitude
- Erratic behaviour on leaving flight level (thrust not set)

This last point is under investigation and will be solved in I7++. The first three problems which will also be solved by I7++ can be temporarily avoided with the use of following recommendation :

I LEVEL CHANGE INITIATION :

1. With PROFILE engaged :

   ALT knob.....turn to select altitude

   ALT knob.....pull to initiate level change

   Do not initiate the level change by disengaging then engaging profile (double push on PROFILE)

Note : This procedure is already recommended in FCOM (2.02.19 page 14)

2. With PROFILE not engaged :

   ALT knob.....turn to select altitude

   ALT knob.....pull to select LVL/CH mode

   Do not initiate the level change by engaging profile

II WHEN APPROACHING ALTITUDE CAPTURE

No mode change from V/S or LVL/CH or ALT* to PROFILE should be made

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From a practical point of view, all problems should be avoided if the following general rule is applied :

- Engage PROFILE at take off according to company policy.
- Disengage it only when a speed constraint in descent (different from 250 kt / 10000 ft) is required : in order to do it select the speed on FCU and pull speed selector.
- If a speed constraint is required during climb or cruise, stay in PROFILE by using tactical SPD mode.
- All level changes sould be made by pulling altitude selector.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AKV/FC DD	File in FCOM 2.19	VALIDITY ALL AIRCRAFT WITHOUT MOD 3791 AND WITHOUT MOD 6789	BULLETIN/ ISSUE N° 58/2 DATE AUG. 89

SUBJECT :

R
R

SPERRY FMS WITH OP++ STANDARD INCORPORATED
LEVEL CHANGE WITH PROFILE MODE

Techn. Dokumentationssteue
Ordnungsnr.: A310-576
Eingang: 10.10.89
Exemplar: 5/5

In relation with PROFILE mode engaged some abnormal aircraft behaviours have been found out :

- FCU selected altitude not maintained
- Level-off performed at non selected FCU altitude
- No level-off performed at preselected FCU altitude
- Erratic behaviour on leaving flight level (thrust not set).

This last point is under investigation and will be solved in I7++. The first three problems which will also be solved by I7++ can be temporarily avoided with the use of following recommendation :

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   Do not initiate the level change by disengaging then engaging profile (double push on PROFILE).

Note : This procedure is already recommended in FCOM (2.02.19 page 14).

2. With PROFILE not engaged :

   ALT knob..... turn to select altitude

   ALT knob..... pull to select LVL/CH mode

   Do not initiate the level change by engaging profile

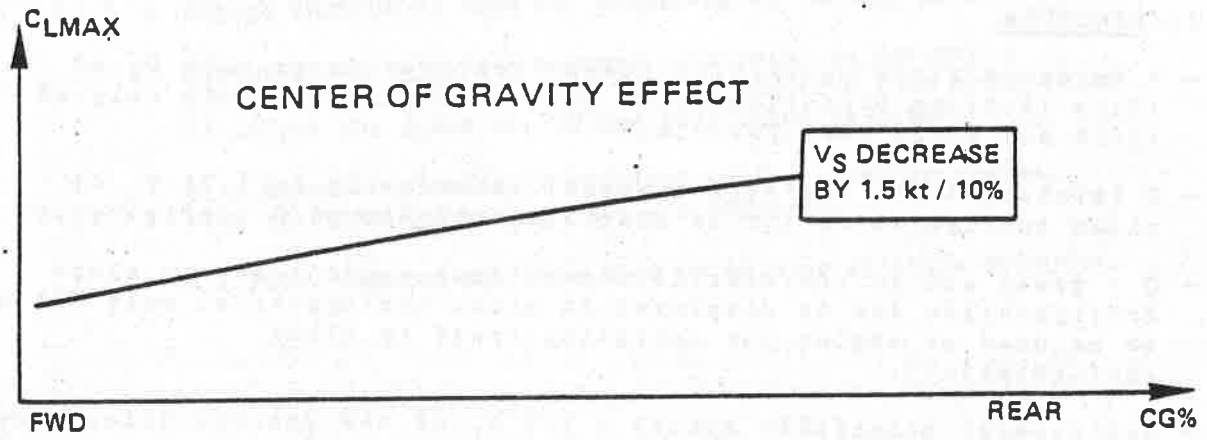
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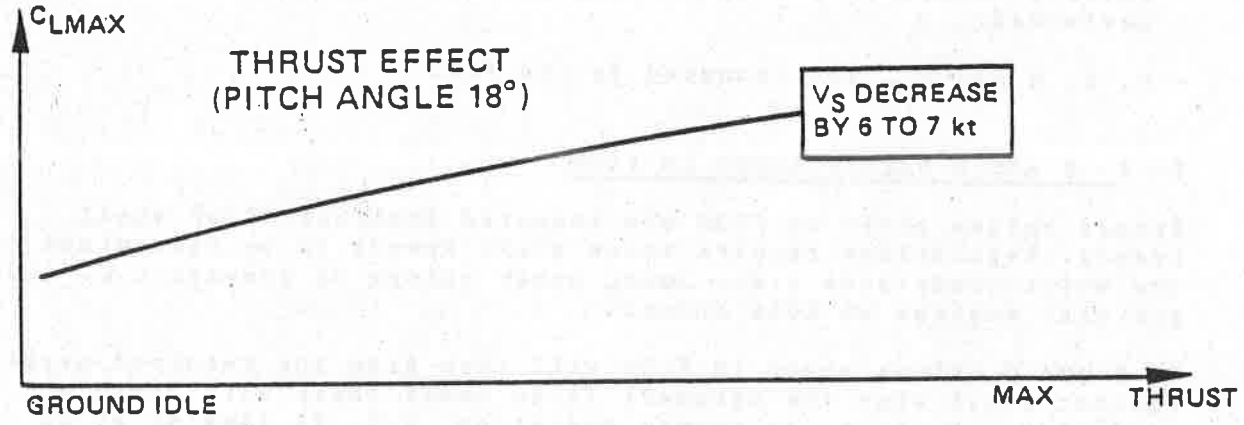
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3. FAC COMPUTATION

The FAC computes all speeds taking into account the actual flight conditions and allows the aircraft to be flown with the correct margin against stall under these flight conditions.

Difference in stall speed between an aircraft with engines at idle and an aircraft with both engines at take-off thrust is 6 to 7 kt. 10% of C.G. variation on the mean aerodynamic chord introduces 1 kt to 2 kt difference on the displayed speeds.





Thrust effect is the biggest one and explains almost completely the difference observed between PFD indication and the theoretical speeds values given in the documentation.

4. COMPARISON BETWEEN SPEEDS CALCULATED BY THE FAC AND THOSE GIVEN IN FCOM

Let us take the example of a two engines take-off at 116 tons (256 000 lb) with 18° pitch angle.

Speeds read in FCOM are (idle thrust, forward C.G. 18%) :
F : 152 kt
S : 186 kt
O : 215 kt
V_{LS} (0/0) : 193 kt

Speeds computed by the FAC taking into account the effect of thrust on stall speeds will be :

Forward C.G. (18%)	Average C.G. (27%)
F : 145 kt	143 kt
S : 177 kt	175 kt
O : 204 kt	203 kt
V_{LS} (0/0) : 183 kt	182 kt

If one engine fails only half of the initial thrust being then available, speeds displayed on the PFD will become :

Forward C.G. (18%)	Average C.G. (27%)
F : 148 kt	146 kt
S : 181 kt	179 kt
O : 209 kt	208 kt
V_{LS} (0/0) : 188 kt	187 kt

Finally, if for any reason, the pilot would reduce the remaining engine throttle to idle thrust, the displayed speeds would become equal to those given in FCOM, if C.G. is located at 18% MAC.

CONCLUSION

The FAC is a powerful computer working in real time which, knowing exactly the flight conditions can compute the operational speeds allowing to have the requested margin against stall.
The documentation can only give these speeds in one particular condition, which in all cases will give the maximum conservatism.

A discrepancy then exists between those two information sources when actual flight conditions are not the certified ones (conservative values). The FAC performs a correct computation while documentation shows conservative figures.

Airbus Industrie
FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/V-FO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT	BULLETIN/ ISSUE N° 63/1 DATE JUNE 85

SUBJECT : AUTO PILOT OVERRIDE

REASONS FOR ISSUE

To provide operational information following some cases where the crew override the auto pilot leading to abnormal pitch behaviour.

REMINDER

Torque limiter, installed between each A/P actuator and the corresponding flight control channel, allows the pilot to override the A/P commands by disconnecting the actuator from the flight control.

However the A/P remains engaged but it is not operative.

When override effort is released the A/P comes back in control.

The loads to be applied to the control column, handwheel, and pedals are approximately as follows :

- Pitch : 20 kg nose down
  46 kg nose up
  } at low speed
- Roll : 15 kg
- Yaw : 65 kg

NOTES

1. When overriding the A/P on pitch axis the TRIM 1 disengages and the TRIM 2 becomes active (This logic allows the crew to stop a trim runaway when the A/P is engaged).
2. Overriding the A/P on pitch axe does not cancel the auto trim orders.
3. No aural warning (whooler) is provided when the horizontal stabilizer is controled by the auto trim.

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EXPLANATIONS

- What can occur when a pilot acts against the A/P ? The following scenario can be imagined :

1- Aicraft descending in final approach.
The A/P is engaged in CMD but the pilot believes that it is engaged in CWS.

2- Aircraft comes in level flight (the A/P holds the altitude pre-selected on the FCU).

3- In order to continue the descent the pilot overrides the A/P through pitch torque limiter leading to full elevator nose down.

4- As the aircraft leaves the selected altitude the A/P gives order to keep this altitude resulting in :

. Nose up order to A/P pitch actuator which is cancelled by crew opposite order on the control column.

. Auto trim nose up order resulting in stabilizer nose up movement at 0.5 degree/sec. until the electrical stop (13°5 nose up) is reached.

5- Since the rate of descent is lower than the expected one the pilot reduces the thrust.

6- In such a configuration :

. Horizontal stabilizer full nose up position

. Elevator full nose down deflection

. Thrust at idle

If the pilot releases his effort on control column the pitch angle will increase, the speed will rapidly decrease leading to a critical situation.

RECOMMENDATIONS

1. When disengaging/engaging the auto pilot check A/P status on PFD.

2. If the A/P does not react as desired check :

   - Engaged modes on PFD.

   - Selected displays on FCU.

WORKING AGAINST THE A/P CAN LEAD TO A DANGEROUS SITUATION

IF ANY ABNORMAL AIRCRAFT BEHAVIOUR IS SUSPECTED
THE FIRST ACTION TO DO IS TO DEPRESS
THE INSTINCTIVE DISCONNECT PUSH BUTTON
AND THEN TO TAKE OVER

Airbus Industrie
FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/VAP/XXXX AI/E-VO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT WITH MOD 3881 EMBODIED	BULLETIN/ ISSUE N° 65/2 DATE JUNE 87

SUBJECT : OUTFLOW VALVE RUNAWAY

REASONS:

To advise flight crews that on aircraft equipped with the new pressurized system, cabin depressurization resulting from outflow valve runaway to the full open position may occur.

BACKGROUND INFORMATION :

Several recent incidents have occurred where the crew performed an emergency descent following excessive cabin rate of climb caused by an irregular outflow valve opening.

The valve full open condition, as well as the excessive cabin rate are detected by the cabin pressure controller, but the FAULT warning plus associated ECAM message and automatic system changeover will only occur after a 20 sec. time delay.

The outflow valve runaway has been identified as a malfunction of the DC/DC converter used on the automatic control boards of the outflow valve. This
R malfunction is caused by temperature effect.
The modification 6488 (Vendor Service Bulletin 88005B-21-03) has been developped to improve this situation.

PROCEDURE :

R The following is recommended :

R 1 - ON GROUND (if modification 6488 is not embodied) :
For parking switch OFF REG 1 and REG 2.

R 2 - IN FLIGHT (recommended in all cases) :
IF ANY ABNORMAL CABIN RATE OF CLIMB IS SUSPECTED (EARS "POP") :

- Active REG p.b.sw .....OFF

NOTE 1 : This action permits to immediately stop the runaway of the active outflow valve and to transfer the regulation to the other system without the 20 seconds wait for the FAULT warning and the automatic transfer.

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OEB A310 N° 65/2

NOTE 2 : Valve closing time is in the order of 5 to 6 seconds.

Select the CAB PRESS page on ECAM and check effective closure of the affected outflow valve.

NOTE : If the outflow valve remains open (dual failure) switch OFF the corresponding OUTFLOW p.b. sw (Valve closing time in this case is about 30 sec.).

Airbus Industrie
FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/XXXX AI/E/V	File in FCOM 2.19	VALIDITY A/C EQUIPPED WITH GE-ENGINES CF6-80-C2	BULLETIN/ ISSUE N° 75/2 DATE MAY, 1986

SUBJECT :

SLOW OR HUNG GROUND START

REASON FOR ISSUE

Some CF6-80C2 engines have experienced slow or hung ground starts after cold soak, such as during the first start of the day.

BACKGROUND INFORMATION

The symptoms of the hung, or slow, start are N2 stagnation at or near starter cutout (sub-idle) accompanied by low EGT. Engineering investigation
R has determined that low frequency sub-idle fuel pump pressure pulsations may distort (lean) the ground starting fuel schedule in the engine fuel control.

Because the EGT is low, it is not urgent that the start be aborted.

However, if it is determined that acceleration has ceased, the start should be aborted, and another start should be accomplished, immediately after N2 coastdown to zero. Experience has shown that this subsequent start will be normal. Because the hung start was cool (and lean) it is not necessary to ventilate the engine by cracking between start attempts.

An engine fuel control modification is under development by the engine manufacturer.

RECOMMENDED PROCEDURE

If a hung start with low EGT occurs :

FUEL LEVER..... OFF,
ENG START selector..... OFF.

Immediately after N2 coastdown to zero :

RESTART per normal start procedure..... PERFORM.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/E-VO	File FCOM 2.19	VALIDITY ALL AIRCRAFT WITH MOD 5911 WITHOUT MOD 4672 AND WITHOUT (MOD 6777 OR 7087)	BULLETIN/ISSUE N° 81/4 DATE 08 JULY 1988

SUBJECT : MANUAL OVERRIDE OF STAND-BY GENERATOR

REASON FOR ISSUE

Failure of IRS n° 1 and n° 3 have been experienced in case of manual override of stand-by generator. These failures are due to electrical transients present during the manual override sequence and the connection of the standby generator to the electrical network.

The problem has been identified and a modification of the LITTON IRS has been launched (Mod 6777 for IRS 90 SOFT 07 and Mod 7087 for IRS 90-100).

Note : This kind of failure does not occur in case of automatic starting of stand-by generator.

PROCEDURE

Until retrofit of the modification, the following procedure should be followed for manual override of standby generator (in case of test of standby generator or application of DC ESS BUS ON BAT procedure) :

- L CTR TK PUMP..... OFF
- R INR TK PUMP 1..... OFF
- L INT TK PUMP 2..... OFF
- STBY GEN..... OVRD

Then reselect L CTR TK PUMP, R INR TK PUMP 1 and L INR TK PUMP 2 to NORM position.

Selection of fuel pumps to OFF before manual override of standby generator will reduce the effect of the second electrical transient responsible of the failure of the IRS.

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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/E-VO	File in FCOM 2.19	VALIDITY ALL AIRCRAFT	BULLETIN/ ISSUE N° 92/1 DATE JULY 9th, 87

SUBJECT : LOC CAPTURE

LOC capture has been reported, showing a large overshoot then a very long time to recover the centerline.

After investigation, it has been discovered that this may happen if particular conditions are met at the time when "LAND" is selected.

These conditions are :

- aircraft track angle close to the runway heading (difference below 7°),

- LOC deviation above 2 dots but inside the normal range for LOC reception.

Then, if an intercept angle is selected in HDG/SEL mode, the overshoot will occur.

So, it is recommended to monitor LOC capture as already mentioned in the flight manual.

A large overshoot is normal if the aircraft speed and the interception angle are high. But following an overshoot, the aircraft should recover the center line positively.

If a late recovery is suspected, disengage LAND mode, select a suitable heading for interception, then reengage LAND.

A modification will be inplemented in the next standard for FCC to correct this anomaly.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/E-VO	File	VALIDITY	BULLETIN/ISSUE N°
Delcuvellerie	FCOM 2.19	ALL AIRCRAFT WITH MOD 6789 WITHOUT MOD 3791 EXCEPT UAE A/C	100/1
			DATE JUNE 88

SUBJECT : OVERSPEED IN DESCENT WITH PROFILE MODE

REASON FOR ISSUE : Overspeed occurences in DESCENT phase with PROFILE mode engaged may be experienced, especially when a high COST INDEX is used.

BACKGROUND INFORMATION : Reported overspeed situations occured during two different cases of guidance :

- When the A/C follows the reference descent path : The FMS controls the aircraft on the descent path with elevators. Apart from speed reversion conditions, thrust is full idle and speed is not controlled.

- When the A/C recaptures the reference descent path from above : The FMS guides the aircraft at descent target speed + 20 kt or 290 kt which ever is higher, limited by MMO only. This speed is controlled on elevators with full idle thrust.

Therefore an overspeed situation may develop upon unpredicted external conditions in both cases.

RECOMMENDATION

. If descent clearance is given by ATC before T/D : Select clearance altitude on FCU, then pull FCU ALT knob.
The descent will be automatically initiated at the T/D. If the pilot estimates that an overspeed situation is developping, he extends speedbrakes as appropriate, but not beyond half extension.

Note : As recommended in FCOM 2.03.17 page 1/2, the use of full speedbrakes above 0.78 M should be avoided for comfort reasons.

The descent can also be initiated before T/D by using the IMM DES function. The initial descent is then performed at 1000 ft/min and the speed is controlled by A/THR. This should decrease the occurences of overspeed situation.

. If descent clearance is given by ATC after T/D :
Select clearance altitude on FCU.
Select desired descent speed on FCU, then pull FCU speed/Mach knob.
The AP will revert from PROFILE to LVL/CH mode, thus protecting the aircraft against overspeed.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/E-VO MHC	File FCOM 2.19	VALIDITY ALL AIRCRAFT WITH MOD 6789 WITHOUT MOD 3791 EXCEPT UAE A/C	BULLETIN/ISSUE N° 100/2 DATE JUN 1989

SUBJECT : OVERSPEED IN DESCENT WITH PROFILE MODE

REASON FOR ISSUE

Overspeed occurences in DESCENT phase with PROFILE mode engaged may be experienced, especially when a high COST INDEX is used.

BACKGROUND INFORMATION

Reported overspeed situations occurred during two different cases of guidance :

- When the A/C follows the reference descent path : The FMS controls the aircraft on the descent path with elevators. Apart from speed reversion conditions, thrust is full idle and speed is not controlled.

- When the A/C recaptures the reference descent path from above : The FMS guides the aircraft at descent target speed + 20 or 290 kt which ever is higher, limited by MMO only. This speed is controlled on elevators with full idle thrust.

Therefore an overspeed situation may develop upon unpredicted external conditions in both cases.

RECOMMENDATION

. If descent clearance is given by ATC before T/D : Select clearance altitude on FCU, then pull FCU ALT knob.
The descent will be automatically initiated at the T/D.
If the pilot estimates that an overspeed situation is developping, he extends speedbrakes as appropriate, but not beyond half extension.

Note : As recommended in FCOM 2.03.17 page 1/2, the use of full speedbrakes above 0.78 M should be avoided for comfort reasons.

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The descent can also be initiated before T/D by using the IMM DES function. The initial descent is then performed at 1000 ft/min (provided the speed is not close to VMO/MMO) and the speed is controlled by A/THR. This should decrease the occurrences of overspeed situation. If IMM DES function is activated close to VMO/MMO, the FMS requests a reversion mode : SPEED mode to the AUTO-PILOT and thrust idle. The consequence is an increase of vertical speed and RETARD selection on EFIS.

If descent clearance is given by ATC after T/D :
Select clearance altitude on FCU.
Select desired descent speed on FCU, then pull FCU speed/Mach knob. The AP will revert from PROFILE to LVL/CH mode, thus protecting the aircraft against overspeed.

Note : If VMO/MMO is exceeded, do not use C.W.S. and refer to OEB 110.

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OPERATIONS ENGINEERING BULLETIN

A310

Issued by AI/E-VO	File FCOM 2.19	VALIDITY ALL	BULLETIN/ISSUE N° 108/1 DATE MAY 1989

SUBJECT : OIL PRESSURE INDICATION - LOW OIL PRESSURE WARNING AND PROCEDURE

I - REASON FOR ISSUE

. Several reports have been received regarding precautionary in-flight shutdown events, initiated in the following conditions :

- Low oil pressure indication, evidenced by the activation of the ECAM advisory mode :

  * Automatic display of the ECAM System Display ENGINE page,

  * Oil Pressure indication being below the advisory threshold (flashing green) or below the low pressure warning threshold (red indication).

- Absence of OIL LO PRESS local warning and associated OIL LO PRESS procedure on ECAM Warning Display.

. This OEB is issued so as to :

- Provide a description of the oil pressure indication and OIL LO PRESS warning systems,

- Highlight the full segregation and independence of these two indicating systems,

- Provide operational recommendations in case of low oil pressure indication not being confirmed by the illumination of the OIL LO PRESS local warning and associated ECAM procedure.

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II - OIL PRESSURE INDICATION AND "OIL LO PRESS" WARNING SYSTEMS

. The Figure 1, hereafter, provides a simplified schematic of the oil pressure indication and OIL LO PRESS warning systems.

. As illustrated by Figure 1, both systems are fully segregated and independent with respect to :

- Electrical power supply,
- Sensor,
- Local or ECAM display.

. The oil pressure indication system consists in :

- The oil pressure transmitter,
- The oil pressure Signal Conditioner Unit (P&W) or Analog Indicator (GE),
- The ECAM System Display/ENGINE page (normal mode or advisory mode).
  * Reference can be made to FCOM 1-17-30 for specific information on advisory and warning thresholds.

. The OIL LO PRESS warning system consists in :

- The low oil pressure switch,
- The OIL LO PRESS light,
- The ECAM System Display/ENGINE page and Warning Display/OIL LO PRESS procedure.
- The associated local warnings :
  * ENG light on WLDP (aircraft without mod 5051 or with mod 6415),
  * MASTER WARNING light (aircraft with mod 5051).
- The associated audio warning (Continuous Repetitive Chime).

. Should a real low oil pressure situation occurs (oil pressure below the low pressure warning threshold, applicable for the specific engine), the low pressure condition will be reflected by both systems :

  - Oil pressure reading below warning threshold on ECAM System Display/ENGINE page,

  - OIL LO PRESS light illumination together with activation of ECAM Warning Display and associated local and audio warnings.

. However, the in-service experience has revealed several cases of oil pressure indication reading low on the ECAM System Display/ ENGINE page, resulting in the activation of the advisory mode, but without the corresponding illumination of the OIL LO PRESS light and the activation of the associated ECAM procedure and local/audio warnings.

. Several engineering changes have been developed and released by Airbus Industrie and engine manufacturers so as to improve the reliability of the oil pressure indicating systems (for detailed information, reference can be made to the Airbus Industrie Technical Follow-Up -TFU- information system).

III - OPERATIONAL RECOMMENDATIONS

. As indicated in the expanded part of the OIL LO PRESS procedure (FCOM 2-05-10), "if low oil pressure(<limit applicable for specific engine type) is only indicated on ENG page (advisory), without other warnings (OIL LO PRESS light, ENG light or MASTER WARNING light - depending on aircraft configuration -, procedure page on ECAM), it can be assumed that the oil pressure transmitter is faulty."

. In such an occurrence, a precautionary engine shutdown should be considered only after a cross-check with other engine parameters (OIL temperature, OIL quantity, VIB level and engine primary parameters). If no abnormal engine operation is evidenced, "Continue engine operation while monitoring engine parameters."

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FLIGHT DIVISION
BP N° 33, 31700 Blagnac, France

OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/FO MHC	File in FCOM 2.19	VALIDITY ALL A/C	BULLETIN/ ISSUE N°110/2 DATE SEPT. 1989

SUBJECT : C.W.S. OPERATIONAL LIMITATIONS

REASON FOR ISSUE :

Two cases of excessive positive G. load in C.W.S. have been encountered. In both cases excessive G. load occured when pilot switched to C.W.S. in order to reduce the speed which was above or close to VMO/MMO.

EXPLANATIONS :

In line experience showed that C.W.S. was often used as a means to recover from a worrying situation (for instance an increase of speed or mach due to wind or temperature changes).

Objective of C.W.S. was to apply small corrections on the flight path.
To facilitate small corrections the servo motor of the autopilot performs elevator deflection requested by the pilot through the control wheel and then cancels the artificial feel. The autotrim is still operational. This explains its great sensitivity.

This sensitivity makes it not suitable for recovering from great variations of path especially at high speed where the elevator efficiency is increased.

RECOMMENDATION :

Consequently, above VMO - 30 kt/M 0.78 we recommend :

- Do not use C.W.S.
- Use the Autopilot in CMD.
- If VMO/MMO exceeded, in descent, as long as possible use the Autopilot in CMD with LEVEL CHANGE mode engaged (increased authority compared with PROFILE mode).
- Only if necessary (as example fast increase of speed near VMO/MMO or exceedance of VMO + 10 kts), use manual mode.

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OPERATIONS ENGINEERING BULLETIN

A 310

Issued by AI/E-YD DD	File FCOM 2.19	VALIDITY ALL A/C WITHOUT MOD 4672	BULLETIN/ISSUE N° 111/2 DATE AUGUST 1989

SUBJECT : IRUs CONTAMINATION BY ISDU MALFUNCTION

REASON FOR ISSUE :

Successive loss of three IRUs in flight has been reported by one operator. Investigation concluded that the incident was caused by a failure in the ISDU.

BACKGROUND INFORMATION

ISDU is capable of interfacing with all three IRU's. Under ISDU malfunction, erroneous labels may be transmitted to the IRUs, making them fail in a progressive sequence.

RECOMMENDATION

Do not switch ISDU ON from start of alignment procedure to parking at destination. This is valid until further notice.

Following procedures must be complied with to operate the aircraft with ISDU switched OFF :

. IRS alignment

Take particular care that aircraft is not moved throughout alignment procedure.

- Check SYS rotary selector set to OFF on ISDU.
- Perform IRS alignment from FMS CDU as usual.
  If alignment procedure fails (ALIGN MODE annunciator flashing on any MSU) :
- Check LAT/LONG on FMS CDU and A/C symbol position on ND.
- Re-enter LAT/LONG on FMS CDU.
- Set MSUs to OFF more than 10 sec and back to NAV.
- Press ALIGN IRS prompt on FMS CDU.

Techn. Dokumentationsstelle
Ordnungsnr.: A 310-548
Eingang: 10.10.89
Exemplare: 3+5

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. ATT mode selection

If ATT mode is to be used (temporary loss of electrical supply or IRS WARN annunciator amber on MSU) :

- Set related MSU mode rotary selector to ATT.
- Maintain wings level. Do not use ISDU.
- Check attitude data come back on PFD after about 40 sec.

If ATT mode is used on IRS 1 :

- Press Capt ATT HDG p/b to supply VOR/DME RMI 1, PFD 1, ND 1 and ADF RMI 2 with information from IRS 3.

If ATT mode is used on IRS 2 :

- Press F/O ATT HDG p/b to supply VOR/DME RMI 2, PFD 2, ND 2 and ADF RMI 1 with information from IRS 3.

If ATT mode is used on IRS 3 :

- Check both Capt and F/O ATT HDG p/bs are released out.

. FMS messages

When following messages are displayed on FMS CDU :

Honeywell FMS : FMC POSITION MISMATCH
VERIFY A/C POSITION.

Smiths FMS : POSN DIFF
CHECK POSN.

- Check aircraft position using conventional VHF means.

CONSEQUENCE ON MMEL

Change present wording of ITEM 34-30 by the following :

R a) For ER operations, both FMS must be operative.

R b) Except for ER operations, one may be inoperative provided A/C
R position is monitored using radio-navigation data.

M	OEB NO	-DATE-- ----VALIDATION CRITERIA----- ----VALIDATION PER AIRPLANE----	
	005-1	010 MAR1983 ALL	A/C FITTED WITH GE ENGINE
	006-1	001 MAR1983 ALL	OEB NOT APPLICABLE
	008-2	001 MAR1984 ALL	ALL AIRCRAFT
	009-4	010 OCT1987 ALL	OEB NOT APPLICABLE
	013-3	010 FEB1984 ALL	OEB NOT APPLICABLE
	015-1	001 JUN1983 ALL	ALL AIRCRAFT
	018-3	010 JAN1984 ALL	OEB NOT APPLICABLE
	019-3	100 OCT1987 ALL	OEB NOT APPLICABLE
	020-5	010 FEB1984 ALL	OEB NOT APPLICABLE
	021-1	010 AUG1983 ALL	A/C FITTED WITH GE ENGINE
	023-3	100 MAR1988 ALL	OEB NOT APPLICABLE
	024-5	100 OCT1987 ALL	OEB NOT APPLICABLE
	026-2	001 OCT1987 ALL	O.E.B. NOT APPLICABLE
	027-7	050 SEP1984 ALL	OEB NOT APPLICABLE
	028-1	030 DEC1983 ALL	ALL A/C WITH GE ENGINES
	029-3	001 JUN1988 503	OEB NOT APPLICABLE
	029-3	010 JUN1988 498-499	PM S5063 OR M6523 W/T M4941
	032-3	001 DEC1984 ALL	ALL AIRCRAFT
	034-2	010 FEB1984 ALL	OEB NOT APPLICABLE
	036-3	100 OCT1987 ALL	OEB NOT APPLICABLE
	037-2	010 APR1984 ALL	OEB NOT APPLICABLE
	038-2	010 JUN1984 ALL	OEB NOT APPLICABLE
	041-2	001 MAR86 ALL	OEB NOT APPLICABLE
	043-1	010 JUN1984 ALL	A/C WITH MOD 5099 + 5429
	046-2	010 APR1988 ALL	OEB NOT APPLICABLE
	052-1	001 DEC1984 ALL	ALL AIRCRAFT
	053-2	100 OCT1987 ALL	OEB NOT APPLICABLE
	057-2	040 JUL1986 ALL	OEB NOT APPLICABLE
	058-1	001 APR1985 ALL	A/C WITHOUT MOD 3791
	059-2	001 OCT1987 ALL	OEB NOT APPLICABLE
	060-1	001 MAY1985 ALL	OEB NOT APPLICABLE
	061-1	001 JUN1985 ALL	ALL AIRCRAFT
	062-2	001 OCT1987 ALL	OEB NOT APPLICABLE
	063-2	100 JUN1989 ALL	OEB NOT APPLICABLE
	065-2	010 JUN1987 ALL	A/C WITH MOD 3881
	067-2	001 OCT1987 ALL	OEB NOT APPLICABLE
	068-2	001 MAY1986 ALL	OEB NOT APPLICABLE
	069-2	001 OCT1987 ALL	OEB NOT APPLICABLE
	070-3	001 APR1989 ALL	OEB NOT APPLICABLE
	071-3	010 JUN1988 ALL	OEB NOT APPLICABLE
	075-2	030 MAY1986 ALL	A/C WITH GE ENG CF6 80C2
	077-3	001 OCT1987 ALL	OEB NOT APPLICABLE
	081-4	040 JUL1988 ALL	OEB APPLICABLE
	082-4	001 FEB1988 ALL	OEB NOT APPLICABLE
	089-2	001 APR1989 ALL	OEB NOT APPLICABLE
	090-1	001 JUN1987 ALL	OEB NOT APPLICABLE
	091-1	001 JUL1987 ALL	OEB NOT APPLICABLE
	092-1	001 JUL1987 ALL	ALL AIRCRAFT
	097-1	100 FEB1988 ALL	OEB NOT APPLICABLE
	099-2	001 APR1988 ALL	OEB NOT APPLICABLE
	100-2	010 JUN1989 ALL	A/C WITH M.6789,WITHOUT 3791
	103-2	001 JUN1989 ALL	OEB NOT APPLICABLE
	104-2	100 SEP1988 ALL	OEB NOT APPLICABLE
	105-2	010 JAN1989 ALL	OEB NOT APPLICABLE
	106-1	100 FEB1989 ALL	OEB NOT APPLICABLE
	107-1	001 MAR1989 ALL	OEB NOT APPLICABLE
	108-1	001 MAY1989 ALL	ALL AIRCRAFT
	109-1	001 JUN1989 ALL	ALL AIRCRAFT
	110-1	001 JUN1989 ALL	ALL AIRCRAFT
N	111-2	001 AUG1989 ALL	ALL A/C WITHOUT MOD.4672

APPLICABLE TO IF MANUALS

THE O.E.B. AFFECTED ARE LISTED BELOW.

N = NEW , C = CANCELLED

M	OEB NO	-DATE--	----VALIDATION CRITERIA-----
N	111-2	001 AUG1989	ALL A/C WITHOUT MOD.4672

M	OEB NO	-DATE--	----VALIDATION CRITERIA-----

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2.00.00 CONTENTS

2.00.01 ORGANIZATION OF THE MANUAL

2.00.02 LIST OF EFFECTIVE PAGES

2.00.03 LIST OF NORMAL REVISIONS

2.00.04 LIST OF TEMPORARY REVISIONS

Vers. : All Eng. : All

Dieser durch Airbus Industrie genehmigte Nachdruck unterliegt dem Änderungsdienst und ist nur für den internen Gebrauch bei INTERFLUG bestimmt.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	GENERAL INFORMATION	2.00.01
		PAGE 1
	ORGANIZATION OF THE MANUAL	REV 12 / SEQ 001

FOREWORD

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

CONTENT

The manual provides operating crew members with information on the technical, procedural and performance characteristics of the aircraft.

It is suitable for training purposes and may be used as a crew manual.

The contents are divided into two volumes :

- Vol. 1 : SYSTEMS DESCRIPTION
- Vol. 2 : PROCEDURES AND PERFORMANCE.

Volume 1 contains description of the aircraft and the systems.
Volume 2 contains operating and performance information plus loading data and is intented :

- either to be used as the necessary basis for the « Operations Department » of an operator to enable him to elaborate his own « Crew Manual ».
- or to be used directly by crew members, initially during the training phase and later in actual operations.

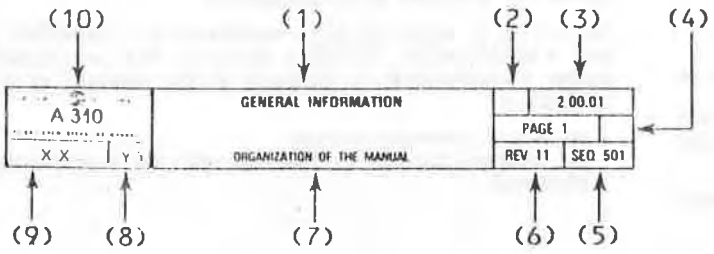
The material included in this volume has been extracted from the Flight Manual as far as the certified parts, are rouler mod.

In the event of the procedures or performance data contained in Vol. 2 inconsistent with the Flight Manual, the latter will supersede.

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

PAGINATION

TOP OF THE PAGE



(1) Chapter title
(2) Blank space
(3) FCOM Volume/Chapter/Section number
(4) Page number followed by L which indicates weights are given in pounds. If there is no indication, the page is valid for both pounds and tons.

When a new page must be inserted between two existing pages, a suffix letter is added to the page number.

Ex. : Page 23-A must be inserted between page 23 and page 24.

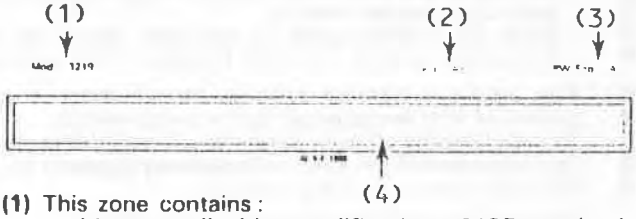
(5) Sequence number :
It allows an easier management of the pages for Airbus Industrie. It will be used by each manual holder to simplify manuals updating. Up to now, this possibility is not available, so disregard the sequence number until specific instructions will be given for its use.

(6) Number of the revision.
(7) Section title.
(8) The two letters abbreviation (eg . YY) indicates a specific page written to comply with local regulations :
- AA : for Australian regulations
- UK : for C.A.A. regulations
- US : for F.A.A. regulations.

(9) Airline two-letters abbreviation (eg XX) if page only applicable to XX airline

(10) Airbus Industrie logo or airline logo. (In this last case references (8) and (9) no longer exist).

BOTTOM OF THE PAGE



(1) This zone contains :
- either, applicable modification (MOD) or/and modification proposal (MP) number(s) (validation criteria).
  When there are more than two MOD or/and MP combined on a given page, they are associated with a GM 9xxx indication (modification groupment). GM 9xxx have no technical implication and serve for internal management and to simplify manual updating since they appear in the « Highlights » and « LEP ».
- or, a « Code » number (ex : 0801A) (validation criteria).
  It has no technical implication and serves for internal management only.
  It allows to avoid creation of pages with the same technical content due to application of different MOD/MP (or MOD/MP combination).
  A table of correspondance between « Code » numbers and MOD/MP number(s) is given at the beginning of each chapter, if need be, after the « CONTENTS » pages.

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

REVISIONS

NORMAL REVISIONS

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

TEMPORARY REVISIONS

Printed on yellow paper, issued to cover urgent matters arising between normal revisions, they are accompanied by filing instructions.
A yellow temporary revision record sheet is provided at the front of each volume, in order to :
- indicate all the temporary revisions superseded by the issue of a normal revision.
- allow the FCOM owner to manually record all the temporary revision with their location in the manual.

This yellow temporary revision record sheet is only published with the issue of each normal revision.
The applicability of each temporary revision is given on the customized list of effective temporary revisions issued with each new temporary revision.

OPERATIONS ENGINEERING BULLETINS

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

HOW TO INSERT A REVISION

GENERAL

FCOM and checklists are customized in such a way to allow an airline to elaborate :
- either, an envelope airline manual (available in a library)
- or, an airplane manual valid for a particular airplane (on board of this airplane).

Two documents added to each revision allow this work :
- the « Letter of Transmittal and Highlights »
- the « List of Effective Pages – LEP ».

They are two lists of pages where each FCOM (or checklist) sheet is represented by a two lines association :
- the first line concerns the face of the sheet
- the second line concerns the verso

when face and verso are printed.

If a sheet is only face printed, it is represented by one line.

Each sheet is associated with one (or more) number which represents the MSN (Manufacturer Serial Number) of an airplane.

It may be associated with tail numbers, too.

The sheet is, then, exclusively linked to a particular airplane in an airline fleet.

- the « letter of Transmittal and Highlights » is a list of all sheets to be removed and/or inserted with an additional information on validity extension or limitation.

  It must be used taking into account the manual to be updated : an airline envelope manual or a manual valid for a particular airplane.

- the « List of Effective Pages – LEP » is a list of all sheets valid for the entire fleet of the airline.

MOVEMENT CODES

The movement codes which appear in the « Letter of Transmittal and Highlights » concern the validation of the sheets and serve to update the manual.

– N = NEW	The sheet is new	– Sheet to be inserted
– R = REVISED	The sheet is revised	– Sheet to be inserted in place of the previous one
– C = CANCELLED	The sheet is cancelled	– Sheet to be removed
– V = VALIDATED	The sheet is validated	– The sheet validity is extended to other airplanes
– D = DEVALIDATED	The sheet is devalidated	– The sheet validity is restricted

In the « LEP », the movement codes are N and R from the « Letter of Transmittal and Highlights » to indicate to the reader new and revised page at the last revision.

HOW TO INSERT A DOCUMENT

According to what has been explained in « GENERAL » and « MOVEMENT CODES » sections, the movement codes interpretation is different if the manual to be updated is :

- an airline envelope manual
- an airplane manual (a manual valid for a particular airplane)

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Actions to be done are explained below :

AIRLINE ENVELOPPE MANUAL			
CODE	MEANING	ACTION	OBSERVATIONS
N	NEW	Sheet to be inserted	The sheet is inserted for first time
R	REVISED	Sheet to be inserted in place of the previous one	The sheet already exists but the contents of the face or/and the verso are updated by the revision.
C	CANCELLED	Sheet to be removed	The sheet is, finally, cancelled.
V	VALIDATED	NO ACTION	The sheet, already exists, but its validity is extended to others airplanes of the airline.
D	DEVALIDATED	NO ACTION	The sheet is devalidated for certains airplanes of the airline, but must be kept in the manual.

AIRLINE PARTICULAR AIRPLANE MANUAL			
CODE	MEANING	ACTION	OBSERVATIONS
N	NEW	Sheet to be inserted in the airplane manuals indicated in the « validity zone ».	Sheet inserted for first time
R	REVISED	Sheet to be inserted in the airplane manuals indicated in the « validity zone », in place of the previous one.	The sheet already exists but the contents of the face or/and the verso are updated by the revision.
C	CANCELLED	Sheet to be removed from all airplane manuals	The sheet is, finally, cancelled.
V	VALIDATED	Sheet to be inserted in the airplane manuals indicated in the « validity zone », only.	The sheet is inserted for first time in the airplane manuals indicated in the « validity zone », only.
D	DEVALIDATED	Sheet to be removed from the airplane manuals indicated in the « validity zone », only.	The sheet is, finally, cancelled for the airplane manuals indicated in the « validity zone » only.

TECHNICAL INFORMATION VALIDATION

Here is the point to be sure the technical information contained in each page :

- is sent, on time to the involved airline
- and, validated to the correct airplane(s)

This is achieved by using validation criteria written on each page.

DEFINITION OF THE PAGE

A page is defined by :

- a reference (Manual Volume/Chapter/Section number/ Page number)
  ex : 2.01.03 page 1
- Validation criteria to determine the page variant
  ex : Unit, Modification number, Version, Engine, ...

So, a page with a given reference may have various variants :

ex : 2.01.03 page 1

ALL/ALL	Variant 1
ALL/ALL MOD : XXXX	Variant 2
ALL/ALL MOD : XXXX + YYYY	Variant 3

The envelope of variants for a given reference covers all Airbus airplanes of a specific type, but the airlines receive part of these variants to cover their whole fleet.

PAGES (VARIANTS) VALIDATION

Each page (variant of a given reference) is validated by use of computer programs.

These programs combine the validation criteria of a reference to determine for which airplane(s) the variants are valid, and so for all existing references of a manual.

A variant may be valid for various airplanes but an airplane cannot have several variants.

AIRCRAFT MODIFICATION STATUS DATA-BASE (AMS-DB)

After transformation of all validation criteria into real and/or fictive modification numbers, the computer programs take validation data into a specific data-base : the Aircraft Modification Status Data-Base (AMS-DB).
The AMS-DB contains modifications validity arranged per airplane Manufacturer Serial Number (MSN).

The AMS-DB is fed with informations from :

- Airbus Industrie, before delivery.
  The DB is updated daily in relation with production changes.
- The airlines via Airbus Industrie (AI/SP22), after delivery.
  The DB is updated daily with information from the airlines on embodiment and/or removal of equipment or any change.

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Should airlines not timely transmit the correct changes to Airbus Industrie for AMS-DB amendment, the manuals cannot be updated accordingly which results in mail exchange and associated waste of time and delay in correct information supply.

BEST WAY TO GET UPDATED DOCUMENTATION

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

AIRBUS INDUSTRIE
BP 33
31707 BLAGNAC CEDEX
FRANCE

R Telex : TLSBICR.. or 530526F

R ATTN : Support Division (AI/SP21)

as soon as any change is completely performed on any airplane.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS	2.01.00
		PAGE 1/2
	CONTENTS	REV 04 SEQ 501

Pages

2.01.01 FOREWORD 1/2

2.01.02 AIRCRAFT GENERAL

General 1-2
Speed ..... 2 to 4

2.01.03 AUTO FLIGHT SYSTEM 1/2

2.01.04 SYSTEMS

Air Conditioning and Pressurization 1
Anti-Ice 1
APU 1
Brakes 1
Electrical 1
Fluid Servicing 2
Fuel 2
Hydraulics 2
Power Plant 3
Rain Repellent 3
Crew Oxygen 4

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS FOREWORD	N 2.01.01 PAGE 1/2 REV 04 OCT 83

1. GENERALITIES

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

IMPORTANT

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

- THE ADDITIONAL LIMITATIONS ARE INDICATED AS A GUIDE IN ORDER TO HAVE AN OPTMISED UTILIZATION OF THE AIRCRAFT.
- ALL REFERENCES TO AIRSPEED OR MACH RELATE TO INDICATED AIRSPEED OR INDICATED MACH UNLESS OTHERWISE NOTED.
- ALL REFERENCES TO ALTITUDE RELATE TO PRESSURE ALTITUDE UNLESS OTHERWISE NOTED.

2. KINDS OF OPERATIONS

THIS AIRPLANE IS CERTIFICATED IN THE TRANSPORT CATEGORY FOR THE FOLLOWING KINDS OF OPERATION WHEN THE APPROPRIATE INSTRUMENTS AND EQUIPMENTS REQUIRED BY THE AIR WORTHINESS AND/OR OPERATING REGULATIONS ARE INSTALLED AND APPROVED AND ARE IN OPERABLE CONDITION.

- CARRIAGE OF PASSENGERS (MAXIMUM NUMBER OF PASSENGERS SEATS : 265)
- CARRIAGE OF CARGO
- ICING CONDITIONS
- EXTENDED OVER WATER FLIGHT AND DICHTING
- DAY AND NIGHT VFR
- IFR
- FOR OPERATION WITH AFS, LIMITATIONS ARE GIVEN IN 2.01.03

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

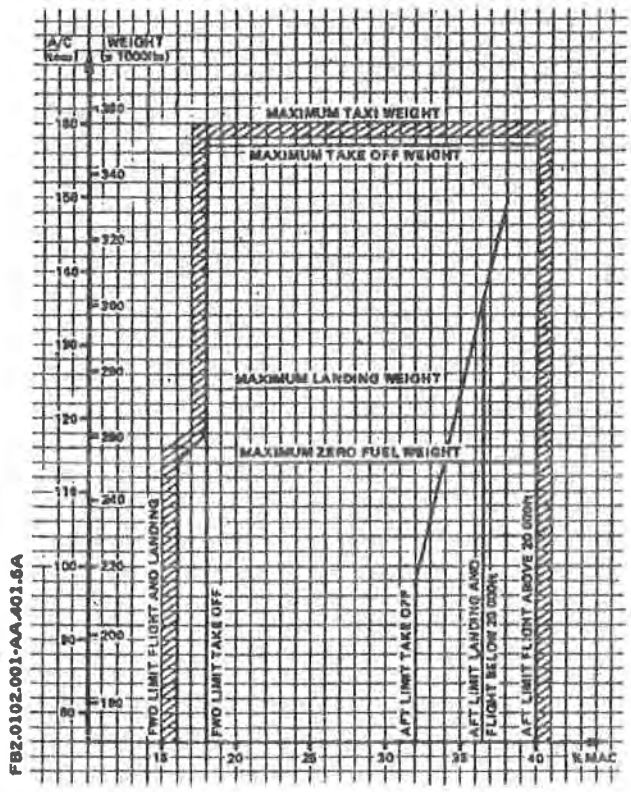
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A310 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS	2.01.02
		PAGE 1
	AIRCRAFT GENERAL	REV 15 / SEQ 401

1 – WEIGHTS/CENTER OF GRAVITY

A. Center of gravity limits

THE LIMITS OF THE CENTER OF GRAVITY ARE GIVEN IN PERCENTAGE OF THE MEAN AERODYNAMIC CHORD, LANDING GEAR EXTENDED. THE MAC IS 5.8287 METERS LONG (229.48 INCHES). STATION 0 IS LOCATED 6.3825 METERS (251.28 INCHES) FORWARD OF FUSELAGE NOSE.



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

B. Weight limitations

	KG	POUNDS
MAXIMUM TAXI WEIGHT	157 900	348 170
MAXIMUM TAKE-OFF WEIGHT (BRAKES RELEASE)	157 000	346 185
MAXIMUM LANDING WEIGHT	124 000	273 420
MAXIMUM ZERO FUEL WEIGHT	114 000	251 370
MINIMUM WEIGHT	80 000	176 400

Under exceptional conditions following a take off at any weight within max take off weight and max landing weight an immediate landing is permitted proyided overweight landing procedure is adhered to.

Exceptional conditions are :

. emergencies

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

When the weight is higher than 153900 kg (339,600 lbs), do not exceed a maximum taxiing speed of 15 kt during a turn.

2 – SPEED

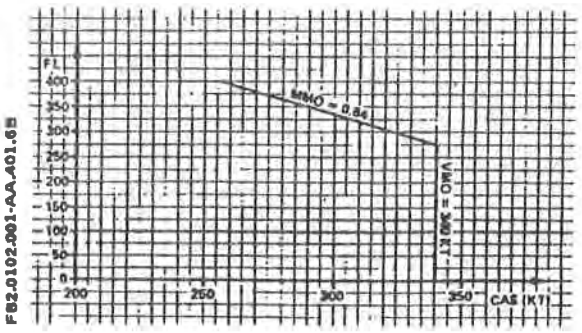
VMCA-VMCG

VMCG	111 KT CAS (113 KT IAS)
VMCA	115 KT CAS (116 KT IAS)

A. Maximum operating speeds

VMO

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



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A310 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS	2.01.02
		PAGE 2
	AIRCRAFT GENERAL	17.01.1990

B. Maximum flaps/slats speeds (VFE)

(1) MAXIMUM SLATS/FLAPS EXTENDED SPEEDS OR OPERATING SPEEDS
Maximum operating altitude : 20000 ft

	SLATS	FLAPS	SPEED (IAS)
TAKE-OFF	15	0	245 KT
TAKE-OFF AND APPROACH	15	15	210 KT
TAKE-OFF, APPROACH AND LANDING	20	20	195 KT
LANDING	20 30	20 40	195 KT 180 KT
HOLDING AND « EN ROUTE »	15	0	245 KT/M 0.54

C. Gear operating speeds

MAXIMUM SPEED AT WHICH THE LANDING GEAR MAY BE EXTENDED OR RETRACTED :
VLO = 270 KT OR M 0.59
MAXIMUM SPEED WITH LANDING GEAR LOCKED DOWN : VLE = 270 KT OR M 0.65

R

D. Kruger :

If Kruger cannot be retracted, do not exceed . . . . . 300 kt/0.65 M

E. Manual pitch trim

When operating with manual pitch trim only, do not exceed . . . . . 285.KT/0.78 M

3 – MISCELLANEOUS

A. Minimum flight crew

THE MINIMUM FLIGHT CREW CONSISTS OF 2 PILOTS.

B. Dispatchibility

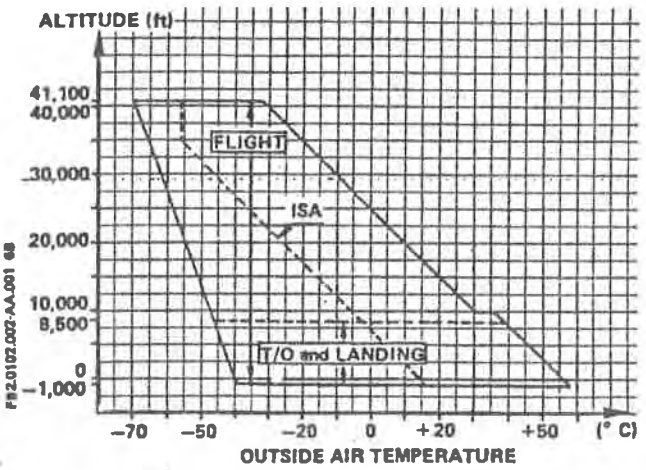
For dispatch in the event of equipment failure or missing parts, refer to MEL/CDL.

C. Flight maneuvering load acceleration limits :

CLEAN CONFIGURATION :		+ 2.5 g to – 1 g
TAKE-OFF LANDING HOLDING (SLATS EXTENDED)	CONFIGURATION :	+ 2 g to 0 g

D. Operating performance limitations :

(1) Environmental envelope



(2) Airport Operation Limitation(take off and landing):

RUNWAY SLOPE (MEAN) ..... ±2%
RUNWAY ALTITUDE ..... 8500 ft
WIND:
Max.tailwind component ..... 10 kt
Cross wind:

0,26	0,3		0,4		0,5	0,55	coefficient μ*)
							[kt]
10	15	20	25	30	35	37	max.crosswind
(5)		(10)		(15)		(20)	(autoland)

*) Braking action(ICAO):POOR($\mu \leq 0{,}25$), MEDIUM TO POOR ($0{,}25 < \mu < 0{,}3$), MEDIUM ($0{,}3 \leq \mu \leq 35$), MEDIUM TO GOOD ($0{,}35 < \mu < 0{,}4$), GOOD ($\geq 0{,}4$)

Note: Wenn die Werte für "WET RWY AND EQUIVALENT" (FCOM 2.18.50/P.1) überschritten sind und die Werte für "CONTAMINATED RWY" angewendet werden müssen, beträgt die höchstzulässige Seitenwindkomponente für den Start 15 kt.

Max. wind for passenger and cargo doors operation ..... 60 kt

BRAKING ACTION/COEFFICIENT:
Der geringste zulässige gemessene Reibungsbeiwert ist $\mu = 0{,}26$.
Die geringste zulässige Bremswirkung ist "MEDIUM TO POOR" (ICAO).
Die Anwendung der WEIGHT/SPEED-DECREMENTS(FCOM) ist nur zulässig, wenn für den betreffenden Platz keine RTOLW-chart für wet/contaminated RWY verfügbar ist.

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F. Tires :

MAXIMUM TIRE SPEED
. . . . . GROUND SPEED = 195.5 kt

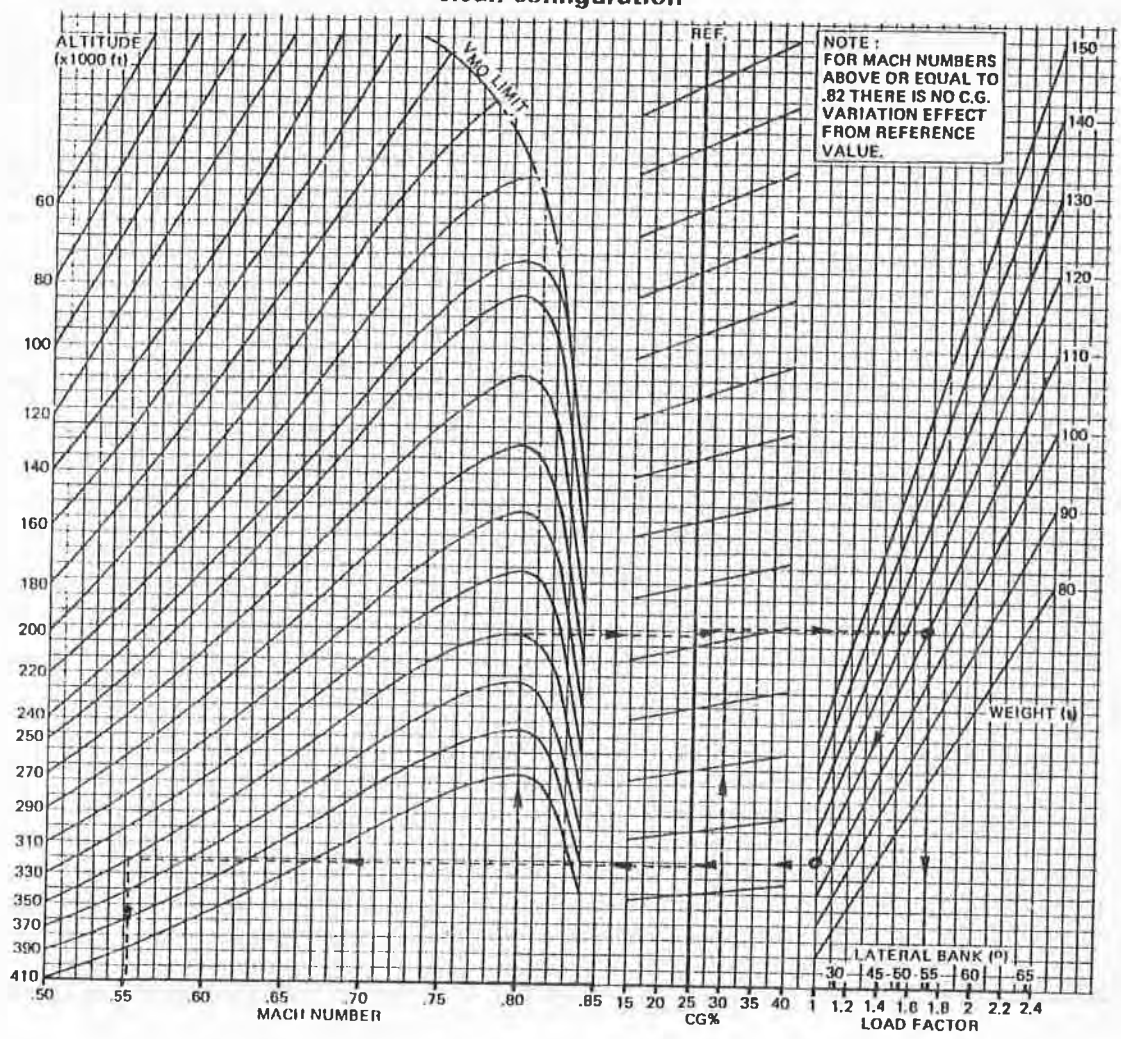
G. Windshield Wipers in use :

Maximum operating speed . . . . . 230 kt

H. Cockpit Windows Open :

Maximum speed . . . . . 225 kt

BUFFET ONSET
clean configuration



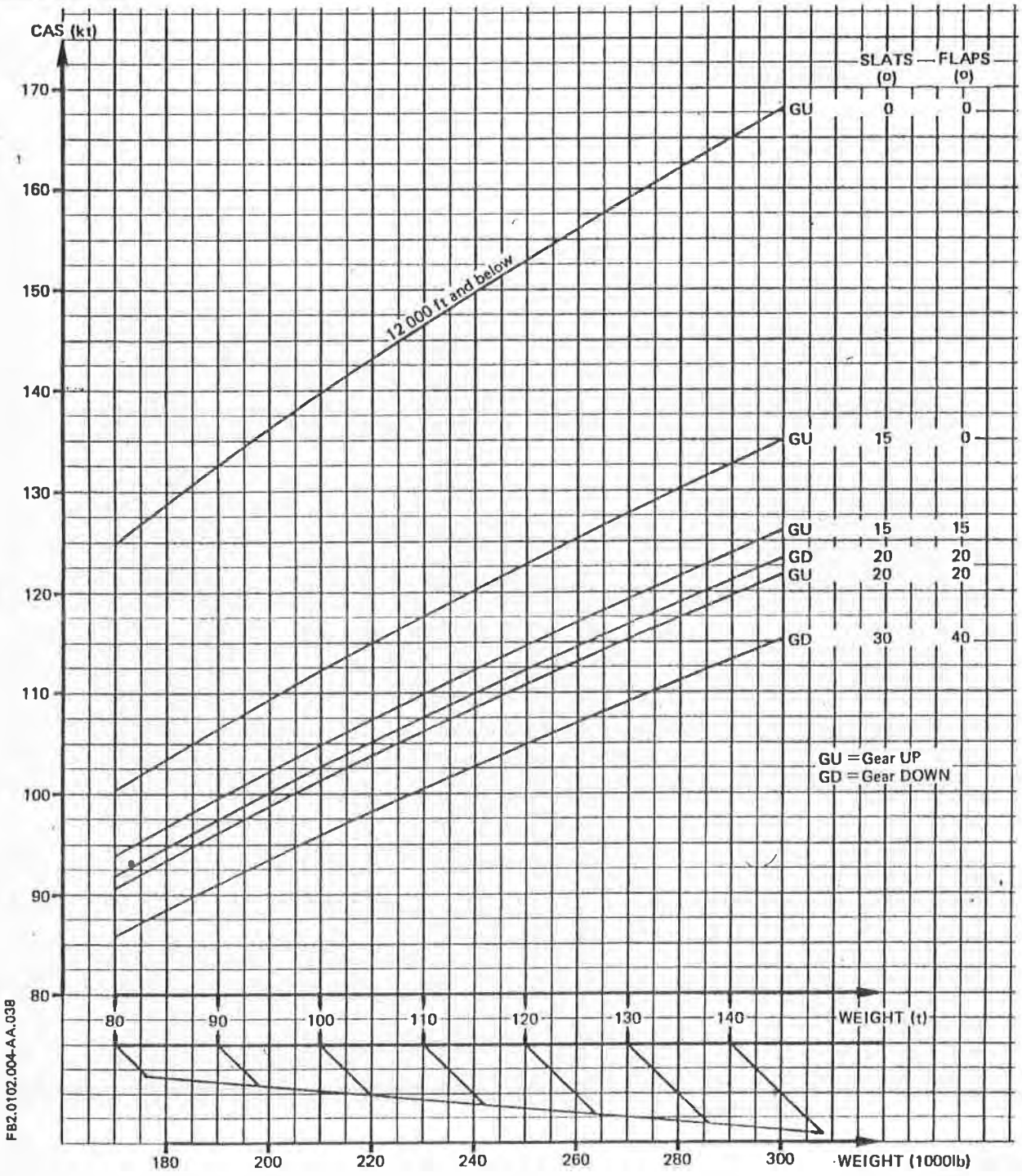
Data : M = .80
FL = 350
Weight = 110 tons
CG = 30 %

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

Mod. : 4863

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VS MINIMUM



Note : In clean configuration, the stall speed at a given weight is increased by 0.7 kt per 1 000 ft above 12 000 ft.

Mod : 4869
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AUTOPILOT :

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

AUTOTHROTTLE

TAKE OFF :
In case ENGINE TRIM is inoperative, do not use ATS at TAKE OFF.

AUTOLAND

AIRPLANE CONFIGURATION
Certified configuration : slats 30°/flaps 40°.

CATEGORY II APPROACH AND AUTOMATIC LANDING

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

CATEGORY III APPROACH AND AUTOMATIC LANDING WITH DECISION HEIGHT

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

CATEGORY III APPROACH AND AUTOMATIC LANDING WITH NO DECISION HEIGHT

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

AUTOMATIC LANDING AND ROLL OUT

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

G.M. 9113 = (Mod. : 4941 + 5757 + 5502 + 5429 + 5528 + 4801)

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1 – AIR CONDITIONING AND PRESSURIZATION

A. Air Conditioning with LP ground unit.

It is prohibited to use conditioned air simultaneously from PACKS and LP ground unit (to avoid chattering of non return valves).

B. Ram Air Inlet :

OPEN ONLY IF DIFFERENTIAL PRESSURE IS LOWER THAN 1 PSI.

C. Maximum cabin differential pressure.

- Positive differential pressure limitation . . . . 8.40 PSI

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

– Maximum cabin differential pressure for landing . . . . . 1 PSI

– Cabin signs « ON » . . . . . 11,300 ± 500 ft

– Passengers oxygen mask drop . . . 14,000 { + 0 ft / – 500 ft

D. Warnings

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

2 – ANTI-ICE

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

3 – APU

A. Starting

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

. Minimum oil quantity indication before start 1/4

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

. Time limit for start (N lower than 50 %) . . . . 70 sec.

. Minimum cooling intervals between start cycles . 1 mn

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

2 – After 3 starter motor duty cycles of 70 sec each, separated by 1 mn cool down, 60 mn must be allowed for cooling (not necessary at high altitude).

3 – Three start attempts are allowed within one hour below 37 000 ft. R
Five start attempts are allowed within one hour above 37 000 ft. R R R

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

B. Operations

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

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

– *ELEC POWER EXTRACTION :*

- At or below 35 000 ft . . . . . 90 kVA
- Above 35 000 ft up to 41 000 ft :
  ISA and below . . . . . 90 kVA
  ISA + 20 . . . . . 75 kVA
  ISA + 35 . . . . . 40 kVA

When using JP5 fuel, the APU operation in flight must be planned such that TAT is maintained above minus 31° C.

C. Rotor speed

Maximum N . . . . . 109 %

D. EGT

Maximum EGT . . . . . 585° C

4 – BRAKES

Maximum brake temperature allowed for take-off . . . . . below 300° C

5 – ELECTRICAL

A. AC power

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

B. DC power

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

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6 – FLUID SERVICING

A. Fuel and fuel additives (engines and APU)

Refer to : – GE specification D50TF2
– A310 Flight Manual chapter 2-04

B. Fuel temperature in tanks

When using JET A without anti-icing additive, it is recommended to fly with TAT higher than minus 32.5° C.

When using JET A1 without anti-icing additive, it is recommended to fly with TAT higher than minus 39.5° C.

C. Oil

Refer to GE specification D50TF2.

CAUTION : The intermixing of different types or brands of lubricating oil or preservative oils must be avoided.
In the event of inadvertent mixing of these oils occurs, the entire engine oil system must be drained, flushed and reserviced with the correct oil without delay in accordance with the Maintenance Manual.

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

GE SERVICE BULLETIN 79.1 AS REVISED

D. Hydraulics

Approved hydraulic fluids are according to specification NSA 307110 :

TYPE II	TYPE IV
SKYDROL 500 B	HYJET IV SKYDROL 500 B4
HYJET W	SKYDROL LD4

Note : (1) The intermixing of these fluids is permitted.
(2) Primary hydraulic fluids are type IV fluids.

E. Rain repellent

Approved rain repellent is Type 3 Repellent RAIN BOE.

7 – FUEL

A. Usable fuel tank capacity

TANK	LITER	US GAL	
OUTER TKS	7400	1955	
INNER TKS	27900	7371	
CTR	19640	5189	
ACT	14000	3704	R
TRIM	6150	1625	
Total	75090	19844	R

B. Fuel quantity indications

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

C. Fuel loading

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

Maximum allowed unbalanced fuel :
. at take-off : 2000 kg (4410 lb) in « inner »
. at landing : 11000 kg (24250 lb) in « inner »
or 3000 kg (6615 lb) in « outer ».

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

D. Fuel management

– Operations with outer tank empty are not allowed.

E. Take-off restrictions

1 – Take-off on center tank is prohibited when fuel quantity is below 1000 kg (2200 lb).

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

F. Landing restrictions

– Landing with more than 2000 kg (4400 lb) in trim tank is not allowed.

8 – HYDRAULICS

A. PWR TRANSF operation in flight :

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

B. System pressure :

– MINIMUM . . . . . 2800 psi
– MAXIMUM . . . . . 3200 psi

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9 – POWER PLANT

A. Thrust setting :

Thrust levels above MAX CONTINUOUS are limited to 5 minutes, or 10 minutes in case of engine failure.

B. EGT :

. TO and GA	960 °C
. MAX CONT	925 °C

. MAX CLIMB* . . . . . 890 °C
. MAX CRUISE* . . . . . 835 °C
* Operational recommendation, not certified limit.

. STARTING :

TIME LIMITATION	EGT (° C) LIMITATION	NOTE
40 seconds	750-820	Must be recorded. Repetitive starts are cause for maintenance actions.
	820-870	Must be recorded. Maintenance action is required before the next start. (Intended flight may be completed).
Unlimited	750	

B. Starter air pressure :

– Recommended . . . . . 25-55 psi

C. Starter duty cycle

– Max continuous . . . . . .5 mn

– Cool starter for 30 s per mn of operation.

– Cool starter for 10 mn after two consecutive 5 mn cycles and prior to each additional 5 mn cycle.

D. Starter reengagement :

R – Maximum N2 . . . . . 30 %

E. RPM

– MAXIMUM N1	117.5 %
– MAXIMUM N2	112.5 %

F. Oil temperature :

– MAXIMUM TRANSIENT (15 mn)	175° C
– MAXIMUM CONTINUOUS	160° C

G. Engine light up time (from fuel lever opening)

– Maximum GROUND . . . . . 25 s
– Maximum FLIGHT . . . . . 45 s

H. Oil quantity :

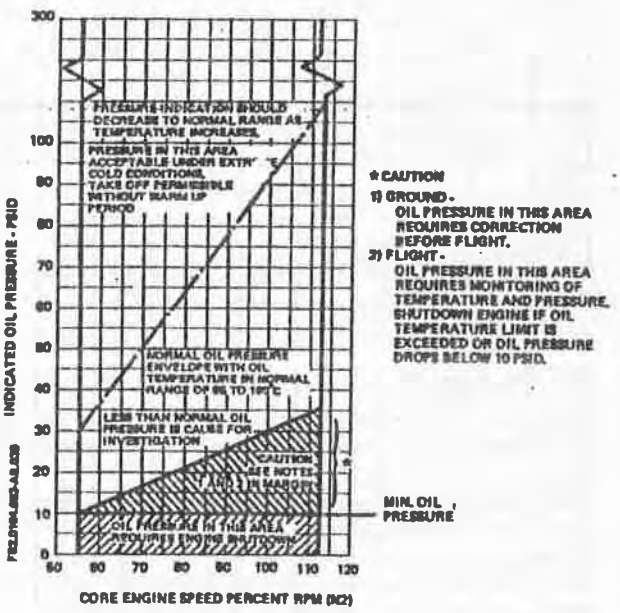
– Min (engine not operating) .. Estimated consumption + 10 quarts (indicated) or 14 quarts (true quantity)

– Min (ground idle) Estimated consumption + 5 quarts (indicated) or 9 quarts (true quantity)

– Maximum consumption . . . . . 0.55 q/h

– Assumed consumption rate to determine maximum flight length . . . . . 0.80 q/h

I. Oil pressure :



J. Reverse thrust

USE OF REVERSE THRUST IN FLIGHT IS PROHIBITED

. Max reverse thrust should not be used below 80 Kt. R

– If reverse unlocked or reverse stowed is selected do not reselect the opposite position before light indication shows end of transit.
– Backing the aircraft with use of reverse thrust is not permitted.

10 – RAIN REPELLENT

Rain repellent must be applied only on wet windshields.

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

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES AND TECHNIQUES GENERAL OPERATING SPEEDS	2.02.01 PAGE 1 REV 17 SEQ 002

1. SYMBOLOGY AND DEFINITIONS

- VS : Minimum stalling speed for a specified configuration. It is a function of the aircraft weight and altitude.
- VMCG : Minimum control speed on ground from which a sudden failure of the critical engine can be controlled by use of primary flying controls only. The other engine remaining at take-off power.
- V1 : Speed at which the pilot can make the decision, following failure of critical engine :
  - either to continue take-off
  - or to stop the aircraft.

  Represented by « 1 » on airspeed scale (or V1 value when out of range).
- VR : Speed at which rotation is initiated to reach V2 at an altitude of 35 feet.
- V2 : Take-off safety speed reached before the altitude 35 feet with one engine failed. Represented by the SPEED SELECT symbol on airspeed scale as any speed selected on FCU.
- VMCA : Minimum control speed in flight at which aircraft can be controlled with 5° Max bank, in case of failure of the critical engine, the other engine remaining at take-off power (take-off flaps setting and gear retracted).
- F : Equal to 1.25 VS Slats 15 /Flaps 0 . It is the minimum speed at which the flaps may be retracted to 0°.
  Represented by « F » on airspeed scale.
- S : Equal to 1.25 VS of Slats 0 /Flaps 0 . It is the minimum speed at which the slats may be retracted to 0°.
  Represented by « S » on airspeed scale.
- O (« GREEN DOT ») : ENGINE OUT OPERATING speed (BEST LIFT TO DRAG RATIO speed or DRIFT DOWN speed) in clean configuration. It corresponds also to the FINAL TAKE OFF speed.

  It is equal to 220 kts at 120 t (264500 lbs) ± 1 kt per ton + 2 kt per 1000 ft above 20000 ft.

  Represented by « O » (green dot) on airspeed scale.
- VFE : Maximum speed for each slats and/or flaps configuration
- VREF : Reference speed used for a normal final approach, it is equal to 1.3 VS Slats 30 /Flaps 40 configuration.
- VLS : Lowest Selectable speed. It is represented by an amber strip along the airspeed scale which appears 5 seconds after lift-off.

  In the T/O schedule VLS = 1.2 Vs of the actual T/O configuration.
  In the LANDING Schedule VLS = 1.3 Vs of the actual landing configuration.
  - Change from T/O to landing schedule is triggered by SLATS/FLAPS handle displacement (either retraction or extention).
  - Change from landing to T/O schedule is triggered by LDG GEAR SHOCK absorber compression (A/C on ground).

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

  In case of SLATS or/and FLAPS JAMMING, VLS represents 1.3 Vs of the present (ABNORMAL) configuration.
- VSS : Stick shaker speed : The speed at which the stick shaker is activated. It is represented by a red and black strip along the airspeed scale. It is equal to 1.138 Vs in clean configuration, 1.08 Vs in other configurations. R R
- FINAL APPROACH SPEED : VAPP
  - VAPP = VLS + CONFIGURATION CORRECTION + WIND CORRECTION.

  Notes : 1 – In SLATS 30 /FLAPS 40 landing configuration, VLS = VREF
  2 – CONFIGURATION CORRECTION : Represents the speed increment to be applied for the approach speed in some cases of failure.
  This increment is indicated in LANDING chapter and in the corresponding emergency/abnormal check list. R R
  - For AUTOLAND or when significant ice accumulation has occured :
    VAPP = VLS + 5 Kt + WIND correction

2. WIND CORRECTION

WIND CORRECTION = 1/3 OF TOTAL WIND OR GUST IF HIGHER

- Maximum wind correction = 15 Kt.
- Do not apply a wind correction if configuration correction is 20 Kt or more.

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES AND TECHNIQUES GENERAL DATA CARD	2.02.01 PAGE 2 REV 06 SEQ 002

LANDING A 310

OCT. 83
AI/V-F 1000

DESTINATION : _____ ALTERNATE : _____

WEIGHT: ____	VREF:	ATIS CODE : _____
FLAPS: _____	VAPP:	RWY : _____
REMARKS :	F :	WIND : ____ / ____ Kt
	S :	VISIBILITY / CEILING : _____
	O :	QNH/GFE : _____
		TEMP : ____ / ____ °C
		TRANS LEVEL : _____

TAKE OFF A 310

OCT. 83
AI/V-F 1000

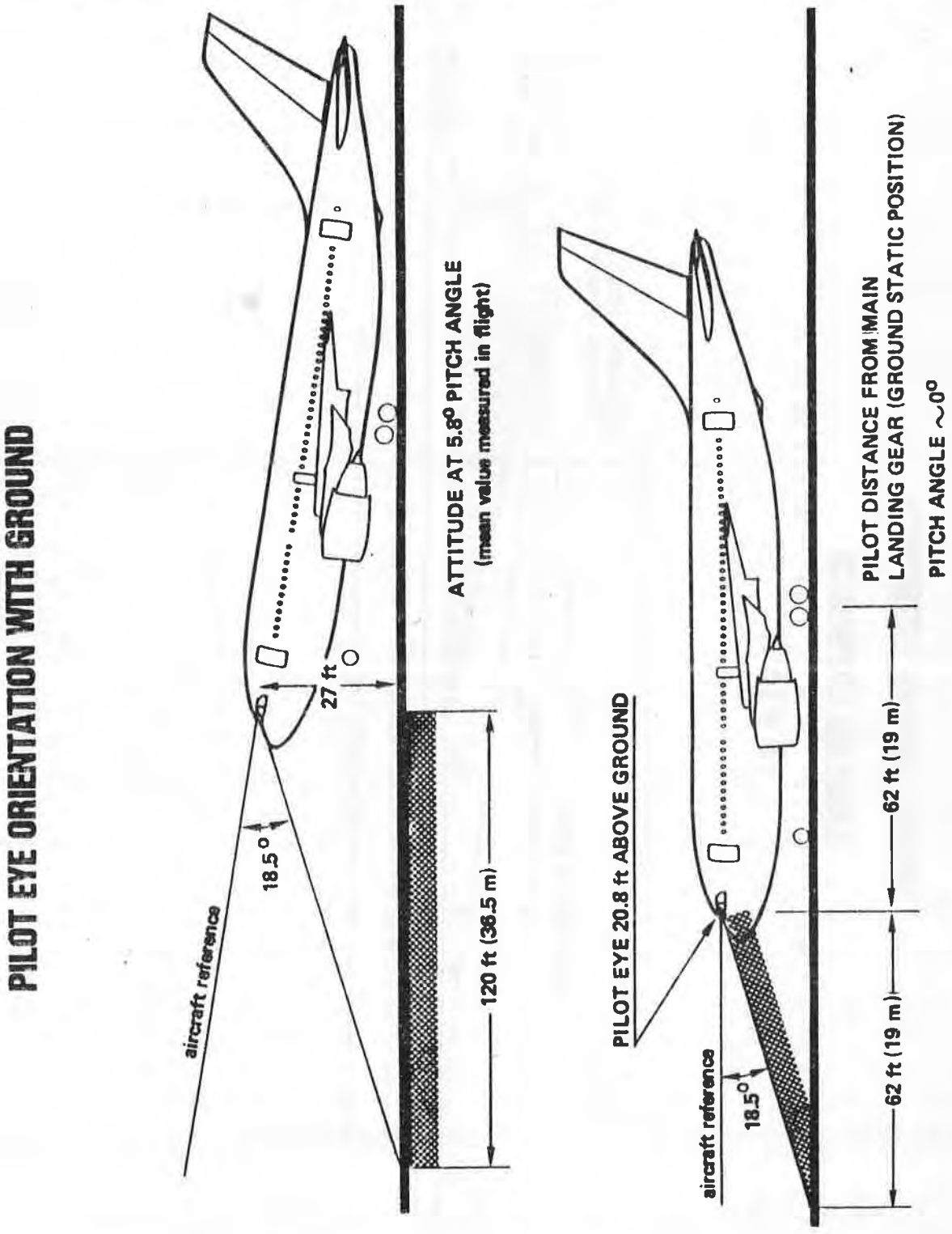
CO RTE/FLT N° _____ FROM/TO ____ / _____ DATE _____

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

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	PROCEDURES & TECHNIQUES GENERAL FLIGHT CHARACTERISTICS	N 2.02.01 PAGE 3 REV 06



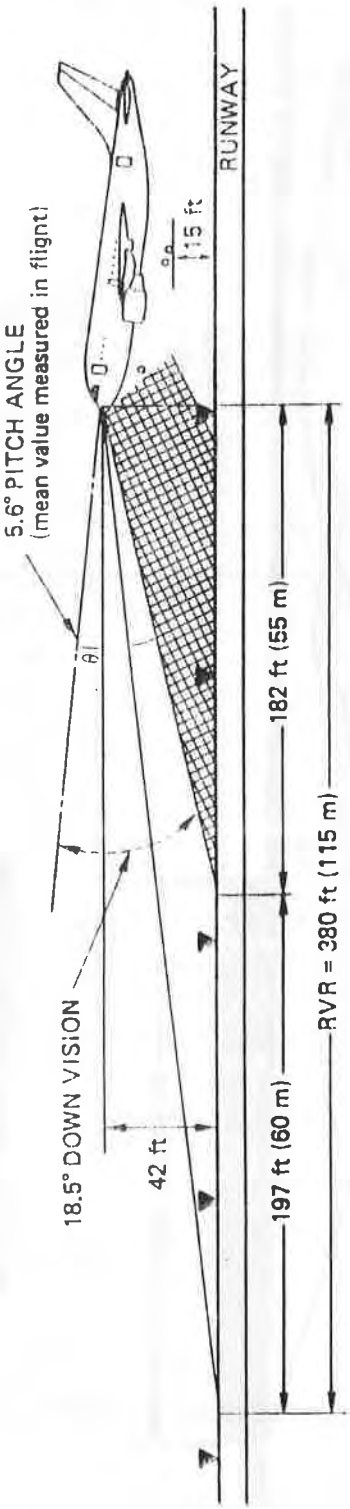
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VISUAL GROUND SEGMENTS

LANDING APPROACH

H = 15 ft



Vers. : All

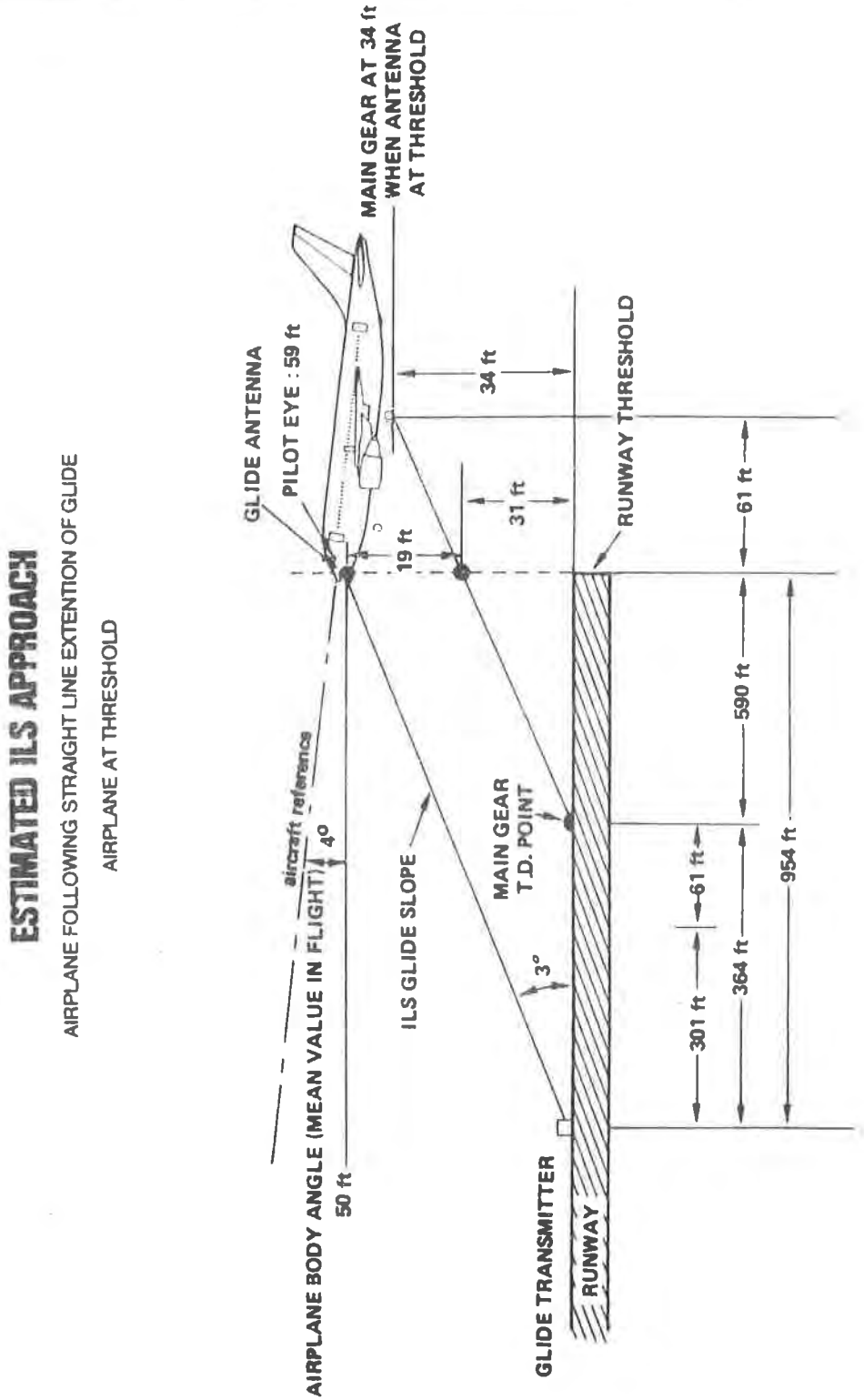
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ESTIMATED ILS APPROACH

AIRPLANE FOLLOWING STRAIGHT LINE EXTENTION OF GLIDE

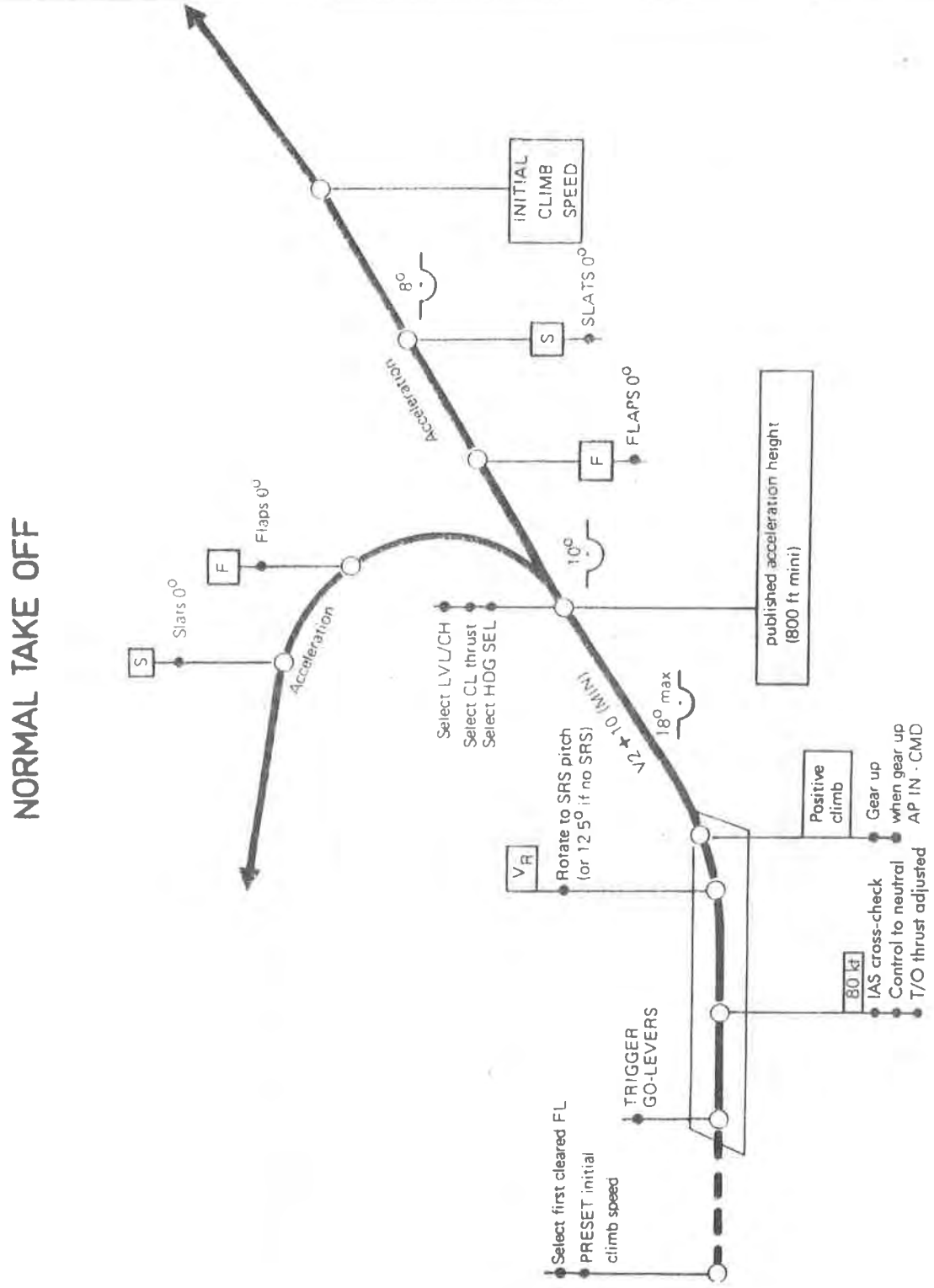
AIRPLANE AT THRESHOLD



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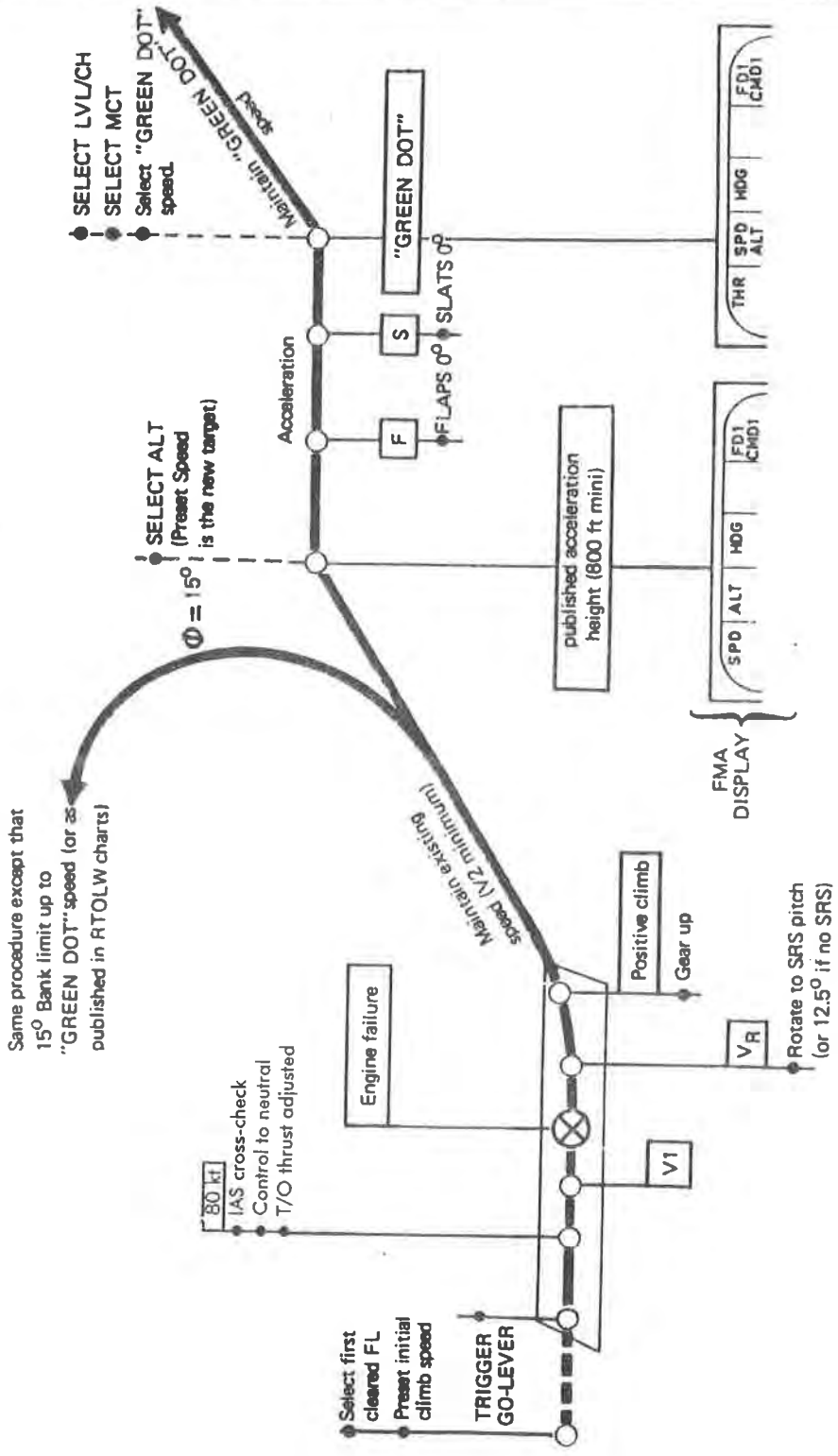
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	PROCEDURES & TECHNIQUES GENERAL FLIGHT PATTERNS	N 2.02.01 PAGE 6 29.12.1989



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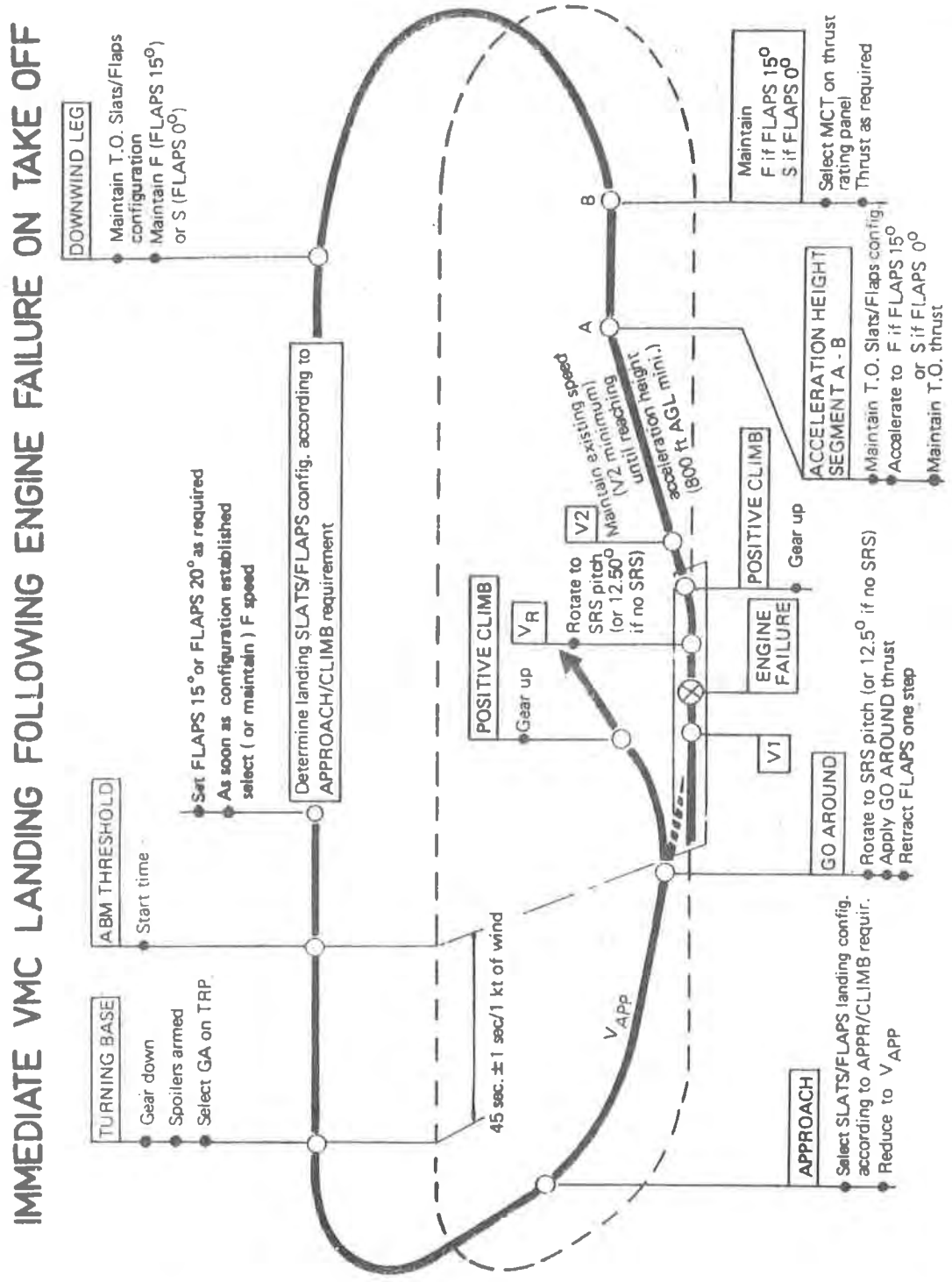


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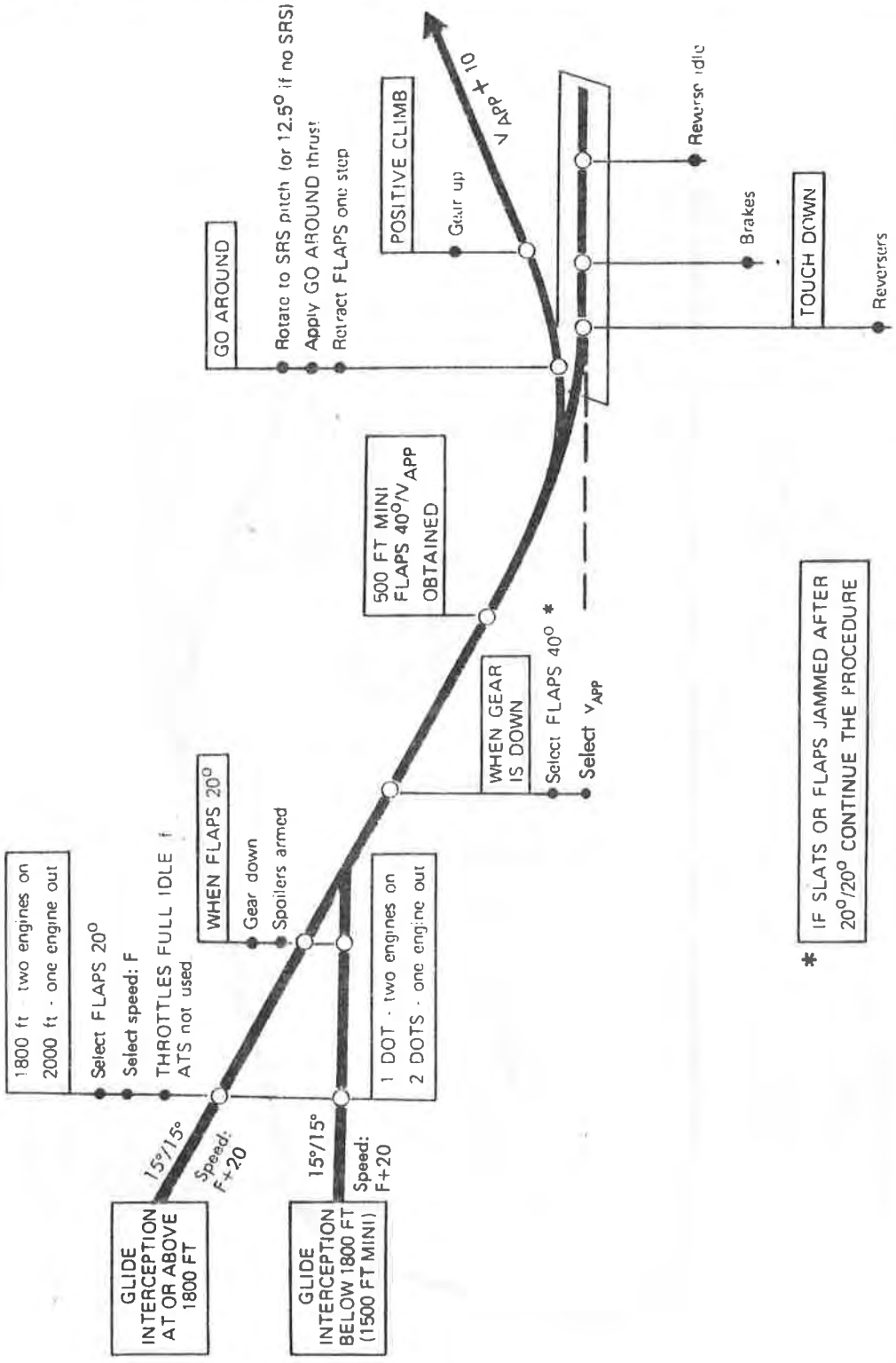


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STANDARD APPROACH : DECELERATED APPROACH

Performed manually or with AP engaged on a stabilized final slope of about 3°
(visual or ILS approach)

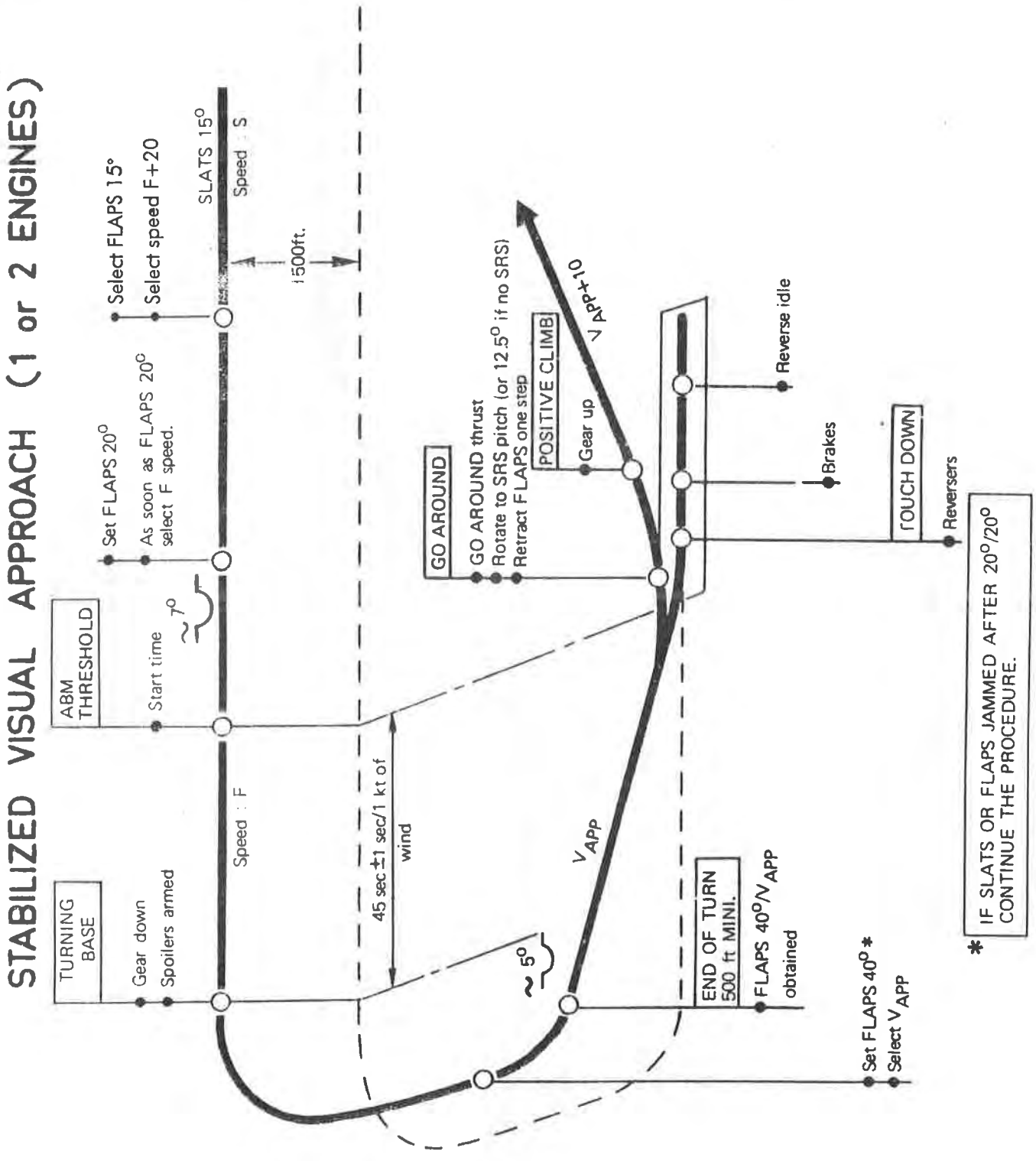


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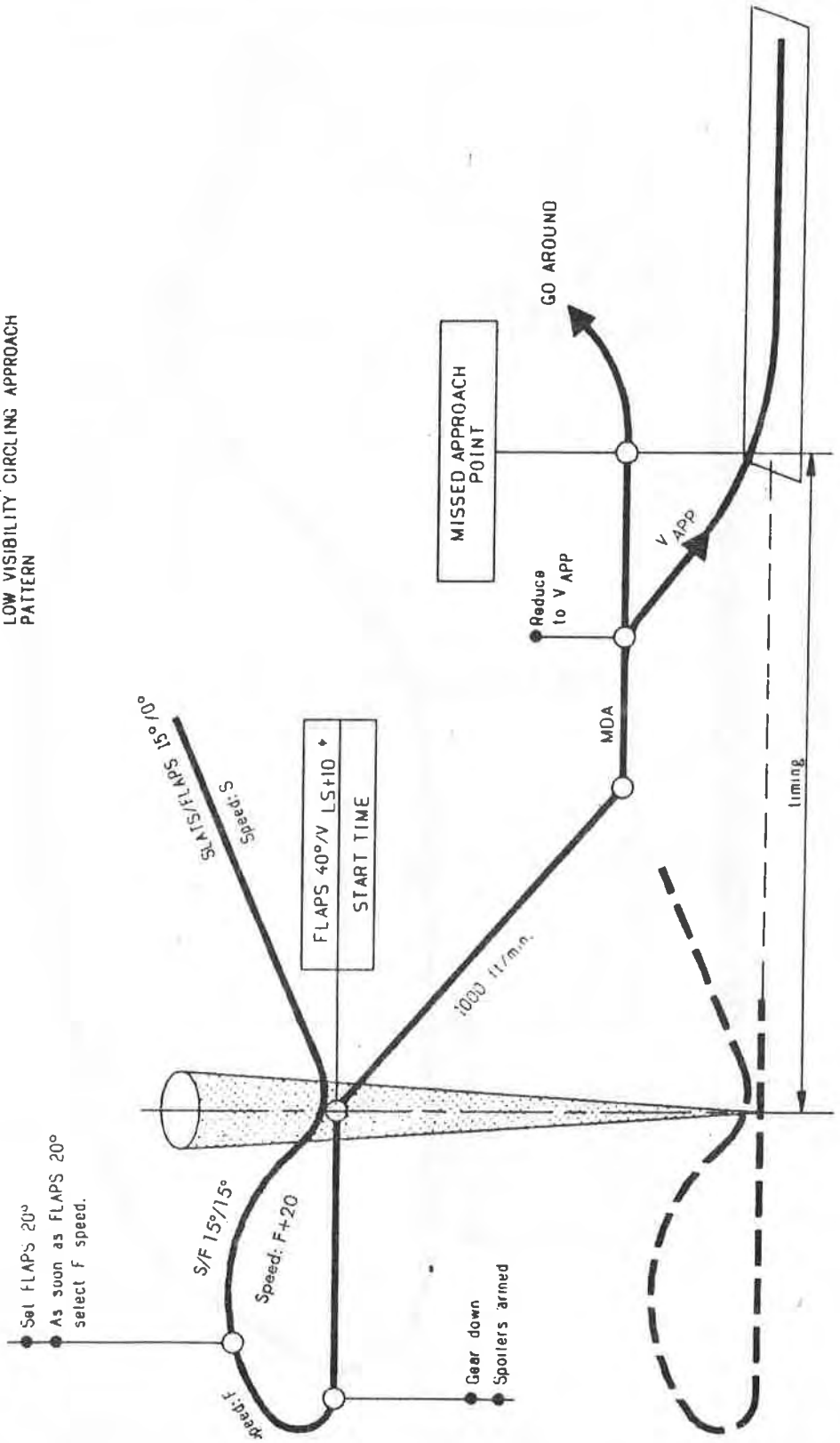
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VOR-ADF NON PRECISION APPROACH (1 or 2 ENGINES)

R R R R R R R R R R

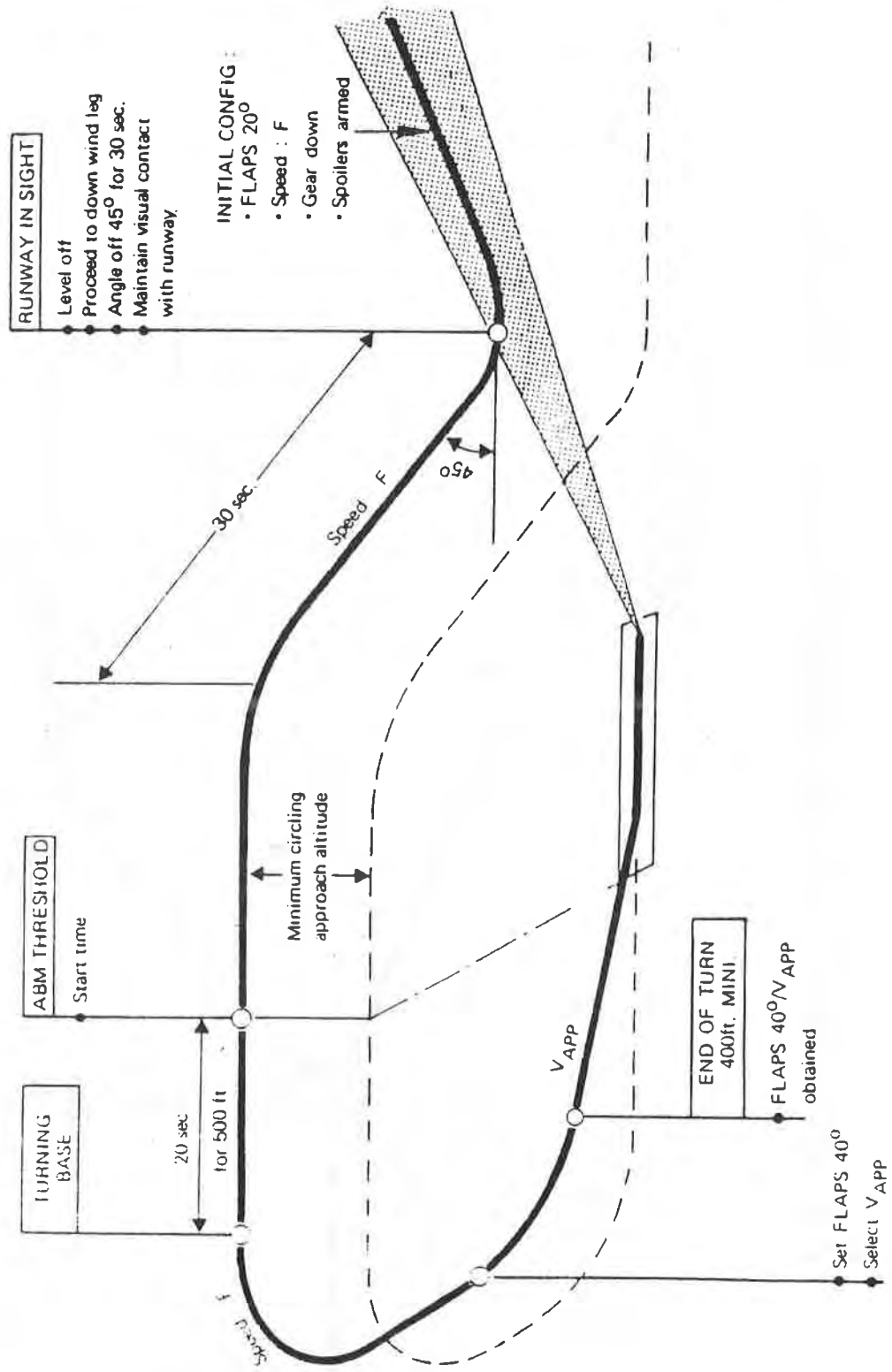


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LOW VISIBILITY CIRCLING APPROACH



Vers. : All

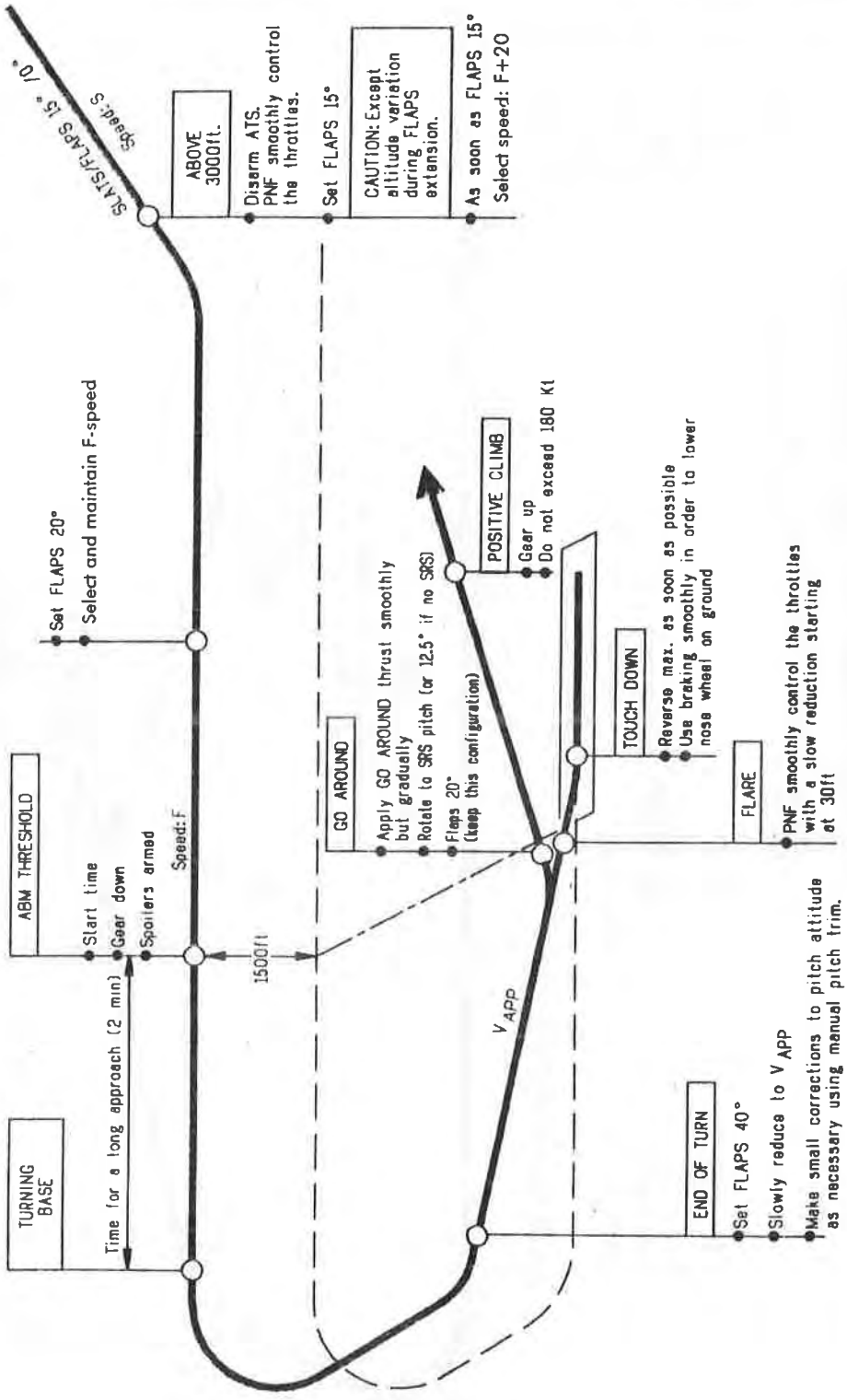
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LANDING WITH JAMMED ELEVATOR

USE MANUAL PITCH TRIM

CAUTION: IF JAMMING OCCURS DURING TAKE OFF ROTATION, BOTH PILOTS MAY HAVE TO ACT TOGETHER ON THE CONTROL COLUMN TO ACHIEVE A SAFE ATTITUDE. IT MAY BE NECESSARY TO USE PITCH TRIM AND ELEVATOR CONTROLS SIMULTANEOUSLY. ATTEMPT TO MAINTAIN THE SPEED BELOW 195KT IN ORDER TO RETAIN INDEPENDANT ELEVATOR SURFACE MOVEMENT, WHEN PITCH IS STABILIZED USE TRIM ONLY.



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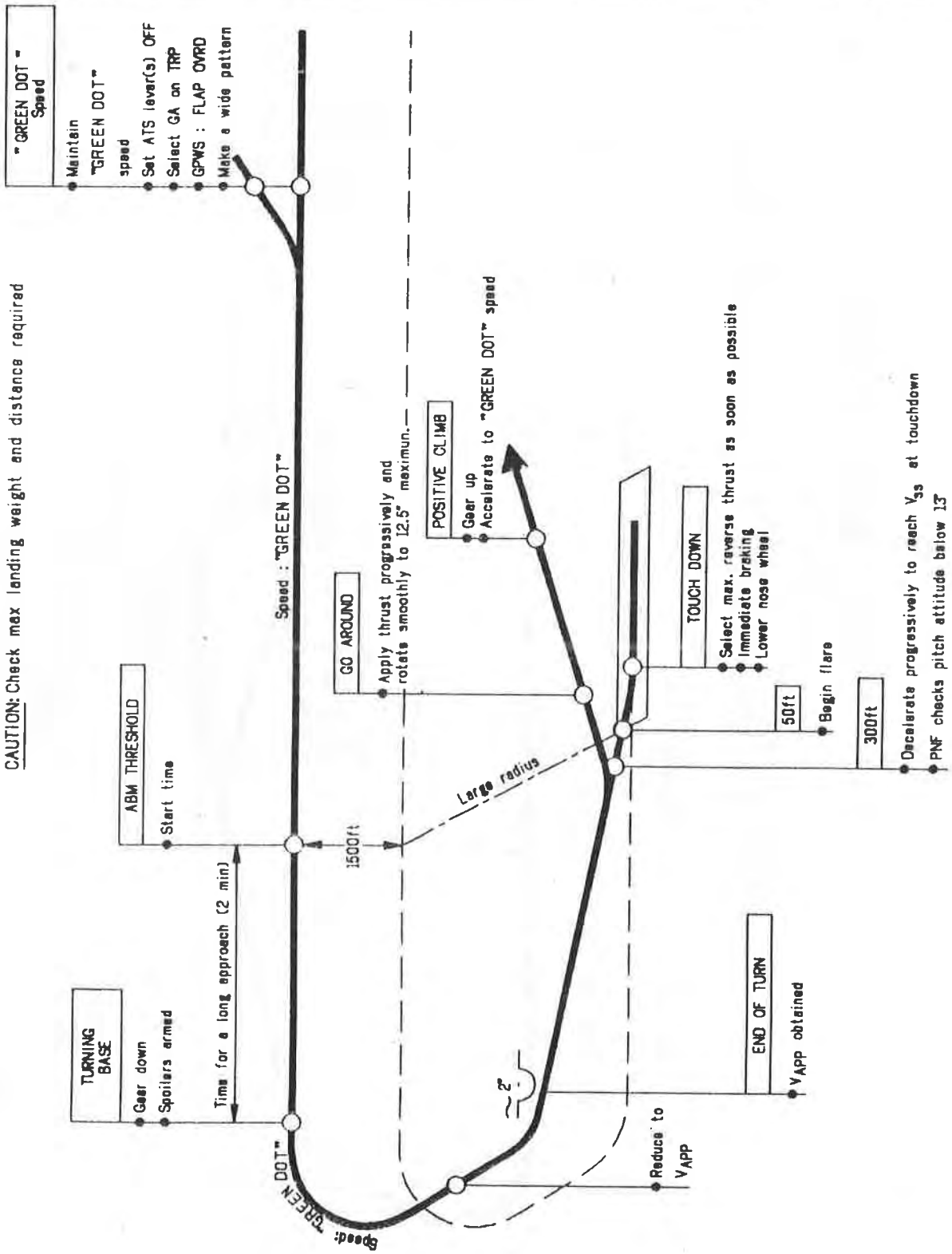
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R R R R R R R

NO FLAPS AND NO SLATS LANDING

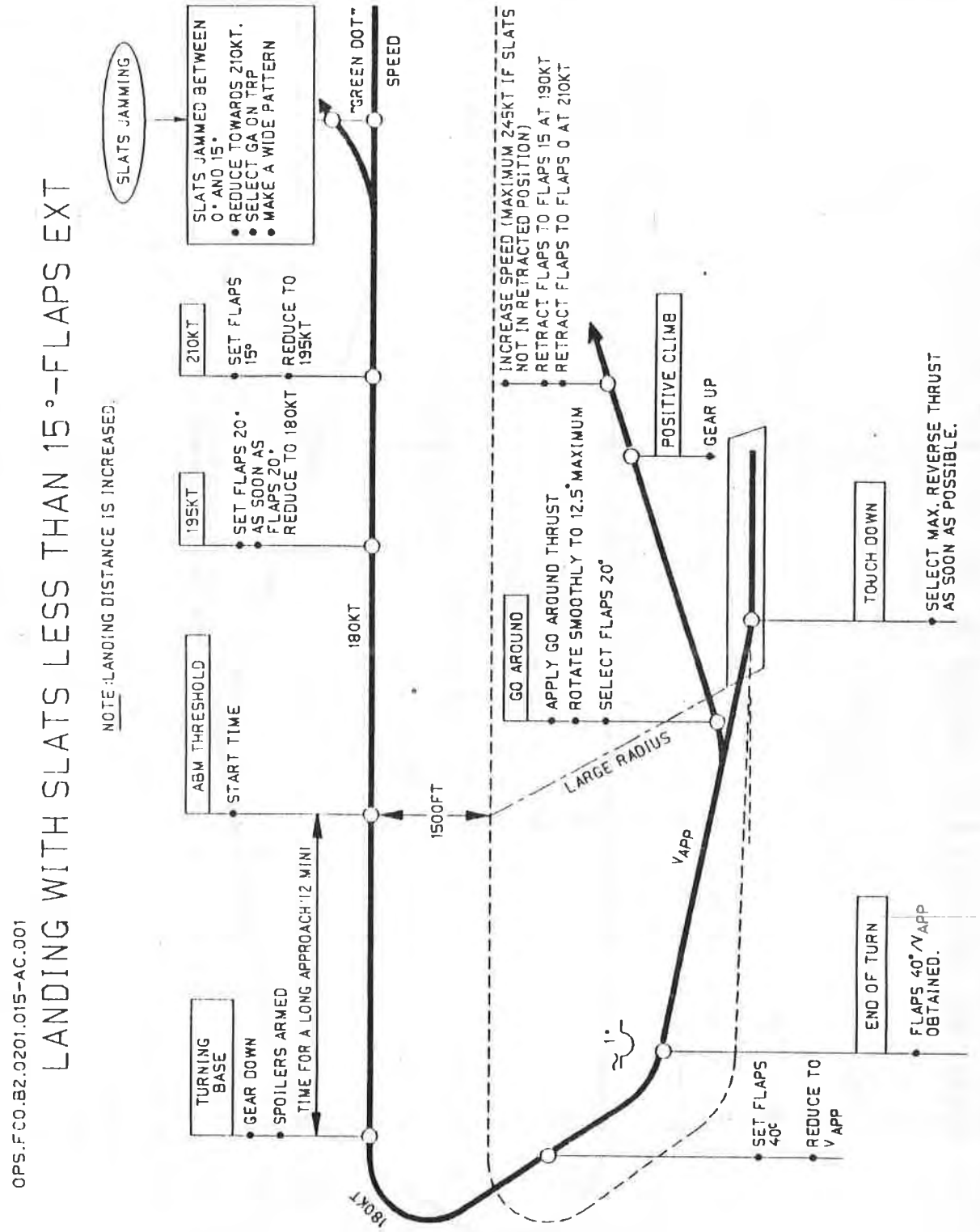
CAUTION: Check max landing weight and distance required



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R
R
R
R
R
R
R
R



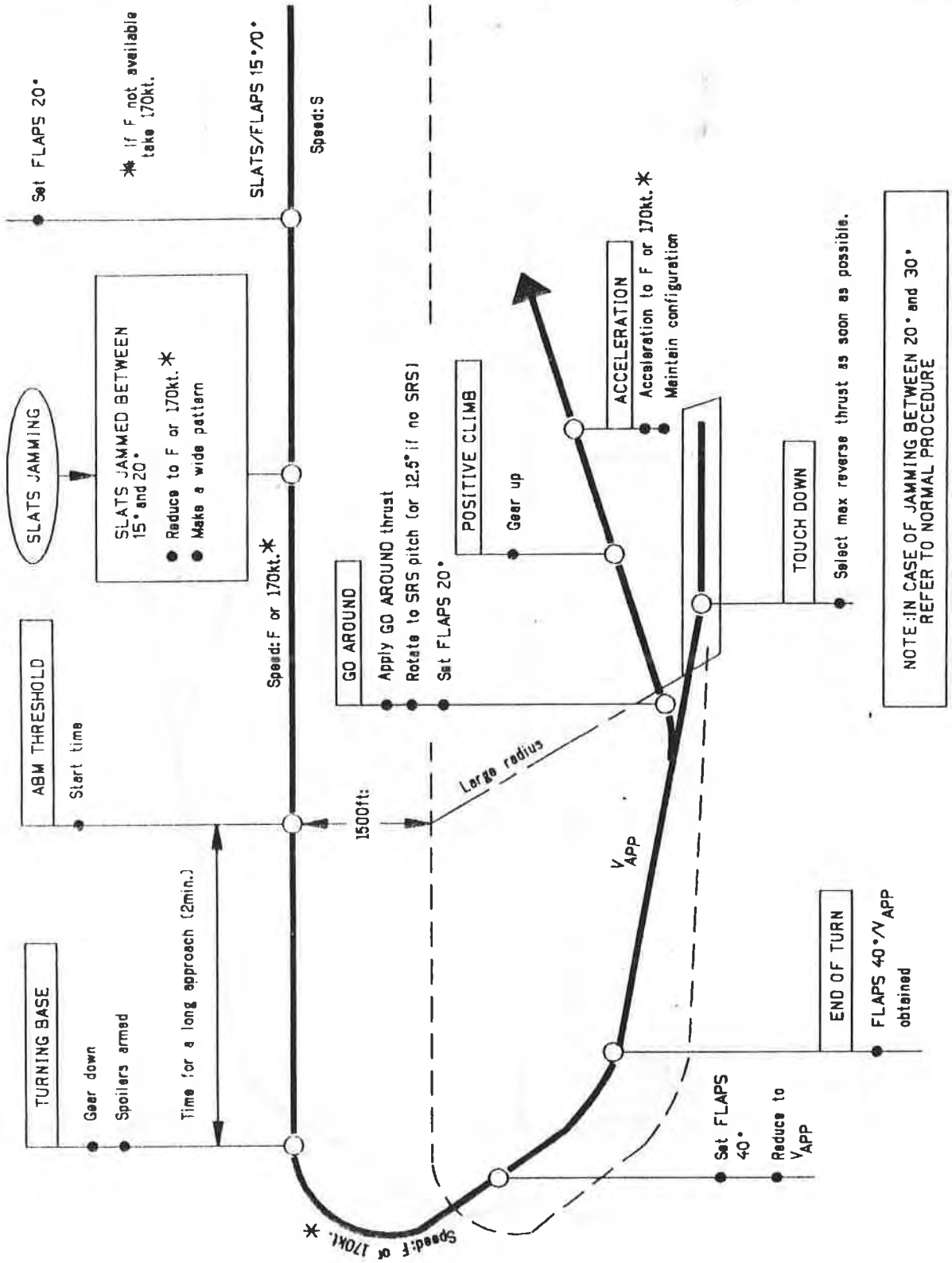
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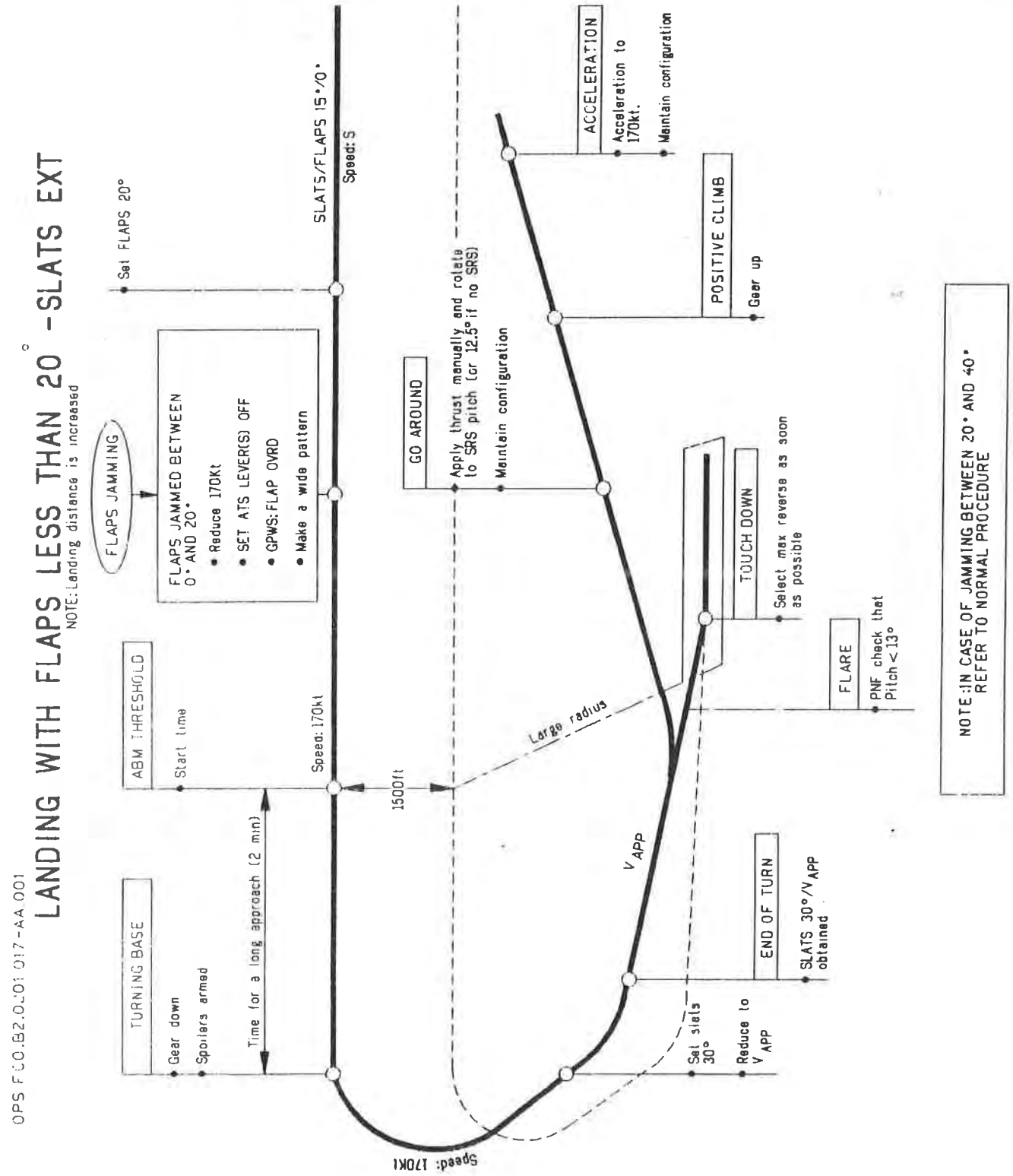
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LANDING WITH SLATS BETWEEN 15° AND 20° - FLAPS EXT



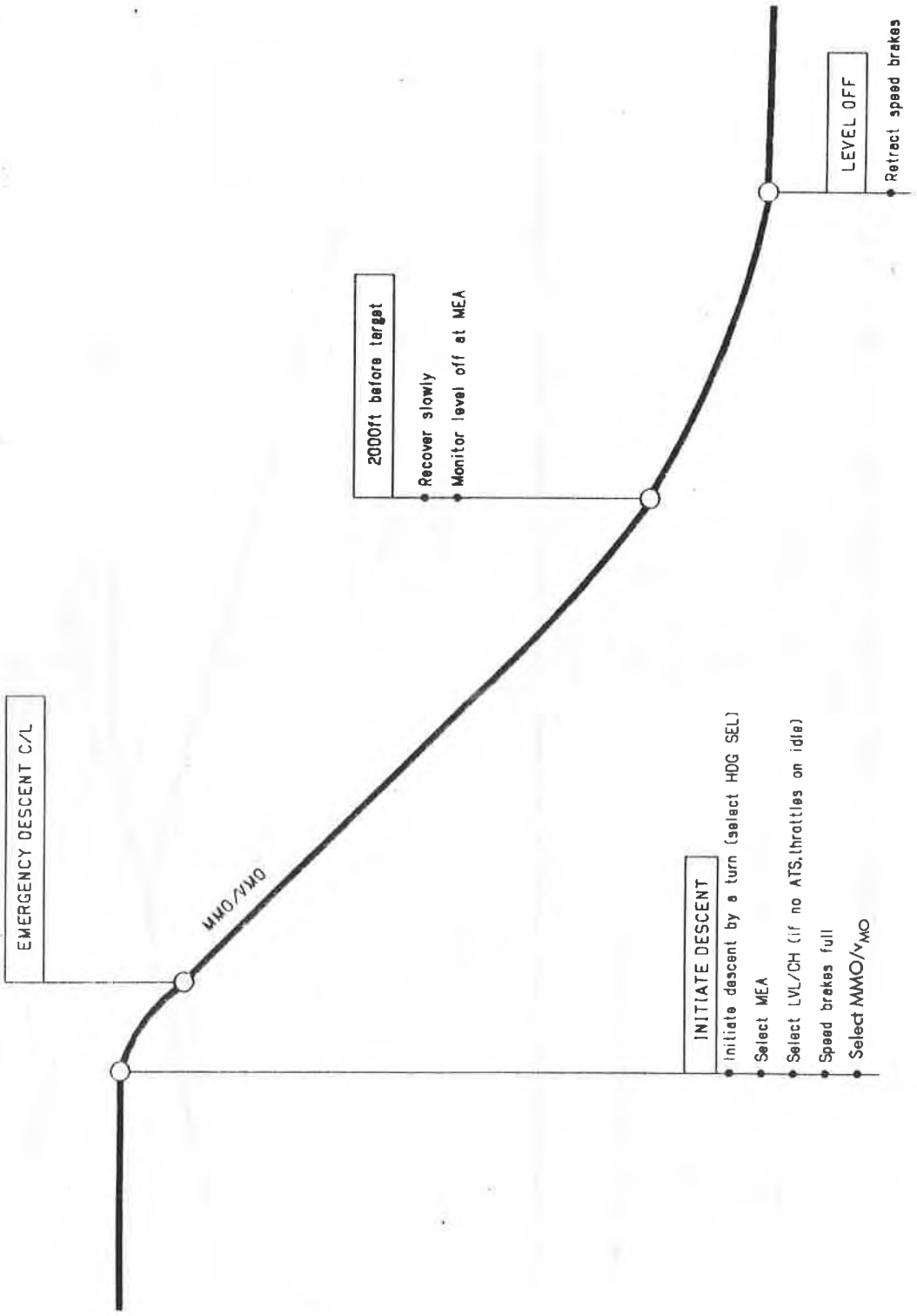
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EMERGENCY DESCENT AT MMO/VMO
NO STRUCTURAL DAMAGE IS ASSUMED

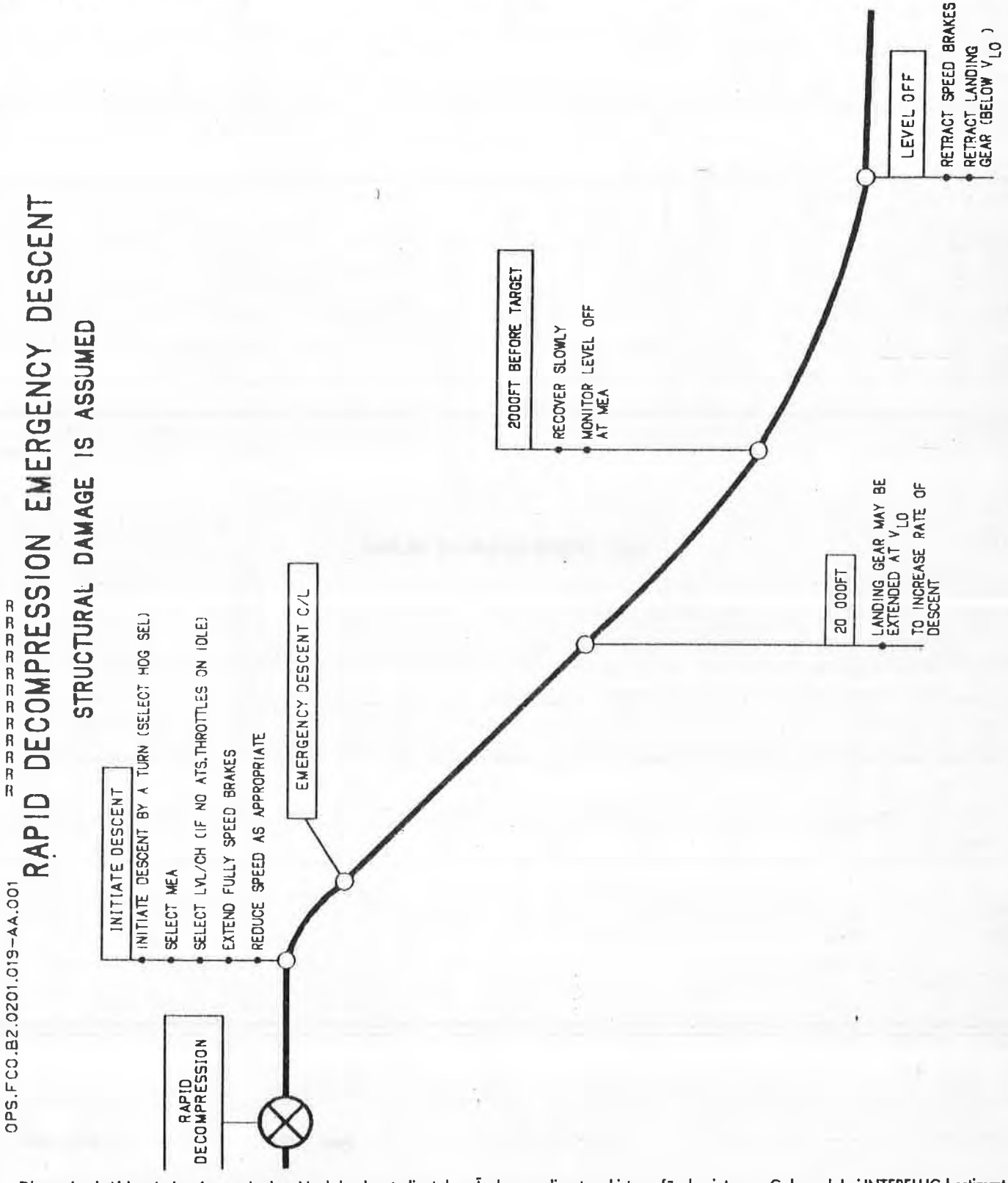


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Eng. : All

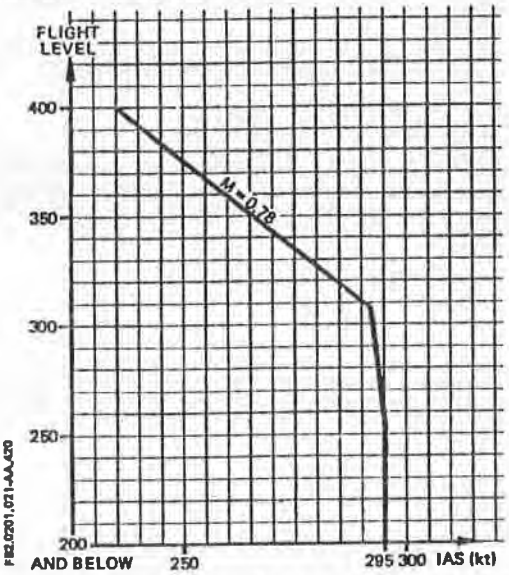
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1. GENERAL

Whenever possible plan to overfly or circumnavigate areas with known severe turbulence. If turbulence is unavoidable, observe the turbulence penetration speed shown by the graph below as a function of altitude.



The turbulence penetration speed affords the best overall protection from inadvertent stall while retaining substantial structural margins.
To judge the margin available until buffet onset is reached, the load-factor will be used as a basis.
A load-factor margin of 0.5 G is considered to be adequate for turbulence penetration in cruise.
On aircraft fitted with a trim tank system, it is recommended to transfer fuel from trim tank to center tank (if space exists) by manually selecting TRIM TK MODE push-button to FWD position. This action moves aircraft center of gravity position forward. TRIM TK MODE push-button can be switched back to AUTO when out of turbulence.

2. TURBULENCE PENETRATION

Before entering an area of known turbulence, secure all loose equipment in the flight deck.

A. Signs
Set Seat Belts and No Smoking switch to ON in advance of the anticipated turbulence.

B. Autopilot
R Keep autopilot engaged in CMD mode.

C. Engine
Disconnect ATS, select CONT RELIGHT.

D. Thrust and Airspeed

Make initial thrust setting for the target airspeed (refer to table given below). Change thrust only in case of extreme airspeed variation and do not chase your Mach or airspeed.
Remember that a transient increase is more advisable that a loss in speed which decreases buffet margins and is difficult to recover.

E. Attitude

If the aircraft is flown manually, hold wings level and desired pitch attitude, using PFD as primary instrument.
In extreme drafts, large attitude changes may occur. Do not use sudden large control inputs ; instead, use moderate inputs to resist changes in attitude.
After establishing the trim setting for penetration speed, do not change stabilizer trim.

F. Altitude

Large altitude variations are possible, but do not chase altitude.
Allow it to vary ; that is, sacrifice in order to maintain desired attitude.

G. Speedbrakes

Whenever speedbrakes are applied, keep hand on speedbrake handle, unless necessary to remove hand to perform some other specific cockpit function (e.g. changing power, resetting altimeter, etc.).

CLEAN CONFIGURATION

FLIGHT LEVEL	GROSS WEIGHT (tons)						
	100	110	120	130	140	150	160
	NOMINAL N 1 %						
410	91.1	94.5	99.2				
390	88.7	90.9	93.9	98.0	103.3		
370	87.0	88.6	90.6	93.2	96.4	101.1	
350	86.1	87.3	88.7	90.5	92.7	95.5	99.2
330	85.7	86.8	87.9	89.2	90.8	92.6	95.0
310	85.5	86.3	87.1	88.1	89.4	90.7	92.3
290	84.6	85.4	86.2	87.0	88.1	89.3	90.6
270	83.2	84.0	84.9	85.9	86.8	87.8	89.0
250	82.4	83.0	83.8	84.7	85.7	86.6	87.6
200	79.0	79.5	80.3	81.1	82.1	82.9	83.8
150	75.3	75.8	76.6	77.4	78.3	79.2	80.1
100	71.6	72.0	72.7	73.5	74.4	75.2	76.1
50	67.9	68.3	68.9	69.7	70.5	71.3	72.2

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Following procedures are given to present special precautions to operators who fly routes that could take their aircraft through the material erupting from active volcanos.

RECOMMENDATIONS

Ground maintenance will stir upash that will settle on exposed lubrificated surfaces and may penetrate seals, enter the gas path, air conditioning system and other orifices on the aircraft.
In view of the potential adverse effects, operations from/to airports with volcanic ash deposits should be avoided if possible.
If such exposure is unavoidable, the following recommendations should apply. Windshield wipers will not be used.

Parking

- Do not use APU. Request ground supply for air conditioning and for electrical power.

Taxi

- Following brakes release, advance the throttles in a smooth, deliberate manner to the minimum required for breakaway.
- Return the throttles to ground idle when rolling.
- Avoid sharp or high speed turns.
- Maintain the bleed valves closed.

Take-off

- Allow ash and dust to settle before take-off
- Make optimum use of the rolling take-off technique
- Enter runway while rolling and slowly but without hesitation, advance the throttles to take off power setting.

Note : If ATS is used for take-off, delay triggering either GO lever to avoid a too fast RPM increase when A/C speed is still low.

In flight

Fly through volcanic ash clouds must be avoided. If inavertently the aircraft enter such a cloud :

- Use crew oxygen
- Passenger oxygen as required depending on contamination
- select CONT RELIGHT
- Disengage ATS. This will prevent the autothrottle from increasing engine thrust.
- Select ON all airbleeds : packs, engine (nacelles) and wing anti ice systems. This will provide additional engine stall margin.
- Monitor EGT.
- Fly out of the ash cloud as soon as possible. Reduce thrust and descent, terrain permitting. This will provide additional stall margin and lower engine turbine temperatures allowing to reduce the accumulation of molten volcanic ash on the turbine vanes.

An anemometric anomaly may occur. In that case, refer to FCOM procedure for flight with unreliable airspeed indication.

Landing

- Use as low a level of reverse thrust as it is feasable after touchdown.
- If use of maximum reverse thrust is anticipated, then apply reverse thrust upon main gear touchdown.

PERFORMANCE PENALTY

Brake efficiency may be deteriorated by the ash layer. The runway friction may be affected. Therefore degraded performance such as wet runway performance should be considered.

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Following recommendations which complement the normal operating procedures should be observed following cold soak-in very low temperatures.

1. EXTERIOR SAFETY INSPECTION BEFORE TAKE OFF :

Check that the APU intake and air conditioning gaps (deflect door and modulating flap) are free from snow and ice. De-ice as necessary. Remove all protective covers.

PRELIMINARY COCKPIT PREPARATION (normal procedures). . . . . .COMPLETED

. APU is started and air conditioning is ON.

R *Note : For APU start :*
R *If 30 sec after MASTER SW ON the APU FLAP*
R *FAULT indication appears on ECAM.*
R *• Wait for 30 sec*
R *• If APU FLAP FAULT disappears :*
R *APU START . . . . . depressed*

WINDOW HEAT. . . . . .ON
SURFACES. . . . .CHECK FREE OF FROST, ICE AND SNOW

All surfaces of the airplane (wing, vertical and horizontal stabilizers, all control surfaces, slats and flaps) must be clear of snow frost and ice before take-off.

For ice accretion on upper wing surface limited at outer tank surface refer to FCOM 2.02.13, ICE AND RAIN PROTECTION, page 2.

Thin hoarfrost is acceptable on the upper surface of the fuselage.

Note : Thin hoarfrost is a typical white cristalline deposit which usually develops uniformally on exposed surfaces during cold and cloudless nights ; which is thin enough to distinguish surfaces features underneath (lines or markings).

On the underside of the wing tank area maximum layer of 3 mm of frost or a maximum 1.5 mm of ice is permissible at take off (3 mm of frost increases the weight by 0.6 Ton ; 1.5 mm of ice increases the weight by 0.3 Ton). If the deposit presents a rough state, decrease the Max TOW (2nd segment limitation) by 1 ton.

Since ice formation rate is considerably increased by the presence of an initial depth of ice, take off with icing conditions along the take off path with adhering frost or ice on other than the undersurface of the wing corresponding to the fuel tank region is not recommended.

FOLLOWING EQUIPMENT. . . . . CHECK FREE OF FROST, ICE AND SNOW

- Landing Gear Assemblies (Lever Locks) and Tires, Landing Gear Doors.
- Engine Inlets, Engine Cowlings, Fan Cone (check Fan rotation) Reverse Assemblies.
- Drains, Bleeds, Pitots and Static Vents.
- Fuel Tank Vents.
- Verify that the commercial water supplies are not frozen and have been refilled (these should have been emptied, prior to cold soak).

Configuration			Exposure time	Water tank drain
air conditioning	Cabin temperature	OAT		
ON	Above 15°C	Between 0 and -15°C	Any	Not required
		Below -15°C	1 h 15 min	Required
OFF		Between 0 and -7°C	1 h 30 min	
		Between -7 and - 15°C	0 h 45 min	
		Below -15°C	any	
After required draining, refilling shall be performed 30 minutes before engine start with warm water (30°C)				

2. BEFORE ENGINE START

- After cold soak in very low temperatures (below minus 15 degrees C) rotate pitch trim wheel several times over the whole trim range with hydraulic systems pressurized by GREEN ELEC PUMPS and PTUs.
  If GREEN ELEC PUMPS are not available, delay action until AFTER ENGINE START, do no attempt electrical trim operation before manual action completed.

Before Start Check-List. . . . . .COMPLETE
External Ground Power Unit. . . . . .CONNECTED
APU BLEED. . . . . .OFF/R
APU. . . . . .STOPPED
EGT APU. . . . . BELOW 350°C

Note : APU may be kept running provided no fluid is directed to the APU air intake and APU BLEED is not used.

Aircraft is now ready for de-icing of the rear fuselage and empennage. After this area has been de-iced, check with ground crew that APU intake is free of de-icing fluid :

APU. . . . . .RESTART
PROBE HEAT. . . . . .ON
Wait 60 sec. then :
APU BLEED. . . . . .ON

3. ENGINE START

- The initial oil pressure which can be much higher than normal, should be progressively reduced to normal as the engine achieves normal operating temperatures.

4. AFTER ENGINE START

- Engine anti-ice should be ON in icing conditions.
- For engine anti-ice operations on ground refer to 2.02.13.
- When aircraft is at the de-icing area and before de-icing the wings and front of aircraft :

Brakes. . . . . .PARK
Engines. . . . . .IDLE
APU BLEED. . . . . .OFF/R
BLEED VALVES. . . . . .OFF/R
PACK VALVES. . . . . .OFF

After de-icing completed on wings and front of aircraft.

Pitots and Statics (Grnd Crew). . . . . .CHECK
Ground Equipment. . . . . .REMOVED
BLEED VALVES. . . . . .ON
PACK VALVES. . . . . .ON
TAXI Clearance. . . . . .OBTAIN
TAXI Check-list. . . . . .READ

CAUTION : Indiscriminate usage or ingestion of de-icing fluid into the engine should be avoided.

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1. GENERAL

Following recommendations should be applied when operating from/to airports contaminated with loose/abrasive particles.

Possibility of loose (abrasive) particles ingestion should be considered when operating from sandy and dusty desert airports, coastal airports or from airports where sand is used to improve braking efficiency during (e.g) winter operation (Airport de-icing chemicals may also be erosive).

R Recommended procedure would allow to minimize vortices which generate beneath the engine inlets and
R cause the ingestion of loose (abrasive) particles that blast fan and compressor blades, resulting in degrated engine performance and increase in fuel consumption.

R *Note : Vortices and foreing object ingestion commonly occur during :*
- *Throttle advance during cross-bleed starts*
- *Taxi break away thrust*
- *Initiation of take-off roll*
- *Reverse thrust at low airspeed*

2. OPERATING TECHNIQUES

A. General considerations

- Minimize operation in particle contaminated air (when operational maneuvers of another aircraft that cause debris and fine particles to become airborne, all jeasable precautions should be taken to avoid ingestion of such contaminant).
- Start engines on clean surfaces where possible.
- Campaign for good airport housekeeping.

B. Taxi

- Following brakes release, advance the throttles in a smooth, deliberate manner to the minimum required for breakaway.
- Return the throttles to ground idle when rolling.
- On airports areas where drifting contaminant is present, avoid sharp or high speed turns.
- Avoid engine overhang.
- Following a backtrack on the runway, wait for dust to clear before beginning the take-off.
- Judgement also suggests that reverse thrust not be used during taxi unless aircraft safety is endangered.

C. Take-off

- Make optimum use of the rolling take-off technique.
- Enter runway while rolling and slowly but without hesitation advance the throttles to take-off power setting.

Note : If ATS is used for take-off, delay triggering either GO lever to avoid a too fast RPM increase when A/C speed is still low.

D. Landing

- Use as low a level of reverse thrust as is feasable after touchdown.
- If use of max reverse thrust is anticipated, then apply reverse thrust upon main gear touchdown.
- Modulate reverse thrust to idle when aircraft speed slows to 80 kt.
- Slow reverse at approximately 60 kt with engines at idle unless aircraft safety is endangered.
- For taxi, limit engine operation to ground idle as much as praticable.

E. Parking

- When an aircraft stays over at any airport where blowing loose (abrasive) particles are in evidence, engine inlet covers should be installed.

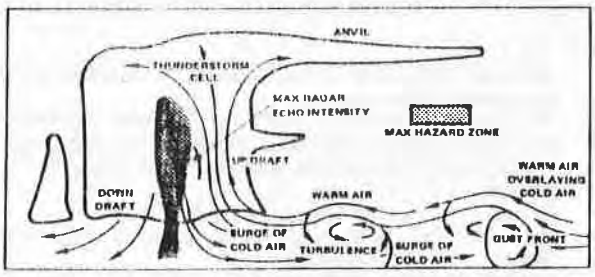
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Windshear-related problems are generally connected to « a change in wind direction and/or speed over a very short distance in the atmosphere ». The most prominent meteorological conditions conducive to this are :

- convective storm shear (air mass & frontal thunderstorms, downburst, wet & dry microburst),
- non-convective (cold & warm) frontal systems,
- windshear associated with strong winds near the ground.

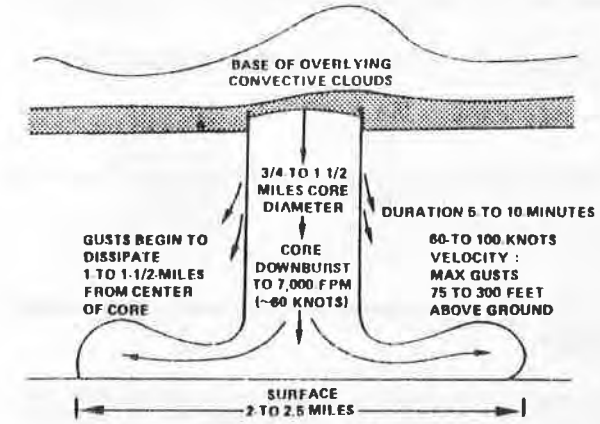
a) Windshear associated with convective clouds & storm cells

- The air-mass thunderstorm develops from localized earth surface heating with air rising and cooling to form cumulus clouds. As these keep growing, heavy rain & hail precipitation begins to develop in the higher areas thereby cutting off the updraft energy source and eventually dissipating the thunderstorm cell. A surge of cold air emerging from the heavy rain and associated downdraft can produce :
  - . a downburst, i.e. strong downdrafts inducing an outburst of damaging winds on or near the ground,
  - . a gust front with blowing dust on the earth surface,
  - . a shear boundary with turbulent flow due to interaction with the warm, undisturbed environmental air,



Air Mass Thunderstorm

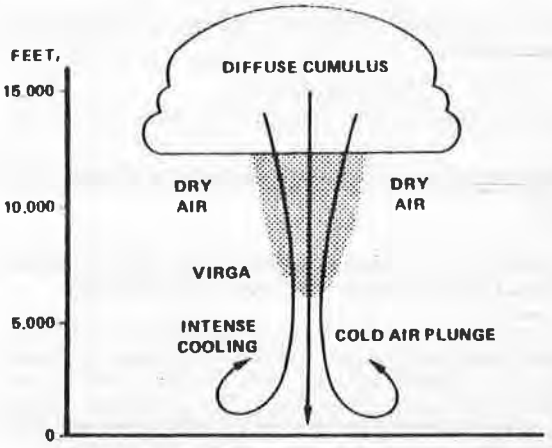
- Frontal thunderstorms are usually more tilted in the vertical allowing precipitation to fall away from the updraft and airflow intensity within the storm accelerating much more than for the simple air-mass thunderstorm, sometimes resulting in a tornado.
- Microbursts consist of intense, non rotating, highly localized downward airflows with velocities up to 7 000 fpm that may emanate below a convective cloud base. Some of these microbursts will expose penetrating aircraft to major safety hazards whatever technique is used in anticipation/reaction.



APPROX TRANSIT TIME AT 150 KNOTS AVERAGE GROUND SPEED : 45 SECONDS

Wet Microburst Cross section

Microbursts can take 2-5 minutes to develop maximum intensity and may then be sustained for an equal period of time. They tend to develop in groups which may be merged delaying dissipation to 30 minutes. Present knowledge contends that approximately one in a hundred heavy rain thunderstorms produce microbursts. It was determined that microbursts can also occur in relatively dry conditions. Once it gains sufficient downward momentum a downflow with evaporative cooling accelerates to the earth's surface to induce a « dry microburst » with very light or non-existant precipitation, called virga. « Wet microbursts » are expected to occur in the wet regions of the world. Dry microbursts are commonly seen in the dry areas and most likely below cumulus cloud when dew point is 30° C or more below ambient temperature.



Dry Microbust Cross-section in Virga

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Changes in meteorological conditions associated with both macro and microbursts tend to be very complicated.

CONDITIONS	MACROBURSTS	MICROBURSTS
Air temperature	: ISA + 15° decreasing	ISA + 15° increasing or decreasing
Dew point spread	: increase (20-40°C)	increase (20-40°C)
Surface pressure	: rise or fall (up to 2/3 mb)	rise or fall (up to 2/3 mb)

b) Windshear associated with non-convective frontal systems

Substantial differences in winds can be encountered by approaching and departing aircraft close to low pressure centers and their associated cold, warm and occluded fronts.

Penetrating a cold front on either side leads to a headwind increase, potentially bringing a performance increasing shear. Pilots are advised to beware of thunderstorms in the vicinity that may contribute to amplify windshear conditions.

Penetrating a warm front on either side exposes to a headwind decrease, potentially results in a performance decreasing shear generally not exceeding performance limits of the aircraft.

Windshear at a warm front is more severe than at a cold front with large head/tail & vertical wind changes in the lowest 1 000 feet above ground level.

The magnitude of the windshear may become significant when :

- the temperature difference accross the front is at least 6° C.
- the temperature gradient of the front shows a minimum of 6° C over 50 Nm,
- the speed of frontal movement is greater than 30 kts.

c) Windshear associated with strong winds near the ground

Very similar to a surface boundary layer with increasing winds and approximately constant wind direction.

Low altitude jet streams may be found in a variety of situations such as strong low altitude jet winds, nocturnal jet winds, terrain induced low altitude windshear, mountain-wave and downslope flows, strong surface winds combined with small hills or large buildings, lake and seabreeze windshear due to temperature gradients between sun-heated terrain and water-cooled air. In particular, strong temperature change accross an inversion may trigger very variable wind conditions.

2. DETECTION OF CONDITIONS

Since there is presently no rigorous way to predict the occurrence of windshear, the following permanent precautions can be helpful to timely detect possibilities leading to this crucial safety hazard.

a) ANALYSE the weather informations during preflight :

- weather messages provided by the airline,
- aviation surface obervations,
- NOTAMS,
- SIGMETS, particularly convective sigmets,
- terminal forecasts,
- area forecasts, possibly mentionning the Low Level Wind Shear Alert System (LLWSAS) installed on the periphery of certain airports (USA only).

b) BE AWARE of pilot reports (PIREPS) on wind shear. PIREPS should include :

- location of shear encoutered,
- altitude of shear encoutered,
- airspeed changed experienced (knots gained or lost)
- type of aircraft undergoing the shear,

Note : It is also strongly recommended that pilots report any windshear encountered to Air Traffic Control.

c) LOOK OUT for weather clues on the way to the airport and/or from the cockpit (parked, taxi or airborne) such as :

- extreme variations in wind velocity/direction in a very short time span,
- isolated rainshowers with or without lightning showing divergences from the raincore and clear curling horizontal vortex rolls, within 5 miles of the airport,
- heavy precipitation along intended flight path,
- lightning, thunderstorms or evidence of any tornadic feature in airport vicinity,
- evidence of a gust front such as blowing dust on the airport surface, suggesting the possible passage of a thunderstorm within 15 minutes,
- evidence of convective activity particularly with anvil clouds in dry areas, supercells, low echos, mushroom, sinkhole and/or giant anteater clouds, cumulo nimbus mamatus and altocumulus.

d) DO NOT IGNORE the existence of other types of windshear due to local obstructions, topographical and meteorological conditions described in 1 c).

Note : It is critical for pilots to realize that each particular windshear observational evidence should be considered cumulative : simultaneous conditions may increase severity of effects.

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e) EXAMINE the approach or take-off area with the airplane weather radar to determine whether thunderstorm cells are in the vicinity of the airport or intended flight path,

- since areas having high rainfall rates are ordinarily accompanied by turbulence, radar echoes from precipitation can be associated with turbulence, especially for thunderstorms with small lines, tornadoes, protruded fingers, V-shaped targets and scalloped edges,
- in some instances the radar echoes may be severely attenuated in passing through large areas of moderate rainfall rate, small areas of high rainfall rate or dry hail (no liquid coating for reflection),
- since radar echoes are due to precipitation reflection, dry environment situations & conditions to dry microbursts may not be detectable by weather radar ;
- flight operations below 10,000 ft such as take-off and landings require 2 to 3 degrees upward tilt for target detections up to 40Nm ; if there is significant weather activity, the tilt angle should be adjusted to provide a solid ground return outside of the desired range to ensure that no overscanning will occur.

f) MONITOR closely the airplane instruments whenever windshear is suspected :

- any rapid change in the relationship between airspeed and groundspeed represents a windshear ; the IRS installed on the aircraft allows to compare airplane groundspeed with its airspeed, both displayed on the ND's.
- airspeed tendency :
  - acceleration in headwind/updraft,
  - deceleration in tailwind/downdraft,

  indicated by a pointer arrow starting from the speed symbol on the PFD's,
- direction and intensity of wind (computed by the IRS and displayed on ND's) allows to compare at the initial approach altitude (1 500 to 2 000 ft AGL) with the reported runway surface wind to check any shear situation between the airplane and the runway,
- speed margin from stick shaker speed (shown by a red and black strip along the speed scale of the PFD's),
- vertical deviation of flight path vector (FPV) bird symbol (displayed on the PFD's and calculated by the IRS) when below the horizon line means the aircraft's flight path is converging toward the ground,
- rate of descent (on stabilized ILS approach) or climb :
  - high rate suggesting a strong headwind,
  - low rate suggesting a strong tailwind,
- pitch attitude :
  increasing – with headwind shear,
  – with downdraft shear,
  decreasing – with tailwind shear,
  – with updraft shear,
- wind correction angle needed to keep the localizer or VOR needle centered and giving an indication of the wind direction :
  - increasing yaw right/roll left, left with increasing crosswind left,
  - increasing yaw left/roll right, right with increasing crosswind right,
- power needed :
  to hold the glideslope :
  - less power necessary suggesting a strong tail wind,
  - more power necessary suggesting a strong headwind,

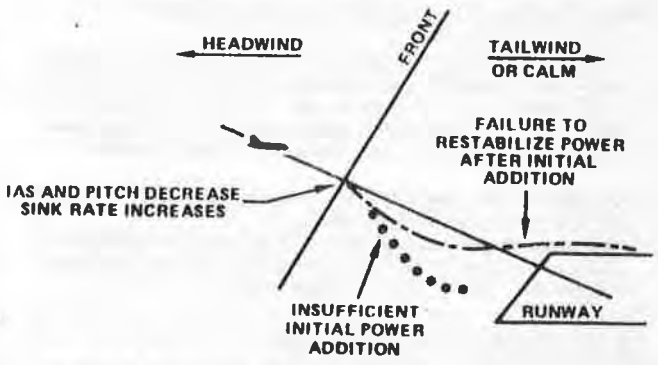
  to hold a climb angle :
  - less power necessary suggesting a strong headwind,
  - more power necessary suggesting a strong tailwind,

3. INFLUENCE OF WINDSHEAR ON AIRCRAFT PERFORMANCE

a) DECREASED PERFORMANCE

Headwind to tailwind
Headwind to calm
Calm to tailwind
Headwind to decreased headwind.

APPROACH WITH A TAILWIND SHEAR



- airspeed decreases, lift decreases,
- A/C nose begins to pitch down,
- A/C begins to drop below the glide slope,

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

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Two serious consequences may result :

- either the pilot pulls the nose up to recapture the glide slope without having added sufficient power : the A/C will loose altitude very rapidly and may even reach the ground before the power deficiency is corrected resulting in a hard landing.
- or sufficient power is set to regain the glideslope before reaching the ground : the « double reverse » problem arises if the pilot does not quickly retard the throttles after glide recapture, i.e. throttles set too high for a stabilized approach in a no-wind condition leading to a long and fast landing.

TAKE OFF WITH A TAILWIND SHEAR



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

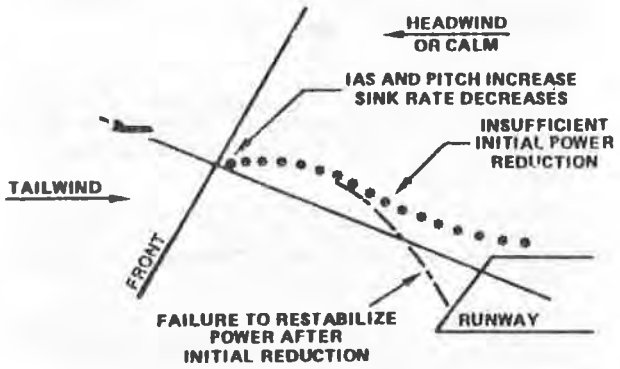
Two important comments are of interest :

- Because of aircraft inertia, attitude and ground speed will be initially maintained upon encountering windshear but airspeed will decrease, causing a reduction in lift which will result in a downward acceleration and a nose down pitching moment.
- Assuming no pilot action, the aircraft will descend below its nominal flight path.
  Because of aircraft stability, original angle of attack and airspeed will eventually be recovered, but on a different flight path below the nominal one.

b) INCREASED PERFORMANCE

Tailwind to headwind
Calm to headwind
Tailwind to calm
Headwind to increased headwind

APPROACH WITH A HEADWIND SHEAR



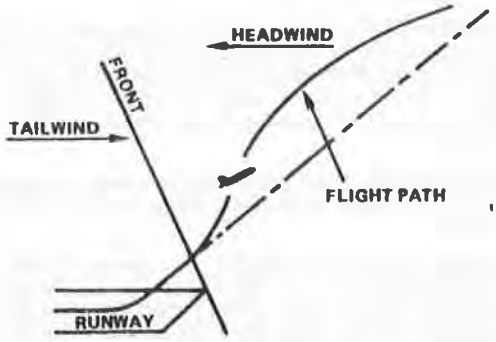
The reverse of the previous case prevails :
- airspeed increases, lift increases,
- A/C nose begins to pitch up,
- A/C balloons above the glide slope,

In this case the A/C is both fast and high in a « power excessive » state.

Two serious consequences may result :

- either the pilot does not initially reduce power and the aircraft will gain altitude and airspeed resulting in a long, fast landing and the possibility of an overrun.
- or the pilot applies the power reduction to regain the glideslope and the initial airspeed : the « double reverse » problem arises if throttles are not re-opened leading to a high sink rate and possibly a short and hard landing.

TAKE OFF WITH A HEADWIND SHEAR



The reverse of the previous case prevails :
- airspeed increases, lift increases,
- A/C nose begins to pitch up,
- A/Crises above its nominal flight path

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Two more comments should be made

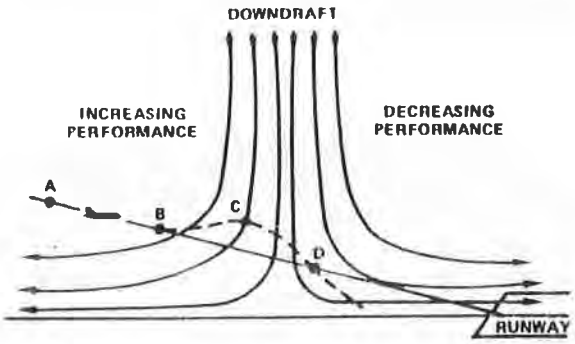
. A headwind shear should not cause a problem since it normally leads to increased aircraft performance.

. The resulting increase in lift may however lead to an excessive angle of attack which could eventually trigger stickshaker activation.

c) INCREASED PERFORMANCE FOLLOWED BY DECREASED PERFORMANCE

Downdraft + tailwind shear

APPROACH THROUGH MICROBURST



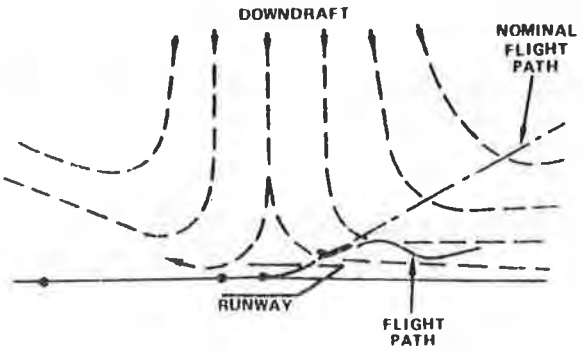
. at point A the aircraft is on speed and on glide slope.
. at point B it encounters an increasing headwind. Its airspeed and pitch increases and it balloons above the glide slope.
. at point C the « moment of thruth » occurs :
If the pilot does not fully appreciate the situation, he may attempt to regain the glide slope by reducing power and pushing the nose down.
But between C and D the headwind ceases, a strong downdraft is entered and the tailwind begins to increase. The consequences are that sink rate becomes rapidly excessive and that ground impact becomes very difficult to avoid.

Two possibilities may arise :

. a go-around initiated at point C or sooner would probably be successful since the A/C is fast and high at this point,

. gradual groundspeed decay shortly after point B coupled with rapidly increasing airspeed could have allowed detection of impending signs of downdraft,

TAKE OFF THROUGH MICROBURST



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

Two comments should be made :

. Initially the pilot may not appreciate fully the situation since he is taking off in increased performance shear conditions. Progression into the downburst core causes a violent and rapid loss of lift, followed by a high sink rate with very little loss of airspeed. Exiting the downburst core below the nominal flight path (after 20 to 40 seconds) is then followed by a low-level decreased performance tailwind shear.

. In a microburst the angle of attack is instantly decreased causing an immediate loss of lift. As the A/C accelerates downward the relative wind is altered restoring the angle of attack. Resulting in a vertical velocity equal to the airmass plus or minus its own rate of climb or descent.

d) Climb & Acceleration capability

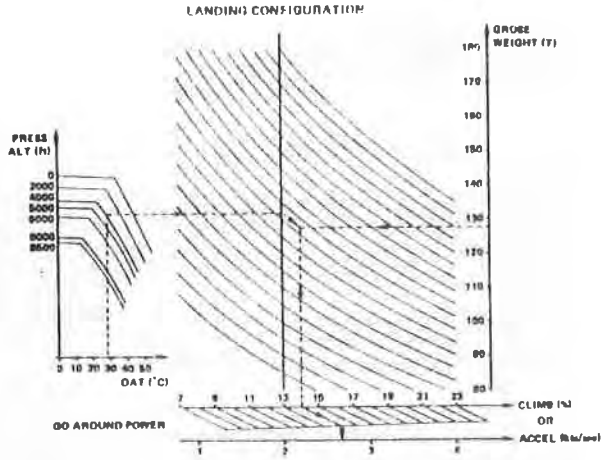
– Engine-out capability provides twin engine aircraft with a thrust/weight ratio that permits very ample aircraft response to windshear conditions. At typical initial climb, approach and go-around speeds an aircraft may require 20 to 30 seconds to clear the distance affected by most severe windshear effects. Optimum use of the aircraft's climb an acceleration capability has to be negotiated over this time span to counter the loss of height or lift in the encounter.

– This section graphically discusses an aircraft's ability to withstand windshear through optimized use of its climb and acceleration capability. Control of pitch attitude and full thrust allows management of this by trading airspeed margin for altitude down to stick shaker onset in extreme case.

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– Level flight acceleration capability can be compared directly to horizontal windshear. In the following graphic example (GW = 126.7 T, OAT = 27° C, Press. Alt. = 4 000 ft, V_{APP} = 145 kts) the aircraft has the capability to maintain level flight in a 2.7 kt/s increasing tailwind shear and will eventually be accelerating relative to the ground at 2.7 kt/s with constant airspeed. If the horizontal shear exceeds the level flight acceleration capability the aircraft will lose airspeed and descend unless pitch attitude is increased to change angle of attack.

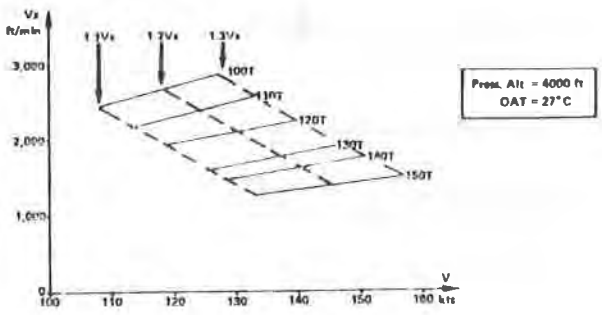
CLIMB GRADIENT OR LEVEL FLIGHT ACCELERATION CAPABILITY



– Likewise, climb gradient capability at constant airspeed can be compared directly to a downdraft. In the example just referred to the aircraft has the capability to maintain level flight in a 2 040 ft/min downdraft without any airspeed change. If the downdraft exceeds this climb gradient capability the aircraft will descend unless pitch attitude is increased to adapt angle of attack.

As illustrated below, climb gradient capability can be maintained at a marginal loss by bleeding off airspeed until a maximum pitch attitude of 17.5°.

CLIMB GRADIENT MAINTAINABILITY



– In practice, windshear conditions will very often be a combination of horizontal an vertical shear components. This will make it necessary to establish a tradeoff between climb gradient and acceleration requirements.

4. PROCEDURES

a) In most cases windshear hazards result from lack of knowledge or understanding of the phenomenon. In a severe windshear encounter, only a few seconds may be available to recognize the problem and react promptly.

Following key points demand the most thorough training and operational emphasis :

– AVOIDANCE as a strict policy of whatever conditions,
– AWARENESS of windshear/downburst conditions onset,
– ANTICIPATION as needed in preflight, before take off and in flight :
  . using all available forecasts and current weather information,
  . making their own observation of thunderstorms, blowing dust, virga, frontal passages, strong surface winds due to obstructions etc.,
  . giving and requesting PIREPS on windshear,
  . using weather radar when available,
  . using knowledge of local microclimate, flight sector etc.
– ASSESSMENT whenever applicable of climb gradient & acceleration capability from FCOM tables and flight plan data,
– ACTION with recovery procedures in full crew coordination when inadvertently caught in windshear/downburst conditions at any phase of flight,
– AIRCRAFT parameters must be fully familiar at any phase of take-off, approach & landing (pitch attitude, performance (IAS, VV etc), throttle settings, autopilot behavior),

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Marginal flight path control below 1,000 ft may be indicated by uncontrolled changes from normal steady flight indications in excess of (+ or -) :

. 15 kts indicated airspeed,
. 500 fpm in vertical speed,
. 5 degrees in pitch attitude,
. 1 dot displacement from glide slope,

Whenever in WINDSHEAR CONDITIONS :

. if IAS decreases rapidly (rate of descent AND GPWS), STRONGLY RESIST any tendency to PITCH DOWN

. if IAS increases rapidly, DO NOT INCREASE PITCH ABOVE 17.5°

. GO AROUND if in approach,

. REMAIN PREPARED for FURTHER WINDSHEAR encounters as these may occur in GROUPS.

b) TAKE OFF INTO SUSPECTED WINDSHEAR

– DELAY take-off until CONDITIONS are more FAVORABLE,

– ASSESS CONDITIONS for a SAFE take-off during this delay,

CREW
. using observations and knowledge,
. checking weather conditions,
. evaluating aircraft shear capability,

– WHEN and only when CONDITIONS are judged SAFE may take-off be comtemplated provided :

CREW
. SELECTS FPV on PFD of PNF,
. SELECTS the LONGEST RUNWAY available (considering runway length, wind and location of storm, virga, frontal areas,)
. MAKES USE OF WEATHER RADAR before the take-off run to ensure a flight path clear of any potential clues,
. SELECTS MAXIMUM TAKE OFF POWER (no flex)
. MONITORS AIRSPEED closely during the take-off run to detect early sign of windshear,

c) WINDSHEAR RECOVERY PROCEDURE AT TAKE-OFF

1. WINDSHEAR WARNING AND GUIDANCE SYSTEM NOT AVAILABLE :

<table>
<tr><td>WINDSHEAR BEFORE V1</td><td colspan="3">WINDSHEAR AFTER V1</td></tr>
<tr><td rowspan="3">ABORT TAKE-OFF</td><td colspan="3">. PF/PNF CALL « WINDSHEAR MAX THRUST »
. PF/PNF DISCONNECT AUTOTHROTTLES AND PUSH FORWARD TO MAXIMUM TAKE OFF THRUST *
. Select TOGA on TRP</td></tr>
<tr><td>BETWEEN V1 AND BEFORE VR</td><td>DURING OR AFTER VR</td><td>DURING INITIAL CLIMB</td></tr>
<tr><td>. PF ROTATES NORMALLY WITHOUT WAITING FOR A DELAYED VR,</td><td>. PF MAKES PROMPT ROTATION UP TO A MAX PITCH ATTITUDE OF 17.5° with high stick efforts if necessary to lift off within remaining runway.</td><td>. PF DISCONNECTS AUTOPILOT IF ENGAGED,
. PF FOLLOWS SRS ORDERS BUT NOT BEYOND 17.5° PITCH ATTITUDE.</td></tr>
<tr><td colspan="4">However flight path control may improve or deteriorate thereafter the following applies without any delay :
. PNF MONITORS CLOSELY VERTICAL FLIGHT PATH (VERTICAL DEVIATION of FPV on PFD) and THROTTLE POSITION,
. PNF CALLS OUT DEVIATIONS FROM NORMAL (IAS and AIRSPEED TREND on PFD, GS and wind on ND, RATE of CLIMB, PITCH, THRUST),
. PF FOLLOWS SRS ORDERS BUT NOT BEYOND 17.5° PITCH ATTITUDE,
. PF ALLOWS IAS TO DECREASE TO INTERMITTENT STICKSHAKER CHECKING SPEED MARGIN on PFD,
. PF/PNF DO NOT CHANGE CONFIGURATION (GEAR, FLAPS) UNTIL OUT OF SHEAR,
. PF RECOVERS SMOOTHLY TO NORMAL CLIMB WHEN OUT OF SHEAR,
. PF INCREASES IAS WHEN POSITIVE CLIMB CONFIRMED.</td></tr>
</table>

* Use of all available thrust is recommended when the possibility exists of ground or obstacle contact.

2. WINDSHEAR WARNING AND GUIDANCE SYSTEM AVAILABLE

When warning occurs at take off :

• *If autopilot is engaged :*
- PF/PNF CALL « WINDSHEAR MAX THRUST »,
- PF/PNF DISCONNECT AUTOTHROTTLE AND PUSH FORWARD TO MAXIMUM TAKE OFF THRUST
. PF DOES NOT DISENGAGE AUTOPILOT

• *If autopilot is not engaged :*
- PF/PNF CALL « WINDSHEAR MAX THRUST »,
- PF/PNF DISCONNECT AUTOTHROTTLE AND PUSH FORWARD TO MAXIMUM TAKE OFF THRUST
. PF FOLLOWS SRS ORDERS (FD BARS)

. PNF MONITORS CLOSELY VERTICAL FLIGHT PATH (VERTICAL DEVIATION of FPV on PFD) and THROTTLE POSITION,
. PF ALLOWS IAS TO DECREASE TO INTERMITTENT STICKSHAKER, CHECKING SPEED MARGIN ON PFD
. PF/PNF DO NOT CHANGE CONFIGURATION (GEAR, FLAPS) UNTIL OUT OF SHEAR,
. PF RECOVERS SMOOTHLY TO NORMAL CLIMB WHEN OUT OF SHEAR,
. PF INCREASES IAS WHEN POSITIVE CLIMB CONFIRMED

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d) APPROACH AND LANDING INTO SUSPECTED WINDSHEAR

- DELAY landing until CONDITIONS are more FAVORABLE or DIVERT to another airport,
- ASSESS CONDITIONS for a SAFE landing during any delay :

CREW
. using obervations AND knowledge,
. checking weather conditions,
. assessing climb or acceleration capability

- WHEN and only when CONDITIONS are judged SAFE may approach AND landing be engaged provided :

CREW
. SELECTS FPV on PFD of PNF,
. MAKES USE OF WEATHER RADAR before the APPROACH to ensure a flight path clear of any potential clues,
. SELECTS the LONGEST RUNWAY available (considering runway length, wind AND location of storm, virga, frontal areas,)
. SELECTS MINIMUM LANDING FLAPS POSITION.
. SELECTS AUTOPILOT IN CMD for more accurate ILS tracking and earlier information of beam deviation.
. SELECTS
$V_{APP} = V_{LS}$ + WIND CORR. (5 kts for AUTOLAND)
WIND CORR. = 1/3 TOTAL WIND OR GUST (whichever higher)
. MONITORS GROUND SPEED THRESHOLD AND AUTOTHROTTLE especially if in auto thrust.

- The GROUND SPEED THRESHOLD method is based on the fact that the inertia of a wide body aircraft is such that rapid wind variations cause great variation of airspeed but very small variations of ground speed. The monitoring of this parameter helps considerably to detect a shear and also provides the trend of the gradient.
A procedure was therefore implemented to recover ground speed threshold (V_{APP} - 10kt) by advancing throttles a soon as ground speed threshold - 10 is reached. This may lead to high indicated airspeed. The fact that GS is closely monitored does not mean that GS is the main speed parameter to follow. The main speed parameter remains IAS which should not be allowed to drop below V_{APP}.
- In case of wind gradient below 1,000 ft the indicated airspeed may be above the V_{FE} of the landing configuration.
If the landing configuration is not settled, it is therefore recommended to keep the flap setting and to modify the approach speed (V_{APP}) by adding a fixed value of 10 kt.
- It is clear that in case of unexpected problems when coming close to the ground the ideal solution is to initiate a Go-Around immediately and follow the speed reference order.
- The A 300-600 is equipped with a high angle of attack protection which is connected to the Speed Reference System. It is triggered when the angle of attack exceeds a certain threshold depending on the configuration. It works provided the autothrottle is armed and pushes the throttles to the GO AROUND thrust.

e) WINDSHEAR RECOVERY PROCEDURE ON APPROACH AND LANDING

1. WINDSHEAR WARNING AND GUIDANCE SYSTEM NOT AVAILABLE :

	ACHIEVE A STABILIZED APPROACH NO LATER THAN 1,000 FT AGL	
IF NOT	. PNF	ANNOUNCES GROUNDSPEED DEVIATION REACHING V_{APP} - 10 kt (GROUND SPEED THRESHOLD) GROUND SPEED, MINUS 5 KT and MINUS 10 KT
	. PF	DISCONNECTS AUTOTHROTTLES AT GROUND SPEED THRESHOLD MINUS 10KT ADVANCES THROTTLES TO RECOVER GROUND SPEED THRESHOLD
	However flight path control may improve or deteriorate thereafter the following applies without any delay :	
	. PNF	MONITORS CLOSELY VERTICAL FLIGHT PATH AND THROTTLE POSITION,
	. PNF	CALLS OUT DEVIATIONS FROM NORMAL (IAS and AIRSPEED TREND on PFD, GS and wind on ND, RATE of DESCENT, PITCH, GLIDE SLOPE DOT, THRUST),
	. PF	DISCONNECTS AUTOTHROTTLE WHEN GOING TO either extreme (IDLE OR MAX POWER)
	. PF	AVOIDS LARGE THRUST REDUCTIONS OR TRIM CHANGES IN RESPONSE TO LARGE SPEED CHANGES,
IF WINDSHEAR IS ENCOUNTERED AND FLIGHT PATH CONTROL BECOMES MARGINAL		
. PF/PNF	CALL « WINDSHEAR GO AROUND »,	
. PF/PNF	TRIGGER « GO LEVERS » PUSH FORWARD TO MAXIMUM GO AROUND THRUST,*	
. PF	DISCONNECTS AUTOPILOT IF ENGAGED,	
. PF	FOLLOWS SRS ORDERS BUT NOT BEYOND 17.5° PITCH ATTITUDE,	
. PF/PNF	DO NOT CHANGE CONFIGURATION,	
. PF	ALLOWS IAS TO DECREASE TO INTERMITTENT STICKSHAKER, CHECKING SPEED MARGIN ON PFD	
. PNF	CALLS OUT DEVIATIONS FROM NORMAL (IAS AND GS on PFD, AIR SPEED TREND on PFD, RATE of DESCENT, PITCH, THRUST),	
. PF	RECOVERS SMOOTHLY TO NORMAL CLIMB WHEN OUT OF SHEAR,	
. PF	INCREASES IAS WHEN POSITIVE CLIMB CONFIRMED	

* Use of all available thrust is recommended when the possibility exists of ground or obstacle contact.

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2. WINDSHEAR WARNING AND GUIDANCE SYSTEM AVAILABLE :

ACHIEVE A STABILIZED APPROACH NO LATER THAN 1.000 FT AGL	
IF NOT	. PNF ANNOUNCES GROUNDSPEED DEVIATION REACHING VAPP - 10 kt (GROUND SPEED THRESHOLD) GROUND SPEED, MINUS 5 KT and MINUS 10 KT
	. PF DISCONNECTS AUTOTHROTTLES AT GROUND SPEED THRESHOLD MINUS 10KT ADVANCES THROTTLES TO RECOVER GROUND SPEED THRESHOLD
	However flight path control may improve or deteriorate thereafter the following applies without any delay :
	. PNF MONITORS CLOSELY VERTICAL FLIGHT PATH AND THROTTLE POSITION,
	. PNF CALLS OUT DEVIATIONS FROM NORMAL (IAS and AIRSPEED TREND on PFD, GS and wind on ND, RATE of DESCENT, PITCH, GLIDE SLOPE DOT, THRUST),
	. PF DISCONNECTS AUTOTHROTTLE WHEN GOING TO either extreme (IDLE OR MAX POWER)
	. PF AVOIDS LARGE THRUST REDUCTIONS OR TRIM CHANGES IN RESPONSE TO LARGE SPEED CHANGES,
IF WINDSHEAR WARNING OCCURS	
• *If autopilot is engaged :*	
- PF/PNF CALL « WINDSHEAR GO AROUND »,	
- PF/PNF TRIGGER « GO LEVERS » PUSH FORWARD TO MAXIMUM GO AROUND THRUST,	
. PF DOES NOT DISENGAGE AUTOPILOT	
• *If autopilot is not engaged :*	
- PF/PNF CALL « WINDSHEAR GO AROUND »,	
- PF/PNF TRIGGER « GO LEVERS » PUSH FORWARD TO MAXIMUM GO AROUND THRUST,	
. PF FOLLOWS SRS ORDERS (FD BARS)	
. PNF MONITORS CLOSELY VERTICAL FLIGHT PATH (VERTICAL DEVIATION of FPV on PFD) and THROTTLE POSITION,	
. PF/PNF DO NOT CHANGE CONFIGURATION,	
. PF ALLOWS IAS TO DECREASE TO INTERMITTENT STICKSHAKER, CHECKING SPEED MARGIN ON PFD	
. PF RECOVERS SMOOTHLY TO NORMAL CLIMB WHEN OUT OF SHEAR,	
. PF INCREASES IAS WHEN POSITIVE CLIMB CONFIRMED	

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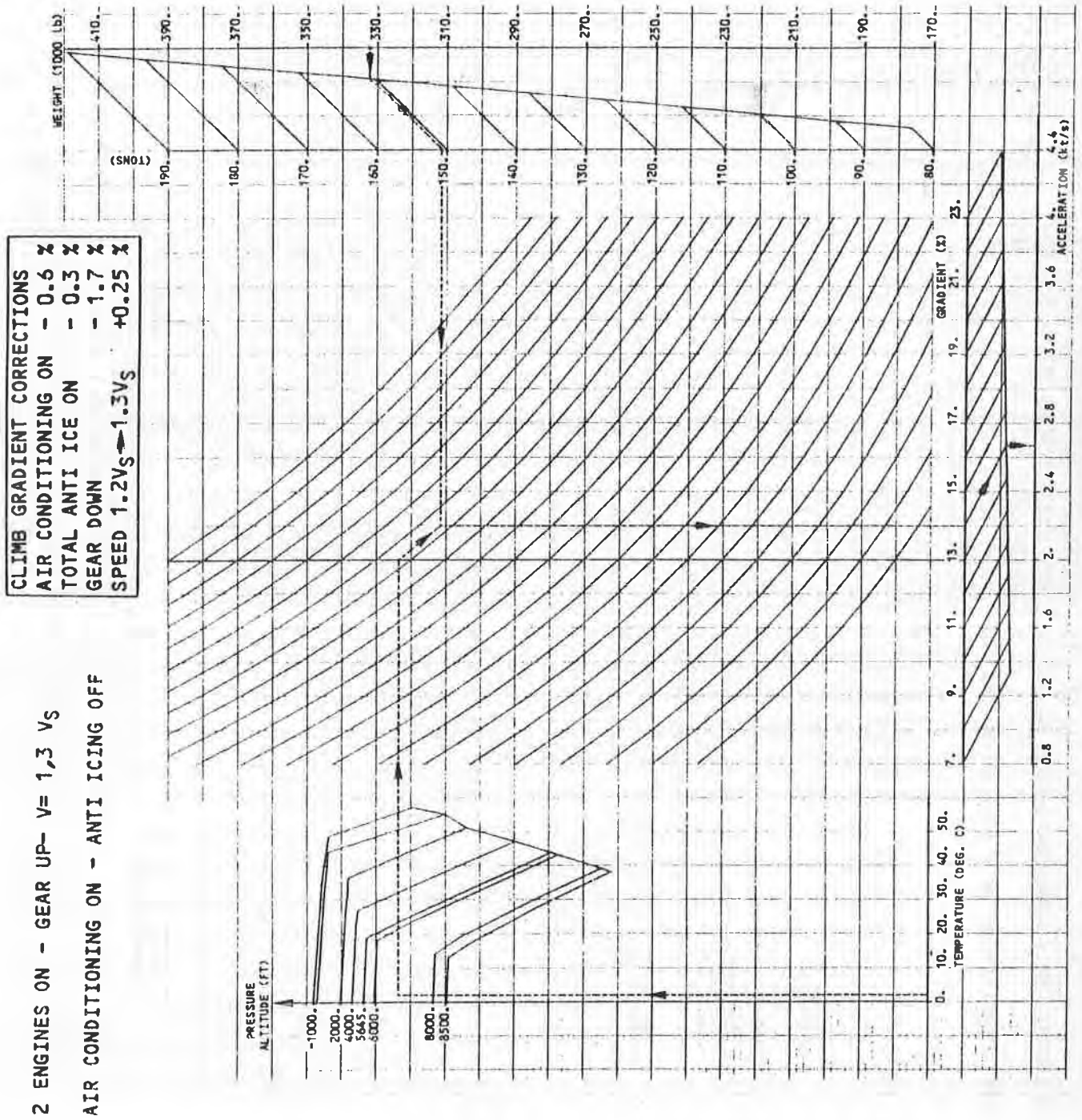
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL

WINDSHEAR PROTECTION

CLIMB GRADIENT – ACCELERATION CAPABILITY

2.02.01 | PAGE 33 | REV 14 | SEQ 035

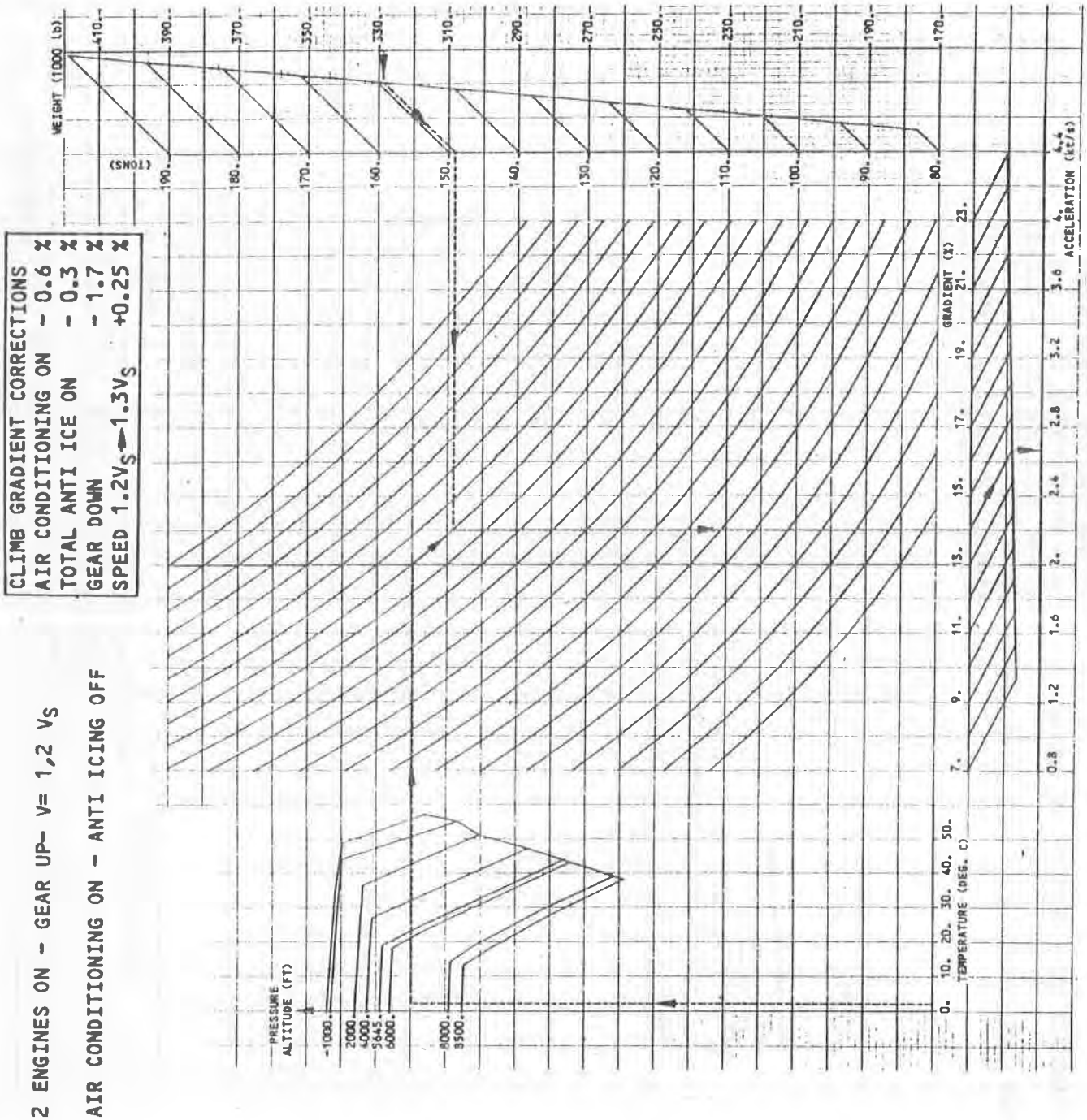
TAKE-OFF CONFIGURATION (SLATS 15 – FLAPS 0)



GE Eng. : 80C2A2

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TAKE-OFF CONFIGURATION (SLATS 15 – FLAPS 15)

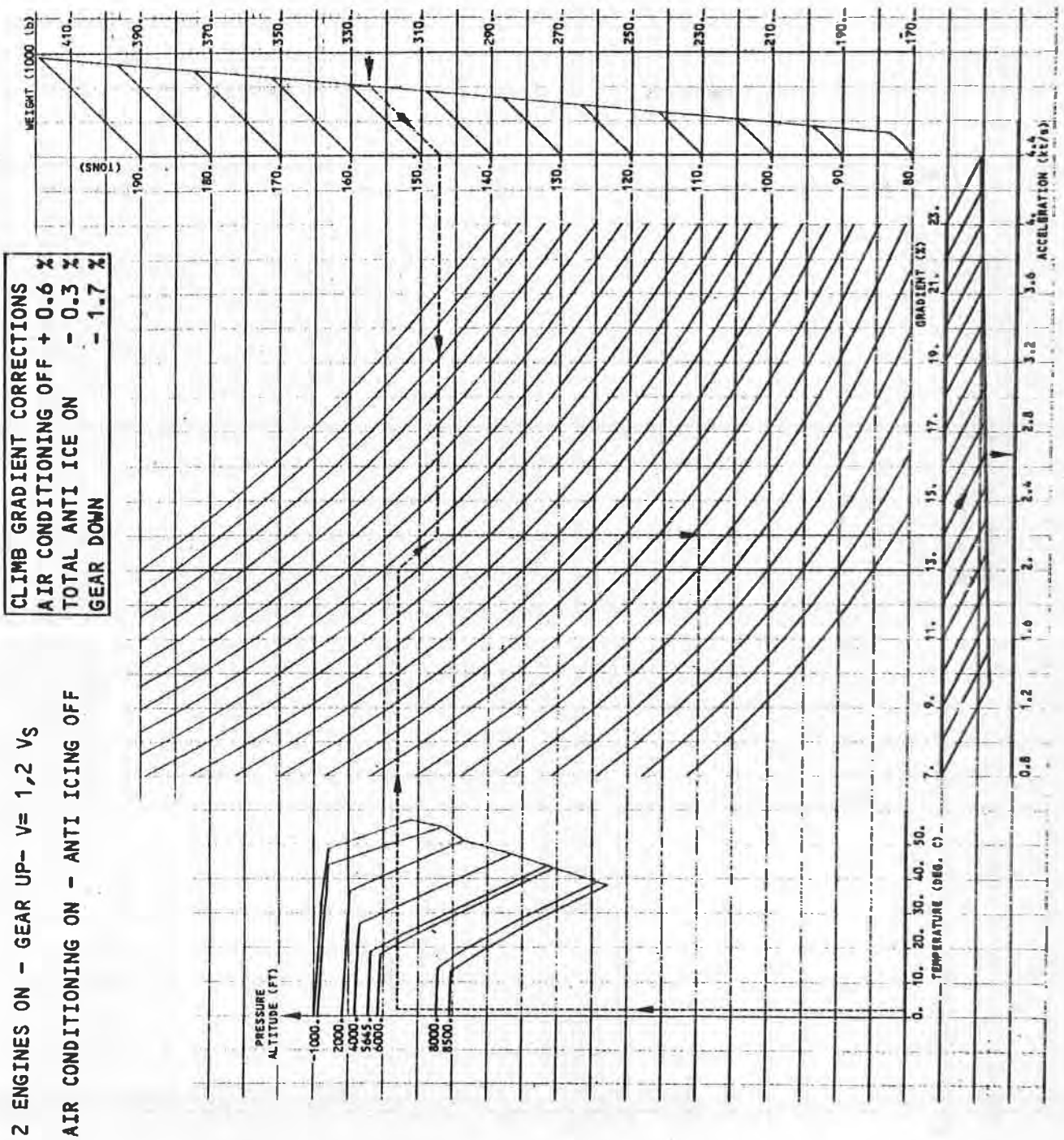


GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	WINDSHEAR PROTECTION	2.02.01	
		PAGE 35	
	CLIMB GRADIENT – ACCELERATION CAPABILITY	REV 14	SEQ 035

TAKE-OFF CONFIGURATION (SLATS 20 – FLAPS 20)



CLIMB GRADIENT CORRECTIONS

AIR CONDITIONING OFF	+ 0.6 %
TOTAL ANTI ICE ON	- 0.3 %
GEAR DOWN	- 1.7 %

2 ENGINES ON - GEAR UP- V= 1,2 V_S

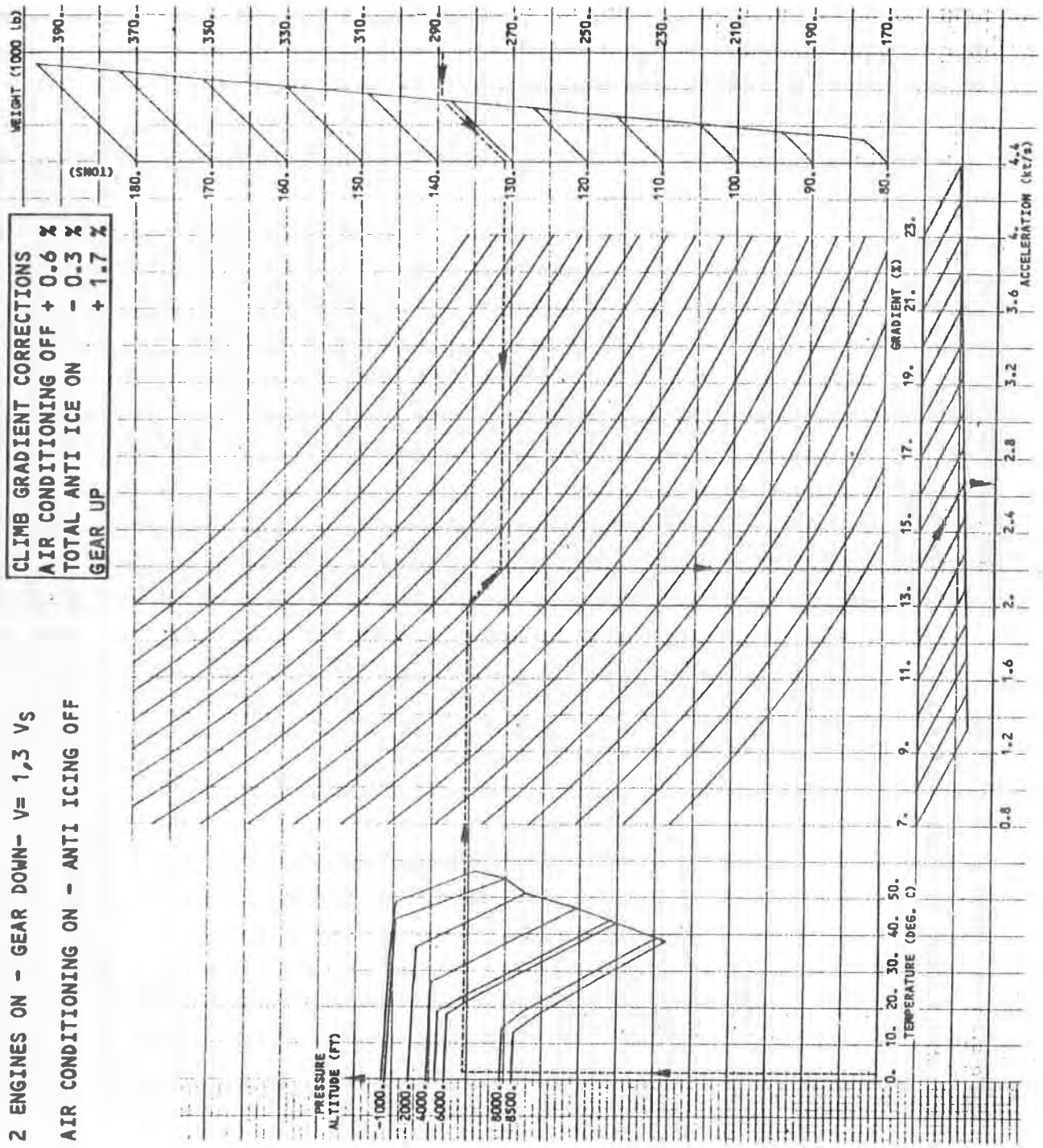
AIR CONDITIONING ON - ANTI ICING OFF

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	WINDSHEAR PROTECTION	2.02.01
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	CLIMB GRADIENT – ACCELERATION CAPABILITY	REV 14 / SEQ 035

LANDING CONFIGURATION (SLATS 30 – FLAPS 40)



GE Eng. : 80C2A2

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

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

PROCEDURE

. FOR THE CAPTAIN

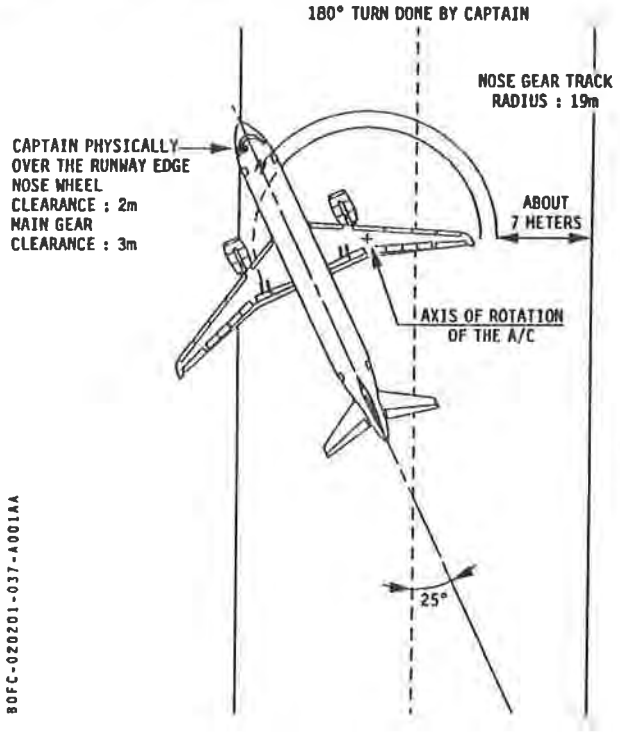
- Taxi on the right hand side of the runway up to about 150 m from the end of the runway.
- Turn left, maintaining 25° divergence with runway axis.
- When the captain is physically over the runway edge, he applies full deflection as quick as possible on the nose wheel and set about 50 % to 55 % N1 for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

R

. FOR THE COPILOT

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

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



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TAKE OFF

1. DECISION TO ABANDON THE TAKE OFF

The ECAM system is such that it allows the activation of proper warnings only when necessary.

For the take off phase, most of the warnings are inhibited from 70 Kt to 400 ft or one minute after lift off whichever occurs first.

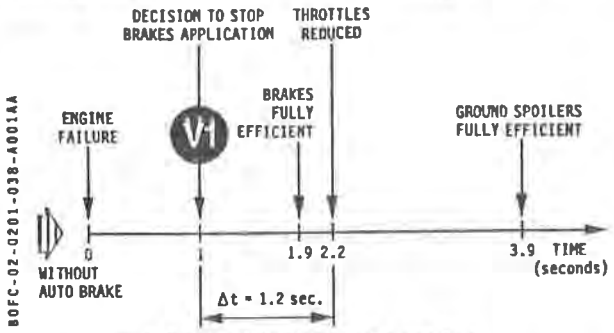
Therefore :

a) For any ECAM warning activation before reaching 70 Kt, it is recommended to abandon the take-off.

b) Above 70 Kt all the ECAM warnings are inhibited except :

- ENGINE or APU fire,
- ENGINE failure,

Stopping distance in case of rejected take off at V1 has been calculated considering the following sequence :



Note : Δt = 1.2 sec : this time splits up into
- *1 second delay to comply with regulation requirement*
- *0.2 second delay which represents the time to retard the throttles*

The experience has unfortunately shown that rejected take off were sometimes hazardous, eventhough the performance are correctly-calculated based on flight tests. This may be due to the following facts or combination of facts :

- delay in initiating stopping procedure is increased
- the tires are damaged
- the brakes are not working correctly or with initial temperature higher than normal
- the runway friction coefficient is lower.

Therefore, above 100 kt, abandoning the take off becomes a serious action which may lead to an hazardous situation, in particular at speeds close to V1.

The decision to reject the take off always lies with the Captain, however we strongly recommend that the decision to abort the take off when the aircraft speed exceeds 100 kt should be restricted only to the occurence of either of the following conditions :

1 – ENGINE FIRE
2 – SUDDEN LOSS OF ENGINE THRUST

This is why the call out « 100 Kt » should be used :

- before which speed, an interruption could be initiated for any reason. In this case if the autobrake is armed on « MAX », an immediate take over will avoid an unnecessarily strong deceleration
- above which speed an interruption should be limited to real serious problem.

In case of nose landing gear vibration appearing above 100 kt it is recommended to continue the take off and reduce the load on the nose gear by application of elevator. (At landing keep the nose gear up until the speed decreases below 100 Kt).

2. ABOVE V1 :

The take off must be continued as the remaining length of the runway may not be sufficient to guarantee a safe rejected take off.

NO ACTION should be taken until flight path is fully controlled and a minimum of 400 ft (recommended 800 ft) has been reached.

3. FLAP/SLAT SELECTION SHEDULE

3.1 BOTH ENGINES OPERATIVE

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

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

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

3.2 ONE ENGINE INOPERATIVE

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

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

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

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

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

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

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APPROACH AND LANDING

The standard approach is the decelerated approach which is very easy to perform in manual as well as with the autopilot engaged (Refer to 2.02.01 page 9).

The advantages of such a procedure are :

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

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

ENGINE PARAMETERS MONITORING

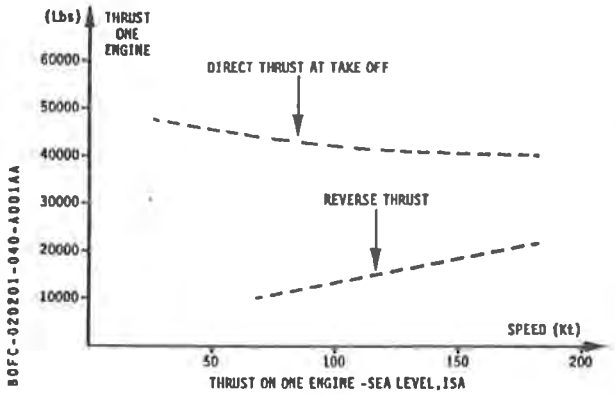
In addition to thrust setting adjustments made by the PNF during take off and landing phases a special attention must be exercised by the PNF to the monitoring of engine parameters (N1/EPR, N2, EGT) in particular during the take off and go around phases.

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES GENERAL REVERSERS EFFECT IN AIRCRAFT DECELERATION	2.02.01 PAGE 40 REV 18 SEQ 001

1. DIRECT AND REVERSE THRUST

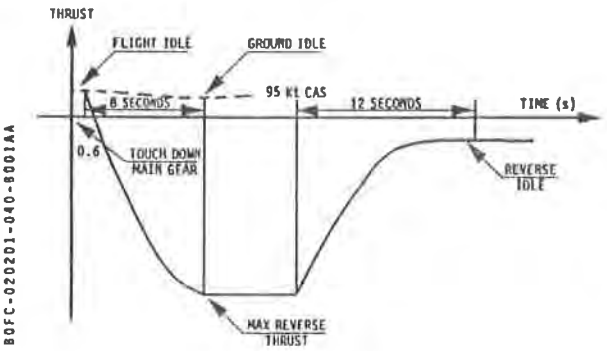
Variation for thrust versus speed at sea level, ISA conditions.



While the maximum direct thrust decreases slowly with the speed increase, the maximum reverse thrust decreases rather quickly with the speed decrease.

2. – REVERSE SEQUENCE

The following graph presents the typical reverse sequence which is taken into consideration for the performance calculation.



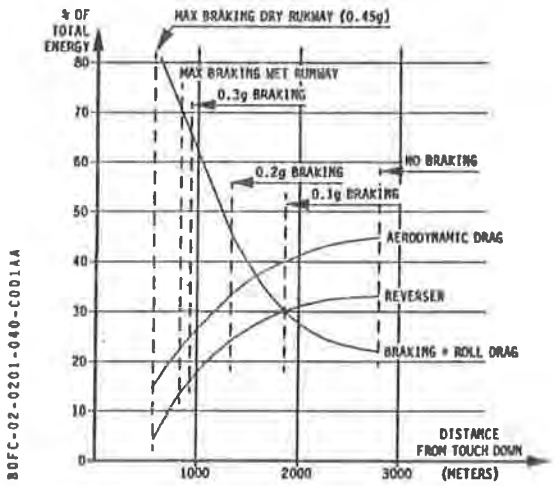
Between touch down and the availability of maximum reverse thrust the time delay is of about 8 seconds. This delay has a very important effect in the participation of the reversers in the aircraft braking. Depending upon the required braking rate the reverse thrust effect will be more or less efficient. As a reference it is important to notice that the stopping time is around 15 seconds with the application of full pressure on brakes.

3. ENERGY DISTRIBUTION (Landing-stop)

It is worth noticing that down to a 0.3 G deceleration rate the part of braking energy due to both reversers remain about 10 % or below. The major part is by far absorbed by the brakes. In addition at this deceleration rate the time during which the maximum reverse thrust is applied stays in the order of 3 seconds at speed ranging from 90 to 70 kts (IAS)

Even on a wet runway where the friction coefficient is half of the dry one, when applying full pressure on brakes the amount of reverse thrust remains very low. Of course in a normal landing with approximately 0.1 G deceleration rate the reversers will participate for a fair amount. Thus relieving the brakes from unnecessary wear.

Dry/wet runway

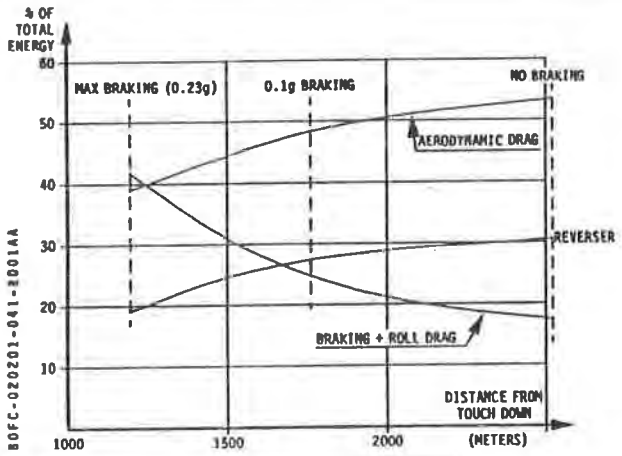


Landing at 123t
Touch down speed 136 kts
Sea level
ISA conditions
Both reversers

The effect on the distance is negligible on dry runway. However, on wet runway, the distance is improved by about 145 meters since the deceleration rate increases by about 0.05 G with the use of both reversers.

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Contaminated runway (1/4 inch of water or slush)



Landing at 123t
Touch down speed 136 kts
Sea level
ISA conditions
Both reversers

On contaminated runway the deceleration energy coming from the reversers accounts for 20 % or more and explains the recommendation to use the reversers on this type of runway.

4. DISPATCH WITH A SINGLE REVERSER

There is no controllability problem when using one reverser only provided the other one is not at max forward thrust. This is a reason why we recommend the use of reverser in case of aborted take-off following engine failure.

In case of dispatch with one fan thrust reverser inoperative :

- either do not use the operative one, or
- it is recommended to select both levers towards deployed position and the non flying pilot has to keep a hand on the throttle lever of the engine having the inoperative fan thrust reverser,

5. RECOMMENDATIONS

Note : A few cases of « veer off » the runway have been encountered on other airplanes due to forward thrust on one side and reverse thrust on the other. In such unexpected situation where the lateral behaviour of the airplane became uncontrollable the best way of curing the problem is to shut down all engines.

6. CONCLUSION

Airbus recommendations are :

1 – Use the reversers to slow down the airplane and save brakes and tyres. Whatever is the situation select always both levers.

2 – If during airplane deceleration, the crew can no longer control the airplane laterally, shut down both engines after having selected forward idle thrust.

3 – On very short runway the main retarding device being the brakes the reverser may not be used.

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES	2.02.02
		PAGE 1
	AIR CONDITIONING	REV 06 / SEQ 001

AVIONICS VENTILATION ON GROUND WITH AIR CONDITIONING PACKS SHUT DOWN

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

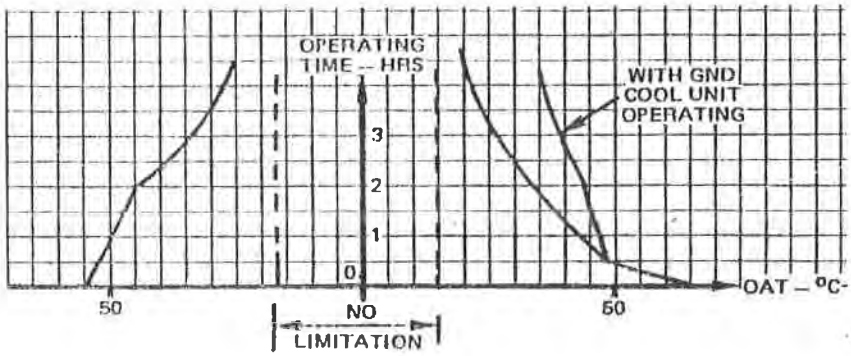
- OAT,
- Avionics compartment door open or closed,
- GND COOL installed and operating or not.

Refer to respective diagrams EQUIPMENT OPERATING TIME.

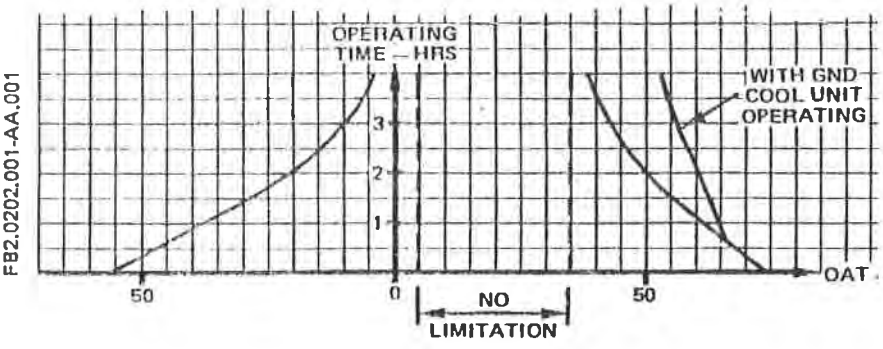
Note : With OAT + 15° C or higher, without GND COOL unit, the avionics compartment door should be opened to improve equipment cooling.

EQUIPMENT OPERATING TIME (ON GROUND, WITHOUT AIR CONDITIONING)

AVIONICS COMPARTMENT DOOR CLOSED



AVIONICS COMPARTMENT DOOR OPEN



PRE CONDITIONING WITH LP EXTERNAL SUPPLY

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

CAUTION

When aircraft is supplied by external LP air, do not attempt to supply air from the APU, engines or external HP air.

Note : 1. It is recommended not to use external HP air for conditioning due to possible refrigeration pack contamination.

2. With external LP air supply it is not possible to control cabin temperature from the cockpit.

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1. ECON FLOW CONTROL

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

2. MAX COOL CONTROL

R - MAX COOL must be selected OFF for normal air conditioning operations.

R - When selected ON, the pack discharge temperature
R limit is decreased from + 4°C to - 7°C

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES AFS / FPV / DFA / WGD USE OF AFS	2.02.03 PAGE 1 REV 18 SEQ 100

1. GENERAL

A. PRELIMINARY NOTE

In section 2-02-03, the following is described :

- USE OF AFS described without taking into account the possible coupling to the FMS.
  Coupling of the AFS to the FMS, will be described in USE OF FMS section (2-02-19).
- USE OF FPV.
- USE OF DFA AND WGD if these systems are installed.

B. INTRODUCTION

The A-310 is equipped with a high performance digital Automatic Flight System (AFS). The use of this system is highly recommended to the crew because it :

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

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

C. AUTOPILOT/FLIGHT DIRECTOR (AP/FD)

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

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

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

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

MAIN RULES OF USE

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

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

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

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

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

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

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

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

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

During an AP switching there is no change in the engaged modes except in the two following cases where the modes come back to the BASIC modes (V/S and HDG) :

- If, AP1 being active and FD1 feeding both PFD's (F/O FD switch pressed on F/O SWITCHING panel), AP2 is engaged in CMD. Same thing if AP1 is engaged when AP2 is active and FD2 feeds both PFD's.
- If, AP1 being active and FD BARS being out of view on PFD2 (FPV/FD switch in OFF or FPV position) AP2 is engaged. Same thing if AP1 is engaged when AP2 is active and FD BARS are out of view on PFD1.

8 – Each AP can be disconnected by setting the corresponding AP lever to OFF. Both AP's are disconnected by pressing either AP instinctive disconnect p.b. on the control wheels.

9 – In case of failure, overriding the action of the AP, by exceeding a pre-set force on the flight controls, is possible when AP is in CMD or CWS.

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

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

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

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

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

Mod. : 5757

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TASK SHARING

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

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

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

D. AUTOTHROTTLE SYSTEM (ATS)

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

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

MAIN RULES OF USE

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

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

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

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

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

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

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

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

CAUTION

Use of ATS is PROHIBITED during TAKE OFF if ENG TRIM is inoperative

2 – PREPARATION BEFORE TAKE OFF

A. DURING COCKPIT PREPARATION

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

PITCH TRIM/YAW DAMPER/ATS LEVERS. . . . . .ARM

B. BEFORE PUSHBACK OR START

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

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

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

CAUTION

Be sure that PRESET is activated before PRESELECTING the new speed.

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

C. DURING TAXIING

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

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

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3 – TAKE OFF, CLIMB, CRUISE

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

The lateral modes are described later.

This profile is based upon the use of :

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

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

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

A. WHEN READY FOR TAKE OFF

GO-LEVERS. . . . . .PRESS

- At the same time :
  The FD's engage in SRS mode.
  A/THR function is engaged (A/THR p.b. illuminates on FCU).
  THRUST mode is engaged in ATS (green THR on both FMA's).

CAUTION

Use of ATS is prohibited during TAKE OFF if ENG TRIM is inoperative. So, in order to avoid engagement of THR or THR L modes when SRS mode is engaged after pressing the GO LEVERS, DISARM the ATS (THR or THR L is automatically engaged when SRS is engaged through the GO LEVERS.).

- The FD PITCH BAR on each ADI will move up to indicate A/C acceleration.
- The FD ROLL BAR, remains centered on each ADI. HDG mode becomes active only at 30 ft (A/C heading at 30 ft will be maintained).

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

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

If the take off is performed backwards the localizer (aircraft heading different from selected course by more than 40°), RWY mode is not engaged.

- As soon as the throttles are at the desired thrust or at 100 KT maximum the A/THR is declutched (blue THR on FMA's).
- At VR, rotate until the PITCH BAR is centered (to maintain V2 + 10 KT or a maximum of 18° pitch attitude).
- In case of engine failure the PITCH BAR will command a pitch attitude to maintain V2 (or the existing speed if it is greater than V2).

B. INITIAL CLIMB

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

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

CAUTION

If ENG TRIM was OFF, rearm ATS and reengage A/THR function.
This causes THR engagement if SRS mode is active in AP/FD.

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

Note : 1. If AP is already engaged in CWS, press CWS/CMD pushbutton to switch to CMD.
2. AP will take into account the engaged modes.

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

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

C. AT ACCELERATION ALTITUDE

– **With two engines :**

LVL/CH p.b.. . . . . .PRESS

TRP. . . . . .SELECT CL (or CR)

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

– **With one engine out :**

- At acceleration altitude :

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

- At « GREEN DOT » speed

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

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D. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

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

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

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

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

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

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

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

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

ATS remains in SPD mode.

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

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

The AP will acquire and maintain this V/S.

As in §3.D when ALT * illuminates.

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

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

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

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

The AP maintains 250 KT.

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

As in 3.D when ALT * illuminates.

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

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

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

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

The ATS automatically engages in THRUST mode.

The AP will acquire and maintain 300 KT.

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

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

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

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

CAUTION

Be sure that PRESET is activated before PRESELECTING the MACH

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

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

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

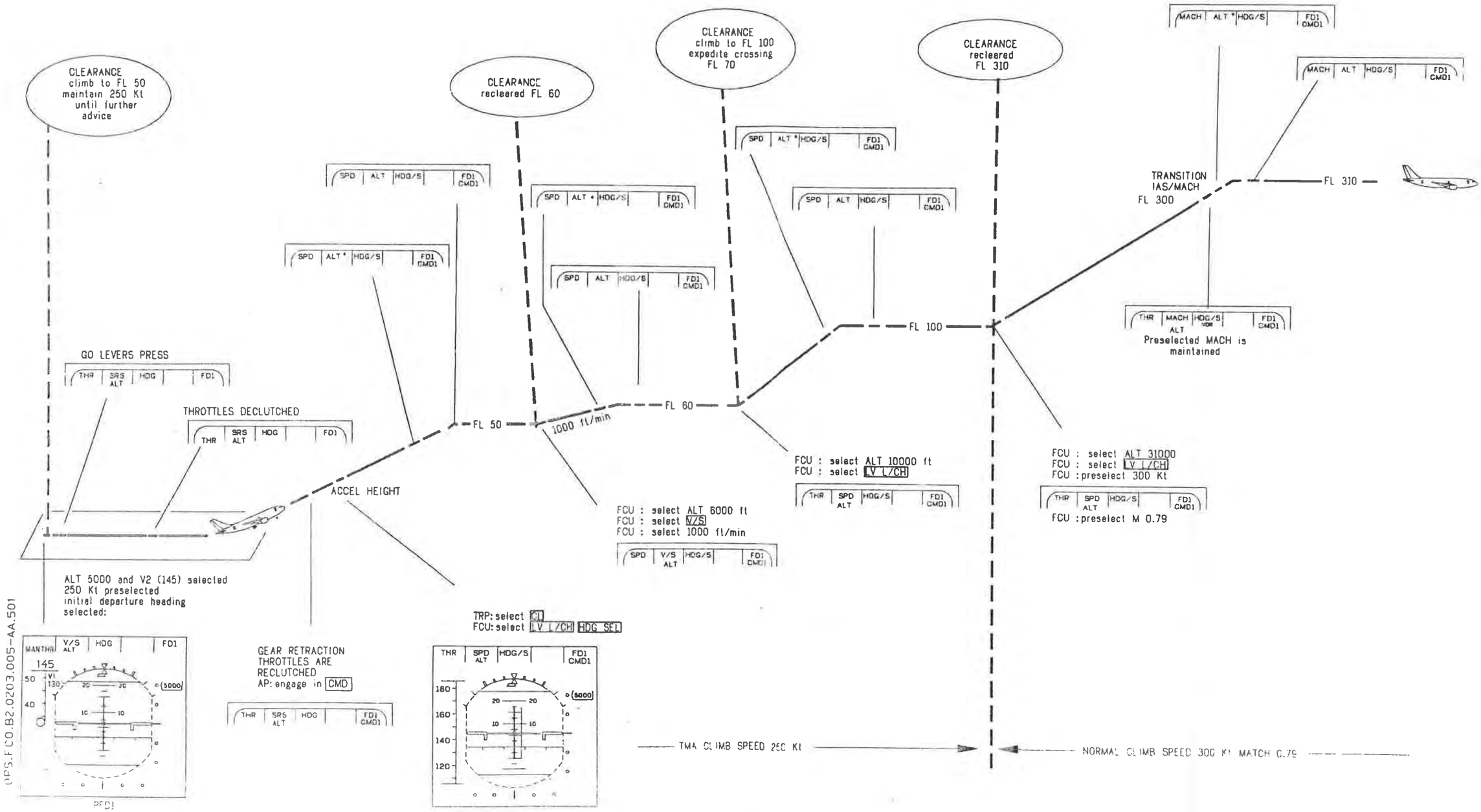
I. CRUISE

The AP maintains FL310 and the ATS maintains MACH 0.79

TRP. . . . . .SELECT CR

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TAKE-OFF, CLIMB, CRUISE



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4 - LATERAL MODES

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

A. HDG mode

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

B. HDG SEL mode

HDG SEL knob .....TURN TO SELECT THE HDG
HDG SEL knob ..... TURN TO SELECT
(Max. bank angle) NORM (25°) or 15 (15°)
HDG SEL knob or HDG SEL p.b. ...PULL TO SELECT HDG SEL MODE / PRESS TO SELECT HDG SEL MODE

HEADING ACQUISITION LOGIC :

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

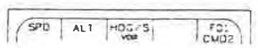
C. VOR mode

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

VOR/NAV/ILS switch ..... SELECT VOR
VOR CONTROL PANEL ..... SELECT VOR frequency and VOR CRS
V/L p.b. ..... PRESS TO SELECT VOR MODE

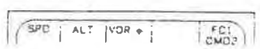
- Intercept at an angle lower than 90°. If the distance to the station is smaller than 30 NM, use smaller (30° or less) intercept angle.
- To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.
- When passing over the station, selected VOR course can be changed by as much as 30° on the VOR control panel.
- The VOR mode comprises 3 phases :

ARM PHASE



BLUE VOR

CAPTURE PHASE



GREEN VOR ◆

TRACK PHASE



GREEN VOR

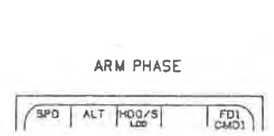
D. LOC mode

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

VOR/NAV/ILS switch .....SELECT ILS
ILS CONTROL PANEL ..... .SELECT ILS frequency and RWY CRS
V/L p.b. .... PRESS TO SELECT LOC MODE

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

ARM PHASE



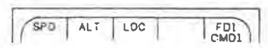
BLUE LOC

CAPTURE PHASE



GREEN LOC ◆

TRACK PHASE



GREEN LOC

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5 – DESCENT – HOLDING

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

This profile is based upon the use of :
- an AP engaged in CMD with ALT HLD mode.
- the ATS, since we are at a high level, engaged in MACH mode.

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

RECOMMENDATION :

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

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

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

ALT SEL knob . . . . . SELECT THE CLEARED FL (FL200 in typical path)

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

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

The AP maintains M 0.79

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

THROTTLES . . . . . FULLY IDLE

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

APPROACH BRIEFING. Decision height . . . . . SELECT

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

B. PRESET OF 300 KT SPEED

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

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

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

CAUTION

Be sure that PRESET is activated before PRESELECTING the SPEED

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

C. WHEN ALTITUDE CAPTURE CONDITIONS ARE MET

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

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

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

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

ALT SEL knob . . . . . SELECT 10000

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

ATS remains in SPD mode

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

V/S knob . . . . . SELECT – 25

The AP will acquire and maintain this V/S

Use speed brakes if necessary to maintain the desired speed.

As in §5.C when ALT* illuminates.

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

ALT SEL knob . . . . . SELECT 4000

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

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

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

The AP will acquire and maintain 250 KT

As in 5.C when ALT * illuminates.

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F. DESCENT FROM 4000 ft TO 3000 ft

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

ALT SEL knob. . . . . .SELECT 3000

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

ATS remains in SPD mode

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

V/S knob. . . . . .SELECT – 10

The AP will acquire and maintain this V/S

As in 5.C when ALT * illuminates.

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

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

The ATS will acquire and maintain this speed.

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C. EQUIPMENTS REQUIRED TO BE OPERATIONAL FOR LAND MODE ENGAGEMENT

(In addition of AP or FD engagement conditions)

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

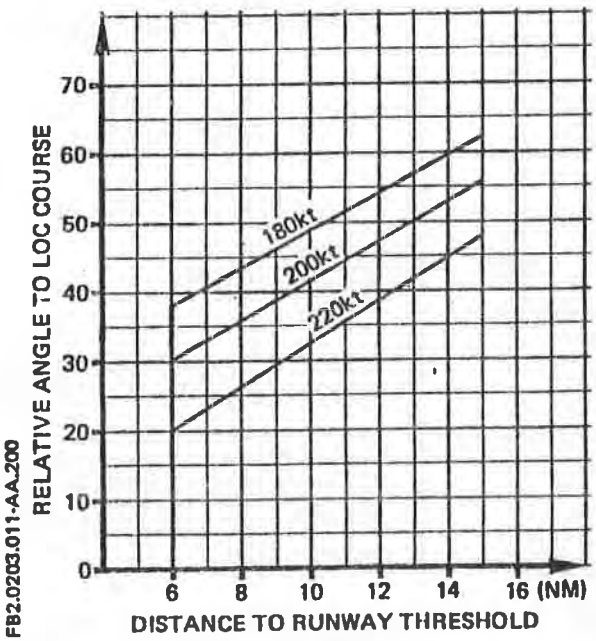
* Capability is indicated on FMA's (Flight Mode Annunciator)

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

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

D. APPROACH AND LANDING PERFORMANCE ENVELOPE

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



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

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

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

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

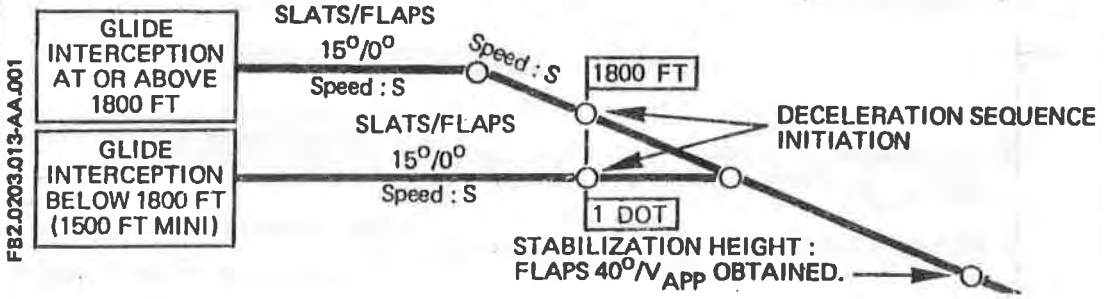
APPLICABILITY :
- In CAT 1 or better and CAT 2 or CAT 3 weather conditions.
- For any glide slope angle.
- with one FD, two FD's, one AP in CMD or two AP's in CMD engaged with LAND mode.

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

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

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	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 WEATHER CONDITIONS
LOC*	HDG SEL knob . . . . . SELECT RWY HDG	
FINAL DECEL SEQUENCE	DECELERATION from « SLATS 15°/S SPEED » to « FLAPS 40°/VAPP » : FLAPS 20° . . . . . SELECT VAPP/GO AROUND ALTITUDE . . . . . SELECT If ATS not used, THROTTLES immediately . . . . . FULL IDLE As soon as FLAPS are 20°, LDG GEAR/GRND.SPLRS . . . . . DOWN/ARM As soon as GEAR DOWN, FLAPS 40° . . . . . SELECT When approaching target speed, if ATS not used, THRUST . . . . . ADJUST  *Note : 1. It is initiated at 1800 FT AGL if G/S INTERCEPTION is AT or ABOVE 1800 FT and 1 DOT BELOW the GLIDE if INTERCEPTION is BELOW 1800 FT* *2. FLAPS 40°/VAPP will normally be obtained 1000 FT below DECELERATION SEQUENCE initiation, and at the latest (case of WIND or unusual GLIDE SLOPE) at 500 FT AGL.*	
FLAPS 40° SELECTED	– AUTOLAND lights . . . . . .TEST* * This also tests the LOC and GLIDE EXCESSIVE DEVIATION WARNINGS on PFD's FINAL CHECK LIST . . . . . .PERFORM PNF reads the CHECKLIST : PNF LANDING GEAR . . . . . DOWN PNF ANTI SKID . . . . . CHECK ALL SLATS/FLAPS . . . . . SET PNF SPOILERS . . . . . ARMED	CM2 reads the CHECKLIST : CM2 LANDING GEAR . . . . . DOWN CM2 ANTI SKID . . . . . CHECK ALL SLATS/FLAPS . . . . . SET CM2 SPOILERS . . . . . ARMED CM2 AUTOLAND . . . . . TESTED
1000 FT QFE	PNF announces « ONE THOUSAND »	CM2 announces « ONE THOUSAND » CM1 puts his hand on the, THROTTLE levers, controls or monitors the SPEED (as appropriate) and looks for external visual references

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	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 WEATHER CONDITIONS	CAT 3 WEATHER CONDITIONS WITH DECISION HEIGHT
700 FT QFE	Each pilot checks the selected CRS on his ND CM2 announces « COURSE SET »		
500 FT QFE	PNF monitors AUTO CALL OUT (or announces « HUNDRED ABOVE » at DH + 100 FT altimeter). PNF announces « LAND GREEN » at 400 FT above ground (altimeter).	CM2 monitors AUTO CALL OUT (or announces « HUNDRED ABOVE » at DH + 100 FT radio altimeter). CM2 announces « LAND GREEN » at 400 FT above ground (altimeter). *Note : AUTO CALL OUT R/A is mandatory for a CAT 3 with two men crew.*	
DH	• PNF monitors AUTO CALL OUT (or announces « MINIMUM »).	• CM2 monitors AUTO CALL OUT (or announces « MINIMUM »).	• CM2 monitors AUTO CALL OUT
	EXTERNAL VISUAL REFERENCES SUFFICIENT		
	• PNF announces « VISUAL » • PF announces « LANDING » (this means that he controls or monitors both FLIGHT PATH and THROTTLES)	• CM1 announces « LANDING » , and performs the landing (he monitors FLIGHT PATH and controls or monitors THROTTLES). *Note : ATS IN SPEED MODE is mandatory for a CAT 3.*	
	• PNF monitors AUTO CALL OUT or announces 200 FT, 100 FT, 50 FT, 30 FT «RETARD», 10 FT.	• CM2 monitors AUTO CALL OUT or announces 100 FT (if below DH), 50 FT, 30 FT « RETARD », 10 FT.	• CM2 monitors AUTO CALL OUT
	• At 30 FT, when PNF announces « RETARD », PF monitors or controls throttle reduction and maintains throttles on idle position until end of ROLL OUT phase	• At 30 FT, when CM2 announces « RETARD », CM1 monitors or controls (as appropriate) throttle reduction and maintains throttles on idle position until end of ROLL OUT phase.	
	EXTERNAL VISUAL REFERENCES INSUFFICIENT Execute a GO AROUND		
TOUCH DOWN	CM2 announces « ROLL OUT »		
	• PF monitors the ROLL OUT mode (through the AP) or disconnects the AP and manually controls the A/C during the roll out phase. He controls THROTTLE position.	• CM1 monitors the ROLL OUT mode (through the AP) or disconnects the AP and manually controls the A/C during the roll out phase. He controls THROTTLE position.	
	• PNF monitors engine parameters and announces speeds.	• CM2 monitors engine parameters and announces speeds.	

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

- *During GLIDE beam capture.*
  - *pitch attitude becomes lower than 0° or greater than 10° nose up.*
  - *vertical speed exceeds + 500 ft/min or – 1250 ft/min.*
- *During the final approach.*
  - *speed becomes lower than V_{APP} – 5 KTS or greater than V_{APP} + 10 KTS.*
  - *pitch attitude becomes lower than 0° or greater than 10° nose up.*
  - *bank angle becomes greater than 7°.*
  - *descent rate becomes greater than 1000 ft/min.*
  - *excessive LOC or GLIDE deviation occurs.*

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

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

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

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

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

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E.1 PROCEDURE FOR ILS BACK-COURSE APPROACH

- tune frequency and set front-course on ILS control panel.
- check approx. approach slope (300 ft/mile is 3°).
- select ND to ROSE or ARC, and VOR/NAV/ILS switch to ILS
- refer to localiser deviation indicated by ND to intercept and maintain localiser back-beam.
  CAUTION : Disregard localiser deviation on PFD, this is reversed.
  Disregard glide slope indications.
- Leave final approach fix stabilised in landing configuration at Vapp + 10
- do not use FD in LAND or V/L mode ; it is recommended to select FPV to assist in maintaining the required glide slope. The « cage » is not usable since it is referenced to the front-course.

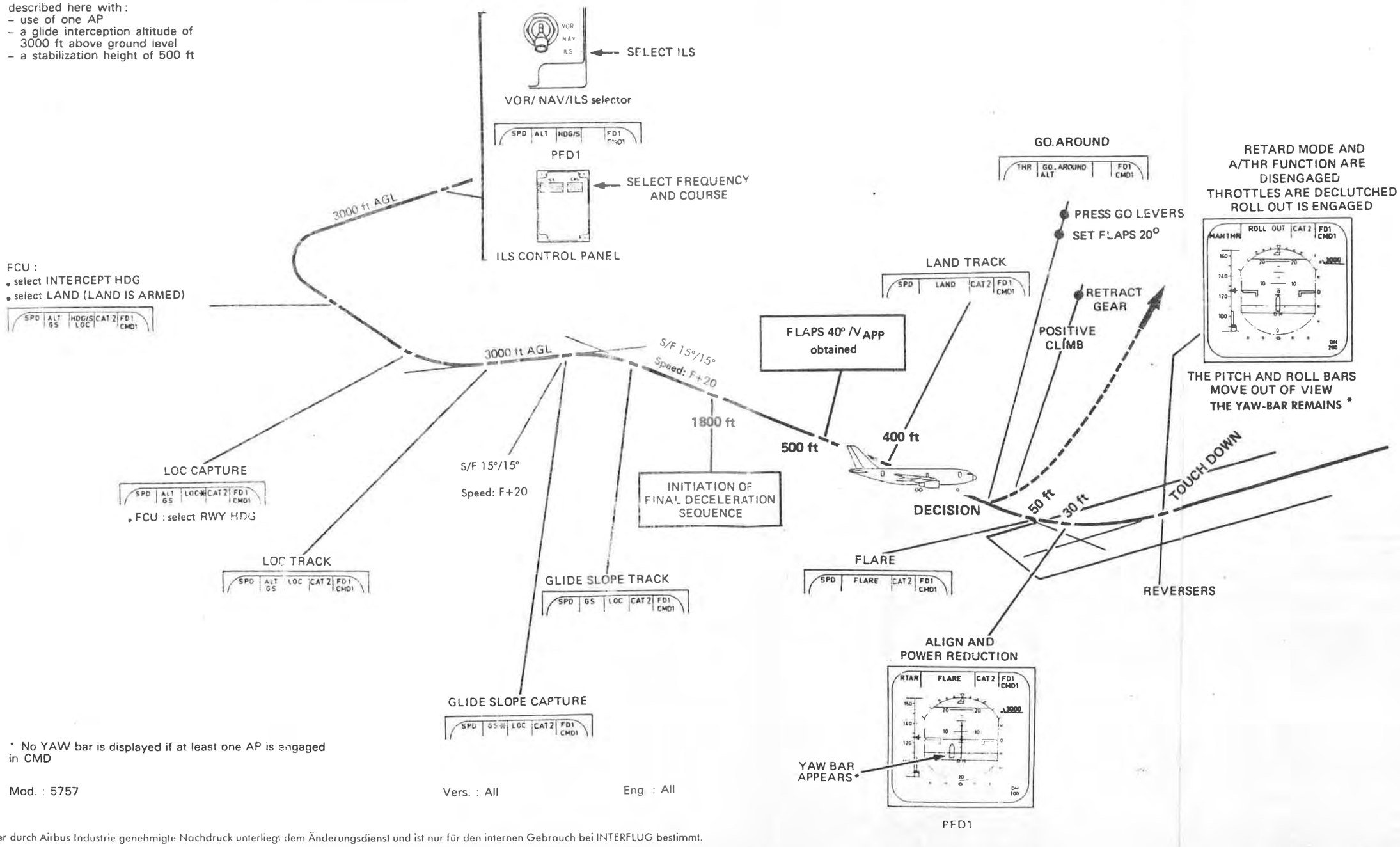
Note : If desired the approach may be flown with AP in CMD using H/SEL to maintain the localizer back-course and V/S to maintain the FPV at the required angle (normally – 3°) on the pitch scale. In this case the AP should be disengaged by 200 ft (see AFS limitations). Another technique is to use AP in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

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STANDARD ILS APPROACH

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



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

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F. GO AROUND

	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 WEATHER CONDITIONS
DH	• PNF announces « NO CONTACT ». • PF announces « GO-AROUND, FLAPS 20 », presses the GO-LEVERS, monitors THROTTLE advancement and controls or monitors (as appropriate) the FLIGHT PATH. *Note : If ATS is not armed, PF pushes throttles full forward.* *If moreover ENGINE TRIM is inoperative, he adjusts throttle to the correct power setting.* • PNF retracts FLAPS one step and monitors engine parameters. • As soon as rate of climb is positive : PF asks for GEAR retraction PNF retracts the gear and confirms « GEAR UP ».	• CM1 announces « GO-AROUND, FLAPS 20 », presses the GO-LEVERS, push throttles full forward* (if no ATS) * if ENGINE TRIM inoperative adjust throttles to the correct power setting. *Note : If ATS is not armed, CM1 pushes throttles to adjust go-around power.* *If moreover ENGINE TRIM is inoperative, he adjusts throttle to the correct power setting.* • CM2 retracts FLAPS one step and monitors engine parameters. • As soon as rate of climb is positive : CM1 asks for GEAR RETRACTION CM2 retracts the gear and confirms « GEAR UP ». *Note : IF AT DH, NO CALL FROM CM1, CM2 PERFORMS A GO-AROUND.*
	CAUTION At each time a GO AROUND is initiated, even if manually done, PRESS THE GO LEVERS IN ORDER TO GET OUT OF LAND MODE	
ACCEL ALT	See also Patterns in following pages. • With TWO ENGINES At acceleration altitude : SPD/MACH setting knob . . . . . SELECT 250 KT LVL/CH p.b. . . . . SELECT LVL/CH MODE TRP . . . . . SELECT CL OR CR THRUST • With ONE ENGINE OUT At acceleration altitude : SPD/MACH setting knob . . . . . SELECT 250 KT ALT HLD p.b. . . . . SELECT ALT MODE At « GREEN DOT » speed LVL/CH p.b. . . . . SELECT LVL/CH MODE TRP . . . . . SELECT MCT THRUST SPD/MACH setting knob . . . . . SELECT « GREEN DOT »	

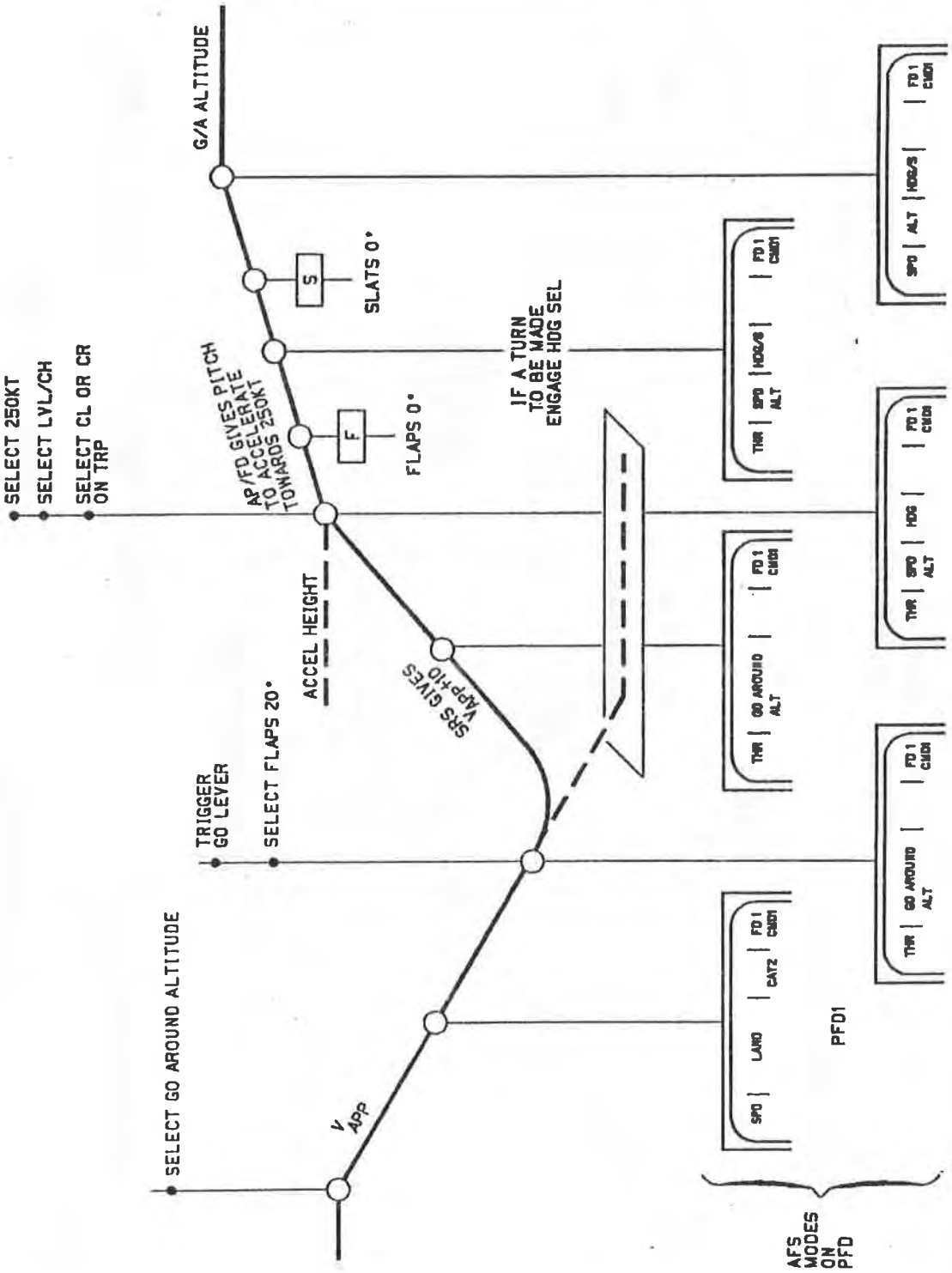
WARNING : 1) During a GO AROUND, an ENGINE FAILURE may lead to the disconnection of one or both AP :
- If 1 AP remains engaged, go on in automatic control.
- If no AP remains engaged, CM1 manually takes over and refers to the MAIN and STANDBY HORIZONS and to the FD BARS (if they are available).

2) In the case of a manual GO AROUND the pitch trim should be adjusted as soon as possible to counteract the strong nose up tendency.

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TWO ENGINE GO AROUND

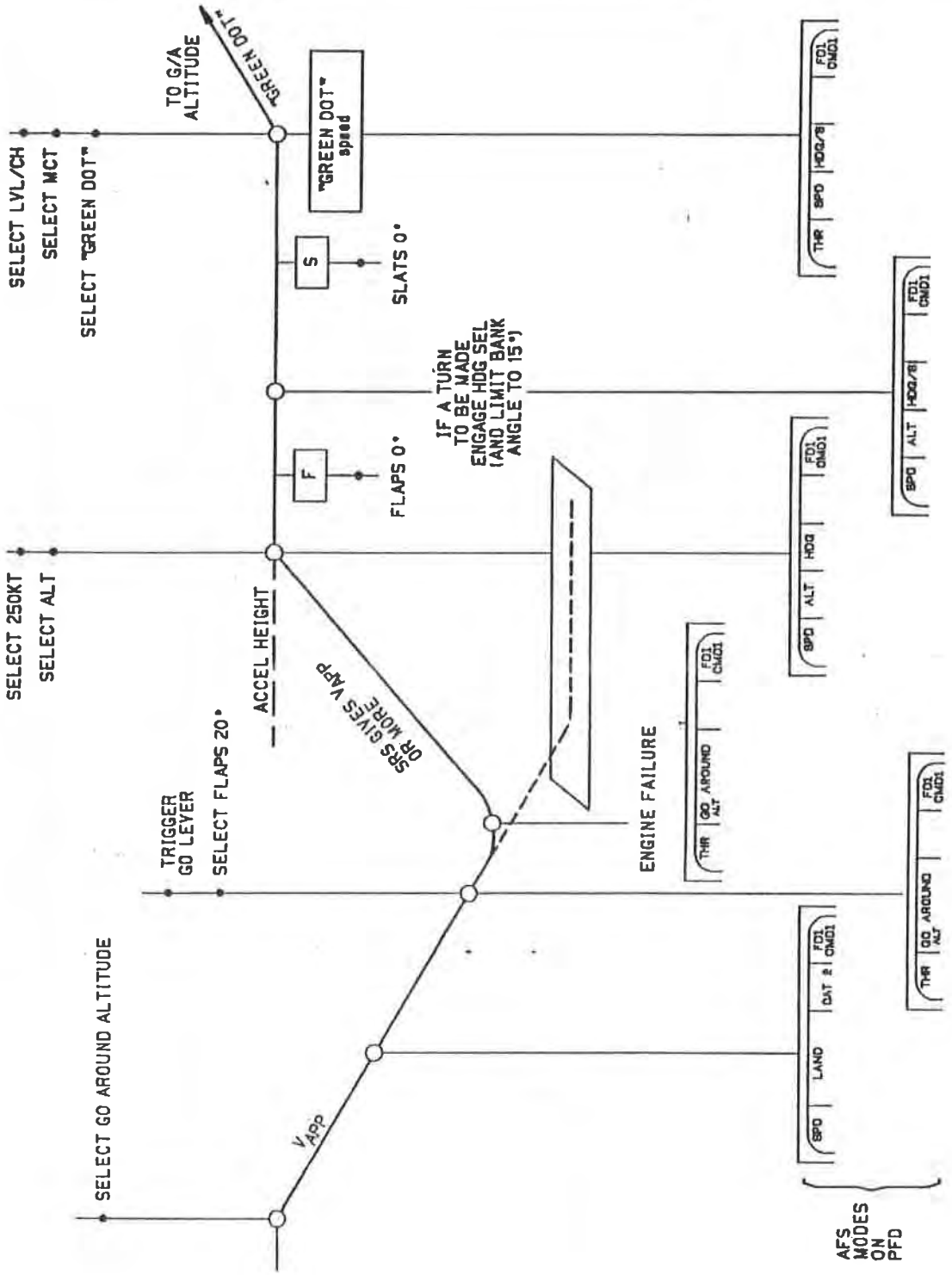


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ENGINE FAILURE DURING GO AROUND



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1 – GENERAL

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

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

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

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

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

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

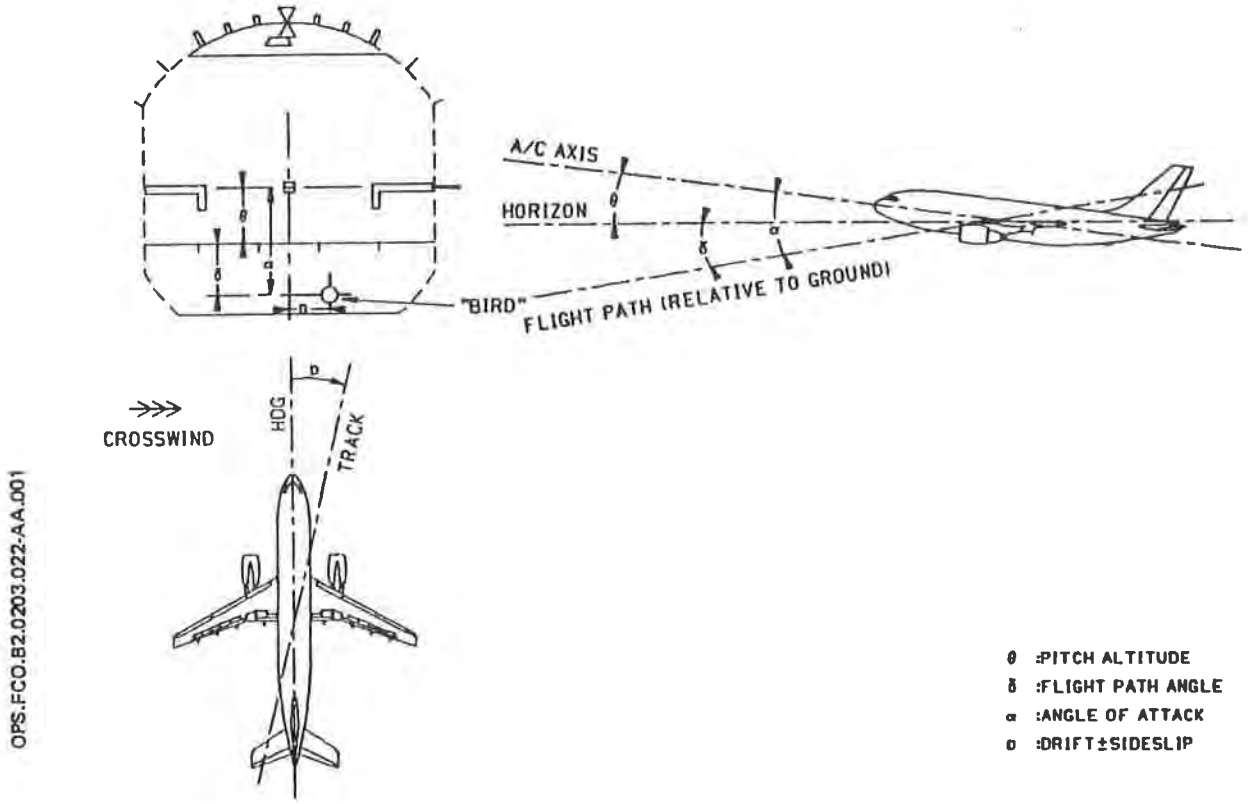
But this doesn't give the crew any reference to fly

– With the FLIGHT PATH VECTOR + the FLIGHT PATH TARGET (« BIRD » + « CAGE »).
In this case the FPV allows the crew, at the same time to :

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

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

PRIMARY INFORMATION GIVEN BY THE FPV (« BIRD »)



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2 - VISUAL APPROACH (USE OF THE « BIRD » ALONE)

APPLICABILITY :

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

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

COMPARISON WITH THE FD :

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

OPERATION (FOR A STANDARD CIRCUIT PATTERN)

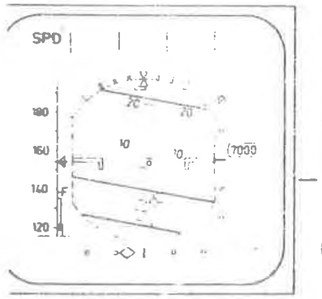
START OF PATTERN	FD/FPV switch ..... LIFT TO SELECT FPV The FLIGHT PATH VECTOR symbol appears on the PFD. It indicates to the crew the present A/C slope and drift. A HDG BUG also appears against the HDG scale of the PFD. It indicates the HEADING selected on FCU. *Notes : 1 - A second action (lift) on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

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

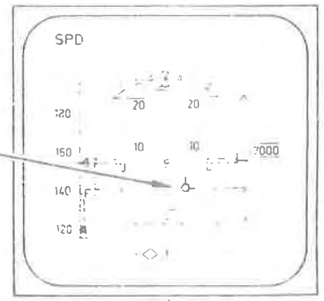
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VISUAL APPROACH WITH THE FPV (« BIRD » ONLY)

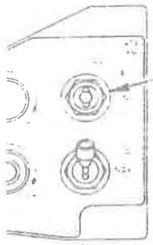


PITCH DOWN THE A/C TO BRING THE «BIRD» ON SUITABLE SLOPE (HERE 3°)

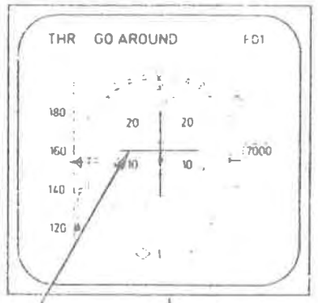


A/C HAS PRESENTLY :
•NO SLOPE
•5° RIGHT DRIFT

TRACK IS PARALLEL TO THE RUNWAY SINCE «BIRD» AND HDG ARE ALIGNED

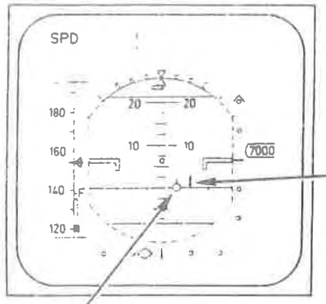


LIFT (UNSTABLE POSITION) TO SELECT FPV



FD BARS AUTOMATICALLY COME BACK WHEN GO AROUND MODE IS ENGAGED

GO AROUND

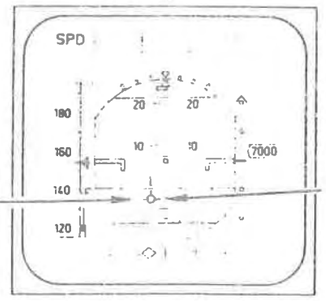


HDG BUG (SELECT RECIPROCAL RWY HDG)

«BIRD»
A/C HAS PRESENTLY
• NO SLOPE
•5° RIGHT DRIFT

A/C TRACK IS NOT PARALLEL TO THE RWY SINCE «BIRD» AND HDG BUG ARE NOT ALIGNED

SELECT RWY HDG ON FCU AND ALIGN "BIRD" WITH HDG-BUG



RWY AXIS IS MAINTAINED SINCE «BIRD» AND HDG BUG ARE ALIGNED

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

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3 – NON PRECISION APPROACH (USE OF THE « BIRD » COMBINED WITH THE « CAGE »

APPLICABILITY

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

COMPARISON WITH THE FD :

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

OPERATION

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

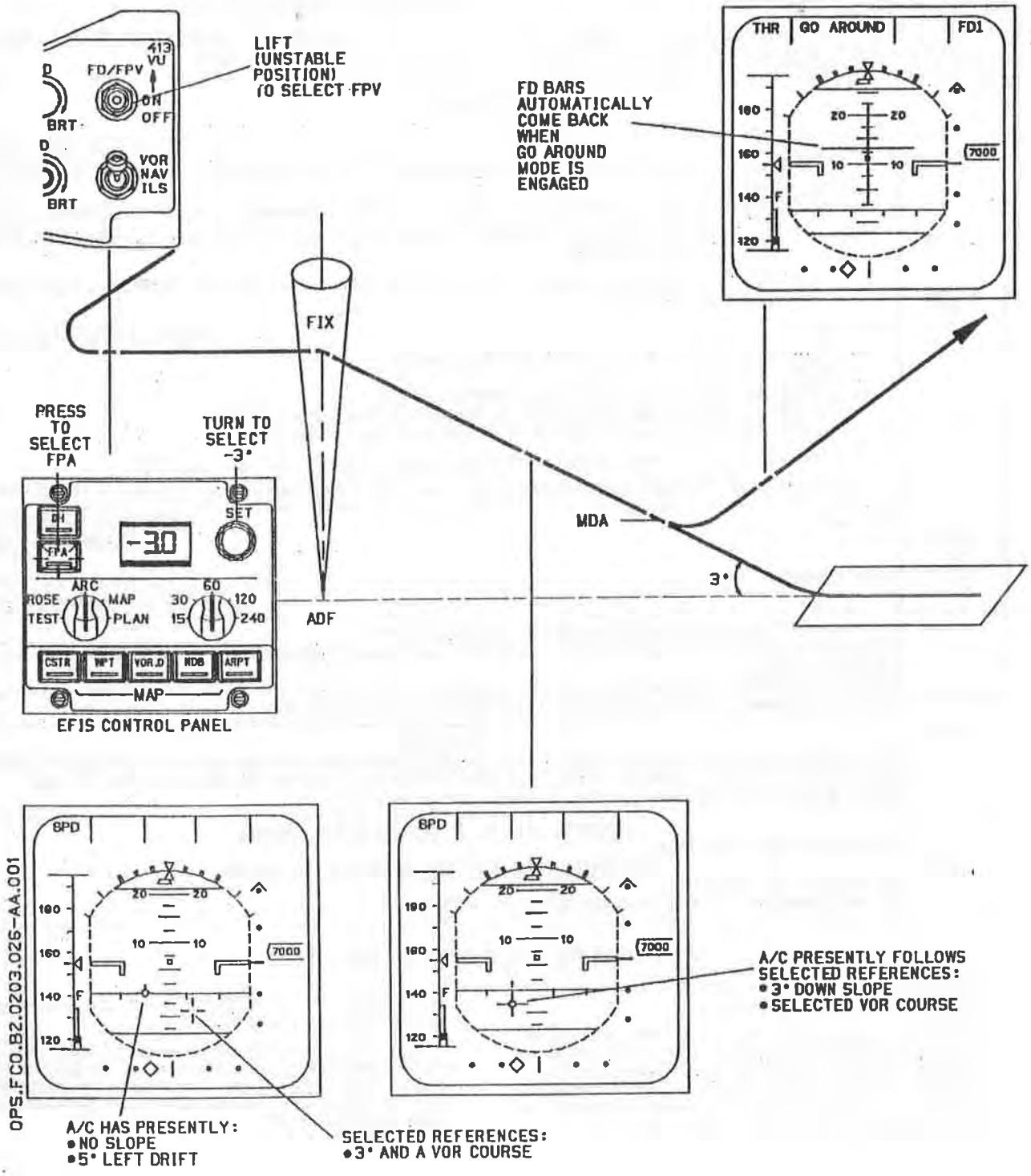
4 – OTHER POSSIBLE USES OF THE FPV :

- Monitoring automatic precision approach, in conjunction with raw ILS data ;
- It allows, particularly, an immediate and direct indication of flight path deviation due to wind-shear or other abnormality. Note that the GS index indicates position, whereas the FPV indicates rate of change of position, i.e. is predictive and therefore provides an earlier indication than the deviation of the GS.
- Cross-check of the achieved climb gradient when obstacle clearance is critical.
- In case of unreliable or failed airspeed indication, in which case the angle of attack (given on the pitch scale) of the PFD by the displacement between the centre-dot and the « BIRD ») can be used as relative pitch altitude. Refer to 2.05.10 p. 53

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NON PRECISION APPROACH WITH THE FPV (« BIRD » + « CAGE »)



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APU AUTOMATIC SHUT DOWN

INDICATIONS :

MASTER CAUTION + SC, FAULT lt, AVAIL lt off. APU stops, APU ISOL VALVE « SHUT » (on lateral panel).

PROCEDURE :

MASTER SWITCH . . . . . OFF
FUEL PUMP . . . . . AUTO

The APU automatically shuts down in case of :

- Overspeed
- Abnormal EGT indication
- Failure of electronic control system
- Air flow reversal
- Incorrect automatic starting cycle
- Abnormal oil press or temp
- Oil clogging
- Overcurrent
- Loss of DC ESS BUS bar

R - Loss of both EGT or SPEED sensors

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EXTERNAL ELECTRICAL POWER SUPPLY

PROCEDURE

EXT PWR AVAIL lt ..... CHECK ON

EXT PWR parameters ..... CHECK

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

EXT PWR ..... ON
. ON light illuminates.

ELECTRICAL PWR distribution ..... CHECK

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

CAUTION

Before disconnecting the EXT ELECT PWR unit from the aircraft, check :

EXT PWR sw ..... OFF
. ON light extinguished and AVAIL light illuminates.

ELECTRICAL SUPPLY FOR MAINTENANCE AND CLEANING

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

PROCEDURE

EXTERNAL POWER UNIT ..... CONNECTED

EXT PWR AVAIL light ..... CHECK ON

MAINT BUS sw ..... ON

The following equipment will be supplied :

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

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AIRCRAFT TRIMMING

The minimum drag for cruise flight is obtained when the control wheel is neutral. This condition is obtained by the following procedure :

- Ensure symmetric fuel loading,
- Ensure accurate symmetric thrust, autothrottle disengaged,
- Engage the autopilot, if not already engaged, in HDG SEL mode and in ALT mode in CMD,
- Adjust the rudder trim in order to get a zero control wheel position (aileron deflection scale on the wheel),
- Verify that the bank angle is not too large for passengers comfort (1.5° appears to be a reasonable value),
- Check again the lateral and trim conditions and retrim if necessary when there is a noticeable change in flight conditions.

Note : The same procedure applies to the low speed range of the aircraft including single engine climbout.

RECOVERY FROM STALL WARNING – STICK SHAKER

Whenever a stall warning (STICK SHAKER) is encountered at low altitude, regard this as a PRIMARY FLIGHT PATH warning :

- Level wings while simultaneously applying full thrust on the available engine(s)
- Recover a reasonable speed in level flight or a very gentle descent, terrain permitting. (VLS as indicated by top of amber band on PFD-airspeed scale).
- If slats/flaps extended to landing position, retract slats/flaps one step.
- When positive climb is obtained, retract landing gear.
  Note : Earlier landing gear retraction is not recommended since opening of gear doors during retraction creates additional drag.
- Execute GO-AROUND.

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FUEL CROSSFEED IN FLIGHT

If it is intended to use fuel from one wing only to balance aircraft :

PROCEDURE :

X FEED . . . . . IN LINE

On the wing from which fuel will be used, check :

ISOL VALVES . . . . . IN LINE

PUMPS . . . . . NORM

On the opposite wing :

INNER TANK PUMPS . . . . . OFF

When fuel balance is completed :

ALL TANK PUMPS . . . . . NORM

X FEED . . . . . X-LINE

CGCC IN ALTERNATE MODE

In case of use of hot JP4, following procedure has to be applied when CGCC goes to Alternate mode with CTR TK not empty and OUTR TK fuel quantity below 2500 kg.

OUTR TK FUEL QTY . . . . . MONITOR

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

  CTR TK PUMPS . . . . . CHECK ON

  OUTR TK PUMPS . . . . . OFF

  INR TK PUMPS . . . . . OFF

  CTR TK FUEL QTY . . . . . MONITOR

  CAUTION : Avoid negative load factors.

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

    OUTR TK PUMPS . . . . . ON

    INR TK PUMPS . . . . . ON

MANUAL FUEL FEED CONTROL

OUTR TK PUMPS (4) . . . . . Check ON

- **To supply from CTR TK :**

  INR TK PUMPS (4) . . . . . OFF

  CTR TK PUMPS (2) . . . . . NORM

- **To supply from INR TK :**

  CTR TK PUMPS (2) . . . . . OFF

  INR TK PUMPS (4) . . . . . NORM

- **To supply from OUTR TK :**

  INR TK PUMPS (4) . . . . . OFF

  CTR TK PUMPS (2) . . . . . OFF

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TRIM TANK SYSTEM

1. GENERAL

The trim tank system has been installed in order to :

- increase the fuel tank capacity,
- decrease the fuel consumption by reducing drag during cruise.

This is effected by controlling the aircraft center of gravity close to the certified aft limit. For this purpose fuel is transferred from center or inner tanks to trim tank and from trim tank to center tank.

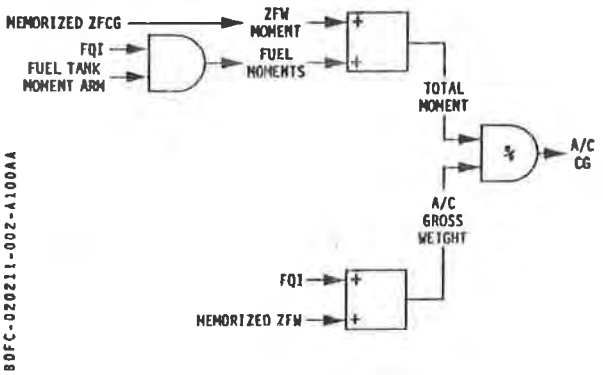
2. CENTER OF GRAVITY COMPUTER

a) Computation of aircraft center of gravity

The CGCC memorizes the ZFW values either :

- received from the FMS or
- computed from the aircraft center of gravity sent by the WBS (if installed)

Then, the CGCC uses the fuel indications received from FQI and the fuel tank moment arms (corrected for aircraft attitude received from IRS) to determine the aircraft CG :



b) Aft transfer

Fuel can be transferred aft either from center tank to trim tank or from inner tanks to trim tank – the fuel is supplied by the CTR or INR tank pumps.
To ensure this automatic transfer the CGCC :

- opens both aft transfer valves (the CGCC may initiate an asymmetrical transfer, if fuel asymmetry between INR TKS is > 200 kg (440 lbs)).
- opens the refuel/transfer valve.

AFT transfer rate is about 150 kg/nm (330 lbs/mn). Manual aft transfer is not possible.

c) Forward transfer

Fuel can be transferred forward from trim tank to center tank.
Four types of forward transfer are possible :

1 – Normal forward transfer

To ensure this automatic transfer the CGCC :
- energizes both trim tank pumps
- opens the forward transfer valve

The normal forward transfer rate is about 120 kg/mn (265 lbs/mn).

2 – Fast forward transfer

To ensure the automatic transfer the CGCC :
- energizes both trim tank pumps
- opens the forward transfer valve and the auxiliary forward transfer valve.

The fast forward transfer rate is about 450 kg/mn (990 lbs/mn).

3 – Gravity forward transfer

Gravity forward transfer is possible in case of failure of both trim tank pumps – Gravity forward transfer may also be requested in the TRIM TK SYS FAULT abnormal procedure. In both conditions, the forward transfer valve and the auxiliary forward transfer valve are open but trim tank pumps are not running. The gravity forward rate depends on aircraft pitch attitude and is about :

- 100 kg/mn (220 lbs/mn) in cruise
- 125 kg/mn (275 lbs/mn) in descent

4 – Manual forward transfer

A manual fast forward transfer can be initiated by the crew by selecting TRIM TK MODE p/b to FWD position – in this condition :

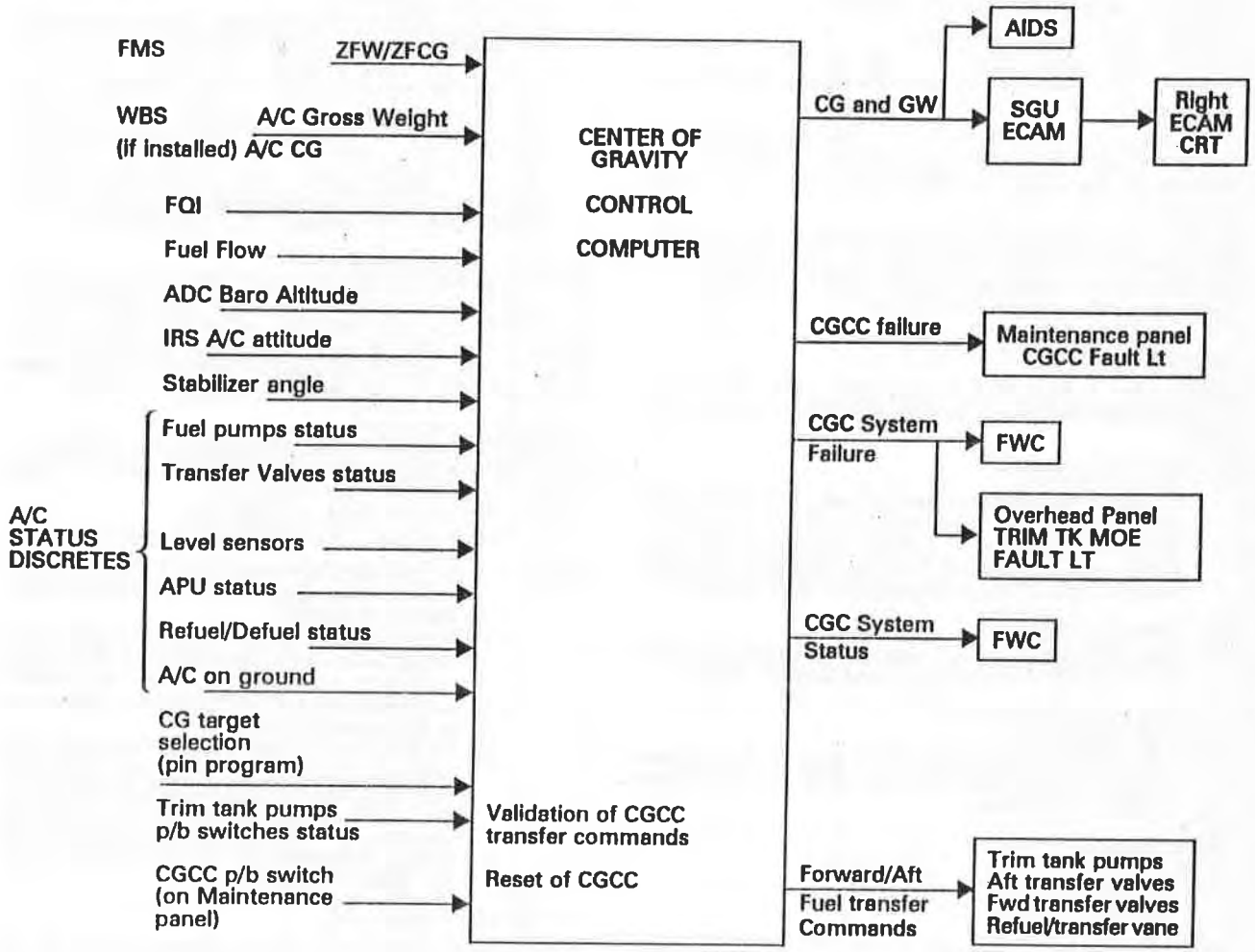
- both trim tank pumps are energized
- the forward transfer valve and the auxiliary forward transfer valve are opened.

Note : This manual forward transfer overrides the CGCC.

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d) System architecture



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3. NORMAL OPERATION

a) CGCC power supply and initialization

CGCC is electrically supplied by :
- 308 PP (DC ESS BUS) or
- 901 PP (DC FILLING BUS) during refuelling if the aircraft is supplied by batteries only.

Normal functioning of the CGCC is initialized by selecting :
- TRIM TK MODE p/b switch to AUTO position and
- At least one TRIM TK PUMP p/b switch to normal position.

If both TRIM TK PUMPS p/b switches are selected OFF, computation of CG is performed by the CGCC but all transfer orders, controlled by the CGCC, are inhibited. There is no CG regulation in flight.

b) Initialization of ZFW/ZFCG

Initialization of ZFW/ZFCG is performed by the CGCC from data received either from the WBS (if installed) or from the FMS.

1 – Data from WBS

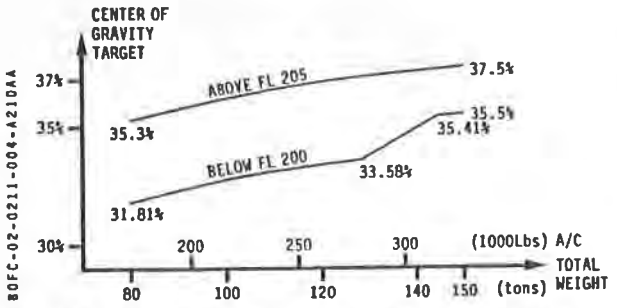
If WBS is installed and operational, the CGCC gives priority (over the FMS data) to the aircraft gross weight and center of gravity data received from WBS – then, using the fuel tank quantities received from FQI, the CGCC computes the ZFW and ZFCG.

2 – Data from FMS

If the WBS data are not available, the CGCC uses the ZFW and ZFCG directly received from the FMS.

The crew has to enter :
- the ZFCG and
- the ZFW or TOGW and block fuel. In the second case, the FMS computes the ZFW and sends this data to the CGCC.

c) CG targets



The CG targets are established taking into account a margin over the certified limits. This margin covers the inaccuracies in the determination of ZFCG.
The CG targets may be shifted forward under three conditions :

1 – By pin – program of the CGCC, it is possible to shift the CG targets by 0.5 %, 1 % or 1.5 %.

2 – In case of degraded accuracy of the fuel quantity indications computed by the FQI, the CGCC shifts the CG targets by 1.5 %.
In this condition a STATUS message is presented on the left ECAM CRT : CG TARGET 1.5 % MORE FWD.

3 – If, after a manual forward transfer (by selection of TRIM TK MODE p/b switch to FWD position) of more than 10 seconds, the CGCC is reset to normal operation (by selecting the TRIM TK MODE p/b switch back to AUTO position), the CGCC shifts the CG targets by 1.5 % for the remaining part of the flight. In this condition a STATUS message is presented on the left ECAM CRT : CG TARGET 1.5 % MODE FWD.

d) Climb below FL 205
As soon as landing gear and slats are retracted, the trim tank isolation valve opens. During climb below FL 205, the CGCC does not regulate to the CG target. It only ensures that the CG target is not exceeded due to fuel consumption. The CGCC initiates a normal forward transfer, when CG target exceedance is imminent.

e) Flight above FL 205
During flight above FL 205, CG regulation is ensured.
The CGCC maintains the CG within 0.5 % forward to the target CG by means of fuel transfer :
- from CTR or INR tanks to TRIM tank,
- from TRIM tank to CTR tank (Normal forward transfer).

Notes : (1) Aft transfer from inner tank is stopped when fuel content of one of the inner tanks is below 500 kg (1100 lbs)

(2) If the CGCC is not able to obtain the aft CG target because the trim tank has reached high level, CG regulation is interrupted and automatically resumed when the CG target is reached due to fuel consumption.

(3) If during CG regulation, the INR tanks become empty but there is still fuel in the TRIM tank, the CG regulation is finished. In this condition the CGCC effects fast forward transfers to maintain the CTR TK fuel quantity between 500 kg (1100 lbs) and 1000 kg (2200 lbs) until the TRIM TK is empty.

f) Descent below FL 200

When crossing FL 200, the CG regulation is stopped. The CGCC initiates a fast forward transfer in order to empty the TRIM tank. Fast forward transfer is stopped if center tank reaches high level of if aircraft center of gravity moves beyond the forward CG limit. As soon as the landing gear is extended, the trim tank isolation valve closes and forward transfer (if not completed) is terminated.

Note : Landing with more than 2000 kg (4400 lbs) in the trim tank is not allowed. If flight has been performed below FL 200, automatic transfer from trim tank to center tank during descent will not take place. In this case it is requested to check trim tank quantity. If trim tank quantity is more than 2000 kg (4400 lbs), a manual forward transfer must be initiated (by selecting TRIM TK MODE p/b switch to FWD position) to transfer fuel from TRIM tank to CTR tank.

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4. ABNORMAL OPERATION ON GROUND

a) Checks during refueling

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

Note : For A/C without mod 6874 (SB 28-2031) when refueling with aircraft supplied by batteries only, some final level calibration sensors are not electrically supplied. Therefore the checks performed by CGCC during refueling are unsuccessful and CGCC goes to Alternate. Reset through maintenance panel (after BITE reading) is possible.

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

FUEL
TRIM TK AFT XFR NOT AVAIL.

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

b) ZFW or ZFCG disagree

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

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

The following information is provided to the crew :

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

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

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c) AFT CG WARNING

In order to cover cases of undetected failure of the CGCC, an aft CG limit monitoring is performed by the FWC taking into account the stabilizer trim position, Mach Number and N1 parameter.

1 – Amber pre-warning « AFT CENTER OF GRAVITY » set at 41 %

Following information is provided to the crew :

- FAULT light on TRIM TK MODE p/b on overhead panel
- MASTER CAUTION light
- Following message on left ECAM CRT
  FUEL
  AFT CENTER OF GRAVITY
  TRIM TK MODE . . . . . FWD
  AFTER 1 MINUTE
  TRIM TK MODE . . . . . AUTO
  associated with the STATUS message
  CG TARGET SHIFTED FWD

Selection of TRIM TK MODE p/b to FWD position during one minute induces a shift of 1.5 % on the CG targets. This warning may be due to inaccuracy in load sheet computation which can be solved by the shift of CG targets and normal operation of the CGCC can be recovered when the system is switched back to AUTO.

This warning only occurs one time during a flight. If the problem is not solved by the shift of CG targets, the monitoring at 41 % is inhibited and only the monitoring at 43 % (EXCESS AFT CG) maintained.

2 – Red warning « EXCESS AFT CG » set at 43 %

Following information is provided to the crew :

- Fault light on TRIM TK MODE p/b on overhead panel
- MASTER WARNING light
- Following messages of left ECAM CRT :
  FUEL
  EXCESS AFT CG
  TRIM TK MODE . . . . . FWD
  TRIM TK PUMP 1 . . . . . ON
  TRIM TK PUMP 2 . . . . . ON
  } if not already on
  associated with the STATUS message :
  AUTO TRIM TK SYS INOP
  FUEL MAN FWD XFR ONLY

In this condition all the fuel is transferred from trim tank to center tank and the CG regulation is terminated.

d) TRIM TK isolation valve NOT OPEN

TRIM TK isolation valve opens automatically as soon as the landing gear and slats are retracted. In case the valve fails to open the following information is provided to the crew :

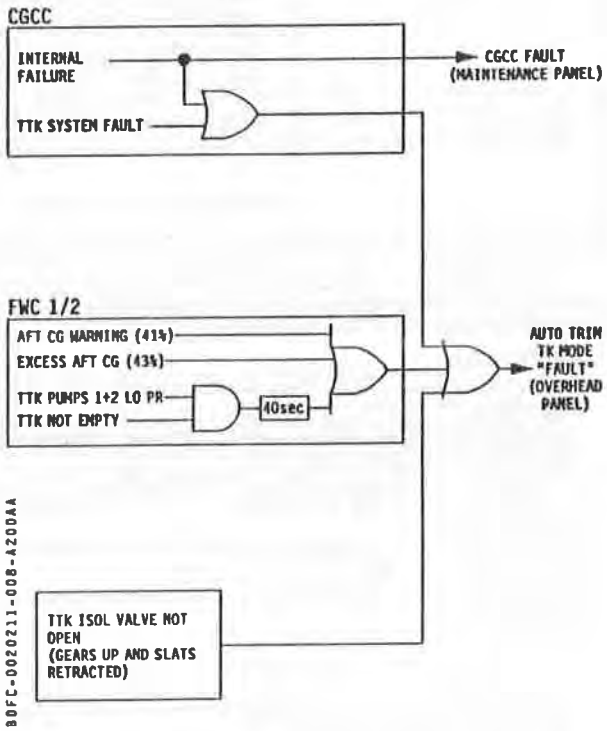
- Fault light on TRIM TK MODE p/b on overhead panel
- MASTER caution light
- Following message on left ECAM CTR
  TRIM TK ISOL VALVE NOT OPEN

e) TRIM TK PUMPS 1 + 2 LOW PRESSURE

During a forward transfer if both TRIM TK pumps are LOW PRESSURE for more than 40 sec with TRIM TK not empty, the following information is provided to the crew via the FWC.

- FAULT light on TRIM TK mode p/b on overhead panel
- MASTER CAUTION light
- Following message on left ECAM CRT :
  TRIM TK PUMP 1 LO PR . . . . . OFF
  TRIM TK PUMP 2 LO PR . . . . . OFF
  associated with the status message :
  FUEL GRAVITY FWD XFR ONLY.

f) SUMMARY OF FAULT LIGHTS CONTROLS



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ECAM MESSAGES CONCERNING TRIM TK OPERATION

MESSAGE	CONSEQUENCE/ACTION	PROBLEM AREA
ON GROUND STATUS CG TARGET SHIFTED FWD	NONE	Degraded accuracy of FQI
TRIM TK AFT XFR NOT AVAIL STATUS AUTO FWD XFR ONLY	CGCC in ALTERNATE Mode. Request CGCC reset. If unsuccessful : Dispatch with fuel in TRIM TK possible. Refer to MMEL.	FQI/CGCC monitor discrepancy during refueling
ZFW OR ZFCG DISAGREE PROC : TRIM TK SYS INIT STATUS PROC : TRIM TK SYS INIT	Check FMS entry and load sheet TOGW and TOCG. Decide use of TRIM TK system depending on delta within tolerances or not. Message inhibited upon slats retraction.	Crosstalk FMS/CGCC
IN FLIGHT STATUS CG TARGET SHIFTED FWD	NONE	Degraded accuracy of FQI T TK MODE p.b selected FWD more than 10 s (e.g. in case of AFT CENTER OF GRAVITY)
TRIM TK AFT XFR NOT AVAIL STATUS AUTO FWD XFR ONLY	CGCC in ALTERNATE Mode. TRIM TK fuel is automatically transferred FWD. Logic prevents overfilling of CTR TK. XFR rate is normal forward transfer after Type 1 failure. Fast forward transfer after Type 2 failure. NO CREW ACTION REQUIRED	Type 1 failures : peripheral malfunctions Type 2 failures : malfunction within TK system
TRIM TK SYS FAULT PROC : TRIM TK SYS FAULT STATUS PROC : TRIM TK SYS FAULT AUTO TRIM TK SYS INOP FUEL FWD XFR ONLY	All automatic transfers inhibited (FWD and AFT). Apply procedure to manually transfer TRIM TK fuel forward. Spillage may occur when CTR TK is overfilled.	CGCC, FQI, XFR system malfunctions. No initial ZFW or ZFCG values after T/O CG reaches 0.3 % aft to target CG. Inadvertent AFT or FWD XFR. No FWD XFR when commanded. Manual operation during ALTERNATE mode.

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ECAM MESSAGES CONCERNING TRIM TK OPERATION

MESSAGE	CONSEQUENCE/ACTION	PROBLEM AREA
IN FLIGHT AFT CENTER OF GRAVITY . TRIM TK MODE . . . . . FWD AFTER 1 MIN . TRIM TK MODE . . . . . AUTO STATUS CG TARGET SHIFTED FWD	Automatic CG regulation is continued with shifted CG target. No further crew action. Further monitoring of 41 % CG is inhibited monitoring of 43 % AFT CG (EXCESS AFT CG) is maintained.	Possible inaccuracy in load sheed calculation.
EXCESS AFT CG . TRIM TK MODE . . . . . FWD . TRIM TK PUMP 1 . . . . . ON . TRIM TK PUMP 2 . . . . . ON STATUS AUTO TRIM TK SYS INOP FUEL GRAVITY FWD XFR ONLY	All TRIM TK fuel is transferred to CTR TK. CG regulation is no longer active.	Severe error of ZFCG/TOCG computation in load and trim sheet. Error of loading. Severe error when entering ZFCG/TOCG into FMS. CG target shift of 1.5 % more FWD at AFT CENTER OF GRAVITY warning was not sufficient for error compensation.
TRIM TK PUMP 1 LO PR . . . . . OFF TRIM TK PUMP 2 LO PR . . . . . OFF – TRIM TK MODE . . . . . FWD STATUS AUTO TRIM TK SYS INOP FUEL GRAVITY FWD XFR ONLY	TRIM TK fuel is transferred FWD by gravity, rate not exceeding engine fuel burn. CG regulation is no longer active. No further crew action required.	TRIM TK PUMP failure. ECAM message appears 40 sec after low pump pressure occurs, while pump operation for forward XFR is commanded.
TRIM TK EMPTY – TRIM TK PUMP 1 LO PR . . . . . OFF – TRIM TK PUMP 2 LO PR . . . . . OFF STATUS AUTO TRIM TK SYS INOP	No further crew action required.	Failure of CGCC logic to command TRIM TK PUMPS to stop after forward XFR, after 3 min with low level sensor dry and fuel qty below 200 kg (440 lbs). T TK low level sensor may have failed wet. ECAM message appears 5 min after first pump low pressure occurs.
TRIM TK ISOL VALVE NOT OPEN (TRIM TK empty) STATUS AUTO TRIM TK SYS INOP (TRIM TK not empty) PROC : TRIM TK SYS FAULT STATUS PROC : TRIM TK SYS FAULT AUTO TRIM SYS INOP FUEL MAN FWD XFR ONLY If ISOL VALVE remains closed after FWD selections : PROC : TRIM TK FUEL UNUSABLE STATUS PROC : TRIM TK FUEL UNUSABLE AUTO TRIM TK SYS INOP	CG regulation is not possible If TRIM TK is not empty, fuel is transferred forward by application of procedure. If TRIM TK ISOL VALVE remains closed after TRIM TK MODE has been selected to FWD, fuel in TRIM TK is trapped. Apply procedure to prevent exceedance of CG limits for flight and landing.	Failure in ISOL VALVE logic (SLATS/LDG GEAR position signals). ISOL VALVE, loss of electrical supply to valve motor ; mechanical jam.

Mod. : 4801 + 7259

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OPERATIONS IN ICING CONDITIONS

1 – ICING CONDITIONS

Icing conditions may be expected when the OAT or the TAT is below 8° C and there is visible moisture in the air (such as clouds, fog with low visibility, rain, snow, sleet, ice cristals) or standing water, slush, ice or snow is present on the taxiways or runways.

At temperatures below – 20° C icing conditions encountered should be less severe.

In addition to the above conditions be alert by ice buildup on unheated portions of the airplane visible from the cockpit.

2 – PROCEDURES

CAUTION

Extended flight in icing conditions with slats extended should be avoided.

2.1. ENGINE ANTI-ICE

When icing conditions are encountered, detected either visually or by ice detection system (if installed) the engine anti-ice system must be selected ON during all ground and flight operations.

WARNING : USE THE CRITERIA OF TEMPERATURE AND VISIBLE MOISTURE AS THE PRIMARY MEANS FOR SELECTING ON THE ANTI ICE SYSTEM WITHOUT WAITING FOR ICE BUILD UP.

If the engine is at ground idle when engine anti-ice is selected during descent, it will advance to flight idle.

R Ignition must be set to CONT.RELIGHT before selecting ENG ANTI ICE ON.
After engine parameters have stabilized, it may be set to OFF.

WARNING : If inlet ice is suspected to have formed prior to turning on the anti-ice system, throttles should be retarded individually to Idle, the ignition set to CONT RELIGHT and anti-icing heat applied before reestablishing normal thrust. Reducing the RPM will minimize the danger of internal damage to the engine as ice which has already formed breaks loose and is ingested. Activating CONT RELIGHT should preclude the possibility of engine flameout due to ice ingestion.

Notes : 1. Electrical power supply failure will cause the nacelle valve to open when air pressure is available, independantly of control switch position.

2. Unnecessary use of the engine anti-ice system should be avoided as performance is adversely affected.

3. Ground operation at minimum idle in icing conditions is permissible for a period not exceeding 30 minutes before any special engine operation for shedding accumulated ice is needed. If the condition exceeds 30 minutes, the engine should be accelerated to an N1 of 60% for a period of 30 seconds.

2.2. WING ANTI-ICE

- Wing anti-ice supply should be selected ON whenever icing conditions exist.
- Wing anti-ice supply by the APU is possible up to 20000 ft.
- In case of suspected significant ice accumulation on non de-iced parts, increase the minimum approach speed by 5 kt and multiply landing distance by 1.1.

Notes : 1. Electrical power supply failure will cause the valve to close, independantly of control selector position.

2. N1 LIMIT corrections and performance penalties are applicable only when supplied by engine bleed air.

2.3 USE OF ICE DETECTION SYSTEM (IF INSTALLED)

Ice detection system does not anticipate ice conditions and therefore it should be considered as a back up for detecting icing conditions. The use of ice detection system leads to DE-ICE and not to ANTI ICE protection.
As engine anti-ice has been certified as an anti-ice protection, the criteria of temperature and visible moisture must be used as the primary means for selecting ENGINE ANTI-ICE without waiting for illumination of « ICE » light on the overhead panel.
Wing anti-ice protection has been certified as a DE-ICING system, and therefore the selection of WING ANTI-ICE system can be based on illumination of « ICE » light on overhead panel.

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WIPERS AND RAIN REPELLENT

WIPERS

The wipers may be selected to SLOW, FAST or OFF. When selected to OFF the wipers will automatically park.

Notes : 1. The WIPERS must not be operated on a dry windshield.
2. The WIPER on CM1 side must be serviceable when landing in CAT III weather conditions.

LIMITATION : MAX OPERATING SPEED 230 kt IAS

RAIN REPELLENT

When a pb is pressed, a timer applies a measured quantity of rain repellent fluid to the windshield. To repeat the cycle the pb must be released and pressed again.

- The Rain Repellent system performances,
  - are diminished by the simultaneous operation of the windshield wipers
  - are better at higher holding speeds than at slow approach speeds.

Notes : 1. It should not be used on a dry or semi dry windscreen as the fluid will congeal and impare visibility. As a precautionary measure, the rain repellent should be applied only to one windshield at a time, preferably the CM2 first.
2. The RAIN REPELLENT on CM1 side must be serviceable when landing in CAT III weather conditions.

R R
ICE ACCRETION ON UPPER WING SURFACE LIMITED AT OUTER TANKS SURFACE

It may happen that following prolonged flight and passing through moisture during descent, an ice accretion appears on the upper surface of wing limited on the outer tanks surface.

If noticed during the flight, it is recommended to burn fuel from the outer tanks up to 1500 kg per tank if possible. In this case reduce the VMO by 5 kt.

If noticed during the turn around, and if it is not possible to de-ice the surface before the next take off, the following procedure should be followed :

- Do not exceed a maximum thickness of 3 mm.
- Apply a penalty of 1 ton to take-off weight.
- Consider an increase of 1 per cent in fuel consumption.
- Before descent use 1500 kg of fuel from each outer tank and reduce VMO by 5 kt. This will allow an increase in temperature of the tank skin during the next refuelling.

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TIRES – GENERAL OPERATING PROCEDURES

1. GENERAL

An in-service surveillance of the tires, including pressure and wear checks, is strongly recommended to increase tire longevity and reliability. Avoid short turn manoeuvers which can cause bead separation from the wheel flanges, resulting in partial or complete loss of tire pressure. Large radius turns at low speed help prevent tire shoulder scrubbing and overdeflection.

2. APPROVED TIRES

Identification and characteristics of approved tires for nose and main landing gears are given in SB 32.2006. It is recommended to avoid mixing of tire types because diameters may be slightly different. However it is possible, for a flight or a series of flights, to replace one or several tires of different type provided these tires are approved for the type of aircraft and its associated weight.

Note : The aircraft ground speed limit as mentioned in chapter limitations must not be exceeded even though the speed limit of the tires is higher.

3. PRESSURE CHECK

Tire pressure must be checked and corrected whenever possible only when the tires are cold (ambient temperature).

R R R R R *Note : Tire Pressure Indicating System (TPIS) can be used (when installed) for pressure check provided that the pressure values given by the TPIS are compared, once a week, to the pressure values given by a pressure gage.*

Do not inflate tires when temperatures are below 0 C, since humidity introduced in the valve may change to ice and result in leakage.

(A). Pressure check before first flight of the day. Record pressure of the 10 tires and comply with directives specified in the following table.

(B). Pressure check at route station. Visually check that the forward tires and the aft tires on each boggie exhibit the same deflection (flatness).
If one tire or both forward or both aft tires exhibit abnormal deflection verify the pressure of all other tires in the same position (forward or aft). If all pressures are the same, no further action is necessary. If the suspected tires pressure is low, increase the pressure to correspond to the other tires checked.
If a suspected tire has already been noted in the aircraft documents it must be changed. Replace adjacent tire if necessary. (Refer to pressure table).

Note : In practice, during aircraft line stop, when the tires are hot it is normal that the pressure reading be appreciably higher than with a cold tire : UNDER NO CIRCUMSTANCES DEFLATE A HOT TIRE.

CAUTION : Inflate tires exclusively with nitrogen. A slight topping up with air is allowed for return to home base.

4. CRITERIA FOR TIRE WEAR AND UTILIZATION LIMITS

Main and nose gear wheel tires whenever the three center tread grooves are worn away even in local areas. So as to reduce the possibility of skidding or aquaplaning utilization life must be restricted so as to maintain some wearable tread pattern at all times around 2 mm (0.08 in). On tires intended for retreading there must be approximately 4 mm (0.16 in) thickness of cushion rubber.

IN SERVICE MONITORING OF TIRE PRESSURE

POSITION OF PRESSURE P RECORDED ON A/C VERSUS NOMINAL PRESSURE : PN	ACTION TO BE TAKEN	Max ramp weight = 153.9 T		
		NLG 40 x 14 PN : 11.3 bars 163 PSI	MLG 46 x 16 PN : 14.6 bars 212 PSI	MLG 49 x 17 PN : 12.1 bars 175 PSI
PN + 0.6 bar < P	Restore to max of NORMAL OPERATING RANGE if tire is to ambient temperature and recorded pressure confirmed by another pressure gage.	Above 11.9 bar 172 PSI	Above 15.2 bar 221 PSI	Above 12.7 bar 184 PSI
PN < P < PN + 0.6	*NORMAL OPERATING RANGE :* (N.O.R.) No action if within N.O.R. during check or initial inflation. Inflate to max of N.O.R.	11.3 to 11.9 bar 163 to 172 PSI	14.6 to 15.2 bar 212 to 221 PSI	12.1 to 12.7 bar 175 to 184 PSI
95 % PN < P < PN	Inflate to max of N.O.R.	10.7 to 11.3 bar 155 to 163 PSI	13.9 to 14.6 bar 201 to 212 PSI	11.5 to 12.1 bar 166 to 175 PSI
90 % PN < P < 95 % PN	Inflate to max of N.O.R. Check within 24 hours. If pressure down replace wheel and report on record card.	10.2 to 10.7 bar 147 to 155 PSI	13.1 to 13.9 bar 191 to 201 PSI	10.9 to 11.5 bar 157 to 166 PSI
80 % PN < P < 90 % PN	Replace wheel.	9.0 to 10.2 bar 130 to 147 PSI	11.7 to 13.1 bar 170 to 191 PSI	9.7 to 10.9 bar 140 to 157 PSI
0 < P < 80 % PN	Replace the wheel and adjacent wheel.	0 to 9.0 bar 0 to 130 PSI	0 to 11.7 bar 0 to 170 PSI	0 to 9.7 bar 0 to 140 PSI

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CARBON BRAKES WEAR

- Steel-brakes are such that wear is directly proportional to the energy applied. In other words, the strongest the brake demand, the greatest the wear.
  This no longer applies with Carbon-brakes where more complex phenomenons (such as temperature) interface. One of them must be underlined due to its great contribution to brakes-wear :
  - Numerous tests have shown that around 50 % of the carbon-brakes wear appears when taxiing before take off with coldbrakes. What must be kept in mind is that cold carbon-brakes are very touchy to numerous solicitations. Wear is proportional to the number of brake applications and not to the energy applied.
- That is why, and despite the obvious lack of procedure as far as braking is concerned, it is worth recalling that when taxiing before takeoff, brake should not be solicited too often. Needless to add that nosewheel steering must be done with the appropriate cockpit command and not through brake pedals.

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UTILIZATION OF THE AUTOBRAKE SYSTEM

1. GENERAL

The autobrake system permits to maintain a constant deceleration rate during landing roll or to apply maximum braking to cover the case of an aborted takeoff.

Main advantages given by the autobrake system are :

- Reduction of pilot action during landing.
- Obtention of optimized deceleration rate fonction of runway length available.
- Smooth deceleration during landing roll.
- Performance improvement at takeoff due to the reduction of the delay of brake application in case of aborted takeoff.
- Brakes and tyre saving : the brakes only supply the torques necessary to maintain the selected deceleration.

2. OPERATION

The system is initiated by ground spoilers extension order (at throttles reduction if ground spoilers are armed). The pilot can take over at any moment by depressing one or both brake pedals (with different load threshold). Autobrake system is operative with GREEN hydraulic braking system only.
Selection of the deceleration rate is by the autobrake panel.

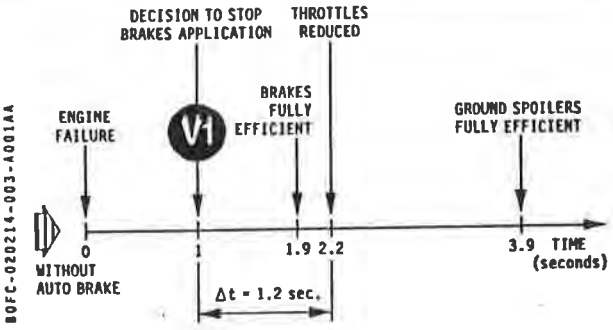
MODE	DECELERATION RATE	TIME DELAY
MAX	Max pressure is applied	none
MED	3.0 m/s²	none
LO	1.7 m/s²	8 sec.

- BEFORE TAKEOFF

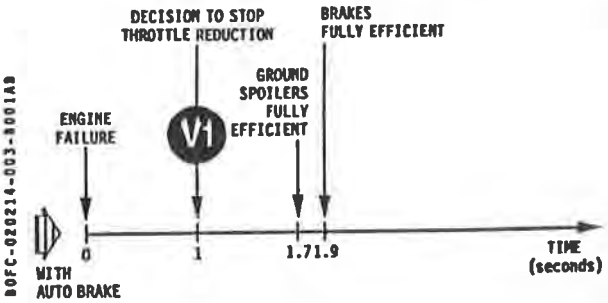
Selection of MAX mode before takeoff will improve safety in the event of an aborted takeoff.

When takeoff must be aborted, the autobrake system will apply the maximum braking as soon as the throttles are closed which represents a single action done without delay (refer to graph below).

SEQUENCE OF EVENTS IN CASE OF ABORTED TAKEOFF



Note : Δt = 1.2 s : this time splits up into
– 1 second delay to comply with FAA requirement
– 0.2 second delay which represents the time to reduce the throttles.



- BEFORE LANDING

When landing on short runway or when operating in low visibility weather conditions the autobraking system will help the pilot. It permits also a straight roll out and optimized landing distances on contaminated runway (see 2.15.30).
However on a normal dry runway we feel that the use of the autobrake is not necessary. In order to save brakes we recommend the use of reverses and below 70 kt the brakes as necessary according to the remaining distance.

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FLIGHT INSTRUMENTS : INDICATIONS AND TOLERANCES

A. Altimeters tolerances :

- ALT 1 or ALT 2 at ground check . . . . . ± 30 ft
- STBY ALT at ground check . . . . . ± 50 ft
- Maximum differences between altimeters :

FL	ALT 1 and ALT 2	STBY ALT to any ALT 1 or ALT 2
at ground check	50 ft	70 ft
FL 50	55 ft	100 ft
FL 100	65 ft	140 ft
FL 200	90 ft	210 ft
FL 300	125 ft	275 ft
FL 400	175 ft	330 ft

B. ASI tolerances

- Maximum differences between ASI :

IAS/Mach	PFD 1 and PFD 2	STBY ASI to any PFD 1 or PFD 2
IAS (130 to 360 kt)	4 kt	8 kt
Mach (0.4 to 0.5)	0.02	–
Mach (0.5 to 0.84)	0.01	–

C. Heading tolerances

- Maximum differences between ND magnetic heading indications . . . . . 4°

NAV-IRS . ATT mode

- **ATT mode should be used in case of :**
  - Temporary lost of electrical supply
  - Partial failure within the IRS (indicated by « IRS WARN » amber annunciator)
- **Following procedure should be applied :**
  - Related MSU mode rot. selector . . . . . ATT
  - Indicated headings . . . . . Check
  - **If heading appears incorrect :**
    - ISDU SYS rot. selector . . . . . select related SYS

With wings level :

- ISDU DSPL rot selector . . . . . HDG STS
- Enter 4 digits for magnetic heading (in degrees and tenths of degrees) on the ISDU keyboard with reference to another IRS in NAV mode, or STD BY compass if there is not IRS in NAV mode.
- Press ENTER

LOSS OF ONE OR BOTH FMS

A. GENERAL

In most cases, when one or both FMS are lost, navigation can be conducted with the remaining FMS (if available) and/or with conventional radionavigation (VOR, ADF, ILS MARKERS, DME). This section intends to give instruction to the crew when no radio navigation fix can be captured.

B. LOSS OF ONE FMS

The flight will be conducted with the remaining FMS. Carefully check that navigation is properly conducted. In case of noticeable differences between waypoints overflown and scheduled one, disregard the FMS informations and apply the procedure recommended in case of loss of both FMS.

C. LOSS OF BOTH FMS

VOR-NAV-ILS switch . . . . . VOR

- If the aircraft is heading straight towards a VOR :

On VOR/DME panel :

VOR frequency . . . . . SET
COURSE . . . . . SET

Even if the aircraft is too far away from the VOR to capture it, this procedure allows to get FPV on PFD and to conduct the flight by maintaining the « bird » in the « cage » up to VOR reception.

- If the aircraft route includes one or several turns before heading straight towards a VOR :

VOR/DME panel :

COURSE . . . . . SET PRESENT ROUTE

Present route will be followed by maintaining the « bird » in the « cage ».

At each turning point, set the precalculated route value as course on VOR/DME panel up to the last turning point where the VOR frequency and the course to follow will be selected.

Note : 1. It will be verified that navigation is properly conducted by checking the geographic position displayed on ISDU.

Note : 2. AP modes can be used.
MAP display cannot be used. ARC or ROSE displays must be used.

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LOSS OF PFD OR ND

- Loss of PFD

  PFD information can be recovered on lower CRT (replacing ND information) either by use of CAPT (or F/O) PFD/ND XFR pushbutton switch or by switching OFF failed PFD through PFD brightness knob.

- Loss of ND

  ND information can be recovered on upper CRT (replacing PFD information) by use of CAPT (or F/O) PFD/ND XFR pushbutton.

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ENGINE START WITH EXTERNAL PNEUMATIC POWER

PROCEDURE

• **BEFORE START :**

ENG BLEED VALVES . . . . . OFF

X FEED . . . . . MAN/IN LINE

Closure of both engines bleed valves eliminates reverse flow leakage.

• **CLEARED TO START :**

Since there is no absolute minimum start pressure limit one should expect extended time to idle and higher EGT peaks if start pressure is too low

Two external pneumatic power units may be used in parallel if the pressure/ flow relation is expected to be marginal.

R – Proceed as for normal engine start procedure.

R • **AFTER 1 ST ENGINE START**

R **CROSSBLEED ENGINE START IS CONSIDERED**
R – Request removal of external pneumatic power unit(s)
R – Apply CROSSBLEED ENGINE START procedure as described further in this chapter.

R **BOTH ENGINES ARE STARTED ON EXTERNAL PNEUMATIC POWER**
R – Proceed as for normal engine start procedure
R – After engine 1/2 start :
R – Request removal of external pneumatic power unit(s)
R – X-FEED . . . . . AUTO/X-LINE
R – ENG 1 and 2 BLEED VALVE . . . . . AUTO

ENG START WITH BAT POWER

PROCEDURE :

• **BEFORE START :**

GEN 1 . . . . . ON

• **CLEARED TO START :**

APU BLEED . . . . . ON

IGNITION . . . . . START B

• **ENG 1 START :**

ENG 1 START button . . . . . DEPRESS and HOLD

Note : Confirm starter motor operation by taking reference to the control column movement.

Start clock.

Announce « 15 SECONDS » when elapsed.

Note : 15 seconds represents the minimum for fuel lever on.

ENG 1 FUEL LEVER . . . . . ON

CAUTION

An EGT rise may occur resulting in an over-temperature.

– **When GEN 1 FAULT light extinguishes :**

ENG 1 START button . . . . . RELEASE

• **AFTER ENG 1 START :**

Complete the cockpit preparation.

Note : Expect 10 mn for IRS alignment.

ENG 2 . . . . . START

CROSSBLEED ENGINE START

PROCEDURE

CAUTION

Use of engine bleed supply and external pneumatic power supply simultaneously is prohibited.

• **BEFORE START :**

APU BLEED . . . . . CHECK OFF

BLEED VALVE (receiving engine) . . . . . OFF

X-FEED . . . . . MAN/IN LINE

BLEED VALVE (supplying engine) . . . . . AUTO

• **CLEARED TO START :**

– Continue the normal engine start procedure

Note : Throttle of the supplying engine may be advanced to increase air bleed pressure up to 40 psi if required.

• **AFTER ENGINE START :**

X-FEED . . . . . AUTO/X-LINE

BLEED VALVE (receiving engine) . . . . . AUTO

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ENGINE VIBRATION

Monitoring

Actual or impending engine problems may be detected by use of vibration monitoring. Since vibration levels are different for each engine, a single reading is not very meaningful, except if a sudden significant increase is encountered. Vibration trend values are more important provided the readings are taken in comparable, stabilized engine conditions.

Indicated vibration levels (N1 and N2) under stabilized cruise conditions should be recorded at least once a day.

High Vibration Level

The VIB ADVISORY on ECAM (N1 above 3 units, N2 above 5 units) constitutes only a guideline to induce the flight crew to closer parameters monitoring and crosscheck.

As guidelines for high vibration, the following levels are valid after engine thermal stabilization (4 minutes). During power changes, transients, or while at Takeoff power settings, VIB indications may normally exceed these values. These guidelines may be used in flight operations at the operators discretion.

N1 VIB INDICATION

Above 3.0 units	High vibration, monitor engine parameters
Above 5.0 units	Retard throttle lever to reduce VIB below 5.0 units. If unsuccessful, consider engine shutdown.

N2 VIB INDICATION

Above 5.0 units	High vibration, monitor engine parameters
Above 7.5 units	Retard throttle lever to reduce VIB below 7.5 units. If unsuccessful, consider engine shutdown.

Validation

High VIB level indications should be considered valid at all times, unless there is a known VIB system fault. Additionally :

- High N1 vibration may be perceptible on the throttle levers and/or aircraft structure. Abnormal engine noise (rumble) may occur.
- High N2 vibration may be accompanied by changes in other engine parameters (e.g. EGT, N1/N2 relationship, OIL PRESS, OIL TEMP, OIL QUANTITY, and/or NACELLE TEMP).

Any abnormal VIB indication should be recorded for maintenance action.

Sudden Increase during Takeoff or Climb

Higher N1 VIB levels with takeoff or climb thrust settings may be experienced since N1 rotor imbalance will increase as engine speed increases. High N2 VIB indications are usually more apparent during low engine speed operation (ground/flight idle).

VIB transients up to one unit, can be considered normal during high thrust operation prior to thermal stabilization (4 minutes) and during power changes.

However, if a sudden significant increase (over 1 unit) in VIB indication occurs :

- Check VIB indication and other engine parameters, as soon as circumstances permit.
  - If NOT accompanied by changing engine parameters, noise, and/or airframe vibration :

    Adjust throttle lever to maintain N1 VIB below 5 units and N2 VIB below 7.5 units and continue engine operation without exceeding that thrust setting, flight conditions permitting.
  - If accompanied by changing engine parameters, noise, and/or airframe vibration :

    Consider engine shutdown, flight conditions permitting.

Sudden Increase during Cruise

If a sudden increase in vibration in excess of one unit is encountered during stabilized cruise setting :

- Closely monitor engine parameters for abnormal indications.
  - If NOT accompanied by changing engine parameters, noise, and/or airframe vibration :

    Adjust throttle lever to maintain N1 VIB below 5 units and N2 VIB below 7.5 units and continue engine operation without exceeding that thrust setting, flight conditions permitting.
  - If accompanied by changing engine parameters, noise, and/or airframe vibration :

    Consider engine shutdown, flight conditions permitting.

Increase during Descent

If a significant increase in vibration is encountered when thrust is reduced to IDLE :

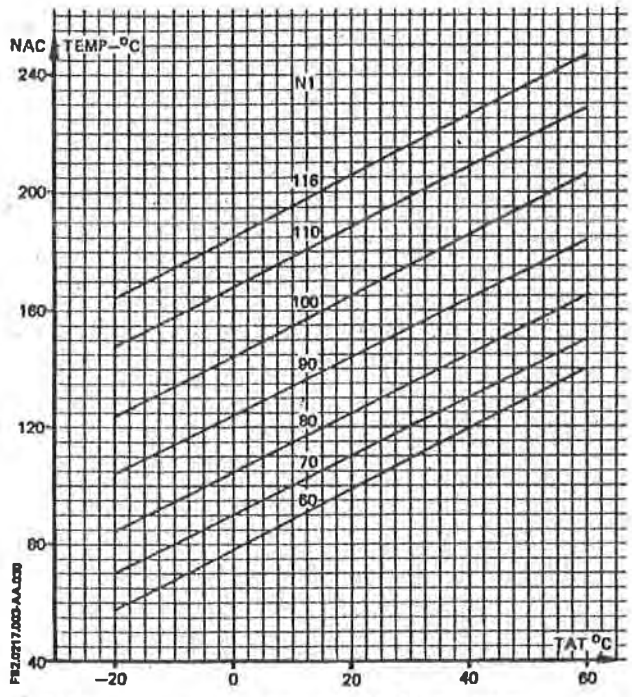
- Advancing throttle levers may reduce N2 vibration level.

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ENGINE « NACELLE TEMP » MONITORING

- Nacelle temperature characteristics will differ between engines as function of « ON-WING » time ; indicated temperature will be highest for high power setting and vary with TAT.
- Nacelle temperature indications not recorded under either of the following conditions should be disregarded :
  (a) Ground operation : N1 above 60 % for at least 3 minutes
  (b) Flight operation : Climb power set for at least 3 minutes
- Indications that significantly exceed the typical nacelle temperatures, shown in the table below, are cause for the engine and its airbleed parameters to be monitored more closely and are subject to maintenance investigation.

TYPICAL NACELLE TEMP REFERENCE



- ADV is displayed on right ECAM, NAC TEMP on ENG page flashes green when :
  NAC TEMP exceeds 200° (A3 engines)
  NAC TEMP exceeds 185° + TAT (C2 engines)
  or
  NAC HEAT ≥ 55 % (with Mod. 3504 embodied)

USE OF CONTINUOUS RELIGHT R

During normal operation under the following conditions the ENG START selector must be set to CONT RELIGHT as precautionary measure to ascertain combustion stability :

- Before Take-off
- In flight
  Severe turbulence, heavy rain, before selection of engine anti-ice ON (may be switched OFF, when engine parameters have stabilized with anti-ice ON).
- Before landing

GE Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES USE OF « SPERRY » FMS 0 – GENERAL	2.02.19 PAGE 1 REV 18 SEQ 110

A. PRELIMINARY NOTE

In this sub-chapter 2-02-19, use of FMS (Data entry, F-PLN revisions, etc...) and also actions necessary for coupling to the AFS (PROFILE and NAV modes engagement, etc...) will be described.
Other AFS modes are described in the « USE of AFS » sub-chapter.

A flight from TOULOUSE (LFBO) to ATHENS (LGAT) with THESALONIKI (LGTS) as alternate is taken as example.

R REMINDER : The database must be loaded and updated
R to render the system operational.
R The depicted examples may only be reproduced with a
R database containing the same data as that used for the
R examples.
R Finally it is recalled that the airline is solely responsible for
R the definition, acquisition, updating, loading and use of its
R own database.

B. INTRODUCTION

The FMS includes two computers (the FMC's) and two Control Display Units (the CDU's). The CDU's allow dialogue between the crew and the FMC's via a screen and an alphanumeric keyboard.

The FMS shall normally be coupled to the AFS (through PROFILE and NAV modes) throughout the whole flight.

When this coupling is active, VERTICAL navigation via PROFILE mode and HORIZONTAL navigation via NAV mode is fully controlled by the FMS which sends its commands to the AFS.

NAV mode can be engaged from 30 ft (at TAKE OFF) to LOC capture (case of an ILS approach) or to a minimum authorized altitude (case of a FMS approach).

PROFILE mode can be engaged from THRUST REDUCTION ALTITUDE (value stored into the FMC data base or 1500 ft AGL by default) to GLIDE capture (case of an ILS approach) or to a minimum authorized altitude (case of a FMS approach).

C. MAIN RULES OF USE

(1) Each FMS function is performed on a specific PAGE displayed on the CDU screen. There are several pages each one grouping information and sub-functions unique to that page.

(2) A page is called on the CDU screen by pressing a function key, a line select key (in certain cases) or the « NEXT PAGE » key (when several pages are simultaneously called by one key).

(3) Two different pages can be selected on the two CDU's.

(4) Data entry into the FMS can be made on either of the CDU's. It will be taken into account by both FMC's.

(5) Any data entry must be checked. Any F-PLN revision must be checked on F-PLN page B by using COURSE and DISTANCE.

(6) Insertion of data on a page (in a data field) is always done via the SCRATCHPAD.

(7) When the SCRATCHPAD is cleared on one side, this does not clear the SCRATCHPAD on the other side (even if, for example, the same message is displayed).

(8) PROFILE and NAV modes are engaged or disengaged, as any other AFS mode, by means of pushbuttons located on the FCU.

(9) When PROFILE is active, a level cannot be left without at least two positive actions of the crew :
- turning ALT knob to select a new level
- pulling this knob to initiate the level change.

(10) In certain cases (e.g. pilot action not accepted, a MESSAGE is displayed in the SCRATCHPAD).

D. TASK SHARING

– AP in CMD : PF makes the REVISIONS.
– AP NOT in CMD : PNF makes the REVISIONS.

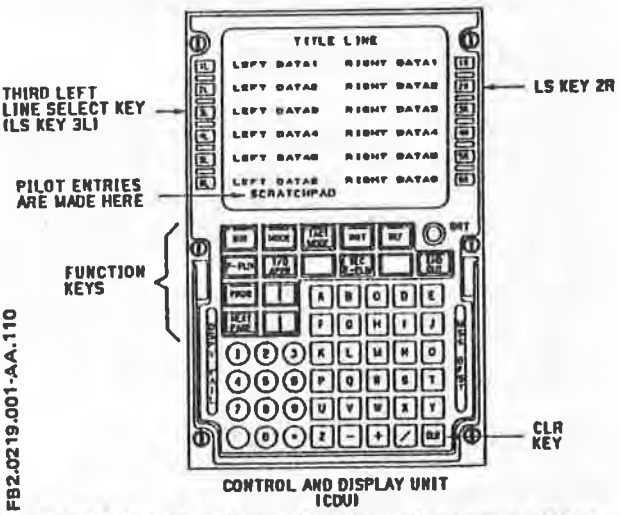
E. SPECIFIC VOCABULARY

WRITE/INSERT = BASIC PILOT DATA ENTRY PROCEDURE

WRITE = TO TYPE A TEXT ON THE KEYBOARD. THIS TEXT IS DISPLAYED IN SCRATCHPAD.

INSERT = TO TRANSFER THIS TEXT FROM THE SCRATCHPAD TO A DATA FIELD (AND SO TO FMC'S) by pressing the LS key adjacent to this DATA FIELD.

F. CDU ARCHITECTURE



In the following procedures, the place where crew actions are to be performed on the CDU screen will be preceded by the name of the concerned datafield followed by the side and the line number.

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SID AND STAR

NAV should not be used to fly a SID or STAR which has been manually built. Furthermore, it is not recommended to built a SID/STAR manually. SID's and STAR's use specific legs such as DME arcs, VOR radial interceptions, conditional altitude legs which cannot be manually constructed. Only DIRECT TO legs may be manually constructed. Therefore if NAV is engaged to fly a SID or a STAR manually constructed, the A/C will be controlled on direct to legs instead of the legs to be flown.

LEAVING THE LATERAL FLIGHT PLAN

It is not recommended to keep PROFILE if NAV is disengaged to leave the lateral F. PLN, especially during climb, approach and go-around. This is because altitude constraints, generally linked to waypoints, will be matched in the corresponding leg even if these waypoints are not overflown.

ALTITUDE CONSTRAINTS

Altitude constraints are coded in the DATABASE and linked to waypoints only. They are provided for advisory and for an optimal flight path construction only. THERE ARE NO MINIMUM EN ROUTE ALTITUDE AND NO SAFE ALTITUDE CODES IN THE DATABASE. THEY REMAIN PILOT RESPONSIBILITY.
On ground, raising the FCU altitude above the altitude constraints has no effect on them. When the A/C is airborne in Descent phase and FCU altitude is lowered below the altitude constraints, they remain valid. When the A/C is airborne in Climb phase and FCU altitude is raised above the altitude constraints, they are canceled and replaced by altitude predictions on the CDU.

F-PLN DISCONTINUITIES

Always check that there are no forecoming discontinuities in the F-PLN. AP disengages as soon as A/C enters a discontinuity. Especially for go-around, NAV and PROF should not be reengaged without a F-PLN checking. A special case is made for a discontinuity following a manual terminated leg. This discontinuity can be cleared only by making a DIRECT TO any WAYPOINT following the leg.
Before performing a F-PLN lateral revision causing a F-PLN DISCONTINUITY, PROFILE should be disengaged in order to avoid the computation of a wrong vertical F-PLN. PROFILE can be reengaged after the F-PLN DISCONTINUITY is cleared.

SPEED CONSTRAINTS AT PROC T

A speed constraint should be inserted at the last waypoint before the turn, otherwise the FMS may enter a PROC T without deceleration and thus overshoot ICAO and/or comfort limits. Consider deceleration using airbrakes to conform to these limits.

PROFILE DISENGAGEMENT

It is recommended to disengage PROFILE by pulling the speed/mach knob on the FCU. The speed window is automatically synchronized and the AFS reverts to LEVEL CHANGE mode.
This procedure should not be used during RNAV approaches because final RNAV approaches must be performed in V/S mode. In this special case PROF should be disengaged by pressing the PROF push-button within 10 sec after dialing VAPP. AFS reverts in V/S mode with V/S automatically synchronized on present vertical speed.
It must be done before G/S interception during ILS approaches.

NAV DISENGAGEMENT

It is recommended to disengage NAV by pulling the HDG SEL knob on the FCU. Pushing the HDG SEL knob will synchronize the FCU heading on actual heading. The AFS reverts to HDG SEL mode.

SPEED TACTICAL MODE

Whenever the crew wants to fly at a specific speed, it is better to do it with the SPD TACT MODE than leaving PROF and using FCU. Thus the vertical guidance is kept. This recommendation is not valid for descent where TACT SPD use would induce a misleading descent path recomputation.
If a specific speed has to be used, it should be done through A/P.
The cost index should NEVER be changed during flight to change A/C speed.

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REVERTING TO A DEFAULTED VALUE

When a defaulted value has been manually changed, it may be recovered by clearing the manual entry (press the CLR key and the corresponding line select key).

NAV ACCURACY AND EFIS ND

FMC 1 and FMC 2 computes their positions independantly with a cross comparison. Each one uses IRS data to compute an INERTIAL position. Whenever it is possible each FMC updates its position with a DME/DME signal or, if not possible, with a VOR/DME signal. This is called RADIO UPDATING which is made automatically when the VOR/NAV/ILS switch is set on NAV or ILS. It takes up to 2 ½ minutes for FMCs to get a position accuracy of less than 0.3 NM when a DME/DME signal is available if its initial accuracy was low (more than 1 Nm).
The navigation accuracy class is called INERTIAL (I) when there is no radio updating and is called RADIO/INERTIAL (R/I) when there is a radio updating. Accuracy class I or R/I is displayed on PROGRESS page. I is good for en route while R/I is needed in terminal area and approach.
Each FMC has 2 purposes : guidance through AP/FD and display of navigation data on ND MAP mode. Each FMC drives its onside AP/FD and ND MAP.
Therefore guidance and display are reliable in terminal area only if the master FMC (onside the engaged AP) is in R/I mode.
ND MAP DISPLAY MAY BE VERY MISLEADING IF THE ONSIDE FMC IS IN INERTIAL MODE
In approach whatever is the navigation accuracy class of FMCs both ND's may be used in MAP mode. Guidance (NAV and PROF) may be kept whatever is the accuracy but if it is I a crosscheck between bearing/distance from a VOR/DME remotely tuned from the CDU which is displayed on DDRMI compared with BRG/DIST TO the same NAVAID on PROGRESS page is required. A non ILS approach with NAV + PROF engaged must not be performed if the nav accuracy class is I. For a non ILS approach PF ND must be used in ROSE or ARC whatever is the accuracy class.

R Messages related to navigation :

- When the NAV accuracy class has been I for more than 10 mn en route or 2 mn in terminal area the message IRS ONLY NAVIGATION is displayed. It is also systematically displayed at the top of descent if the accuracy is I.
- If no IRS is available in NAV mode, the FMCs use only radio instruments for position fixing and the message RADIO ONLY NAVIGATION is displayed. If neither radio nor IRS navigation is possible, the FMCs use a dead reckoning mode and the message DEAD RECKONING NAV is displayed.

R R – The message INDEPENDENT OPERATION is displayed if one of following conditions exists :

R R • a difference greater than 5 NM is detected between A/C position calculated by FMC1 and FMC2.

R • the leg switching in the two FMC is not the same.

R • there is a FCU problem.

R R If INDEPENDENT OPERATION message is displayed, apply this procedure :

R R R R R R R R • in some cases PLEASE WAIT message appears a few seconds after INDEPENDENT OPERATION. This means that the FMS tries to come back to dual operation. This message sequence can occur several times ; as long as these two messages are displayed (one after the other) DON'T MAKE ANY ACTION.

R R R R R R R R • As soon as INDEPENDENT OPERATION is permanently displayed, check F–PLN display on CDU and A/C position given by each FMC with available radio navigation systems.

R • Select the AP on the side where the FMC is good.

R R • In terminal area : select ARC or ROSE mode on the side where the FMC is not occurate.

R R R R – The message VERIFY A/C POSITION is displayed if a difference greater than 12 NM is detected between average IRS position (computed by a FMC) and the Radio/Inertial position (computed by the same FMC)

R When this message occurs :

R R • Crosschek A/C position given by each FMC with other navigation aids.

R • If both FMC are good : NO ACTION

R R • If one FMC is not occurate, couple the AP to the other FMC.

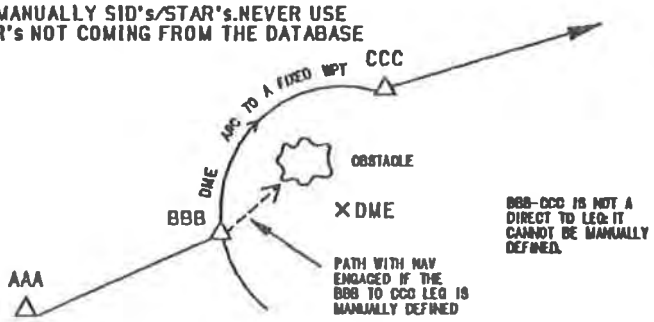
R R • In terminal area : select ARC or ROSE mode or the side where the FMC is not occurate.

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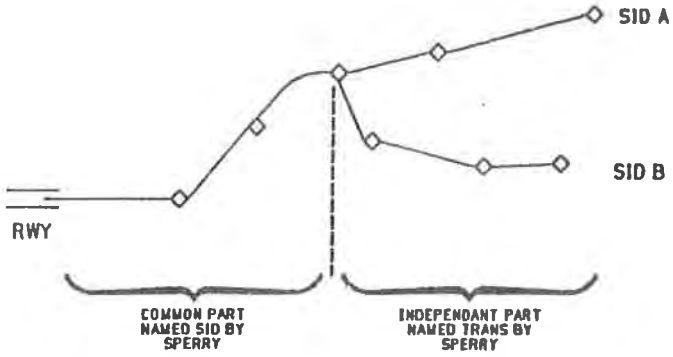
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– DO NOT CONSTRUCT MANUALLY SID's/STAR's.NEVER USE NAV TO FLY SID's/STAR's NOT COMING FROM THE DATABASE

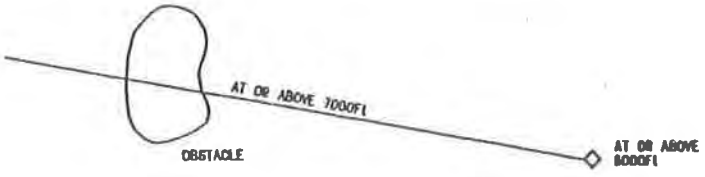


– IT MAY BE NECESSARY TO SELECT A TRANS AFTER A SID/STAR EVEN IF NO TRANS IS MENTIONED IN NAV DOCUMENTS

SID : COMMON PART WITH OTHER SIDS (SAME RWY)+TRANS (INDEPENDANT PART)
STAR : COMMON PART WITH OTHER STARS (SAME RWY)+TRANS (INDEPENDANT PART)



– TAKE CARE OF THE FCU SETTING FOR ALTITUDE CONSTRAINED LEGS.



ONLY THE WAYPOINT CONSTRAINT (5000Ft) CAN BE CODED IN THE DATABASE.
FCU SHOULD BE SET AT 7000Ft TO FLY THE LEG.

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1A DURING COCKPIT PREPARATION

DATA BASE VALIDITY . . . . CHECK ON STATUS PAGE

This page is automatically displayed at power on

PERF FACTOR . . . . . CHECK

This value must not be changed by the crew.
If it is not zero, be sure that the value displayed has been set by authorized people.

VOR/NAV/ILS switch . . . . . SET TO NAV

Autotune functions are activated

INIT A : FMC INITIALIZATION

INIT KEY . . . . . PRESS TO DISPLAY INIT A

COMPANY ROUTE INITIALIZATION

CO RTE/FLT (1L) . . . . . WRITE/INSERT

Cost Index and CRZ FL are normally stored with CO RTE in DATA BASE and thus are automatically displayed. If not they should be inserted.

AIRPORT PAIR INITIALIZATION

ORIGIN/DESTINATION (1R) . . . . . WRITE/INSERT

As soon as the origin/destination is inserted the RTE SELECTION page is displayed.

First case : there are several routes stored in the DATA BASE between the given airport pair. The first one is displayed on the RTE SELECTION page. Others may be displayed by pressing NEXT key.

* INSERT prompt . . . . . PRESS to select the route displayed on RTE SEL page

Second case : there is no route (NONE is displayed) on RTE SELECTION page or pilot doesn't want to select the proposed routes.

RETURN > prompt . . . . . PRESS

It will be necessary to construct the ROUTE waypoint by waypoint on the F-PLN page.
In this case Cost Index and CRZ FL are not given with ORIGIN/DESTINATION and thus should be inserted.

ALTERNATE

ALTERNATE (2R) . . . . . CHECK or WRITE/INSERT

Alternate is normally stored in the data base with the destination.

ALTN key (2R) . . . . PRESS to display the ALTN RTE on RTE SELECTION PAGE

If there is no ALTN route NONE is displayed. It should be constructed waypoint by waypoint on F-PLN page.

* INSERT prompt . . . . . PRESS to select the ALTN RTE displayed

DEPARTURE COORDINATES

LAT/LONG (3L, 3R) . . . . . CHECK

If the A/C is at a gate with published coordinates, these may be used to update the airfield coordinates provided automatically on INIT page A. If the gate coordinates are not published, airfield coordinates will be used for IRS alignment.
To change coordinates, use the slew keys to increase or decrease the displayed value.

COST INDEX (4L) . . . . . CHECK or WRITE/INSERT

If there is a COST INDEX given by DATABASE with the CO RTE, it should not be changed as it defines the airline cost policy for this route.

If no COST INDEX is given by DATA BASE use the one given by the airline.
If no COST INDEX is inserted, there won't be any prediction for the ECON strategic mode and a message will be displayed at engine start.

IRS ALIGNMENT

When entering the cockpit , MSU's should have been OFF. If not, set them OFF more than 10 sec and back to NAV, to erase the displayed coordinates on ISDU.

ALIGN IRS prompt (4R) . . . . . PRESS

LAT/LONG are sent to IRS

ALIGN IRS prompt is displayed only if LAT/LONG is filled and one MSU is set to NAV.

ISDU . . . . . CHECK that valid coordinates have been sent

CRZ DATA

CRZ FL . . . . . CHECK or INSERT and CHANGE

Normally it is given with CO RTE. CRZ FL is not limited by MAX ALT computed at weight entry.

CRZ TEMP . . . . . CHANGE if necessary

defaulted to ISA at CRZ FL

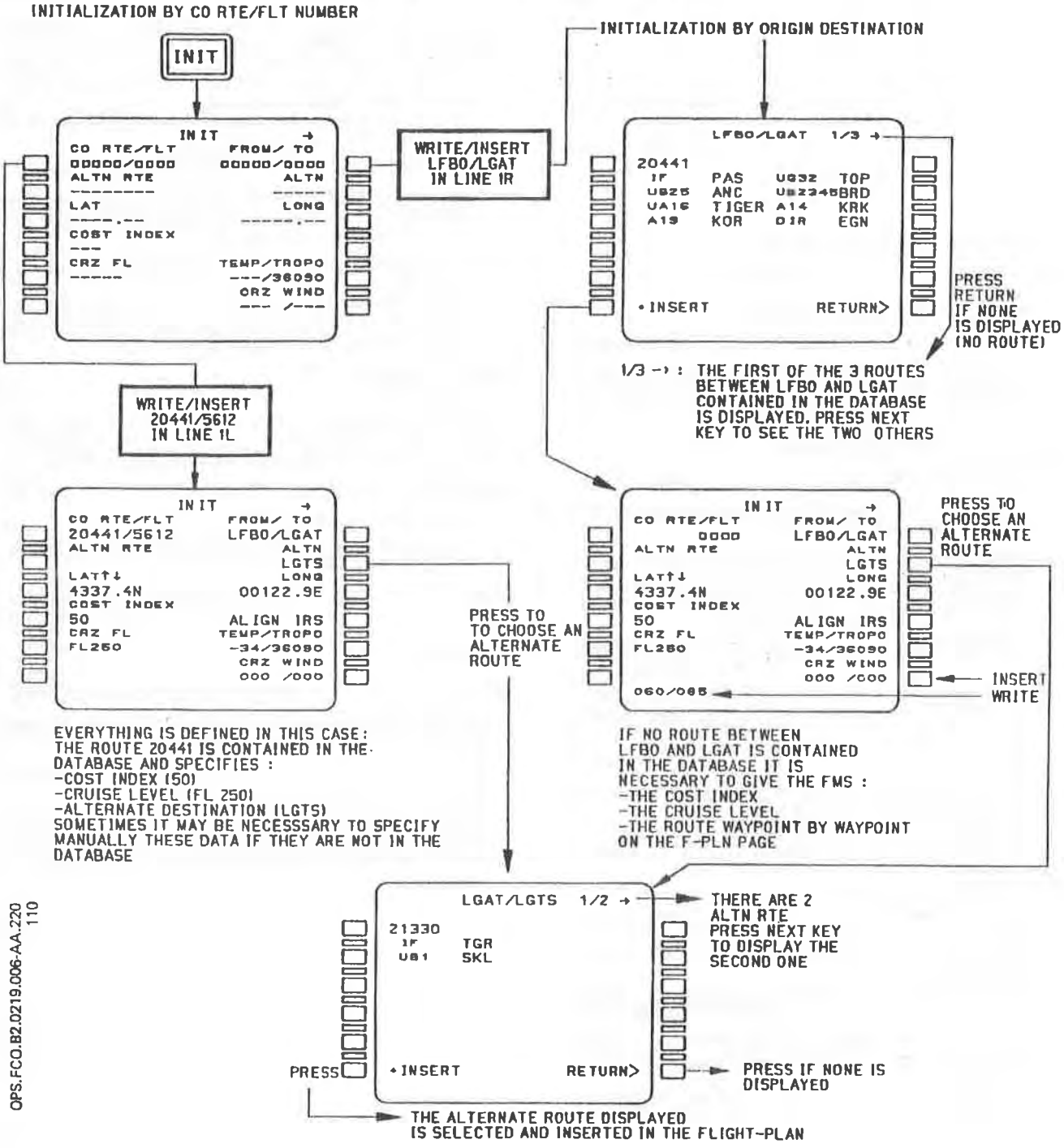
CRZ WIND DIRECTION/VELOCITY . . . . WRITE/INSERT

Wind at departure will be inserted on F-PLN page B.

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ROUTE DEFINITION



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1B WHEN THE CREW GETS THE LOAD SHEET

INIT B : WEIGHT ENTRIES

INIT KEY . . . . . PRESS to display INIT page A

NEXT KEY . . . . . PRESS to display INIT page B

ZFW (zero fuel weight) and ZFWCG (ZFW center of gravity) must be known by the FMS in order to initialize the CGCC (center of gravity control computer).
For that purpose ZFW may be directly inserted (in this case BLOCK entry is not mandatory). But it may also be computed by the FMS if TOGW and BLOCK are entered.

ZFW or TOGW . . . . . WRITE/INSERT

ZFWCG (Take off) . . . . . WRITE/INSERT

Taxi fuel is defaulted according to the airline policy. It may be changed.

FUEL PLANNING ON INIT B only if needed before engine start

BLOCK . . . . . WRITE/INSERT

TOGW is deduced by summing ZFW and BLOCK. BLOCK is automatically replaced by FOB (fuel on board) at engine start and thus is needed only for fuel computations before engine start.

MAX FL and OPT FL . . . . . CHECK

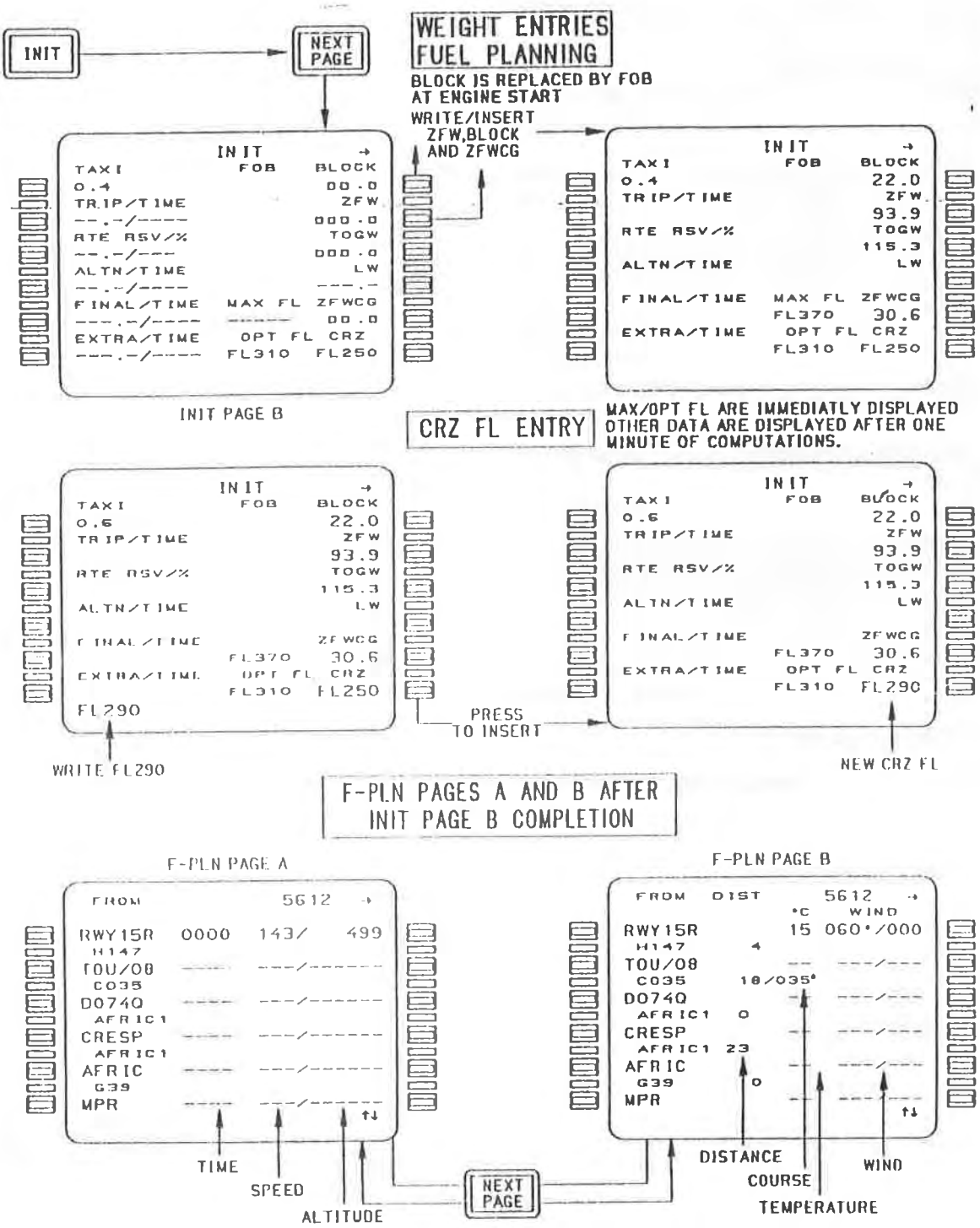
They are displayed just after BLOCK is inserted.

CRZ FL . . . . . MAY BE CHANGED

1C AT ENGINE START

FUEL PAGE . . . . . DISPLAY/CHECK FOB/FF + FQ.

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1D BEFORE PUSHBACK OR START

TAKE OFF DATA

TO/APP KEY . . . . . PRESS to display TAKE OFF page

F, S, O speeds . . . . . CHECK

CAUTION : In case of FMS « LAT ONLY » configuration, O, S and F values are not valid. They must be manually entered by the crew.

V_1 (1L) . . . . . WRITE/INSERT

V_R (2L) . . . . . WRITE/INSERT

V_2 (3L) . . . . . SELECT ON FCU KNOB

V_2 is recopied from FCU to TAKE OFF page.

THR RED (2R) . . . . . CHECK/MAY BE CHANGED

Not lower than 1 500 ft AGL

ACCEL ALT (3R) . . CHECK/CHANGE if noise abatment is not required

Not lower than THR RED

TO SHIFT LS KEY (1R) . . . . . PRESS SELECT prompt if take off is initiated at about 1000 m away from the runway threshold

Pressing this key inserts a 970 m shift from RWY threshold.

1E TAXI

ALT KNOB (FCU) .. SELECT FIRST CLEARED ALTITUDE

CM 2 . . . . . CHECK/INSERT SID

PAGE SELECTION ON CDU

PF . . . . . F-PLN page A

PNF . . . . TAKE OFF page or F-PLN page for revisions

EFIS SELECTION

PF . . . . . MAP mode

If a VOR radial is to be followed PF may select ROSE or ARC

PNF . . . . . MAP mode

IF NAV MODE IS USED

PROFILE on FCU . . . . . ARM/CHECK FMA

NAV on FCU . . . . . ARM/CHECK FMA

NAV should not be used at take off if the SID to be flown is not defined in the DATABASE.

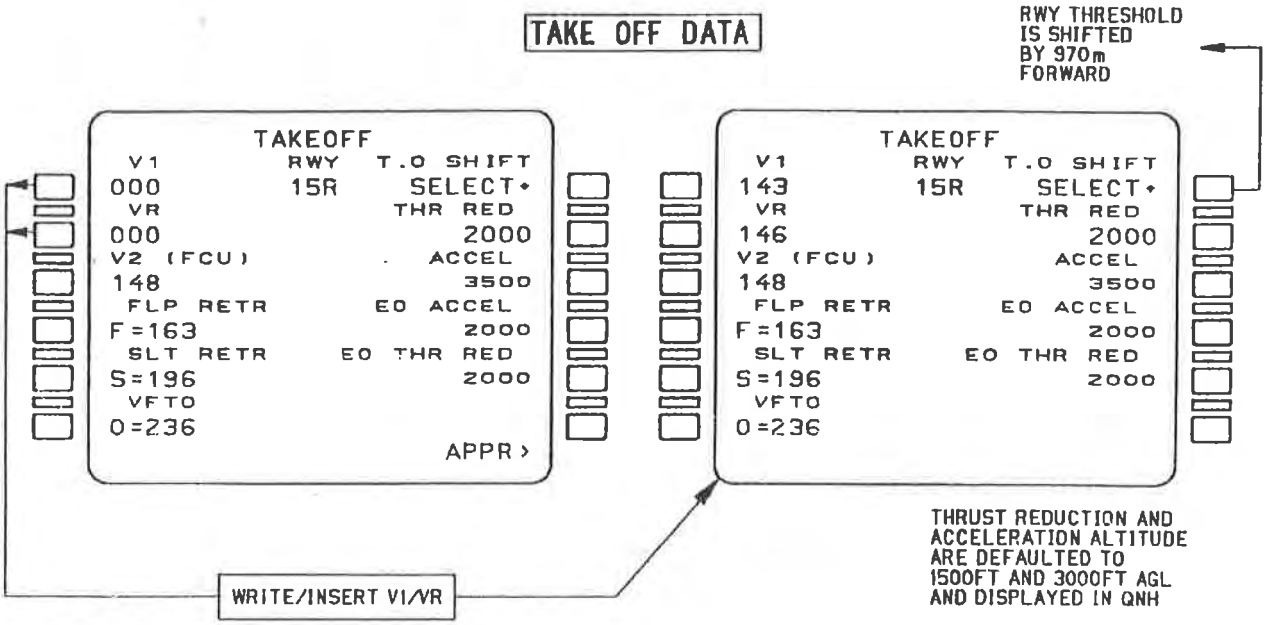
THRUST SELECTION ON TRP

FLX TO TEMP . . . . . SELECT ON TRP

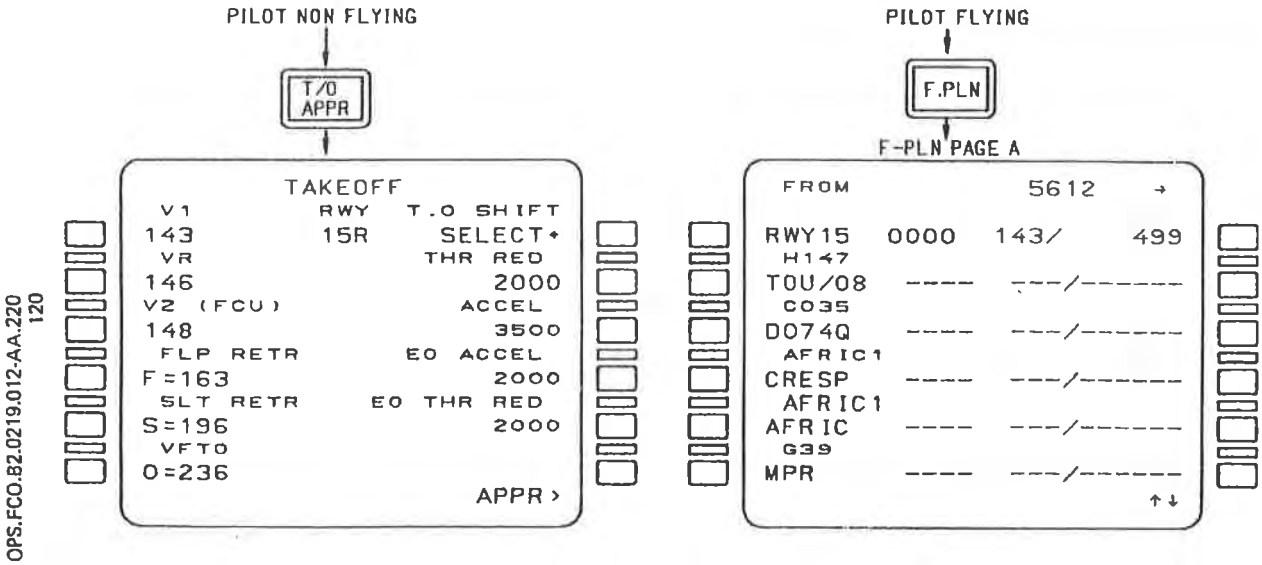
If a high temperature leads to FLX TO thrust lower than the CLB thrust the FMS will increase thrust from the TO thrust to the CLB thrust. So do not hesitate to use FLX TO and PROFILE mode at take off.

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NORMAL PAGE SELECTION FOR TAKE OFF



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A typical vertical path including most of the events which may be encountered is presented. FMS use according to usual ATC clearances is also presented. The SPD TACT mode may be used thoughout the climb to control the A/C speed.

3A WHEN INITIAL CLIMB SPEED IS REACHED

PF . . . . . KEEP F-PLN page A

PNF . . . . . SELECT PROGRESS page

AP in CMD : F-PLN revisions are performed by PF
AP not CMD : F-PLN revisions are performed by PNF

3B AT FCU ALT (7000 FT)

A/C levels off. P.SPD/P. ALT are engaged in lieu of P. THR/P. CLB. Predictions are made assuming an immediate return to climb.

3C CLIMB TO FL 200

Clearance for FL 200 is given by ATC. Two positive actions are required to leave FCU ALT.

FCU ALT KNOB . . . . . TURN TO SELECT 20 000 FT

FCU ALT KNOB . . . . . PULL TO INITIATE CLIMB.

P. SPD/P. ALT revert to P. THR/P. CLB.

MAX CLIMB TACT MODE

Expedite reaching FL 200 is requested by ATC

TACT MODE key . . . . . PRESS to display TACT MODE PAGE

Predictions (time, distance) to FL 200 for MAX CLB mode are displayed after 15 sec.

MAX CLB (3L) . . PRESS to activate maxi climb mode.

- Max climb is a max angle of climb mode.
- It is performed at green dot. FMS green dot (target speed on PFD) and FAC green dot (0 on PFD) may be slightly different. A/C will climb at the highest. Predictions are made with FMS target speed.
- Max climb mode is active until next level off.
- Max climb is replaced by the selected strategic mode when the level off is reached.

3D CLIMB FROM FL 200 TO FL 290

Clearance to FL 290 is given before reaching FL 200.

FCU ALT KNOB . . . . . TURN TO SELECT 29 000 FT

Here pulling is not needed as A/C is not at FCU ALT.

USE OF PD POINTS

During climb, you are requested to be above FL 260 10 NM before MPR. A PD (Place Distance) point may be inserted then constrained as follows :

MPR/ – 10 . . . . . WRITE on F-PLN page

MPR LS key . . . . . PRESS to insert PD

PD 01 waypoint is created and displayed before MPR. Its insertion must be made by pressing MPR LS key and not the above ls key (AFRIC) as it would have been made for a classical waypoint.

/+ 260 . . . . . WRITE/INSERT by pressing the right LS key next to PD 01.

PD 01 is now constrained by an AT OR ABOVE FL 260 constraint.

If this constraint cannot be matched in the present active mode, the message ALT ERROR AT PD 01 – XXX will be displayed, – XXX meaning that A/C will be at 26 000 – XXX ft at PD 01. Moreover an amber FCU level off symbol is displayed on the ND's. MAX CLB tactical mode should be selected in this case.

TURBULENCE

The SPD TACT MODE should be used with a double speed/mach entry :

295/.78(4L) . . . . . WRITE/INSERT

LS KEY 4L . . . . . PRESS to activate

TRANSITION IAS/MACH ALTITUDE

The optimum mach according to the active mode is targeted then held.

CRZ FL CHANGE DURING CLIMB

Increasing CRZ FL :

FCU ALT KNOB . . . . . TURN

The CRZ ALT is automatically changed in the F-PLN. Check it on PROGRESS. The message NEW CRZ ALT is displayed.

Decreasing CRZ FL :

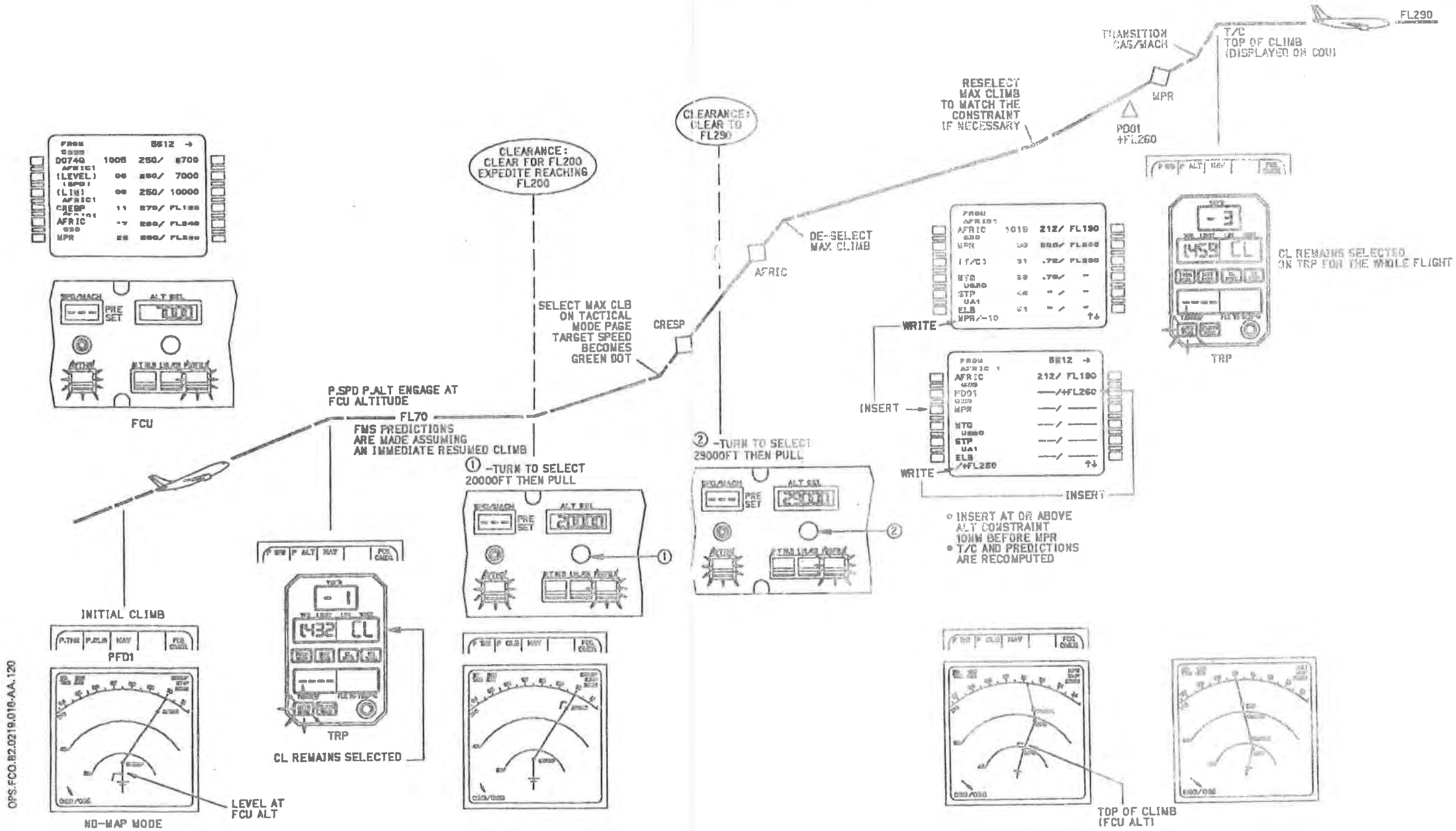
CRZ FL . . . . . CHANGE on PROGRESS

FCU ALT KNOB . . . . . TURN

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES AND TECHNIQUES USE OF « SPERRY » FMS 3 – CLIMB	2.02.19 PAGE 16 REV 15 SEQ 120



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4A REACHING CRZ FL

A/C levels off.
MAX CRZ thrust is automatically selected inside FMS.
A/C CRZ ALT is held by FMS within a ± 50 FT margin in order to avoid throttle activity. It is cost efficient, so PROF should be used whenever it is possible.

PF . . . . . F-PLN page

PNF . . . . . PROGRESS page

AP in CMD, revisions are made by PF
AP not in CMD, revisions are made by PNF

If a TIME constraint has been inserted in the F-PLN at a downward waypoint, and if this constraint cannot be matched in the present strategic mode, the FMS will order a speed increase or decrease during cruise phase only. In this case CSTR is displayed on the left of PROGRESS page title line.

All following procedures are optional and to be performed only if needed according to cruise conditions.

4B STEP

STEP CLIMB AT OPTIMUM

Assuming that optimum flight level (here 310) is higher than present CRZ FL (comparison may be made on PROGRESS), you may get step predictions (time, distance to the step point) on STEP PRED page as to make a step climb request to ATC.

LS KEY 1 R (FROM WPT) . . . . . PRESS to display VERT REV page at FROM WPT

STEP PRED > prompt . . . . . PRESS to display STEP PRED page at OPTIMUM POINT

STEP FL (1 L) here OPT FL . . . . . WRITE/INSERT

An other FL may be inserted.

WIND AT STEP FL (3L) . . . . . WRITE/INSERT

If no wind is inserted, the FMS will use its own computed wind.
AN optimum step point is computed.

TIME/DISTANCE TO STEP POINT . . . . . READ

FUEL/TIME SAVINGS/LOSSES . . . . . READ

These predictions are given for an optimum step since step pred page was accessed from the FROM WPT.

STEP CLIMB AT A GIVEN WAYPOINT

Clearance for FL 310 is given by ATC only after passing STP.

STP RIGHT LS KEY . . . . . PRESS to display VERT REV page at STP

STEP PRED > prompt . . . . . PRESS to display STEP PRED page AT STP

STEP FL here 310 . . . . . WRITE/INSERT

Other actions and informations are similar to STEP AT OPTIMUM POINT.

STEP CLIMB INSERTION/CONFIRMATION

Your step request is accepted by ATC

* INSERT prompt on STEP page . . . . . PRESS

FCU ALT KNOB . . . . . TURN to select 31 000 FT

FCU ALT KNOB . . . . . PULL

P. CLB ARMED . . . . . CHECK ON FMA

IMM CLB prompt on CDU (1 R) . . . . . CHECK

- The A/C will stay at present CRZ FL until step point is reached.
- At step point, a climb will be initiated without any pilot action.
- P. CLB blue on FMA will flash 30 sec before reaching the step point to advise that an altitude change will be initiated without any pilot action.
- If the crew doesn't want to wait until the step point for climbing IMM CLB prompt should be pressed : an immediate climb is initiated.
- If the FCU is not dialed at the step point the step is removed.
- If the FCU ALT is below the STEP FL, the step will be performed at the FCU ALT.

A step of less than 5 min is not accepted.

STEP DESCENT

Same operations as for step climb. STEP FL must be higher than the highest altitude constraint.

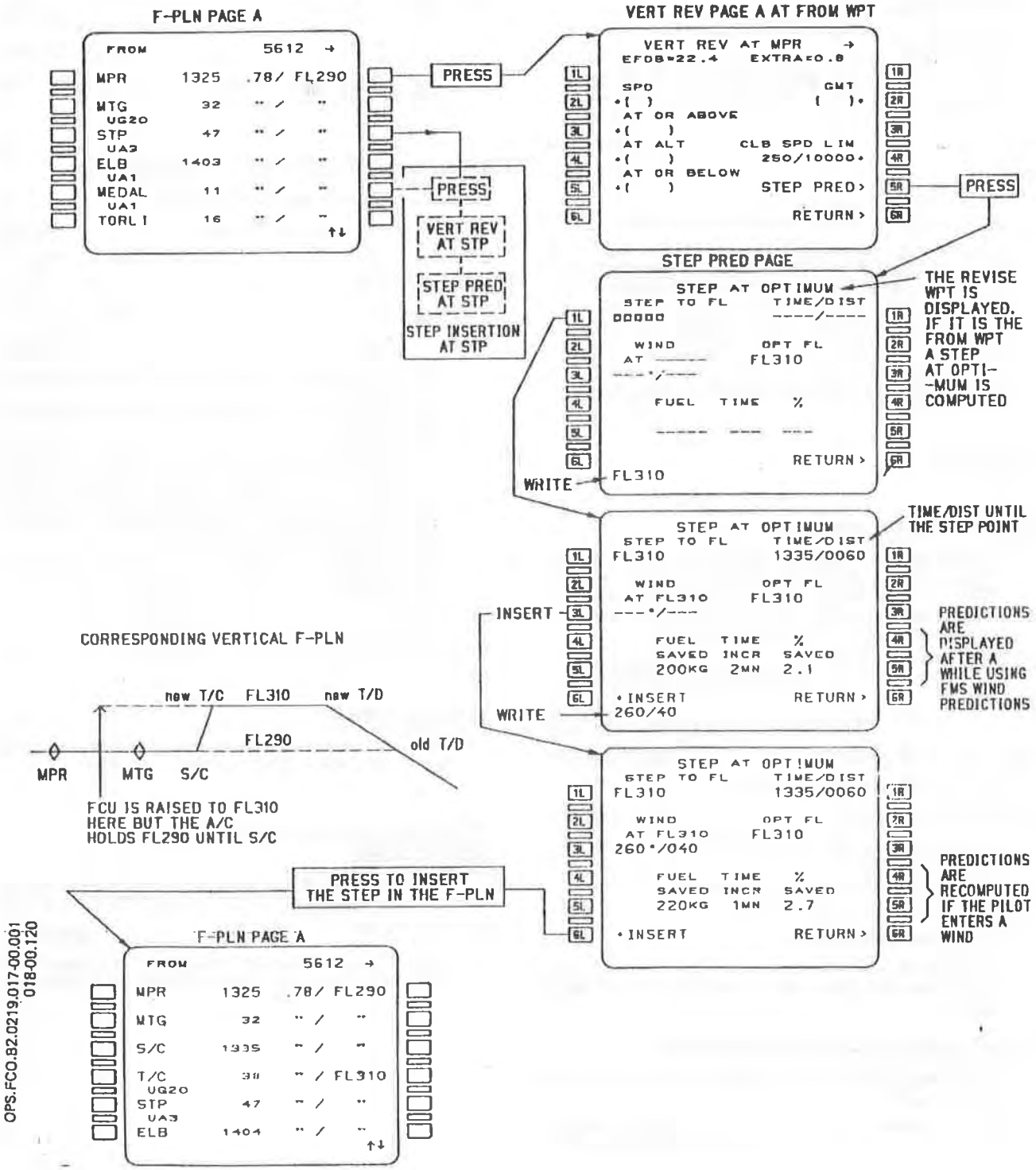
IMMEDIATE STEP CLIMB WITHOUT PREDICTIONS

It is also possible to perform a step in the easier following way (without accessing STEP PRED page).

FCU ALT KNOB . . . . . TURN/PULL

CRZ ALT is automatically changed. A message NEW CRZ ALT is displayed. Flight predictions are restarted.

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4C USE OF « DIR TO » FUNCTION AND « AIRWAY » PAGE

When passing PONZA (PNZ), ATC asks to fly directly to TEANO (TEA) then to join BRINDISI (BRD) by the UA 14 AIRWAY.

This lateral revision will be done by using the « DIR TO » page then the « AIRWAY » page.

DIR TO WAYPOINT INSERTION :

DIR key . . . . . PRESS

TEA . . . . . WRITE/INSERT IN LINE 1L

The display then returns to the F-PLN page with TEA waypoint inserted and a discontinuity between TEA and the « TO » waypoint of the original F-PLN.

Note : If the DIR TO waypoint is a waypoint belonging to the original F-PLN, it can also be entered by simply pressing the left LS key beside the desired DIR TO waypoint (on the DIR TO page).
In this case no F-PLN DISCONTINUITY will be inserted into the F-PLN.
All waypoints of the F-PLN can be viewed on the DIR TO page by using slewing.

As soon as the DIR TO waypoint is inserted, an immediate turn manoeuver is initiated.

AIRWAY INSERTION FROM TEA TO BRD

Access AIRWAY page via LATERAL REVISION page at TEA :

- LS KEY 2 L . . . . . PRESS TO DISPLAY (next to TEA) « LAT REV FROM TEA » page
- LS KEY 2 L . . . . . PRESS TO DISPLAY (next to AIRWAY) « AIRWAY » page
- LS KEY 2 L . . . . . PRESS TO VIEW THE (next to UA 14) UA 14 AIRWAY

UA 14 AIRWAY is displayed with all the waypoints which belong to this airway.

Since we want to introduce the portion between TEA and BRD we have to :

LS KEY 4 L (next to BRD) . . . . . PRESS

The display returns to F-PLN page A with the portion of airway (from TEA to BRD) inserted into the F-PLN.

This new route will be followed by the A/C through NAV mode.

4D SELECTION OF AN OTHER MODE (STRATEGIC OR TACTICAL)

If a segment with MIN FUEL mode appears necessary to fulfil the required fuel reserve :

MODE KEY ON CDU . . . . . PRESS

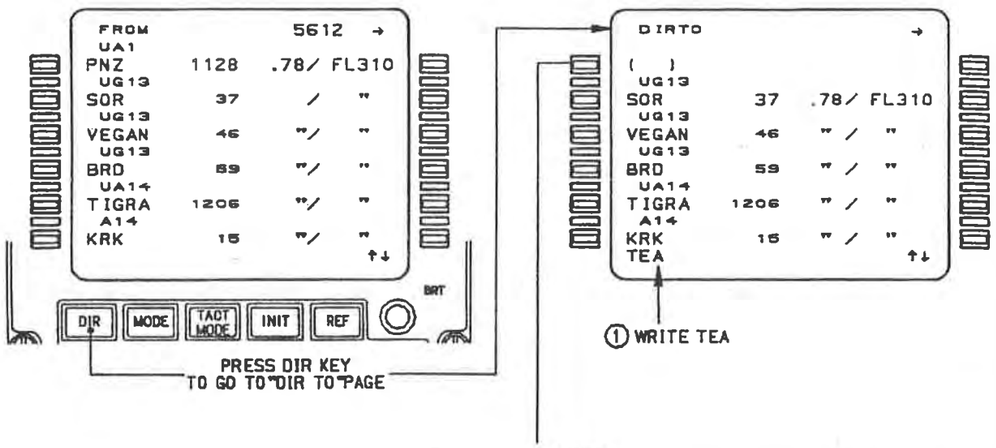
LS KEY 3L (next to MIN FUEL) . . . . . PRESS TO ACTIVATE MIN FUEL MODE

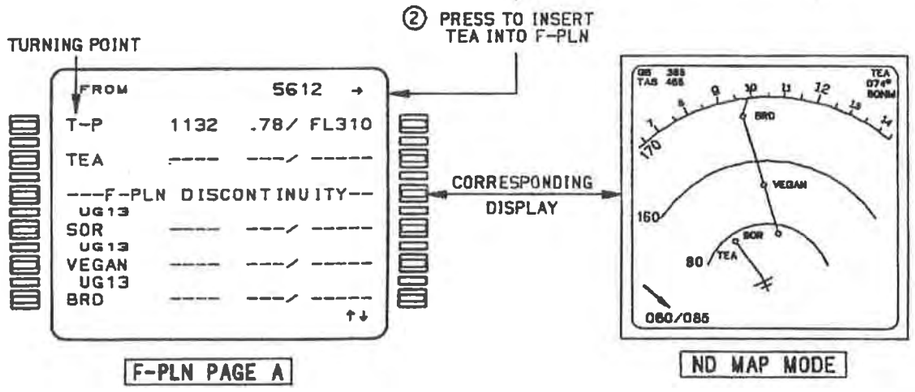
Note : This mode being a STRATEGIC mode, it will be active for the whole remaining flight, unless another mode is selected.

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DIR TO/AIRWAY

DIR TO WAYPOINT INSERTION



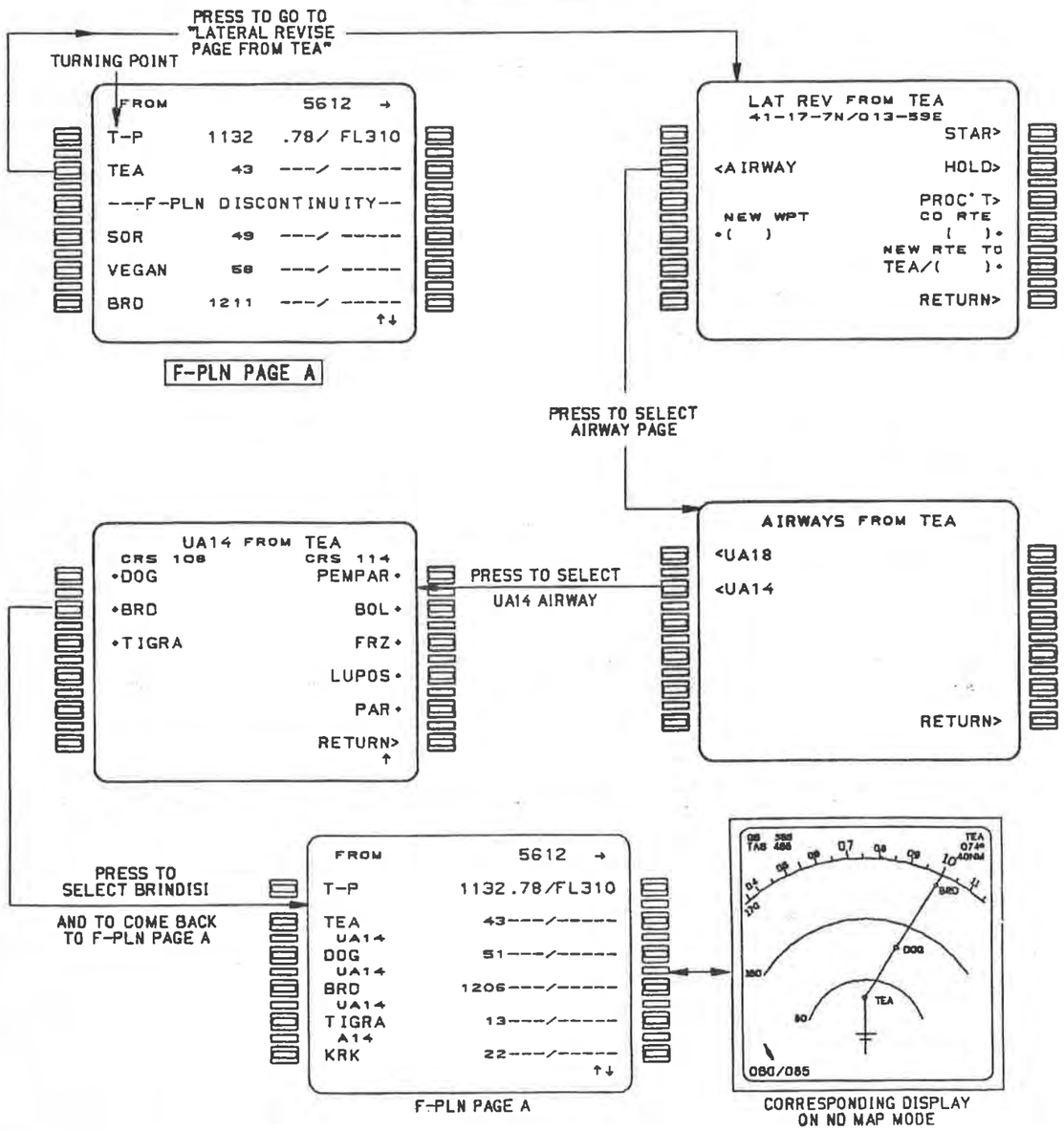


NOW UA 14 AIRWAY MUST BE INSERTED FROM TEA TO BRD

During any F-PLN revision (vertical or lateral) there are no more predictions (dashes are displayed) until they are recomputed after revision completion (about 1 minute of recomputation).

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AIRWAY INSERTION



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5B WHEN DESCENT CLEARANCE IS GIVEN BY ATC

Clearance is given for 2 000 FT.

FCU ALT KNOB . . . . . TURN to select 2 000FT

FCU ALT KNOB . . . . . PULL

P. THR/P. DES ARMED . . . . . CHECK FMA

IMM DES prompt on CDU (1 R) . . . . . DISPLAYED

The FMS will hold the CRZ FL until the top of descent. 30 sec before reaching the T/D, P. DES will flash to indicate that the descent will be initiated without any further pilot action.

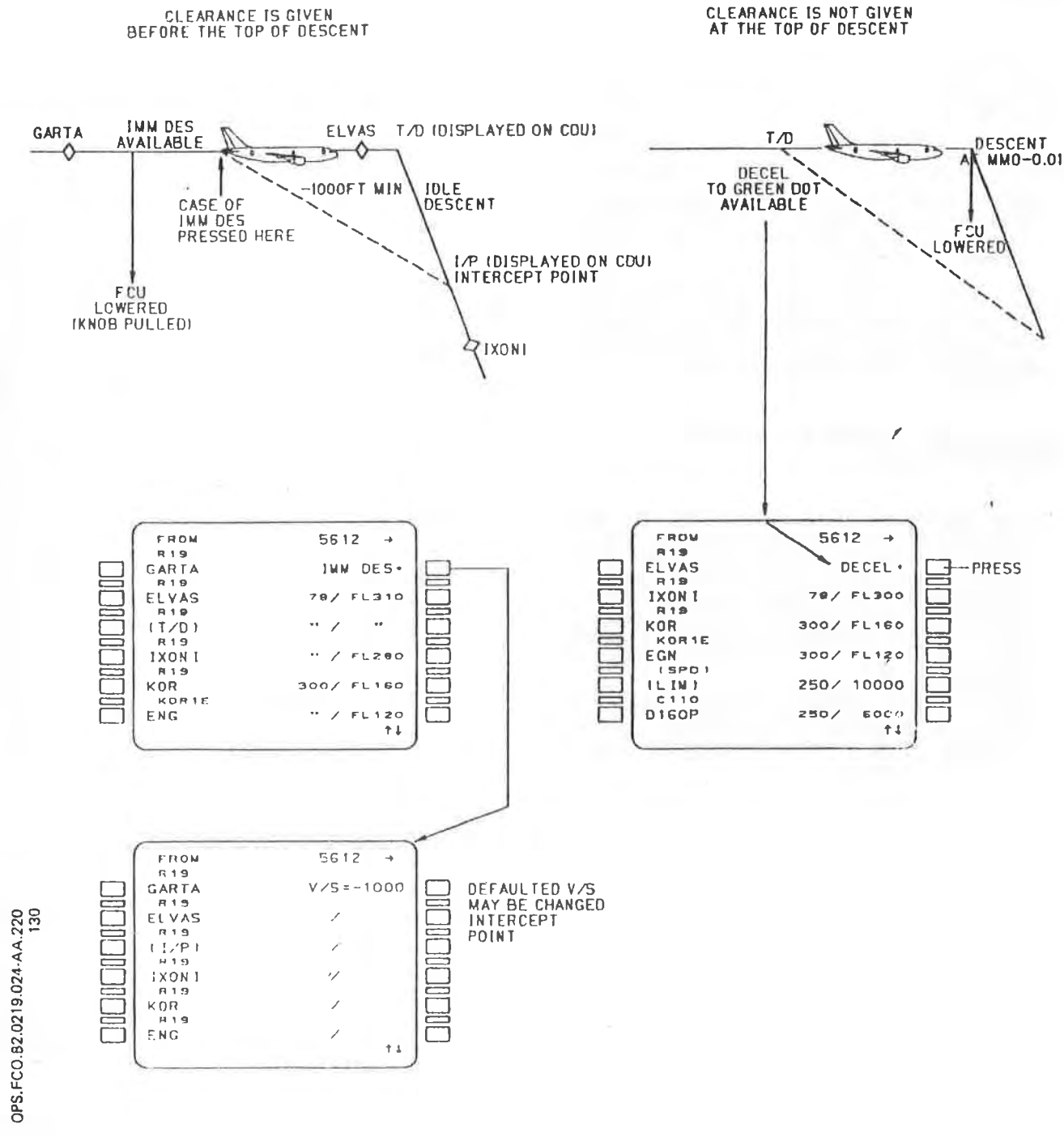
The descent may be initiated immediately (before reaching T/D) by pressing IMM DES prompt on CDU (F-PLN or PROGRESS line 1R). In this cas the descent will be performed at 1 000 FT min (value which can be changed on CDU) until the precomputed path is reached.

5C IF DESCENT CLEARANCE IS NOT YET GIVEN BY ATC AT T/D

When passing the T/D the A/C holds the CRZ ALT as the FCU has not yet been lowered. DECEL prompt is displayed in line 1 R. Pressing this prompt makes the A/C reduce speed to green dot (highest value between FAC and FMS if they are different). As soon as clearance is given by ATC, turn and pull FCU ALT knob. In order to recapture the computed descent path from above, the A/C will initiate a descent :

– at target speed + 20 kt or 290 kt which ever is greater, upper limited by 340 kt, MMO or VMO – 10 kt which ever is lower above 10000 ft.
– at target speed + 20 kt or 250 kt which ever is lower below 10000 ft.

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6A REPRESSURIZATION SEGMENT if any

If a repressurization segment is required, it is computed by the FMS assuming a 300 ft/min cabin rate of descent. A message REPR XXX NM BFR T/D is displayed (repressurization XXX nautical miles before the top of descent).
In our exemple XXX is 20 NM. When reaching this distance :

IMM DES prompt on CDU (1R) . . . . . PRESS

P. DES ENGAGEMENT . . . . . CHECK ON FMA

Descent is initiated at 1 000 ft/min (this value may be changed manually on CDU Line 1R).
Computations are restarted. An intercept point (I/P) is computed where the A/C will intercept the precomputed descent path and is displayed in the F-PLN on CDU.

6B WHEN REACHING THE TOP OF DESCENT (OR THE INTERCEPT POINT)

The descent path is initiated without any pilot action.

P. THR/ P. DES ENGAGEMENT . . . . . CHECK FMA
When full idle position is reached by throttles :

RETARD . . . . . CHECK FMA

A vertical deviation scale is displayed on ND (in place of G/S scale) and the VDEV value is displayed on PROGESS page in line 1 R. It indicates the eventual vertical distance between A/C position and the computed descent path.

VDEV . . . MONITOR ON ND and on PROGRESS page

IF ANTI-ICE ON . . . . . EXTEND HALF AIRBRAKES

6C IDLE DESCENT

The computed descend path is earth referenced. The A/C is controlled on the path with elevator and, until one of several conditions is met, there is no speed guidance performed by ATS (RETARD mode). The path has been computed in order to get a glide speed in accordance with the selected strategic MODE. Yet, the speed is monitored by the FMS and if for any reasons (unpredicted winds for instance) this speed doesn't stay in a margin, there will be the following FMS response :

- A/C speed : target speed + 20, or V_{MAX} – 2 kt, MORE DRAG message flashes on PFD asking the pilot to extend airbrakes.

MORE DRAG FLASHES . . EXTEND HALF AIR BRAKES
(full if anti-ice on)

If the speed returns to target speed MORE DRAG disappears at target speed + 5

MORE DRAG DISAPPEARS . . . RETRACT AIRBRAKES
(HALF if anti-ice on)

It may be necessary to keep air brakes extended to prevent the speed to increase again.

- A/C speed = target speed – 20 or
  green dot – 10 which ever is the highest.

ATS reverts in P. SPD to increase thrust. If airbrakes have been extended, there is the LESS DRAG message displayed on CDU (not on PFD) instead of P. SPD reversion. If it is not sufficient there is then a P. SPD reversion.

6D P. SPD DESCENT

There is a P. SPD reversion each time the following conditions occurs :

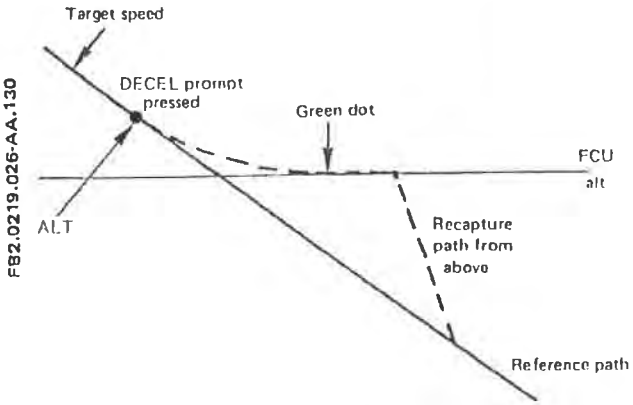
- A/C speed falls below target – 20 or green dot – 10
- A constraint (speed or altitude) is encountered. Usually it is the SPD LIM (250 kt/10 000 ft).
- During any F-PLN recomputation. After they are made, RETARD is recovered.
- Another performance mode is selected.

Usually there is a 10 degrees throttles forward motion and the speed is controlled around this thrust value. In P. SPD, MORE DRAG appears when A/C speed is target speed + 15 kt and it disappears when A/C speed returns below target + 2 kt.

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AT FCU ALT

As ALT * engages, a DECEL prompt is displayed on the F-PLN page. It must be pressed immediately in order to reach green dot so that the A/C will deviate slower from the descent path.



SPEED CONSTRAINT (250 KT/10 000 ft)

The reference path has been computed to meet the constraint. If this speed constraint is lower than the initial target speed (usually it is the SPD LIM), a decel point is computed (at about 12 000 ft for the SPD LIM) and the deceleration is performed at – 1000 ft/min.

TGT SPEED . . . . . CHECK IT SHIFTS to speed constraint

ALT CONSTRAINT

If the altitude of the constraint is reached before the constrained waypoint, the FMS orders a level off.

P.SPD/P. ALT ENGAGEMENT . . . . . CHECK

If the constraint will not be matched an amber FCU level off symbol is displayed on the ND.

MAXIMUM DESCENT

If ATC asks you to make a quick descent until 7 000 ft for instance :

MAX DES MODE . . . . . SELECT ON TACT MODE page

In this case the descent path is not followed anymore. At 7 000 ft :

PREVIOUS MODE . . . . . RESELECT

The A/C levels off to return back to the precomputed path.

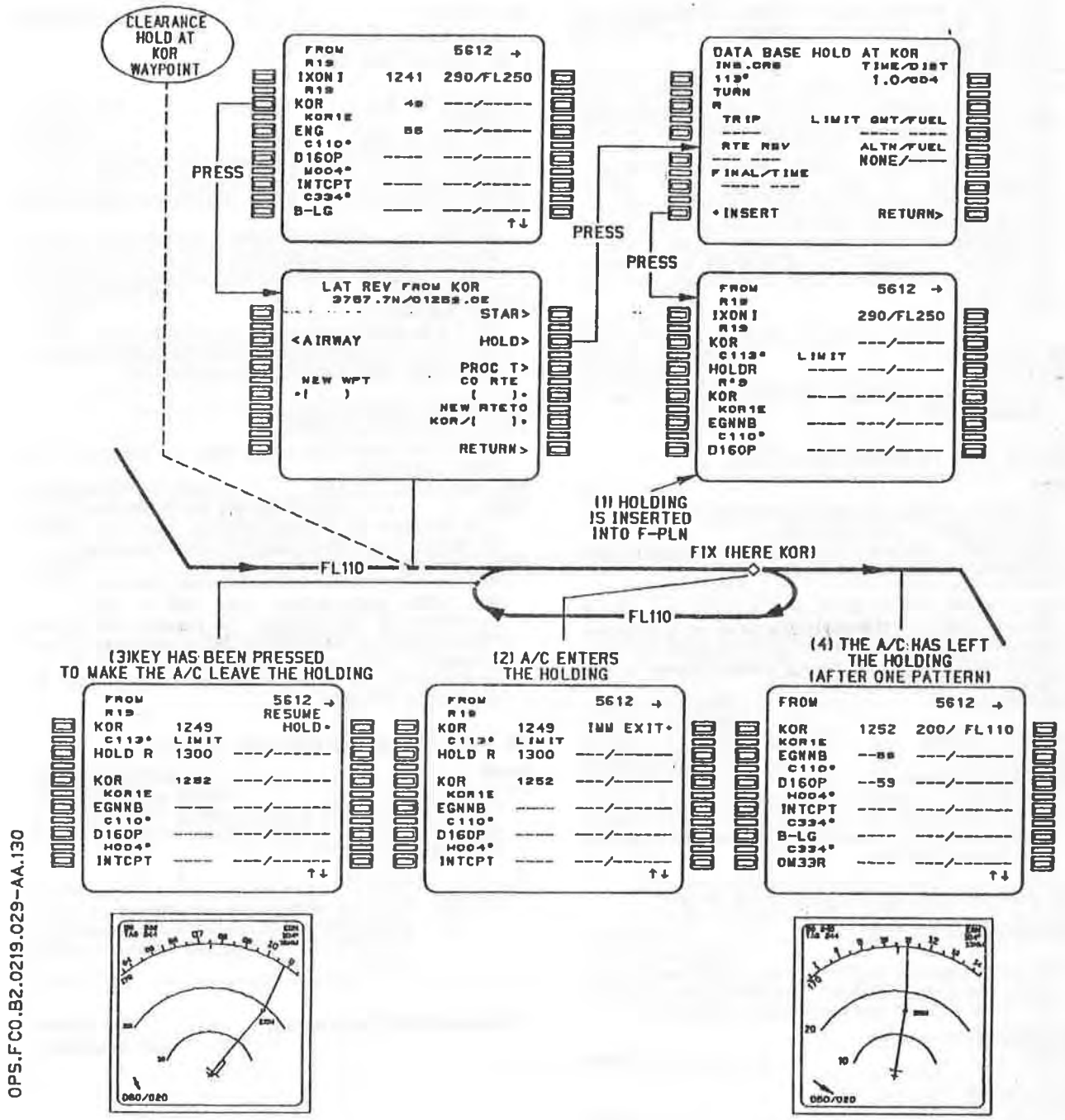
STEEP VERTICAL SEGMENTS

Along steep vertical segments, predicted speed is computed assuming a minimum available deceleration rate of 10 kts per 1000 ft of altitude change.

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HOLDING



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8A DURING THE WHOLE APPROACH

NAV mode should not be kept if the STAR being flown has not been defined by DATABASE (see general recommendations).

NAV ACCURACY CLASS . . . . CHECK ON PROGRESS.
At Entry in TERMINAL AREA, the ACCURACY CLASS must be checked on PROGRESS page. « I » is good for EN-ROUTE only. « R/I » means RADIO UPDATING ACCURACY, good for TERMINAL AREA (less than 50 NM from destination airport) and RNAV approach. Consequently, if the message « IRS ONLY NAVIGATION » is displayed, or if the NAV accuracy is not R/I, a cross check between bearing/distance from a VOR/DME remotely tuned from the CDU and displayed on DDRMI compared with BRG/DIST to the same NAVAID on PROGRESS page is mandatory to keep NAV mode.

PF ND MODE . . . . . MAP for ILS approach otherwise ROSE or ARC

PNF ND MODE . . . . . MAP may be kept

ND RANGE . . . . . SELECT 15

For non ILS approach PF ND must be used in ROSE or ARC.

8B AT THE TRANSITION LEVEL

BARO . . . . . SET QNH

From this moment, the A/C is controlled by the FMS on a path based on QNH altitudes.
If the QNH is different from 1013 mb the path in QNH is different from the path in FL.
In order to avoid a sudden change of the path followed by an abrupt FMS order to pitch up or down to go to the new path, the change is filtered so as to slow the path change. The vertical deviation will slowly go up or down upon QNH value, then will return slowly to zero as the A/C catches the QNH path.

TO/APPR key (PF) . . . . . PRESS to display APPROACH page

LANDING CONFIG . . . . . SELECT (defaulted to 30/40)

WIND CORR . . . . . WRITE/INSERT

MDA (if RNAV approach) . . . . . WRITE/INSERT

The VAPP is computed and the point where the A/C should decelerate is also computed. VAPP will be reached during the final descent if the slats/flaps are extended as follows.

8C FROM THE DECELERATION POINT

TARGET SPEED ON PFD . . . . . CHECK IT FALLS AT VAPP

The deceleration is performed at – 1 000 ft min or if it is not enough at – 500 ft min. The A/C levels off at FCU ALT (here 2 000 ft) and continues to decelerate.

AT GREEN DOT + 10 KT

SLATS . . . . . EXTEND

AT S + 10 KT

FLAPS 20 . . . . . EXTEND

LANDING GEAR . . . . . EXTEND

AT F + 10 KT if a 30/40 approach is performed

FLAPS 40 . . . . . EXTEND

8D ILS APPROACH

VOR/NAV/ILS SW . . . . . SET TO ILS

ILS FREQ . . . . . SELECT

LAND push button . . . . . PRESS

The LOC beam will be intercepted with an angle of 20°. Thus if there is a cross track error the A/C cannot fly a leg parallel to the LOC beam making the interception impossible.

At LOC interception, NAV is automatically disengaged, and the FMS updates its navigation so as to cancel its cross track error. The along track erroris not cancelled.

DESIRED SPEED . . . . . SELECT ON FCU

SPEED SELECTOR . . . . . PULL

From this moment there is no more FMS guidance and the remaining flight is controlled only by AFS until it is disengaged (see USE OF AFS subchapter).

8E RNAV APPROACH

The R/I navigation accuracy class is mandatory for RNAV approach.

NAV ACCURACY CLASS . . . . . CHECK on PROGRESS

MDA . . . . . WRITE/INSERT on APPROACH page

It is inserted for display purpose only. The FINAL APPROACH prompt appears on APPROACH page.

FINAL APPROACH prompt . . . . . PRESS

Pressing this prompt has the same purpose as pressing the LAND push button. The A/C is cleared to go below the FCU altitude. The pseudo glide slope intercept point is displayed on ND in white as a top of descent (↘).
At this point the FMS orders the final descent to runway on a 3° glide slope.

AT 1 000 FT ABOVE GROUND LEVEL

VAPP . . . . . SELECT ON FCU

PROFILE push button . . . . . PRESS to DISENGAGE

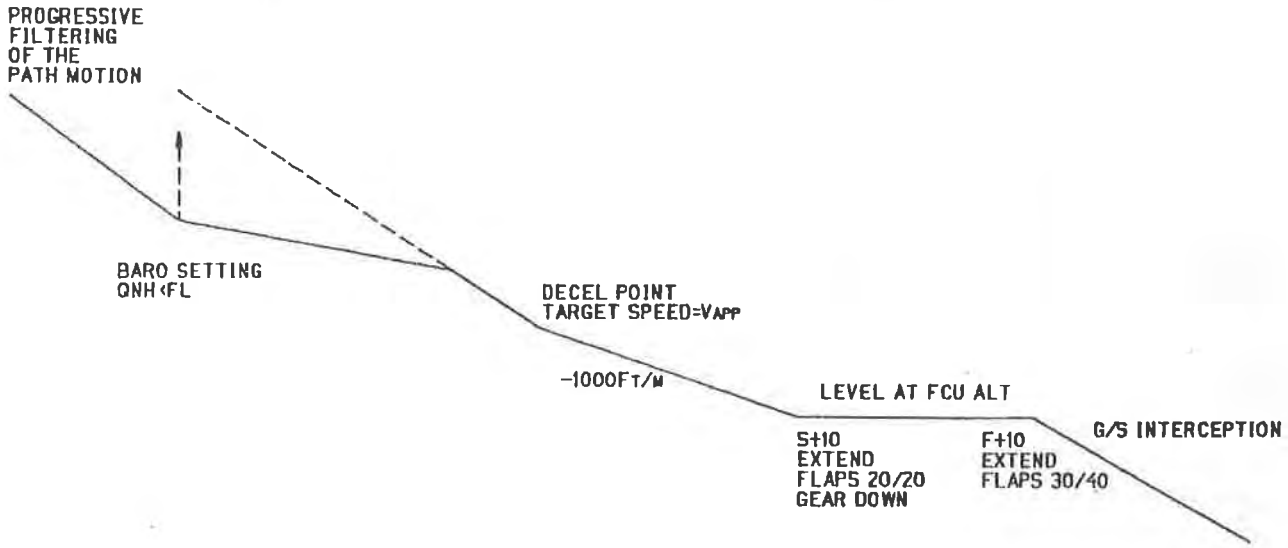
The remaining flight is performed in V/S mode, the vertical speed being automatically synchronized at PROF disengagement.

CAUTION : PROFILE should not be disengaged by pulling the speed knob on FCU because LVL/CHG will be engaged instead of V/S mode.

AP DISCONNECT push button . . . . . PRESS when necessary.

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VERTICAL PROFILE

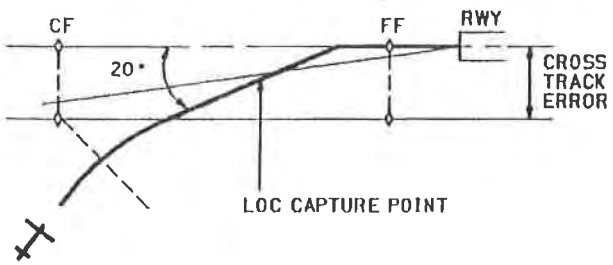


LATERAL NAVIGATION

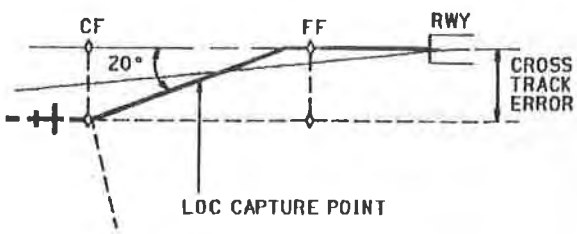
LOC INTERCEPTION WITH A 20° ANGLE

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1)LEG SWITCHING BEYOND CF WPT COMBINED WITH A CROSS TRACK ERROR



2)AIRCRAFT FLYING ON WRONG RWY AXIS, PARALELL TO LOC AXIS



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PURPOSE

The following FMS performance charts allow to know in advance or to check in flight the different FMS speed/mach and altitude targets according to the cost index and flight parameters.

COST INDEX

The COST INDEX CI = 60 $\frac{kt}{kf}$ where

kt = cost of one second of flight
kf = cost of one kilogram of fuel.

When CI = O the ECON strategic mode corresponds to a MIN FUEL mode. When CI = 999 (max value), the ECON strategic mode corresponds to a MIN TIME mode.

CHARTS

There are 8 charts :

1 – Optimum initial climb speed.
2 – Optimum final climb, cruise and initial descent mach.
3 – Optimum cruise altitude.
4 – Optimum descent speed.
5 – Maximum altitude.
6 – Maximum endurance speed (holding clean).
7 – Max slope climb speed (MAX CLIMB MODE).
8 – Flight envelope.

SPD/MACH targets

The FMS computes an optimum climb speed, descent speed and cruise mach.

During climb, when climb speed is equal to cruise mach, the latter becomes the target for the remaining climb segment, for the cruise and for the beginning of the descent until it is equal to the optimum descent speed.

LIMITATIONS

These charts don't always take care of the operational limitations but these limitations are taken in account by the FMS. These limitations are :

VMAX = 330 kt (even if VMO = 340 kt)
MMAX = 0.82
HMAX = 41 000 ft limited by the 1.3 g buffet margin
VMIN = MAX (GREEN DOT FAC, GREEN DOT FMS)

In addition the speed is limited by ICAO rules : 250 kt below 10 000 ft ICAO holding speeds.

ACCURACY

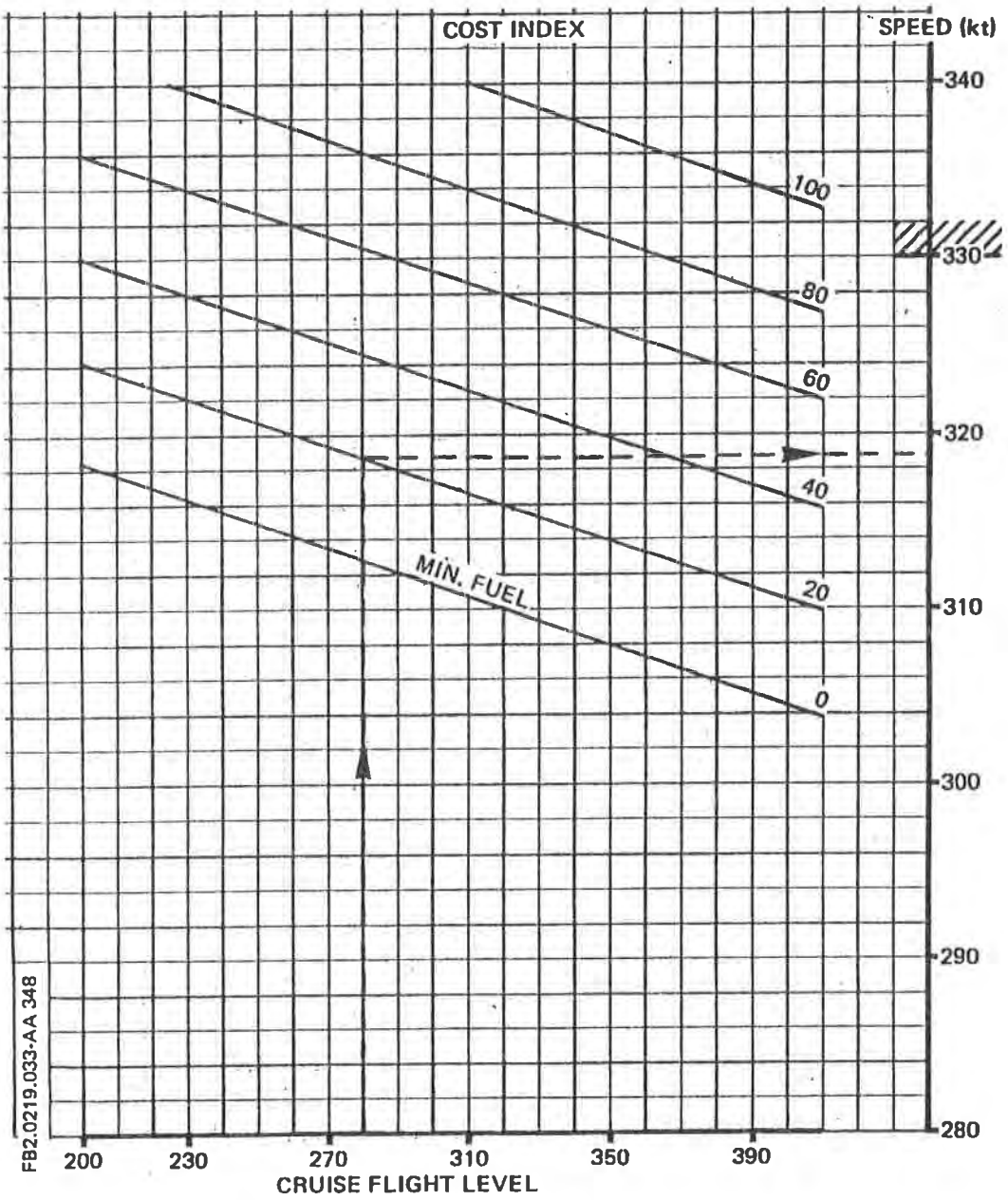
The drawings of these charts give a speed accuracy better than 10 kt.

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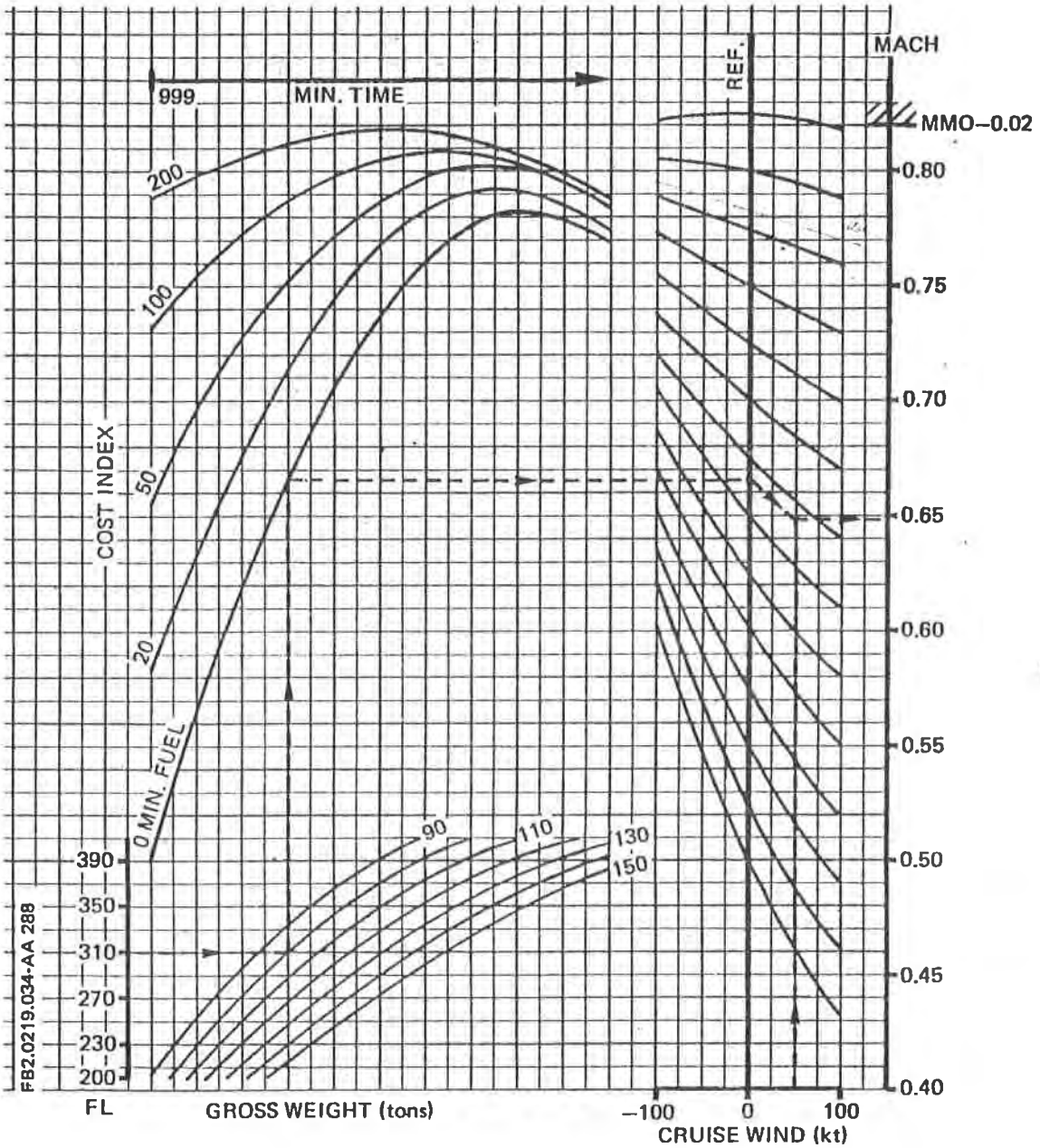
INITIAL CLIMB SPEED FOR STRATEGIC MODE

BELOW 10 000 FT CLIMB SPEED ≤ 250 KT



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FINAL CLIMB, CRUISE AND INITIAL DESCENT MACH FOR STRATEGIC MODE

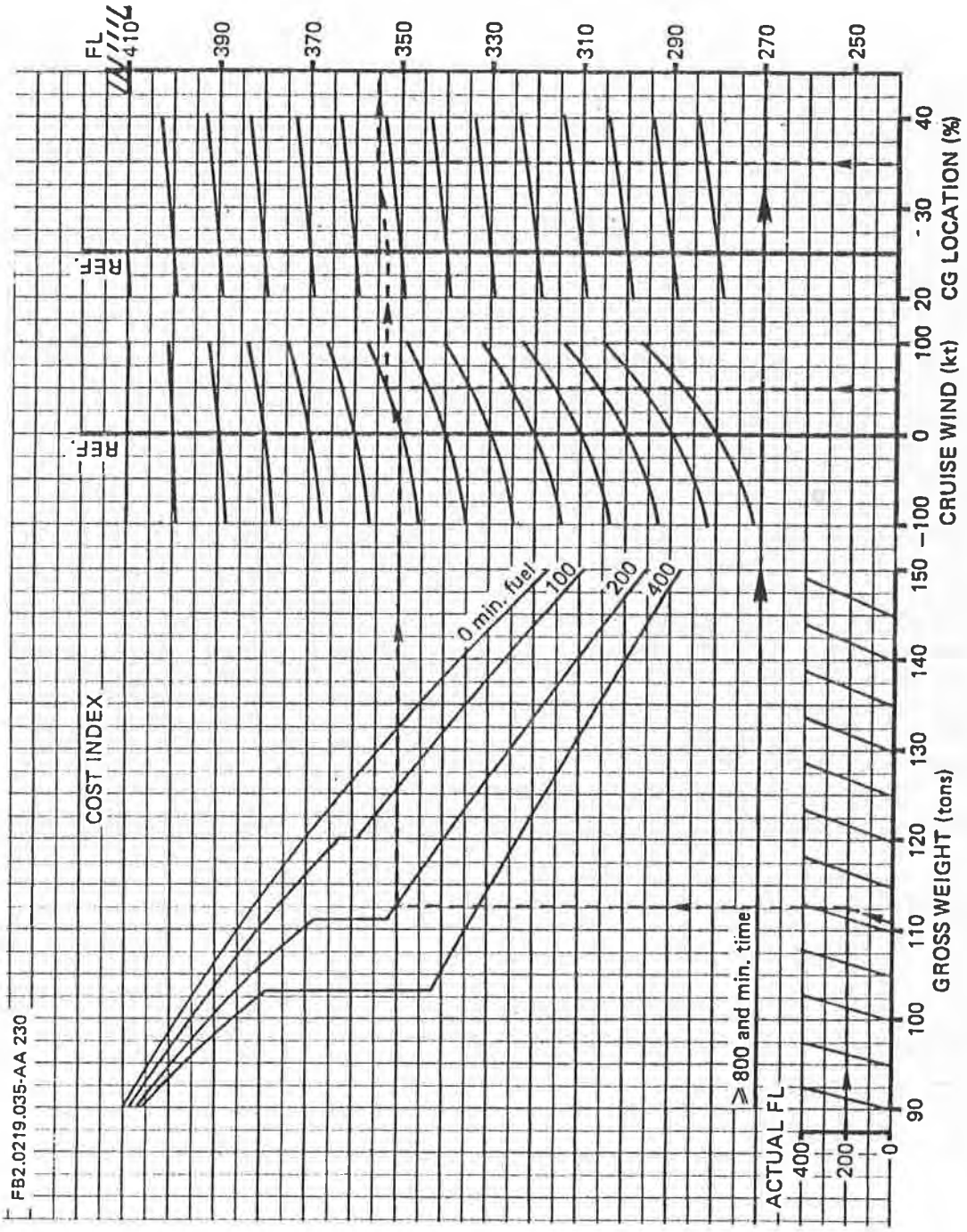


USE ONLY FOR CRUISE FLIGHT > 5 mn

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OPTIMUM ALTITUDE FOR STRATEGIC MODE



This chart gives the OPTIMUM FL taking into account the climb segment from ACTUAL FL.
The OPTIMUM ALTITUDE is upper limited to the altitude giving a 5mn cruise phase.

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GE Eng. : 80C2A2

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GENERAL

Normal procedures describe actions which are necessary for the routine operation. While the sequence of procedures follows the natural phases of flight, the sequence of action in a procedure follows a standardized scan of panels or equipment except when required by the logic of actions priority.

For all actions relevant expanded information is given if necessary.

All actions of a procedure are either required to operate the airplane safely in the related phase of flight or to prepare the airplane for the following phase of flight. Each action is assigned to a specific crewmember to ensure coordinated operation.

Basic principle during preparation is the "all white lights out"(dark cockpit) concept. After scan and during normal operation all the white lights are extinguished.The use of lights to indicate operation is limited to a minimum(i.e. anti-ice, econ flow) after engine start. Primarily, ECAM messages are used to deal with non normal conditions or configurations.

Scanning or monitoring panels out of normal field of view is thereforenot required during normal operation.

Similar to the technical concept of the airplane(dark and quite during normal operation) verbal crew communication will be limited to commands, requests, announcements and callouts.

If an wrong or incompatible command is given or an desired configuration is not achieved, verbal feedback is required.

AUTOMATIC SYSTEMS

During normal operation flight is controlled through the FMS in NAV and PROFILE modes until operational conditions necessiate use of AFS only modes or manual flight(with or without F/D). Due to multitude of possible choices detailed AFS and FMS operation will be found in "Procedures and techniques" and "Special operations".

TASK SHARING

Revision to the FMS Selection of modes or references to the AFS(incl.ATS)	
Manual flight CWS	Autopilot in CMD
Request by PF appropriate wording	Perform Revision/ PF selection
Perform revision/ PNF selection	----- PNF
Crosscheck as applicable on FMA,PFD, ND, FMS, CDU(s) Both	

APPLICATION OF NORMAL PROCEDURES

Normal procedures are performed by recall.

During "FLIGHT AND COCKPIT PREPARATION" two versions of the Normal Procedures may be applied:

a) the "Complete Procedure" including all actions laid down in the FCOM.

b) the "Reduced Procedure" following the same scan as the "Complete Procedure", omitting however, mainly system tests and functional checks to the extent indicated by brackets marked Ø.

The "Complete Procedure" must always be performed:

- after any non-routine maintenance actions, or
- after the airplane was left unattended by qualified personnel, or
- after the "Leaving Airplane Procedure" was performed by the previous crew , or
- if there is any doubt about the airplane status.

It rests with the responsibility of the crew to perform the "Reduced Procedure" in all other cases since the "Reduced Procedure" ensures correct positions and indications of all controls and instruments for a safe and economic airplane operation.

NORMAL CHECKLIST

Normal procedures that may have a direct adverse impact if not properly accomplished, are covered by the related Normal Checklist. The item is included in the checklist only if the omission is not detectable by other means (lights, warning messages). Additionally, aspects of economic importance may be included.

PRINCIPLES OF NORMAL CHECKLIST APPLICATION

The normal checklist is applied after the appropriate procedure is completed. The Pilot Flying(on the ground CM 1) shall request reading of a checklist by announcing its title.

Reading of a checklist shall include the title.

- The Normal Checklist is read by PNF(on the ground CM 2).

Normal Checklists are of the "CHALLENGE/RESPONSE" type.

The appropriate CM shall respond to the challenge after having verified the existing configuration. The other CM shall cross-check , whenever feasable , the validity of the response.The challenger shall wait for the response before proceeding with the checklist.

Upon completion he shall announce: "...CHECKLIST COMPLETED".

If the actual configuration is not in accordance with the checklist standard, corrective action shall be initiated. If corrective action is not possible, the response must be modified to reflect the actual situation(specific answer).

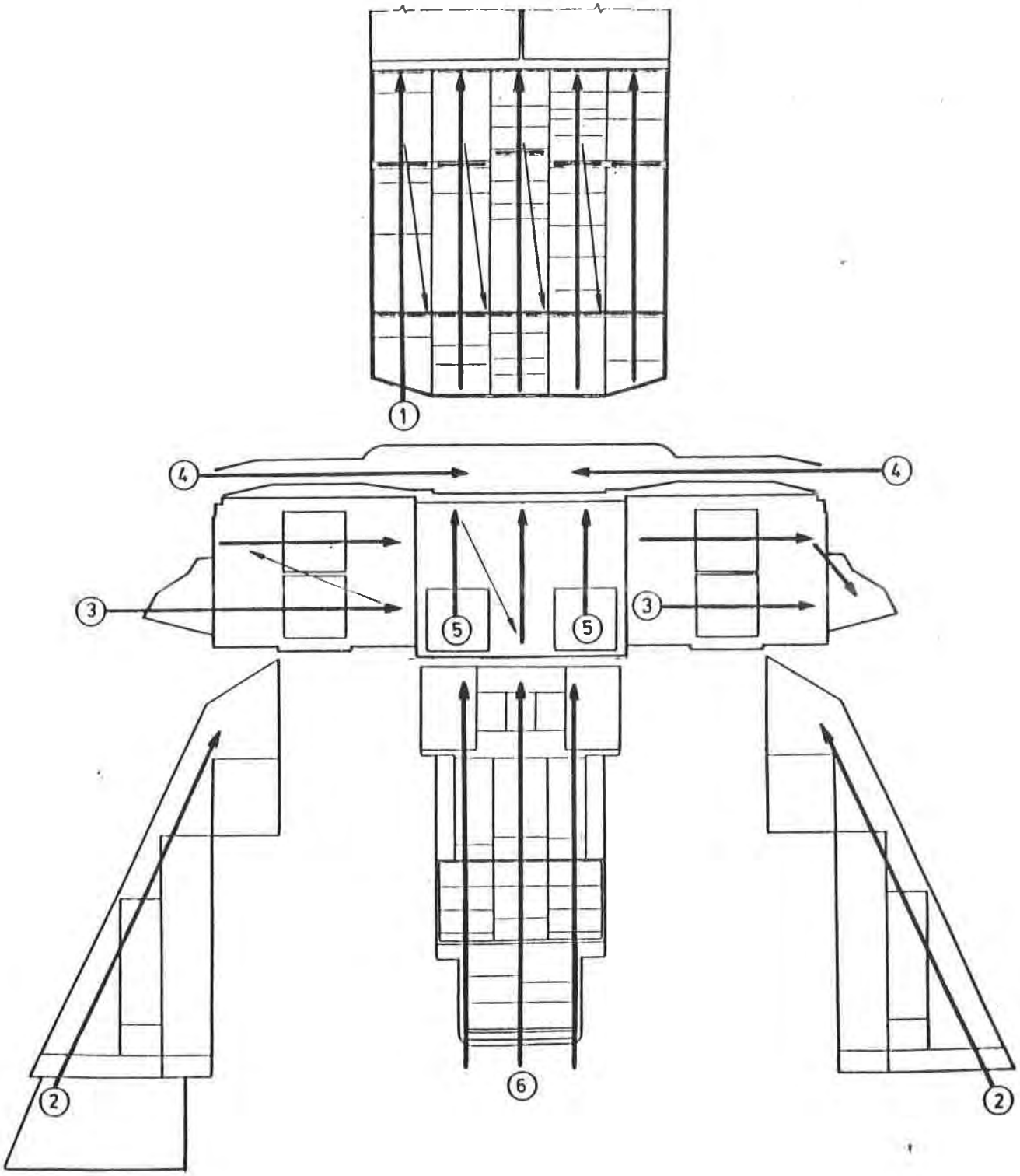
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CAUTION FOR TRAINING :

In case of training below 1000 ft, some of the warnings remain inhibited and therefore when TO INHI or LDG INHI is displayed on CRT MEMO page, it is necessary to depress RECALL PB on ECAM control panel to cancel the inhibition.

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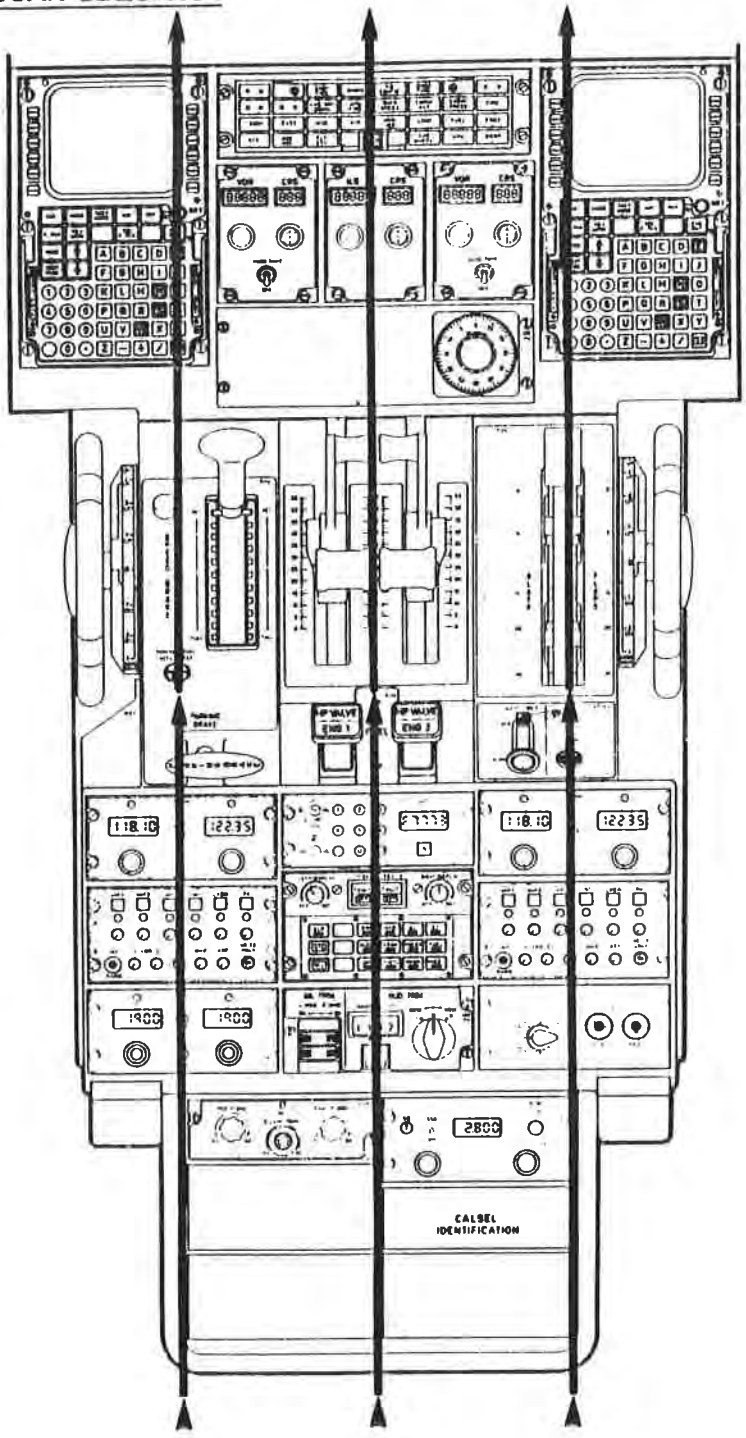


Vers. : All Eng. : All

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PEDESTAL SCAN SEQUENCE



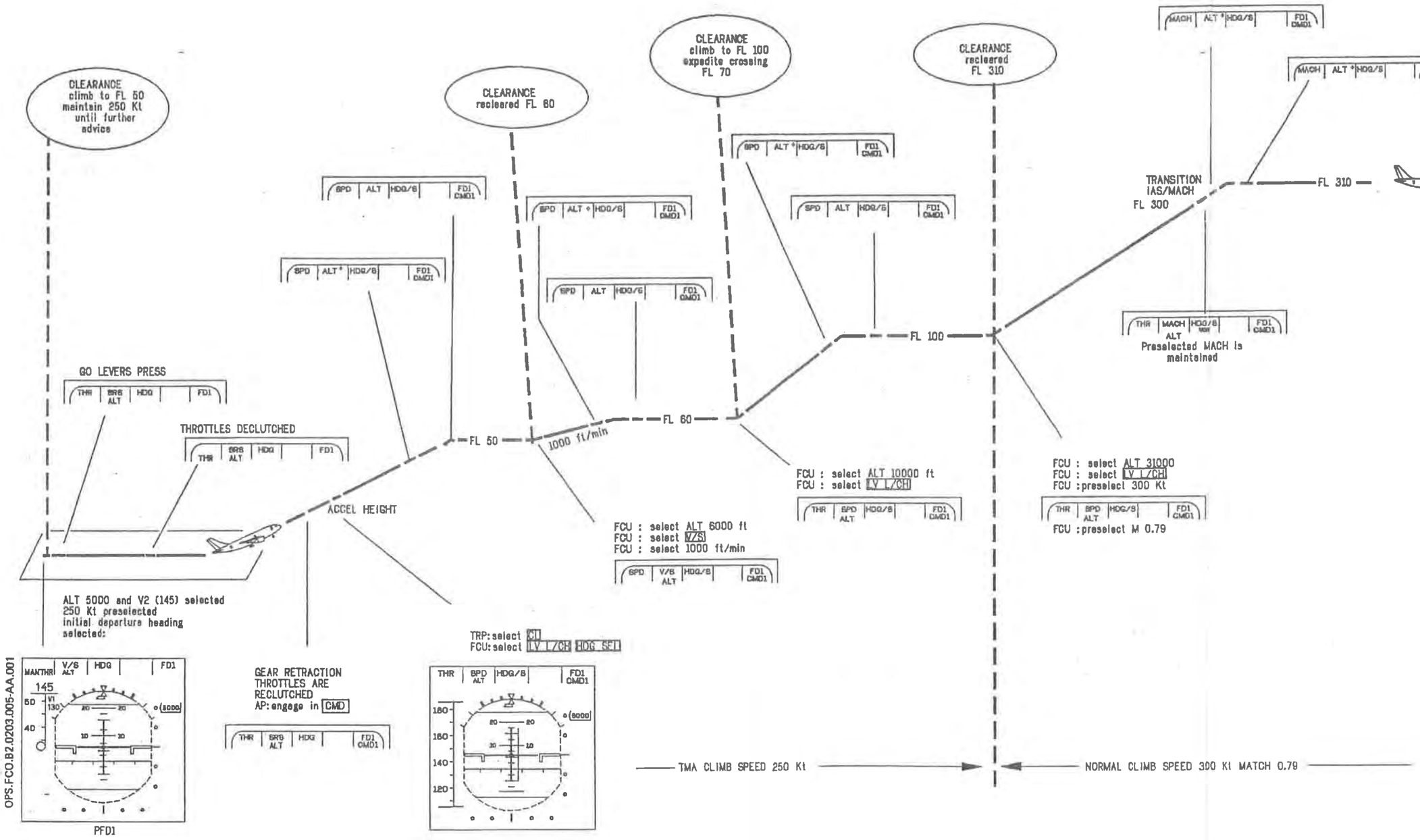
Vers. : All

Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES	2.02.03
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TAKE - OFF, CLIMB, CRUISE



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4 – LATERAL MODES

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

A. HDG mode

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

B. HDG SEL mode

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

HDG SEL knob. . . . . .TURN TO SELECT
(Max. bank angle) NORM (25°) or 15 (15°)

{ HDG SEL knob . . . PULL TO SELECT HDG SEL MODE
or
HDG SEL p.b. . . . PRESS TO SELECT HDG SEL MODE

HEADING ACQUISITION LOGIC :

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

C. VOR mode

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

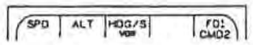
VOR/NAV/ILS switch. . . . . .SELECT VOR

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

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

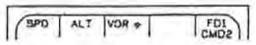
- Intercept at an angle lower than 90°. If the distance to the station is smaller than 30 NM, use smaller (30° or less) intercept angle.
- To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.
- When passing over the station, selected VOR course can be changed by as much as 30° on the VOR control panel.
- The VOR mode comprises 3 phases :

ARM PHASE



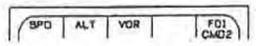
BLUE VOR

CAPTURE PHASE



GREEN VOR ◆

TRACK PHASE



GREEN VOR

D. LOC mode

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

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

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

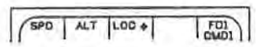
V/L p.b. . . . . .PRESS TO SELECT LOC MODE

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

ARM PHASE

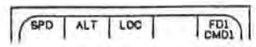
BLUE LOC

CAPTURE PHASE



GREEN LOC ◆

TRACK PHASE



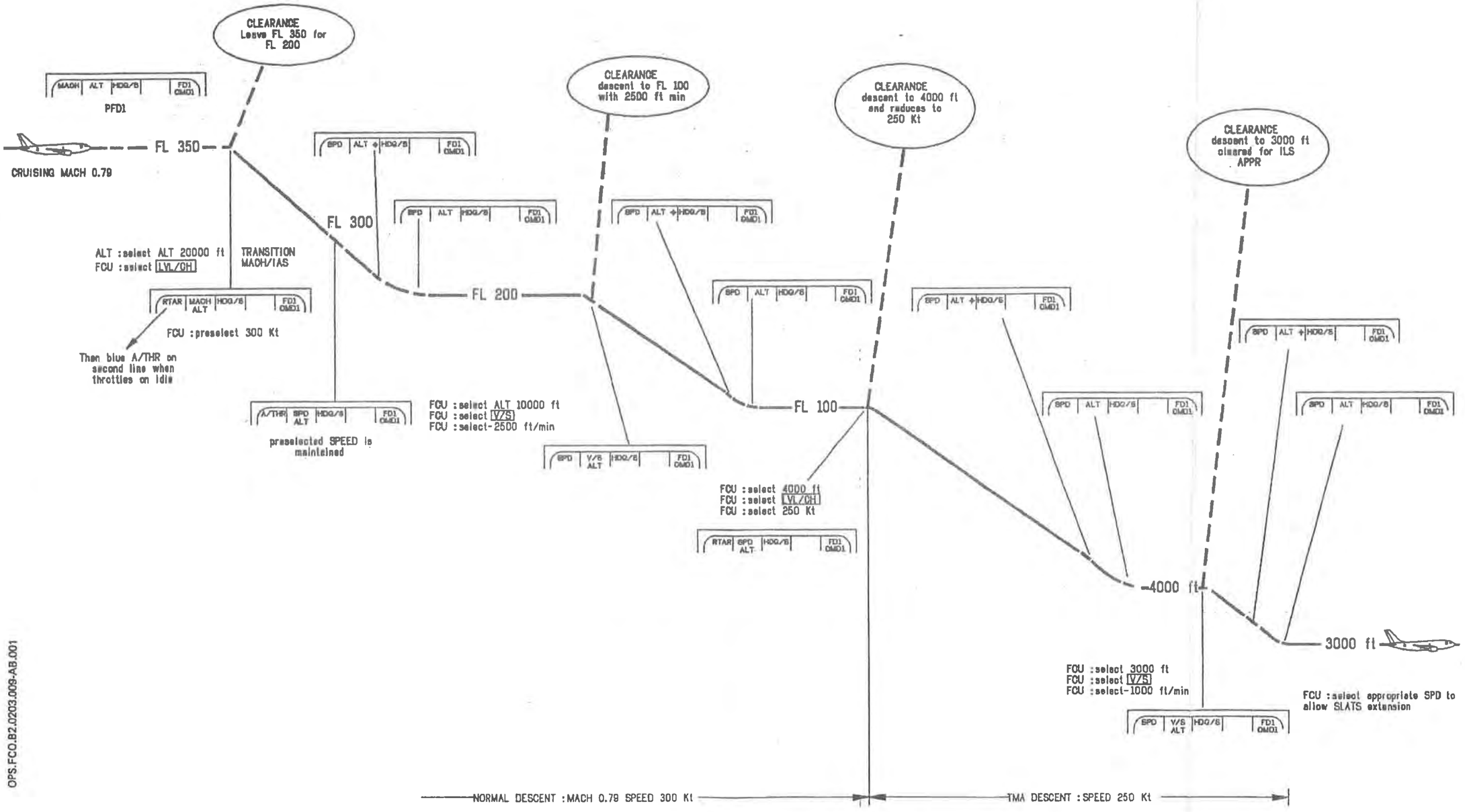
GREEN LOC

OPS.FCO.B2.0203.006-AA.001

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A310 FLIGHT CREW OPERATING MANUAL	PROCEDURES and TECHNIQUES AFS / FPV / DFA / WGD USE OF AFS	2.02.03 PAGE 9 REV 18 SEQ 001

DESCENT



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6 – APPROACH AND LANDING

A. GENERAL

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

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

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

flight crew – aircraft system – runway facilities

and this capability defines the applicable weather minima.

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

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

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

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

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

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

CAT III :

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

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

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

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

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

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

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

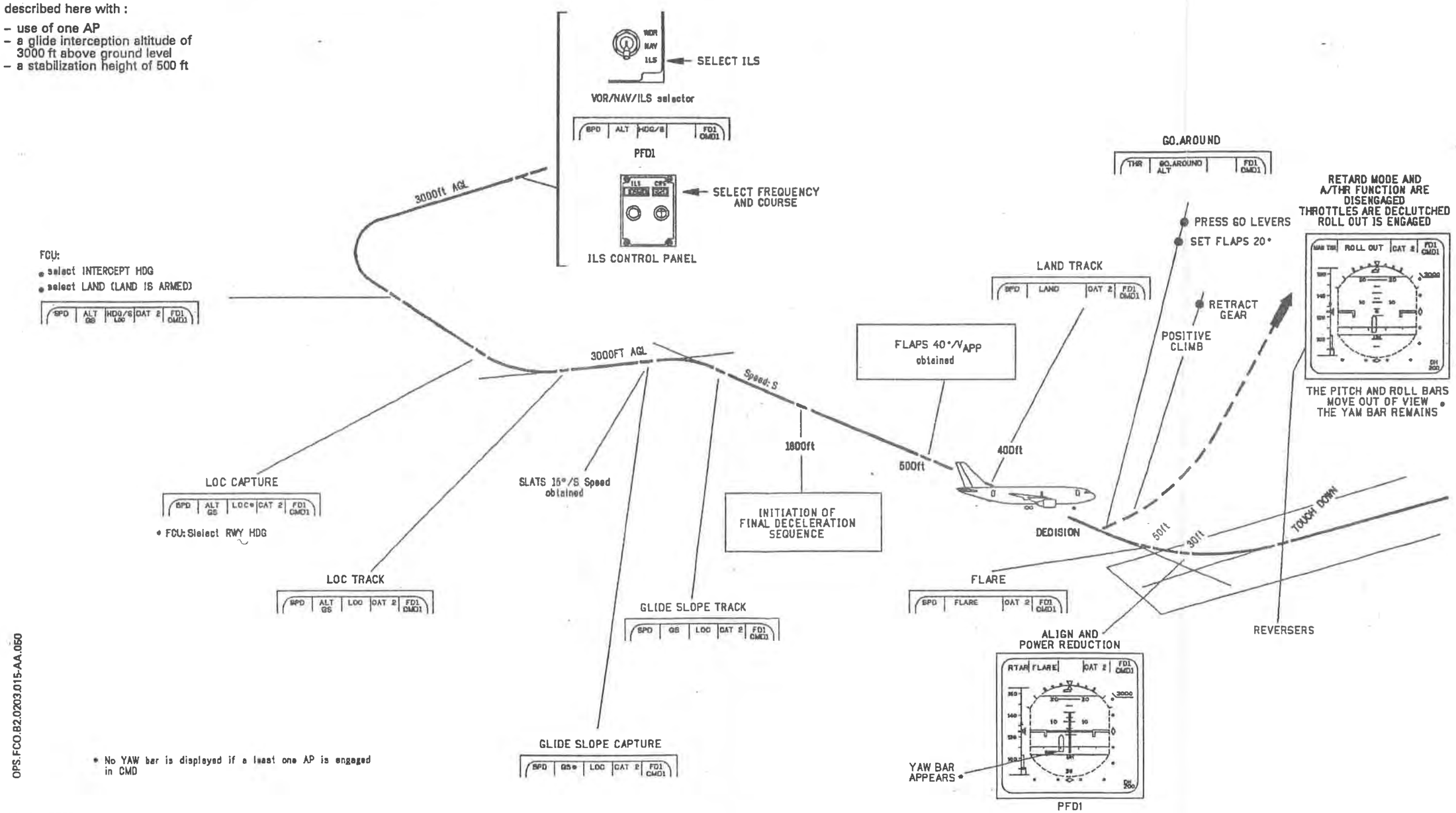
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STANDARD ILS APPROACH

described here with :

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



OPS.FCO.B2.0203.015-AA.050

Mod. : 5757

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F. GO AROUND

	CAT 1 OR BETTER WEATHER CONDITIONS	CAT 2 WEATHER CONDITIONS
DH	• PNF announces « NO CONTACT ». • PF announces « GO-AROUND, FLAPS 20° », presses the GO-LEVERS, monitors THROTTLE advancement and controls or monitors (as appropriate) the FLIGHT PATH. *Note : If ATS is not armed, PF pushes throttles full forward.* *If moreover ENGINE TRIM is inoperative, he adjusts throttle to the correct power setting.* • PNF retracts FLAPS one step and monitors engine parameters. • As soon as rate of climb is positive : PNF announces « POSITIVE CLIMB ». PF asks for GEAR retraction PNF retracts the gear and confirms « GEAR UP ».	• CM1 announces « GO-AROUND, FLAPS 20° », presses the GO-LEVERS, push throttles full forward* (if no ATS). * If ENGINE TRIM inoperative adjust throttles to the correct power setting. *Note : If ATS is not armed, CM1 pushes throttles to adjust go-around power.* *If moreover ENGINE TRIM is inoperative, he adjusts throttle to the correct power setting.* • CM2 retracts FLAPS one step and monitors engine parameters. • As soon as rate of climb is positive : CM2 announces « POSITIVE CLIMB ». CM1 asks for GEAR RETRACTION CM2 retracts the gear and confirms « GEAR UP ». • CM2 announces 200 FT, 300 FT. *Note : IF AT DH, NO CALL FROM CM1, CM2 PERFORMS A GO-AROUND.*
	CAUTION At each time a GO AROUND is initiated, even if manually done, PRESS THE GO LEVERS IN ORDER TO GET OUT OF LAND MODE	
ACCEL ALT	See also Patterns in following pages. • With TWO ENGINES At acceleration altitude : SPD/MACH setting knob . . . . . SELECT 250 KT LVL/CH p.b. . . . . SELECT LVL/CH MODE TRP . . . . . SELECT CL OR CR THRUST • With ONE ENGINE OUT At acceleration altitude : SPD/MACH setting knob . . . . . SELECT 250 KT ALT HLD p.b. . . . . SELECT ALT MODE At « GREEN DOT » speed LVL/CH p.b. . . . . SELECT LVL/CH MODE TRP . . . . . SELECT MCT THRUST SPD/MACH setting knob . . . . . SELECT « GREEN DOT »	

WARNING : 1) During a GO AROUND, an ENGINE FAILURE may lead to the disconnection of one or both AP :
- If 1 AP remains engaged, go on in automatic control.
- If no AP remains engaged, CM1 manually takes over and refers to the MAIN and STANDBY HORIZONS and to the FD BARS (if they are available).

2) In the case of a manual GO AROUND the pitch trim should be adjusted as soon as possible to counteract the strong nose up tendency.

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G. PROCEDURES FOLLOWING FAILURES (LAND MODE ENGAGED)

ENGINE FAILURE DURING THE APPROACH

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

FAILURE OF HYDRAULIC SYSTEM WITHOUT HYDRAULIC FLUID LOSS

ABOVE 1000 FT :

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

BELOW 1000 FT :

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

Mod. : 4941 + 5757

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FAILURES AND ASSOCIATED ACTIONS DURING A CAT 2 APPROACH

	SINGLE WARNINGS	ACTIONS (AT TIME OF WARNING DETECTION) 1000 ft / 700 ft / 400 ft / 200 ft / 100 ft / DH	OBSERVATIONS
A/C SYSTEMS	SLATS/FLAPS failure (JAMMED AT 20°/20°)	REVERT TO CAT 1 MINIMA — NOT APPLICABLE	FOR SAFETY REASONS, APPROACH AND AUTOMATIC LANDING CAN BE CONTINUED WITH CAT2 MINIMA.
	ANTI-SKID SYSTEM FAILURE	NOT APPLICABLE	DISENGAGE AP AT TOUCHDOWN
	HYDRAULIC FAILURE (WITHOUT FLUID LOSS)	TRANSFER. NO CAPABILITY LOSS	
	ALPHA FLOOR ACTIVATION	DISENGAGE A/THR MODE. CHECK SPEED AND RE-ENGAGE A/THR	
	ENGINE FAILURE	REVERT TO CAT 1 MINIMA	
FLT INSTRUMENTS	STBY HORIZON FLAG	REVERT TO CAT 1 MINIMA	
	red « RA » (radio altimeter) on two PFD's	REVERT TO BASIC MODES MINIMA (CAT1)	AP/FD NOT AVAILABLE IN LAND. DISENGAGE A/THR AT 30 FT AND MANUALLY REDUCE POWER R
	red « CHECK ATT » on two PFD's *	TRANSFER : – IF WARNING DISAPPEARS, A CAT 2 IS STILL POSSIBLE – IF NOT, REVERT TO CAT 1 MINIMA	* THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY HORIZON. BELOW 1000 FT, CM 1 PERFORMS A MANUAL GA USING STBY HORIZON.
	red « ATT » on one PFD		
	Diagonal line on one PFD and ND		
	red « CHECK HDG » on two ND's **		** THE FIRST ACTION, BEFORE TRANSFERING, IS TO CHECK WITH STBY COMPASS.
	red « HDG » on one ND		
	red « SPD »		DO NOT MAKE ANY SWITCHING BELOW 1000 FEET
AFS and FMA	NO « LAND » at 400 FT	NOT APPLICABLE	
	« AP OFF » warning	TRY TO RECOVER. IF IMPOSSIBLE REVERT TO CAT 1 MINIMA	
	LOSS of « CAT 2 »		
	LOC or G/S EXCESSIVE DEVIATION on PFD	MONITOR ILS TRACK	
	« AUTOLAND » light	NOT APPLICABLE	
	INCORRECT selected CRS on ND's at 400 ft	NOT APPLICABLE	DURING FLARE, OVERRIDE AP WITH RUDDER TO LINE UP A/C. DISENGAGE THE AP AT TOUCH DOWN
	NO « FLARE » at 30 FT		AT 30 FT, DISCONNECT AP AND MANUALLY COMPLETE THE LANDING
	FOR MULTIPLE WARNINGS MOST LIMITING APPLIES	1000 ft / 700 ft / 400 ft / 200 ft / 100 ft / DH	

GO AROUND IF INSUFFICIENT VISUAL REFERENCES

LAND

Mod. : 5757

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TECHNICAL CONDITION OF THE A/C

- The crew will verify the technical state of the aircraft (HIL), in respect to airworthiness, acceptability of malfunctions (MEL) and influence to the flight plan.

WEATHER BRIEFING

- Crew will receive weather briefing.
- Briefing should include :
  - . Actual and expected weather conditions for take-off and climb-out including runway conditions.
  - . Enroute significant weather : winds and temperatures.
  - . Terminal forecasts for destination and alternate airports.
  - . Actual weather for destination and alternates for short range flights and recent past weather if available.
  - . Survey of the meteorological conditions at airports along planned route.

NAV/COM FACILITIES EN ROUTE

- The crew will study the latest relevant NOTAMS, and will check that all required facilities at departure, destination and alternate airports are operational and that they fulfill the appropriate requirements.

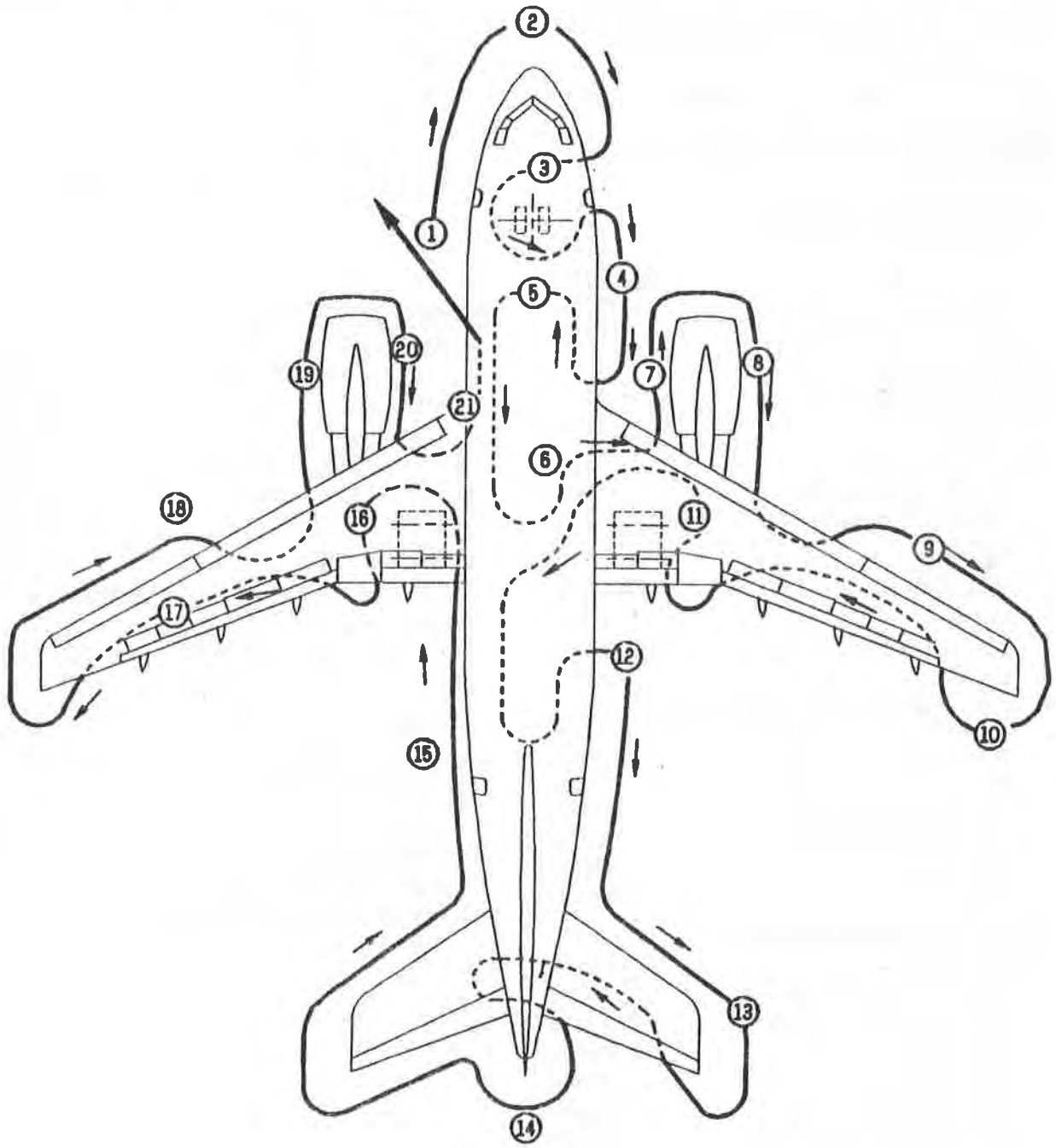
FLIGHT PLANS & OPERATIONAL REQUIREMENTS

- The crew will check the company flight plan, in respect to routing, altitudes and flight time.
- The crew will check the estimated load figures and will calculate max allowed take-off and landing weights.
- The Captain will decide the amount of fuel necessary for a safe conduct of the flight, taking in consideration possible economic fuel transportation.
- The Captain will check ATC flight plan and ensure it is filed according to the prescribed procedures.

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EXTERIOR WALK – AROUND



OPS.FCO.B2.0305.001-00.540

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The exterior inspection is primarily a visual check to ensure that the overall condition of the A/C, the visible components and equipments are safe for the following flight.
It is normally performed by maintenance or in the absence of maintenance by the F/O before each originating flight. Items marked by asterisks (*) will be performed again by the F/O prior to each flight.

CONTROL SURFACES, SLATS/FLAPS & SPOILERS

During exterior walk around, observe flight control surfaces, slats, flaps and spoilers are clear and **memorize** surfaces position.

1) LEFT FORWARD FUSELAGE

* – Static ports ..... CLEAR
– Exterior lights ..... CONDITION
* – Angle of attack probe ..... CONDITION
* – Toilet service access door ..... CLOSED

2) NOSE SECTION

* Pitot probes and covers ..... CHECK/REMOVED
* TAT probes ..... CONDITION
* Radome and latches ..... CHECK
– Oxygen compt venturi ..... CHECK
– Oxygen over pressure disk ..... GREEN

3) NOSE GEAR

* – Nose wheel chocks ..... IN PLACE
* – Wheels and tires ..... CONDITION
– Nose gear structure ..... CONDITION
– Taxi lights ..... CONDITION
– External electric PWR access door (if EXT PWR not necessary) ..... CLOSED
* – Nose wheel steering selector and by-pass pin ..... CHECK
– Proximity detectors ..... CLEAN
– Hydraulic lines and control cables .... CONDITION
– Wheelwell ..... CHECK
* – Safety pin ..... REMOVED

4) RIGHT FORWARD FUSELAGE

* – Cargo doors ..... CHECK
* – Cargo loading control door ..... CHECK
* – Cargo door selector access door ..... CHECK
– Exterior lts ..... CONDITION
* – Static ports ..... CLEAR
* – Angle of attack probes ..... CONDITION
– Lower fuselage access doors ..... CLOSED

5) LOWER CENTER FUSELAGE

– Extract valve/fan ..... OPEN & RUNNING
– Antennas ..... CONDITION
– Ground air conditioning door ..... CLOSED
– Fresh water service door ..... CLOSED
– Ram air inlet flap ..... CLOSED
– Ground air conditioning/engine starting door ..... CLOSED
– Pack air intakes ..... CLEAR
– Landing gear door opening on ground (access doors) ..... CLOSED
* – Refueling electric control panel (access door) ..... CLOSED
– Packs air outlets and flaps ..... CLEAR

6) RIGHT CENTER WING

– Wing ventilation air intake ..... CLEAR
– RH Inner fuel tank water drain valves .... CHECK
– Drip sticks ..... SECURED
– Landing light ..... CONDITION
– Yellow hydraulic access door ..... CLOSED
– Ram air turbine doors ..... CLOSED
* – Slat 1 & kruger ..... CONDITION

7) ENGINE 2 LEFT SIDE

* – Cowlings ..... CLOSED/LATCHED
* – Drain mast ..... CHECK R
– Hydraulic filter access door ..... CLOSED
– Starter valve manual override access door ..... CLOSED
* – Engine inlet and fan blades ..... CHECK

8) ENGINE 2 RIGHT SIDE

– Anti-ice exhaust ..... CLEAR
– Engine oil access door ..... CLOSED
– Turbine exhaust ..... CLEAR
– Pylon overpressure door ..... CLOSED
– Fire agent bottles access door ..... CLOSED
– Pylon drains ..... CHECK

GE Eng. : 80C2A2

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9) RIGHT WING LEADING EDGE

- * – Slats 2 and 3 ..... CONDITION
- – Refuel plugs ..... CHECK
- – Drip sticks ..... SECURED
- – RH outer fuel tank water drain valves .... CHECK
- – Surge tank air inlet ..... CLEAR
- * – Fuel Vent. O/press disc ..... INTACT
- * – Wing tip ..... CHECK

10) RIGHT WING TRAILING EDGE

- – Static dischargers ..... CHECK
- * – Control surfaces ..... CHECK
- – Flap track fairing's ..... CHECK
- * – Flaps ..... CONDITION

11) MAIN RIGHT LANDING GEAR AND FUSELAGE

- * – Wheel chocks ..... REMOVED
- * – Wheels and tires ..... CONDITION
- – Brakes and brake wear indicators ... CONDITION
- – Proximity sensors ..... CLEAN
- – Hydraulic lines ..... CHECK
- – Pitch damper pressure drop indicator .... CHECK
- – Landing gear structure ..... CHECK
- – Gear uplock hook ..... CONDITION
- – Downlock spring ..... CHECK
- – Wheelwell ..... CHECK
- – Landing gear door ..... CLOSED
- – Water drain mast ..... CHECK
- – Antennas and beacon ..... CHECK

12) RIGHT AFT FUSELAGE

- – Cargo loading control access door ..... CHECK
- – Cargo compartment door hydraulic selector access door ..... CHECK
- – Cargo door lock-unlock control lever .... CHECK
- – Cargo doors ..... CHECK
- – Outflow valves ..... CHECK
- * – Toilet service access door ..... CHECK
- – Tail cone access door ..... CLOSED
- – RH landing gear down lock indicator pin ..... EXTENDED
- – Tail skid ..... CHECK

13) TAIL SECTION

- * – Stabilizer and elevator ..... CHECK
- * – Fin and rudder ..... CHECK
- – Static dischargers ..... CHECK
- * – Fuel vent O/press disc ..... INTACT
- – Trim tank water drain valves ..... CHECK
- – Tail vent tank water drain valve ..... CHECK
- – Drip stick ..... SECURED

14) APU

- – APU doors ..... CLOSED
- – APU air intake ..... OPEN
- – APU drain and vents ..... CHECK
- – Oil cooler exhaust ..... CHECK
- – APU exhaust ..... CLEAR
- – APU fire agent discharge indicator . CHECK RED DIAPHRAGM IN PLACE

15) LEFT AFT FUSELAGE

- – LH landing gear downlock indicator pin ..... EXTENDED
- – Stabilizer and elevator ..... CHECK
- * – Fresh water drain ..... CHECK
- – Green hydraulic access door ..... CLOSED

16) MAIN LEFT LANDING GEAR

- – Wheelwell ..... CHECK
- – Landing gear door ..... CLOSED
- * – Wheels chocks ..... REMOVED
- * – Wheels and tires ..... CONDITION
- – Brakes and brake wear indicator .... CONDITION
- – Proximity sensors ..... CLEAN
- – Hydraulic lines ..... CHECK
- – Landing gear structure ..... CHECK
- – Gear uplock hook ..... CONDITION
- – Downlock spring ..... CHECK

17) LEFT WING TRAILING EDGE

- * – Flaps ..... CONDITION
- – Flap track fairings ..... CHECK
- * – Control surfaces ..... CHECK
- – Static dischargers ..... CHECK

18) LEFT WING LEADING EDGE

- * – Wing tip ..... CHECK
- – Surge tank air inlet ..... CLEAR
- * – Fuel vent O/press disc ..... INTACT
- – LH outer fuel tank water drain valves ... CHECK
- – Drip sticks ..... SECURED
- – Refuel plugs ..... CHECK
- * – Slats 2 and 3 ..... CONDITION

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R

19) ENGINE 1 LEFT SIDE

- Pylon drains ..... CHECK
- Fire agent bottle access door ..... CLOSED
- Pylon overpressure door ..... CLOSED
- * Cowlings ..... CLOSED/LATCHED
- * Drain mast ..... CHECK
- Hydraulic filter access door ..... CLOSED
- Starter valve manual override access door ..... CLOSED
- * Engine inlet and fan blades ..... CHECK

20) ENGINE 1 RIGHT SIDE

- Anti ice exhaust ..... CLEAR
- Engine oil access door ..... CLOSED
- Turbine exhaust ..... CLEAR

R

21) LEFT CENTER WING

- * Slat 1 & Kruger ..... CONDITION
- Blue hydraulic access door ..... CLOSED
- Landing light ..... CONDITION
- Drip sticks ..... SECURED
- LH inner fuel tank water drain valves ... CHECK
- Wing ventilation air intake ..... CLEAR

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CM 1 EXTERIEUR SAFETY INSPECTION

Completion ensures that the airplane and/or its surroundings are not obviously unsafe for operation.

Wheel Chocks . . . . . IN PLACE
Check chocks are set on nose landing gear wheels.

Landing Gear Doors . . . . . CHECK
If landing gear doors are open x-check that landing gear doors position corresponds with their respective ground door opening handle position.

Reversers . . . . . CHECK
Memorize reverser position.

Control Surfaces, Slats, Flaps, Spoilers . . . . . OBSERVE
Observe flight control surfaces area is clear, memorize surfaces position.

CM 1 COCKPIT SAFETY INSPECTION

This procedure must be performed before airplane system(s) are powered. It must be performed if there is any doubt that all safety aspects are covered.

Completion ensures there will be no danger to the airplane and/or personnel when the different sources of energy will power the associated system(s).

Perform these checks prior assuming normal crew position.

Airplane condition at crew arrival

◆ Not electrically suppplied

BAT (3) . . . . . CHECK THEN AUTO
Set BAT 1 to AUTO.
Check BAT 1 voltage is at least 23 V.
Repeat battery check with batteries 2 and 3 by setting the battery to be checked to AUTO first before setting the others to OFF.
Set all batteries to AUTO and observe flow bars in-line.

Emergency Inverter Condition . . . . . CHECK
Check AC EMER ON INV and DC ESS ON BAT lights illuminated. Set AC ELEC IND selector to EMER BUS and check INV parameters in white arc.
Caution: In case of EMER INV malfunction, switch off batteries before any other action to avoid damage to the electronic equipment.

Electrically supplied
Caution: Do not pressurize the green hydraulic system without ground crew clearance if a gear door is open.

Radar . . . . . OFF
VHF 1 . . . . . SET
Select desired frequency on VHF 1. Check loudspeaker is on.

Speedbrake Handle . . . . . X-CHECK IN AGREEMENT
X-check speed brake handle position corresponds with speed brakes and ground spoiler position. If handle position disagrees with surfaces position, set handle correspondingly.

Reverse Levers . . . . . X-CHECK IN AGREEMENT
X-check reverse levers position corresponds with reverser position.

SLATS/FLAPS Handle . . . . . X-CHECK IN AGREEMENT
X-check SLATS/FLAPS handle position corresponds with slats and flaps position. If handle position disagrees with surfaces position, set handle correspondingly.

Landing Gear Lever/Lights . . . . . DOWN/3 GREEN

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Maintenance Status ..... CHECK 1
Examine TLB.
Ensure airplane status is in agreement with MEL/CDL requirements.
Report status to CM2.

BAT (3) ..... AUTO 1
C/B Panels ..... CHECK 1

Desired ELEC PWR Source

APU GEN

APU FIRE Handle ..... IN/GUARDED 1
Check fire handle is in, guarded and safetied.

APU FIRE PROTECTION ..... TEST 1
Extinguish any white light.
Press SQUIB TEST pushbutton and check AGENT SQUIB light illuminates.
Press LOOP TEST pushbutton. Check LOOP A light illuminates and observe APU FIRE warning (Audio/Fire Handle/MASTER WARNING or CRT/ LOOP A and LOOP B) is triggered.
Release LOOP TEST pushbutton. Observe APU FIRE warning is cancelled and LOOP B remains activated for a few seconds.

APU ..... START 1 Ø
Set APU MASTER SW to ON.
Check FUEL PUMP LO PR light off (may be momentarily on).
If FUEL PUMP LO PR lt stays on, select OVRD position.
Press APU START Pb-switch. Check ON lt and ACCEL lt illuminate.
Check AVAIL lt illuminated and ACCEL light extinguished.

EXT PWR

EXT PWR AVAIL Light ..... CHECK ON 1
EXT PWR ..... ON 1
Press EXT PWR Pb-switch. Check ON light illuminates.
AVAIL light extinguishes.

ELEC PWR ..... CHECK 1
Check no amber light illuminated except GEN 1 and GEN 2 FAULT lights.

VENT Panel ..... CHECK 1
Extinguish any white light.

ECAM System ..... CHECK/SET 1
Extinguish any white lights on ECAM control panel. Adjust brightness.

Emergency Equipment ..... CHECK 2
Check following equipment is in place:

- Life jackets
- Asbestos gloves
- Axe
- Flashlights
- Smoke goggles
- Portable fire extinguisher(lockwired, pressure within the green area)
- Oxygen masks
- Portable oxygen equipment and full-face-masks, bottle pressure within the green area and 4 adapters stowed underneath right aft window
- 3 RH and LH evacuation handles
- L/G gravity extension handle

Ø

Rain Repellent Bottle ..... CHECK 2
Verify rain repellent bottle level and pressure.

Ship's Papers ..... CHECK 2
Check FBH/FCOM aboard
Check NAVKIT, valid for the route to be flown, on board.

L/G Handcrank ..... CHECK STOWED 2

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Note: Due to the "all-white-lights-out" philosophy extinguishing of any white light during the scan is mandatory and therefore related panels are not listed in the following procedures. This will bring the systems in their normal configuration.
If applicable recycle systems thru OFF/R to extinguish FAULT lights.

Overhead Panel

Cabin Signs ..... **AUTO/ON** 1
No Smoking AUTO, Seat Belts ON.

HYD PWR ..... **CHECK** 1
Check 3 fluid level indications are normal within the upper small green arc, indication above the upper small green arc is acceptable.

ISDU ..... **OFF** 1 Ø
MSU 1 ..... **NAV** 1
Prior long range flights (more than 6 hours) or flights with high percentage of IRS navigation only turn MSU off for more than 10 s to enable a full IRS alignment.

EXT LT ..... **SET** 1
Set STROBE selector in AUTO position, BEACON selector in OFF position and remaining switches as required.

ANTI ICE Panel ..... **CHECK** 1
Extinguish any blue light.

PITCH TRIM 1 & 2 ..... ON 1
Note: Do not engage PITCH TRIM levers within 1 min following engine shutdown. Such an action would prevent TCC/FMC re-initialization.

YAW DAMPER 1 & 2 .....ON 1
ELEC PWR Panel .....CHECK 1
Check both IDG disconnect pushbuttons are guarded and safetied.

ENG 1 FIRE Handle .....IN/GUARDED 1
Check fire handle is in, guarded and safetied.

ENG 1 FIRE Protection .....TEST 1
Press SQUIB TEST pushbutton and check both AGENT SQUIB lights illuminate.
Press LOOP TEST pushbutton. Check LOOP A light illuminates and observe ENG FIRE warning (Audio/Fire Handle/MASTER WARNING or CRT/LOOP A and LOOP B) is triggered.
Release LOOP TEST pushbutton. Observe ENG FIRE warning is cancelled and LOOP B remains activated for a few seconds. Ø

ELEC IND Panel .....SET AS DESIRED 1
Landing Gear Annunciator .....CHECK 1 Ø
Check for normal indication.

ENG START Selector ..... OFF 1
FUEL QTY Panel .....CHECK 1
FUEL Panel .....SET 1
Check flowbars for correct position.
For EROPS only:
Open/close X FEED and check proper indications. Ø

APU FIRE Handle (if not already performed) ..... IN/GUARDED 1
Check fire handle is in, guarded and safetied.

APU FIRE Protection (if not already performed) ..... TEST 1
Press SQUIB TEST pushbutton and check AGENT SQUIB light illuminates.
Press LOOP TEST pushbutton. Check LOOP A light illuminates and observe APU FIRE warning (Audio/Fire Handle/ CRT/LOOP A and LOOP B) is triggered.
Release LOOP TEST pushbutton. Observe APU FIRE warning is cancelled and LOOP B remains activated for a few seconds. Ø

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MSU 3 ..... **NAV** 1
Same as for MSU 1

CABIN PRESS Panel ..... **CHECK** 1
Check RATE LIMIT Knob in NORM position.
RATE light extinguished.
Check CAB ALT, DIFF PRESS and CABIN V/S for logical indication.

CARGO COMPT SMOKE DET ..... **CHECK** 1
Check DISCH 1/DISCH 2 lights extinguished.
Check both AGENT switches are guarded and safetied.

OXYGEN Panel ..... **CHECK** 1
Check MAN OVRD pushbutton is guarded and safetied.
Check PASSENGER SYS ACTUATED light extinguished.
Check system high pressure indicator for correct pressure
If pressure is below 1400 psi check oxygen duration chart.
Check low pressure indicator in green sector.

ENG 2 FIRE Protection ..... **TEST** 1
Same as for ENG 1.

EMER EXIT LT ..... **ARM** 1
Set EMER EXIT LT selector in ARM position and check DISARM light extinguished.

AIR BLEED Panel ..... **AS REQUIRED** 1
If APU airconditioning required set APU BLEED switch to ON. Check PACK VALVES 1 and 2 flow bars in line.

COMPT TEMP Panel ..... **CHECK** 1
Select MAX COOL off.
If less than 130 passengers ECON FLOW should be preselected.
Check all COMPT TEMP selectors at AUTO (12 o'clock) position, and COMPT/DUCT temp. indication selector at CRT position.

MSU 2 ..... **NAV** 1
Same as for MSU 1

FMS ..... **CHECK/SET** 2
On STATUS page check data base validity and PERF FACTOR.

FMC initialize.

Gate/Ramp Coordinates ..... **CHECK** 1

CM1/2 Side Console

HYD RAM AIR TURBINE Handle ..... **SAFETIED** B
SVCE INTPH JACKS ..... **OFF** 1
SNIFFER FAN ..... **CHECK** 2
Press SNIFFER FAN pushbutton and listen to fan noise.

Oxygen Mask ..... **TEST** B
- Depress INT on audio panel and adjust volume.
- Select interphone transmit.
- Push down and hold RESET/TEST slide control and observe blinker momentarily yellow.
- Notice oxygen flow sounds through loudspeaker.
- Squeeze side levers to inflate the harness.
- Blinker momentarily yellow.
- Release side levers and RESET/TEST slide control.
- Set N/100 %manual control to 100 %.

Full Face Mask ..... **STOWED** B

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CM1/2 Instrument Panel

GPWS Selector . . . . . SAFETIED 1
Check GPWS selector lock wired in NORM position.

CAPT SWITCHING . . . . . CHECK 1 Ø
Extinguish any light illuminated in the lower section of each pb-switch.

EFIS . . . . . CHECK B
Select PFD and ND brightness as necessary. Set EFIS control panel as required. Normal position for ND is MAP, select range 15 NM for T/O. Check for correct display.

Compass Indications . . . . . X-CHECK B
Crosscheck compass indications of ND and RMI's.
Check standby compass. Ø

Standby Airspeed Indicator . . . . . CHECK B
Check pointer on zero and set all bugs at 12 o'clock position.

PFD . . . . . CHECK B
Check for correct display.

Vertical Speed Indicator . . . . . CHECK B
Check no flag and pointer zero.

Clock . . . . . CHECK B Ø
Check time and date. Adjust if necessary.

Altimeter . . . . . SET & CHECK B
CM1 and CM2 check on their respective altimeter no red flag is visible.
Set current QNH and check that indicated altitude shows approximately field elevation.
Compare indications of CM1 and CM2 altimeters.

Metric Altimeter . . . . . CHECK 1
Set subscale as required. Check either yellow or red/white striped flag is visible on the left drum of altitude counter.

GPWS . . . . . TEST 2
Note: Flaps must be < 15° for system test.
Press and hold GPWS pushbutton.
"GLIDE SLOPE" aural warning sounds once.
Check GPWS lights and GPWS FAULT light illuminate.
Thereafter "WHOOP-WHOOP-PULL-UP" aural warning sounds several times. GPWS lights extinguish. Ø
Release GPWS pushbutton, check that GPWS FAULT light extinguishes.
Note: If pb-switch is held for a longer time all GPWS callouts will be heard.

F/O SWITCHING . . . . . CHECK 2
Extinguish any light illuminated in the lower section of each pb-switch.

Glareshield

Nav Selector . . . . . NAV B
Flight Guidance Selector . . . . . ON B
FCU . . . . . SET PF
Arm PROFILE and NAV mode. Set altitude counter on first cleared altitude.
Note: NAV should not be used initially if the SID is not defined in the data base.

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COCKPIT PREPARATION

Center Instrument Panel

Standby Altimeter ..... CHECK 1
Check standard pressure is set on subscale.
Check either yellow or red and white striped flag is visible on the left drum of altitude counter.
Note: With airplane on ground vibrator flag is in view.

Standby Horizon ..... CHECK/SET 1
Check no flag.
Erect if necessary.

BRK-A/SKID Selector ..... NORM/ON 1
SFPI ..... CHECK 1
Engine Instruments ..... CHECK 1
Check:
- no flags
- logical readings
- N1 pre-selection pb is pushed
- REV and REV UNLK Lts off.
- OIL QTY (min. 10 QT + estimated consumtion)

Thrust Rating Panel ..... CHECK 2
Check logical TAT reading.

LANDING ELEVATION ..... SET 2
LDG GEAR WARN TEST ..... PERFORM 2 Ø
Depress LDG GEAR WARN TEST pb and observe down arrow lt on, continuous horn sounds and ECAM system is activated.

Pedestal

ADF ..... AS REQUIRED PF
Set, if required by SID.

Radios ..... CHECK 2 Ø
Check VHF COM, VHF NAV, ADF and SELCAL.
In case HF is required, it must be checked.
Caution: Do not use HF during refuelling or de-/antiicing.

VHF COM ..... SET 2
Set No.1 is used for primary communication (ATC) during all phases of flight.
Sets No.2/3 are used for secondary communication (company, emergency frequency).

HF ..... AS REQUIRED 2
SPEEDBRAKE ..... ARM 1
Check red band.

ATC Transponder ..... ON 1 Ø
Check transponder and ALT RPTG ON.

FUEL Levers ..... OFF 1
EMER AUDIO CANCEL Switch ..... GUARDED 1
Check switch is guarded and safetied.

T. O. CONFIG TEST ..... PERFORM 1 Ø
Note: Check slats retracted prior test.
Push T.O. CONFIG TEST pb and check message on left ECAM display.

ILS ..... SET PF
Select T/O runway ILS frequency and course if desired.

FMS 1/2 ..... CHECK/SET B
CM2: Cross-check routing with OFPL or ATC flightplan.
Check constraints (SPD, ALT).
If required, enter T/O RWY, SID, TRANS, via LAT REV.
Set FMS 2 to INIT B page.
Set FMS 1 to FLT PLN.
CM1: Crosscheck routing with OFPL or ATC flightplan.

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PNF EXTERIOR INSPECTION

Exterior Inspection . . . . . .PERFORM

Make an inspection with emphasis on tire and brake condition.

Nose Gear, Wheels and Tires

Right Engine and Cowl

Right Main Gear, Wheels, Brakes and Tires

Left Main Gear, Wheels, Brakes and Tires

Left Engine and Cowl

Note: At stations ,where no maintenance personnel is available, perform "Additional Preflight Check" as given in "Special Procedure:"

FINAL COCKPIT PREPARATION

Takeoff Data . . . . . PREPARE B

CM2: Compute FLX TOW and/or PTOW (RTOLW Charts)
Prepare T/O-Data form in case of: contaminated runway
antiskid failure
TRP inoperative

CM 1: Crosscheck

Thrust Rating Panel ..... SET 2

Select TOGA and compare THR LIMIT with QRH-Chart using indicated TAT.
Select FLX TO unless TOGA required and set FLX TO TEMP.
Check THR LIMIT bugs correspond to THR LIMIT display.

Fuel Quantity ..... CHECK B

- After refuelling is completed:
- Check fuel quantity corresponds to FLIGHT PLAN fuel, X check with sum of individual tank quantities.
- Check fuel unbalanced within limits.
- For ETOPS flights only on lateral panel:
  - Set ANN LT switch to READ position.
  - Set FUEL QTY FAULT SIM switch to CHAN 2 position.
  - Record fuel quantity indications on overhead panel.
  - Set FUEL QTY FAULT SIM switch to CHAN 1 position.
  - Check that the fuel quantity indications on overhead panel do not change by more than 100 kg compared with the previous recorded values.
  - Set FUEL QTY FAULT SIM switch to normal position.
  - Set ANN LT switch to OFF position.

Seats ..... ADJUST B

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FMS ..... LOAD B
CM2: On INIT B page insert ZFW and:

Select T/O APPR
Insert V1 and VR (only if different from V1)
Insert ACCEL altitude
CM1: X-checks
PF: Select FLT PLN
PNF: Select T/O APPR

SPD Selector ..... V2 SET 1
On PRESET set 250 kt.

Doors ..... CHECK CLSD 1
PARKING BRAKE ..... AS REQUIRED 1
If no push back required verify parking brake handle is pulled and set. Check brake pressure indicator shows applicable parking brake pressure.
If push back is expected, leave parking brake off, feet should not be on the brake pedals.
Caution: Avoid the use of brakes during pushback.

Sliding Windows ..... CHECK CLSD B
FLT RCDR ..... ON 1
BEACON ..... ON 1
If NAV lights required select NAV & LOGO position.

BEFORE START CHECKLIST

Generally, the checklist is read before pushback.

Flight Recorder ..... ON	1
Cabin Signs ..... AUTO, ON	1
Beacon ..... ON	1
Oxygen System ..... CKD	1
Oxygen masks ..... CKD	B
T/O Speeds ..... ___, ___ CM1 reads V1 and V2 on PFD 1. CM2 checks on FMS. CM2 reads V1 and V2 on PFD 2. CM2 announces VR.	B
Altimeters ..... ___, ___ CM1 announces subscale setting and altitude. CM2 announces subscale setting and altitude to verify correct setting and indication.	B
Fuel ..... ___ TONS Announce T. FUEL quantity indicated on ECAM MEMO page.	1
TRP ..... ___, ___° CM1 announces FLX TO and FLX TO TEMP or TOGA.	1
Speedbrake ..... ARMED	1
Parking Brake ..... as required	1

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COMMUNICATION PROCEDURE FOR ENGINE START

COCKPIT:	GROUND:
Ground from cockpit	Go ahead
Ready to start all engines	All engines clear
Prior to taxiing	
Prepare airplane for taxiing and give hand signal on left side.	Wait for hand signal. Note: As a standard the handsignal shall be given from left side. If, however, this side is dangerous for ground personnel, ground will advise so and coordinate with CM1.

COMMUNICATION PROCEDURE FOR PUSH BACK

COCKPIT:	GROUND:
Ground from cockpit	Go ahead
Ready for push back	Steering "bypass" Release brakes.
Brakes released	Pushing back
When push back is completed	
	Set parking brake.
Parking Brake set	Tow bar removed. Steering normal

COMMUNICATION PROCEDURE FOR SUPPLY OF EXTERNAL ELECTRIC/GROUND AIR

COCKPIT:	GROUND:
Ground from cockpit	Go ahead
Connect external electric	External electric connected
When ready for engine Start	
Ready for ground air	Ground air available
When electric power available from engine/APU generator	
Remove external electric	External electric removed
When engines are started or airplane pneumatic pressure is available	
Remove ground air	Ground air removed

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES ENGINE START	2.03.09 PAGE 1 29.12.1989

CREW COORDINATION FOR ENGINE START

The engine start procedure follows the "overlapping engine start" concept.

The term "overlapping engine start" refers to any procedure in which start actions on an engine commence before the preceding engine has reached ground idle stabilization.
Normal starting sequence: 2, 1.

Condition	CM 1	CM 2
BEFORE START checklist completed	Proceed with COMMUNICATION PROC. FOR ENGINE START	
Ground clearance for engine start received	Announce: "ENGINE 2 START"	Set ENG START panel Push START 2 Pb Check: - OPEN light on - pneumatic pressure rise
	Monitor N2	
N2 RPM 18%	Place ENG 2 FUEL lever on. Monitor EGT	Start timing. Monitor EGT and time
EGT rises	Monitor EGT and N2	Reset stop watch
N2 RPM 45%	Monitor N2, EGT and N1	Check OPEN light out. Monitor EGT
EGT decreases from peak value and N1 indication is positive	Announce: "ENGINE 1 START" Continue to monitor parameters of engine 2 (see Note)	Push START 1 Pb Check: - OPEN light on - pneumatic pressure rise Monitor N2 of engine 1.
Engine 2 EGT decreasing rapidly and N2 and N1 indication stabilized on ground idle values	Monitor N2 of engine 1	
N2 RPM 18%	Place ENG 1 FUEL lever on. Monitor EGT	Start timing. Monitor EGT and time
EGT rises	Monitor EGT and N2	Reset stop watch
N2 RPM 45%	Monitor N2, EGT and N1	Check OPEN light out. Monitor EGT
EGT decreases from peak value and N1 positive	Continue to monitor parameters of engine 1 until stabilized	With both generators on bus apply "AFTER START PROCEDURE"

Note: When a malfunction is indicated on engine 2, CM1 announce nature of malfunction.
When the malfunction is verified, the start attempt on engine 1 must be discontinued.
CM1 announce "START SELECTOR OFF", CM2 will set ENG START selector to OFF.
Apply procedure applicable to malfunction.

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- Engine start has been demonstrated with a max. tailwind component of 50 kt.

"ENGINE 2 START" ..... ANNOUNCE 1
ENG START Selector ..... SET 2
Set ENG START selector to START A (odd days) or START B (even days).
START Pb 2 ..... PUSH 2
Check OPEN light on.
Pneumatic Pressure ..... CHECK 2
Check pneumatic pressure is established on right ECAM display unit. It is recommended to use a pneumatic pressure of 25 psi to 55 psi for engine start.
Note: Start pressure below 25 psi may result in increased engine start times and higher EGT peaks.
N2 RPM ..... MONITOR B
ENG 2 FUEL Lever (N2 RPM 18%) ..... ON 1
Note: ENG TRIM FAULT light illuminates and stays on until approx. N2 RPM 45% is reached.
Clock ..... START 2
Start CHRONO function after fuel lever in ON position.
EGT Rise ..... OBSERVE B
Verify EGT increase within 25 s after fuel lever has been set to ON.
Clock ..... RESET 2
EGT and N2 RPM ..... MONITOR B
Start Valve ..... CHECK CLOSED 2
OPEN light out shortly after N 2 RPM 52 %.
EGT Decrease ..... OBSERVE 1
Observe EGT decreasing rapidly from peak value.
N1 RPM ..... OBSERVE 1

After EGT decreases from peak value and N1 indication is positive:
"ENGINE 1 START" ..... ANNOUNCE 1
START Pb 1 ..... PUSH 2
Check OPEN light on.
Pneumatic Pressure ..... CHECK 2
N2 RPM (Eng 1) ..... MONITOR 2
Idle Parameters (Eng 2) ..... CHECK 1
N1 and N2 will be stabilized approximately 5 s after EGT decrease from peak value. Check oil pressure in green range.
ENG 1 FUEL Lever (N2 RPM 18%) ..... ON 1
Start engine 1 using same procedures as for engine 2.

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	AFTER START	29.12.1989

Note: Items performed by CM2 may be started with both generators on bus.

ANTI ICE ..... AS REQUIRED 2
At the first flight of the day set ENG 1 and ENG 2 ANTI ICE pb-switch to ON.
Check ON blue lights illuminate.
Set ENG ANTI ICE pb-switches and WING ANTI ICE SUPPLY pb-switch as required for takeoff.

APU ..... OFF 2
Ignition ..... CONT RELIGHT 2
Set ENG START selector to CONT RELIGHT.

APU BLEED ..... OFF 2
Pitch Trim ..... SET 1
Set value calculated for takeoff.

Note 1: Check Pitch Trim Lever 2 ..... ON 1

Note 2: It is possible to ensure engagement status of A/P by selecting each A/P to ON(CWS) for 5 sec; if unsuccesful FAC and/or FCC 28 V DC C/B's may be recycled, 20 sec off and 4 min on before attempting to reengage any TRIM, YAW DAMPER, or A/P.

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.11
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	TAXI	29.12.1989

Ground Crew Clearance ..... RECEIVE 1
CM1 personally identify the hand signal of responsible ground crew.

Taxi Area Clear ..... VERIFY 1/2
CM1 and CM2 verify that taxi area is free of obstructions.
Although the wing tip is visible from the cockpit, caution is necessary while turning the airplane on congested areas on the ramp. If necessary, have the ground crew monitor the wing tip clearance.

ATS 1&2 ..... ARM 1

Parking Brake ..... RELEASE 1
Taxiing ..... PERFORM 1
Thrust usage:
To break away from the ramp smoothly increase thrust to minimum required for the airplane to roll forward (max. 50% N1), then reduce thrust.
Caution: Avoid high thrust due to jet blast hazards. Be aware of FOD (Foreign Object Damage) during taxiing.

Directional control and taxi speed:
Nose wheel and rudder pedal steering are used.

Rudder pedal steering is preferably used at faster taxi speeds (max. 30 kts) and where only small directional changes are required.

Taxi on the centerline (inboard foot on the centerline when taxiing straight). Make all turns at a slow taxi speed (max. 15 kts) with as large a radius as possible. Minimum radius turns result in heavy side loads and unnecessary scrubbing and heating of tires.

After completing a turn and before stopping, return the nose steering wheel to center and roll forward enough to allow the nose wheel to center, relieving tire and structural twisting stresses on the main gear.

The long wheel base must be considered during turns. The nose wheel is approximately 4 m aft of the pilot. The main wheels are an additional 15 m (310) aft of the nose gear and the center of turns is always in line with the wheels. This means the pilot is always outside of the centerline in a turn and must overshoot the desired centerline when entering a turn.

When necessary to perform a tight turn at slow speed, the engine outboard to the turn can be used to assist turning if the area of jet blast is clear.

Brakes ..... CHECK 1
Check brake operation and check brake pressure zero during brake action.
Caution: If the brakes fail during ground operations, immediately select the BRK/A/SKID sw to ALTN/OFF. If immediate stopping is required and pedals are ineffective with antiskid OFF the airplane may be stopped with parking brake (full pressure application will occur).

At light weights or downhill the airplane may accelerate to a higher taxi speed than desired. Do not ride the brakes to prevent high taxi speed. Allow the airplane to accelerate, then brake smoothly to a slow taxi speed, release the brakes smoothly and repeat the sequence. Intermittent brake usage provides a cooling period between brake applications.
Idle reverse thrust can be used during taxi to reduce brake usage on clean taxiways and runways.
Do not use this procedure on snow, ice and slush-covered runways.

SLATS/FLAPS Extension ..... COMMAND 1
Command appropriate T/O SLAT or FLAP setting. This initiates also subsequent actions of the taxiing procedure.

SLATS/FLAPS ..... EXTEND 2
Set SLATS/FLAPS handle and check SLATS/FLAPS position on SFPI.

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Flight Controls .....CHECK B

CM2: Select F/CTL on ECAM control panel.
Check full travel and feel of the elevator and ailerons/spoilers. X-check with ECAM system display.
CM1: Hold nose wheel steering handle and check full travel and feel of rudder.
CM2: Check indications on system display and announce "Full left/Full right".

Check all indications return to zero position with respective controls neutral on ECAM system display, except aileron where droop position is indicated.
Deselect F/CTL display on ECAM control panel.

AIL & RUD TRIM ..... ZERO B

Check trim position on control wheel and RUD TRIM.

FMS (if required) ..... SET 2

Situations may require entering/altering RWY and/or SID.
CM2: Enter required data
CM1: Crosschecks before T/O briefing
PF/PNF: Reselect standard FMS-setup.

CTR TK PUMPS (if required) ..... OFF 2

CTR TK pumps have to be switched off for takeoff when feeding out of CTR TK with CTR TK fuel less than 1000 kg.

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Note: If taxiing cannot be continued for a longer time period (temporary closing of airport, extreme ATC situation, remote gate waiting position etc.) ensure APU operation and cut engines. If restart is intended, complete Before Start checklist first. Restart of engines is permitted without fireguard.

TAXIING CHECKLIST

Anti Ice	as required	1
Trim	0, 0, ___	1
Flight Controls	CKD	1
Slats/Flaps	___/___	1

Takeoff Briefing ..... PERFORM PF

Brief on specific aspects of the intended T.O. and departure.

The minimum contents shall be:
1. Type of T.O. (standard, noise abatement or local procedures).
2. SID including first altitude to be maintained.
3. EOSID including EO ACCEL altitude and minimum sector altitude.
4. Consideration on margins for RTO.

CM1 confirm validity of briefing if CM2 is PF.

Cabin Report ..... RECEIVE 1

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	BEFORE TAKE OFF	29.12.1989

Upon entering takeoff runway:

Auto Brake . . . . . MAX 2
Depress MAX pushbutton and check ON light illuminates.

BEFORE TAKEOFF CHECKLIST

Cabin Report . . . . . RECEIVED	1
Packs . . . . . as required	1
Normally, takeoff is performed with packs supplied by engine bleeds. In this case respond with ON ENGINE. If APU BLEED supplies packs respond with ON APU. If unpressurized takeoff is performed respond with OFF. For related procedures refer to Supplementary Procedures.	
Auto BRK . . . . . MAX	1

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.13
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	TAKE OFF AND CLIMB	29.12.1989

Runway Alignment ..... ACHIEVE 1
Control Transfer (if CM2 is designated PF) ..... ANNOUNCE B
To indicate that CM2 has to take over control of rudder pedals and control column
CM1 announces: "YOU HAVE CONTROL"
CM2 confirms: "I HAVE CONTROL"
Note: To detect an ELEV JAM keep control column slightly forward of neutral position and release progressively to achieve neutral position by 80 kt.

Brakes ..... RELEASE 1
Normally a rolling takeoff is performed.
Static T/O: Avoid more than 70% N1 with brake pedals depressed.

T. FUEL ..... CHECK PNF
If fuel consumption monitoring required, observe T. FUEL on ECAM MEMO page.

"TAKEOFF" ..... ANNOUNCE 1
Clocks ..... START B
Start CHR (chrono) and ET (elaps time).

TO/GA Levers ..... ACTUATE 1
For T/O procedures with ATS off or ENG TRIM off refer to Supplementary Procedures.

PFD/ND ..... CHECK B
Observe THR, SRS/P CLB and HDG or RWY/NAV on PFD.
SRS pitch command bar is not valid before rotation.

Observe FMS updating (airplane symbol at runway on ND).

Directional Control ..... USE RUDDER PF
Engine Instruments ..... MONITOR B
PNF: Monitor particularly N1 and EGT.
Monitor ATS operation and adjust throttle setting if necessary.
PF: Check T/O power achieved.
Further monitoring if feasible.

Airspeed Indicators ..... X-CHECK B
PNF: Announce "EIGHTY".
PF acknowledges "CHECKED". If any excessive deviation is detected the actual value is called.

Autothrottle Declutch ..... CHECK 1
Verify on FMA that green THR changed to blue THR. If not, operate A/THR quick disconnect pb's and call out "MANUAL THRUST".

"V1/VR" ..... ANNOUNCE PNF
Rotation ..... PERFORM PF
Rotate airplane smoothly with one continuous motion to a pitch attitude of 18° maximum. Keep the pitch command bar centered after rotation to capture and maintain at least V2 + 10 kt.

Landing Gear ..... RETRACT B
PF: Positive rate of climb indicated on VSI and altimeter/radio altimeter, command "GEAR UP".
PNF: Pull L/G Lever and move it to UP.
Check normal sequence of gear and door lights.
Check landing gear lights are out.

Autopilot ..... AS RQRD PF
Engine Instruments ..... OBSERVE PNF
Scan frequently engine instruments and ECAM ENGINE page during initial climbout.
If not absolutely necessary delay ATC call until 1500 ft.

Climb N1 ..... CHECK PNF
At 1500 ft check LIM MODE indication CL on TRP. If CL thrust is higher than FLX TO thrust, the latter is increased slowly to reach CL thrust before 20000 ft.
Check engine parameters stabilized at new thrust setting.
ECAM Flight Phase ..... CHECK PNF
Check T/O-INHIBIT is cancelled on ECAM MEMO page. If not press RCL pb.

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L/G Lever ..... NEUTRAL PNF
Ignition ..... OFF PNF
Set ENG START selector to OFF.

SPEEDBRAKE ..... DISARM 1
SLATS/FLAPS ..... RETRACT B
PF: Command "FLAPS UP" or "SLATS UP" at flap or slat retraction speed.
PNF: Set SLATS/FLAPS handle. Check slat/flap retraction.

ALT SEL ..... SET PF
Set assigned altitude/FL.
Other pilot crosschecks.
During manual flight PNF sets assigned altitude/FL.

FMS Progress Page ..... SELECT PNF
Altimeters ..... SET & X-CHECK B
Climb Speed ..... ACQUIRE PF
CTR TK PUMPS (if required) ..... NORM PNF
If CTR TK PUMPS have been switched off for T/O (fuel in CTR TK less than 1000 kg) push CTR TK PUMPS pb on.

TAKE OFF WITH PMC ON AND ATS OFF:

"TAKE OFF" ..... ANNOUNCE 1
Brakes ..... RELEASE 1
TO/GA Levers ..... ACTUATE 1
Check FMS(refer to "FMS USE") and advance the throttles promptly and smoothly.
Clocks ..... START B
Throttles ..... ADJUST PNF
Obtain N 1 command = take off N 1.
Take off N 1 (prior to reaching 80 kts) ..... CHECK PNF
"POWER SET" ..... ANNOUNCE PNF

TAKE OFF WITH PMC OFF:
The take off must be performed without ATS.

ATS-lever to "OFF" ..... SET PNF
"TAKE OFF" ..... ANNOUNCE 1
TO/GA Levers ..... ACTUATE 1
Check FMS(refer to "FMS USE") and advance the throttles in order to set N 1 = 70 %.
Brakes(when N 1 = 70 %) ..... RELEASE PF
Clocks ..... START B
Throttles ..... ADJUST PNF
Adjust the throttles smoothly to obtain take off N 1.
Take off N 1 (prior to reaching 80 kts) ..... CHECK PNF
"POWER SET" ..... ANNOUNCE PNF

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	AFTER TAKE OFF	29.12.1989

AFTER TAKEOFF CHECKLIST

Packs ..... ON ENG Confirm that packs are supplied by engine bleeds.		PF
Altimeters ..... ___,___ PF announces subscale setting and altitude. PNF announces subscale setting and altitude to verify correct setting and indication.		B
T/O Inhibit ..... CANCELLED		PF
SEAT BELTS ..... OFF		1

Mod. : 7172

GE Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES CLIMB	2.03.15 PAGE 1/2 REV 15 SEQ 100

CM

(PNF) **EXTERIOR LTS**

- When reaching FL 100 switch RWY TURN OFF lts off.

(ALL) **RADAR**

- As required.

(PF) **ICE PROTECTION**

- Monitor TAT on MEMO page.
- Ice protection as required.

FMS

See details of FMS use in chapter 2.02.19.

(PNF) **FUEL**

If AUX TK contained fuel upon departure, on top of climb confirm AUX TK fuel XFR on ECAM FUEL page.

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.16
		PAGE 1/2
	CRUISE	29.12.1989

AUX TK fuel XFR on ECAM FUEL page ..... **CONFIRM PNF**
On top of climb if AUX TK contained fuel upon departure.

Cruise N1 ..... **CHECK B**
Check LIM MODE indication CR on TRP.

Cruise Data ..... **CHECK B**
If fuel consumption monitoring required, calculate gain/loss by subtracting actual fuel quantity (MEMO page) from fuel quantity at takeoff (MEMO page).

Flight Plan Program ..... **MONITOR B**
Standard FMS-setup:
PF: FLT PLN page
PNF: PROGRESS page

Landing Information ..... **RECEIVE PNF**
FMS ..... **SET PF**
Select TRANS, STAR, APPR as required.

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	DESCENT / APPROACH / FINAL	29.12.1989

LANDING ELEVATION ..... CHECK PNF
STATUS ..... CHECK PF
Push STS pb and check ECAM message.

ALT SEL ..... SET B
PF: Set assigned altitude/FL if autopilot in CMD.
Other pilot crosschecks.
PNF: Set assigned altitude/FL during manual flight.

Descent ..... INITIATE PF
FUEL in TRIM TK(on ECAM FUEL Page) ..... CHECK PNF
If flight has been performed below FL 200 , check that there is less than 200 kg of fuel in trim tank . If there is more than 200 kg fuel in trim tank , check TRIM TK PUMPS are selected ON and select TRIM TK MODE push-button to FWD position.
Speedbrake ..... AS REQUIRED PF
Note 1: Use of full speedbrake above 0.78 M is uncomfortable for passengers.
Note 2: Do not use speedbrake in SLATS 3O/FLAPS 40 configuration.
Landing Briefing(MSA,final altitude, minimum, MAP, RWY-length, go around) ..... PERFORM PF
Altimeters ..... SET & X-CHECK B
For instrument approaches to Cat 1, non-precision and circling minima set altitude cursor to minimum.
DH (on EFIS refer to "procedure and techniques 2.02.03.") ..... SET B
SEAT BELTS ..... ON 1

APPROACH CHECKLIST

Status ..... CKD PF
Altimeters ..... ___,___ B
PF announces QNH subscale setting and altitude.
PNF announces QNH subscale setting and altitude to verify correct setting and indication.
Landing Elevation ..... ___ PF
PF announces selected value.

SLATS/FLAPS ..... EXTEND B
PF: Command "SLATS 15" or "FLAPS ___" at slat/flap extension speed.
Set speed bug if autopilot in CMD.
PNF: Set SLATS/FLAPS handle. Check slat, flap extension.
Set speed bug during manual flight.

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ND Range . . . . . SELECT 15 B
Normal mode is MAP.

Nav Selector . . . . . ILS B

Landing Gear . . . . . EXTEND B
PF: Command "GEAR DOWN"
PNF: Pull L/G Lever and move it to DOWN. Check normal sequence of gear and door lights.

SPEEDBRAKE . . . . . ARM 1
Check red band. Check SPEED BRAKE light on SFPI is out.

Ignition . . . . . CONT RELIGHT PNF
Set ENG START selector to CONT RELIGHT.

Auto Brake . . . . . ARM B
PF: Order the desired mode.
PNF: Depress the appropriate pushbutton and check related ON light illuminates.
Note: Use of MAX mode should be restricted to contaminated short runways.

SLATS/FLAPS . . . . . EXTEND B
PF: Command "FLAPS ___" at flap extension speed. Set speed bug if autopilot in CMD.
PNF: Set SLATS/FLAPS handle.
Check slat/flap extension. Set speed bug during manual flight.

ALT SEL . . . . . SET B
PF: Select Missed Approach altitude after GS* if autopilot in CMD.
PNF: Select Missed Approach altitude after GS* during manual flight.

Target Speed . . . . . SET B
PF: Set speed bug if autopilot in CMD.
PNF: Set speed bug during manual flight.

Cabin Report . . . . . RECEIVE 1

Autopilot . . . . . AS REQUIRED PF

FINAL CHECKLIST

Speedbrake	ARMED	1
Gear Lights	3 GREEN	PF
Slats/Flaps	___/___	PF

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	LANDING	29.12.1989

Touchdown ..... PERFORM PF
Use rudder for directional control down to taxi speed.

Reverse Levers ..... PULL PF

PF: Pull reverse thrust levers to the reverse idle mechanical stop.
Note: Do not select opposite direction before light indication shows end of transit.

PNF: Check both REV UNLK lights are on. Check both REV lights illuminate. Check both REV UNLK lights go out.
Note: If one or both REV UNLK lights remain on, apply reverse normally.

PF: Pull reverse thrust levers.
Note: Reverse thrust can be applied before nose gear touchdown.
With sufficient runway length use approx. 70% N1 only.
If SAT is below 0°C modulate the reverse thrust not to overshoot go-around N1 minus 10%.

PNF: Monitor N1, N2 and EGT.

Brakes ..... AS REQUIRED PF
Monitor auto brake performance. If required, take over brake control by a slight pressure application on both brake pedals, latest when taxi speed is reached.

Deceleration ..... MONITOR PNF
Auto braking: Observe green bar corresponding to selected mode illuminates.
Manual braking: Observe speed trend vector shows deceleration.

"EIGHTY" ..... ANNOUNCE PNF
Reverse ..... IDLE/STOW B

PF: Initiate reverse thrust reduction at 80 kt so as to be in reverse idle thrust by 60 kts.
Stow reversers.
Note: Do not select opposite direction before light indication shows end of transit.
Reverse may be kept in idle down to taxi speed.

PNF: Check REV UNLK lights illuminate, REV lights extinguish.
Then REV UNLK lights extinguish when levers are set to down.

Note 1: Do not recycle if reverser fails to stow. Engine shutdown is recommendet.
Note 2: If AIR BLEED pressure is not sufficient for reverser stowage, ENG 1 and ENG 2 IDLE CTL P/B may be pulled., to increase N 2 from ground idle to flight idle . This should provide sufficient pressure for stowage. Reset C/B as soon as stowage completed.

Autopilot ..... DISENGAGE PF
Control Transfer (if CM2 was PF) ..... ANNOUNCE B
After reaching taxi speed on runway centerline
CM1 announces: "I HAVE CONTROL"
CM2 confirms: "YOU HAVE CONTROL"
CM1 takes control of the airplane.

Taxiing ..... PERFORM 1

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES STANDARD CALL-OUT PROCEDURE	2.03.20 PAGE 1 29.12.1989

STANDARD CALL-OUT PROCEDURE DURING CLIMB/DESCENT:
During climb and descent a pre-warning shall be given by the PNF by calling out 2000 ft and 1000 ft before reaching the level , to which clearance has been received.

STANDARD CALL-OUT PROCEDURE DURING APPROACH:
The following mandatory call-outs shall be made by the crew member specified in the right-hand column:

CONDITION	CALL-OUT	CM
Final Altitude Passing Fix(e.g. NDB,OM) inbound	".....(fix)...../FINAL ALTITUDE CHECKED"	PNF
Deviation from Final Altitude ± 100 ft or more	".....(fix)...../...FEET LOW(HIGH)"	PNF
If no Final Altitude specified(e.g. Visual Approach): Reaching/passing 1500 ft above Aerodrome Elevation	"FIFTEEN HUNDRED"	PNF
500 ft above Touchdown Zone Elevation (barometric)	"FIVE HUNDRED" "CHECKED"	PNF PF
*Approaching Minimum Non-Prec.& CAT I ~ 100 ft above Minimum (barometric) CAT II/III 100 ft above Miniumum(radio)	"APPROACHING MINIMUM"	PNF
*At Minimum	"MINIMUM"	PNF
Approach Lights and/or Runway in Sight (Non-Prec. & CAT I)	"APPROACH LIGHTS (RUNWAY) AHEAD" or "APPROACH LIGHTS (RUNWAY) LEFT (RIGHT)"	PNF
	"IN SIGHT"	PF
Requested visual Reference established	"CONTINUE"	CM 1
Missed Approach required	"GO AROUND, FLAP"	CM 1
Hights above Ground(radio) 400 ft 300 ft 200 ft 100 ft 50 ft 40 ft 30 ft 20 ft 10 ft	(if no autom. call-out available) "FOUR HUNDRED" "THREE HUNDRED" "TWO HUNDRED" "ONE HUNDRED" " FIFTY" "FOURTY " "THIRTY" "TWENTY" "TEN"	PNF

* Depending on weather conditions CM 1 may decide to omit the call-outs "APPROACHING MINIMUM" and "MINIMUM" if the runway is clearly visible by announcing "CONTINUE", but not before the "FIVE HUNDRED" call.

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES CAT II OPERATION	2.03.20 PAGE 2 29.12.1989

NORMAL SEQUENCE OF ACTIONS:

Cockpit operating procedures during CAT II approaches are identical to the standard used for all instrument approaches except for a special task sharing during the final phase of flight and during landing. CM 1 shall be PF and CM 2 shall be PNF, even during go-around.

The CM 1 and CM 2 instrument scan has to include the FMA display and correct sequence of the modes shall be observed.

Caution: Both pilots be especially alert to AFS malfunctions and take immediate corrective actions as required(see PROCEDURES AFTER FAILURES/WARNINGS - FCOM 2.02.03. page 20).

CONDITION	CM	PROCEDURE
Descent/Approach	B	Set DH according to IAL chart.
ILS Approach	B	Follow Supplementary Procedure "USE OF AFS/APPROACH AND LANDING".
	2	Depress AUTOLAND light and check CM 1 and CM 2 AUTOLAND lights flash.
OM inbound	2	Call out: "OUTER MARKER. FINAL ALTITUDE CHECKED"(or deviation).
500 ft BARO	2	Call out: "FIVE HUNDRED".
	1	Acknowledge by: "CHECKED".
400 ft RA	1	Check LAND on FMA.
	1	Check capability CAT 2 or 3 on FMA.
	B	Check runway course selection on ND.
100 ft above DH setting	2	Call out: "APPROACHING MINIMUM".
	1	Go head-up and concentrate on expected visual cues.
	2	Stay head-down and monitor automatic approach by instrument scan.
Minimum(DH)	1	Decide wether required visual reference is established or not.
Required visual reference established	1	Call out: "CONTINUE". Monitor approach and landing by visual cues.
	2	Stay head-down during landing roll.
Missed approach required	1	Call out: "GO AROUND/FLAP". Initiate an automatic go-around and readopt instrument scan.
	2	Stay head-down, monitor automatic go-around and check GO AROUND on FMA.
	B	Follow Supplemetary Procedure "USE OF AFS/APPROACH AND LANDING/ TWO ENGINE GO-AROUND" - FCOM 2.02.03. page 17.

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.21
		PAGE 1/2
	AFTER LANDING	29.12.1989

"FLAPS UP" or "SLATS UP" ..... COMMAND 1
Command after leaving runway.
Normally, only flaps are retracted, retract also slats if Leaving Airplane procedure is anticipated.
This also initiates subsequent actions of the After Landing procedure.

SPEEDBRAKE ..... RETRACT 1
Retract ground spoilers with a momentary forward action on one throttle, then return throttle to idle.

Radar ..... OFF 2
SLATS/FLAPS ..... RETRACT 2
Pitch Trim ..... SET TO 1° UP 2
Ignition ..... OFF 2
Engine Oil Quantity ..... CHECK 2
Check oil quantity and set bugs on gauges.
If oil quantity is below 12 quarts refilling of oil is necessary.

APU ..... START 2
Delay APU start if longer taxiing time is anticipated.

ENG 1 (if desired) ..... SHUT DOWN 1
If EGT exceeded 650°C on final or 750°C during reverse operate the engine at or near idle for three minutes prior to shutdown to thermally stabilize the engine hot section.

APU BLEED ..... AS REQUIRED 2

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.22
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	PARKING	29.12.1989

PARKING BRAKE ..... ON 1
Observe brake pressure.
Note: Parking brake must stay on as long as engine is running, even if chocks are in place.

EXT PWR (if required) ..... ON 2
Engine Fuel Lever(s) ..... OFF 1
Set engine (1 and) 2 fuel lever(s) to OFF.
Check N1, N2 and EGT decrease.
Note: If N 2 does not decrease upon fuel lever selection to OFF (HP VALVE light illuminated) pull fire handle. Engine will shut down after 70 to 90 sec.
Caution: Do not reengage PITCH TRIM levers within 12 sec following engines shut down. Such an action would prevent TCC re-initialization for the next flight resulting in take off thrust lower than required.

SEAT BELTS ..... OFF 1
EXT LT ..... AS REQUIRED 1
Select BEACON OFF. Other lights as required.

ANTI-ICE ..... OFF 2
TRIM TK MODE ..... AUTO 2
WINDOW HEAT ..... OFF 2
PROBE HEAT ..... OFF 2
PARKING BRAKE ..... OFF 1
Release parking brake after chocks in place.

PARKING CHECKLIST

Parking Brake	OFF 1
Radar	OFF 1
Slats/Flaps	—/— 1
Anti-Ice	OFF 1
Trim TK Mode	AUTO 1
Window Heat	OFF 1
Probe Heat	OFF 1
AIDS Formal Reports	CHECK 1

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A310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES	2.03.23
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	LEAVING THE AIRCRAFT	29.12.1989

This procedure shall be accomplished every time the airplane is left unattended by qualified personnel or an estimated ground time of more than 2 hours can be assumed.

ECAM . . . . . OFF 2
Turn LEFT and RIGHT ECAM DISPLAY brightness knobs to OFF.

SPEEDBRAKE . . . . . DISARM 1
EFIS . . . . . OFF B
Turn PFD and ND brightness knobs to OFF.

CARPET HEAT . . . . . OFF B
ISDU . . . . . OFF 1
MSU's (3) . . . . . OFF B

Note: If latitude is above 70° N, IRS may not align in NAV mode. Therefore it is recommendet to leave IRS operating(MSU rotary sel left in NAV position) during stops above 70° N.

FUEL PUMPS . . . . . OFF 2
CREW OXYGEN . . . . . OFF 2
EMER EXIT Lts . . . . . DISARM 2
APU BLEED . . . . . OFF 2

Desired ELEC PWR Source

- APU GEN (END)
- EXT PWR on all busses
  Apply Suppl. Proc. EXTERNAL ELECTRICAL POWER SUPPLY, then:
  APU . . . . . OFF 2
  (END)
- EXT PWR on MAINT BUS only
  Apply Suppl. Proc. ELECTRICAL SUPPLY FOR MAINTENANCE AND CLEANING, then:
- None required

APU . . . . . OFF 2
BAT . . . . . OFF 2

Caution: If APU is running when leaving the aircraft do not switch off the BATTERIES.

LEAVING AIRPLANE CHECKLIST

ECAM . . . . . OFF	1
Speedbrake . . . . . DISARMED	1
EFIS . . . . . OFF	1
Carpet Heat . . . . . OFF	B
ISDU . . . . . OFF	1
MSU's . . . . . OFF	1
Fuel Pumps . . . . . OFF	1
Oxygen System . . . . . OFF	1
Emer Exit Lts . . . . . DISARMED	1
APU Bleed . . . . . OFF	1

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	NORMAL PROCEDURES CHECK LIST	2.03.24
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DEPARTURE

	BEFORE START	
1-2	COCKPIT PREP	COMPLETE
1	SIGNS	ON
2	GEAR PINS & COVERS	REMOVED
1	FUEL QUANTITY	CHECKED
2	NAV SYSTEMS	NAV
1-2	T/O DATA V-BUGS	SET
2	LDG ELEV	SET
1-2	ALTIMETERS	SET
1	BRK-A/SKID	NORM / ON
1	BEACON	ON
1	PARKING BRK	AS REQD

	AFTER START	
1	TRIMS	SET
2	SLATS / FLAPS	SET
2	SPOILERS	ARMED
1	ANTI ICE	AS REQD
2	ECAM STATUS	CHECK

	BEFORE TAKE-OFF	
PF	FLIGHT CONTROLS	CHECK
ALL	FLIGHT INST	CHECK
ALL	TRP / T.O. SPEEDS	CONFIRM
PNF	T.O. CONFIG	SET / TEST
---	---	---
PNF	TRANSPONDER	SET
PNF	AUTO BRAKE	MAX
PNF	IGNITION	CONT RELIGHT
PNF	PACKS	OFF

	AFTER TAKE-OFF	
PNF	LANDING GEAR	UP/NEUTRAL
PNF	SLATS/FLAPS	RETRACT
PNF	PACKS	ON
ALL	ALTIMETERS	SET
PNF	LDG LIGHTS	OFF

ARRIVAL

	APPROACH	
PNF	ECAM STATUS	CHECK
ALL	ALTIMETERS / MDA / DH	SET
ALL	V-BUGS	SET
PNF	SIGNS	ON
PNF	IGNITION	AS RQRD R
PNF	LDG ELEV/CAB ALT	CHECK

	LANDING	
PNF	LANDING GEAR	DOWN
PNF	ANTI SKID	CHECK
ALL	SLATS / FLAPS	SET
PNF	SPOILERS	ARMED

	AFTER LANDING	
PNF	TRANSPONDER	OFF
PNF	SLATS / FLAPS	AS REQD
PNF	SPOILERS	DISARMED
PNF	APU	START

	PARKING	
2	APU BLEED	ON
1	ENGINES	OFF
1	LIGHTS / SIGNS	AS REQD
2	FUEL PUMPS	OFF/SET
2	TRIM TK MODE	CHECK AUTO
2	WINDOW & PROBE HEAT	OFF
2	NAV SYSTEMS	OFF
1-2	CRT'S	DIM / OFF
1	PARKING BRAKE / CHOCKS	AS REQD

	LEAVING AIRCRAFT	
2	APU BLEED	OFF
2	OXYGEN	OFF
2	EMER EXIT LT	OFF
2	APU and BATTERIES	OFF

Mod. : 4801

GE Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	EMERGENCY PROCEDURES INTRODUCTION	2.04.10 PAGE 1 17.01.1990

GENERAL

The emergency procedures have been established for application in the event of a serious failure. They are applied following the « Read and Do » principle, except for memory items.

MEMORY ITEMS are :

- CONT RELIGHT in case of both engine flameout,
- RAT in case of both engine flameout,
- THROTTLE, SPD BRK in case of emergency.

PRESENTATION

The procedures are presented in the basic checklist format with an adjacent expanded part which provides

- indications of the particular failure,
- explanation for actions, where the reason is not self-evident,
- additional background information.

The abbreviations used are identical with the abbreviations presented on ECAM and the nomenclature on the cockpit panels.

All actions are printed in capital letters.

Memory items are BOXED for identification.

Information also displayed on ECAM are printed in capital letters ;
Other information, not on ECAM, are printed in small letters.

If actions depend on a precondition, a preceeding black square is used to identify the precondition.
If actions depend on a sequential precondition or a phase of flight, a preceeding black dot is used to identify this. Black squares and black dots do not appear on ECAM, since only the actions appropriate to the actual condition are displayed.

Procedure items which are displayed on ECAM are marked by a continuous vertical line.
STATUS items are marked by a dashed line.
Beginning and end of ECAM display are marked by respective horizontal lines.

TASK SHARING

For all procedures the general task sharing stated below is applicable.

The pilot flying remains pilot flying throughout the emergency procedure.

PF -Pilot flying -Responsible for:

- Throttles of normally working engines
- Flight path and airspeed control
- Aircraft configuration
- Navigation
- Communications(by decision of CM 1)

PNF -Pilot non- flying -Responsible for:

- Throttles of faulty or not working engines
- ECAM and checklist reading
- Execution of required actions or request of execution by PF, if applicable
- Actions on OVHD panel
- Engine fuel levers (monitored by PF)
- Communications (by decision of CM 1)

PROCEDURES INITIATION

Emergency procedures will be initiated on CM 1 command.
No action will be taken (apart from audio warning cancel) until :

. Flight path is stabilized,
. At least 400 ft above runway in case of failure during takeoff.
(No emergency procedure action below 400 ft should equally apply for approach and go-around).

- Whenever a procedure calls for LAND ASAP, the seriousness of the situation as well as a suitable airport should be considered.
However, whenever fire is encountered on the airplane, landing at the nearest suitable airport is recommended. After conducting any fire suppression/smoke evacuation procedure, even though smoke has dissipated, if it has not been or cannot be visibly verified that the fire is extinghuished immediately land at the nearest airport.

LDG DIST – LDG SPD

LDG DIST increase is in all cases based on the minimum demonstrated landing distance 30/40.

LDG SPD increments have to be added to the actually displayed VLS.

ECAM

Warning inhibition during takeoff

Above 70 kt until reaching 400 ft above runway in general ECAM warnings are inhibited except :

- ENGINE FIRE
- ENGINE FAIL
- APU FIRE

The following ECAM warnings are only inhibited from 70 kt until lift-off :

- ENG OIL PRESS LO
- ENG OVER LIMIT
- NAV ADC
- EXCESSIVE BRAKE TEMP

TAKEOFF CONFIG warning is inhibited from lift-off on.

Crew coordination

When carrying out a procedure displayed on ECAM it is essential that both pilots are aware of the present display. Before any CLEAR action a crosscheck is recommended to confirm that no cyan message remains (except in case of NO ACTION FEEDBACK), which can be eliminated by a direct action.

NO CLEAR ACTION BEFORE CROSS-CONFIRMATION

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Example of Crew Coordination and Cross-Confirmation

WARNING DISPLAY	PILOT FLYING	PILOT NOT FLYING
HYD BLUE RSVR OVHT - BLUE PUMP ..... OFF	- READ FAILURE - TAKE ATC RADIO CTL	- READ FAILURE
	CM 1 REQUEST ECAM ACTION	
		- PERFORM ECAM ACTION OR REQUEST EXECUTION BY THE PF(loudly) - Read PROC if applicable
	CM 1 request paperC/L if applicable	
HYD BLUE RSVR OVHT BLUE PUMP OFF BLUE SYS LO PR		- REQUEST [CLEAR]
	- CHECK ECAM ACTION COMPLETED - CONFIRM [CLEAR]	
* FLT CTL SLATS SYS 1 FAULT SPLR 7 FAULT ..... OFF SPLR 3+2 FAULT ..... OFF YAW DAMPER 1 OFF		- PERFORM PANEL CLEAN UP(lowly) - CHECK NO CYAN ON ECAM - REQUEST [CLEAR]
	- CHECK ECAM - CONFIRM [CLEAR]	
[STATUS] LAND 3 INOP LDG DIST:MULTIPLY BY 1.2 PROC: HYD SYS LO PR BLUE HYD SYS INOP SPLR PARTIALLY INOP SLATS SLOW		- READ STATUS LINE BY LINE
	CM 1 request paperC/L Note: STATUS will be called in APPROACH C/L	
		- PERFORM PAPER C/L
		- REQUEST [CLEAR]
	- CONFIRM [CLEAR]	

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EXCESS AFT CG

TRIM TK MODE ..... FWD
TRIM TK PUMP 1 & 2 ..... CHECK ON
AUTO TRIM TK SYS INOP
FUEL MAN FWD XFR ONLY
● If TRIM TK VALVE remains closed:
TRIM TK FUEL UNUSABLE PROC (5) ..... APPLY

EXCESS AFT CG

Indications :
Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : EXCESS AFT CG proc.
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light ON

- This warning is triggered when the THS position reaches a deflection limit (which represents a center of gravity of 43 %). This deflection limit is computed by the FWC and depends on Mach and N1 values.
- This warning should be preceded by the AFT CENTER OF GRAVITY warning which occurs when the center of gravity reaches 41 %.

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IN FLT ENG FIRE	
THROTTLE	IDLE
FUEL LEVER	OFF
FIRE HANDLE	PULL
1ST AGENT AFTER 10s	DISCH
■ IF FIRE AFTER FURTHER 30 s:	
2ND AGENT	DISCH
LAND ASAP	
SINGLE ENG OPER PROC (1)	APPLY

IN FLIGHT ENG FIRE

Indications :

Continuous repetitive chime
ENG 1 or ENG 2 FIRE handle illuminated.
MASTER WARNING
Left ECAM CRT : ENG FIRE proc
Right ECAM CRT : ENG page
ENG 1 or 2 FUEL LEVER illuminated
LOOP A and LOOP B (ENG 1 or 2) lights

- If fire warnings cease, fire drill may be abandoned.
- The 10 seconds delay allows N1 to decrease, reducing nacelle ventilation which increases the agent effect.
- Continuous repetitive chime stops when pulling fire handle. May be cancelled by use of AUDIO CANCEL sw.
- Fire handle remains illuminated as long as a fire is detected.
- Do not attempt to restart engine.
- Refer to « SINGLE ENG OPERATION » procedure.

ON GND ENG FIRE	
THROTTLE	IDLE
■ WHEN A/C STOPPED:	
PARKING BRK	SET
FUEL LEVER	OFF
FIRE HANDLE	PULL
1ST AGENT	DISCH
2ND FUEL LEVER	OFF
ATC (VHF 1)	NOTIFY
CABIN CREW (PA)	ALERT
■ If fire after 30s:	
2ND AGENT	DISCH
FIRE HANDLES (ENG & APU)	PULL
FUEL ISOL VALVES	OFF
RAM AIR	ON
■ If evacuation required:	
EVACUATION	INITIATE
BAT (before leaving aircraft)	OFF/R

ON GROUND ENG FIRE

- Same indications and comments as in flight.
- The aircraft may be stopped using full reverse.
- The 10 sec delay before discharging agent is not required on ground.
- Notify ATC the nature of the emergency and state intentions. Only VHF 1 is available on battery only.
- RAM AIR is selected ON, to facilitate doors opening by opening all OUTFLOW valves.
- Batteries are left ON until leaving the aircraft to ensure cabin communication. Switching the batteries OFF stops the cockpit voice recorder (CVR) and prevents tape erasure.

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APU FIRE

FIRE HANDLE ..... PULL
AGENT AFTER 10s ..... DISCH
MASTER SW ..... OFF

■ IF FIRE WARN PERSISTS:
LAND ASAP

APU FIRE

Indications :
Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : APU FIRE proc.
Right ECAM CRT : APU page
Fire handle illuminated
LOOP A and LOOP B lights

- The 10 seconds delay allows the airflow from the APU cooling fan to reduce, which increases the agent effect.
- Do not attempt to restart APU.

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BOTH ENGINE FLAME OUT

IGNITION . . . . . CONT RELIGHT
RAT . . . . . ON
THROTTLES . . . . . IDLE
FUEL SUPPLY . . . . . CHECK
OPTIMUM SPD 260
COMMUNICATIONS VHF1/ATC1

■ If neither engine starts within 45s :
FUEL LEVERS . . . . . OFF
After 30s Ventilation
FUEL LEVERS . . . . . ON
RELIGHT (within 45s) . . . . . MONITOR

■ If neither engine starts :
FUEL LEVERS . . . . . OFF
REPEAT START ATTEMPT (After 30s Ventilation).

NOTE : Below FL200 APU may be started for electrical power supply, and be used for starter assisted relight if required.

■ If engine recovered:
SYSTEMS affected . . . . . RESTORE

■ If neither engine recovered :
ELEC PUMPS (if available and APU GEN operating) . ON

● Before slats extension :
LAND RECOVERY (if on BAT only) . . . . . ON
APPROACH CONFIG . . . . . FLAPS 15°/VREF + 25
FUEL LEVERS . . . . . OFF
FORCED LDG (22) or DITCHING (23) PROC . . APPLY

BOTH ENGINES FLAME OUT

- CONT RELIGHT selected during rundown ensures an immediate restart attempt.
- Fuel supply check consists of confirming correct fuel panel setting according to remaining fuel quantity, ISOL VALVES OPEN.
- It is recommended to don the oxygen masks to anticipate cabin depressurization.
- The optimum airspeed to achieve best lift to drag ratio, and to allow simultaneously an effective windmilling start attempt is 260 kt.
- Avoid abrupt rudder and elevator inputs because RUD TRAVEL and PITCH FEEL are in low speed configuration.
- When one engine relights, the ECAM is reactivated and provides ENG FAIL/ENG SHUT DOWN message for the not operating engine.
  In addition, the systems which are to be restored with regard to the operating engine are displayed simultaneously.
  Refer to ECAM as soon as image reappears.
- If APU GEN is available the ELEC PUMPS may be used to restore GREEN hydraulic pressure.

IF BOTH ENG ARE LOST :

- If electrical power supply from APU is not available, LAND RECOVERY is selected ON to restore SLATS/FLAPS/SPLRS operation.
- SLAT/FLAP operating times are noticeably increased due to the reduced hydraulic system capability.
- Flap 15° configuration is considered the optimum setting obtaining best controllability and optimum rate of descent (estimated approximately 1,500 ft/mn).
- The recommended speed Vref + 25 ensures an adequate stall margin at the 15° flaps configuration and optimum rate of descent.
- RAT operation is guaranteed above 140 kt.
- In short final reduce speed as required by landing terrain in order to touch down with minimum V/S.

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AVIONICS SMOKE

SNIFFER FAN . . . . . OPERATE

■ IF SMOKE CONFIRMED:

OXY MASKS/GOGGLES . . . . . ON

CREW COMMUNICATIONS . . . . . ESTABLISH

VHF 1 / ATC 1 . . . . . SELECT

PILOT FLYING CM1

TRIM TK MODE . . . . . FWD

APU GEN . . . . . OFF/R

OVRD SUPPLY 1 AND 2 . . . . . ON

VENT EXTRACT . . . . . OVBD

PITCH TRIM 1 / YAW DAMPER 1 / AP-FD1 . . RESET

LAND ASAP

LDG GEAR POSITION DET . . . . . SYS 1

PACKS (If required) . . . . . MAN CTL

SMOKE REMOVAL PROC (10) (If necessary) . . APPLY

● AFTER ABOUT 3 MINUTES

■ IF no FAULT Lt on CTR TK L PUMP

FUEL X FEED . . . . . IN LINE

INR TK PUMPS 2L AND 1R . . . . . OFF

● When CTR TK L PUMP FAULT Lt comes on

INR TK PUMPS 2L AND 1R . . . . . ON

FUEL X FEED . . . . . X LINE

CTR TK L PUMP . . . . . OFF

■ IF FAULT Lt on CTR TK L PUMP

CTR TK L PUMP . . . . . OFF

NOTE : Fuel feed from outer tanks is only possible by gravity.

● Before slats extension:

LAND RECOVERY . . . . . ON

LDG SPD INCREMENT . . . . . + 10 KT

LDG DIST . . . . . MULTIPLY BY 1.4

NOTE : Reverse inop

AVIONICS SMOKE

Indications :

Continuous repetitive chime

MASTER WARNING

Left ECAM CRT : AVIONICS SMOKE proc.

Right ECAM CRT : Nil

AVIONICS SMOKE light.

- If AVIONICS SMOKE warning appears together with MIN EQPT BAY SMOKE or other SMOKE warnings, suspect AIR COND SMOKE as probable cause of warnings. R R R
- Ensure crew communication is established.
  Avoid the use of interphone position to minimize the interference from oxygen mask breathing noise.
- Check oxygen mask at 100 %. It is recommended to set the EMERGENCY pressure selector to overpressure position.
- VHF 1, ATC 1 are selected due to loss of VHF 2, ATC 2.
- Depressing both OVRD SUPPLY switches cuts off AC BUS 1, AC BUS 2 and DC NORM BUS.
  About 2/3 of equipment is shed. CM2 PFD/ND and altimeter are no longer indicating. ECAM CRT are not available.
- APU GEN must be selected OFF to open XFR contactors, when APU is operating.
- Only one fuel pump in each inner tank and one fuel pump in center tank remain supplied.
  Waiting for 3 minutes before check of CTR TK L PUMP FAULT lights allows sufficient fuel gravity transfer from trim tank to center tank (if any fuel in trim tank). As CTR TK fuel quantity is not available, CTR TK is confirmed empty by the illumination of FAULT light on CTR TK L PUMP p/b.
  Transfer from center tank to inner tanks will be accomplished when CTR TK L PUMP FAULT light illuminates (Fuel quantity indicator not supplied).
- With LAND RECOVERY switch in ON position SPLRS/SPD BRK 1, 4, 6, 7, FLAPS, SLATS and A/SKID are recovered. KRUGERS remain lost.
- VLS must be augmented by 10 Kt due to KRUGERS inoperative.
- The landing distance is increased due to partial loss of GND SPLRS and augmentation of VLS.

R R R

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MIN EQPT BAY SMOKE

SNIFFER FAN . . . . . OPERATE

■ IF SMOKE CONFIRMED:

VHF 2 . . . . . SELECT

VENT EXTRACT . . . . . OVBD

MIN EQPT C/B's . . . . . PULL

CAPT ADC INST . . . . . SYS 2

ATC . . . . . SYS 2

Affected EQPT . . . . . OFF

CARGO COMPT SMOKE

AGENT 1 . . . . . DISCH

LDG ELEVATION 10 000FT

NOTE : If the procedure is applied during climb (with immediate turn-back decided) or during approach, do not set 10 000 ft on LDGELEVATION (apply normal procedure for setting of LDG ELEVATION)

● One hour later :

AGENT 2 . . . . . DISCH

MIN EQPT BAY SMOKE

Indications :
Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : MIN EQPT BAY SMOKE proc.
Right ECAM CRT : nil.
SMOKE lt on C/B panel

- If MIN EQPT BAY SMOKE warning appears together with AVIONICS SMOKE or other SMOKE warnings, suspect AIR COND SMOKE as probable cause of warnings. R R R
- With MIN EQPT BAY SUPPLY C/B's pulled, the following equipment are lost :
  a) VHF 1
  b) Public address
  c) Fuel OUTR TK LO LVL detection
  d) Engine 1 and 2 fire detection
  e) Engine 1 bleed air control
  f) Crew oxygen control
  g) Cab press sys 1
  h) ADC 1
  i) ADC 2 BARO SET

CARGO COMPT SMOKE

Indications :
Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : COMPT SMOKE proc
Right ECAM CRT : nil
SMOKE lt.

- Smoke warning automatically closes ISOL and TEMP CONTROL valves.
- Bottle 2 is to be discharged one hour after bottle 1 (DISCH AGENT 2 light illuminated), or during approach, whichever is earlier.
- When bottle 2 discharge is initiated, the DISCH AGENT 2 light will extinguish, but the DISCH 2 light (indicating bottle discharged) will only illuminate with a delay of appr. 30 min, due to the FLOW restrictor.

NOTE : Expect SMOKE warning to remain after AGENT discharge, even if smoke source is extinguished. Gases from smoke source are not evacuated and smoke detectors are sensitive to extinguishing agent as well (FREON gas).

- Opening the access door to the forward cargo compartment from the main bay will result in a decrease of agent concentration.
- Inform the ground crew not to open the door of affected cargo compartment door unless passengers have disembarked and fire services are present.
- Maximum protection time is 260 minutes R
- If SMOKE warning is displayed on ground with cargo compartment doors open, do not initiate AGENT DISCH. Request ground crew to investigate and fight smoke source.
- If SMOKE warning is displayed with cargo compartment doors closed but aircraft still on ramp, request ground crew to open cargo compartment doors and investigate, and fire services to fight the smoke source. If ground crew and fire services not readily available, initiate AGENT DISCH. Consider effect on livestock, if carried.

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SMOKE REMOVAL

SEAT BELT / NO SMOKING	ON
CABIN FANS	OFF
COMPT TEMP ISOL VALVES	OFF/R R
ECON FLOW	OFF
LDG ELEVATION	10 000 FT/MEA
CAB PRESS RATE LIM	MAX
NOTE 1 : CAB ALT warning will appear.	R
NOTE 2 : If the procedure is applied during climb (with immediate turn-back decided) or during approach, do not set 10 000 ft on LDG ELEVATION (apply normal procedure for setting of LDG ELEVATION)	R R R R R
DESCENT (FL 100 or MEA)	INITIATE
■ When Δ P 1 PSI or below :	
RAM AIR	ON
COCKPIT To open window if required	
MAX SPD	225
HEADSETS	ON
COCKPIT WINDOW	OPEN
CAUTION : Due to increased noise level pay particular attention to visual warnings.	

SMOKE REMOVAL

Note : The efforts to extinguish the fire and to terminate the smoke source should be the primary concern. If this is not possible, the captain must judge, whether survival depends on elimination of an extreme concentration of smoke or toxic fumes in the passenger cabin.
Therefore he can decide to increase the ventilation rate by applying the SMOKE REMOVAL procedure regardless of the effect, which the increased airflow might have on the fire.

- The smoke removal procedure should be applied in case of dense smoke or toxic fumes or if smoke generation cannot be stopped.
- In case of smoke in cabin if may be necessary to make a PA announcement to minimize apprehension.
- CABIN FANS are selected OFF to avoid recirculation of contaminated air.
- CARGO ISOL VALVES are closed to prevent a CARGO SMOKE warning triggered by smoke originating in the cabin.
- ECON FLOW is selected OFF to provide full airflow from packs.
- It is recommended to fully open the cockpit ventilation means and to close the cockpit/cabin door.
- Since the most effective means for smoke removal is use of RAM AIR, descent is initiated to FL 100 or MEA while cabin altitude is increased to 10000 ft.
  The increase of cabin altitude also reduces, at least temporarily the smoke concentration.
- At FL 100 or MEA opening of the RAM AIR valve is possible, when ΔP is 1 psi or below, without oxygen requirement for further flight (except when MEA above FL 140).
- If cockpit smoke removal requires, one sliding window may be opened when at or below 225 kt. To facilitate opening, it is recommended to select both PACKS OFF before and reselect PACKS ON after opening. Headsets must be donned to ensure crew communication inspite of high noise level with one window open.

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LOSS OF BOTH ENG GENERATORS

GEN 1 and 2 . . . . . OFF/R then ON

■ If GEN 1 and GEN 2 not recovered :
(no supply by APU GEN) R

APU MASTER SWITCH R
(If APU not required for bleed) . . . . . CHECK OFF R

STBY GEN OPERATION . . . . . CONFIRM

PITCH TRIM 1 . . . . . RESET

YAW DAMPER 1 . . . . . RESET

TRIM TK MODE . . . . . FWD

COMMUNICATIONS VHF1/ATC1

VENT EXTRACT . . . . . OVBD

PACK 1 . . . . . MAN CTL

LDG GEAR POSITION DET . . . . . SYS 1

RUDDER TRAVEL 1 . . . . . OFF then ON after 1 mn

BUS EQPT LIST (8 - STBY GEN) . . . . . CHECK

LAND ASAP

NOTE : FUEL X FEED opens automatically.

FUEL MANAGEMENT

■ If CTR + TT FQI above 500 kg (1100 Lbs) : R

Fuel feed from CTR TK
L INR TK PUMP 2 . . . . . OFF
R INR TK PUMP 1 . . . . . OFF

■ When CTR + TT FQI below 500 kg (1100 Lbs) : R

Fuel feed from INR TK
L INR TK PUMP 2 . . . . . ON
R INR TK PUMP 1 . . . . . ON

• When L INR TK empty or fuel unbalance
(max 4000 kg / 8800 Lbs) : R
L INR TK PUMP 2 . . . . . OFF

• When R INR TK empty or fuel unbalance
(max 4000 kg / 8800 Lbs) : R
L INR TK PUMP 2 . . . . . ON

NOTE : Repeat cycle until both INR TK empty.

■ When L and R INR TK empty :
Fuel feed from OUTR TK (by gravity only)
IGNITION . . . . . CONT RELIGHT
MAX FL . . 250 (200 IF JP4/JET B USED/MEA
OUTR TK ISOL VALVES . . . . CHECK IN LINE
INR TK ISOL VALVES . . . . . OFF
CAUTION : Avoid rapid throttle movement and negative load factors.

continued

LOSS OF BOTH ENG GENERATORS

Indications :

Single chime

MASTER CAUTION

The following lights illuminate on ELEC panel : GEN 1 and 2 FAULT lights, AC BUS 1 and 2, DC NORM BUS OFF lights.

- Generators reset may be successful if the origin of the fault was an electrical transient (lightning strike for instance).
- If the loss is caused by subsequent GEN or IDG failure, refer to GEN FAULT or IDG FAULT (use of APU if available. In case of unsuccessful APU start make sure that APU MASTER switch is reselected OFF).
- In case of GEN recovery, restore systems following ECAM INDICATIONS.
- Check of APU MASTER SWITCH to OFF is requested to confirm operation of stand-by generator (performed by checking that DC ESS BUS ON BAT and AC EMER on INV ligths are extinguished). Indeed with APU MASTER SWITCH set to ON and APU N < 60 % during stand-by generator operation, DC ESS BUS is supplied by batteries and therefore DC ESS BUS ON BAT light is illuminated. R R R R R R R
- If operation of stand-by generator is not confirmed, set STBY GEN p/b to OVRD position for manual start of stand-by generator. If manual start is unsuccessful, the aircraft is supplied by batteries only. R R R R R
- APU start is possible below 20 000 ft during operation of stand-by generator. During APU start sequence, DC ESS BUS is supplied by batteries to avoid auto shut down of stand-by generator (due to high DC loads). If APU start is unsuccessful, APU MASTER SWITCH must be re-selected OFF. R R R R R R
- Only INR TK PUMPS 2L and 1R and CTR TK L PUMP remain supplied. They are supplied one at a time with the following priority order :
INR TK 2L, INR TK 1R, CTR TK L
Selection of TRIM TK MODE FWD allows gravity transfer from TRIM TK to CTR TK (if any fuel in TRIM TK).
- Fuel feed from CTR TK is ensured by selecting INR TK PUMPS 2L and 1R OFF.
- Fuel feed from INR TKs is accomplished alternatively from left or right tank. Switching from one tank to the other one is made when the tank is empty or in case of fuel unbalance (4 000 kg/8 800 lbs maximum).

(continued)

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LOSS OF BOTH ENG GENERATORS (cont'd)

● Just before slats extension :
LAND RECOVERY . . . . . ON

■ If all hydraulic systems available :
LDG SPD INCREMENT . . . . . + 10 kt
LDG DIST . . . . . MULTIPLY by 1.4

■ If YELLOW HYD SYS LO PR :
FLAPS INOP
LDG SPD INCREMENT . . . . . + 10 kt
LDG DIST . . . . . MULTIPLY by
• FLAPS < 20° 1.8
• FLAPS ≥ 20° 1.5

■ If BLUE HYD SYS LO PR :
SLATS INOP
LDG SPD INCREMENT . . . . . + 10 kt
LDG DIST . . . . . MULTIPLY by
• SLATS < 15° 1.8
• SLATS ≥ 15° 1.5

L / G GRAVITY EXTENSION PROC (21) . . . . . APPLY

NOTE : In case of go around, do not retract landing gear.

R

LOSS OF BOTH ENG GENERATORS (continued)

- VENT EXTRACT is selected to OVBD to ensure ventilation of electronic bay with blower fans lost. FLOW warning may occur during descent at low power setting.
- For equipment supplied by stand-by generator, refer to BUS EQPT LIST.
- Switching LAND RECOVERY to ON restores SPLRS and SPD BRK 1, 4, 6, 7, FLAPS, SLATS and A/SKID. KRUGERS remain lost.
- VLS is increased by 10 kt due to KRUGERS inoperative.
- The landing distance is increased due to partial loss of GRND SPLRS and augmentation of VLS.
- If yellow hydraulic system is lost (in case of loss of GEN 2 due to engine 2 failure), flaps are lost and landing distance is increased to take into account this failure.
- If blue hydraulic system is lost (in case of loss of GEN 1 due to engine 1 failure), slats are lost and landing distance is increased to take into account this failure.
- Landing gear is extended by gravity to avoid disconnection of stand-by generator which may occur during normal landing gear extension due to temporary pressure drop in green hydraulic system.
  For the same reason, it is not recommended to retract landing gear in case of go around.

Note : In case of discrepancies between CM1 and STBY airspeed indications, disregard STBY indication (probe not de-iced).

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DUAL HYD SYS LO PR

■ BLUE remaining:
LAND ASAP
MAX SPD 285/.78
MAX FL 350
USE ELEV WITH CARE ABOVE SPD 170.
BRK/A/SKID . . . . . ALTN / OFF
GPWS . . . . . FLAP OVRD
● If YELLOW PUMP failed:
RAT . . . . . ON
Affected YELLOW eqpt . . . . . RESTORE

■ GREEN remaining:
LAND ASAP
AVOID USING PTU
● If YELLOW PUMP failed:
RAT . . . . . ON
Affected YELLOW eqpt . . . . . RESTORE

■ YELLOW remaining:
LAND ASAP

FOR APPROACH

■ If SYS lost by RSVR OVHT or LO AIR PR:
Related PUMP . . . . . ON
Affected eqpt . . . . . RESTORE

■ IF YELLOW SYS lost by RSVR LO LEVEL:
RAT . . . . . ON
CAUTION : If YELLOW SYS powered by RAT, and second failing HYD system not recovered, DUAL HYD SYS LO PR will apply for landing.

■ If BLUE remaining with FLAPS less than 20°: R
ATS LEVERS . . . . . OFF R

■ If unable to restore:
● BLUE remaining:
• KRUG RETRACTED
LDG SPD INCREMENT . . . . . + 10 KT
LDG DIST:
. FLAPS LESS THAN 20° .. MULTIPLY BY 3.1
. FLAPS 20° OR MORE . . MULTIPLY BY 2.7
• KRUG EXTENDED
LDG DIST:
. FLAPS LESS THAN 20° .. MULTIPLY BY 2.9
. FLAPS 20° OR MORE . . MULTIPLY BY 2.5
REV EFFECT . . . . . MULTIPLY BY .8
L/G GRAVITY EXT PROC (21) . . . . . APPLY
MAX BRK PRESS . . . . . 1000 PSI

(continued)

DUAL HYD SYS LO PR

Indications :
Continuous Repetitive chime
MASTER WARNING
Left ECAM CRT : procedure
Right ECAM CRT : HYD page
Local alert lights according to the secondary failures

- It is recommended to avoid using PTU in order not to decrease the reliability of the remaining GREEN hydraulic system.
- Hydraulic system failure may be due to loss of system pressure or fluid.
- RAT should be extended if yellow circuit is lost provided yellow tank is not empty. If the yellow circuit is powered by the RAT, yellow hydraulic pressure cannot be guaranteed below 140 kt and therefore will not be available for landing.

  Refer to table SYSTEMS STATUS WITH ONE HYD CIRCUIT REMAINING for more detailed information.

Flight on BLUE system (Yellow and Green systems failed)

- Altitude is limited to FL 350 due to loss of both PITCH TRIM.
- If YELLOW HYD pressure is recovered by RAT, leave BRK/A/SKID in OFF.
- Airspeed is limited due to loss of PITCH TRIM and PITCH FEEL systems.
- Selecting RAT to ON for approach may at least temporarily provide an opportunity for stabilizer trim and flap extension.
- If flaps are stuck at less than 20°, ATS must be disarmed to prevent operation of alpha floor. R R
- VLS is augmented by 10 kt due to KRUGERS inoperative.
- Landing distance is increased due to LDG SPD increment, partial loss of GND SPLRS, A/SKID OFF and flaps not extended. If the flaps were extended when the failure occurred, and remain, the landing distance increase is reduced respectively.
- BRK/A/SKID is switched OFF to avoid YELLOW brake accumulator pressure loss caused by antiskid operation. The yellow accumulator pressure should read 3,000 psi before landing. If below this value the PARKING BRAKE ACCU PRESS pb may be operated to recharge the brake accumulator.
- As antiskid is not available, limit brake pressure to 1,000 psi and at low ground speed adjust brake pressure as required. Landing on an icy runway should be avoided.

(continued)

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DUAL HYD SYS LO PR (continued)

■ If unable to restore :

● GREEN remaining :

LANDING CONFIG / GPWS 20/20
LDG SPD INCREMENT . . . . . + 10 KT
LDG DIST . . . . . MULTIPLY BY 1.8
L/G GRAVITY EXT PROC (21) . . . . . APPLY

● YELLOW remaining :

SLATS 15° OR MORE

. KRUG RETRACTED
LDG SPD INCREMENT . . . + 10 KT
LDG DIST . . . . . MULTIPLY BY 2

. KRUG EXTENDED
LDG DIST . . . . . MULTIPLY BY 1.8

SLATS LESS THAN 15°

LDG DIST . . . . MULTIPLY BY 2.1
REV EFFECT . . . . MULTIPLY BY .8

L/G GRAVITY EXT PROC (21) . . . . . APPLY

DUAL HYD SYS LO PR (continued)

Flight on GREEN system (Yellow and Blue systems failed)

- If the PTU was used to repressurize the first failing HYD system, it is recommended to select the PTU to OFF to maintain GREEN system full capability and integrity.
- VLS is augmented by 10 kt and landing configuration is limited to 20/20 due to reduced lateral controllability caused by partial loss of roll spoilers.
- Landing distance is increased due to ground spoilers partially inoperative and LDG SPD increment.
- Landing gear is extended by gravity to maintain GREEN system full capability and integrity.

Flight on YELLOW system (Green and Blue systems failed)

- VLS is augmented by 10 kt if slats are extended 15° or more but KRUGERS remain retracted.
- Landing distance is increased due to LDG SPD increment partial loss of GND SPLRS loss of normal braking (GREEN) and slats not extended. If slats were extended when the failure occured, and remain, the landing distance increase is reduced respectively.

SYSTEMS STATUS WITH ONE HYD CIRCUIT REMAINING

SYS AVAIL	(B)	-G-	-Y-	-B-	(B)	-Y-	-B-	-G-	(Y)
A/P	LOST			LOST **			N° 2 ONLY		
YAW DAMPER	N° 1 ONLY			LOST			N° 2 ONLY		
PITCH FEEL	LOST			N° 1 ONLY			N° 2 ONLY		
STAB	LOST								
KRUG	LOST						LOST		
SLATS	SLOW			SLOW			LOST		
FLAPS	LOST			SLOW			SLOW		
SPLR and SPD BRK	3 and 2,7 ONLY			5 ONLY			4 and 1,6 ONLY		
L/G NORM EXT	LOST			DO NOT USE			LOST		
N.W. STEER.	LOST			LOST *			LOST		
BRK-A/SKID	ALTN/OFF			NORM/ON			ALTN/ON		
AUTO BRAKE	LOST						LOST		

* Nose wheel steering is lost due to L/G gravity extension.
** AP is lost due to loss of YAW DAMPERS.

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EMER DESCENT

THROTTLES	IDLE
SPD BRK	FULL
OXY MASK	AS RQRD
SPD	MMO/VMO
CAUTION : ***If structural damage is suspected reduce speed as appropriate.***	
SEAT BELTS and NO SMOKING	ON
IGNITION	CONT RELIGHT
ATC/TRANSPONDER	NOTIFIED/AS RQRD
MEA	CHECK
LDG ELEVATION	SET

EMERGENCY DESCENT

- The descent is initiated in turn, do not exceed a maximum bank angle of 30° and a maximum nose down pitch attitude of 5° in stabilized conditions.
  It is recommended to use the A/P when initiating descent.
- The following applies, in case of rapid decompression :
  a) Ensure crew communication is established with oxygen masks.
  b) Avoid the use of interphone position to minimize interference from oxygen mask breathing noise.
  c) Passenger signs come on automatically when cabin altitude exceeds 11,300 ft.
  d) Passenger oxygen masks drop automatically when cabin altitude exceeds 14,000 ft.
- Maximum airspeed is MMO/VMO. But, if structural damage is suspected use the flight controls with care and reduce speed as appropriate.
- Notify ATC of the nature of the emergency encoutered and state the intentions.
  In the event ATC cannot be contacted select ATC code A77 or transmit the distress message on one of the following frequencies :
  (VHF) 121.5 MHz or (HF) 2.182 KHz.

CAUTION

Only VHF 1/ATC 1 are available on batteries only.

- Landing gear may be extended when below 20,000 ft at VLO/VLE 270 Kt to increase rate of descent.

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DITCHING

■ PREPARATION (time permitting)

CABIN CREW . . . . . NOTIFY
ATC / TRANSPONDER . . . . . NOTIFY/AS RQRD
SEAT BELTS / NO SMOKING . . . . . ON
GPWS . . . . . OFF
CABIN and COCKPIT . . . . . PREPARE

. Loose equipment secured
. Survival equipment prepared
. Belts and shoulder harness locked

CAB PRESS-LDG ELEVATION . . . . . SET

■ APPROACH

L/G LEVER . . . . . UP
SLATS and FLAPS . . . . . MAX AVAIL
IGNITION . . . . . OFF
CABIN REPORT . . . . . OBTAINED
EMER EXIT LT Sel . . . . . ON R

■ BEFORE DITCHING

OUTFLOW FWD and AFT . . . . . OFF/CLOSED
MAN PRESS . . . . . CHECK OFF
BLEED VALVES (ENG and APU) . . . . . OFF/R
RAM AIR . . . . . OFF/CLOSED
"SAFETY POSITION!" . . . . . ORDER

NOTE : Touchdown with approximately 11° pitch attitude with minimum aircraft V/S.

■ DITCHING

BOTH FUEL LEVERS . . . . . OFF

■ AFTER DITCHING

FIRE HANDLES (ALL) . . . . . PULL
CABIN CREW (PA) . . . . . NOTIFY
FUEL ISOL VALVES . . . . . OFF
EVACUATION . . . . . INITIATE
BAT (before leaving A/C) . . . . . OFF/R

DITCHING

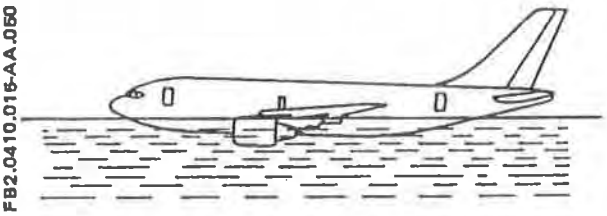
– Notify ATC of the nature of the emergency encountered and state intentions.
In the event of no ATC contact select ATC code A77 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2.182 KHZ.

CAUTION

VHF1/ATC1 only are available on batteries only.

– Notify the cabin crew the nature of emergency encountered and intentions.
Specify the available time.

– Reference aircraft attitude after ditching.



– *Note : The direction of ditching is mainly dependent on wind and state of sea and these factors may be assessed as follows :*

(1) Wind direction :

This may be assessed by observing the waves, wich move and break down wind, spray from wave tops is also a reliable indicator.

(2) Wind speed :

The following conditions can be used as a guide to wind speed :

A few white crest . . . . . 8-17 Kt
Many white crest . . . . . 17-26 Kt
Streaks of foam along water . . . . 23-35 Kt
Spray from waves . . . . . 35-43 Kt

(3) State of sea :

This is better assessed from a height of 500 to 1000 ft, particularly direction of swell which may not be as obvious as the less important wave direction when seen from a lower altitude.

– When there is no swell, align into the wind. In the presence of a swell, and provided that drift does not exceed 10 degrees, land parallel to the swell, and as nearly into wind as possible. If drift exceeds 10 degrees, land into wind. The presence of drift on touchdown is not dangerous, but every effort should be made to minimize roll.

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ON GROUND EMER/EVACUATION

AIRCRAFT/PARKING . . . . . STOP/SET
ATC (VHF 1) . . . . . NOTIFY

■ If EVACUATION required:

BOTH FUEL LEVERS . . . . . OFF
CABIN CREW (PA) . . . . . NOTIFY
EMER EXIT LT Sel . . . . . ON
FIRE handles (ENG and APU) . . . . . PULL
FUEL ISOL VALVES . . . . . OFF
AGENTS (ENG and APU) . . . . . AS RQRD
RAM AIR . . . . . ON
EVACUATION . . . . . INITIATE
BAT (before leaving A/C) . . . . . OFF/R

R

ON GROUND EMERGENCY - EVACUATION

- Careful analysis is required to decide on passenger evacuation, however, useful time should not be wasted.
- Notify ATC of the nature of the emergency, and state intentions.

CAUTION

VHF 2 is not available on batteries only.

- Notify the cabin crew about the emergency encountered and the intentions, use P/A to minimize apprehension.
- RAM AIR is selected ON to facilitate doors opening.
- Switching the batteries OFF stops the cockpit voice recorder (CVR) and prevents tape erasure.

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FORCED LANDING

PREPARATION (time permitting)

CABIN CREW ..... NOTIFY
ATC / TRANSPONDER ..... NOTIFY/AS RQRD
SEAT BELTS / NO SMOKING ..... ON
GPWS ..... OFF
CABIN & COCKPIT ..... PREPARE
- Loose equipment secured
- Survival equipment secured
- Belts and shoulder harness locked

CAB PRESS-LDG ELEVATION ..... SET

APPROACH

L/G LEVER ..... DN
If applicable, rotate GRAVITY EXT handcrank back to the normal position, then stow.
SLATS and FLAPS(if engines running) ... MAX AVAIL
GND SPLRS ..... ARM
IGNITION ..... OFF
CABIN REPORT ..... OBTAIN

BEFORE IMPACT

PACKS 1 and 2 ..... OFF
RAM AIR ..... ON
BRACE FOR IMPACT ..... ORDER
NOTE: Touchdown with approximately 11° pitch attitude with minimum aircraft V/S.

IMPACT

BOTH FUEL LEVERS ..... OFF

AFTER IMPACT

FIRE HANDLES (ALL) ..... PULL
When A/C stopped:
- CABIN CREW (PA) ..... NOTIFY
- FUEL ISOL VALVES ..... OFF
- AGENTS (ENG & APU) ..... DISCH
- EVACUATION ..... INITIATE
- BAT (before leaving A/C) ..... OFF/R

FORCED LANDING

- Notify ATC of the nature of emergency encountered and state intentions.
  In the event of no ATC contact select ATC code A77 or transmit the distress message on one of the following frequencies, (VHF) 121.5 MHZ or (HF) 2.182 KHZ.

CAUTION

Only VHF 1/ATC 1 are available on batteries only.

- Notify the cabin crew of the nature of emergency encountered and the intentions.
  Specify the available time.
  If the nature of the emergency permits, allow cabin crew to make P/A announcement that will minimize apprehension.

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CREW INCAPACITATION

In case of incapacitation of a cockpit crew member, the remaining crew member shall as soon as practicable call a cabin attendant.
The best way to request assistance from the cabin crew, is by P/A system :
« ATTENTION », PURSER TO COCKPIT PLEASE « . The Purser or any other C/A must proceed to the cockpit immediately.

The C/A then must :

- Tighten and manually lock the shoulder harness of the incapacitated crew member :
- Push the seat completely aft ;
- Recline the seat back.

It takes 2 people to remove the dead weight of an unconscious body from a seat without endangering any controls and switches.
If it is not possible to remove the body, one cabin attendant shall remain in the cockpit to take care of and observe the incapacited crew member.

In coordination with the purser :

- Request assistance from any medically qualified passenger.
- Check if a type qualified company pilot is on board to replace the incapacitated crew member.

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A310 FLIGHT CREW OPERATING MANUAL	ABNORMAL PROCEDURES INTRODUCTION	2.05.10 PAGE 1 17.01.1990

GENERAL

The abnormal procedures represent the actions applicable after a failure to ensure adequate safety and to ease the further conduct of flight.

PRESENTATION

The procedures are presented in the basic checklist format with an adjacent expanded part which provides

- indications of the particular failure,
- explanation for actions, where the reason is not self-evident,
- additional background information.

The abbreviations used are identical with the abbreviations presented on ECAM and the nomenclature of the cockpit panels.

All actions are printed in capital letters.

Information also displayed on ECAM is printed in capital letters. Other information, not on ECAM, is printed in small letters.

If actions depend on a precondition, a preceeding black square is used to identify the precondition.

If actions depend on a sequential precondition or a phase of flight, a preceeding black dot is used to identify this.

Black squares and black dots do not appear on ECAM, since only the actions appropriate to the actual condition are displayed.

Procedure items which are displayed on ECAM are marked by a continuous vertical line in the checklist.

STATUS items are marked by a dashed vertical line.

Beginning and end of ECAM display are marked by respective horizontal lines.

TASK SHARING

For all procedures the general task sharing stated below is applicable

The pilot flying remains pilot flying throughout the procedure. Certain actions can only be performed from either the right or the left seat. PF and PNF duties must be distributed accordingly.
(e.g. : L/G gravity extension handcrank, sniffer fan tube and pushbutton – reachable and operable from right seat only).

PF -Pilot flying -Responsible for:

- Throttles of normally working engines
- Flight path and airspeed control
- Aircraft configuration
- Navigation
- Communications(by decision of CM 1)

PNF -Pilot non- flying -Responsible for:

- Throttles of faulty or not working engines
- ECAM and checklist reading
- Execution of required actions or request of execution by PF, if applicable
- Actions on OVHD panel
- Engine fuel levers (monitored by PF)
- Communications (by decision of CM 1)

PROCEDURES INITIATION

Procedures will be initiated on CM 1 command.
No action will be taken (apart from audio warning cancel) until

. Flight path is stabilized,

. At least 400 ft above runway in case of failure during takeoff.
(No abnormal procedure action below 400 ft should equally apply for approach and go-around).

LDG DIST – LDG SPD

LDG DIST increase is in all cases based on the minimum demonstrated landing distance 30/40.

LDG SPD increments have to be added to the actually displayed VLS.

ECAM

Warning Inhibition During Takeoff

Above 70 Kt until reaching 400 ft above runway in general ECAM warnings are inhibited except :
- ENGINE FIRE
- ENGINE FAIL
- APU FIRE

The following ECAM warnings are only inhibited from 70 Kt until lift-off :

- ENG OIL PRESS LO
- ENG OVERLIMIT
- NAV ADC
- EXCESSIVE BRAKE TEMP

TAKEOFF CONFIG warning is inhibited from lift-off on.

Crew Coordination

When carrying out a procedure displayed on ECAM it is essential, that both pilots are aware of the present display. Before any CLEAR action a cross check is recommended to confirm that no cyan message remains (except in case of no action feedback), which can be eliminated by a direct action.

NO CLEAR ACTION BEFORE CROSS-CONFIRMATION R

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Example of Crew Coordination and Cross-Confirmation

WARNING DISPLAY	PILOT FLYING	PILOT NOT FLYING
HYD BLUE RSVR OVHT - BLUE PUMP ..... OFF	- READ FAILURE - TAKE ATC RADIO CTL	- READ FAILURE
	CM 1 REQUEST ECAM ACTION	
		- PERFORM ECAM ACTION OR REQUEST EXECUTION BY THE PF(loudly) - Read PROC if applicable
	CM 1 request paperC/L if applicable	
HYD BLUE RSVR OVHT BLUE PUMP OFF BLUE SYS LO PR		- REQUEST CLEAR
	- CHECK ECAM ACTION COMPLETED - CONFIRM CLEAR	
* FLT CTL SLATS SYS 1 FAULT SPLR 7 FAULT ..... OFF SPLR 3+2 FAULT ..... OFF YAW DAMPER 1 OFF		- PERFORM PANEL CLEAN UP(lowly) - CHECK NO CYAN ON ECAM - REQUEST CLEAR
	- CHECK ECAM - CONFIRM CLEAR	
STATUS LAND 3 INOP LDG DIST:MULTIPLY BY 1.2 PROC: HYD SYS LO PR BLUE HYD SYS INOP SPLR PARTIALLY INOP SLATS SLOW		- READ STATUS LINE BY LINE
	CM 1 request paperC/L Note: STATUS will be called in APPROACH C/L	
		- PERFORM PAPER C/L
		- REQUEST CLEAR
	- CONFIRM CLEAR	

Advisory Conditions

In case of system ADV display only monitoring of the flashing parameters is required.

If time and situation permit, it might be favorable to apply preventive action to avoid

- further development into an abnormal condition or
- unnecessary stress of equipment or
- deterioration of flight economy.

Refer ADVISORY CONDITIONS table.

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ENGINE FAIL

IGNITION	CONT RELIGHT
THROTTLE	IDLE
■ If no immediate relight:	
FUEL LEVER	OFF
■ IF DAMAGE:	
FIRE HANDLE	PULL
1ST AGENT (AFTER 10S if in flight)	DISCH
SINGLE ENG OPER PROC (1)	APPLY

ENGINE FAIL

Indications :

An engine flame-out may be recognized by

- Rapid decrease in EGT, N2, FF followed by decrease in N1.

Engine damage may be accompanied by

- Explosion
- Significant increase in A/C vibrations and/or buffeting,
- Repeated or uncontrollable engine stalls,
- Associated abnormal indications such as hydraulic fluid loss, no N2 indication.

When N2 below 54.2 %, OIL PRESS below 8 psi :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : ENG FAIL proc.
- Right ECAM CRT : ENG page.

- CONT RELIGHT selected during rundown ensures an immediate restart attempt, and protects the non affected engine.
- Shut down the engine if no immediate relight.
- The causes of engine flameout can generally be divided into two categories :
  - External causes such as icing, very heavy turbulence, fuel mismanagement, etc. These causes, which may affect both engines, can generally be easily determined and an immediate relight can be attempted before N2 decreases below 15 %.
  - Internal causes, such as engine stalls or failures, usually affect a single engine and are not so easily determined. In these cases the engine is shut down, then the cause of the flameout investigated. If it cannot be positively determined what caused the flameout, the need for engine restart should be evaluated against the risk of further engine damage or fire, that may result from a restart attempt.
- If damage is suspected, the ENG FAIL procedure should be applied, even if ENG FAIL indications are not presented on ECAM. In this case the paper C/L must be used.
  As precautionary measure the FIRE handle is pulled and AGENT discharged.

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SINGLE ENG OPERATION

LAND ASAP

■ If reverse UNLK :
MAX SPD 240

■ If wing anti ice on :
AIR X-FEED . . . . . MAN/IN LINE
PACK 1 or 2 . . . . . OFF
Affected eqpt . . . . . OFF
. GEN
. PACK
IF HYD LO PR { . HYD PUMPS ; . SPLR and SPD BRK
FUEL X-FEED . . . . . IN LINE

NOTE : The second PACK may be recovered by AIR X-FEED provided WING ANTI ICE is OFF and ENG FIRE handle is not pulled.

APU : START.
APU BLEED usable below FL 200.

AFT CG WARNING INOP.

NOTE : If ENG 1 FIRE handle is pulled, do not use APU bleed air. Confirm APU BLEED selector in OFF/R to maintain PACK 2 air supply by ENG 2 bleed.

● FOR APPROACH :

NOTE : If available ELEC PUMPS and PTU may be selected ON to recover affected HYD system and related equipment.

IGNITION . . . . . CONT RELIGHT
APPROACH CONFIG . . . . . CHECK

■ If SPLRS not recovered :
LDG DIST . . . . . MULTIPLY BY 1.3

■ If reverse UNLK :
LDG DIST . . . . . MULTIPLY BY 1.1

■ If SPLRS not recovered and reverse UNLK :
LDG DIST . . . . . MULTIPLY BY 1.4

SINGLE ENGINE OPERATION

Indications :

When FUEL LEVER is selected to OFF :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : ENG SHUT DOWN proc
- Right ECAM CRT : ENG page.

- One PACK must be closed when using wing anti ice (precooler performance).
- Fuel management may be required to keep fuel in balance. Use FUEL FEED MAN CTL.
- APU (if available) should be started to replace inoperative generator.
- As N1 parameter is used in the computation of aft CG warning, this warning is inhibited in case of engine failure.
- **For approach and landing :**
  a) Refer to FCOM section Flight Patterns.
  b) The flap configuration to be used is dependent upon the single engine approach climb gradient requirements.
  c) It is recommended that the operative engine air bleed is closed during final approach, to provide an increase in approach climb gradient. Use APU bleed air (if available).
  d) If ENG 1 FIRE handle is pulled, to avoid possible contamination from related engine bleed, it is not allowed to use APU bleed air and the X-BLEED valve must be closed. Consequently APU Bleed air is not to be used to replace ENG 2 Bleed air for PACK 2 operation.
  The X-BLEED valve is to be opened (with possible use of APU Bleed) only if wing anti-ice is required because asymetrical wing anti-ice (if X-BLEED is maintained closed) must be avoided. R R
  e) Affected services may be recovered for approach and landing by selecting ELEC PUMPS and associated PTU switch to ON.
- If SPLRS are not recovered, the landing distance is increased due to partial loss of GND SPLRS.
- If engine shutdown was caused by REV UNLK, the landing distance is increased due to the V_{REF} increment of 10 kt, which is taken into account by the EFIS.
- In case of SPLRS not recovered combined with REV UNLK the landing distance increase is 1.4.

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ENG OVER LIMIT

THROTTLE . . . . . BELOW LIMIT

MAX POINTER INDICATION

■ N1 – 117.6 to 123.5 %
N2 – 112.6 to 113.0 %
EGT – 961° to 970° R R

Normal engine operation may be resumed to next landing.

■ N1 – 123.6 to 125.5 %
N2 – 113.1 to 113.5 %
EGT – 971° to 979° R R

THROTTLE . . . . . IDLE

Only use higher thrust at Captain's discretion.

■ N1 – Above 125.5 %
N2 – Above 113.5 %
EGT – Above 980°

If conditions permit :

FUEL LEVER . . . . . OFF

SINGLE ENG OPER PROC. (1) . . . . . APPLY

ENG OVER LIMIT

Indications :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : OVER LIMIT proc
- Right ECAM CRT : ENG page.

CAUTION

Normal limits must not be deliberately exceeded.

- Verify max pointer(s) to detemine limit exceedance and proceed accordingly.
- Over limit conditions and primary engine parameters must be recorded for maintenance purposes.
- If conditions do not permit engine shutdown, land as soon as possible using the minimum thrust required to sustain safe flight.

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ENG RESTART IN FLIGHT

FUEL SUPPLY . . . . . CHECK
THROTTLE . . . . . IDLE
IGNITION . . . . . CONT RELIGHT

FL 300 or below

● N2 above 15 % (WINDMILLING START) : R
FUEL LEVER . . . . . ON
RELIGHT within 45s . . . . . MONITOR
IGNITION . . . . . AS REQD R
SYSTEMS affected . . . . . RESTORE

● N2 below 15 % (STARTER ASSISTED) : R
BLEED AIR (from ENG or below FL 200 APU) ESTABLISH
START . . . . . ON
FUEL LEVER between 15 % N2 . . . . . ON
RELIGHT (within 45s) . . . . . MONITOR

■ If restart unsuccessful : R
FUEL LEVER . . . . . OFF R
ALLOW FOR 30 SEC. ENGINE VENTILATION R
START PUSH BUTTON . . . . . RELEASE R
START OPEN LIGHT . . . CHECK EXTINGUISHED R
PACK VALVES . . . . . CHECK OPENED R
SECOND RESTART ATTEMPT . . . . CONSIDER R

■ If restart successful : R
IGNITION . . . . . AS REQD
SYSTEMS affected . . . . . RESTORE

ENGINE RESTART IN FLIGHT

- Monitor especially N2 and EGT to confirm successful relight within the time limit.
- If the initial relight attempt with N2 above 15 % is not successful either perform a repeat or continue with the procedure for N2 below 15 %.
  Allow 30 sec between each attempt for fuel drainage.
- If restart unsuccessful, allow pack valves re-opening, for maintaining aircraft pressurization, before proceeding with a new restart attempt. R R R
- If an engine hung start occurs (i.e. engine fails to accelerate to flight idle and does not respond to throttle), place FUEL LEVER in OFF position for 2 seconds or the time required to check that fuel flow decreases, then place FUEL LEVER in ON position. If unsatisfactory shut down the engine.
- Bleed air is established from either :
  - Opposite engine BLEED by selecting X FEED to MAN/OPEN and closing the ENG BLEED VALVE of the receiving engine
  or
  - APU when below FL 200 by selecting APU BLEED sw to ON.
- It is recommended to maintain throttle at idle for one minute after relight. R

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ENG OIL LO PR	
■ IF OIL PRESS BELOW 10 PSI:	
THROTTLE	IDLE
FUEL LEVER	OFF
SINGLE ENG OPER PROC. (1)	APPLY

ENG OIL LO PRESS

Indications :

Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : ENG OIL LO PR proc
Right ECAM CRT : ENG page
OIL LO PRESS light

- If low oil pressure (< 10 psi) is only indicated on ENG page (advisory) without other warnings (OIL LO PR, light, procedure page on ECAM), it can be assumed, that the oil pressure transducer is faulty. Continue engine operation while monitoring other engine parameters.

ENG OIL FILTER CLOG	
THROTTLE	BELOW WARN
■ IF WARN AT IDLE AFTER 3 MN:	
FUEL LEVER	OFF
SINGLE ENG OPER PROC. (1)	APPLY

ENG OIL FILTER CLOG

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : ENG OIL FILTER CLOG proc
Right ECAM CRT : ENG page
OIL CLOG light

- If conditions do not permit engine shutdown, land as soon as possible using the minimum thrust required to sustain safe flight.

ENG OIL TEMP HI	
■ OIL TEMP between 161° and 175° C	
OIL parameters	MONITOR
NOTE: If OIL TEMP rise follows throttle reduction, advancing throttle may reduce OIL TEMP. If OIL TEMP rise occurs at high thrust, reduce throttle.	
■ OIL TEMP between 161° and 175° C more than 15 min or OIL TEMP above 175° C:	
THROTTLE	IDLE
FUEL LEVER	OFF
SINGLE ENG OPERATION PROC. (1)	APPLY

ENG OIL TEMP HI

Indications :

Right ECAM CRT : ENG Page
161° C to 175° C OIL TEMP flashing green
above 175° C OIL TEMP steady amber

- A rise in oil temperature during normal, stabilized engine operation may indicate a system malfunction. The engine should be closely monitored for other indications of possible engine malfunction.
- Increased power setting may reduce the OIL TEMP due to increase of fuel flow across the fuel/oil heat exchanger.

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ENG TRIM FAULT

THROTTLE 1 + 2 . . . . . REDUCE
ENG TRIM . . . . . OFF
ENG PWR . . . . . AS REQD

ENG TRIM FAULT

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : ENG TRIM FAULT proc
Right ECAM CRT : ENG page.
ENG TRIM – FAULT light.

CAUTION

Reduce the throttles to decrease N1 by approx. 20 % prior to selecting ENG TRIM OFF in order to prevent an overspeed.

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FUEL FILTER CLOG	
THROTTLE	BELOW WARN
■ IF WARN AT IDLE: ENG PWR FOR SAFE FLT ONLY.	

FUEL FILTER CLOG

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : FUEL FILTER CLOG proc
Right ECAM CRT : ENG page
FUEL CLOG light on main inst. panel

– Throttle may be advanced beyond warning to sustain safe flight.

Mod. : 5051

GE Eng. : All

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ENG REV UNLK

■ IF BUFFET OR BANK:
- THROTTLE ..... IDLE
- FUEL LEVER ..... OFF
- MAX SPD 240
- SINGLE ENG OPER PROC (1) ..... APPLY

ENG REV UNLK (IN FLIGHT)

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : REVERSE UNLK proc
- Right ECAM CRT : ENG page
- REV UNLK light

- Abnormal aircraft behaviour may be exhibited by buffeting, vibration and rolling.
- The REV UNLK light alone without abnormal aircraft behaviour may be a false warning.

ENGINE STALL

THROTTLE ..... IDLE
ENG parameters ..... CHECK

■ Abnormal:
- AIR BLEED HP VALVE ..... OFF
- AIR X FEED (if in line) ..... MAN-X LINE

● If stall recurs:
- FUEL LEVER ..... OFF
- SINGLE ENG OPER PROC (1) ..... APPLY

■ Normal:
- ENG ANTI ICE ..... ON
- WING ANTI ICE SUPPLY ..... ON
- THROTTLE ..... SLOWLY ADVANCE

● If stall recurs:
Reduce thrust and operate below the stall threshold, or at the pilots discretion continue to operate at idle.

● If stall does not recur:
Continue engine operation.

NOTE: The EGT must not be more than 20 °C above the previous trend level or the other engine EGT. Restrict N1 accordingly.

ENGINE STALL

Indications :
- Varying degrees of abnormal engine noise (rumbling- bangs)

- **Identification of stalling engine**

It may be difficult to identify the stalled engine. Typical symptoms are :

Increase in EGT,
Increase in FF,
Shift in N2,
Perceptible vibrations or increase in vibration indication.

- Closing HP VALVE and AIR X FEED may clear low thrust stalls if caused by inflow bleed (8th stage check valve malfunction).
- If engine damage is suspected, apply ENG FAIL checklist.
- Operation of ENG and WING ANTI ICE will increase the stall margin but EGT will increase as well.
- The report for maintenance action on the stalled engine should include :
TAT, ALT, IAS, N1, weather conditions.

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THROTTLE JAM

AUTO THROTTLE . . . . . DISENGAGE
WING ANTI ICE . . . . . ON
DESCENT . . . . . INITIATE

Caution :

1) Do not reduce the unaffected engine N1 below 60 %
2) Do not shut down the affected engine unless limits are exceeded.

● When below max altitude for the weight :

WEIGHT (t)	80	100	120
MAX ALTITUDE (ft)	37000	33000	29000

If required :

MAX SPD 270 KTS/.59
L/G . . . . . DOWN

Expect throttle become free before reaching 8000 ft.

NOTE : *Should one throttle remain jammed (Possibly mechanical malfunction) :*

- *Shut down affected engine during approach when mechanical jam is obvious since throttle does not become free below 5000 ft.*
- *Single Engine Operation Proc -Apply*
- *LDG DIST multiply by 1.3*
- *With one throttle lever remaining out of idle position after touch down : AUTOBRAKE, REVERSE and automatic GND SPLR extension are inop.*

THROTTLE JAM

In any case the autothrottle should be disengaged. The descent planning should be made taking into account the circumstances.

• **One throttle jammed**

- Initiate descent by reducing power on the unaffected engine to minimum 60 % N1 (in order to keep the temperature inside the unaffected pylon relatively high) and by extending speed brakes as required.
- Do not shut down the affected engine unless certified limits are exceeded because the low temperature inside the pylon resulting from the shut down engine may cause the cable to remain jammed even at low altitude. This could make an eventual relight and use of that engine impossible. To increase the rate of descent the landing gear may be extended if below 270 Kts/.59 Mach.
- Before decelerating to 270 Kt/.59M confirm max. altitude for actual weight is not exceeded (to prevent buffeting).

• **Both throttles jammed**

- Under very unfavorable temperature conditions (ISA-25) expect throttle nbr 1 to become free at about 10 000 ft, throttle nbr 2 at 5000 ft, otherwise at higher altitudes.

ENG START OPEN

AVOID ICING CONDITIONS R
■ If wing anti-ice OFF R
BLEED VALVE affected . . . . . OFF/R R
AIR XFEED . . . . . Check X line R
APU BLEED (if left side affected) . . . . . OFF/R R
PACK VALVE affected . . . . . OFF R

ENG START OPEN R

Indication : R
START 1 or 2 OPEN light R
on ENG START panel R

This procedure applies only if wing anti-ice is not required. R
In case of engine start valve opening in flight, all bleed air R
should be removed from the starter. R
If wing anti-ice is required, starter may be damaged. R

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ENG or APU LOOP FAULT	
Affected LOOP ..... OFF	

ENG or APU LOOP FAULT

Indications :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : LOOP FAULT proc
- Right ECAM CRT : Nil
- LOOP light on overhead panel

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ENGINE FAILURE ON TAKEOFF

Indications :
Engine fire or severe damage
Loss of thrust

Aborted takeoff. Engine failure before V1

- If an engine failure occurs before reaching V1, the takeoff should be aborted.
- Immediately when the engine failure is recognized, simultaneously select the throttles to idle and apply wheel braking or check operation of AUTO BRK.

Note : 1 If the takeoff is aborted above 100 kt it is recommended that maximum reverse thrust is selected on both engines.
2 The autobrake system (if installed) is initiated by the same logic which operates the ground spoilers.

Continued takeoff with engine failure between V1 and V2.

- If an engine failure occurs after passing V1 the takeoff must be continued.
- At VR rotate to the safe pitch attitude (or the attitude commanded by the Speed Reference System).
- At 50 ft and with positive rate of climb select the landing gear up.
- Maintain the airspeed at V2.

Note : In the case where flexible takeoff thrust was used, the performance may be improved if required, by setting the operative engine to the go-around thrust.

- Use sufficient rudder to hold a constant heading whilst maintaining the control wheel at about neutral.

Note : If a change of heading is required, aileron application should be limited to avoid an increase in drag due to roll spoiler deployment.

- At acceleration height, level off and allow the speed to increase.
  - At F speed retract the flaps
  - At S speed retract the slats.
- At 0 – speed (engine out operating speed in clean configuration – green dot) resume the climb using maximum continuous thrust and maintain 0 speed.

Note : MAXIMUM TAKEOFF THRUST IS ONLY ALLOWED FOR 10 MINUTES.

Engine failure during initial climb out.

- Following the engine failure adopt the safe pitch attitude (or the attitude commanded by the Speed Reference System), continue with the actions given for the continued takeoff case.

START VALVE REMAINS CLOSED

ENG START selector ..... OFF

- Advise ground crew to prepare for manual start valve operation

GRND SERVICE INTPH ..... ON

- When ground crew member is ready, order « START 1 or 2 »

ENG START selector ..... START A (or B)
ENG START button ..... PRESS
START VALVE ..... ORDER OPENING
– Continue the normal engine start procedure.

- When N2 at 45 %

START VALVE ..... ORDER CLOSURE
– Continue the normal procedure.

START VALVE FAILS TO CLOSE

ENG START selector ..... OFF
OPEN Light ..... CHECK OUT
IF OPEN Light remains illuminated :
Starter Air supply ..... REMOVE

- APU supply :
  ENG 1/2 BLEED VALVES ..... OFF
  APU BLEED VALVE ..... OFF
- Crossbleed supply :
  BLEED VALVE (supplying engine) ..... OFF
- External pneumatic power supply :
  External pneumatic power ..... ORDER SHUT OFF

When BLEED PRESS at zero :

FUEL LEVER ..... OFF
– Maintenance action is due.

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PREMATURE START VALVE CLOSURE

FUEL LEVER . . . . . OFF

- When N2 at 0 % :

  ENG START button . . . . . DEPRESS and HOLD
  – Crank the engine for 30 seconds.

  FUEL LEVER . . . . . ON

- When N2 at 45 % :

  ENG START button . . . . . RELEASE
  – Continue the normal procedure.

ARM LIGHT OR START BUTTON FAILURE

The procedure covers failures within the starting circuit which are caused by a fault of the 45 % N 2 signal of an engine.

Such a fault can result in :

– ONE ARM LIGHT DOES NOT ILLUMINATE WITH ENG START SELECTOR IN A START POSITION.

– ENG START BUTTON DOES NOT HOLD IN.

Note : Start engine with failing ARM Light first.

ENG START button . . . . . DEPRESS and HOLD

OPEN Light . . . . . CHECK ON

- At 15 % N 2 minimum :

  FUEL LEVER . . . . . ON

- When N 2 at 45 % :

  ENG START button . . . . . RELEASE

  OPEN Light . . . . . CHECK OUT, Latest at IDLE.

Note : After second engine start both ARM Lights will illuminate, even with one 45 % N 2 signal fault, until ENG START selector is set to OFF.

NO « N1 » DURING ENGINE START (GROUND)

- Request ground crew to visually check for fan rotation.

FAN rotation within 30 seconds of N2 idle operation

- **CONFIRMED :**
  – Continue the normal engine start procedure.
  – If, after engine start, N1 indication is still failed, maintenance action is due.

- **NOT CONFIRMED :**
  (Suspect low pressure assembly seizure).

CAUTION

Do not exceed ground idle N2 until fan rotation is confirmed

FUEL LEVER . . . . . OFF
– When N2 at 0 %
Immediately perform new start attempt as for normal procedure.

FAN rotation within 30 seconds of N2 idle operation :

- **CONFIRMED :**
  – Continue the normal engine start procedure.
  – If, after engine start, N1 indication is still failed, maintenance action is due. R R

- **NOT CONFIRMED :**

  FUEL LEVER(s) . . . . . OFF

  START selector . . . . . OFF

  Note : Do not attempt a further start unless maintenance action has been carried out.

NO « N2 » DURING ENGINE START (GRND)

ENG START selector . . . . . OFF

Corresponding HYD LO PR Lights during start attempt :

EXTINGUISHED :

– Apply « ENGINE START WITH N2 INDICATION FAILED » procedure

- **NOT EXTINGUISHED :**
  (suspect starter motor failure)
  – Maintenance action is due.

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ENGINE START WITH N2 INDICATION FAILED

Note : Be aware that associated starter cut-out circuit may be inoperative.

- **Before start**
  GEN 1 (2) . . . . . Check ON
- **Engine start**
  Note : Confirm starter motor operation by checking the GREEN/YELLOW (BLUE) HYD LO PR lights extinction.
  ENG 1 (2) START button . . . . . DEPRESS and HOLD
  – Start clock
  – Announce « 15 SECONDS » when elapsed.
  ENG 1 (2) FUEL LEVER . . . . . ON

CAUTION
A hot start may occur.

- When GEN 1 (2) FAULT extinguishes
  ENG 1 (2) START button . . . . . RELEASE
  – START OPEN Light check extinguished.
- After engines start
  – Continue the normal procedures.

HOT START

Indications :
- Rapid EGT rise
- N2 increases below normal
- FF normal or high
- Tailpipe burning may be reported by ground crew.

Note : If starting EGT exceeds 820°C, but otherwise is within time/temperature limits, the start may be continued and the intended flight may be completed. However, maintenance action must be taken before next engine start.

– Announce « EGT 750° »
– Start clock
  • If EGT above 870° C or above 750° C for more than 40 seconds :
    – FUEL LEVER . . . . . OFF
    – Crank the engines for 30 seconds
    – ENG START selector . . . . . OFF
    – Perform normal engine shut down procedure
    – Maintenance action is due
– Record EGT maximum value
– Stop clock when EGT below 750° C.

CAUTION
If fuel flow was exceeding 320 KG/h during first start attempt or if attainable N2 was below 15 %, use extreme caution on second start attempt.

ENGINE SHUTDOWN FIRE

Indications :
- EGT fails to decrease when FUEL LEVER is set to OFF

and/or
- Internal tailpipe fire reported by ground crew

CAUTION
Except as a last resort, do not use external fire agent, as serious engine damage may result.

FUEL LEVER . . . . . CHECK OFF
ENG FIRE handle . . . . . PULL
ENG START selector . . . . . CRANK
AIR BLEED PRESS . . . . . ESTABLISH
Select AIR X FEED to MAN/IN LINE if ENG 2 affected
Note : Internal engine damage will normally not occur provided starter is activated with minimum delay. Although APU BLEED remains the normal powering source, it may be necessary to connect external pneumatic power.

- When N2 BELOW 30 % :
  START button . . . . . DEPRESS
  – Crank the engine for 30 sec or until the evidence of burning has ceased. R
  ENG START selector . . . . . OFF
  – Maintenance action is due.

INTERNAL ENGINE FIRE
(DURING ENGINE START ON GROUND)

INDICATIONS
- EGT increases rapidly when FUEL LEVER is set to ON
- Internal tailpipe fire reported by ground crew

CAUTION
Except as a last resort, do not use external fire agent, as serious engine damage may result.

FUEL LEVER . . . . . OFF
AIR X FEED . . . . . MAN/IN LINE
ENG FIRE handle . . . . . PULL
– Crank the engine for 30 sec or until the evidence of burning has ceased.
ENG START selector . . . . . OFF
– Maintenance action is due.

GE Eng. : All

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NO LIGHT UP DURING ENGINE START (GRND)

CAUTION

Never select other igniter until 30 sec. motoring is completed.

Indications :
- EGT does not rise within published time limits
- N1/N2 and FF are normal

FUEL LEVER . . . . . OFF
– Crank the engine for 30 seconds
ENG START selector . . . Select other « START » igniter

R *Note 1 : Changing ENG START selector from one START igniter to the other may interrupt the starting sequence*

R *Note 2 : If starting sequence was interrupted, check N2 below 20 % before starter reengagement. Perform a new engine start attempt.*

FUEL LEVER . . . . . ON
ENG start within 25 seconds from FUEL LEVER ON
- SATISFACTORY :
  ENG . . . . . RESUME NORM OPERATION
- NOT SATISFACTORY :
  FUEL LEVER (s) . . . . . OFF
  ENG START selector . . . . . OFF
  – Maintenance action is due

HUNG START (GND)

Indications :
Abnormally slow acceleration after light-up
N2 stagnation below idle
EGT creeping up but remaining within limits

Note : Every effort should be made to record the primary engine parameters for maintenance analysis.

FUEL LEVER . . . . . OFF
– Crank the engine for 30 sec.
ENGINE START selector . . . . . OFF
– If starter air pressure was low :
  Cross bleed engine start . . . . . Consider
Before second start attempt :
HP bleed VALVE (related engine) . . . . . OFF
Second start attempt . . . . . Perform
– If successful :
  HP bleed VALVE (related engine) . . . . . AUTO
  – Monitor primary engine parameters closely, especially when accelerating
    . If abnormal or if engine surges :
      FUEL LEVER . . . . . OFF
      Maintenance action is due
– If second start attempt unsuccessful :
  FUEL LEVER . . . . . OFF
  ENG START selector . . . . . OFF
  Maintenance action is due.

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FUEL GRAVITY FEEDING

IGNITION . . . . . CONT RELIGHT
X-FEED . . . . . X-LINE
CAUTION : Avoid rapid throttle movement and negative load factors.

CTR TK
Do not consider gravity fuel feed from CTR TK only

INR TK
INR TK above 2000 Kg (4400 lbs) :
MAX FL . . . . . 200 (150 IF JP4/JETB USED)/MEA
INR TK ISOL VALVE (affected) . . . . CHECK IN LINE
OUTR TK ISOL VALVE (affected) . . . . . OFF
● When INR TK below 2000 Kg (4400 lbs) :
OUTR TK ISOL VALVE (affected) . . . . . IN LINE

OUTR TK
MAX FL . . . . . 250 (200 IF JP4/JETB USED)/MEA
OUTR TK ISOL VALVE (affected) . . . CHECK IN LINE
INR TK ISOL VALVE (affected) . . . . . OFF

R

FUEL GRAVITY FEEDING

- Fuel gravity feeding with all tanks affected is not considered in this procedure. It is assumed to be required only in case of loss of all AC generation and flight on batteries only.
  Refer to LOSS OF BOTH ENG GENERATORS.
- The selection of CONT RELIGHT is to protect the engine against flame-out caused by possible fuel supply surges.
- Descent to the specified flight level should provide sufficient static pressure to supply the engine driven fuel pumps.
  If fuel pressure fluctuations of 10 psi or more occur, descend to a lower altitude.
- Keeping throttle movements slow and avoiding low load factors will prevent supply surges.
- If the CTR TK only is affected, gravity feed is not recommended. Due to the increased consumption at the required lower altitude the recovery of CTR TK fuel does not constitute a reasonable advantage.
- If an INR TK is affected, the respective OUTR TK must be isolated to prevent OUTR TK feed.
  INR TK feed must be stopped, when the level reaches 2 000 kg/4400 lb.
  Below this level the non-return valve in the CTR TK feed line may not remain closed, resulting in fuel surges and even air suction. Consequently the OUTR TK must be used.
- If an OUTR TK is affected and pumps in the related INR TK operate in AUTO FEED MODE, monitor INR TK QTY and select INR TK ISOL VALVES to OFF, when pumps stop.
  Should pumps operate in FUEL FEED MAN CTL, select INR TK ISOL VALVES and INR TK PUMPS to OFF at first indication of PUMP FAULT (LO).

OUTER TK LO LEVEL

FUEL MANAGEMENT . . . . . CHECK

OUTER TANK LO LEVEL

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : LO LEVEL proc
Right ECAM CRT : FUEL page

- Be aware of VMO/MMO limit with either OUTR TK below 2000 kg/4400 lb : 340/.84

CAUTION

If CTR TK or INR TK are not empty, select FUEL FEED MAN CTL by switching either both CTR TK PUMPS or all four INR TK PUMPS to OFF.

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TRIM TK SYS INIT

ZFW OR ZFCG DISAGREE

ECAM and load sheet TOGW and TOCG . . . COMPARE

■ If ECAM values show a discrepancy of more than 1000 kg (2200 Lbs) or 1.5 % CG : R

ZFW and ZFWCG . . . . . REENTER

ECAM and load sheet TOGW and TOCG . . COMPARE

■ If ECAM values still show a discrepancy of more than 1000 kg (2200 Lbs) or 1.5 % CG : R

TRIM TK PUMPS . . . . . OFF

TRIM TK SYS . . . . . DO NOT USE

TRIM TK PUMP LO PR

TRIM TK PUMP (effected) . . . . . OFF

■ IF BOTH PUMPS OFF and TRIM TK not empty :

TRIM TK MODE . . . . . FWD

FUEL GRAVITY FWD XFR ONLY

AUTO TRIM TK SYS INOP

● IF TRIM EMPTY and PUMPS LO PR :

TRIM TK PUMP 1 and 2 . . . . . OFF

AUTO TRIM TK SYS INOP

AFT CENTER OF GRAVITY

TRIM TK MODE . . . . . FWD

AFTER ABOUT 1 MN

TRIM TK MODE . . . . . AUTO

CG TARGET SHIFTED FWD

TRIM TK SYS INIT

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : ZFW or ZFWCG DISAGREE proc.
Right ECAM CRT : FUEL page

- This warning is triggered on ground when the CGCC detects a discrepancy between the values received from the two FMS or when the crew performs a new initialization of ZFW or ZFCG in case of single FMS operation.
- In case of discrepancies between load sheet and ECAM values, trim tank system should not be used to ensure that the center of gravity remains in the certified limit.
- If ECAM values are within tolerances, the trim tank system is fully operative and the message should be cleared.

TRIM TK PUMP LO PR

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : PUMP LO PR proc.
Right ECAM CRT : FUEL page
LO PR light(s) on FUEL panel

- In case of both pumps failure, both pumps are selected off and the trim tank system becomes inoperative. If trim tank is not empty, transfer from trim tank to center tank is ensured by selecting TRIM TK MODE push-button to FWD position. As trim tank pumps are selected OFF, this transfer is ensured by gravity only.

AFT CENTER OF GRAVITY

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : AFT CENTER OF GRAVITY proc.
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- This warning is triggered when the THS position reaches a deflection limit (which represents a center of gravity of 41 %). This deflection limit is computed by the FWC and depends on Mach and N1 values.
- Selection of TRIM TK MODE push-button to FWD position for at least 1 minute, moves the CGCC target 1.5 % forward (37 % at 150 tons/330700 lbs, 35.6 % at 80 tons/176400 lbs).
- This warning may be due to inaccuracy in load sheet computation which can be solved by the shift of CGCC target.
- This warning can only occur one time during the flight. If the CG reaches 41 % after the shift of CGCC target, this warning will not be triggered. Only the EXCESS AFT CG warning (center of gravity reaching 43 %) remains available.

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TRIM TK SYS FAULT

IN FLIGHT

CTR TK FQI AVAILABLE

TRIM TK MODE . . . . . FWD
TRIM TK PUMP 1 and 2 . . . . . CHECK ON

● If no FWD XFR :
TRIM TK FUEL UNUSABLE PROC (5) . . . . . APPLY

■ When CTR TK above 14 T (31000 Lbs)
TRIM TK PUMPS 1 AND 2 . . . . . OFF
NOTE : Remaining TRIM TK fuel will be transfered by gravity (at low rate) to the CTR TK.

CTR TK FQI NOT AVAILABLE

TRIM TK MODE . . . . . FWD
TRIM TK PUMP 1 and 2 . . . . . CHECK ON

ON GROUND

Do not select TRIM TK MODE p/b to FWD position.
Refer to ground crew for maintenance action or consider dispatch under MMEL conditions.

TRIM TK SYS FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : TRIM TK SYS FAULT proc.
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- TRIM TK MODE is selected FWD to initiate manual transfer from trim tank to center tank.
- When CTR TK fuel quantity reaches 14 tons/31000 lbs TRIM TK pumps are selected OFF to decrease the rate of transfer (transfer only ensured by gravity) in order to avoid overfilling of center tank.
- Forward transfer can be confirmed by checking trim tank fuel quantity decrease or transfer indications (on FUEL page of ECAM system display).
- If forward transfer does not occur, fuel is stuck in trim tank and TRIM TK FUEL UNUSABLE procedure should be applied.

TRIM TK FUEL UNUSABLE

OUTR TK ISOL VALVES . . . . . CHECK IN LINE
OUTR TK PUMPS . . . . . CHECK NORM
INR TK PUMPS . . . . . OFF
CTR TK PUMPS . . . . . OFF
ACT (IF INSTALLED) . . . . . FWD

■ When OUTR TK LO LVL :
INR TK PUMPS . . . . . NORM

■ If required :
CTR TK PUMPS . . . . . NORM

CAUTION : Consider diversion as fuel consumption from INR TK when below 2 × 8000 kg (17700 Lbs) or from CTR TK may lead to exceedance of aircraft aft CG limit for landing.

LDG SPD INCREMENT . . . . . + 6 kt
LDG DIST . . . . . MULTIPLY by 1.1

TRIM TK FUEL UNUSABLE

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : TRIM TK ISOL VALVE NOT OPEN proc.
Right ECAM CRT : FUEL page
TRIM TK MODE FAULT light

- To reduce the probability of center of gravity exceeding the aft limit, tanks must be emptied in the following order : OUTER tanks, INNER tanks and CENTER tank.
- Fuel consumption from INR TK (when below 2 x 8000 kg /17700 lbs) or from CTR TK will move the CG rearward of the CG value at time of failure. In this case, diversion should be considered to avoid exceedance of aft CG limit for landing.
- With TRIM TK MODE selected FWD, automatic transfer from ACT to CTR TK is inhibited until TRIM TK is empty. Therefore, in case of trim tank fuel unusable, it is necessary to manually ensure transfer from ACT to CTR TK by selecting ACT p/b to FWD position.

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ACT FUEL UNUSABLE

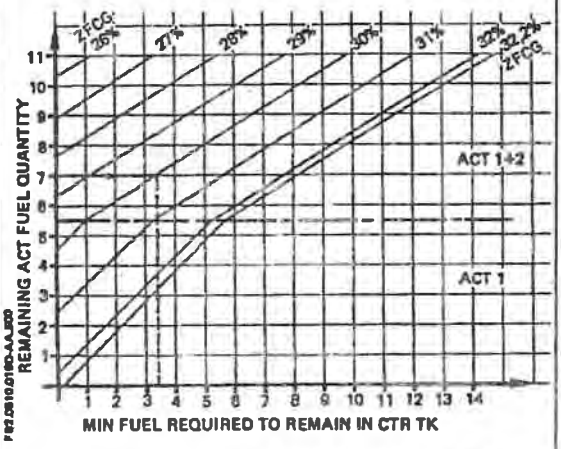
ZFCG . . . . . CHECK

■ If ZFCG 25,5 % MAC or below :

ALL CTR TK FUEL can be used

■ If ZFCG above 25,5 % MAC :

Determine the minimum fuel quantity required to remain in CTR TK using this graph.



CAUTION : To ensure aircraft center of gravity inside limits for flight and landing, the fuel required to remain in CTR TK must not be used.

● When fuel QTY required to remain in CTR TK is reached :

CTR TK PUMPS L and R . . . . . OFF

CTR TK fuel is unusable

NOTE : CTR TK fuel QTY may increase above min fuel required in CTR TK due to transfer from TRIM TK to CTR TK. It is allowed to use this extra fuel quantity in CTR TK.

ACT FUEL UNUSABLE

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : AUX TK FWD MODE FAULT proc
Right ECAM CRT : FUEL page
ACT FWD light

– CTR TK fuel consumption moves the CG aft.

- When ZFCG is below 29.5 % MAC, there is no risk to exceed the aft CG limit for landing. All CTR TK fuel can be consumed.
- When ZFCG is above 29.5 % MAC, a certain amount of fuel must remain in the CTR TK to prevent exceedance of aft CG for landing.

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FUEL TK PUMP FAULT / LO PR

CTR TK

■ If one FAULT Lt on :
CTR TK PUMP (affected) . . . . . OFF
FUEL X-FEED . . . . . IN-LINE

■ If both FAULT (or FAULT/OFF) Lts on :
CTR TK PUMPS . . . . . OFF
FUEL FEED MAN CTL

INR TK

■ If one FAULT Lt on :
INR TK PUMP (affected) . . . . . OFF

■ If In one INR TK both FAULT (or FAULT/OFF) Lts on :
INR TK PUMPS (affected TK) . . . . . OFF

● If INR TK not empty :
FUEL X-FEED . . . . . IN LINE
INR TK above 2000 Kg (4400 lbs) :
FUEL GRAVITY FEED PROC (5) . . . . . APPLY

■ If in both INR TK both FAULT (or FAULT/OFF) Lts on :
INR TK PUMPS (all) . . . . . OFF

● If CTR TK not empty :
FUEL FEED MAN CTL

● If CTR TK empty and INR TK above 2000 Kg (4400 lbs) :
FUEL GRAVITY FEED PROC (5) . . . . . APPLY

OUTR TK

■ If one PUMP LO PR :
OUTR TK PUMP (affected) . . . . . OFF

■ If both PUMP in one TK LO PR :
FUEL GRAVITY FEED PROC (5) . . . . . APPLY

FUEL TK PUMP FAULT/LO PR

Indications :
Single chime (if two pumps fail in one tank)
MASTER CAUTION
Left ECAM CRT : PUMP LO PR proc
Right ECAM CRT : FUEL page
FAULT (LO PR) light(s) on FUEL panel

– If one CTR TK pump fails, FUEL X-FEED is selected open to avoid OUTR TK feeding on the concerned side and resultant fuel assymetry.

– If both CTR TK pump FAULT (or FAULT/OFF) lights illuminate, the reason is either.
. Pump FAULT (LO pressure) with CTR TK not empty
or
. AUTO FEED FAULT with CTR TK empty, and any CTR TK PUMP running or INR TK PUMPS not started in either TK
or
. CTR TK empty (LO) during FUEL FEED MAN CTL.

In case of both pumps failure do not consider gravity feed from CTR TK.
In case of AUTO FEED FAULT the OFF selection of both CTR TK PUMPS deactivates the AUTO FEED logic and the INR TK PUMPS will start running.

– Monitor FQI to check that inner tanks are feeding. If feed is not as required check outer tank pumps are selected ON and select all other pumps OFF and then select required pumps ON.
Should this not allow correct operation, AUTO FEED CTL C/B should be pulled.

– If in one INR TK both Pump FAULT (FAULT/OFF) lights illuminate, the reason is either
. PUMP FAULT (LO pressure) with INR TK not empty
or
. INR TK empty (LO) with pumps still running.

In case of both pumps failure with INR TK above 2000 kg/4400 lbs FUEL GRAVITY FEED procedure may be applied. R

– If in both INR TK both PUMP FAULT (FAULT/OFF) lights illuminate,the reason is AUTO FUEL FEED FAULT. With CTR TK not empty, the CRT TK PUMPS do not run or any INR TK PUMP is running. The OFF selection of all INR TK PUMPS deactivates the AUTO FEED logic and CTR TK PUMPS will start.

Monitor FQI to check that center tank is feeding. If feed is not as required check outer tank pumps are selected ON and select all other pumps OFF and then select required pumps ON.
Should this not allow correct operation, AUTO FEED CTL C/B should be pulled.

If both pumps fail in an OUTR TK, apply FUEL GRAVITY FEED proc, when other tanks are empty.

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AC EMER BUS OFF

CRT AMBER CAUTIONS NOT AVAIL
– MONITOR OVERHEAD PANEL

ATC	SYS 2
CAB PRESS REG 1	OFF
CAPT ADC INST	SYS 2
ATS 1	RESET
CAPT EFIS	SYS 3
BUS EQPT LIST (8)	CHECK

AC EMER BUS OFF

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : CRT AMBER CAUTIONS message
- Right ECAM CRT : NIL
- Local alert lights according to the secondary failures

– The AC EMER BUS failure can be identified by the illumination of CAB PRESS REG 1 FAULT light and SLATS SYS 1 FAULT light.
If these two lights are not illuminated together, check if AC BUS 2 OFF light is illuminated (which indicates failure of AC BUS 2). If AC BUS 2 OFF light is not illuminated, the warning comes from the failure of one FWC.

– The AC EMER BUS OFF warning may be caused by a failure in a sub-BUS

– Out of the listed affected equipment switch off only those items, where secondary failure is indicated or obvious.

AC ESS BUS OFF

OVRD SUPPLY 1 OR 2	ON	
PITCH TRIM 1	RESET	
YAW DAMPER 1	RESET	
■ If unsuccessful :		
VENT EXTRACT	OVBD	
FUEL X FEED (IF CTR TK in use)	IN LINE	R
Affected eqpt	OFF	
. PITCH FEEL 1 . RUD TRAVEL 1	. L INR TK PUMP 2 . R INR TK PUMP 1 . CTR TK L PUMP	
BUS EQPT LIST (8)	CHECK	

AC ESS BUS OFF

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : AC ESS BUS OFF proc
- Right ECAM CRT : ELEC/AC page
- AC EMER BUS ON INV Light

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DC ESS BUS ON BAT

STBY GEN . . . . . OVRD

DC ESS BUS ON BAT

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : DC ESS BUS ON BAT proc
- Right ECAM CRT : ELEC/DC page
- DC ESS ON BAT light

- Manual selection of STBY GEN allows the DC ESS BUS to be supplied by the standby generator (AC ESS BUS and AC EMER BUS remain supplied as usual).
- Manual selection of STBY GEN leads to loss of 308 PP and therefore the following equipment are lost :
  - Center of gravity control computer (CG CC)
  - FCC 1, FAC 1, FCU 1, TCC 2 R
  - L INR 2, R INR 1 and CTR L fuel pumps cannot be supplied simultaneously. R R

DC NORM BUS OFF

AVOID ICING CONDITIONS
LAND RECOVERY . . . . . ON
Affected eqpt . . . . . OFF
. RUD TRAVEL 2 . SPLR 3 and 2,5
. KRUGER
. PITCH FEEL 2 . CAB PRESS REG 2
. WING ANTI ICE . WINDOW HEAT
. FUEL PUMPS (all except L INR 2
R INR 1
CTR L)
LDG SPD INCREMENT . . . . . + 10 KT
LDG DIST . . . . . MULTIPLY BY 1.4
BUS EQPT LIST (8) . . . . . CHECK
FUEL GRAVITY FEEDING PROC.(5)(OUTR TK only) . APPLY

DC NORM BUS OFF

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : DC NORM BUS OFF proc
- Right ECAM CRT : ELEC/DC page
- DC NORM BUS OFF light

Note : The DC NORM BUS OFF warning is triggered by the failure of one particular sub DC NORM BUS circuit (106 PP). If this warning is displayed, it may be a sub BUS failure only.
Switch OFF secondary failures only as indicated or obvious.
The rest of DC NORM BUS circuits remains operative.

- Pushbutton lighting on OVHD panel is lost to a great extent. Consequently, if selecting affected equipment to OFF, pay special attention to identifying the particular pushbutton. Action feedback is indicated on ECAM only.
- Approach speed is increased due to loss of KRUGERS.
- Landing distance is increased due to LDG SPD increment and partial loss of GND SPLRS.
- Automatic fuel feed mode selection is lost. If fuel is remaining in CTR TK, fuel X feed should be opened to avoid fuel unbalance. R R R

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AC BUS 1 OFF/AC ESS BUS OFF

OVRD SUPPLY 1 or 2 . . . . . ON	R
PITCH TRIM 1 . . . . . RESET	
YAW DAMPER 1 . . . . . RESET	
Affected eqpt . . . . . OFF	
. SPLR 2, 3, 6, 7 . L OUTR TK PUMP 2	
. L WINDOW HEAT . R OUTR TK PUMP 1	
. TRIM TK PUMP 1	
LDG DIST . . . . . MULTIPLY BY 1.3	
BUS EQPT LIST (8) . . . . . CHECK	

AC BUS 1 OFF/AC ESS BUS OFF

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : NIL

Right ECAM CRT : AC BUS 1 OFF proc

AC BUS 1 OFF + AC ESS BUS OFF lights on ELEC panel

Local alert lights according to the secondary failures.

Note : *The AC BUS 1 OFF warning is triggered by the failure of one particular sub AC BUS 1 circuit. If this warning is displayed without AC ESS BUS warning and no other warning on ELEC panel, it is preferable only to switch OFF secondary failures as indicated or obvious.*
The rest of the AC BUS 1 circuits remains operative.
Depending on kind of failure the left ECAM CRT may remain available.

- The action feedback is only partially effective on warning display.
- The procedure assumes complete AC BUS 1 failure with resultant AC ESS BUS failure, followed by recovery of AC ESS BUS when OVRD SUPPLY is selected to ON.
- Landing distance is increased due to partial loss of GND SPLRS.

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AC BUS 2 OFF	
CRT AMBER CAUTIONS NOT AVAIL – MONITOR OVERHEAD PANEL	
FUEL X-FEED (if CTR TK in use) ..... IN LINE ATC ..... SYS 1 Affected eqpt ..... OFF . PITCH FEEL 2 . L INR TK PUMP 1 . RUD TRAVEL 2 . L OUTR TK PUMP 1 . SPLR 4 & 1, 5 . R OUTR TK PUMP 2 . R WINDOW HEAT . R INR TK PUMP 2 . CTR TK R PUMP . TRIM TK PUMP 2	
LDG DIST ..... MULTIPLY BY 1.3	a
BUS EQPT LIST (b) ..... CHECK	a

AC BUS 2 OFF

Indications :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : CRT AMBER CAUTIONS message
- Right ECAM CRT : NIL
- AC BUS 2 OFF light on ELEC panel
- Local alert lights according to the secondary failures.

Note : The AC BUS 2 OFF warning is triggered by the failure of one particular sub AC BUS 2 circuit. If this warning is displayed, it may be a sub BUS failure only.
Switch OFF secondary failures only as indicated or obvious.
The rest of the AC BUS 2 circuits remains operative.
Depending on kind of failure the right ECAM CRT may remain available.

- In case of complete AC BUS 2 failure, CRT amber cautions are lost.
- The AC BUS 2 failure can be identified by the illumination of AC BUS 2 OFF light. If this light is not illuminated, check if CAB PRESS REG 1 FAULT light and SLATS SYS 1 FAULT lights are illuminated together (which indicates failure of AC EMER BUS). If these two lights are not illuminated together, the warning comes from the failure of one FWC.
- Landing distance is increased due to partial loss of GND SPLRS.

IDG FAULT	
IDG ..... DISC	
GEN ..... OFF/R	
APU : START.	

IDG FAULT

Indications :

- Single chime
- MASTER CAUTION
- Left ECAM CRT : IDG OIL (LO PR or OVHT) proc
- Right ECAM CRT : ELEC/AC
- FAULT light on ELEC panel

- When pushing IDG switch in DISC position, the switch must be released as soon as the affected GEN FAULT light comes on.
- APU (if available) should be started to replace inoperative generator.

Note : If DISC position is maintained for more than 3 seconds, damage to the disconnect solenoid may occur.

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GEN FAULT	
GEN	OFF/R
APU : START	

GEN FAULT

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : GEN FAULT proc
- Right ECAM CRT : ELEC AC page
- FAULT light on ELEC panel

- APU (if available) should be started to replace inoperative generator.

GEN LOAD HI	
GALLEY	SHED

GEN LOAD HI

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : GEN LOAD HI proc
- Right ECAM CRT : ELEC/AC page
- GEN HI light on ELEC panel

- This indicates that the load is 10 % greater than the rated output of the generator and will normally only occur when only one generator is operating.

BATTERY OVERHEAT	
BAT affected	OFF/R
■ If ECAM inop:	
ALL BAT	OFF/R
BAT (one by one)	ON
BAT affected	OFF/R

BATTERY OVERHEAT

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : BAT OVHT proc
- Right ECAM CRT : ELEC/DC page
- BAT OVHT light on ELEC panel

- This is an indication that an excess charge rate has been detected by the battery charge limiter which if not corrected could lead to an increase in battery temperature. The affected battery is automatically disconnected and the corresponding « in line » indication is extinguished.

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HYD RSVR LO AIR PR / OVHT – PUMP LO PR

NOTE: In case of HYD RSVR LO AIR PR apply procedure only IF PRESSURE FLUCTUATES.

PUMP(S) ..... OFF
Affected eqpt ..... OFF
BLUE : SPLRS 3 & 2, 7 YELLOW: PITCH FEEL 2
SPLRS 4 & 1, 6

GREEN: PITCH FEEL 1
SPLR 5

HYD SYS LO PR PROC (12) ..... APPLY

HYD RSVR LO AIR PR

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : RSVR LO AIR PR proc
- Right ECAM CRT : HYD page
- AIR light on HYD panel.

- This warning detects a tank air pressure below 22 psi. The warning extinguishes when the air pressure increases to 25 psi.
- If the warning occurs and all system pressures are normal without abnormal fluctuation, action is not required.
- The risk of pump cavitation increases with altitude. If GREEN system is affected, use of ELEC PUMPS may cause pump damage.
- Refer to HYD SYS LO PR for system recovery and approach.

HYD RSVR OVHT

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : RSVR OVHT proc
- Right ECAM CRT : HYD page
- OVHT light on HYD panel.

- If the GREEN system is affected each pump may be selected to ON in turn to attempt to determine affected pump.
- Refer to HYD SYS LO PR for system recovery and approach.

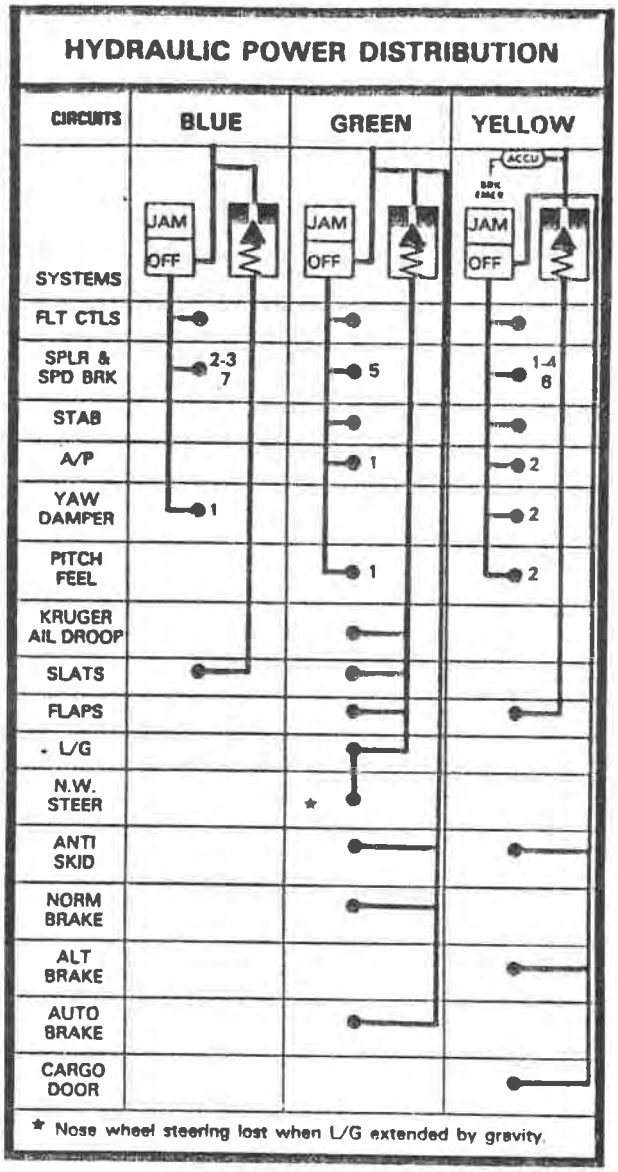
HYD PUMP LO PR

Indications :
- Single chime
- MASTER CAUTION
- Left ECAM CRT : PUMP LO PR proc
- Right ECAM CRT : HYD page
- PUMP LO PR light on HYD panel.

- Refer to HYD SYS LO PR for system recovery and approach.

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HYDRAULIC POWER DISTRIBUTION



Vers. : All

Eng. : All

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DUAL SERVO LO PR

LAND ASAP

■ BLUE SERVO remaining:

MAX SPD 285/.78
MAX FL 350
USE ELEV WITH CARE ABOVE SPD 170.
Affected eqpt ..... OFF

■ IF YELLOW PUMP LO PR:

RAT ..... ON

FOR APPROACH

■ If one SERVO LO PR caused by related RSVR OVHT or LO AIR PR:

ENG PUMP(S) ..... ON
Affected eqpt ..... RESTORE

CAUTION: If YELLOW SYS powered by RAT, DUAL SERVO LO PR will apply for landing.

■ If unable to restore:

BLUE or YELLOW remaining

● GREEN HYD SYS lost (KRUG inop):

LDG SPD INCREMENT ..... + 10 KT
LDG DIST ..... MULTIPLY BY 1.5
L/G GRAVITY EXT PROC (21) ..... APPLY

● GREEN SERVO only inop (KRUG avail):

LDG DIST ..... MULTIPLY BY 1.3
L/G GRAVITY EXT PROC (21) ..... APPLY

GREEN remaining

LANDING CONFIG 20/20
LDG SPD INCREMENT ..... + 10 KT
LDG DIST ..... MULTIPLY BY 1.8
L/G GRAVITY EXT PROC (21) ..... APPLY

DUAL SERVO LO PR

Indications :

Continuous repetitive chime
MASTER CAUTION
Left ECAM : Procedure
Right ECAM : HYD page
LO PR lights on SERVO CTL panel
Local alert lights according to secondary failures

- If only BLUE SERVO remaining, PITCH TRIM and PITCH FEEL systems are lost. Airspeed and altitude are limited respectively. PITCH FEEL system is in LO SPD mode.
- If YELLOW system is recovered by use of RAT, be aware that YELLOW hydraulic pressure is not guaranteed below 140 Kt. It will not be available for landing.
- The procedure is applicable when two servo systems are lost or one servo and one hydraulic system fail.

  The different combinations of failure result in different landing distance increase or VLS augmentation.
- Approach with BLUE or YELLOW SERVO remaining :

  . If GREEN hydraulic system is lost VLS is augmented by 10 Kt due to KRUGERS inoperative. The landing distance is increased due to LDG SPD increment, partial loss of GND SPLRS, and alternate braking (YELLOW).

  . If GREEN SERVO is lost only, the landing distance is increased due to partial loss of GND SPLRS.
  The landing gear is extended by gravity, to maintain GREEN system full capability and integrity..
- Approach with GREEN SERVO remaining :

  VLS is augmented by 10 Kt and landing configuration is limited to 20/20 due to reduced lateral controllability caused by partial loss of roll spoilers.

  Landing distance is increased due to landing configuration, LDG SPD increment and partial loss of GND SPLRS.

  The landing gear is extended by gravity to maintain GREEN system full capability and integrity.

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NO FLAPS and NO SLATS LANDING

R R R R

NOTE : If flaps and slats are suspected to be lost due to non-identified electrical failure, select LAND RECOVERY ON in an attempt to restore flaps and slats normal operation.

ATS LEVERS . . . . . OFF

GPWS . . . . . FLAP OVRD

LDG DIST . . . . . MULTIPLY BY 1.8

■ If handle in RET position :

TRP . . . . . Select TOGA

NOTE 1 : Maintain VLS (VREF + 60) down to 300 ft. Then from 300 ft decelerate to reach VSS at touchdown. Use full reverse.

NOTE 2 : GA mode is lost. Manual GO – AROUND only, without FD guidance.

NO FLAPS AND NO SLATS LANDING

Indications :

Slat/Flap control jammed in the retracted position.

- The ATS and GPWS must be disarmed, to prevent operation of the alpha floor, and nuisance GPWS warnings on final approach.
- If the SLATS/FLAPS handle is in the RET position, AFS-GA mode is lost. Select TOGA on TRP. GA thrust will be obtained at full forward throttle position.

  GO-AROUND guidance is not available on FD. If GO-levers are triggered, FD is frozen in the last acquired mode and displays the related commands. The only way to restore FD is to select both FPV/FD switches OFF for at least 3 sec and then ON. The FD will re-engage in basic modes : V/S and HDG.
- Deceleration to stick shaker speed may cause stick shaker operation in the landing flare.
- Apply reverse thrust even before nosewheel touchdown. Lower nosewheel as soon as possible and select max reverse.

KRUGER FAULT

■ If not retracted:

MAX SPD 300/.65

FUEL CONSUMPTION INCREASED

■ If not extended:

LDG SPD INCREMENT . . . . . +10 KT

LDG DIST . . . . . MULTIPLY BY 1.1

KRUGER FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : KRUGER NOT RETRACTED proc
OR
KRUGER NOT EXTENDED proc

Right ECAM CRT : NIL

KRUGER warning on SFPI.

- If KRUGER are not retracted with slats retraction observe speed limit 300 kt/0.65 M.
- With KRUGER not retracted during flight an increase in fuel consumption up to 9 % compared to nominal flight conditions (KRUGER retracted, no airspeed/Mach limitation, optimum altitude) must be expected.

  The specific range penalty is 3 % for the same gross weight, airspeed up to 300/.65, and the same altitude.
- If KRUGER remain retracted with slats extended, VLS is augmented 10 kt and landing distance increased respectively.

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DUAL FLAPS or SLATS SYS FAULT

FLAPS FAULT
GPWS . . . . . FLAP OVRD
FUEL CONSUMPTION INCREASED
■ If FLAPS < 20°
LDG DIST . . . . . MULTIPLY BY 1.3
FOR APPR : ATS . . . . . OFF
■ If FLAPS ≥ 20°
LDG DIST . . . . . MULTIPLY BY 1.1

SLATS FAULT
■ If SLATS ≥ 15°
■ If TRIM TK not empty
TRIM TK SYS FAULT PROC . . . . . APPLY
AFT CG WARNING INOP
AUTO TRIM TK SYS INOP
FUEL MAN FWD XFR ONLY
■ If AUX TK not empty
AUX TK AUTO XFR INOP
■ If CTR TK not empty
L INR TK PUMP 1 . . . . . OFF
L INR TK PUMP 2 . . . . . OFF
R INR TK PUMP 1 . . . . . OFF
R INR TK PUMP 2 . . . . . OFF
FUEL FEED MAN CTL
LDG DIST . . . . . MULTIPLY BY
KRUG EXT 1.1
KRUG RETR 1.2
FUEL CONSUMPTION INCREASED
■ If SLATS < 15°
LDG DIST . . . . . MULTIPLY BY 1.3
AUTO FWD XFR ONLY
FUEL CONSUMPTION INCREASED

DUAL FLAPS OR SLATS SYS FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : FLAPS OR SLATS STUCK proc
OR
SLATS SYS 1 AND 2 FAULT proc
OR
FLAPS SYS 1 AND 2 FAULT proc
Right ECAM CRT : NIL or FUEL page
Both FLAPS FAULT or SLATS FAULT lights ON
TRIM TK MODE FAULT light ON (if TRIM TK not empty)

- If flaps are stuck, further flap operation is inhibited.
- If flaps are stuck at less than 20°, ATS must be disarmed to prevent operation of alpha floor.
- In case of flap vane jam, flaps can be selected opposite to the direction in which the jam occurred.
- If flaps or slats fail, select slats/flaps lever as normal.
- If slats do not retract below 15°, TRIM TK ISOL VALVE remains closed and TRIM TK SYS FAULT warning is triggered with a time delay of 20 mn. R R R
- GPWS is selected to FLAP OVRD to avoid nuisance warnings. Disarm ATS to prevent alpha floor operation.
- Correct operation of slats or flaps system may be recovered by cycling slats or flaps.

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SPLR / SPD BRK FAULT

SPLR affected . . . . . OFF/R

■ If more than 3 roll spoilers per wing affected:
LANDING CONFIG/GPWS 20/20
LDG SPD INCREMENT . . . . . + 10 KT
LDG DIST . . . . . MULTIPLY BY 1.8

■ If more than 2 ground spoilers per wing affected:
LDG DIST . . . . . MULTIPLY BY 1.3

SPLR/SPD BRK FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : SPLR/SPD BRK FAULT proc
Right ECAM CRT : FLT CTL page
FAULT on spoiler panel.

- If only one spoiler affected, select OFF/R. No further action required.
- If more than three roll spoilers affected (more than three pairs selected OFF), landing configuration 20/20 must be selected and approach speed is increased due to reduced lateral control. R
  GPWS LANDING FLAPS switch should be selected to 20 to avoid nuisance warnings. R
  Landing distance is increased due to partial loss of GND SPLRS, landing configuration and VLS augmentation.
- If more than two spoilers affected (more than two pairs selected OFF) landing distance will be increased due to partial loss of GND SPLRS.
- If the spoiler is stuck in extended position, it is recommended to apply the SERVO CTL JAM procedure to depressurize the corresponding spoiler. R R R
  Note : In case of additional problem on hydraulic system not linked to the spoiler, restore the SERVO CTL. R R R

INADVERTANT STICK SHAKER

■ If false STALL warning occurs:
STICK SHAKER C/B on failed side . . . . . Pull
. WARN CAPT-STICK SHAKER (21VU-A9)
OR
. WARN F/O-STICK SHAKER (21VU-A10)

INADVERTANT STICK SHAKER

Indications :
Stick shaker
Cricket audio warning.

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PITCH FEEL FAULT

PITCH FEEL affected . . . . . OFF/R

■ If both PITCH FEEL OFF and FAULT lts. off:

MAX SPD 285/.78

USE ELEV WITH CARE ABOVE SPD 170.

■ If both PITCH FEEL OFF and FAULT lts. on:

PITCH FEEL IN HIGH SPEED.

PITCH FEEL FAULT

Indications :

Single chime (only if both system fail)

MASTER CAUTION

Left ECAM CRT : PITCH FEEL FAULT proc

Right ECAM CRT : NIL

FAULT (1 OR/AND 2) on pitch feel panel

- If only one pitch feel system failed, select system OFF/R.
- If both systems failed, and selecting OFF/R extinguishes the fault lights, pitch feel is in low speed configuration. Limit speed to 285/0.78 and use pitch control with care due to reduced control forces.
- If both systems failed and selecting OFF/R does not extinguish either fault light, pitch feel is in high speed configuration. Expect higher control forces during approach and landing.

PITCH TRIM FAULT

PITCH TRIM . . . . . RESET

■ If both PITCH TRIM inop:

PITCH TRIM . . . . . MANUAL

MAX SPD 285/.78

MAX FL 350

• IF MAN CTL INOP:

STAB JAM PROC (15) . . . . . APPLY

PITCH TRIM FAULT

Indications :

Single chime (only if both systems fail)

MASTER CAUTION

Left ECAM CRT : PITCH TRIM FAULT proc.

Right ECAM CRT : NIL

PITCH TRIM (1 OR/AND 2) levers tripped.

- If pitch trim fails, independently of any other failure, attempt to reset. R
  If pitch trim fails as a consequence of a primary failure (e.g. electrical failure), no attempt to reset should be performed unless recovery of primary failed equipment. R R R R
- If both pitch trim systems failed, use manual pitch trim and limit speed to 285 kt/0.78 M. Altitude is limited to FL 350 to obtain acceptable longitudinal stability and to keep 1.4 G margin to buffet onset.
- If manual pitch trim not available, assume stabilizer jammed.

STABILIZER JAM

Before reducing speed:

PITCH FEEL 1 and 2 . . . . . OFF/R

MAX SPD 285/.78

USE ELEV WITH CARE ABOVE SPD 170.

STABILIZER JAM

- Maintain speed at which the stabilizer jam was detected to delay onset of out of trim forces as long as possible.
- Before deceleration select PITCH FEEL 1 + 2 OFF/R. PITCH FEEL FAULT will now appear on ECAM CRT. Pitch control inputs should be made with care, not to overcontrol the aircraft.

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RUDDER TRAVEL FAULT

RUD TRAVEL affected . . . . . OFF/R

■ If both RUD TRAVEL OFF and FAULT lts. off:
USE RUDDER WITH CARE ABOVE SPD 170.

■ If both RUD TRAVEL OFF and FAULT lts. on:
RUD TRAVEL IN HIGH SPEED.
MAX X WIND FOR LDG 20

RUDDER TRAVEL FAULT

Indications :
Single chime (only if both systems failed)
MASTER CAUTION
Left ECAM CRT : RUDDER TRAVEL FAULT proc
Right ECAM CRT : NIL
FAULT (1 OR/AND 2) on rudder travel panel.

- If only one rudder travel system failed, select affected system OFF/R.
- If both rudder travel systems failed, the restriction of rudder movement at speeds in excess of 170 kt is lost. Use rudder with extreme caution.
- If both rudder travel systems failed and selecting OFF/R does not extinguish the fault light/s, the rudder deflection is restricted in the high speed configuration. Therefore maximum crosswind for landing is 20 kt.

RUDDER TRIM RESET FAULT

TRIM RESET . . . . . MANUAL

RUDDER TRIM RESET FAULT

Indications :
FAULT on RUDDER TRIM panel.

Rudder trim neutralising is only available through the trim selector.

YAW DAMPER FAULT

YAW DAMPER . . . . . RESET

YAW DAMPER FAULT

Indications :
Single chime (only if both systems failed)
MASTER CAUTION
Left ECAM CRT : YAW DAMPER FAULT proc
Right ECAM CRT : NIL
One or both YAW DAMPER levers tripped.

- If yaw damper fails, independently of any other failure, attempt to reset.
  If yaw damper fails as a consequence of a primary failure (e.g. electrical failure), no attempt to reset should be performed unless recovery of primary failed equipment.
- Autopilot is inoperative when both yaw dampers fail. In case of dutch roll keep controls at neutral and do not use rudder. A pilot action may introduce a pilot induced oscillation causing passenger discomfort. Natural damping will stop dutch roll. R R
  If necessary descent below FL 290. R

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SERVO CTL JAM

SERVO CTL . . . . . OFF
Affected eqpt . . . . . OFF
BLUE: SPLR 3 and 2,7 YELLOW: PITCH FEEL 2
SPLR 4 and 1,6
GREEN: PITCH FEEL 1
SPLR 5

■ If BLUE or YELLOW affected:
LDG DIST . . . . . MULTIPLY BY 1.3

SERVO CTL JAM

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : SERVO CTL JAM proc

Right ECAM CRT : FLT CTL page after SERVO CTL SW OFF

Servo Ctl JAM on Servo Ctl panel.

- The warning is activated by detection of a jam of any of the servo control unit input valves.
- Systems lost by selecting the related SERVO CTL pushbutton to OFF are as follows :

Affected system	Flight Controls	SPD BRK SPLRS	Automatic Pilot	Yaw Damper	Pitch Feel	Stabilizer
Blue	1 Actuator	2 + 3 + 7		N° 1		
Green	1 Actuator	5	N° 1		N° 1	1 Actuator
Yellow	1 Actuator	1 + 4 + 6	N° 2	N° 2	N° 2	1 Actuator

- Landing distance is increased due to partial loss of ground spoilers if B or Y SERVO CTL is selected OFF.

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RUDDER JAM	
BANK ANGLE LIMIT	15°
MAX X WIND FOR LDG	20

ELEVATOR JAM	
ELECTRICAL PITCH TRIM	USE
MAX SPD	285/.78
For Approach:	
MANUAL PITCH TRIM	USE
NOTE : – Select FLAPS 15 above 3000 ft at slats maneuvering speed (S). – PNF controls throttles.	

RUDDER JAM

- Rudder jam is detected by an inhability to operate the rudder pedals and may lead to AP disconnection. R R
- Observe the bank angle limitation of 15°.
- Observe the crosswind limitation for landing of 20 kt.

ELEVATOR JAM

- If jamming occurs before V1 the takeoff should be aborted.
- If jamming occurs during takeoff above V1, both pilots may have to simultaneously operate the pitch control to achieve rotation. Trim should be used as required, but with caution, to help achieve and maintain a stabilized flight path.
  The two elevator surfaces can only be operated independently below 195 kt.
- During approach FLAPS 15 must be selected above 3000 Ft, since this initial flap extension requires rapid trim adjustment and may lead to slight deviation from flight path. The trim changes with further flap extension are much smaller.
- PNF controls the throttles to relieve PF for full concentration on flight path control. Autothrottle may be used during approach.
- Manual trim is used to avoid overcontrolling.
- The landing flare should be commenced earlier than normal, by use of the manual pitch trim, but the throttle closure point should be delayed because of pitch change with engine power reduction.
- At all times avoid rapid power changes.

ABNORMAL PITCH BEHAVIOR

In case of abnormal behavior of the aircraft in the longitudinal axis, one of the possible causes is PITCH trim runaway.

The following procedure is valid in all cases :

- Hold the control wheel.
- Maintain firmly the trim wheel.
- Disengage the AP if engaged and maintain firmly the control wheel.
- Trim as necessary, using the trim wheel.
- Confirm both PITCH TRIM levers have tripped.
  Analyse the pitch runaway cause and act accordingly.

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LDG WITH ABNORM L/G

■ **PREPARATION**

CABIN CREW ..... NOTIFY
ATC / TRANSPONDER ..... NOTIFY/AS RQRD
SEAT BELTS / NO SMOKING ..... ON
GPWS ..... OFF
CABIN & COCKPIT ..... PREPARE
. Loose equipment secured
. Survival equipment prepared
. Belts and shoulder harness locked
FUEL WEIGHT (if possible) ..... REDUCE

● **If abnormal NOSE L/G:**

CG location (if possible) ..... AFT
. 10 pax from front to rear ≃ + 2 %
. 10 pax from mid to rear ≃ + 1 %

● **If abnormal MAIN L/G:**

FUEL unbalance (if possible) ..... ESTABLISH
. Reduce fuel on side with failed L/G
GND SPLRS ..... DO NOT ARM

■ **APPROACH**

GRAVITY EXT handcrank ..... BACK TO NORM
L/G LEVER ..... DN
BRK/A/SKID (if nose L/G affected) ..... ALTN/OFF
IGNITION ..... OFF
CABIN REPORT ..... OBTAINED

■ **BEFORE LANDING**

PACKS 1 and 2 ..... OFF
RAM AIR ..... ON
"SAFETY POSITION" ..... ORDER

■ **TOUCH DOWN**

BOTH FUEL LEVERS ..... OFF

■ **AFTER TOUCH DOWN**

FIRE HANDLES (ALL) ..... PULL

● When A/C stopped:

CABIN CREW (PA) ..... NOTIFY
FUEL ISOL VALVES ..... OFF
AGENTS (ENG & APU) ..... DISCH
EVACUATION ..... INITIATE
BAT (before leaving A/C) ..... OFF/R

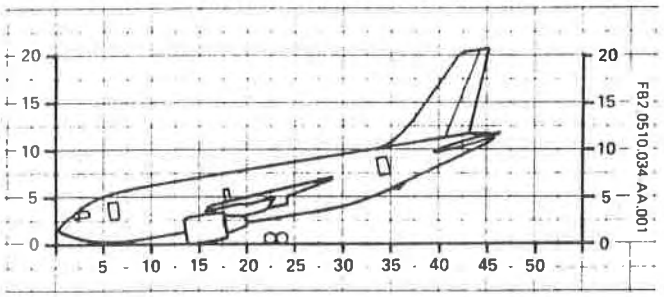
LANDING WITH ABNORM L/G

- The procedure is intended for use when one or more landing gear fail to extend or/and lockdown following the application of either normal or gravity gear extension procedure.
  It is considered preferable to use all available gear locked down rather than carry out a belly landing. Under these circumstances, a hard surface runway landing is to be recommended.
  Full advantage should be taken of foam spread on the runway.
- Notify ACT of the nature of emergency encountered and state intentions.
- Notify the cabin crew of the nature of emergency encountered and state intentions.
  Specify the available time.
- GPWS is selected OFF to avoid nuisance warning.
- Burn off fuel down to the minimum possible impact weight. This reduces VREF and as a consequence the load factor for impact and the energy that must be dissipated.
- Rotating the GRAVITY EXT handcrank back to normal position may result in landing gear door(s) closure, and under certain failure conditions pressurize the landing gear actuators.

TOUCH DOWN TECHNIQUES

• NOSE GEAR UNSAFE

- Reference aircraft attitude after impact



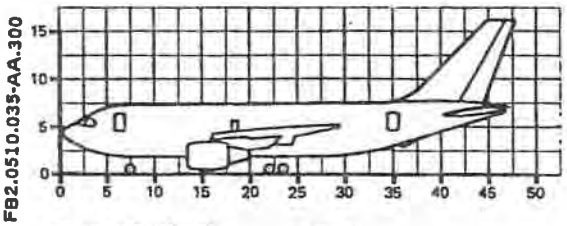
- Trim the stabilizer to nose up upon touchdown. R
- Use the brakes as compatible with the elevator efficiency.
- Be aware that forward passenger doors evacuation rates are considerably reduced, due to abnormal slide inclination. R R R
- Aft passenger/crew doors should preferably not be used for evacuation.

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LANDING WITH ABNORM L/G (continued)

• **ONE MAIN GEAR UNSAFE**

– Reference aircraft attitude after impact



– Use control wheel input as necessary to maintain the unsupported wing up as long as possible.

– Apply rudder and brakes upon pod impact for directional control.

L/G UNSAFE INDICATION

■ L/G selected DOWN :

● Green light(s) off on both panels :

L/G GRAVITY EXT (21) . . . . . PERFORM

• If unsuccessful :

LDG WITH ABNORM L/G PROC (22) . . . APPLY

● Green light off on one panel :

L/G POS DET SYS . . . . . CORRECT PANEL

■ L/G selected UP :

● Red light(s) on, on both panels :

MAX SPD 270

L/G . . . . . DOWN

FUEL CONSUMPTION INCREASED

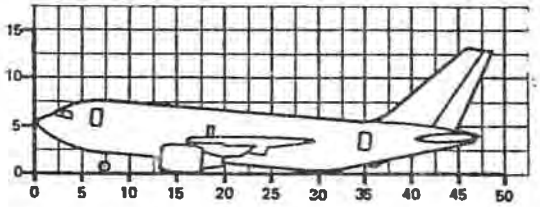
● Red light on, on only one panel :

One panel correct . . . . . CHECK

L/G POS DET SYS . . . . . CORRECT PANEL

• **BOTH MAIN GEARS OR ALL GEARS UNSAFE**

– Reference aircraft attitude after impact



– Touch down with approximately 6° of pitch attitude but not beyond to ensure the tail section impacts first.

– Be aware that aft passenger doors evacuation rates are considerably reduced, due to abnormal slide inclination.

L/G UNSAFE INDICATION

Indications :

Single chime (nil if one L/G panel correct)

MASTER CAUTION

Left ECAM CRT : Procedure

Right ECAM CRT : Nil

L/G panel(s)

LANDING GEAR SELECTED DOWN :

– If all green lights are illuminated on one panel, the unsafe indication is false.

– For confirmation of LDG GEAR position mechanical gear down lock indicators check by a cabin attendant should be considered.

– Possible aural warning will be cancelled when setting the L/G POS DET switch to the panel with three green indications (OVHD -SYS 2, CTR INSTR. – SYS 1).

– If the landing gear is extended at speeds near VLO it may be necessary to decelerate to obtain satisfactory uplock of the landing gear doors.

– If one gear remains unlocked, perform turns to increase load factor and perform alternating side slips in an attempt to lock the gear. Eventually perform a light touch and go to lock the gear by the force imposed during the touch.

LANDING GEAR SELECTED UP :

– If light(s) illuminated on one indicator panel but indications are normal on the other panel, the unsafe indication is false.

– Flight with landing gear extended has a significant effect on fuel consumption and climb gradient (see SPECIAL OPERATIONS).

– Landing gear down selection may be delayed if performance requires.

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L/G LEVER INTERLOCKED

L/G POS DET SYS . . . . . OTHER SYS

■ If second attempt unsuccessful :

L/G LEVER . . . . . DOWN

MAX SPD 270

FUEL CONSUMPTION INCREASED

L/G LEVER INTERLOCKED

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : Procedure

Right ECAM CRT : Nil

L/G GRAVITY EXTENSION

GRAVITY EXT HANDCRANK . . . . . INSERT/ROTATE

L/G LEVER . . . . . DOWN

GEAR DOWN INDICATIONS . . . . . CHECK

CAUTION : Nose wheel steering inop.

■ If unsuccessful :

LDG WITH ABNORM L/G PROC (22) . . . . . APPLY

GRAVITY EXTENSION

- The manual gear handle should be rotated clockwise 20 full turns until the mechanical stop is reached. Increasing loads are to be expected beyond 16 turns then beyond 18 turns. R R R
- When the landing gear is down, the amber door lights remain illuminated due to the doors remaining open.
- If after performing the gravity extension procedure, the indicator lights show an unsafe indication, visually check the landing gear position.
  Main gear : Positions for checking red pins on upper wing surface are marked by inverted T-symbols on cabin side walls.
  Nose gear : Checking of mechanical indicator on nose gear drag strut through window in avionics compartment.
- *Note : After gravity extension for training purposes the L/G must be reset for normal operation and recovery of nose wheel steering :*
  . With L/G lever in NEUTRAL the handcrank must be rotated counter clockwise to the final stop (approx 20 turns).
  . The L/G lever must be selected down to repressurize the locks and actuators of L/G and gear doors.
  When L/G and L/G DOORS indications are normal, the L/G lever may be selected UP.

L/G DOOR NOT CLOSED

■ If amber light(s) ON, on both panels :

MAX SPD 270

FUEL CONSUMPTION INCREASED

L/G DOOR NOT CLOSED

Indications :

Single chime (nil if one L/G panel correct)

MASTER CAUTION

Left ECAM CRT : Procedure

Right ECAM CRT : Nil

L/G panel

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BRAKES TEMP HI

■ Before T.O. :
BRK FAN (if installed) . . . . . ON
DELAY T.O.

■ In flight :

● IF PERF PERMITS :
LEAVE L/G DN FOR COOL.
BRK FAN (if installed) . . . . . ON

BRAKES TEMP HI

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : BRK TEMP HI proc
Right ECAM CRT : BRK page
HOT light

– During taxiing, before or after flight when one brake temperature is significantly higher than the others, i.e. 100° C above the average value, this is an indication of possible brake binding.
BRK/A/SKID should be selected to ALTN/ON and the brake temperatures monitored.

– It is recommended not to set parking brake while brake hot warning is activated. R R

Note : Delay landing gear retraction after takeoff unless performance requires.

ANTI SKID FAULT

BRK/A/SKID . . . . . ALTN/ON
LDG DIST . . . . . MULTIPLY BY 1.1

■ If warn remains :

● One « R » out per gear :
LDG DIST . . . . . MULTIPLY BY 1.1

● More than one « R » out per gear :
MAX BRK PRESS . . . . . 1000 PSI
LDG DIST . . . . . MULTIPLY BY 1.5
AUTO BRAKE INOP.

ANTI SKID FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : ANTI SKID FAULT proc
Right ECAM CRT : WHEEL page
BRK FAIL light

– If more than one wheel per gear is affected :
· Limit brake pressure to approximately 1000 psi, and at low ground speed adjust brake pressure as required.
· Avoid landing on icy runway.

– Landing distance is increased for reduced braking efficiency.

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BLEED HP VALVE FAULT

BLEED HP VALVE affected . . . . . OFF

BLEED PRESS LO AT IDLE.

■ If warn remains :

AIR X FEED . . . . . MAN

AIR X FEED . . . . . IN LINE

ONE PACK (if wing anti-ice on) . . . . . OFF

BLEED VALVE affected . . . . . OFF/R

BLEED HP VALVE FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : HP VALVE FAULT proc

Right ECAM CRT : AIR BLEED page

FAULT light on AIR BLEED panel.

- If after having selected the BLEED HP VALVE to OFF the warning remains (BLEED HP VALVE jammed open) the BLEED VALVE must be closed.
- If wing anti ice is ON, one pack must be selected OFF due to precooler performance.
- With the BLEED HP VALVE closed, reverser on affected side may not deploy due to insufficient air pressure from IP.

ENG BLEED VALVE FAULT

BLEED VALVE affected . . . . . OFF/R

AIR X FEED . . . . . MAN

AIR X FEED . . . . . IN LINE

ONE PACK (if wing anti-ice on) . . . . . OFF

ENG BLEED VALVE FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : BLEED VALVE FAULT proc

Right ECAM CRT : AIR BLEED page

FAULT light on AIR BLEED panel.

- Following the detection of a fault the affected system valves will close automatically.
  The associated actions confirm automatic operation and extinguish related warnings, allowing flight to be continued with one pack supplied.
- WING ANTI ICE valve and PACK valve will close after BLEED VALVE is closed, due to lack of air supply.
  One pack must be closed when using wing anti ice due to precooler performance.
  Without using wing anti-ice one pack must also be closed if engine power settings above max. climb thrust are used or anticipated.
- If at high altitude and low speed the second bleed valve fails (precooler performance) the IP BLEED may be recovered by selecting the HP VALVE to OFF.
  In this case restore the HP VALVE for descent.

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AIR X - FEED FAULT

AIR X FEED ..... MAN

AIR X FEED FAULT

R

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : AIR X FEED FAULT proc
Right ECAM CRT : AIR BLEED page
FAULT light on AIR BLEED panel.

BLEED LEAK

AVOID ICING CONDITIONS
ANTI ICE WING SUPPLY ..... OFF
AIR X FEED (if in line) ..... MAN
AIR X FEED (if in line) ..... X LINE
BLEED VALVE affected ..... OFF/R
APU BLEED (if left side affected) ..... OFF/R
Affected eqpt ..... OFF
. PACK

BLEED LEAK

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : BLEED LEAK proc
Right ECAM CRT : AIR BLEED page
LEAK light on AIR BLEED panel.

- Following the detection of a leak the affected system valves will close automatically. The associated actions confirm automatic operation and extinguish related warnings, allowing flight to be continued with one pack supplied.
- PACK VALVE will close due to lack of air supply.
- If pack on unaffected side is not available descend to FL 100 or MEA which ever is higher and select RAM AIR to ON when CAB differential pressure is below 1 psi.

APU BLEED LEAK

APU BLEED ..... OFF/R

APU BLEED LEAK

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : BLEED LEAK proc
Right ECAM CRT : AIR BLEED page
LEAK light on AIR BLEED panel.

- APU BLEED VALVE and X FEED valve (if AUTO) close automatically.

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VENT EXTRACT LO FLOW	
VENT EXTRACT ..... OVBD	

VENT EXTRACT LO FLOW

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : VENT EXTRACT LO FLOW proc

Right ECAM CRT : Nil

FLOW light on VENT panel.

- VENT EXTRACT to OVBD position controls the overboard valve to partially open.

VENT OVBD VALVE FAULT	
OVBD VALVE ..... OFF	
■ If valve not closed:	
CAB PRESS ..... CHECK	

VENT OVBD VALVE FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : OVBD VALVE FAULT proc

Right ECAM CRT : CAB PRESS page

FAULT light on VENT panel.

- The VENT OVBD VALVE should automatically close after second engine start. If it remains open after OFF selection, maintenance action is due.

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CARGO ISOL VALVES FAULT	
FWD (BULK) ISOL VALVES . . . . . OFF/R	

CARGO ISOL VALVE FAULT

Indications :
MASTER CAUTION
Left ECAM CRT : CARGO ISOL VALVE FAULT proc
Right ECAM CRT : AIR COND page
FAULT light on COMPT TEMP panel.

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AIR PACK FAULT

■ Pack not supplied :
PACK . . . . . OFF
■ Pack overheat :
PACK . . . . . OFF
PACK MODE SEL . . . . . MAN/COLD
● WHEN TURB TEMP BELOW LIMIT :
PACK . . . . . ON
PACK . . . . . MAN CTL
■ Both packs inoperative :
MAX FL 100/MEA
● WHEN ΔP BELOW 1 PSI :
RAM AIR . . . . . ON

AIR PACK FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : PACK FAULT proc
Right ECAM CRT : AIR BLEED page
FAULT light

- The FAULT light may illuminate for one of the following reasons :
  a) Valve is not in agreement with selected (manual or automatic) position or pack not supplied.
  b) Overheat detection at the turbine inlet or compressor outlet.
- If a pack fault occurs due to low supply pressure (less than 10 PSI), the ENG BLEED VALVE FAULT warning will be delayed for 60 sec (wing anti-ice ON), or inhibited (wing anti-ice OFF).
  With wing anti-ice OFF and if power settings above MAX CLIMB are not used or anticipated, the pack can be recovered by selecting OFF the bleed valve, opening the air X-feed valve and selecting the pack ON.
- If both packs are inoperative descend to FL 100 or MEA whichever is higher and select RAM AIR to ON when CAB differential pressure is below 1 psi.

COMPT HOT AIR SUPPLY OVHT

HOT AIR SUPPLY . . . . . OFF/R
Affected compt . . . . . MAN/COLD
■ WHEN OVHT DISAPPEARS :
HOT AIR SUPPLY . . . . . ON
Affected compt . . . . . MAN CTL

COMPT HOT AIR SUPPLY OVHT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : HOT AIR SUPPLY OVHT proc
Right ECAM CRT : AIR COND page
OVHT light on COMPT TEMP panel.

- If the OVHT warning is caused by the trim air valve jammed open, it will reappear when using MAN CTL. In this case select HOT AIR SUPPLY OFF/R and leave OFF.
  Control COMPT TEMP by adjusting PACK TEMP manually as required.

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CABIN PRESS - REG FAULT

CAB PRESS REG (affected) ..... OFF

■ If both REG affected:

MAN PRESS ..... ON

CAB PRESS MAN CTL PROC (20) ..... APPLY

CAUTION: *When both CAB PRESS REGULATORS are selected OFF, the CAB ALT warning and the cabin pressure indications on ECAM are no longer provided.*

CABIN PRESS – REG FAULT

Indications:

Single chime
MASTER CAUTION
Left ECAM CRT: CAB PRESS REG FAULT proc
Right ECAM CRT: CAB PRESS page
FAULT light on CABIN PRESS panel.

– CAB PRESS REG selected to OFF confirms automatic transfer to the non-affected system.

CABIN PRESS - LO ΔP

EXPECT HI CABIN RATE.

A/C V/S ..... REDUCE

CABIN PRESS – LO ΔP

Indications:

Single chime
MASTER CAUTION
Left ECAM CRT: CAB PRESS LO ΔP proc
Right ECAM CRT: CAB PRESS page
LO ΔP light on CAB PRESS panel.

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CAB PRESS – MAN CTL

CAUTION: When both CAB PRESS REGULATORS are selected OFF, the CAB ALT warning and the cabin pressure indications on ECAM are no longer provided.

CLIMB or CRUISE

FL	400	350	300	250	200 and BELOW
TARGET CAB ALT (ft)	8500	6800	5000	2500	0

CAB V/S (until target CAB ALT) ..... 500 FT/MN

BEFORE DESCENT

CAB V/S (until LDG ELEVATION) .... appr 350 FT/MN
For high aircraft V/S adjust CAB V/S accordingly.

BEFORE LANDING

V/S CTL ..... UP (Full open)

ON GROUND

PACKS 1 and 2 ..... OFF

● Before doors opening:
ΔP ..... Check zero

CABIN PRESS – MAN CTL

- The table of FL against CAB ALT gives the relationship required to obtain 8 psi.
- Monitor V/S and CAB ALT frequently and adjust as necessary. Dont allow aircraft altitude to go below cabin altitude.
- Maximum differential pressure is limited to 8,85 psi by the two manometric safety valves.
  To avoid cabin pressure oscillations it is recommended to maintain differential pressure in the green arc.
- For descent, set 400-500 ft/min cabin V/S.
- On ground both packs are selected OFF to improve depressurization.

EXCESS CAB ALT

OXY MASK ..... ON
DESCENT ..... AS REQD

■ IF RAPID DECOMPRESSION:
EMER DESCENT PROC (20) ..... APPLY

EXCESS CAB ALT

Indications :

Continuous repetitive chime
MASTER WARNING
Left ECAM CRT : EXCESS CAB ALT proc
Right ECAM CRT : CAB PRESS system page

- Check for pressurization system fault. If system fault is indicated, apply appropriate procedure.
- If no abnormal indications, start descent.
- If decompression is rapid, apply EMER DESCENT procedure.

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WING ANTI ICE VALVES FAULT

■ IN FLIGHT

● If WING SUPPLY selected ON (valve not open):

WING MODE SEL ..... ALTN

■ If FAULT remains:

WING SUPPLY ..... OFF

AVOID ICING CONDITIONS.

● If WING SUPPLY selected OFF (valve not closed):

THRUST LIM PENALTY

■ ON GROUND

BLEED VALVES (ALL) ..... OFF

WING ANTI ICE VALVES FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : WING VALVE NOT OPEN/ CLOSED proc

Right ECAM CRT : NIL

FAULT light on ANTI ICE system panel

- Anti Ice FAULT is indicated when disagreement between valve position and selected position exists.
- On ground, selecting BLEED VALVES OFF will prevent a slat overheat.
- The thrust limit penalty for ANTI ICE ON remains valid. It is taken into consideration by the TCC.

ENG ANTI ICE FAULT

■ If ENG ANTI ICE selected ON (valve not open):

AVOID ICING CONDITIONS.

■ If ENG ANTI ICE selected OFF (valve not closed):

THRUST LIM PENALTY.

ENG ANTI ICE FAULT

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : ENG ANTI ICE FAULT proc

Right ECAM CRT : NIL

Local FAULT light on ANTI ICE panel

- Anti Ice FAULT is indicated when disagreement between valve position and selected position exists.
- If a valve does not close, when selected OFF, the thrust limit penalty for ANTI ICE ON remains valid. It is taken into consideration by the TCC.

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PROBE HEAT FAILURE	
Corresponding ADC IND or STBY IND ..... MONITOR	

PROBE HEAT FAILURE

Indications :

Single chime

MASTER CAUTION

Left ECAM CRT : Proc

Right ECAM CRT : Nil

Corresponding local warning light on PROBE HEAT panel.

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WINDOW HEAT FAULT

WINDOW HEAT affected . . . . . OFF/R

WINDOW HEAT FAULT

Indications :

Single chime
MASTER CAUTION
Left ECAM CRT : WINDOW HEAT FAULT proc
Right ECAM CRT : Nil
FAULT light on WINDOW HEAT panel

COCKPIT WINDOW CRACKED

WINDOW HEAT (if arcing) . . . . . OFF/R

WINDOW condition :

■ One or more single cracks (on front window) :

NIL action required.



■ One or more single cracks (on lateral window) or total surface in criss cross (on lateral or front window)

Max ΔP . . . . . 5 PSI
Max FL 250
LDG ELEVATION . . ADJUST FOR 5 PSI



ΔP = 5 PSI	FL	100	150	200	250
	LDG ELEV SETTING	0	2700	6000	9200

● Before descent :

LDG ELEVATION .. SET DESTINATION ELEVATION

R R R R R R R

COCKPIT WINDOW CRACKED

– One or more single cracks on front window concern only the outer ply and do not affect the structural integrity. R

– Max. flight level is restricted to FL 250 in order to obtain ΔP 5 PSI without excessive cabin altitude and resultant CAB ALT warning.

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AIR COND SMOKE

OXY MASKS . . . . . ON
CREW COMMUNICATION . . . . . ESTABLISH
GOGGLES . . . . . AS REQD
APU BLEED . . . . . OFF/R
PACK 1 VALVE . . . . . OFF

■ If smoke persists :
PACK 1 VALVE . . . . . AUTO
PACK 2 VALVE . . . . . OFF
SMOKE REMOVAL PROC (10) (If necessary) . . APPLY

CABIN EQUIPMENT SMOKE

GALLEY . . . . . SHED
SMOKE REMOVAL PROC (10) (If necessary) . . . APPLY

AIR COND SMOKE

Indications :
Visible smoke, odor.
Several SMOKE warnings may be triggered.

– As a result of contamination within the air conditioning system AVIONICS SMOKE, MIN EQPT BAY SMOKE or BAT SMOKE warnings may simultaneously be triggered. Apply AIR COND SMOKE procedure only if visible smoke or strong odor is encountered. R R R R R

– Ensure crew communication is established.
Avoid the use of interphone position to minimize interference from oxygen mask breathing noise.
Check oxygen masks at 100 %. It is recommended to set the EMERGENCY pressure selector to overpressure position.

– It is recommended to switch CAB FANS to OFF, to prevent recirculation of contaminated cabin air.

CABIN EQUIPMENT SMOKE

– GALLEY switch disconnects all galley power supply.

Note : Sidewall, ceiling, entrance areas and passenger reading lights may be switched off from the cabin lighting panel.

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ADC FAULT

ADC INST SWITCHING . . . . . SYS AVAILABLE
ATC . . . . . SYS AVAILABLE
ATS . . . . . RESET

■ If both ADC FAULT:
STBY INST . . . . . USE
MAX SPD 285
MAX FL. 310
USE ELEV WITH CARE ABOVE SPD 170
USE RUD WITH CARE ABOVE SPD 170
PITCH TRIM . . . . . MANUAL
Affected eqpt . . . . . OFF
. PITCH FEEL 1 and 2
. RUD TRAVEL 1 and 2.
TRIM TK AFT XFR NOT AVAIL

• When Flaps are extended:
PITCH TRIM . . . . . RESET
YAW DAMPER . . . . . RESET

IRS FAULT

■ IRS 1 or 2:
CAPT (F/O) ATT/HDG . . . . . SYS 3
ATS (if tripped) . . . . . RESET

■ IRS 3:
ATT/HDG ON SYS 3 . . . . . DO NOT USE

ADC FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : ADC 1 (2) FAULT proc
Right ECAM CRT : Nil
Fail flags on Capt or F/O instruments
PITCH TRIM and YAW DAMPER 1 (2) levers tripped if flaps retracted

- With a single ADC failure, instruments may be switched to the serviceable side. The FD associated to the faulty ADC is inoperative except in G/S track and land track phase of LAND mode. For recovery select on respective SWITCHING panel FD to SYS 1 (or 2). R R
- The respective Auto pilot, Pitch trim, and Yaw damper will be inoperative.
  ATS can be reselected after instrument switching.
- If double ADC fault : mach indication is lost. Both Auto pilots, both Pitch trims, both Yaw dampers and ATS will be inoperative. Due to Pitch Feel and Pitch Trim Fault the speed is limited to 285/.78. Since the mach indication is lost, the FL has to be limited to 310, where 285 kt does not exceed M.78.
  Perform descent with care.
  (FL 400 – max 235 kt, FL 350 – max 265 kt).

  YAW DAMPERS and PITCH TRIMS may be reset when FLAPS 15° or more. The APs can be reset after GS capture (GS green on FMA).

IRS FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : IRS FAULT proc
Right ECAM CRT : Nil
IRS WARN on OVHD panel.

- With a single IRS system failure instruments (ATT/HDG) may be switched to the serviceable side.
- The respective Auto pilot and Yaw damper and lost. If ATS was in SPD mode at time of fail it tripped, but it can be reset after instrument switching.

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EFIS SGU FAULT

■ EFIS SGU 1 or 2:
CAPT (F/O) EFIS . . . . . SYS 3

■ EFIS SGU 3:
EFIS ON SYS 3 . . . . . DO NOT USE

AUTO FLIGHT SYSTEM – DISTRIBUTION

PERIPHERAL INOPERATIVE	FAC 1			FAC 2			FCC 1		FCC 2	
	YAW DAMP 1	PITCH TRIM 1	FLT PROT 1	YAW DAMP 2	PITCH TRIM 2	FLT PROT 2	AP 1	FD 1	AP 2	FD 2
HYD BLUE	INOP									
HYD GREEN							INOP			
HYD YELLOW				INOP					INOP	
* RUD TRAVEL 1 and 2	INOP if flaps < 15°			INOP if flaps < 15°						
IRS 1	INOP		INOP				INOP	INOP		
IRS 2				INOP		INOP			INOP	INOP
2 IRS's	INOP		INOP	INOP		INOP	INOP	INOP	INOP	INOP
ADC 1	INOP if flaps < 15°		INOP				INOP **	INOP **		
ADC 2				INOP if flaps < 15°		INOP			INOP **	INOP **
* PITCH TRIM 1+2							INOP		INOP	
* YAW DAMPER 1+2							INOP		INOP	
* FAC 1 + 2							INOP	INOP	INOP	INOP
FCU							INOP	INOP	INOP	INOP

* No effect with single eqpt failure.

R ** Except in GS track and land track phase of LAND mode.

PERIPHERAL INOPERATIVE	TCC	
	ATS	TRP
* ADC 1 + 2	Disarms – Rearming not possible.	INOP
IRS 1	Disarms if SPD/M mode engaged. Rearming possible after ATT/HDG switching to SYS 3	
* FAC 1 and 2	Disarms – Rearming not possible	
ENG TRIM 1 or 2 FAILED	Any ATS mode (SPD, MACH or THRUST) is lost, if CL or CR is selected on TRP. Mode re-engagement is possible, when ENG TRIM is selected OFF.	
FCU FAILED	Disarms. Rearming possible Mode re-engagement not possible	
Both AP's and FD's	A/THR Function (and associated mode) is lost, but not THR L mode. A/THR re-engagement possible with only SPD/MACH mode available.	

* No effect with single eqpt failure.

EFIS SGU FAULT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : EFIS SGU 3 FAULT proc
Right ECAM CRT : Nil

- EFIS SGU 3 FAULT is only displayed by ECAM, when not selected.
- SGU 1 or 2 FAULT (or 3, when selected) are only indicated by diagonal lines on displays.
- If SGU 3 is used to replace SGU 2, the mode selected for PFD 1 indication (FD or FPV) will be displayed on PFD 2 as well. Reselect as desired.

Note : EFIS – Saturation

If EFIS ND is saturated due to excessive information presentation, the display is blanked out.

To recover NAV display :
• Mode Rot. Selector – PLAN

If recovery unsuccessful :
• Range Rot. Selector – Reduce Range

Mod. : 5051

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OVERWEIGHT LANDING

LANDING CONFIGURATION . . . . . DETERMINE
LANDING DIST . . . . . CHECK
PACK VALVE 1 and 2 . . . . . OFF or supplied by APU

NOTE : Touchdown as smooth as possible (Maximum V/S at touchdown 360ft/mn).

OVERWEIGHT LANDING

- When the overweight landing has to be performed following an operational turnback, refer to corresponding RTLOW chart, or to FCOM to find approach and landing configuration as a function of the approach climb limiting weight.
- Selecting packs off (or supplied from APU) will increase the maximum thrust available from the engines.

DOOR NOT CLOSED IN FLIGHT

CABIN
DOOR CONTROL HANDLE . . . . . PUSH
LOCKING INDICATOR . . . . . CHECK

■ IF ABNORM CAB RATE OR CONFIRMED UNLOCKED :
LDG ELEVATION . . . . . 10 000 FT
MAX FL 100/MEA

FWD or AFT or BULK CARGO or LOWER ACCESS
IF ABNORM CAB RATE :
LDG ELEVATION . . . . . 10 000 FT
MAX FL 100/MEA

AVIONIC or FWD COMPT
No Action

DOOR NOT CLOSED IN FLIGHT

Indications :
Single chime
MASTER CAUTION
Left ECAM CRT : DOOR warning proc
Right ECAM CRT : DOOR page with DOOR and designation in amber

- If a door is confirmed unlocked or if DOOR warning is accompanied by abnormal increase of cabin altitude, the ΔP cabin must be reduced by aircraft descent and landing elevation selection.

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SPEED CONTROL WITH UNRELIABLE AIRSPEED INDICATION

GENERAL

The following instructions provide guidelines in case of complete loss of airspeed information or unreliable airspeed indications displayed on all indicators.

Although this situation is highly improbable (it may occur in case of radome burst or pitot icing), the procedures will help the crew to control the speed inside the operational envelope (i.e. between VMO/VFE and 1.3 Vs).

It is assumed that a reliable altitude indication is available on stand-by instrument, and radio altimeter during approach (2.500 ft).

PROCEDURE

The procedure is based on the use of the pitch attitude and engine N1 associated with weight, configuration and flight profile.

FPV can be selected, allowing to use the angle of attack (given on the pitch scale of the PFD by the displacement between the center-dot and the « bird ») as relative pitch attitude.

SYSTEMS CHECK

When all airspeed information is erroneous or lost, the effect on the following systems has to be considered and, if necessary, the systems have to be disengaged :

- Pitch feel.
- Rudder travel.
- Yaw damper.
- Pitch Trim.
- Auto Pilot.

Note : For the approach, when coupled to the ILS, the information delivered by the flight director is valid.

The stall warning/protection is still available.
Observe the restricted flight envelope.

INFORMATION

The following table presents information to enable the flight to be continued to the landing.
It is recommended to cruise at low or medium levels (between FL 100 and FL 250) using the N1 given in the table « N1 VS WEIGHT AND CONFIGURATION » for 280 kt.

Note : If the failure is due to a radome destruction the drag will be increased and therefore N1 must be increased by about 7 % (fuel flow will increase by about 33 %) to achieve approximately 280 kt.

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SPEED CONTROL WITH UNRELIABLE AIRSPEED INDICATION

PHASE OF FLIGHT (Schedule Speed)	PITCH ATTITUDE	ANGLE OF ATTACK	ENGINE THRUST	REMARKS	
Take-off (V2 + 10 kt)	+ 18°	8°	T.O. or FLEX T.O.		
Acceleration and configuration changes					
Flaps retraction	+ 10°	5°	CL	Can be performed as soon as pitch is decreased.	R
Slat retraction	+ 7°	5°	CL	Shall be performed 30 sec after flap retraction or when slat lever can be moved forward.	R
Note : If stick shaker is encoutered	(+ 5°)		CL	Level off for at least 60 sec then resume climb.	
Climb (280 kt/.78)					
to FL 100	+ 9°	2°	CL	If possible remain between FL 100 and FL 250	
From FL 100 to FL 200	+ 7°		CL		
From FL 200 to FL 290	+ 5°		CL		
Above FL 290	+ 4°		CL		
Cruise					
Select thrust setting for IAS = 280 kt limited to M = 0.78	+ 2°	1.5°	f (IAS or M)	Maintain altitude. Limit bank angle to 15°.	R
Descent (.78/280 kt)	— 1.5°	2°	Idle	Do not use SPEEDBRAKES	
Approach (in level flight)			See graph next page for approx thrust to maintain pitch attitude		
Slats extension 0 (green dot)	+5°/+4.5°	5°			R
Flap extension to 15° S	+7°/+4.5°	7°			R
Flap entension to 20° F + 20kt	+6°/+4.5°	7°		Extend gear 1 dot below GS	R
Flap extension to 40° F	+8°/+4.5°	7°			R
Final approach (– 3° gradient) V_{REF} + 10	+ 4°	7°			
Flare	4 to 6°	–	Idle	Thrust reduction at 20 ft.	

Notes : 1. Angles of attack are valid for all weights. R

2. Extension of speed brakes has a large effect on angle of attack and pitch attitudes. Therefore it is recommended to avoid the use of speed brakes during flight with unreliable airspeed indication. R R

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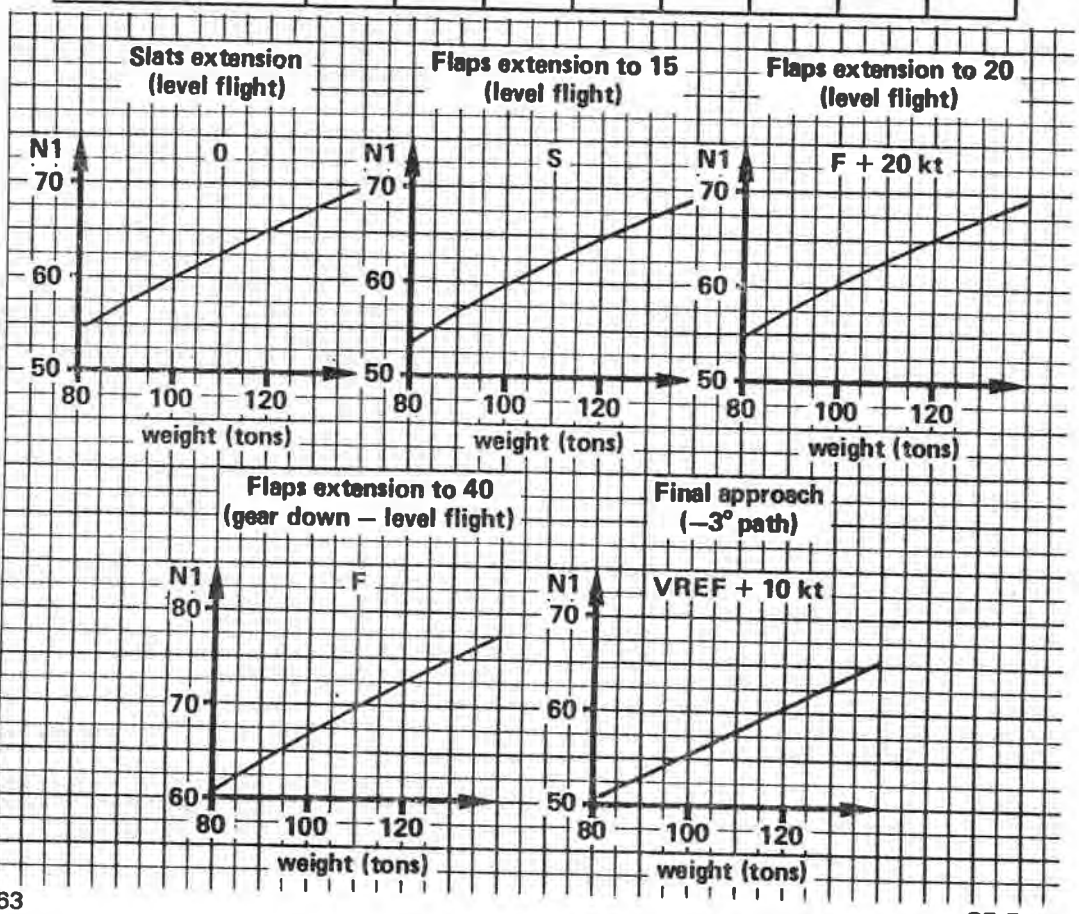
SPEED CONTROL WITH UNRELIABLE AIRSPEED INDICATION

N1 VERSUS WEIGHT AND CONFIGURATION TO MAINTAIN RECOMMENDED AIRSPEED

ISA

N1 to maintain 280 kt IAS

FL \ WEIGHT (tons)	90	100	110	120	130	140	150	160
290	82.3	83.2	84.2	85.3	86.3	87.5	88.9	90.4
250	79.3	80.2	81.2	82.2	83.3	84.5	85.8	87.0
200	75.6	76.4	77.4	78.4	79.4	80.6	81.8	82.9
150	71.6	72.4	73.3	74.3	75.4	76.5	77.7	78.8
100	67.8	68.6	69.5	70.4	71.4	72.5	73.6	74.8
50	64.1	64.8	65.6	66.5	67.5	68.5	69.6	70.7



Mod. : 4863

GE Eng. : 80C2A2

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PRECAUTIONS WITH BOMB ON BOARD

According to experiences, explosives brought on board of aircraft are fitted with time or altitude fuses.
For that reason a suspicious article considered to be an explosive, may be transported to a location in the aircraft, where in case of detonation the least damage to aircraft structure and systems is expected.
This least risk bomb location is :

RIGHT HAND AFT CABIN DOOR

Suspicious article ..... Secure against slipping, avoid shocks
Passengers ..... Lead away from suspicious article

AIRCRAFT PROCEDURES

R R R R *Note : As precautionary measure the application of Aircraft Procedures is recommended, even if Bomb on Board is not confirmed, but a founded serious BOMB THREAT is received.*

Cabin Crew ..... Notify
LANDING ELEVATION selector ..... Set indicated cabin altitude
Emergency descent ..... Initiate
- Descend to indicated cabin altitude, Avoid any increase of cabin altitude and g-loads.

When cabin differential pressure is zero :
RAM AIR ..... ON
GALLEY ..... SHED
Airspeed ..... Reduce to 210 or below
Slats ..... Extended
Landing Gear ..... Down
Landing Field ..... Select next suitable airport

When aircraft on ground and stopped :
Evacuation ..... Initiate

- By descent to the existing cabin altitude and respective setting of LANDING ELEVATION selector cabin $\Delta P = 0$ is obtained, thus reducing the structural load of the fuselage as far as possible without decrease of cabin pressure.
- The speed reduction reduces loads as well and permits extension of landing gear and slats as precautionary measure for the case of eventual damage.
- With $\Delta P = 0$ RAM AIR is selected to ON for complete opening of all OUTFLOW VALVES, thus providing a means for instantaneous pressure relief, if required.
- Electrical power in the vicinity of the least risk bomb location is considerably reduced by GALLEY SHED to prevent eventual consequences in case of damage.
- For the selection of the next suitable airport the pressure altitude of the intended landing field must be considered, not to exceed the existing cabin altitude.
- Evacuation should be initiated without delay using escape slides and/or airport facilities as available. Do not use AFT CABIN DOORS.

CABIN PROCEDURES

Passengers near RH AFT CABIN DOOR .... Lead away
- When the descent is completed, passengers should occupy seats remote from door or rest on the floor in protected areas. An area of at least 16 ft away from the least risk bomb location should remain free.

Oxygen bottles and fire extinguisher
at RH AFT CABIN DOOR ..... Remove (if installed)
- All loose items, which might create a hazard in case of detonation, should be removed from the least risk bomb location.

Escape slide arming lever ..... DISARM (PARK)
- Leave door closed and locked.

Passengers near bomb location .... Protect head with pillows, blankets, etc... or sit in brace position.
Suspicious article ..... Carry to door and secure on top of support arm in attitude found.
- The least risk bomb location should be prepared before moving the suspicious article.
- The presumable explosive must be placed in an area of the door, which provides least resistance to an eventual explosion. This area is the door center on top of the door support arm, as close to the door lining as possible.
  Depending on size it may be possible to fix the article in this location using adhesive tape or similar means. If not, it is recommended to pile up hand luggage against the door to provided a shelf on which to deposit the article and then secure to the door.

Suspicious article ..... Tamp
- Cover the bomb with plastic sheets to keep it dry, when subsequently wetted material is used.
- Cover the floor in the door area with luggage etc for floor protection.
- Surround and cover the bomb with at least 25 cm of wetted material, preferably blankets and pillows, but do not put anything between bomb and door.
- Fill the area around the bomb with seat cushions and similar soft material up to the cabin ceiling, compressed as much as possible. The more soft material is stacked around the explosive, the less damage will occur.

WARNING
USE SOFT MATERIAL ONLY.
AVOID ANY METAL OBJECTS, WHICH COULD BECOME DANGEROUS PROJECTILES

Passengers ..... Advise
- All passengers must remain seated with seat belts on and head below back rest.
- Passengers seated close to the least risk bomb location must protect their heads with pillows or blankets or must assume brace position.

Evacuation ..... Execute
- Do not use AFT CABIN DOORS for disembarkation of passengers.
- Use airport facilities to disembark without delay. If use of escape slides is deemed necessary, the emergency exit on right handside should not be used.

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FWS FAULT

Indications :

MASTER CAUTION

Left ECAM CRT :

- CRT AMBER CAUTIONS NOT AVAIL
  or
- FWS FAULT (on MEMO page)

« CRT AMBER CAUTIONS NOT AVAIL » :

A part of amber warnings and associated MASTER CAUTION are lost.

- Monitor overhead panel.

Note : For following warnings there is no local warning light :
- *A/SKID selected OFF.*
- *L/G lever lock.*
- *Radio altimeter fault.*
- *EFIS SGU 3 FAULT.*
- *Automatic call out.*
- *Door unlocked (system display available).*
- *AC emergency bus off.*
- *Ground spoilers not extended.*

« FWS FAULT » :

MASTER WARNING, MASTER CAUTION and ECAM warning display are lost.

- Monitor overhead panel.

Note : Following warnings are totaly lost (no local warning).
- *O/SPEED (Vmax strip available on PFD) ;*
- *STALL (Vss strip available on PFD) ;*
- *LDG GEAR (3 green lights available on L/G panels) ;*
- *EXCESS CAB ALT (CAB ALT indicator available) ;*
- *HYD TANK LO LEVEL (QTY indicators available) ;*
- *ALTITUDE ALERT ;*
- *DOOR (DOOR page on CRT available) ;*
- *AFS capacity change (clic).*

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ADVISORY CONDITIONS

SYSTEM	CONDITION	RECOMMENDED ACTION
AIR BLEED	TURBINE INLET TEMP ≥ 95° C to ≤ 120° C	PACK VALVE – OFF for a cooling period
APU	EGT ≥ 540° C	
CAB PRESS	CAB DIFF PRESS ≥ 8,6PSI	In level flight : Other CABIN PRESS SYS – SELECT In Climb : RATE LIM SEL – MAX Aircraft rate of climb – Reduce, if required.
	CAB VERTICAL SPEED V/S ≥ V/S selected + 50 %	
	FWD and AFT OUTFLOW VALVE position difference > 40 %	Other CABIN PRESS SYS – SELECT
ELEC – AC	IDG Outlet Oil Temp ≥ 142° C	Reduce electrical load, if possible e.g. GEN-OFF (MAIN GALLEY supply is lost) Observe OIL TEMP evolution. If required, reengage generator, when temperature has dropped. Restrict use of generator to short duration, if temperature rises again excessively. *Note : After IDG DISC, this advisory may appear at low thrust setting due to :* *– low cooling effect* *– high nacelle temperature affecting IDG temp bulb.*
FUEL	Fuel Unbalance : INR TK > 3000Kg OUTR TK > 3000Kg	FUEL management – CHECK
WHEEL	SPLRS Extended at WHEEL SPD > 50KT	

R

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ADVISORY CONDITIONS

SYSTEM	CONDITION	RECOMMENDED ACTION
ENGINE	OIL TEMP > 160° C	Refer to ENG OIL TEMP HI procedure
	OIL PRESS > 90 PSI < 16 PSI	Monitor oil pressure decrease, while engine is warming up. Check oil level. If level low anticipate engine shutdown
	OIL QTY < 2 qt	If quantity low at high power setting, expect level increase after power reduction, monitor oil pressure
	FUEL PRESS < 50 PSI	Check tank pump operation. If normal avoid rapid throttle movement
	NAC TEMP > 185° C + TAT Mod 3504 NAC HEAT > 55 %	Monitor engine parameters and crosscheck with other engine
	VIBRATION (NI) > 3 units (N2) > 5 units	Check engine parameters and crosscheck with other engine. Record vibration level in stabilized cruise conditions.

R

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	N	2.06.00
		PAGE 1/2	
	CONTENTS	REV 04	OCT 83

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2.06.20 CARGO LOADING

General 1

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AFT cargo compartment .. 2

BULK cargo compartment . 3

2.06.30 FUEL LOADING

General information 1-2

Refueling procedure 2-3

Overwing filling 3

Use of manual (magnetic) indicators ..... 3 to 6

Defuelling procedure 7

Fuel transfer procedure ... 7

2.06.40 WEIGHT & BALANCE

Load & trim sheet ..... 1 to 4

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	N	2.06.10
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	DEFINITIONS	REV 04	OCT 83

1. BASIC WEIGHT

It is the aircraft weight without any load. This means a weight not including crew members, pantry load, fuel load and traffic load but including the commercial arrangement of the corresponding version and the not expendable fuel.

2. DRY OPERATING WEIGHT

It is the weight of the aircraft in operating configuration. It is obtained by addition of the BASIC WEIGHT, crew members and pantry load.

3. TAKE-OFF FUEL

It is the weight of the inboard fuel at take-off.

4. OPERATING WEIGHT

It is the weight obtained by addition of the DRY OPERATING WEIGHT and the TAKE-OFF FUEL.

5. TOTAL TRAFFIC LOAD

It is the weight of the payload including cargo loads, passengers and passengers bags.

6. ZERO FUEL WEIGHT

It is the weight obtained by addition of the TOTAL TRAFFIC LOAD and the DRY OPERATING WEIGHT.

7. TAKE-OFF WEIGHT

It is the weight at take-off. It is equal to the addition of the ZERO FUEL WEIGHT and TAKE-OFF FUEL.

8. TRIP FUEL

It is the weight of the fuel necessary to cover the normal leg without reserves.

9. LANDING WEIGHT

It is the weight at landing. It is equal to TAKE-OFF WEIGHT minus TRIP FUEL.

10. REFERENCE DATA:

Datum line ..... STA 0 (26.67 m (87.50 ft) forward of 25 % MAC)
Leading edge of MAC ..... STA 25.2132 m (82.72 ft)
Length of MAC ..... 5.8287 m (19.124 ft)

Vers. : All

Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	R	2.06.20
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	CARGO LOADING	REV 05	

1. GENERAL

The cargo is loaded in three underfloor cargo holds designated FWD, AFT and BULK, and designed category C as defined by FAR.
Doors for the forward and aft cargo hold are hydraulically powered. The bulk cargo door is manually operated from outside or inside the aircraft.

2. FWD CARGO COMPARTMENT

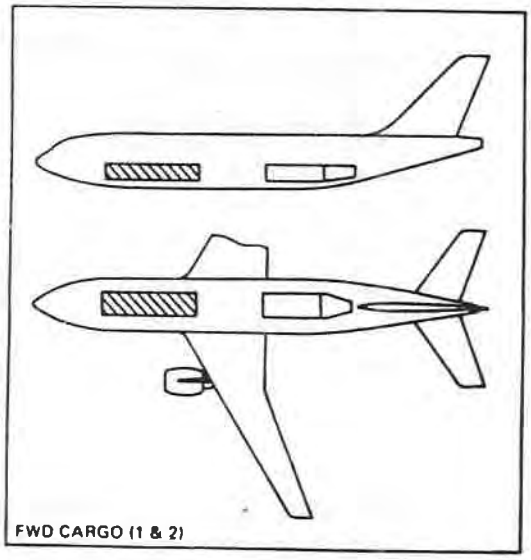
The FWD cargo is provided with a semi automatic loading system as is designed to carry containers and pallets. It is prohibited to carry bulk freight in this cargo. FWD cargo is divided in 2 zones (1 & 2).

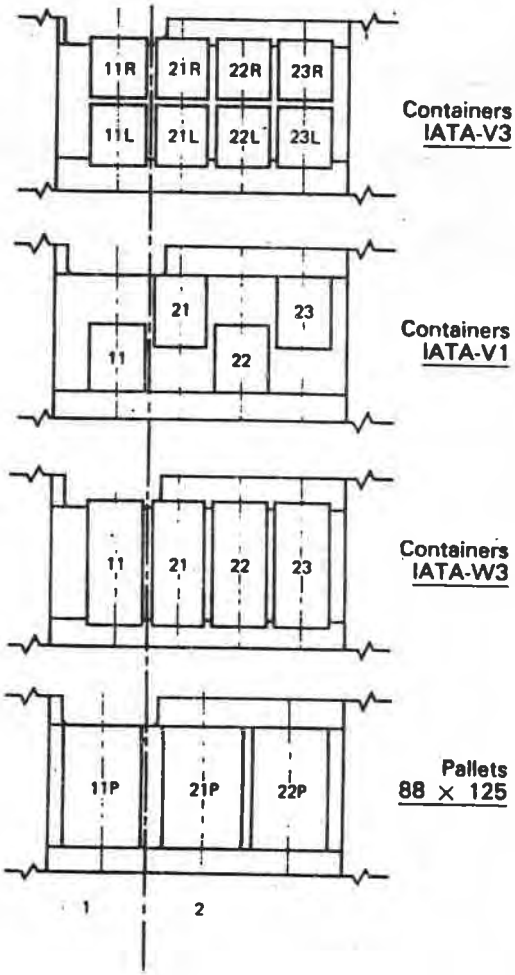
MAX CONTAINER WEIGHT		
IATA V3	IATA V1	IATA W3
1 587 kg (3 500 lb)	1 587 kg (3 500 lb)	3 175 kg (7 000 lb)

MAX PALLET WEIGHT	
IATA A2 (88 × 125 in)	IATA W2 (60.4 × 125 in)
4 627 kg (10 200 lb)	3 175 kg (7 000 lb)

MAXIMUM CUMULATIVE LOAD (1 + 2): 12 700 kg (28 000 lbs)

Non certified containers are limited to 1284 kg (2830 lb) for half size containers and to 2568 kg (5660 lb) for full size containers.


FWD CARGO (1 & 2)



Vers. : All

Eng. : All

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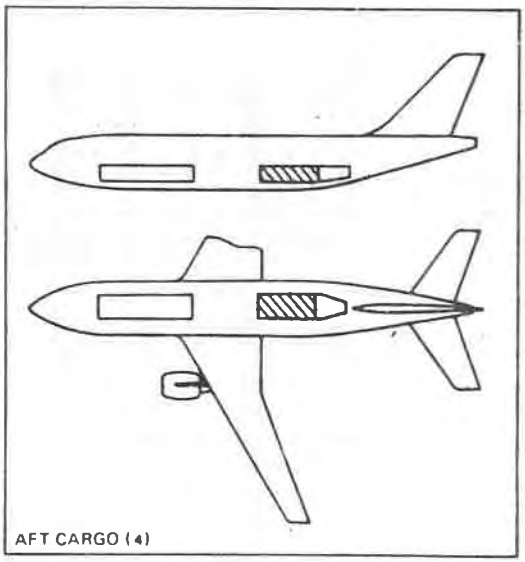
3. AFT CARGO COMPARTMENT

The AFT cargo is provided with a semi automatic loading system and is designed to carry containers. It is prohibited to carry bulk freight in this cargo.

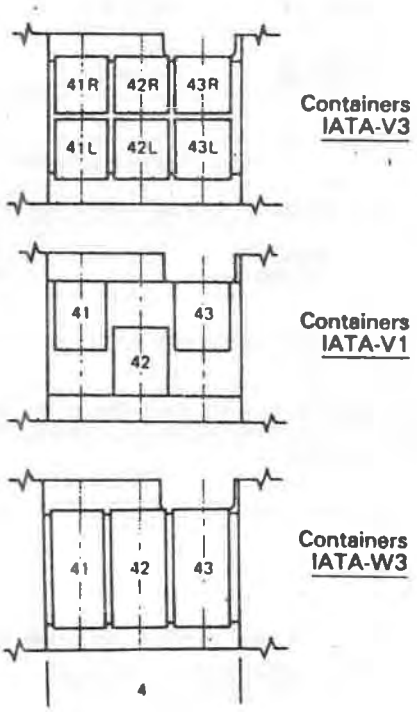
MAX CONTAINER WEIGHT		
IATA V3	IATA V1	IATA W3
1 587 kg (3 500 lb)	1 587 kg (3 500 lb)	3 175 kg (7 000 lb)

R MAXIMUM OVERALL LOAD WEIGHT: 9 525 kg (21 000 lb)

Non certified containers have the same limitations.



AFT CARGO (4)



Vers. : All

Eng. : All

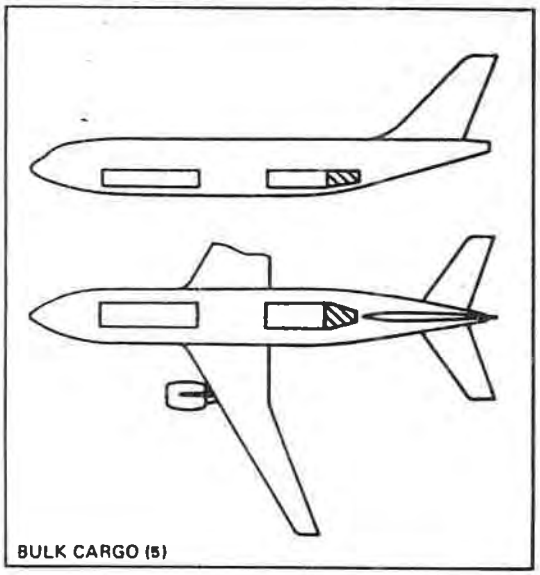
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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	N	2.06.20
		PAGE 3	
	CARGO LOADING	REV 07	

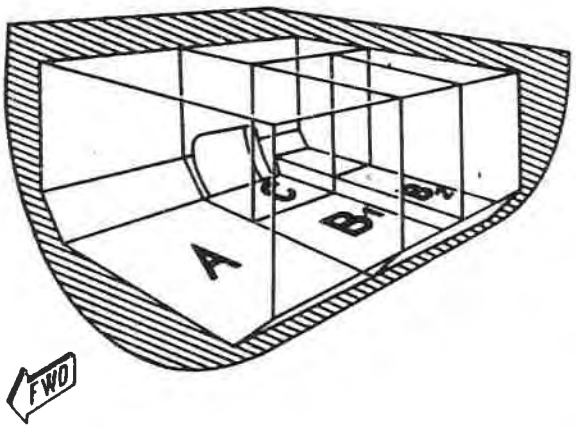
4. BULK CARGO COMPARTMENT

This compartment is provided for bulk freight loading and the transportation of livestock.

	Zone	A	B1 *	B2	C	TOTAL
BULK CARGO	MAX WEIGHT	1 840 kg (4 055 lb)	656 kg (1 445 lb)	274 kg (600 lb)	door area	2 770 kg (6 100 lb)
	Max distributed unit load on the floor : 732 kg/m2 (150 lb/ ft2) Max local load on the floor : 272 kg/ft2 (600 lb)					



BULK CARGO (5)



Vers. : All

Eng. : All

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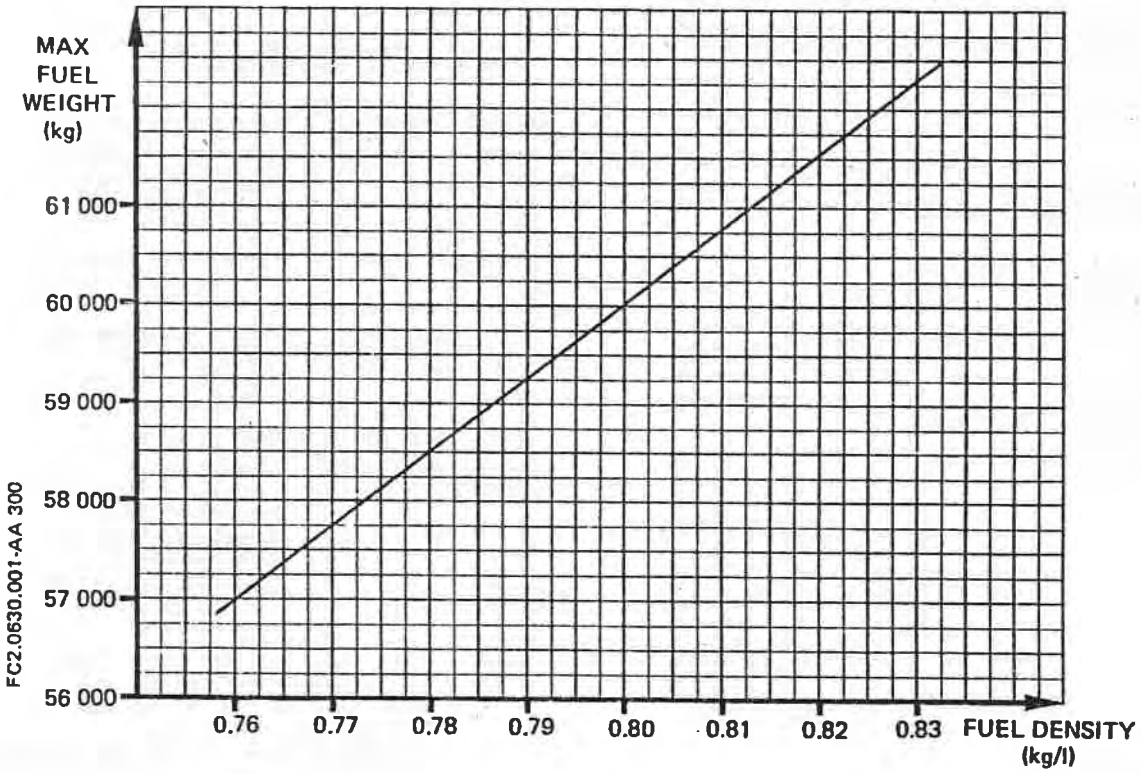
A310 FLIGHT CREW OPERATING MANUAL	LOADING / FUEL / LOAD and TRIM SHEET	2.06.30
		PAGE 1
	FUEL LOADING	REV 18 / SEQ 300

1 – GENERAL INFORMATION

A – MAXIMUM TOTAL FUEL CAPACITY :

	LITERS	US GAL
OUTER TANKS	7 400	1 955
INNER TANKS	27 900	7 371
CENTER TANK	19 640	5 189
TRIM TANK	6 150	1 625
ACT	14 000	3 704
TOTAL	75 090	19 844

B – MAXIMUM FUEL WEIGHT :

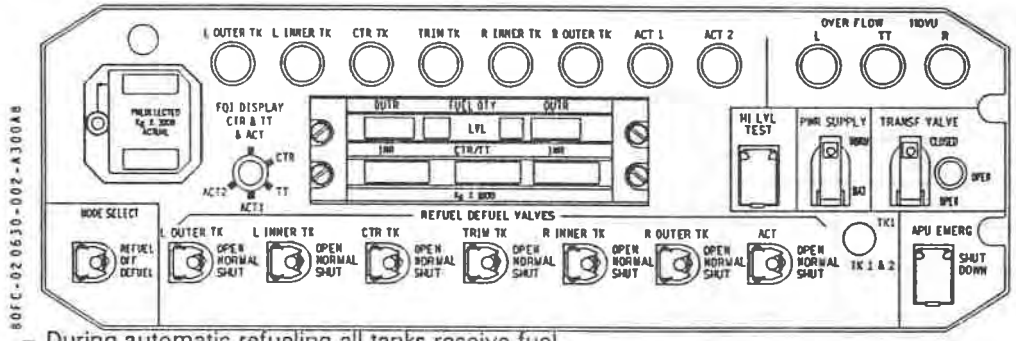


Mod. : 4801 + 6920 + 7468

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A310 FLIGHT CREW OPERATING MANUAL	LOADING / FUEL / LOAD and TRIM SHEET	2.06.30
		PAGE 2
	FUEL LOADING	REV 18 / SEQ 300

C – REFUEL/DEFUEL CONTROL PANEL



- During automatic refueling all tanks receive fuel simultaneously. (Except ATC2 which can be filled only when ACT1 is full).
  Tanks become full in the order outers, inners center ACT1 trim and ACT2. For manual refueling the tanks must be filled in the same order.
- With the tanks filled to the maximum nominal total fuel capacity, there is sufficient space in each tank to allow a 2 % thermal expansion of fuel without spillage through the vent system.
- The vent tank in each wing has a volume of 190 liters (50 US GAL). The vent tank in trim tank has a volume of 120 liters. (32 US GAL)
- If necessary during refueling procedures, close relevant refuel/defuel valves(s) to isolate associated tank(s) as required.

2 – REFUELING PROCEDURE

- Position access platform for access to refuel/defuel couplings. Observe the safety precautions and make certain that tanker and aircraft are properly grounded. Connect tanker-to-aircraft grounding cable to grounding point on main landing gear.

  CAUTION : Do not use fuel pump 1 of left inner tank or/and fuel pump 2 of right inner tank, because of the risk of overfuelling the inner tank through the refuelling drain valve. If a pump is required use pump 2 of left inner tank or pump 1 of right inner tank.

  On overhead panel, check TRIM TK MODE p/b is in AUTO position. Selection of TRIM TK MODE p/b in FWD position prevents refuelling of TRIM TK and may lead to fuel spillage.

FUELING PANEL

- Set PWR SUPPLY switch to BAT if aircraft electrical network is to be powered by aircraft on-board batteries, otherwise check that NORM position is selected.
- Depress TEST pb and check :
  · eight HIGH LEVEL plus three OVERFLOW lights come on
  · within 2 seconds all 8's are displayed on FUEL QTY, PRESELECTED and ACTUAL indicators
- Check TRANSF VALVE sw is at CLOSED position and guarded. OPEN light is off.

AUTOMATIC REFUELING	MANUAL REFUELING
– Check REFUEL/DEFUEL VALVE sw are at NORMAL position and guarded	– Raise REFUEL/DEFUEL VALVE sw guards and place all switches in SHUT position
– Pull preselector knob and rotate to set required fuel quantity	– Place MODE SELECTOR sw in REFUEL position
– Push preselector knob	– Place appropriate tank REFUEL/DEFUEL VALVES switch(es) in OPEN position.
Note : When preselector knob is pulled ACTUAL contents display goes off	– Start refueling
– Place MODE SELECTOR sw in REFUEL position.	– Monitor individual tank contents on FUEL QTY indicator and select appropriate tank REFUEL/DEFUEL VALVE switch(es) to SHUT as tank contents reach required fuel.
– Start refueling.	

Notes : 1. Total time to fill wing tanks is approximately 19 minutes.
2. Total time to fill all the tanks is approximately 60 minutes.
3. As tanks become full, fuel flow will be interrupted by high level sensors, and appropriate tank HIGH LEVEL lt will illuminate.
4. CGCC goes to alternate mode at the end of refueling if aircraft is only electrically powered by batteries or maintenance buses (due to fuel tank calibration sensors not powered during refueling).

Mod. : 4801 + 6920 + 7468

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- After refueling, check that ACTUAL quantity is within 100 kg (or 220 lbs) of PRESELECTED quantity.
- Place FUEL QTY switch in CTR position and then in TT position and check that disposition of fuel in center and trim tanks is correct.
- Place MODE SELECTOR switch in OFF position and guarded.
- Check/set all REFUEL/DEFUEL VALVE sw in NORM position and guarded.
- If applicable, place PWR SUPPLY sw in NORM position and guarded.

3 - OVERWING (GRAVITY) FILLING

Note : The inner and outer tanks may be gravity filled. The center and trim tanks are replenished by transferring fuel from the wing tanks using the aircraft transfer system.

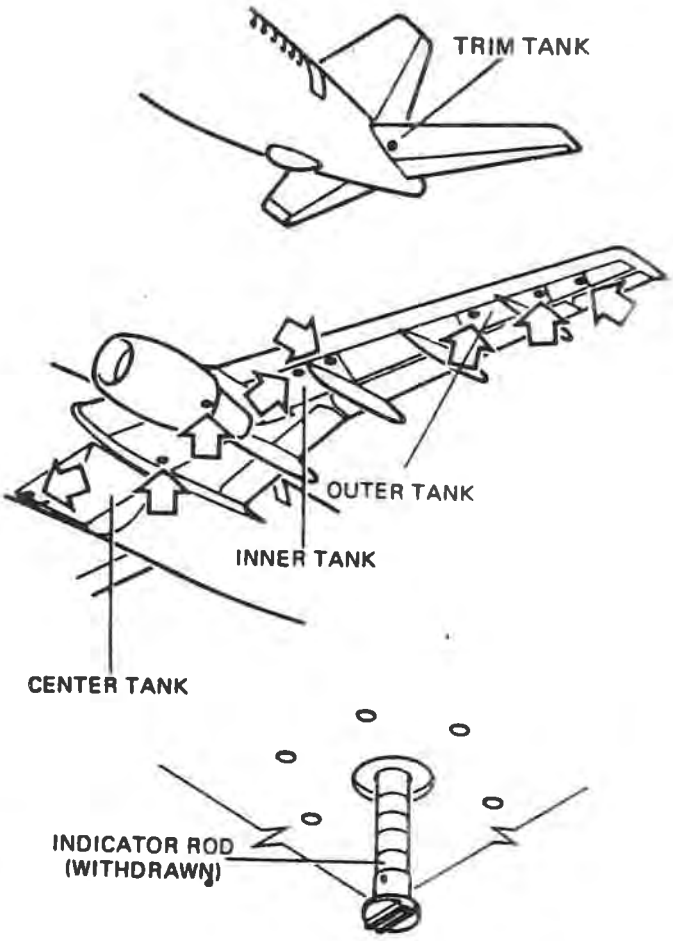
- Position access platform for access to overwing refueling caps and attach refueling hose grounding cable to grounding connection at overwing refueling cap. Remove overwing refueling cap.
- Commence filling, monitor quantity of fuel delivered on FQI, and observe the HIGH LEVEL indicator lights on refuelling panel.
  Stop filling when required fuel level is reached or when HIGH LEVEL indicator light(s) come on.
- Replenish center and trim tanks by transferring fuel from inner tanks. Complete replenishment of inner tanks.
- In the avionic compartment, on rack 92VU and computer 15QT (FQI FUEL GAGING AMPLI), press RECIRCULATION/MEMORY CLEAR pushbutton.
- Make an entry in aircraft technical log stating that, at first opportunity, the fuel recirculation procedures is to be performed.

Note : All displays on FUEL QTY indicators will show a dash for the least significant digit denoting degraded accuracy, until the fuel recirculation procedure has been performed, or pressure refueling of the inner right tank has occured.

4 - USE OF MANUAL (MAGNETIC) INDICATORS

Note : Indicators are disposed as follows :

- Three in each outer tank.
- four in each inner tank.
- one in center tank.
- one in trim tank (used only to check trim tank empty).



- Read and note attitude of aircraft pitch and roll axes on clinometers in main landing gear bay
- Position access platform
- Unlock indicator rod with screwdriver and slowly withdraw rod until magnetic attraction between rod and float magnets is felt.

Note : Do not use force when withdrawing indicator rod as this will disengage float magnet from rod magnet and bring rod down on to mechanical stop.

- Note the graduation on rod which aligns with wing bottom surface.
- Compare reading with fuel Quantity Chart, using fuel specific gravity and aircraft attitude readings noted previously.
- Replace indicator rod and lock with screwdriver.

Mod. : 4801

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II. Increase in loading flexibility by manual refuelling

The manual refuelling procedures given hereafter are applicable when the following conditions are met all together :

- Fuel planning does not require total fuel capacity (full trim tank capacity not necessary).
- Fuel planning requires more than 28 tons (both inner tanks full).

R - TOCG is outside the TO limit and therefore dispatch is not allowed.

In these conditions, the dispatch can become possible by filling partially the trim tank (even if the center tank is not full). First of all, using trim tank CG correction, determine how much fuel must be filled in trim tank to

R get the TOCG inside the TO limit.

Then apply one of the two procedures described hereafter :

a) First procedure
- Raise REFUEL/DEFUEL VALVE switch guards and place all switches in SHUT position.
- Place MODE SELECTOR switch in REFUEL position.
- Refuel OUTER and INNER TANKS by selecting corresponding REFUEL/DEFUEL VALVE switches in OPEN position and then in SHUT position when reaching high level.
- Place CTR and TRIM TK REFUEL/DEFUEL VALVE switches in OPEN position.
- Refuel CTR and TRIM TANKS. When reaching required fuel quantity, set corresponding REFUEL/DEFUEL VALVE switches in SHUT position.

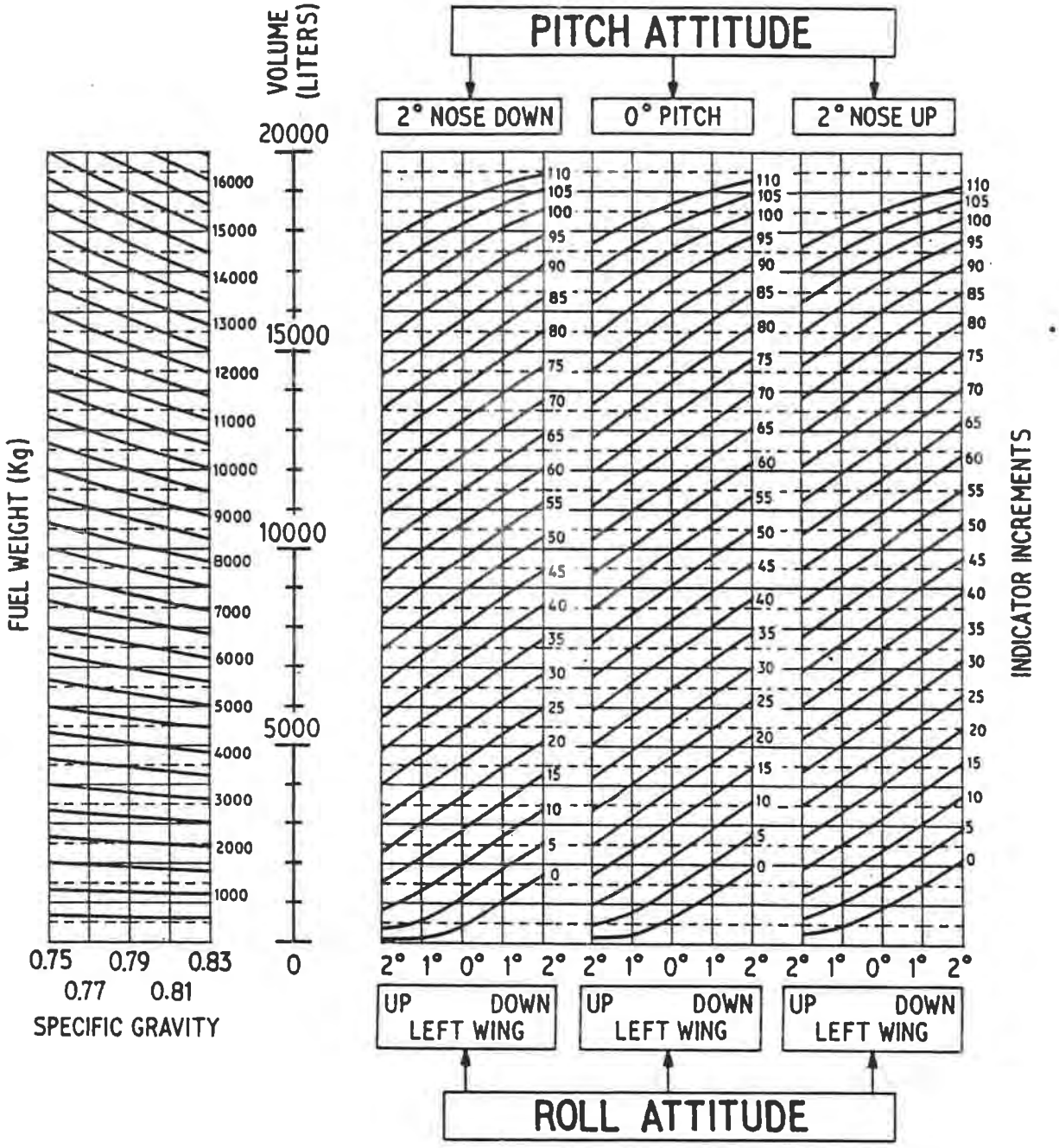
Note : Make sure that at least 500 kg of fuel goes through the cadensicon (Right Inner tank).

b) Second procedure
- Perform the refuelling as usually by selecting the required fuel quantity on the preselector.
- Transfer the required fuel quantity from center tank to trim tank as follow :
  - On overhead panel select both CTR TK PUMPS ON and select FUEL X-FEED valve IN LINE.
  - On refuel/defuel panel :
    - keep MODE selector on REFUEL position
    - set TRANSFER VALVE to OPEN position
    - raise TRIM TK REFUEL/DEFUEL VALVE switch guard
    - set TRIM TK REFUEL/DEFUEL VALVE switch to OPEN
    - when reaching required fuel quantity in trim tank, set REFUEL/DEFUEL VALVE switch to SHUT
    - set TRANSFER VALVE to CLOSED position
    - set MODE selector on OFF position
    - set TRIM TK REFUEL/DEFUEL VALVE switch to NORM
  - On overhead panel select both CTR TK PUMPS OFF and select FUEL X-FEED valve X-LINE.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	2.06.30
		PAGE 4
	FUEL LOADING	REV 04 OCT 83

SECONDARY FUEL GAUGING SYSTEM
- MANUAL (MAGNETIC) LEVEL INDICATORS CTR TANK



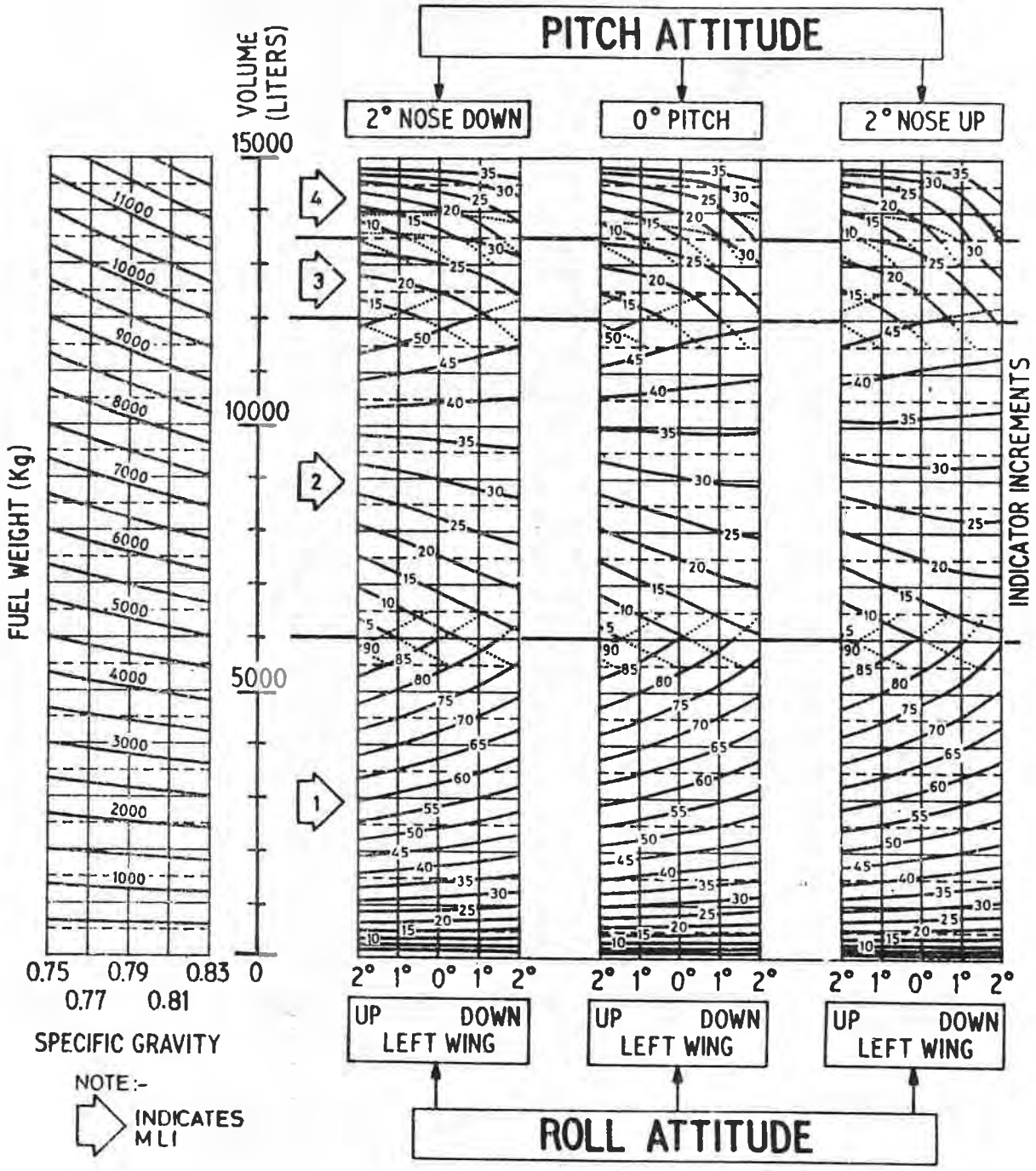
Vers. : All

Eng. : All

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AIRBUS INDUSTRIE A 340 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	N 2.06.30
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SECONDARY FUEL GAUGING SYSTEM – MANUAL (MAGNETIC) LEVEL INDICATORS INNER TANKS

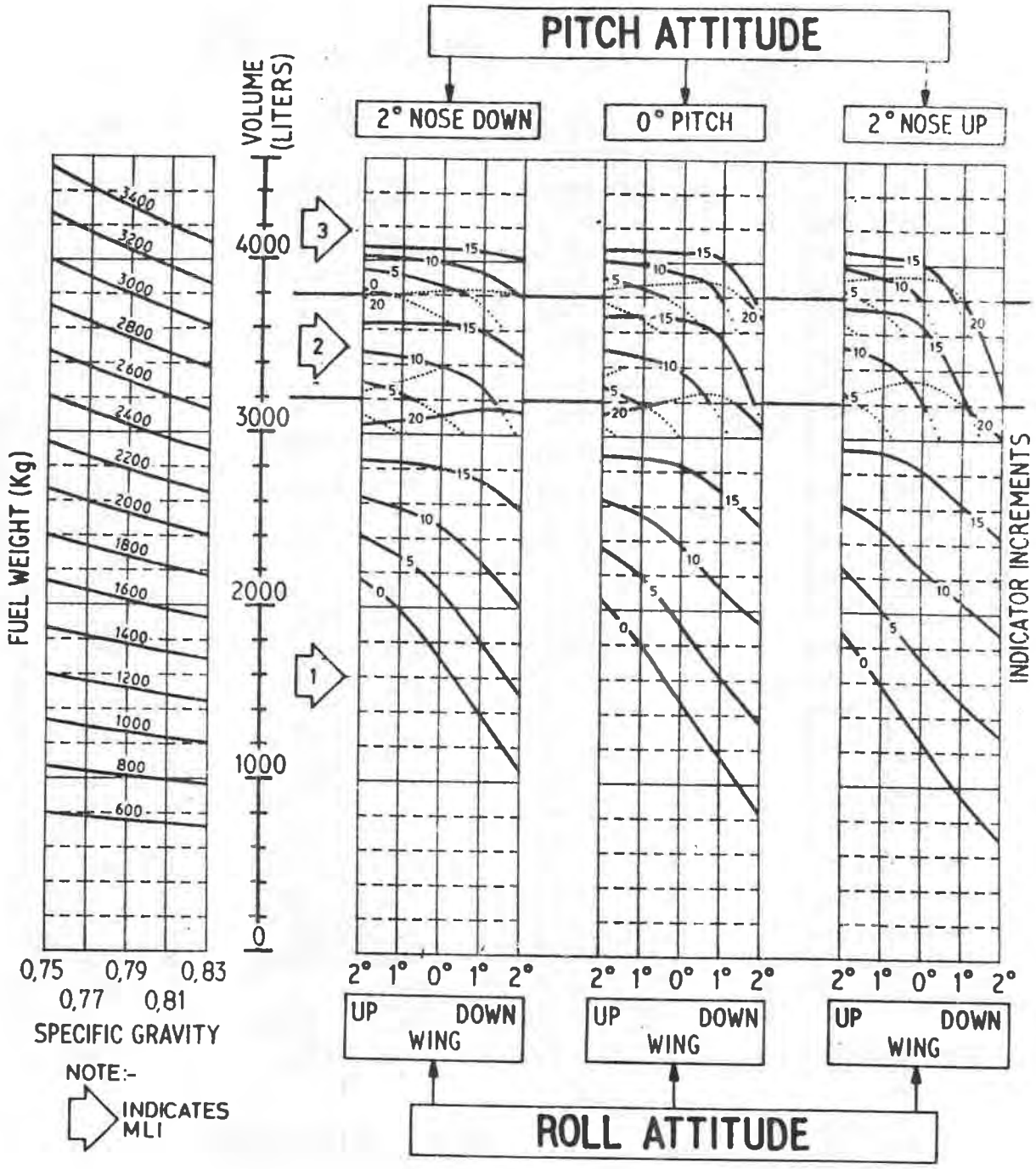


Vers. : All Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	N	2.06.30
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SECONDARY FUEL GAUGING SYSTEM
- MANUAL (MAGNETIC) LEVEL INDICATORS OUTER TANKS



Vers. : All

Eng. : All

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5 - DEFUELLING PROCEDURE

- Position platform for access to refuel/defuel couplings. Observe the safety precautions and make certain that tanker and aircraft are properly grounded. Connect tanker-to-aircraft grounding cable to grounding point on main landing gear.
- Set PWR SUPPLY switch to BAT if aircraft electrical network is to be powered by aircraft on board batteries, otherwise check that NORM position is selected.

DEFUELLING BY MEANS OF SUCTION

- Check TRANS VALVE is closed, the switch is guarded, OPEN light is off.
- Set the MODE SELECTOR switch to DEFUEL position.
- Set the REFUEL/DEFUEL VALVE switch of the tank to be defuelled to OPEN position.
- Start defuelling by applying suction.

DEFUELLING BY MEANS OF TANK PUMPS

- Check REFUEL/DEFUEL VALVE switches are at NORMAL position.
- Set the MODE SELECTOR switch to DEFUEL position.

a) Outer, inner and center tanks.

- Set the TRANSFER VALVE sw to OPEN position. Check to OPEN light is on.

On the overhead panel:

- Set the X-FEED switch to OPEN position (pressed-in, flowbar in line).
- In each tank to be defuelled set one or two PUMPS ON.
- Check the pumps of the tanks not to be defuelled are off.

Note: For inner tanks use only pump 2 of left tank and pump 1 of right tank.

b) Trim tank
On the overhead panel:
- Set one or two TRIM TK pumps ON.
- Check the pumps of the other tanks are off.

- After defuelling, reset overhead FUEL panel and REFUEL/DEFUEL panel to NORMAL configuration.

6 - FUEL TRANSFER PROCEDURE

. On the REFUEL/DEFUEL panel:

- Set the PWR SUPPLY switch to BAT if aircraft elecrical network is to be powered by aircraft on board batteries, otherwise, check that NORM position is selected.
- Set the MODE SELECTOR switch to REFUEL position.
- Set the REFUEL/DEFUEL VALVE switches of the tanks to be filled to OPEN position.
- Set the REFUEL/DEFUEL VALVE switches of the tanks not to be filled to SHUT.

a) Transfer from outer, inner or center tanks.

- Set the TRANSF VALVE switch to OPEN. Check the OPEN light is on.

. On the overhead FUEL panel:

- Set the X-FEED pb switch to OPEN (pressed in flowbar in line).
- Check the PUMPS of the tanks not to be defuelled are OFF.
- Set one or two PUMPS for each tank to be defuelled ON.

Note: For inner tank defuelling, use only pump 2 of left tank or/and pump 1 of right tank.

b) Transfer from trim tank.
On the overhead FUEL panel:
- Check the PUMPS of the tanks not to be defuelled are OFF.
- Set one or two TRIM TK PUMPS ON.

After fuel transfer, reset overhead FUEL panel and REFUEL/DEFUEL panel to NORMAL configuration.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING/FUEL/LOAD & TRIM SHEET	2.06.40
		PAGE 1
	WEIGHT & BALANCE	17.01.1990

BALANCE- CHART

The balance-chart (see 2.06.40 p.2) allows the determination of the CG-location(MAC) of the aircraft function of dry-operating-weight, pantry adjustments, cargo-load, passengers and fuel on board. It must be checked, that ZFCG and TOCG are within the corresponding limits.

CAUTION

The CG-limits of the INTERFLUG-Balance-Chart are the certified limits of the aircraft ,which must **not be exceeded.**

UTILISATION

1.Computation of the basic-index:

Take the corresponding value from the table 2.2.1/1(BDH-310) or compute the basic-index using the formulae:

$$BI = [(MAC_{BW} - 25)\cdot BW_{[t]}\cdot 0{,}029]+80$$

2.Computation of the dry operating-index/weight:

For computation of actual dry operating index/weight use the table "DOI/DOW COMPUTATION"(back of balance-chart - see 2.06.40 p.3).

Example 1

(DOI/DOW-computation)

Conditions:

BI	83,7	
BW	79125 kg	
crew	cockpit	2 persons
	purser station	2 persons
	fwd door	1 person
	emergency exit	2 persons
	galley 6/7	2 persons
water	200 kg	
galley	G 1 1000 kg	
	G1C 500 kg	
	G6/7 1000 kg	

Computation (see 2.06.40 p.3)

Results:

Dry-operating-index/weight: 78,3 / 82040 kg

3.Computation of CG-location:

Example 2

Conditions:

DOI	78,3	
DOW		82040 kg
cargo	1	1000 kg
	2	1000 kg
	4	1000 kg
	5	1000 kg
passengers	10 (CPT A)	750 kg
	50 (CPT B)	3750 kg
ZFW		94290 kg
fuel(density=0,8)		54000 kg
TOW		148290 kg

Computation (see balance-chart 2.06.40 p.2):

a)Enter index-scale with 78,3(1)and apply corresponding index variations according to cargo and passenger loading through the scales of cabin-compartments and cargo-holds. Draw from the final point (cabin C) a vertical line down to the zero-fuel-weight of 94290 kg(2).Read corresponding LIZFW = 84,5.

b)Check that the intersection is within the corresponding ZFW limit. If not it is necessary to rearrange loading.

c)With the table "FUEL INDEX CORRECTION" (back of balance-chart/2.06.40 p.3) determine fuel index correction +39 and apply corresponding correction on fuel-index-correction scale to determine intersection of TOW-line and TOW-index(3).Read TOI = 123,5 and corresponding TOMAC = 35,2 %. Check that the intersection is in the corresponding TO-limit.

d)With TOMAC = 35,2 % determine in the corresponding scale "PITCH-TRIM" of 1,5 DOWN (4).

Example 3

Conditions:

DOI	78,3	
DOW	82040 kg	
pantry weight deviation:	zone E:	-500 kg
	zone G:	+500 kg

Using the table on top of the balance-chart for corrections in case of pantry-weight-deviations (see 2.06.40 p.4) compute corrected DOI/DOW:

corrected DOI	85,8	
corrected DOW		82040 kg
cargo	1	2500 kg
	2	1000 kg
	4	0 kg
	5	0 kg
passengers	35 (CPT A)	2625 kg
	75 (CPT B)	5625 kg
ZFW		93790 kg
fuel(density=0,8)		17000 kg
TOW		110790 kg

Computation (see balance-chart 2.06.40 p.4):

Proceed as described in example 2 up to take off weight index determination. In this example the TOCG is out of take off limit (1) . It is possible to get it inside the limit by filling partially the trim tank. If refuelling is already performed, apply a manual refuelling procedure to transfer 400 kg from center tank to trim tank (2).Read corresponding TOMAC = 18,3 % (3) and determine the corresponding scale "PITCH-TRIM" of 2,9 UP (4).

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AIRBUS INDUSTRIE
A 310
FLIGHT CREW OPERATING MANUAL

LOADING / FUEL / LOAD & TRIM SHEET

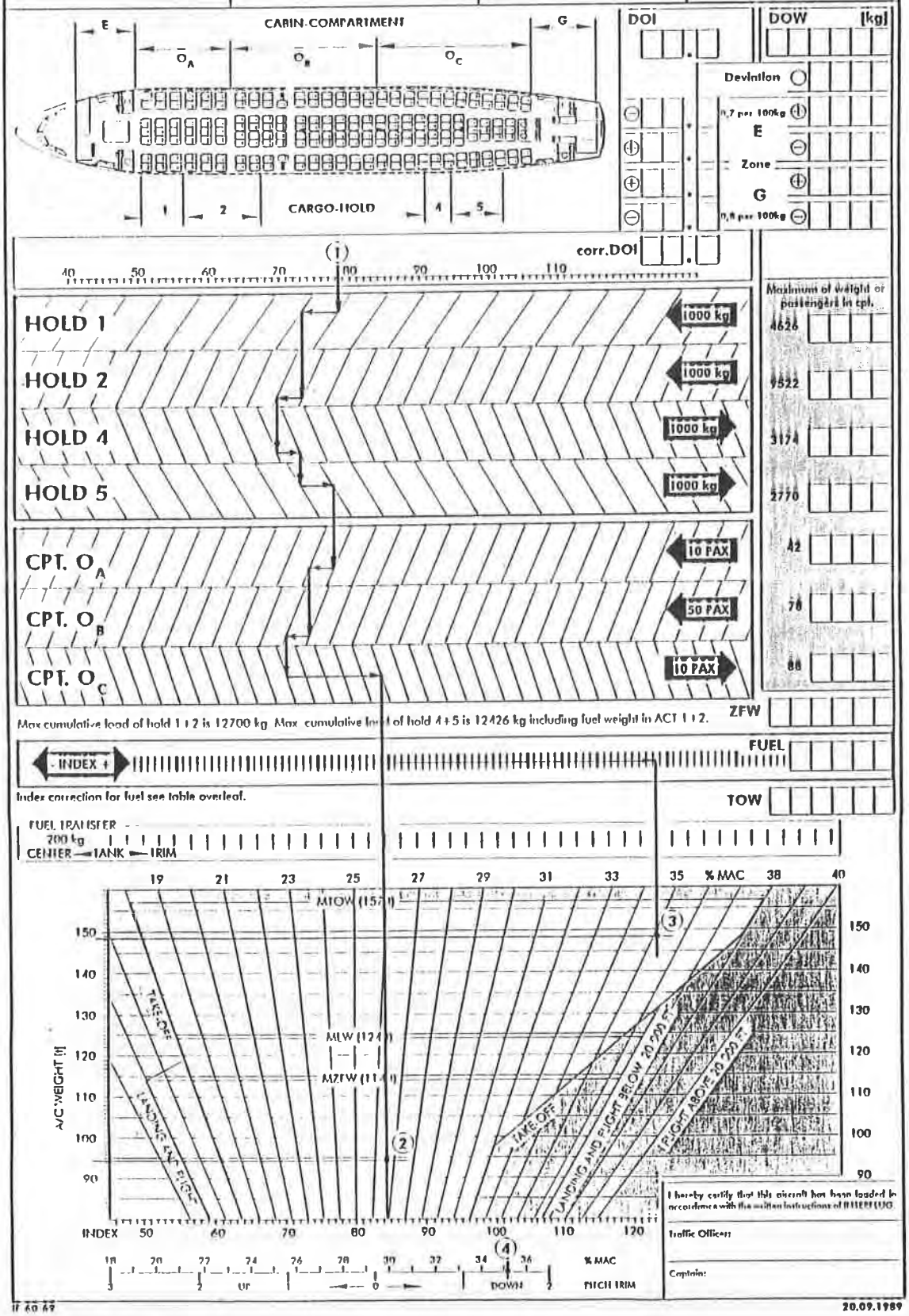
WEIGHT & BALANCE

2.06.40
PAGE 2
17.01.1990

INTERFLUG BALANCE-CHART N° 60

A310-304
Version: 42C / 166M

DATE: | FL.N°: | A/C: DDR-AB | STN:



IF 60 69

20.09.1989

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LOADING / FUEL / LOAD & TRIM SHEET	2.06.40
		PAGE 3
	WEIGHT & BALANCE	17.01.1990

DOI/DOW-COMPUTATION

ITEM			MAX.WEIGHT PER IT. [KG]	BI/BW INCLUDES	INDEX-INFLUENCE PER KG	INDEX-INFLUENCE PER ITEM	INDEX-CORR. +	INDEX-CORR. −	WEIGHT-CORR. +	WEIGHT-CORR. −
COCKP. CREW	PILOT		80	—	-0,00890	-1,424/2 PERS.		1,424	160	
	MEMBER 3				-0,00855	-0,684/1 PERS.				
	MEMBER 4				-0,00829	-0,663/1 PERS.				
POTABLE WATER			400	400 KG	-0,00222	+0,222/-100 KG	0,444			200
C/A	PURSER STATION		65		-0,00749	-0,487/1 PERS.		0,974	130	
	FWD DOOR				-0,00695	-0,452/1 PERS.		0,452	65	
	EMERGENCY EXIT				-0,00164	-0,107/1 PERS.		0,214	130	
	GALLEY 6A/7A				+0,00704	+0,458/1 PERS.	0,916		130	
GALLEY STRUCTURE & PROVIANT	G1	E	1040	—	-0,00798	-0,7/100 KG		7.98	1000	
	G1C		800		-0,00704			3,52	500	
	G10		436		-0,00663					
	G6+6A	G	1315		+0,00781	+0,8/100 KG	7.81		1000	
	G7+7A									
ADDITIONAL CABIN STOWAGE CPTS.	FWD		227		-0,00794					
	AFT		58		+0,00854					
						Σ	9,17	-14,564	3115	-200
						INDEX/WEIGHT-CORRECTION:	-5,394		2915	
						BASIC-INDEX/WEIGHT:	83,7		79125	
						DRY OPERATING INDEX/WEIGHT:	78,3		82040	

FUEL INDEX TABLE

W[t]	corr.	W[t]	corr.	W[t]	correction						W[t]	correction					
					FUEL-DENSITY[kg/l]												
	0,785				0,780	0,785	0,790	0,795	0,800	0,810		0,780	0,785	0,790	0,795	0,800	0,810
1	+1,0	21	+0,4	41,0	-13,2	-13,0	-12,8	-12,5	-12,3	-11,9	51,0	+20,3	+17,0	+13,7	+10,4	+7,1	+0,6
2	+2,4	22	+0,3	41,5	-13,8	-13,6	-13,3	-13,1	-12,9	-12,5	51,5	+25,6	+22,3	+19,0	+15,7	+12,4	+5,8
3	+4,0	23	+0,1	42,0	-14,5	-14,2	-14,0	-13,7	-13,5	-13,0	52,0	+30,9	+27,6	+24,2	+20,9	+17,6	+11,0
4	+5,7	24	+0,1	42,5	-15,2	-14,9	-14,6	-14,4	-14,1	-13,6	52,5	+33,9	+32,9	+29,5	+26,2	+22,9	+16,3
5	+7,8	25	+0,3	43,0	-15,5	-15,7	-15,4	-15,1	-14,8	-14,2	53,0	+41,9	+38,4	+34,9	+31,5	+28,1	+21,5
6	+9,5	26	+0,5	43,5	-14,7	-15,2	-15,8	-15,8	-15,5	-14,9	53,5	+45,6	+44,1	+40,5	+36,9	+33,5	+26,2
7	+8,6	27	+0,9	44,0	-13,8	-14,4	-14,9	-15,5	-16,1	-15,6	54,0	+46,8	+46,3	+45,7	+42,5	+39,0	+32,1
8	+7,8	28	+0,8	44,5	-12,9	-13,5	-14,1	-14,6	-15,2	-16,3	54,5	+48,1	+47,6	+47,0	+46,4	+44,6	+37,5
9	+6,9	29	-0,2	45,0	-12,0	-12,6	-13,2	-13,8	-14,4	-15,5	55,0	+49,4	+48,8	+48,2	+47,6	+47,1	+43,1
10	+6,2	30	-1,2	45,5	-11,2	-11,7	-12,3	-12,9	-13,5	-14,7	55,5	+50,7	+50,1	+49,5	+48,9	+48,4	+47,2
11	+5,5	31	-2,3	46,0	-10,3	-10,9	-11,5	-12,0	-12,6	-13,8	56,0	+51,9	+51,3	+50,7	+50,2	+49,6	+48,4
12	+4,8	32	-3,3	46,5	-9,4	-10,0	-10,6	-11,2	-11,7	-12,9	56,5	+53,2	+52,6	+52,0	+51,5	+50,9	+49,7
13	+4,2	33	-4,4	47,0	-8,6	-9,1	-9,7	-10,3	-10,9	-12,0	57,0	+54,4	+53,8	+53,3	+52,7	+52,1	+51,0
14	+3,6	34	-5,5	47,5	-7,7	-8,3	-8,8	-9,4	-10,0	-11,2	57,5	+55,7	+55,2	+54,6	+54,0	+53,4	+52,3
15	+3,0	35	-6,5	48,0	-6,8	-7,4	-8,0	-8,6	-9,1	-10,3	58,0	+56,9	+56,4	+55,8	+55,2	+54,8	+53,5
16	+2,4	36	-7,6	48,5	-4,4	-6,5	-7,1	-7,7	-8,3	-9,4	58,5	+58,3	+57,7	+57,1	+56,5	+56,0	+54,8
17	+2,0	37	-8,7	49,0	-0,6	-3,8	-6,2	-6,8	-7,4	-8,5	59,0		+58,9	+58,3	+57,7	+57,2	+56,0
18	+1,5	38	-9,7	49,5	+4,6	+1,4	-1,9	-5,1	-6,5	-7,7	59,5			+59,6	+59,1	+58,5	+57,3
19	+1,1	39	-10,8	50,0	+9,8	+6,5	+3,3	0,0	-3,2	-6,8	60,0				+60,3	+59,7	+58,5
20	+0,7	40	-11,9	50,5	+15,1	+11,8	+8,5	+5,2	+2,0	-4,5	60,5						+59,8
											61,0						+61,1

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AIRBUS INDUSTRIE
A 310
FLIGHT CREW OPERATING MANUAL

LOADING/FUEL/LOAD & TRIM SHEET

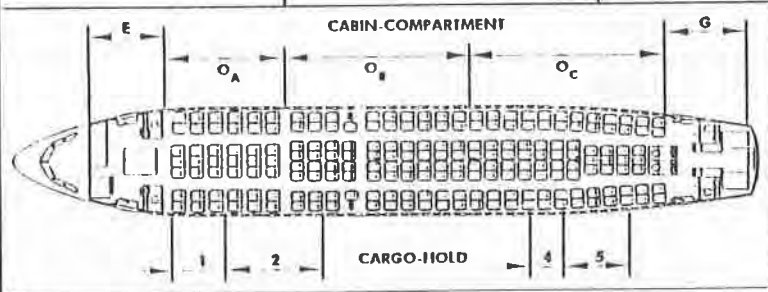
WEIGHT & BALANCE

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INTERFLUG BALANCE-CHART N° 60

A310-304
Version: 42C / 166M

DATE: | FL.N°: | A/C: DDR-AB | STN:



DOI 78.3

DOW [kg] 82040

Deviation

⊖		0,7 per 100kg ⊕	
⊕	3.5	E	⊖ 500
⊕	4.0	Zone	⊕ 500
⊖		G	0,8 per 100kg ⊖

corr.DOI 85.8

40 50 60 70 80 90 100 110

Maximum of weight or passengers in cpt.

HOLD 1	1000 kg	4626
HOLD 2	1000 kg	9522
HOLD 4	1000 kg	3174
HOLD 5	1000 kg	2770
CPT. O_A	10 PAX	42
CPT. O_B	50 PAX	76
CPT. O_C	10 PAX	88

ZFW

Max cumulative load of hold 1 + 2 is 12700 kg. Max. cumulative load of hold 4 + 5 is 12426 kg including fuel weight in ACT 1 + 2.

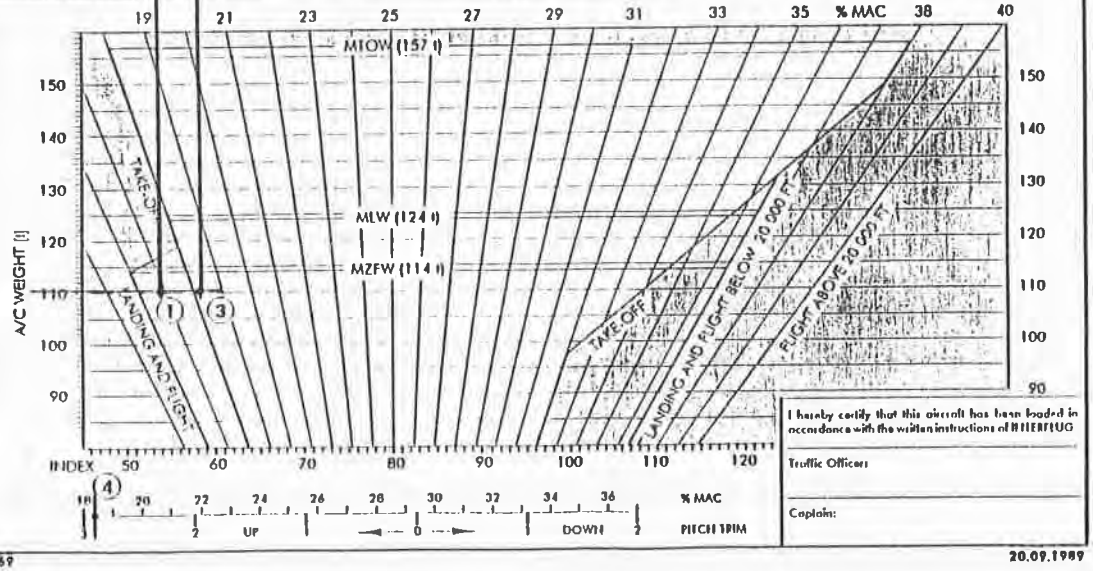
FUEL

- INDEX +

Index correction for fuel see table overleaf.

TOW

FUEL TRANSFER
200 kg
CENTER ◄ TANK ► TRIM



I hereby certify that this aircraft has been loaded in accordance with the written instructions of INTERFLUG

Traffic Officer:

Captain:

IF 60.69

20.09.1989

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA	N	2.08.00
		PAGE 1/2	
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2.08.10 OPERATING DATA **Pages**

Mach – Z – IAS – TAS – SAT – TAT 1

International Standard Atmosphere (ISA) 2

QNH And True Altitude → QFE And Pressure Altitude. 3

True Altitude → Pressure Altitude (Function of SAT). 4

Conversion Meters → Feet 5

Conversion Feet → Meters 6

Differential Pressure Versus Aircraft Altitude And Cabin Altitude 7

Conversion QFEMB – IN HG – Press. Alt. FT 8

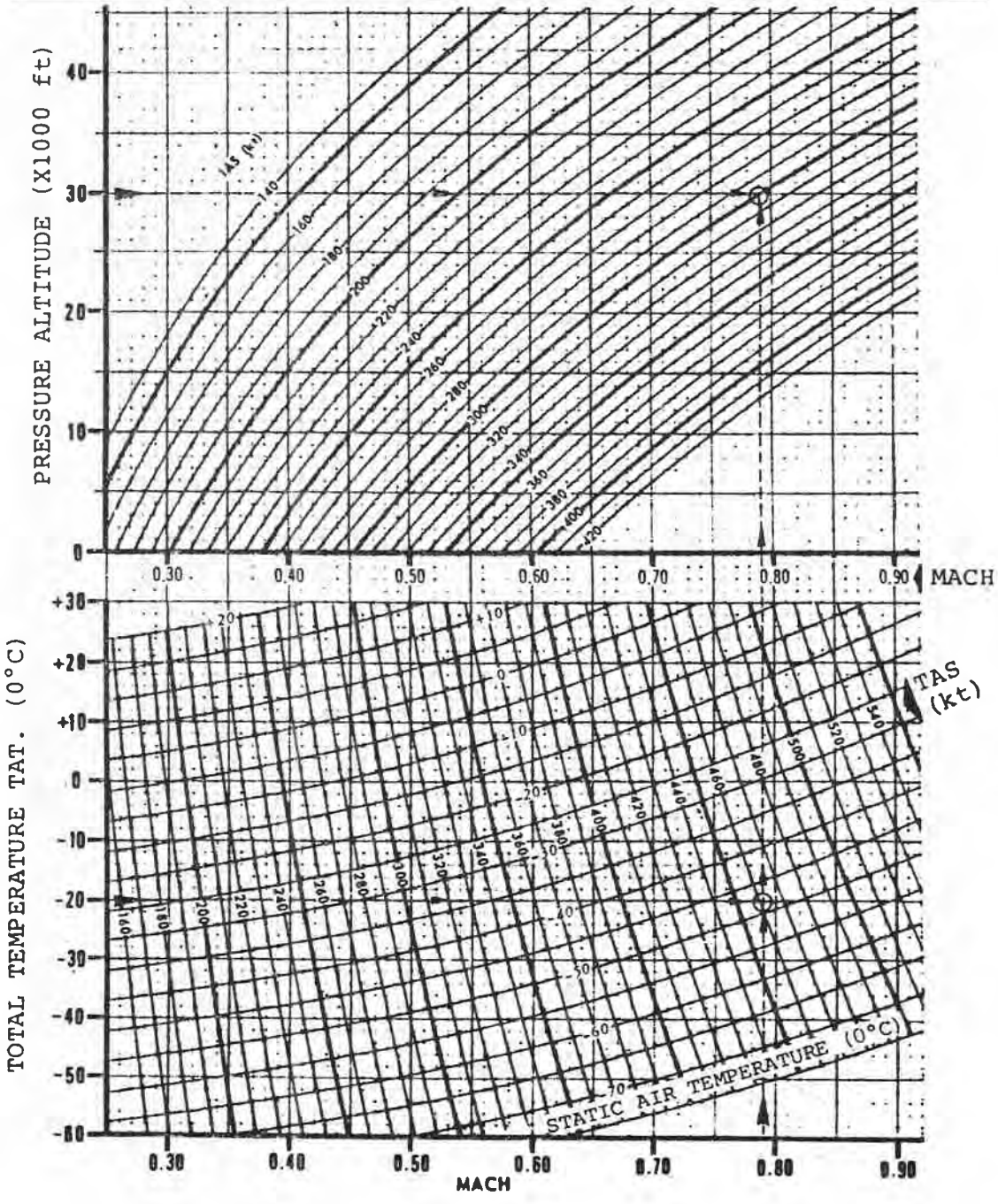
TAT Versus SAT and Mach Number 9/10

Vers. : All Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA MACH – Z – IAS – TAS – SAT – TAT	N	2.08.10
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DATA		RESULTS	
PRESSURE ALTITUDE	30,000 ft	IAS	300 kt
MACH	.790	STATIC AIR TEMPERATURE (SAT)	- 48 °C
Total temperature	- 20 °C	TRUE AIRSPEED (TAS)	462 kt



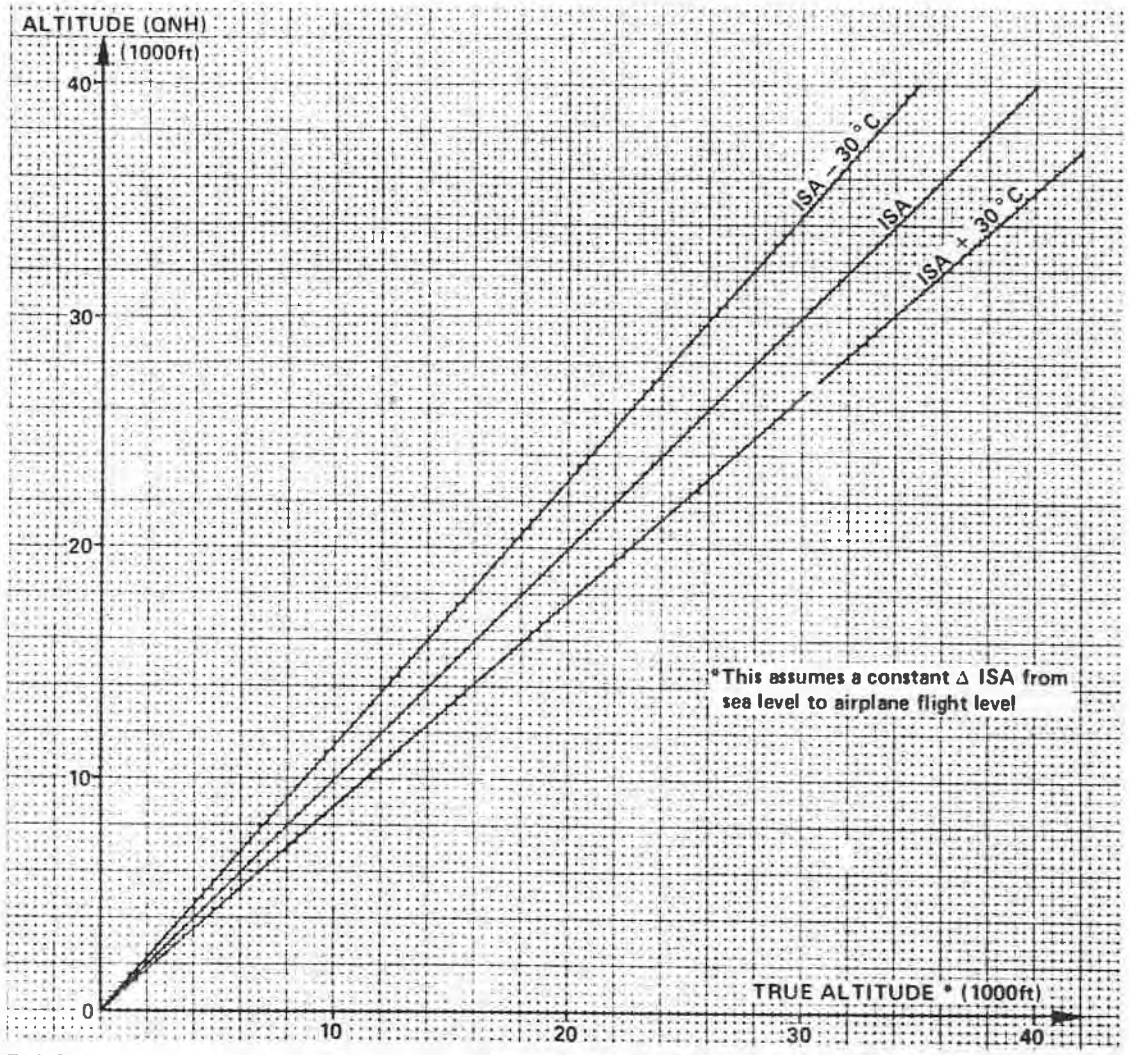
Vers. : All

Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA ALTITUDE TEMPERATURE CORRECTION (FUNCTION OF SAT)	2.08.10	
		PAGE 4	
		REV 14	SEQ 001

FOR HIGH ALTITUDE USE



FOR LOW ALTITUDE USE

ALTITUDE QNH MINUS TERRAIN ELEVATION (ft) →		Δ Z CORRECTION (ft)					
		500	1000	1500	2000	2500	3000
Δ ISA	— 10 °C	— 17	— 34	— 51	— 68	— 85	— 102
	— 20 °C	— 35	— 70	— 105	— 140	— 175	— 210
	— 30 °C	— 52	— 104	— 156	— 208	— 260	— 312
	— 40 °C	— 70	— 140	— 210	— 280	— 350	— 420

CORRECTED (TRUE) ALTITUDE = QNH ALTITUDE + Δ Z

Note : A constant Δ ISA from ground to airplane level has been assumed.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA CONVERSION METERS → FEET	N 2.08.10 PAGE 5 REV 04 OCT 83

DATA	RESULT
	2,200 m : 7217.8 ft
2,211 m	11 m : + 36.09 ft
	2,211 m : 7253.89 ft

Multiply	by	to get
m	3.281	ft

m	0	1	2	3	4	5	6	7	8	9
0	0.	3.28	6.56	9.84	13.12	16.40	19.68	22.97	26.25	29.53
10	32.81	36.09	39.37	42.65	45.93	49.21	52.49	55.77	59.05	62.34
20	65.62	68.90	72.18	75.46	78.74	82.02	85.30	88.58	91.86	95.14
30	98.42	101.70	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.79	141.07	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.16	180.44	183.72	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.53	219.81	223.09	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.90	259.18
80	262.46	265.74	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.27	298.55	301.83	305.11	308.40	311.96	314.96	318.24	321.52	324.80
	0	10	20	30	40	50	60	70	80	90
100	328.08	360.89	393.70	426.50	459.31	492.12	524.93	557.74	590.54	623.35
200	656.16	688.97	721.78	754.58	787.39	820.20	853.01	885.52	918.62	951.43
300	984.24	1017.0	1049.9	1082.7	1115.5	1148.3	1181.1	1213.9	1246.7	1279.5
400	1312.3	1345.1	1377.9	1410.7	1443.6	1476.4	1509.2	1542.0	1574.8	1607.6
500	1640.4	1673.2	1706.0	1738.8	1771.6	1804.4	1837.2	1870.1	1902.9	1935.7
600	1968.5	2001.3	2034.1	2066.9	2099.7	2132.5	2165.3	2198.1	2230.9	2263.8
700	2296.6	2329.4	2362.2	2395.0	2427.8	2460.6	2493.4	2526.2	2559.0	2591.8
800	2624.6	2657.4	2690.3	2723.1	2755.9	2788.7	2821.5	2854.3	2887.1	2919.9
900	2952.7	2985.5	3018.3	3051.1	3084.0	3116.8	3149.6	3182.4	3215.2	3248.0
	0	100	200	300	400	500	600	700	800	900
1000	3280.0	3608.9	3937.0	4265.0	4593.1	4921.2	5249.3	5577.4	5905.4	6233.5
2000	6561.6	6889.7	7217.8	7545.8	7873.9	8202.0	8530.1	8858.2	9186.2	9514.3
3000	9842.4	10170	10499	10827	11155	11483	11811	12139	12467	12795
4000	13123	13451	13779	14107	14436	14764	15092	15420	15748	16076
5000	16404	16732	17060	17388	17716	18044	18372	18701	19029	19357
6000	19685	20013	20341	20669	20997	21325	21653	21981	22309	22638
7000	22966	23294	23622	23950	24278	24606	24934	25262	25590	25918
8000	26246	26574	26903	27231	27559	27887	28215	28543	28871	29199
9000	29527	29855	30183	30511	30840	31168	31496	31824	32152	32480

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL

OPERATING DATA

CONVERSION FEET → METERS

N	2.08.10
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DATA	RESULT
	400 ft : 121.92 m
403 ft	3 ft : + 0.91 m
	403 ft : 122.83 m

Multiply	by	to get
ft	0.3048	m

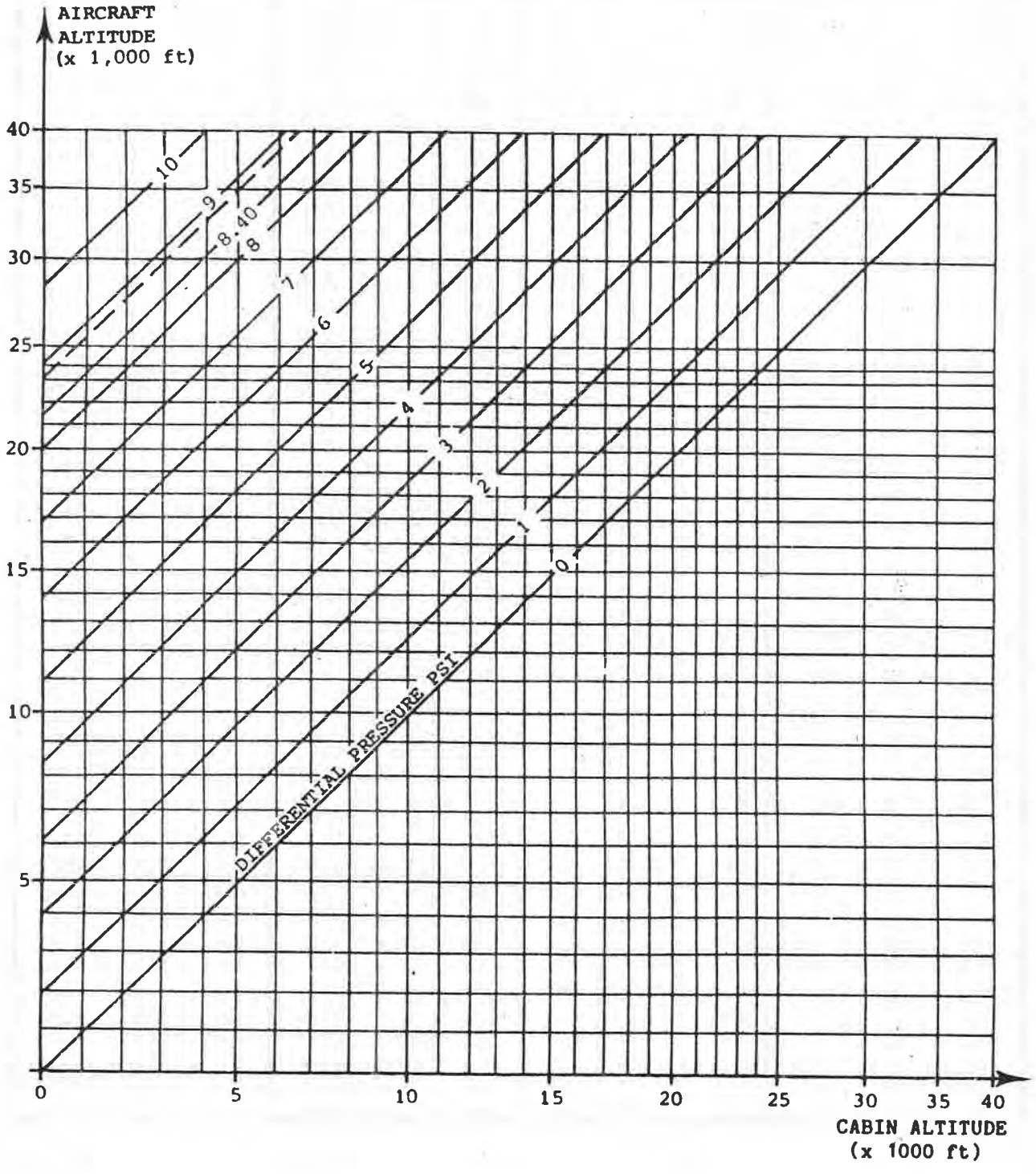
ft	0	1	2	3	4	5	6	7	8	9
0	0	0.30	0.61	0.91	1.22	1.52	1.83	2.13	2.44	2.74
10	3.05	3.35	3.66	3.96	4.27	4.57	4.88	5.18	5.49	5.79
20	6.10	6.40	6.71	7.01	7.32	7.62	7.92	8.23	8.53	8.84
30	9.14	9.45	9.75	10.06	10.36	10.67	10.97	11.28	11.58	11.89
40	12.19	12.50	12.80	13.11	13.41	13.72	14.02	14.33	14.63	14.94
50	15.24	15.54	15.85	16.15	16.46	16.76	17.07	17.37	17.68	17.98
60	18.29	18.59	18.90	19.20	19.51	19.81	20.12	20.42	20.73	21.03
70	21.34	21.64	21.95	22.25	22.56	22.86	23.16	23.47	23.77	24.08
80	24.38	24.69	24.99	25.30	25.60	25.91	26.21	26.52	26.82	27.13
90	27.43	27.74	28.04	28.35	28.65	28.96	29.26	29.57	29.87	30.18
	0	10	20	30	40	50	60	70	80	90
100	30.48	33.53	36.58	39.62	42.67	45.72	48.77	51.82	54.86	57.91
200	60.96	64.01	67.06	70.10	73.15	76.20	79.25	82.30	85.34	88.39
300	91.44	94.49	97.54	100.53	103.63	106.68	109.73	112.78	115.82	118.87
400	121.92	124.97	128.02	131.06	134.11	137.16	140.21	143.26	146.30	149.35
500	152.40	155.45	158.50	161.54	164.59	167.64	170.69	173.74	176.78	179.83
600	182.88	185.93	188.98	192.02	195.07	198.12	201.17	204.22	207.26	210.31
700	213.36	216.41	219.46	222.50	222.55	228.60	231.65	234.70	237.74	240.79
800	243.84	246.89	249.94	252.98	256.03	259.08	262.13	265.18	268.22	271.27
900	274.32	277.37	280.42	283.46	286.51	289.56	292.61	295.66	298.70	301.75
	0	100	200	300	400	500	600	700	800	900
1000	304.80	335.28	365.76	396.24	426.72	457.20	487.68	518.16	548.64	579.12
2000	609.60	640.08	670.56	701.04	731.52	762.00	792.48	822.96	853.44	883.92
3000	914.40	944.88	975.36	1005.8	1036.3	1066.8	1097.3	1127.8	1158.2	1188.7
4000	1219.2	1249.7	1280.2	1310.6	1341.1	1371.6	1402.1	1432.6	1463.0	1493.5
5000	1524.0	1554.5	1585.0	1615.4	1645.9	1676.4	1706.9	1737.4	1767.8	1798.3
6000	1828.8	1859.3	1889.8	1902.2	1950.7	1981.2	2011.7	2042.2	2072.6	2103.1
7000	2133.6	2164.1	2194.6	2225.0	2255.5	2286.0	2316.5	2347.0	2377.6	2407.9
8000	2438.4	2468.9	2499.4	2529.8	2560.3	2590.8	2621.3	2651.8	2682.2	2712.7
9000	2743.2	2773.7	2804.2	2834.6	2865.1	2895.6	2926.1	2956.6	2987.0	3017.5
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	3048.0	3352.8	3657.6	3962.4	4267.2	4572.0	4876.8	5181.6	5486.4	5791.2
20000	6096.0	6400.8	6705.6	7010.4	7315.2	7620.0	7924.8	8229.6	8534.4	8839.2
30000	9144.0	9448.8	9753.6	10058	10363	10668	10973	11278	11582	11887
40000	12192	12497	12802	13106	13411	13716	14021	14326	14630	14935
50000	15240	15545	15850	16154	16459	16764	17069	17374	17678	17983

Vers. : All Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA DIFFERENTIAL PRESSURE VERSUS AIRCRAFT ALTITUDE AND CABIN ALTITUDE	N · 2.08.10 PAGE 7 REV 04 · OCT 83

positive differential pressure limitation 8.40 PSI
safety relief, max differential pressure 8.85 PSI



Vers. : All

Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	OPERATING DATA CONVERSION QFE MB – IN HG – PRESS. ALT. FT.	N 2.08.10 PAGE 8 REV 04 OCT 83

QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft	QFE mb	in.HG	PRESS. ALT. ft
1050	31.01	-989									
1048	30.95	-936	958	28.29	1543	868	25.63	4219	778	22.97	7131
1046	30.89	-883	956	28.23	1601	866	25.57	4281	776	22.92	7199
1044	30.83	-830	954	28.17	1658	864	25.51	4343	774	22.86	7267
1042	30.77	-776	952	28.11	1715	862	25.45	4405	772	22.80	7335
1040	30.71	-723	950	28.05	1773	860	25.40	4468	770	22.74	7402
1038	30.65	-669	948	27.99	1831	858	25.34	4531	768	22.68	7470
1036	30.59	-615	946	27.94	1889	856	25.28	4593	766	22.62	7538
1034	30.53	-562	944	27.88	1947	854	25.22	4656	764	22.56	7607
1032	30.47	-508	942	27.82	2005	852	25.16	4718	762	22.50	7676
1030	30.42	-454	940	27.76	2062	850	25.10	4781	760	22.44	7745
1028	30.36	-400	938	27.70	2120	848	25.04	4844	758	22.38	7815
1026	30.30	-346	936	27.64	2178	846	24.98	4907	756	22.32	7885
1024	30.24	-292	934	27.58	2236	844	24.92	4970	754	22.27	7955
1022	30.18	-238	932	27.52	2294	842	24.86	5033	752	22.21	8025
1020	30.12	-184	930	27.46	2353	840	24.81	5097	770	22.15	8095
1018	30.06	-129	928	27.40	2412	838	24.75	5161	748	22.09	8161
1016	30.00	-74	926	27.34	2471	836	24.69	5225	746	22.03	8231
1014	29.94	-20	924	27.29	2530	834	24.63	5289	744	21.97	8301
1012	29.88	34	922	27.23	2589	832	24.57	5353	742	21.91	8371
1010	29.83	89	920	27.17	2647	830	24.51	5417	740	21.85	8442
1008	29.77	144	918	27.11	2707	828	24.45	5481	738	21.79	8512
1006	29.71	199	916	27.05	2767	826	24.39	5545	736	21.73	8583
1004	29.65	254	914	26.99	2826	824	24.33	5610	734	21.68	8654
1002	29.59	309	912	26.93	2885	822	24.27	5675	732	21.62	8725
1000	29.53	364	910	26.87	2944	820	24.21	5740	730	21.56	8796
998	29.47	419	908	26.81	3004	818	24.16	5805	728	21.50	8867
996	29.41	475	906	26.75	3064	816	24.10	5870	726	21.44	8939
994	29.35	530	904	26.70	3124	814	24.04	5935	724	21.38	9010
992	29.29	586	902	26.64	3183	812	23.98	6000	722	21.32	9082
990	29.23	641	900	26.58	3243	810	23.92	6065	720	21.26	9154
988	29.18	697	898	26.52	3303	808	23.86	6131	718	21.20	9226
986	29.12	753	896	26.46	3363	806	23.80	6197	716	21.14	9298
984	29.06	809	894	26.40	3424	804	23.74	6263	714	21.08	9371
982	29.00	865	892	26.34	3484	802	23.68	6329	712	21.03	9443
980	28.94	921	890	26.28	3545	800	23.62	6394	710	20.97	9516
978	28.88	977	888	26.22	3606	798	23.56	6461	708	20.91	9589
976	28.82	1033	886	26.16	3667	796	23.51	6528	706	20.85	9662
974	28.76	1089	884	26.10	3728	794	23.45	6595	704	20.79	9735
972	28.70	1145	882	26.05	3789	792	23.39	6661	702	20.73	9809
970	28.64	1202	880	25.99	3850	790	23.33	6727	700	20.67	9882
968	28.59	1259	878	25.93	3911	788	23.27	6794	698	20.61	9956
966	28.53	1316	876	25.87	3973	786	23.21	6861	696	20.55	10030
964	28.47	1373	874	25.81	4034	784	23.15	6928	694	20.49	10104
962	28.41	1430	872	25.75	4096	782	23.09	6995	692	20.43	10179
960	28.35	1486	870	25.69	4157	780	23.03	7063	690	20.38	10253

Vers. : All Eng. : All

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AIRBUS INDUSTRIE
A 310
FLIGHT CREW OPERATING MANUAL

OPERATING DATA

TAT VERSUS SAT AND MACH NUMBER

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SAT / M	55	50	45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	55
.20	-53	-48	-43	-38	-33	-28	-23	-18	-13	-8	-3	2	7	12	17	22	27	32	37	43	48	53	58
.25	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	14	19	24	29	34	39	44	49	54	59
.30	-51	-46	-41	-36	-31	-26	-21	-15	-10	-5	0	5	10	15	20	25	30	35	41	46	51	56	61
.35	-50	-45	-39	-34	-29	-24	-19	-14	-9	-4	2	7	12	17	22	27	32	37	43	48	53	58	63
.40	-48	-43	-38	-33	-27	-22	-17	-12	-7	-2	4	9	14	19	24	29	35	40	45	50	55	60	66
.45	-46	-41	-36	-31	-25	-20	-15	-10	-5	1	6	11	16	21	27	32	37	42	47	53	58	63	68
.50	-44	-39	-34	-28	-23	-18	-13	-7	-2	3	8	14	19	24	29	35	40	45	50	56	61	66	71
.53	-43	-38	-33	-27	-22	-17	-12	-6	-1	4	10	15	20	25	31	36	41	46	52	57	62	67	73
.54	-42	-37	-32	-26	-21	-16	-11	-5	0	5	11	16	21	27	32	37	42	48	53	58	64	69	74
.56	-41	-36	-31	-25	-20	-15	-9	-4	1	7	12	17	22	28	33	38	44	49	54	60	65	70	76
.58	-40	-35	-30	-24	-19	-14	-8	-3	2	8	13	18	24	29	34	40	45	50	56	61	66	72	77
.60	-39	-34	-29	-23	-18	-12	-7	-2	4	9	14	20	25	30	36	41	46	52	57	63	68	73	79
.62	-38	-33	-27	-22	-17	-11	-6	-1	5	10	16	21	26	32	37	43	48	53	59	64	69	75	80
.64	-37	-32	-26	-21	-15	-10	-5	1	6	12	17	22	28	33	39	44	49	55	60	66	71	76	82
.66	-36	-31	-25	-20	-14	-9	-3	2	7	13	18	24	29	35	40	46	51	56	62	67	73	78	84
.68	-35	-29	-24	-18	-13	-8	-2	3	9	14	20	25	31	36	42	47	53	58	63	69	74	80	85
.70	-34	-28	-23	-17	-12	-6	-1	5	10	16	21	27	32	38	43	49	54	60	65	71	76	82	87
.72	-32	-27	-21	-16	-10	-5	1	6	12	17	23	28	34	39	45	50	56	61	67	72	78	84	89
.74	-31	-26	-20	-14	-9	-3	2	8	13	19	24	30	35	41	47	52	58	63	69	74	80	85	91
.76	-30	-24	-19	-13	-7	-2	4	9	15	20	26	32	37	43	48	54	59	65	71	76	82	87	93
.78	-28	-23	-17	-12	-6	0	5	11	16	22	28	33	39	44	50	56	61	67	72	78	84	89	95
.80	-27	-21	-16	-10	-5	1	7	12	18	24	29	35	41	46	52	58	63	69	74	80	86	91	97
.82	-26	-20	-14	-9	-3	3	8	14	20	25	31	37	42	48	54	59	65	71	76	82	88	93	99
.84	-24	-19	-13	-7	-1	4	10	16	21	27	33	39	44	50	56	61	67	73	78	84	90	96	101
.86	-23	-17	-11	-6	0	6	12	17	23	29	35	40	45	52	58	63	69	75	81	86	92	98	104

Vers. : All

Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING	N	2.09.00
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Engine Ratings 1
Throttle Setting ..... 1 and 2

2.09.20 THRUST SETTING

Take off N1 – PMC ON – M.100 1
Take off N1 – PMC OFF – M.100 2
Flex Take Off N1 – M.225 3
Go around N1 – M.225 4
Maximum Continuous N1 – IAS = 230 kt 5
Maximum Climb N1 – IAS 250/300/M.79 6
Maximum Cruise N1 – IAS 250/300/M.79 ..... 7/8

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING GENERAL	R 2.09.10 PAGE 1 REV 05

1 GENERAL

The thrust management system is basically a traditional hydro-mechanical control system with digital electronic supervision of the speed governor. The Power Management Control (PMC) « trims » the hydro-mechanical control governor to allow the required fuel flow producing the desired engine thrust.
The hydro-mechanical control has full authority for engine start, up to a thrust level slightly above idle. Beyond this level, the PMC assumes the supervisory function and establishes the required thrust according to throttle lever angle(TLA).

2 ENGINE RATINGS

A – Max Take off

This is the maximum thrust certified for take off and is normally time limited to five minutes.
This time limit is extended to 10 minutes for engine out contingency as authorized by the approved AFM.

B – Flex Take off

It is a derated take off thrust as compared to the max permissible. The calculation of the related N1 is a function of the flex temperature set on the thrust rating panel. The flex temperature is a function of the aircraft weight and environmental conditions and guarantees that the regulatory performance requirements are met.

C – Maximum Continuous

The maximum continuous rating is the maximum thrust certified for continuous use. This rating should be used, at the pilot's discretion, only when required to ensure safe flight (engine failure).

D – Maximum Climb

The Maximum climb rating is the maximum thrust approved for normal climb. operation.

E – Maximum Cruise

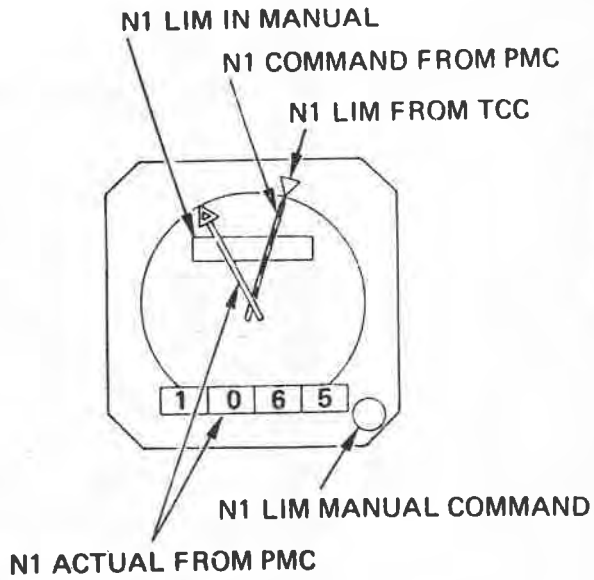
The maximum cruise rating is the maximum thrust approved for normal cruise operation.

F – Maximum Go Around

It is the maximum permissible thrust during go-around. Selection on thrust rating panel is identical to the selection of maximum take off rating.

3 THROTTLE SETTING

A – N1 INDICATION



B – POWER MANAGEMENT CONTROL (PMC) ON :

Normal thrust management is obtained with the Thrust Control Computer (TCC) in combination with the Power Management Control (PMC).
Usual rating are achieved for a fixed Throttle Lever Angle (TLA) :

MAX TLA (BLEEDS OFF) corresponds to :

. TAKE OFF OR GO-AROUND if Pressure altitude is lower than 15000ft and mach number lower than 0.50.

. MAX CONTINUOUS if pressure altitude is greater than 16000ft or mach number greater than 0.55.

Note : With bleeds on, the ratings will be achieved at a TLA less than MAX TLA.

TLA ≃ 39° corresponds to :

. MAX CLIMB. (if pressure altitude greater than 26000 ft Max Climb = Max continuous).

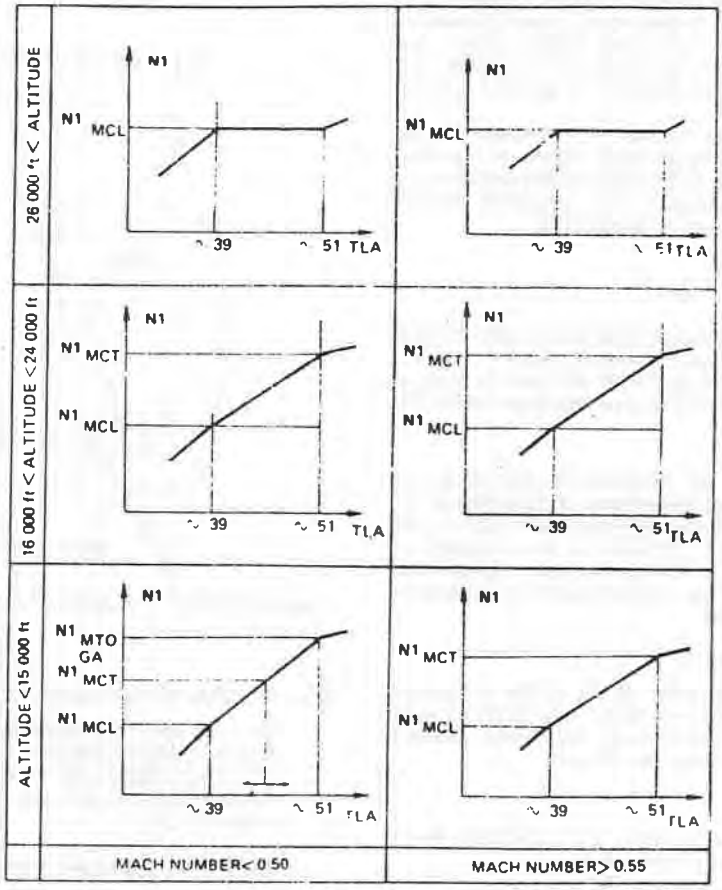
TLA = 0

. Approach or minimum (descent) idle are selected depending on slat position, anti-icing selection and landing gear position.

Vers. : All GE Eng. : All

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TLA RATINGS RELATION (PMC ON; NO BLEED)



B.1 Throttle setting at take off (PMC ON)

For full take off thrust or flexible take off thrust the throttles should be promptly and smoothly advanced to align the « N1 COMMAND » pointer on the N1 indicator with the N1 LIMIT bug (or the TARGET N1 for flex take off).
Check that take off N1 is set prior to reaching 80 Kt.
With PMC on, during a bleeds off full rated take off, the throttles will be at the full forward position. For all other take off conditions (with PMC on or off), take off thrust will be established at a throttle position less than full forward.
With auto-thrust armed throttle setting is made automatically after activation of at least one « GO LEVER ».

B.2 Throttle setting during climb and cruise at max rating

After manual or automatic selection of the desired mode on the Thrust Rating Panel (TRP) either CL or CR or MCT, the pilot (manually) or TCC (automatically) moves the throttle lever in order to obtain N1 COMMAND = N1 LIMIT or N1 TARGET depending on the AP/FMS mode selection.

C – POWER MANAGEMENT CONTROL (PMC) OFF :

The N1 COMMAND pointer remains in its lowest position on the N1 indicator.
Thrust setting is made in a conventional way. The pilot (manually) or TCC (automatically) moves throttle levers to obtain ACTUAL N1 = N1 LIMIT (or N1 TARGET).

Take off must be performed without ATS.

Vers. : All GE Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING TAKE-OFF N1	2.09.20
		PAGE 1
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CF6-80C2A2

TAKE OFF N1

NO AIR BLEED

MACH=.100

N1 CORRECTIONS FOR AIR BLEED

AIR CONDITIONING ON	-.700
ENGINE ANTI-ICE ON	-.600
ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.100

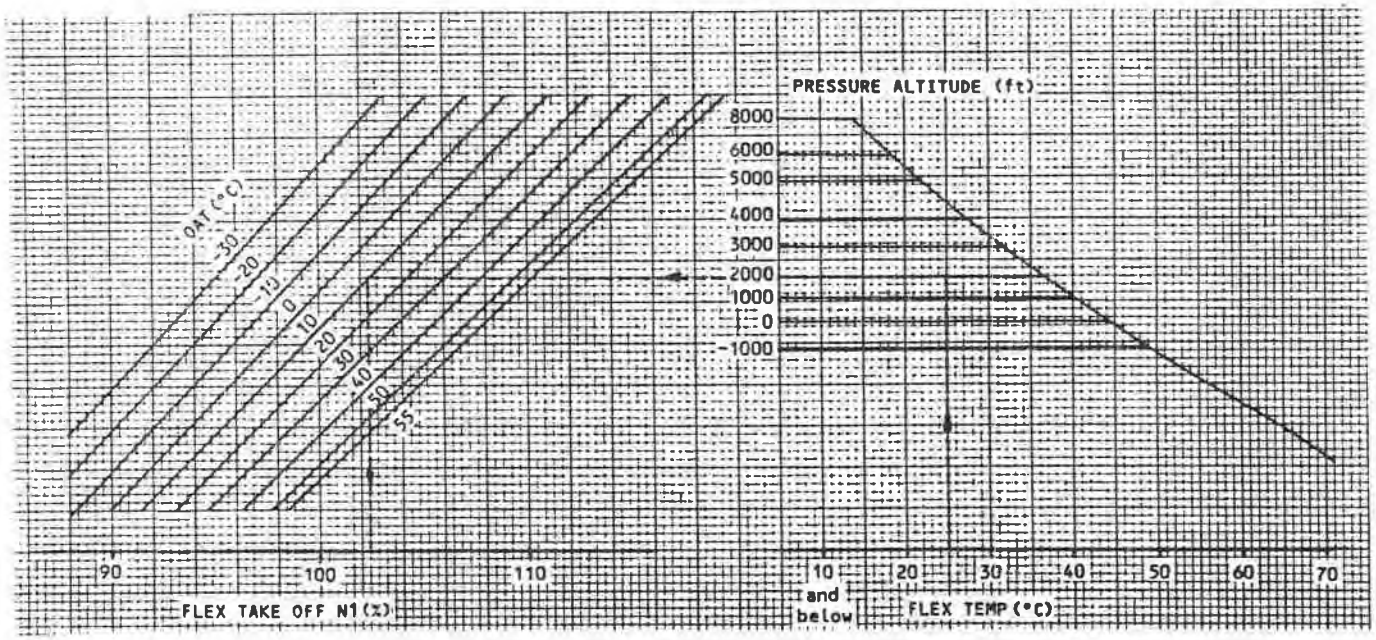
SAT (C)	ALTITUDE (FT)										
	-1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	89.8	91.0	92.1	93.0	94.2	95.5	97.1	98.3	98.8	99.5	99.8
-30.0	91.7	92.9	94.0	94.9	96.2	97.5	99.1	100.4	100.9	101.6	101.9
-20.0	93.6	94.8	95.9	96.9	98.2	99.5	101.1	102.4	103.0	103.6	104.0
-10.0	95.4	96.6	97.7	98.7	100.1	101.4	103.1	104.4	105.0	105.6	106.0
-5.0	96.3	97.5	98.7	99.7	101.0	102.3	104.0	105.4	105.9	106.6	107.0
.0	97.2	98.4	99.6	100.6	101.9	103.3	105.0	106.3	106.9	107.6	108.0
2.0	97.5	98.8	99.9	100.9	102.3	103.6	105.4	106.7	107.3	108.0	108.4
4.0	97.9	99.2	100.3	101.3	102.7	104.0	105.7	107.1	107.7	108.4	108.8
6.0	98.2	99.5	100.7	101.7	103.0	104.4	106.1	107.5	108.1	108.8	109.2
8.0	98.6	99.9	101.0	102.0	103.4	104.8	106.5	107.9	108.5	109.2	109.6
10.0	98.9	100.2	101.4	102.4	103.8	105.1	106.9	108.3	108.9	109.5	110.0
12.0	99.3	100.6	101.7	102.7	104.1	105.5	107.2	108.6	109.2	109.9	110.3
14.0	99.6	100.9	102.1	103.1	104.5	105.9	107.6	109.0	109.6	110.3	110.4
16.0	100.0	101.3	102.4	103.5	104.8	106.2	108.0	109.4	110.0	110.1	110.2
18.0	100.3	101.6	102.8	103.8	105.2	106.6	108.4	109.8	109.8	109.9	109.9
20.0	100.7	102.0	103.1	104.2	105.6	107.0	108.7	109.5	109.5	109.6	109.6
22.0	101.0	102.3	103.5	104.5	105.9	107.3	109.0	109.1	109.2	109.3	109.2
24.0	101.3	102.6	103.8	104.9	106.3	107.7	108.6	108.8	108.9	108.9	108.8
26.0	101.7	103.0	104.2	105.2	106.6	108.0	108.3	108.5	108.6	108.6	108.5
28.0	102.0	103.3	104.5	105.6	107.0	108.0	108.0	108.2	108.2	108.2	108.1
30.0	102.3	103.7	104.9	105.9	107.3	107.8	107.8	107.9	107.9	107.8	107.7
32.0	102.7	104.0	105.2	106.3	107.5	107.5	107.5	107.6	107.5	107.4	107.4
34.0	103.0	104.3	105.5	106.6	107.3	107.2	107.2	107.2	107.2	107.0	107.0
36.0	103.3	104.7	105.9	107.0	107.0	106.9	106.9	106.9	106.8	106.8	106.8
38.0	103.7	105.0	106.2	106.8	106.7	106.7	106.6	106.6	106.6	106.5	106.5
40.0	104.0	105.4	106.6	106.5	106.5	106.4	106.3	106.3	106.3		
42.0	104.3	105.7	106.3	106.3	106.2	106.1	106.1	106.1			
45.0	104.8	105.8	105.7	105.8	105.8	105.7	105.7				
50.0	105.1	104.7	105.0	105.3							
55.0	104.3	103.8									

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING FLEX TAKE-OFF N1	2.09.20 PAGE 3 REV 11 | SEQ 535

CF6-80C2A2 FLEX TAKE OFF N1 NO AIR BLEED	N1 CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	
	AIR CONDITIONING ON	-.700
	ENGINE ANTI-ICE ON	-.600
	ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.100



GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING	2.09.20
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	GO AROUND N1	REV 11 / SEQ 535

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GO AROUND N1

AIR CONDITIONING ON

MACH=.225

N1 CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)

AIR CONDITIONING OFF	+.700
ENGINE ANTI-ICE ON	-.600
ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.500

SAT (C)	ALTITUDE (FT)										
	-1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	8500.
-40.0	89.4	90.6	91.6	92.5	93.6	94.8	96.3	97.6	98.1	98.8	99.1
-30.0	91.3	92.5	93.5	94.4	95.6	96.8	98.4	99.7	100.2	100.9	101.2
-20.0	93.1	94.4	95.4	96.4	97.6	98.7	100.4	101.7	102.2	102.9	103.3
-10.0	95.0	96.2	97.3	98.2	99.5	100.7	102.3	103.7	104.2	104.9	105.3
-5.0	95.8	97.1	98.2	99.2	100.4	101.6	103.3	104.6	105.2	105.9	106.3
.0	96.7	98.0	99.1	100.1	101.3	102.6	104.3	105.6	106.2	106.9	107.3
2.0	97.1	98.3	99.5	100.4	101.7	102.9	104.6	106.0	106.6	107.3	107.7
4.0	97.4	98.7	99.8	100.8	102.1	103.3	105.0	106.4	107.0	107.7	108.1
6.0	97.8	99.1	100.2	101.2	102.4	103.7	105.4	106.8	107.4	108.0	108.5
8.0	98.1	99.4	100.6	101.5	102.8	104.0	105.8	107.2	107.7	108.4	108.8
10.0	98.5	99.8	100.9	101.9	103.2	104.4	106.2	107.5	108.1	108.8	109.2
12.0	98.8	100.1	101.3	102.2	103.5	104.8	106.5	107.9	108.5	109.2	109.6
14.0	99.2	100.5	101.6	102.6	103.9	105.1	106.9	108.3	108.9	109.6	109.7
16.0	99.5	100.8	102.0	103.0	104.3	105.5	107.3	108.7	109.3	109.4	109.4
18.0	99.9	101.2	102.3	103.3	104.6	105.9	107.6	109.0	109.1	109.2	109.2
20.0	100.2	101.5	102.7	103.7	105.0	106.2	108.0	108.7	108.8	108.9	108.8
22.0	100.5	101.8	103.0	104.0	105.3	106.6	108.3	108.4	108.5	108.6	108.5
24.0	100.9	102.2	103.4	104.4	105.7	107.0	107.9	108.1	108.2	108.2	108.1
26.0	101.2	102.5	103.7	104.7	106.0	107.3	107.6	107.8	107.8	107.8	107.8
28.0	101.6	102.9	104.1	105.1	106.4	107.3	107.3	107.5	107.5	107.5	107.4
30.0	101.9	103.2	104.4	105.4	106.8	107.0	107.0	107.2	107.2	107.1	107.0
32.0	102.2	103.6	104.7	105.8	107.0	106.8	106.8	106.8	106.8	106.7	106.6
34.0	102.6	103.9	105.1	106.1	106.7	106.5	106.5	106.5	106.5	106.3	106.3
36.0	102.9	104.2	105.4	106.5	106.4	106.2	106.2	106.2	106.1	106.1	106.1
38.0	103.2	104.6	105.8	106.3	106.2	105.9	105.9	105.9	105.9	105.8	105.8
40.0	103.6	104.9	106.1	106.0	105.9	105.7	105.6	105.6	105.6		
42.0	103.9	105.2	105.8	105.8	105.6	105.4	105.3	105.4			
45.0	104.4	105.3	105.3	105.3	105.2	105.0	105.0				
50.0	104.7	104.3	104.5	104.8							
55.0	103.9	103.4									

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING	2.09.20
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	MAXIMUM CONTINUOUS N1 – IAS = 230 KT	REV 11 / SEQ 535

CF6-80C2A2 MAXIMUM CONTINUOUS N1 AIR CONDITIONING ON VC=230 KT	N1 CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)	
	AIR CONDITIONING OFF	+.900
	ENGINE ANTI-ICE ON	-.500
	ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.500

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	86.1	90.3	94.0	97.4	99.8	100.0	100.3	101.8	101.8	101.8	101.1
-35.0	87.0	91.3	95.0	98.4	100.8	101.0	101.4	102.9	102.9	102.9	102.2
-30.0	87.9	92.2	96.0	99.4	101.9	102.1	102.5	104.0	104.0	104.0	103.2
-25.0	88.8	93.2	97.0	100.5	102.9	103.1	103.5	105.0	105.0	105.0	104.3
-20.0	89.7	94.1	98.0	101.5	104.0	104.2	104.6	106.1	106.1	105.8	105.3
-15.0	90.6	95.0	98.9	102.5	105.0	105.2	105.6	107.1	107.0	104.7	104.1
-10.0	91.4	95.9	99.9	103.5	106.0	106.2	106.6	107.5	106.0	103.8	102.8
-8.0	91.8	96.3	100.2	103.8	106.4	106.6	107.0	107.1	105.7	103.5	102.4
-6.0	92.1	96.7	100.6	104.2	106.8	107.0	106.9	106.8	105.4	103.3	102.1
-4.0	92.5	97.0	101.0	104.6	107.2	107.4	106.8	106.5	105.2	103.0	101.9
-2.0	92.8	97.4	101.4	105.0	107.6	107.8	106.2	106.2	104.9	102.7	101.6
.0	93.2	97.7	101.7	105.4	108.0	108.0	106.0	106.0	104.8	102.4	101.4
2.0	93.5	98.1	102.1	105.8	108.4	108.0	105.8	105.8	104.4	102.0	101.1
4.0	93.8	98.4	102.5	106.2	108.8	108.0	105.6	105.6	104.1		100.8
6.0	94.2	98.8	102.9	106.5	108.9	107.8	105.4	105.3	103.8		100.6
8.0	94.5	99.2	103.2	106.9	108.8	107.6	105.2	105.1	103.5		
10.0	94.8	99.5	103.6	107.3	108.8	107.5	105.0	104.9			
12.0	95.2	99.9	104.0	107.6	108.6	107.4	104.8	104.7			
14.0	95.5	100.2	104.3	107.5	108.3	107.3	104.6				
16.0	95.8	100.6	104.7	107.4	108.1	107.2	104.4				
18.0	96.2	100.9	105.0	107.2	108.0	107.1	104.2				
20.0	96.5	101.2	104.9	107.1	107.9	107.0					
22.0	96.8	101.6	104.6	106.9	107.8	106.9					
24.0	97.2	101.9	104.3	106.7	107.7	106.8					
26.0	97.5	102.0	104.1	106.5	107.6						
28.0	97.8	101.8	103.8	106.3	107.4						
30.0	98.1	101.5	103.6	106.1	107.3						
32.0	98.4	101.2	103.4	105.9							
34.0	98.3	101.0	103.1	105.7							
36.0	98.2	100.7	102.9	105.5							
38.0	98.0	100.5	102.6								
40.0	97.6	100.3	102.4								
45.0	96.9	99.7									
50.0	96.2	99.1									
55.0	95.5										

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	THRUST SETTING	2.09.20
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MAXIMUM CLIMB N1

AIR CONDITIONING ON

250/300/.78

N1 CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)

AIR CONDITIONING OFF	1.200
ENGINE ANTI-ICE ON	-.600
ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.300

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	83.5	87.4	90.9	92.1	93.4	94.5	96.2	97.5	99.1	100.8	100.6
-30.0	85.3	89.2	92.8	94.0	95.4	96.5	98.2	99.6	101.3	103.0	102.7
-20.0	87.0	91.0	94.7	96.0	97.4	98.5	100.2	101.7	101.3	105.1	104.8
-10.0	88.7	92.8	96.6	97.8	99.3	100.4	102.2	103.7	105.4	103.3	102.8
-5.0	89.5	93.7	97.5	98.8	100.2	101.3	103.1	104.7	104.3	102.4	101.8
.0	90.3	94.5	98.4	99.7	101.2	102.3	104.1	104.7	103.4	101.7	101.2
2.0	90.7	94.9	98.7	100.0	101.5	102.7	104.5	104.3	103.1	101.4	101.0
4.0	91.0	95.2	99.1	100.4	101.9	103.0	104.2	104.0	102.8	101.1	100.7
6.0	91.3	95.6	99.4	100.8	102.3	103.4	103.9	103.7	102.5	100.8	100.4
8.0	91.6	95.9	99.8	101.1	102.6	103.6	103.6	103.4	102.3	100.5	100.1
10.0	92.0	96.3	100.2	101.5	103.0	103.3	103.4	103.1	102.0		
12.0	92.3	96.6	100.5	101.8	103.3	103.1	103.1	102.9	101.8		
14.0	92.6	96.9	100.9	102.2	103.4	102.9	102.9	102.7	101.5		
16.0	92.9	97.3	101.2	102.6	103.2	102.7	102.7	102.5	101.2		
18.0	93.3	97.6	101.6	102.9	103.0	102.5	102.5	102.3	100.9		
20.0	93.6	97.9	101.9	102.8	102.8	102.3	102.3	102.0			
22.0	93.9	98.3	101.6	102.6	102.6	102.1	102.1	101.8			
24.0	94.2	98.6	101.3	102.4	102.3	101.9	101.9	101.6			
26.0	94.5	98.9	101.0	102.1	102.1	101.7	101.7				
28.0	94.8	98.9	100.7	101.9	101.9	101.4	101.5				
30.0	95.1	98.6	100.5	101.7	101.7	101.2					
32.0	95.5	98.4	100.3	101.4	101.5	101.0					
34.0	95.6	98.2	100.0	101.2	101.2	100.7					
36.0	95.4	97.9	99.8	101.0	101.0						
38.0	95.1	97.7	99.6	100.8	100.7						
40.0	94.8	97.4	99.3	100.5							
42.0	94.5	97.2	99.1	100.3							
45.0	94.0	96.8	98.7	99.9							
50.0	93.2	96.1									
55.0	92.4										

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL

THRUST SETTING

MAXIMUM CRUISE N1 – IAS 250/300/M.78

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MAXIMUM CRUISE N1

AIR CONDITIONING ON

250/300/.78

N1 CORRECTIONS FOR AIR BLEED (APPLICABLE TCC OFF)

AIR CONDITIONING OFF	1.200
ENGINE ANTI-ICE ON	-.600
ENGINE ANTI-ICE AND WING ANTI-ICE ON	-1.300

TAT (C)	ALTITUDE (FT)										
	0.	4000.	8000.	12000.	16000.	20000.	24000.	28000.	32000.	36000.	40000.
-40.0	80.5	84.4	87.9	89.1	90.4	91.5	93.2	94.5	96.0	97.5	95.6
-30.0	82.3	86.2	89.8	91.0	92.4	93.5	95.2	96.6	98.2	99.7	97.7
-20.0	84.0	88.0	91.7	93.0	94.4	95.5	97.2	98.7	100.2	101.8	99.6
-10.0	85.7	89.8	93.6	94.8	96.3	97.4	99.2	100.7	102.2	100.0	97.8
-5.0	86.5	90.7	94.5	95.8	97.2	98.3	100.1	101.7	101.2	99.1	96.8
.0	87.3	91.5	95.4	96.7	98.2	99.3	101.1	101.7	100.3	98.4	96.2
2.0	87.7	91.9	95.7	97.0	98.5	99.7	101.5	101.3	99.9	98.1	96.0
4.0	88.0	92.2	96.1	97.4	98.9	100.0	101.2	101.0	99.7	97.8	95.7
6.0	88.3	92.6	96.4	97.8	99.3	100.4	100.9	100.7	99.4	97.5	95.4
8.0	88.6	92.9	96.8	98.1	99.6	100.6	100.6	100.4	99.2	97.2	95.1
10.0	89.0	93.3	97.2	98.5	100.0	100.3	100.4	100.1	98.9		
12.0	89.3	93.6	97.5	98.8	100.3	100.1	100.1	99.9	98.6		
14.0	89.6	93.9	97.9	99.2	100.4	99.9	99.9	99.7	98.4		
16.0	89.9	94.3	98.2	99.6	100.2	99.7	99.7	99.5	98.1		
18.0	90.3	94.6	98.6	99.9	100.0	99.5	99.5	99.3	97.8		
20.0	90.6	94.9	98.9	99.8	99.8	99.3	99.3	99.0			
22.0	90.9	95.3	98.6	99.6	99.6	99.1	99.1	98.8			
24.0	91.2	95.6	98.3	99.4	99.3	98.9	98.9	98.6			
26.0	91.5	95.9	98.0	99.1	99.1	98.7	98.7				
28.0	91.8	95.9	97.7	98.9	98.9	98.4	98.5				
30.0	92.1	95.6	97.5	98.7	98.7	98.2					
32.0	92.5	95.4	97.3	98.4	98.5	98.0					
34.0	92.6	95.2	97.0	98.2	98.2	97.7					
36.0	92.4	94.9	96.8	98.0	98.0						
38.0	92.1	94.7	96.6	97.8	97.7						
40.0	91.8	94.4	96.3	97.5							
42.0	91.5	94.2	96.1	97.3							
45.0	91.0	93.8	95.7	96.9							
50.0	90.2	93.1									
55.0	89.4										

GE Eng. : 80C2A2

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V2 VERSUS WEIGHT AND V2/Vs RATIO – SLATS 15/FLAPS 0

V2 (KT IAS)

V2/Vs

	WEIGHT (TONS)	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
R	158	172	173	174	176	177	179	180	181	183	184	186	187	188	190	191
R	156	171	172	173	175	176	177	179	180	182	183	184	186	187	189	190
	154	169	171	172	174	175	176	178	179	181	182	183	185	186	187	189
	152	168	170	171	172	174	175	177	178	179	181	182	183	185	186	188
	150	167	169	170	171	173	174	175	177	178	180	181	182	184	185	186
	148	166	168	169	170	172	173	174	176	177	178	180	181	182	184	185
	146	165	166	168	169	170	172	173	174	176	177	179	180	181	183	184
	144	164	165	167	168	169	171	172	173	175	176	177	179	180	181	183
	142	163	164	165	167	168	169	171	172	173	175	176	177	179	180	181
	140	161	162	164	165	166	168	169	170	172	173	174	175	177	178	179
	138	160	161	162	164	165	166	168	169	170	172	173	174	176	177	178
	136	159	160	161	163	164	165	166	168	169	170	172	173	174	176	177
	134	158	159	160	161	163	164	165	167	168	169	170	172	173	174	176
	132	156	158	159	160	162	163	164	165	167	168	169	170	172	173	174
	130	155	156	158	159	160	162	163	164	165	167	168	169	170	172	173
	128	154	155	157	158	159	160	162	163	164	165	167	168	169	170	172
	126	153	154	155	157	158	159	160	162	163	164	165	167	168	169	170
	124	152	153	154	155	157	158	159	160	162	163	164	165	166	168	169
	122	150	152	153	154	155	157	158	159	160	161	163	164	165	166	168
	120	149	150	152	153	154	155	157	158	159	160	161	163	164	165	166
	118	148	149	150	152	153	154	155	156	158	159	160	161	162	164	165
	116	147	148	149	150	152	153	154	155	156	158	159	160	161	162	163
	114	145	147	148	149	150	151	153	154	155	156	157	158	160	161	162
	112	144	145	147	148	149	150	151	152	154	155	156	157	158	160	161
	110	143	144	145	146	148	149	150	151	152	153	155	156	157	158	159
	108	142	143	144	145	146	147	149	150	151	152	153	154	156	157	158
	106	140	142	143	144	145	146	147	148	150	151	152	153	154	155	156
	104	139	140	141	142	144	145	146	147	148	149	150	152	153	154	155
	102	138	139	140	141	142	143	144	146	147	148	149	150	151	152	153
	100	136	137	139	140	141	142	143	144	145	146	147	149	150	151	152
	98	135	136	137	138	139	141	142	143	144	145	146	147	148	149	150
	96	134	135	136	137	138	139	140	141	142	143	145	146	147	148	149
	94	132	133	134	136	137	138	139	140	141	142	143	144	145	146	147
	92	131	132	133	134	135	136	137	138	139	140	142	143	144	145	146
	90	129	131	132	133	134	135	136	137	138	139	140	141	142	143	144
	88	128	129	130	131	132	133	134	135	136	137	138	140	141	142	143
	86	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141
	84	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
	82	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
	80	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136

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V2 VERSUS WEIGHT AND V2/Vs RATIO – SLATS 15/FLAPS 15

V2 (KT IAS)

V2/Vs

WEIGHT (TONS)	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
R 158	160	161	163	164	165	166	168	169	170	172	173	174	176	177	178
R 156	159	160	161	163	164	165	167	168	169	171	172	173	174	176	177
154	158	159	160	162	163	164	166	167	168	169	171	172	173	175	176
152	157	158	159	161	162	163	165	166	167	168	170	171	172	173	175
150	156	157	158	160	161	162	163	165	166	167	169	170	171	172	174
148	155	156	157	159	160	161	162	164	165	166	167	169	170	171	172
146	154	155	156	158	159	160	161	163	164	165	166	168	169	170	171
144	153	154	155	157	158	159	160	162	163	164	165	166	168	169	170
142	152	153	154	155	157	158	159	160	162	163	164	165	167	168	169
140	151	152	153	154	156	157	158	159	161	162	163	164	166	167	168
138	150	151	152	153	155	156	157	158	159	161	162	163	164	166	167
136	149	150	151	152	153	155	156	157	158	160	161	162	163	164	166
134	147	149	150	151	152	154	155	156	157	158	160	161	162	163	164
132	146	148	149	150	151	152	154	155	156	157	158	160	161	162	163
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124	142	143	144	145	147	148	149	150	151	152	154	155	156	157	158
122	141	142	143	144	145	147	148	149	150	151	152	153	155	156	157
120	140	141	142	143	144	145	146	148	149	150	151	152	153	155	156
118	138	140	141	142	143	144	145	146	148	149	150	151	152	153	154
116	137	138	140	141	142	143	144	145	146	147	149	150	151	152	153
114	136	137	138	139	141	142	143	144	145	146	147	148	150	151	152
112	135	136	137	138	139	140	142	143	144	145	146	147	148	149	150
110	134	135	136	137	138	139	140	141	142	144	145	146	147	148	149
108	132	134	135	136	137	138	139	140	141	142	143	144	146	147	148
106	131	132	133	134	136	137	138	139	140	141	142	143	144	145	146
104	130	131	132	133	134	135	136	137	139	140	141	142	143	144	145
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100	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142
98	126	127	128	129	130	131	132	133	135	136	137	138	139	140	141
96	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
94	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138
92	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
90	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
88	120	121	122	123	124	125	126	127	128	129	129	130	131	132	133
86	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
84	117	118	119	120	121	122	123	124	125	126	127	127	128	129	130
82	116	116	117	118	119	120	121	122	123	124	125	126	127	128	129
80	114	115	116	117	118	119	120	121	122	123	123	124	125	126	127

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V2 VERSUS WEIGHT AND V2/Vs RATIO – SLATS 20/FLAPS 20

V2 (KT IAS)

	WEIGHT (TONS)	V2/Vs 1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35
R	158	155	156	157	159	160	161	162	164	165	166	167	169	170	171	172	174
R	156	154	155	156	158	159	160	161	163	164	165	166	168	169	170	171	173
R	154	153	154	156	157	158	160	161	162	163	165	166	167	168	169	170	172
R	152	152	153	155	156	157	159	160	161	162	164	165	166	167	168	169	170
R	150	151	152	154	155	156	158	159	160	161	163	164	164	166	167	168	169
R	148	150	151	153	154	155	157	158	159	160	162	163	163	165	166	167	168
R	146	149	150	152	153	154	156	157	158	159	161	162	162	164	165	166	167
R	144	148	149	151	152	153	154	156	157	158	159	161	161	162	164	165	166
R	142	147	148	150	151	152	153	155	156	157	158	160	160	161	162	164	165
R	140	146	147	149	150	151	152	154	155	156	157	158	159	160	161	163	164
R	138	145	146	148	149	150	151	152	154	155	156	157	158	159	160	161	163
R	136	144	145	147	148	149	150	151	153	154	155	156	157	158	159	160	161
R	134	143	144	146	147	148	149	150	152	153	154	155	156	157	158	159	160
R	132	142	143	144	146	147	148	149	150	152	153	154	154	156	157	158	159
R	130	141	142	143	145	146	147	148	149	150	152	153	153	154	156	157	158
R	128	140	141	142	143	145	146	147	148	149	150	152	152	153	154	156	157
R	126	139	140	141	142	144	145	146	147	148	149	150	151	152	153	154	156
R	124	137	139	140	141	142	144	145	146	147	148	149	150	151	152	153	154
R	122	136	138	139	140	141	142	144	145	146	147	148	149	150	151	152	153
R	120	135	136	138	139	140	141	142	144	145	146	147	147	149	150	151	152
R	118	134	135	137	138	139	140	141	142	143	145	146	146	147	148	150	151
R	116	133	134	136	137	138	139	140	141	142	143	144	145	146	147	148	149
R	114	132	133	135	136	137	138	139	140	141	142	143	144	145	146	147	148
R	112	131	132	133	134	135	137	138	139	140	141	142	143	144	145	146	147
R	110	130	131	132	133	134	135	136	137	139	140	141	141	142	143	144	146
R	108	128	129	131	132	133	134	135	136	137	138	140	140	141	142	143	144
R	106	127	128	130	131	132	133	134	135	136	137	138	139	140	141	142	143
R	104	126	127	128	130	131	132	133	134	135	136	137	137	138	140	141	142
R	102	125	126	127	128	129	130	131	133	134	135	136	136	137	138	139	140
R	100	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
R	98	122	123	125	126	127	128	129	130	131	132	133	133	134	135	136	138
R	96	121	122	124	125	126	127	128	129	130	131	132	132	133	134	135	136
R	94	120	121	122	123	124	125	126	128	128	129	130	131	132	133	134	135
R	92	119	120	121	122	123	124	125	126	127	128	129	129	130	131	132	133
R	90	117	118	120	121	122	123	124	125	126	127	128	128	129	130	131	132
R	88	116	117	118	120	120	121	122	123	124	125	126	127	128	128	129	130
R	86	115	116	117	118	119	120	121	122	123	124	125	125	126	127	128	129
R	84	114	114	116	117	118	119	120	121	121	122	123	124	125	126	127	127
R	82	112	113	114	115	116	117	118	119	120	121	122	122	123	124	125	126
R	80	111	112	113	114	115	116	117	118	119	120	120	121	122	123	124	124

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OPERATING SPEEDS :

F – S – « GREEN DOT » – VREF

SPEED / WEIGHT (tons)	F (1.25 Vs 15/0)	S (1.25 Vs 0/0)	« GREEN DOT » SPEED below 20000 FT	VREF (1.3 Vs 30/40)
R 158	177	222	258	156
R 156	175	220	256	155
R 154	174	219	254	154
R 152	173	217	252	153
R 150	172	216	250	152
R 148	171	215	248	151
R 146	170	213	246	150
R 144	169	212	244	148
R 142	167	210	242	147
R 140	167	209	240	146
R 138	166	207	238	145
R 136	164	206	236	144
R 134	163	204	234	143
R 132	162	203	232	142
R 130	161	201	230	141
R 128	159	200	228	140
R 126	158	198	226	139
R 124	157	197	224	138
R 122	156	195	222	137
R 120	154	193	220	136
R 118	153	192	218	135
R 116	152	190	216	133
R 114	151	189	214	132
R 112	149	187	212	131
R 110	148	185	210	129
R 108	147	184	208	127
R 106	145	182	206	126
R 104	144	180	204	125
R 102	142	178	202	124
R 100	141	177	200	123
R 98	140	175	198	121
R 96	138	173	196	120
R 94	137	171	194	119
R 92	135	170	192	118
R 90	134	168	190	117

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1. DEFINITION OF FLEXIBLE TAKE-OFF

In many cases, the aircraft takes off at a weight lower than the maximum permissible weight. In consequence, it is possible to continue to comply with limitations regulations (Runway, 2nd segment, obstacle) with a decreased thrust adapted to the weight : this is called FLEXIBLE TAKE-OFF and the thrust is called FLEXIBLE THRUST.

2. UTILIZATION OF FLEXIBLE TAKE-OFF

Flexible take-off can be used when the actual take-off weight is lower than the maximum permissible take-off weight for the actual temperature. As this weight decreases when temperature increases, it is possible to assume a temperature at which actual take-off weight would be the limiting one. This temperature is called FLEXIBLE TEMPERATURE or assumed temperature.

3. AIRWORTHINESS REQUIREMENTS

(A) Thrust reduction :

Thrust reduction must not exceed 25 % of the full rated take off thrust. To meet this requirement, the flexible temperature must not be higher than ISA + 57 °C.

(B) Flexible take-off is not recommended on contaminated runways.

(C) The operator shall at regular intervals check the maximum thrust in order to detect any possible engine deterioration, unless the operator has an adequate engine performance monitoring program to follow up the engine parameters.

4. DETERMINATION OF FLEXIBLE TEMPERATURE AND CORRESPONDING N1

(A) Flexible temperature

See in section 2.10.30 how to determine flexible temperature.
Flexible temperature must not be higher than ISA + 57 °C.

(B) Corresponding N1

This can be determined :
- either by inserting flexible temperature on Thrust Rating Panel then selecting FLX TO
- or with chart N1 FLEX TO of chapter 2.09 THRUST SETTING.

5. DETERMINATION OF ASSOCIATED SPEEDS

See how to determine these speeds in section 2.10.30

6. CLIMB FOLLOWING A FLX TO

- Without profile mode :
  Before take off, compare FLX TO N1 and CL N1. If FLX TO N1 is lower than CL N1, select CR at thrust reduction altitude. When rate of climb becomes lower than 1 000 ft/mn, select CL.

- With profile mode :
  At thrust reduction altitude, CL is automatically selected. If FLX TO N1 is lower than CL, the FMS will gradually increase the thrust from FLX TO to reach CL before 20 000 ft.

7. CONSEQUENCE OF FLEXIBLE TAKE OFF USE

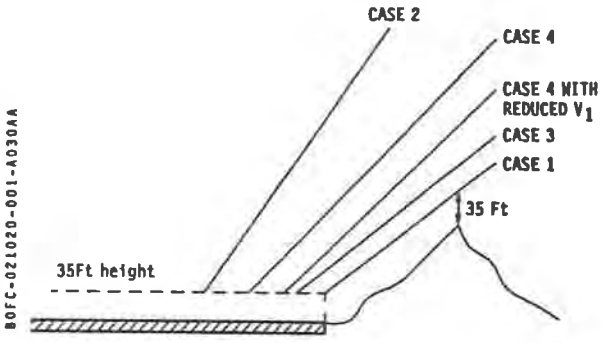
- **On engine life**

  Use only necessary and sufficient thrust to take off a given aircraft weight saves engine life.

  Higher is the thrust reduction rate, higher is the improvement on engine life.

- **On climb performance**

  At same speed and weight, an increase in thrust gives a better climb gradient.
  At same thrust, speed and weight the climb gradient remains the same.
  Flight path considering engine failure and decision at V_1 :



GE Eng. : All

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– On runway performance

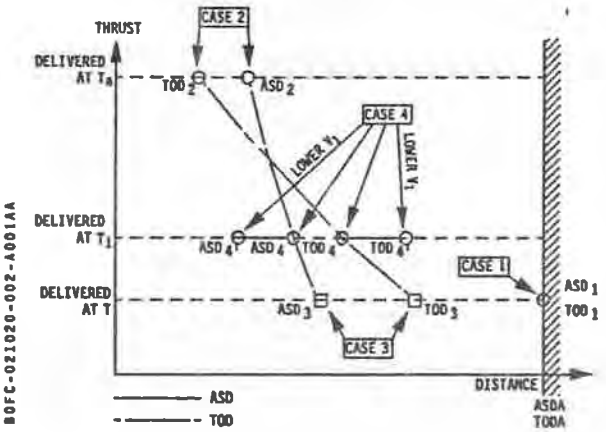
Assumptions : – Given take off flaps setting
– Given runway (ASDA = TODA)
– Given wind
– Given aircraft weight W
– QNH = 1013 mb – No bleed
– Under these conditions, the take off chart indicates :
. temperature T higher than flat rating temperature
. V_1, VR and V_2
. runway limitation code (second segment condition is not limiting).

Conclusion :

T is the maximum temperature at which W weight can be taken off.

What happens on runway performance considering engine failure at V_1 ?

To take off the given weight W, depending on the used take off thrust, the variation of accelerate stop distance and take off distance is as follows :



	TEMPERATURE			TAKE-OFF THRUST		TAKE-OFF SPEEDS	
	MAX associated with given TOW	ACTUAL	FLEX	MAX	FLEX		
CASE 1	T	T	—	Thrust delivered at T	—	V_1, V_R, V_2	– used ASD_1 = ASDA – used TOD_1 = TODA
CASE 2	T	t_a	—	Thrust delivered at T_a	—	V_1, V_R, V_2	– used ASD_2 shorter than ASD_1 – used TOD_2 shorter than TOD_1
CASE 3	T	t_a	T	—	Thrust delivered at T	V_1, V_R, V_2	Since true airspeeds are lower at t_a than at T : – used ASD_3 shorter than ASD_1 – used TOD_3 shorter than TOD_1 CASE 3 corresponds to the highest possible derating
CASE 4	T	t_a	T_1	—	Thrust delivered at T_1	V_1, V_R, V_2	Less derating than in case 3 is used : – used ASD_4 shorter than ASD_3 – used TOD_4 shorter than TOD_3
						V_R, V_2, lower V_1	V_1 reduction combined with the use of less derating leads to : – used ASD_4 shorter than ASD_4 – used TOD_4 longer than TOD_4 A temperature decrement of 1.5° C may be associated with a V_1 reduction of 1 kt

T : higher than flat rating temperature
t_a : lower than T
T_1 : higher than t_a and T_1 lower than T

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8. RECOMMENDATION WHEN PERFORMING FLEXIBLE TAKE OFF

Our recommendation is to use the higher derating possible in order to save engine life.

Nevertheless, adaptation of thrust derating is feasible. When improvement on accelerate stop distance and take off distance looks suitable, it is possible for the given weight, using always the same take off chart :

1) To select a temperature lower than the maximum one and keep the speeds defined at maximum temperature.

or

2) To move towards the left side of the take off chart. This introduces a lower maximum temperature and in general lower take off speeds V_1, V_R and V_2.

or

3) To select a temperature lower than the maximum one and to decrease the V_1 decision speed by 1 kt per 1.5° C decremented from maximum temperature.
The V_1 decrement should be limited to a maximum of 5 kt.

Using one of the three above possibilities, do not forget to check that the selected temperature is greater than the actual temperature and greater than flat rating temperature.

9. CONCLUSION

Depending on environmental take off conditions, we may recommend the following procedure :

CONDITIONS	PROCEDURE	REASON
Dry, well paved runway	– Use flaps configuration giving the maximum derating. – If equivalent derating is obtained, choose the configuration giving the lowest speeds.	Save engine life
High altitude take off	– Use flaps 15°	Save tire Add comfort
Badly paved runway or Accelerate stop distance limited runway and warm brakes	– Use flaps 15° or – Move towards left side of take off chart or – Select a flex temperature lower than the maximum one and decrease V1 by 1 kt per 1.5° C decremented from flexible temperature with a maximum of 5 kt reduction.	Save tire Add comfort Improve stopping distance
Wet or contaminated runway	– Use flaps configuration giving the lowest speeds	Improve stopping distance
Windshear expected along take off path	– Use maximum thrust	Maintain acceleration capability

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF REGULATORY TAKE OFF AND LANDING WEIGHT CHARTS (RTOLW CHARTS)	2.10.30 PAGE 1 REV 14 SEQ 030

1. INTRODUCTION

These charts enable the crew to determine for the corresponding runway :

- the maximum permissible take-off weight for the ambient pressure, temperature and surface wind conditions, or :
- for a given aircraft weight, the maximum temperature at which a take-off would be permitted. This temperature (corrected for QNH and airbleeds) is called the flexible Temperature.

The flexible temperature may be selected on the THRUST RATING PANEL or used in the FLEX TO N1 Chart to obtain the corresponding flexible N1 (Refer to chapter 09). This reduced power setting provides performance in compliance with regulations in the event of engine failure at V1.

A specific chart is established for each runway. It is based on standard atmospheric pressure and takes account of the significant obstacles along the specified flight path.

What does the crew know ?

- runway
- reference pressures
- actual temperature and / or T/O weight
- wind

What does the crew need to know ?

- maximum take-off weight for the actual temperature, wind and QNH
- maximum temperature corresponding to the actual weight, wind and QNH, becoming the flexible temperature when reduced thrust take-off is possible.

What are the entries into the chart ?

For the given runway, enter the corresponding chart with :

- wind and actual temperature to determine maximum take-off weight
- wind and weight to determine maximum temperature.

What are the outputs ?

After making corrections due to QNH variations and bleeds, the outputs are :

- maximum take-off weight or maximum temperature
- nature of the performance limitation
- V1, VR and V2

R In addition, maximum go-around temperature for both
R approach configurations is indicated.
R Single engine Climb out procedure may be indicated.

2. EXPLANATION OF THE OUTPUTS OF THE CHART

A. Flap setting

The flap setting is indicated on top of the chart in the right corner.

B. Maximum take-off weight

The weight corresponding to any box is the sum of entry weight and weight increment. It is the maximum permissible T/O weight corresponding to the temperature shown in the box.

C. Maximum temperature (° C)

The temperature shown in the box is the maximum temperature at which the maximum weight determined as above can be lifted.

D. Limitation

This indicates the nature of the limitation or the balance between two limitations as resulting from the optimization. Limitation codes are as follows :

1 – Maximum structural weight
2 – Second segment
3 – Runway
4 – Obstacle
5 – Tire speed
6 – Brake energy
7 – Runway 2 engines operative (if applicable)

E. V1 : decision speed (IAS)

F. VR : rotation speed (IAS)

G. V2 : safety speed (IAS)

This speed is to be maintained up to the acceleration height (or altitude) in case of engine failure to obtain the expected performance associated with the given configuration and data.

Note : The SRS provides automatically the correct pitch guidance. In the absence of SRS indication, it is recommended to initially set a safe pitch attitude of 12.5°.

3. CORRECTIONS. Refer to page 2.10.30 page 6

In order to get the most out of the chart, there are two kinds of corrections :

- either on weight when determining maximum take-off weight
- or on maximum temperature when determining the flexible or limiting temperature.

Any QNH variation from the standard, for which the chart is calculated, will affect either the maximum temperature or the weight. The air bleeds will affect the maximum temperature or the weight in the same manner.

GE Eng. : All

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A. Corrections on weight

The effect of QNH variations or bleed consists of an addition or substraction to the weight as specified on each chart.

1st step

In order to avoid a loss in weight when the actual temperature does not appear in the chart, the weight gradients on both sides of the flat rating temperature are given on top of the chart (Grad 1/Grad 2). Flat rating temperature is given, named Tref. Using the data, weight and temperature, given in the upper box of column selected according to the wind, add the weight determined by multiplying the weight gradient by the difference of temperature between actual temp. and that given in the box.

When these two temperatures (actual and max.) are on each side of flat rating temperature, two steps are necessary. First multiply the weight gradient given above Tref by the difference between max. temp. and flat rating temperature. Then multiply the weight gradient given below Tref by the difference between flat rating temperature and actual temperature. Add these two values to the max. weight of the first box.

Note : Weight gradients must only be used to extrapolate above the maximum weight shown in the RTOLW chart (upper box of the chart). They do not allow to interpolate between two boxes, neither between two filled boxes, nor between one filled and one blank box.

2nd step

From this maximum weight, subtract or add the weight increment equivalent to the QNH variation from standard as indicated on the chart. Subtract bleed effect if any. The final weight is the max. permissible TOW for the actual environmental conditions.

B. Corrections on temperature

QNH variations and bleeds affect the maximum temperature corresponding to a given weight. The resulting temperature called flexible temperature must be checked as shown on the chart in order to avoid :

- either a take-off at a higher weight than allowed by the maximum available level of thrust when the flexible temperature is lower than Tref or actual temperature.
- or setting a thrust derated by more than allowed : maximum derated thrust : **maximum thrust at ISA + 57° C for the actual conditions.**

This maximum derating corresponds to a maximum flexible temperature of ISA + 57° C.

This final CT will be set on the THRUST RATING PANEL (TRP).
Any temperature below Tref should not be set on the TRP.
The maximum value of CT which may be set is ISA + 57° C.
The setting of a temperature lower than actual will result in dashes being displayed on the TRP.

Note : Take-off charts for wet runways, when based on the use of reverse thrust, may show for some conditions a weight higher than on dry runway. It is then necessary to compare both charts (dry and wet) and to retain the lowest weight and the associated speeds determined on wet runway R R R R R R

4. ADDITIONAL INFORMATION

A. Single engine climb out procedure

The performance given in the chart is consistent with the specified flight path in case of engine failure, and takes account of significant obstacles.

When the procedure to follow is not the standard instrument departure, a specific procedure is described.

When the specified procedure requires a turn, the turn will be performed with a 15° bank angle maximum until 1500 ft or green dot speed is reached.

The acceleration height (or altitude) ensures that the highest obstacle will be cleared by at least 400 ft when accelerating in level flight to green dot speed after an engine failure, in the most adverse conditions. The height is never less than 800 ft above airport elevation.

B. Speeds (IAS)

F – Flaps retraction speed, one engine out (1.25 Vs slats out)
S – Slats retraction speed, one engine out (1.25 Vs clean)
Green dot – Optimum climb out speed, one engine out (1.45 Vs clean).

C. Supplementary operating instructions for take-off

(1) Contaminated runway

A runway is contaminated if it is covered by a layer of water greater than 3 mm (0.12 in) in depth, or by slush, snow or ice. In that case refer to chapter 2.18. Take-off should be executed with full thrust.

(2) Wet runway

(a) No measurable standing water
No penalty if according to the texture of the runway surface, the braking efficiency is equal to or better than « MEDIUM ».

(b) Measurable-layer of standing water not greater than 3 mm (0.12 in) in depth covering continuously the runway.

Refer to 2.18.

(3) Antiskid failure

Refer to MMEL

(4) Spoilers inoperative

Refer to MMEL

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D. Landing information

TGA is the maximum temperature at which the approach climb gradient condition is satisfied as a function of weight. Two TGA and flap settings are presented in order to choose the most appropriate as a function of the scheduled landing weight and temperature. The configurations 15/15 and 20/20, specified under TGA, are the configurations in which the required gradient of 2.1 % is satisfied, with one engine failed. The single engine approach is normally performed with one step of flaps further down until overshoot is decided, while the 2 engines approach is performed with up to two steps (if applicable) beyond the indicated flaps position. In both cases, one step of flaps is retracted when the Go-Around is decided.

The required gradient of 2.1 % is considered at the airport reference altitude. The power setting is « Go-Around » thrust with the air conditioning ON. The speed is 1.3 Vs of the specified flap setting.

The temperature TGA is also published for weight higher than the maximum landing weight in order to cover the overweight landing condition.
If the OAT is greater than the temperature TGA, follow the overweight landing procedure requiring to land in configuration 20/20.
Again, the indicated setting is one step of flaps below the approach configuration.

Note : If no bleed for air conditioning is extracted from the engines, the minimum gain to be expected is :
- *1° C on the temperature*
- *or 1 ton on the weight.*

5. INTERPOLATION

It is allowed to interpolate weight, temperature and speeds between two consecutive boxes of a column, or of a line.

6. METHOD OF APPLICATION

A. Maximum take-off weight determination

(1.)

Enter with actual wind and actual temperature

(2.)

Read or interpolate total weight or determine total weight by adding the effect of weight gradient to the weight of the first box.

(3.)

Apply weight corrections and determine maximum T/O weight.

(4.)

Take parameters and flaps setting corresponding to this weight and actual wind.

B. Flexible temperature determination

(1.)

Enter with actual weight and actual wind.

Read max. temperature of the box or interpolate

(2.)

Apply temperature corrections.
Determine corrected temperature (CT)
MAX TEMP. + CORRECTION = CT.

Check CT

(3.)

When OAT is TREF or lower	
If CT is lower than TREF :	*If CT is higher than TREF*
No flex take-off possible. Determine max. T/O weight as under para 6.A	Take this CT as FLEX TEMP. Limit flex temp to ISA + 57°C

When OAT is higher than TREF	
If CT is lower than OAT :	*If CT is higher than OAT :*
No flex take-off possible. Determine max. Take-off weight as under para 6.A	Take this CT as FLEX TEMP. Limit flex temp to ISA + 57°C

Take parameters corresponding to the weight and actual wind. Set the flaps as indicated.

7. RESEARCH OF OPTIMUM USE OF THE CHART (valid only when flexible take-off is possible) :

On some airports, the runway structure is not perfect and it may be advisable to take-off as soon as possible. On some others, particularly in altitude, maximum performance is often limited by tire speed. In this case, actual T/O weight or temperature permitting, it may be interesting to take-off with a lower speed.

The chart offers the possibility of trading a lower take-off speed against the unnecessary temperature margin (which is the temperature above max. permissible CT) or even against some thrust reduction.

For this purpose, move to the left of the actual wind until :
- either the maximum for flexible temperature is met (ISA + 57 °C) to take the full advantage of the unused temperature above that figure.
- or a temperature, which, as a compromise, represents less than the maximum permissible thrust reduction.

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8. RTOLW CHARTS – COMPLEMENTARY INFORMATION : EFFECT OF QNH OR/AND BLEEDS

R
R
R
R

AIRCRAFT MODEL

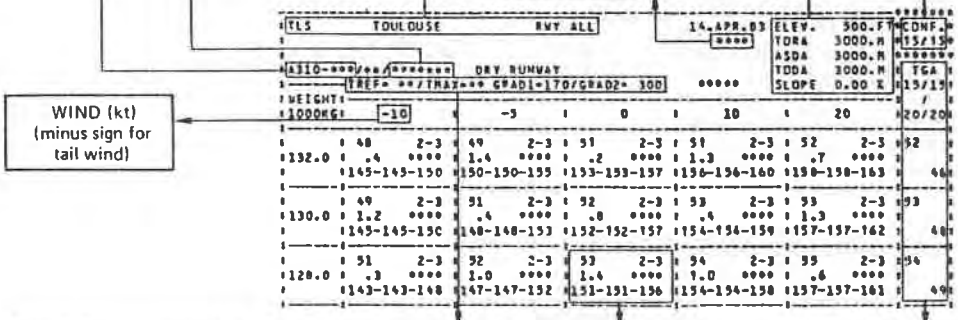
ENGINES
Manufacturer - Model

AIRPORT CHARACTERISTICS

BRAKES
Manufacturer - Max brake energy value in MJ
(BM = Messier Steel)
(BB = Bendix Steel)
(CM = Messier Carbon)

TAKE OFF CONFIGURATION SLATS/FLAPS

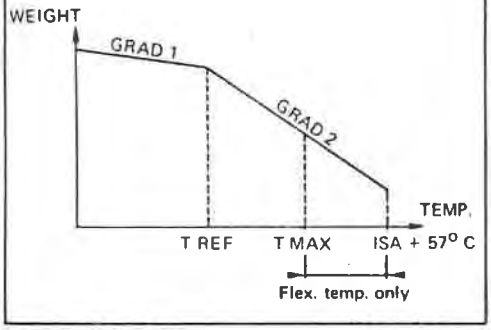
WIND (kt)
(minus sign for tail wind)



T REF = Flat rating temperature

T MAX = Maximum certified temperature (ISA + 40°C)

GRAD 1 / GRAD 2 } Weight gradients in kg/°C for each side of T REF. Usable to determine the maximum take off weight for a temperature lower than the temperature shown in the first box of a column.



TAKE OFF PARAMETERS COMPUTED FOR 1013 mb QNH AND BLEEDS OFF

TEMPERATURE (°C)	LIMITATION CODE
(53)	(2 - 3)

WEIGHT INCREMENT (t)
(1.4)

V_1 (kt IAS)	V_R (kt IAS)	V_2 (kt IAS)
(151)	(151)	(156)

Temperature : max temp. at which entry weight (128 t) plus weight increment (1.4 t) can be taken off under no wind.

Limitation code :

1 = structure
2 = 2nd segment
3 = runway
4 = obstacle
5 = tyre speed
6 = brake energy

Max. temp. at which approach climb gradient for go around on one engine is satisfied under indicated flap/slat setting.
Air conditioning ON.

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

CORRECTIONS ON TEMPERATURE IF FLEX. TAKE OFF PERFORMED		CORRECTIONS ON WEIGHT IF TAKE-OFF WITH FULL THRUST PERFORMED
Add 1° C per 25 mb	QNH above 1013 mb •	Add 20 kg/mb
Sub 1° C per 7 mb	QNH below 1013 mb	Sub 170 kg/mb
Sub 2° C	Engine A/ICE ON	Sub 2000 kg
Sub 5° C	Total A/ICE ON	Sub 4800 kg
Sub 3° C	Air conditioning ON	Sub 2500 kg

COMPARE CORRECTED TEMP. (CT), FLAT RATING TEMP. (T REF) AND OAT		
	CT Higher than OAT and CT Higher than T REF	Take CT as flex. Temp. limited to ISA + 57° C
	Both conditions above not fulfilled	NO FLEX. Determine MAX TOW

• No correction when Airport pressure altitude = 0 ft or below

GE Eng. : 80C2A2

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LFPB PARIS LE BOURGET RWY 07 FAR						ELEV. 217.FT	CONF.
					****	TORA 3000.M	*15/15*
						ASDA 3050.M	*******
A310-***/**/******* DRY RUNWAY						TODA 3050.M	TGA
TREF= **/TMAX=** GRAD1= 80/GRAD2= 700					*****	SLOPE .70 %	15/15
WEIGHT 1000KG	-10	-5	0	10	20		20/20
	43 4-4	46 4-4	48 4-4	49 4-4	50 4-4		52
132.0	.6 ****	.6 ****	1.0 ****	1.1 ****	1.1 ****		
	147-147-152	148-148-152	151-151-155	152-152-157	154-154-158		47
	45 4-4	48 4-4	50 4-4	51 4-4	52 4-4		54
130.0	.8 ****	.4 ****	.2 ****	.2 ****	.1 ****		
	146-146-151	147-147-152	149-149-154	151-151-155	152-152-157		49
	47 4-4	49 4-4	51 4-4	52 4-4	53 4-4		54
128.0	.8 ****	1.1 ****	.7 ****	.7 ****	.7 ****		
	145-145-150	146-146-151	148-148-153	150-150-155	151-151-156		50
	49 4-4	51 4-4	52 4-4	53 4-4	54 4-4		54
126.0	.4 ****	.3 ****	1.3 ****	1.3 ****	1.2 ****		
	144-144-149	145-145-150	149-148-152	149-149-154	150-150-155		52
	50 4-4	52 4-4	54 4-4	55 4-4	56 4-4		54
124.0	1.0 ****	.9 ****	.4 ****	.6 ****	.6 ****		
	143-143-148	144-144-149	146-146-150	149-148-153	149-149-153		53
	52 4-4	54 4-4	55 4-4	57 4-4	58 4-4		54
122.0	.2 ****	.0 ****	1.2 ****	.1 ****	.1 ****		
	142-142-146	143-143-147	146-146-150	147-147-152	147-147-152		54
	53 4-4	55 4-4	57 4-4	58 4-4	59 4-4		54
120.0	.9 ****	.8 ****	.7 ****	.8 ****	.8 ****		
	141-141-145	143-143-147	146-146-150	147-147-151	147-147-151		54
	55 4-4	57 4-4	59 4-4	60 4-4	61 4-4		54
118.0	.3 ****	.5 ****	.3 ****	.3 ****	.2 ****		
	139-139-144	142-142-147	145-145-150	145-145-150	145-145-150		54
	56 4-4	59 4-4	60 4-4	61 4-4	62 4-4		54
116.0	1.1 ****	.1 ****	1.1 ****	1.1 ****	1.0 ****		
	139-139-143	141-141-145	144-144-149	144-144-149	145-145-149		54
	58 4-4	60 4-4	62 4-4	63 4-4	64 4-4		54
114.0	.9 ****	1.0 ****	.6 ****	.6 ****	.4 ****		
	139-139-143	140-140-145	143-143-147	143-143-147	143-143-147		54
	60 4-4	62 4-4	64 4-4	65 4-4	65 4-4		54
112.0	.6 ****	.6 ****	.1 ****	.0 ****	1.1 ****		
	138-138-143	139-139-143	141-141-146	141-141-146	142-142-146		54
	62 4-4	64 4-4	65 4-4	66 4-4	67 4-4		54
110.0	.3 ****	.2 ****	.9 ****	.8 ****	.6 ****		
	137-137-142	138-138-142	141-141-145	141-141-145	141-141-145		54
	66 4-4	68 4-4	69 4-4	70 4-4	71 4-4		54
105.0	.7 ****	.5 ****	.9 ****	.7 ****	.5 ****		
	134-134-139	137-137-141	138-138-142	139-139-143	138-138-142		54
	71 4-4	71 4-4	71 4-4	71 4-4	71 ***		54
100.0	.0 ****	1.9 ****	3.4 ****	4.4 ****	0.0 ****		
	133-133-138	135-135-139	137-137-141	139-139-143	114-124-129		54

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF REGULATORY TAKE OFF AND LANDING WEIGHT CHARTS (RTOLW CHARTS)	2.10.30 PAGE 6 REV 15 SEQ 035

9. EXAMPLES

See enclosed chart to follow examples.

A. Determination of maximum take-off weight.

DATA
OAT = 10°
QNH = 1003 mb
20 kt head wind
Air conditioning on

(1) Enter in 20 kt head wind column and read temperature and weight, in first line at 50° . . . . . 133.1 t

(2) Use weight gradients for increase in weight capability between 50° and 10° :
between 50° and TREF = 34° . . . 16 × 0.7 11.2 t
between 34° and 10° . . . . . 24 × 0.08 1.9 t
Total weight . . . . . 146.2 t

(3) Effect of QNH . . . . . 10 × 0.17 1.7 t
144.5 t

(4) Effect of air conditioning . . . . . 2.5 t
Maximum capability . . . . . 142.0 t

R Maximum permissible take off weight, depending on
R version, for example : 132 t

(5) Read Take-off parameters in 132 t line for 20 kt head wind Flaps 15°
V1 = 154 kt
VR = 154 kt Limitation : obstacle
V2 = 158 kt

B. Determination of flexible temperature.

DATA
OAT = 15°
Take-off weight : 122 tons
QNH = 1038 mb
No wind
Air conditioning OFF

(1) Enter with 122 tons and no wind and read temperature . . . . . 55°

(2) Effect of QNH . . . . . + 1°
Corrected temperature . . . . . = 56°

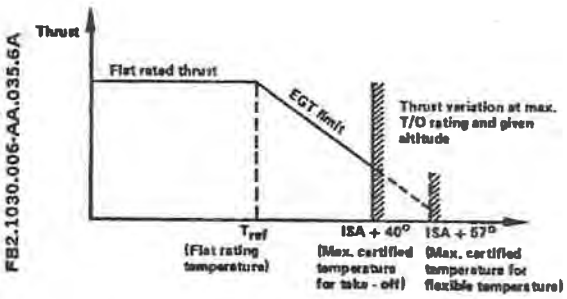
(3) Check CT is lower than 71° (ISA + 57°).
Flex temperature to be set on THRUST CONTROL COMPUTER : . . . . . 56°

(4) Read take-off parameters in 122 tons line for no wind
V1 = 146 kt
VR = 146 kt
V2 = 150 kt

10. EXPLANATION OF TAKE-OFF PERFORMANCE CALCULATION

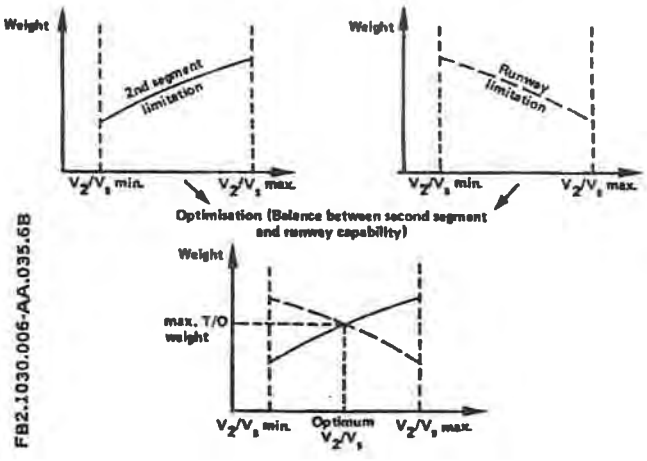
The performance calculation is optimized. This means that considering the runway, the obstacles (if any) and the environmental conditions, the maximum take-off weight, associated to the optimum flap setting is the resulting parameter. Conversely, a max. TO temperature will result if the chart is entered with the actual TO weight.

A. Engine thrust



B. Airplane performance

Considering a given runway and wind, given temperature and pressure conditions, given flap setting, the max. weight that can be lifted varies with the V2/Vs ratio.

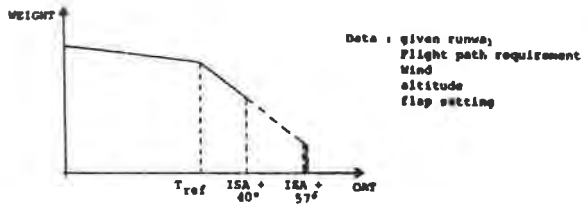


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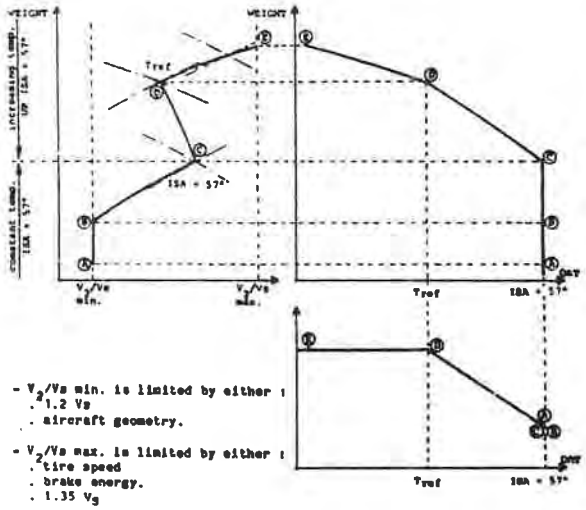
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	TAKE OFF REGULATORY TAKE OFF AND LANDING WEIGHT CHARTS (RTOLW CHARTS)	N 2.10.30 PAGE 7/8 REV 04 OCT 83

If the same calculation is done for all temperature at the same pressure altitude and on same runway, the resulting graph is :



This graph is converted into a tabular form in one column of the take-off chart.

If we enter more deeply in details, the column of a chart represents the optimization line as presented below.



Between (D) and (E), i.e. below Tref, the thrust remains constant. However the weight which can be lifted increases when the temperature decreases. This is due to the TAS decreasing along with the temperature for the same IAS, which in turn allows an acceleration to a higher IAS on the same runway length and consequently leads to a higher weight being lifted.

Between (D) and (C), the thrust decreases, and, consequently, the weight, when the temperature increases.

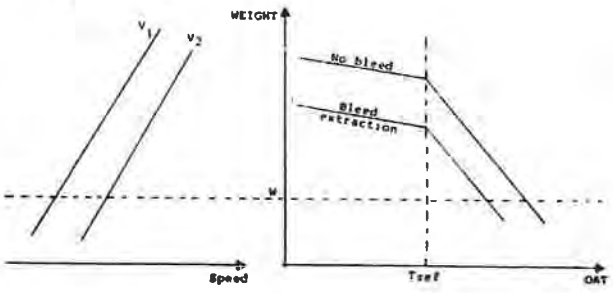
Between (C) and (B), the thrust remains constant at the level delivered at ISA + 57 °. The optimization line follows the climb limiting weight, until the minimum V2/Vs value is reached. Then, towards (A), the V2/Vs ratio remains constant.

C. Effect of wind, runway length and bleeds

As a general rule, the optimization leads to balance ASD and TOD, which means having a single V1. However, on very long runway, the airplane being limited by the second segment climb gradient, it is possible to have a wide range of V1, V1 min. being limited by TOD and V1 max. by ASD.

Concerning the wind effect, it must be noted that a tail wind makes the runway « shorter » and a head wind makes the runway « longer », which in the last case leads to a lower V1 min.

In case of air bleed, it is interesting to note that the available max. thrust decreases, and, consequently, the weight for a given temperature.



In addition, for a given weight W, with or without bleed, the take-off speeds are the same.

Vers. : All Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF QUICK REFERENCE TABLES	2.10.40 PAGE 1 REV 15 SEQ 040

INTRODUCTION :

These tables enable the crew to quickly determine take off performance out of an airport, for which no take off chart has been established. They are obviously conservative.

USE OF TABLES :

A first table gives the corrections to be applied to the runway length versus wind and runway slope. For each flap setting three other tables give, for three different pressure altitudes (0, 1000 and 2000 ft) function of temperature and corrected runway length, maximum take off weight, limitation codes and associated speeds. At the top of the table TREF and TMAX are given. For pressure altitude above 2000 ft the flight manual has to be used. Two graphs give for each configuration the penalty to apply in case of obstacles on the flight path.

HOW TO PROCEED ?

Enter the first table with runway length, slope and wind data. Determine the corrected runway length by applying the corrections due to slope and wind data. Select then the configuration as a function of this corrected runway length and enter the table(s) corresponding to the proper configuration and airport pressure altitude. As far as airport pressure altitude is concerned, two methods may be applied :

- either interpolate the take off performance by using the two tables enclosing the airport pressure altitude,
- or, if one only need a conservative figure, use the table corresponding to the pressure altitude immediately above the one of the considered airport.

Enter then the proper column of the table(s) with the corrected runway length as criteria. Once again, two methods may be applied :

- either interpolate the take off performance between the two columns enclosing the corrected runway length
- or, if one only need a conservative figure, use the column corresponding to the foregoing value of the corrected runway length.

A. DETERMINATION OF MAXIMUM TAKE OFF WEIGHT

Enter the proper table(s) and column(s) as explained above with the actual OAT and read maximum take off weight, limitation codes, V1, VR and V2. If necessary interpolate weight and speeds.
In case of obstacles refer to pages 13 to 18 and apply the corresponding weight and speed decrements.

B. DETERMINATION OF FLEXIBLE TEMPERATURE

Determination of flexible temperature is only possible without any obstacle on the flight path.
Enter the proper table(s) and column(s) with the actual take off weight and determine flexible temperature.

C. LIMITATION CODES :

2 : second segment
3 : runway
5 : tirespeed
6 : brake energy

Note : Limitation codes 1 (structural weight) and 4 (obstacles) do not appear in quick reference tables.

D. CORRECTIONS FOR WIND AND RUNWAY SLOPE

Runway length (m)		1 500	2 000	2 500	3 000	3 500	4 000
Effect of wind	per kt of tail* wind subtract (meters)	30	40	50	60	65	75
	per kt of head wind add (meters)	8	10	12	14	15	17
Effect of runway slope	per percent uphill slope subtract (meters)	75	175	225	300	365	440
	per percent downhill slope add (meters)	25	40	65	75	85	100

* For runway length above 2750 m
. reduce Max. Take-off weight by 2.5 tons (5500 lb)/kt tail wind R
. reduce V_1 by 2 kt/kt tail wind
. reduce V_R and V_2 by 1 %/kt tail wind.

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E. EXAMPLE

Pressure altitude : 1400 FT
Temperature : 36° C
Runway length : 3500 m
Wind : 10 kt head
Slope : 1 % up

1. Determination of corrected runway length :

   Runway length 3500
   Correction due to wind . . . . . 10 × 15 = + 150
   Correction due to slope . . . . . — 365

   Corrected runway length . . . . . = 3285 m

   Take-off configuration : 15/0

2. Determination of a conservative figure as maximum take-off weight :

   Pressure altitude : 1400 FT ; Use the table corresponding to 2000 FT (2.10.40 page 5)
   Corrected runway length : 3285 m ; enter the column corresponding to 3250 m
   Read the maximum take-off weight on the line corresponding to the temperature 36° C : 150.2 tons
   V_1 = 161 kt, Vr = 166 kt, V_2 = 169 kt.

3. Determination of a precise figure as flexible temperature for the actual take-off weight of 145 tons

   - Interpolate the temperature corresponding to 145 tons for the corrected runway length of 3285 m at 1000 and 2000 ft pressure altitude.
     Results :
     1000 FT : 51° C, V_1 = 162 kt, Vr = 165 kt, V_2 = 168 kt
     2000 FT : 46° C, V_1 = 160 kt, Vr = 163 kt, V_2 = 166 kt

   - Interpolate between these two values to get the flexible temperature at 1400 FT pressure altitude :
     49° C, V_1 = 161 kt, V_R = 164 kt, V_2 = 167 kt

4. Determination of a conservative figure as maximum take-off weight in case of a 992 ft height obstacle located at 15 km from runway end. From 2.10.40 page 5, as in paragraph 2, find TOW and associated speeds without obstacle :
   151.6 tons V_1 = 162 kt, Vr = 166 kt, V_2 = 170 kt.
   2.10.40 page 14 :
   Corrected obstacle height for uphill runway :
   992 + 58 = 1050 ft
   Weight decrement : 9.0 tons.
   Maximum take-off weight :
   151.6 – 9.0 = 142.6 tons,
   V_1 = 162 – 6 = 156 kt,
   Vr = 166 – 6 = 160 kt,
   V_2 = 170 – 6 = 164 kt.

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SLATS 15/FLAPS 0
PRESSURE ALTITUDE : 0 FT
TREF = 44 / TMAX = 55

TEMPERATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	3000	3250	3500	3750	4000
–20	163.0 2-3 172-175-179	165.0 6-2 176-180-183	165.0 6-2 173-180-183	165.0 6-2 171-180-183	165.0 6-2 168-180-183
–10	161.7 2-3 170-173-177	163.7 2-6 173-177-181	164.6 2-6 173-179-183	165.0 2-2 171-180-184	165.0 2-2 169-180-184
0	160.4 3-3 168-171-175	162.4 2-6 171-175-179	163.2 2-6 170-177-181	164.1 2-6 170-179-183	164.9 2-6 169-181-184
10	158.1 3-3 167-169-174	161.0 2-6 168-173-177	161.9 2-6 168-174-178	162.8 2-6 167-176-180	163.6 2-6 167-178-182
20	155.8 3-3 165-168-172	159.5 6-6 166-170-174	160.5 2-6 165-172-176	161.4 2-6 165-174-178	162.3 2-6 164-176-180
30	153.6 3-3 164-167-171	157.1 6-6 165-169-173	159.0 6-6 163-170-174	160.1 2-6 163-172-176	161.0 2-6 162-174-178
40	151.4 3-3 162-166-170	154.8 6-6 163-168-172	156.7 6-6 162-169-173	158.6 6-6 161-170-174	159.7 2-6 160-172-176
44	150.5 3-3 162-166-170	153.8 6-6 163-167-171	155.8 6-6 161-169-172	157.7 6-6 160-170-173	159.1 2-6 160-171-175
46	148.9 3-3 161-165-169	152.9 6-6 163-167-171	154.8 6-6 162-168-172	156.2 2-6 161-169-173	157.1 2-6 160-171-175
48	147.3 3-3 161-164-168	151.9 6-6 163-167-170	153.3 2-6 162-168-172	154.1 2-6 162-170-173	155.0 2-6 161-171-175
50	145.7 3-3 160-163-167	150.3 2-3 163-167-170	151.2 2-6 163-168-172	152.1 2-6 163-170-174	152.9 2-6 162-172-175
52	144.1 3-3 160-163-166	148.0 2-3 163-166-170	149.2 2-6 164-169-172	149.9 2-6 164-170-174	150.7 2-6 163-172-176
54	142.5 3-3 159-162-165	145.6 2-3 163-166-169	147.1 2-6 165-169-172	147.8 2-6 165-170-174	148.5 2-6 164-172-176
56	140.8 3-3 158-161-164	143.3 2-3 163-165-169	145.0 2-6 166-169-173	145.7 2-6 165-171-174	146.3 2-6 165-172-176
58	138.7 2-3 158-160-163	140.9 2-3 162-165-168	142.8 2-3 166-169-172	143.5 2-6 166-171-174	144.1 2-6 166-172-176
60	136.4 2-3 158-160-163	138.5 2-3 162-164-167	140.3 2-3 166-168-172	141.3 2-6 167-171-174	141.5 2-6 167-173-176
62	134.1 2-3 157-159-162	136.1 2-3 162-164-167	137.9 2-3 166-168-171	138.7 2-6 169-171-175	138.8 2-6 169-173-176
64	131.8 2-3 157-159-161	133.8 2-3 161-163-166	135.5 2-3 166-167-170	135.9 2-6 170-172-175	136.0 2-6 170-174-177
66	129.4 2-3 157-158-161	131.4 2-3 161-163-165	132.8 2-3 165-167-170	133.1 2-3 170-172-175	133.2 2-2 170-173-176
68	127.1 2-3 156-158-160	129.0 2-3 161-162-165	130.1 2-3 165-167-169	130.3 2-2 169-171-174	130.3 2-2 169-171-174
70	124.8 2-3 156-157-159	126.6 2-3 161-162-164	127.3 2-3 165-166-169	127.4 2-2 168-169-172	127.4 2-2 166-169-172
72	122.5 2-3 156-157-159	124.2 2-3 161-162-164	124.5 2-3 166-166-169	124.5 2-2 166-167-170	124.5 2-2 164-167-170

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.003-AA.080

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SLATS 15/FLAPS 0
PRESSURE ALTITUDE : 1000 FT
TREF = 40 / TMAX = 53

TEMPERATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	3000	3250	3500	3750	4000
−20	160.8 2-3 170-173-177	163.0 2-6 174-178-182	163.8 2-6 174-180-184	164.6 2-6 173-182-185	165.0 2-2 172-183-186
−10	159.5 2-3 168-171-175	161.6 2-6 172-176-179	162.5 2-6 171-177-181	163.3 2-6 170-179-183	164.1 2-6 170-181-185
0	157.6 3-3 166-169-173	160.3 2-6 169-173-177	161.2 2-6 169-175-179	162.0 2-6 168-177-181	162.8 2-6 167-179-182
10	155.3 3-3 165-168-172	158.9 2-6 167-171-175	159.8 2-6 166-173-176	160.7 2-6 166-174-178	161.5 2-6 165-176-180
20	153.0 3-3 164-167-171	156.9 6-6 165-169-173	158.5 2-6 164-170-174	159.4 2-6 163-172-176	160.3 2-6 163-174-178
30	150.8 3-3 162-166-170	154.5 6-6 163-168-172	156.4 6-6 162-169-173	158.1 2-2 161-170-174	159.0 2-6 161-172-176
40	148.6 3-3 161-165-168	152.1 6-6 162-167-170	154.0 6-6 161-168-171	155.9 6-6 160-169-173	157.2 2-6 159-170-174
42	147.3 3-3 160-164-168	151.3 6-6 162-166-170	153.2 6-6 161-167-171	155.1 6-6 160-168-172	156.2 2-6 159-170-174
44	145.8 3-3 160-163-167	150.4 6-6 162-166-169	152.3 6-6 161-167-171	153.5 2-6 160-168-172	154.3 2-6 160-170-174
46	144.3 3-3 159-163-166	149.5 3-3 162-166-169	150.8 2-6 162-167-170	151.6 2-6 161-169-172	152.4 2-6 161-170-174
48	142.8 3-3 159-162-165	147.8 2-3 162-165-168	148.9 2-6 162-167-171	149.7 2-6 162-169-172	150.5 2-6 161-170-174
50	141.4 3-3 158-161-164	145.7 2-3 162-165-168	147.1 2-6 163-167-171	147.8 2-6 163-169-172	148.5 2-6 162-170-174
52	139.9 3-3 158-161-164	143.6 2-3 161-164-167	145.2 2-6 164-167-171	145.9 2-6 163-169-172	146.6 2-6 163-171-174
54	138.4 3-3 157-160-163	141.5 2-3 161-164-167	143.3 2-6 164-167-171	144.0 2-6 164-169-172	144.7 2-6 164-171-174
56	136.8 3-3 156-159-162	139.5 2-3 161-163-166	141.4 2-3 165-167-171	142.1 2-6 165-169-172	142.7 2-6 164-171-174
58	135.2 3-3 156-158-161	137.4 2-3 160-163-166	139.3 2-3 164-167-170	140.2 2-6 165-169-172	140.9 2-6 165-171-174
60	133.3 2-3 155-158-160	135.4 2-3 160-162-165	137.2 2-3 164-166-169	138.4 2-6 166-169-172	138.6 2-6 166-171-174
62	131.3 2-3 155-157-160	133.3 2-3 160-162-164	135.1 2-3 164-166-169	136.1 2-6 167-170-173	136.2 2-6 167-171-174
64	129.3 2-3 155-157-159	131.3 2-3 159-161-164	133.0 2-3 164-165-168	133.7 2-3 168-170-173	133.8 2-6 168-172-175
66	127.2 2-3 155-156-159	129.2 2-3 159-161-163	130.9 2-3 163-165-167	131.3 2-3 168-169-172	131.4 2-5 169-172-174
68	125.3 2-3 154-156-158	127.2 2-3 159-160-163	128.6 2-3 163-165-167	128.9 2-3 168-169-172	128.9 2-2 168-170-173
70	123.3 2-3 154-155-158	125.1 2-3 159-160-162	126.2 2-3 163-165-167	126.4 2-2 167-169-171	126.4 2-2 167-169-171

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.004-A.A.080

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40
		PAGE 5
	QUICK REFERENCE TABLES	REV 18 / SEQ 080

SLATS 15/FLAPS 0
PRESSURE ALTITUDE : 2000 FT
TREF = 36 / TMAX = 51

TEMPE-RATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	3000	3250	3500	3750	4000
–20	158.5 2-3 168-171-175	160.9 2-3 173-176-180	161.8 2-6 172-178-182	162.6 2-6 172-180-184	163.3 2-6 171-182-185
–10	157.0 3-3 166-169-173	159.6 2-6 170-174-178	160.4 2-6 170-176-179	161.3 2-6 169-177-181	162.0 2-6 169-179-183
0	154.6 3-3 165-168-172	158.2 2-6 168-171-175	159.1 2-6 167-173-177	159.9 2-6 167-175-179	160.7 2-6 166-177-180
10	152.3 3-3 163-167-171	156.5 6-6 165-169-173	157.7 2-6 164-171-174	158.5 2-6 164-172-176	159.4 2-6 163-174-178
20	149.9 3-3 162-165-169	154.0 6-6 163-168-172	155.9 6-6 162-169-173	157.2 2-6 162-170-174	158.1 2-6 161-172-176
30	147.7 3-3 161-164-168	151.6 6-6 162-166-170	153.5 6-6 161-167-171	155.4 6-6 160-169-172	156.8 2-6 159-170-174
36	146.4 3-3 160-164-167	150.2 6-6 161-166-169	152.1 6-6 160-167-170	154.0 6-6 159-168-171	155.9 6-6 158-169-173
38	145.2 3-3 159-163-167	149.4 6-6 161-165-169	151.3 6-6 160-166-170	153.2 6-6 159-167-171	154.7 2-6 158-169-172
40	143.9 3-3 159-162-166	148.6 6-6 161-165-168	150.5 6-6 160-166-170	152.3 2-2 159-167-171	153.1 2-6 159-169-172
42	142.6 3-3 158-162-165	147.8 3-3 161-165-168	149.6 6-6 160-166-169	150.6 2-6 160-167-171	151.5 2-6 159-169-172
44	141.3 3-3 158-161-164	146.4 3-3 161-164-167	148.2 2-6 161-166-169	149.0 2-6 160-167-171	149.8 2-6 160-169-172
46	139.9 3-3 157-160-164	145.0 3-3 160-163-166	146.5 2-6 161-166-169	147.3 2-6 161-167-171	148.1 2-6 160-169-172
48	138.6 3-3 157-160-163	143.4 2-3 160-163-166	144.9 2-6 162-166-169	145.6 2-6 161-167-171	146.4 2-6 161-169-172
50	137.3 3-3 156-159-162	141.6 2-3 160-162-165	143.2 2-6 162-166-169	144.0 2-6 162-167-171	144.6 2-6 162-169-172
52	135.9 3-3 156-158-161	139.7 2-3 159-162-165	141.6 2-6 163-166-169	142.3 2-6 162-167-171	143.0 2-6 162-169-172
54	134.4 3-3 155-158-160	138.0 2-3 159-161-164	139.9 2-3 163-166-169	140.7 2-6 163-167-170	141.3 2-6 163-169-172
56	133.0 3-3 155-157-160	136.2 2-3 158-161-164	138.1 2-3 163-165-168	139.1 2-6 164-167-170	139.7 2-6 163-169-172
58	131.7 3-3 154-156-159	134.5 2-3 158-161-163	136.4 2-3 162-165-167	137.5 2-6 164-167-170	138.1 2-6 164-169-172
60	130.3 3-3 153-156-158	132.7 2-3 158-160-163	134.6 2-3 162-164-167	135.9 2-6 165-167-170	136.3 2-6 165-169-172
62	129.0 2-3 153-155-157	131.0 2-3 157-160-162	132.8 2-3 162-164-166	134.2 2-6 166-168-170	134.3 2-5 165-169-172
64	127.2 2-3 153-154-157	129.2 2-3 157-159-161	131.0 2-3 161-163-166	132.2 2-3 166-167-170	132.3 2-5 165-169-172
66	125.6 2-3 152-154-156	127.5 2-3 157-159-161	129.2 2-3 161-163-165	130.2 2-3 165-167-170	130.2 2-5 166-168-171
68	123.9 2-3 152-154-156	125.8 2-3 157-158-160	127.5 2-3 161-163-165	128.1 2-3 165-167-169	128.2 2-5 166-168-171

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.005-AA.080

Code : 1040A

GE Eng : 80C2A2

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SLATS 15/FLAPS 15
PRESSURE ALTITUDE : 0 FT
TREF = 44 / TMAX = 55

TEMPERATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	2250	2500	2750	3000	3250
–20	154.8 2-3 155-157-162	157.8 2-3 161-164-168	160.4 2-3 166-170-174	162.7 2-3 172-175-179	163.5 2-2 174-178-181
–10	153.4 2-3 153-155-160	156.5 2-3 158-162-166	159.2 2-3 164-167-171	161.5 2-3 169-173-177	163.2 2-2 173-178-181
0	152.0 3-3 150-153-158	155.3 2-3 156-160-164	158.0 2-3 161-165-169	160.3 2-3 166-171-174	162.3 2-3 171-176-179
10	149.7 3-3 149-152-157	154.0 2-3 154-157-162	156.8 2-3 159-163-167	159.2 2-3 164-169-172	161.2 2-3 169-174-177
20	147.4 3-3 147-151-156	152.8 2-3 152-156-160	155.6 2-3 157-161-165	158.0 2-3 162-167-170	160.1 2-6 166-172-175
30	145.1 3-3 146-149-154	151.6 2-3 150-154-158	154.5 2-3 155-159-163	156.9 2-3 160-165-168	158.9 2-6 164-169-173
40	142.9 3-3 145-148-153	149.7 3-3 148-152-157	153.2 2-3 153-158-162	155.7 2-3 158-163-167	157.8 2-6 161-167-171
44	142.0 3-3 144-148-153	148.7 3-3 148-152-156	152.7 2-3 152-157-161	155.2 2-3 157-162-166	157.2 2-6 161-167-170
46	140.5 3-3 144-147-152	147.2 3-3 147-151-155	150.4 2-3 152-157-161	152.9 2-3 157-162-166	155.1 2-3 161-167-170
48	138.9 3-3 143-146-151	145.4 2-3 147-150-155	148.2 2-3 152-156-160	150.6 2-3 157-161-165	152.7 2-3 161-166-170
50	137.3 3-3 143-146-150	143.1 2-3 147-150-154	145.9 2-3 152-156-160	148.2 2-3 156-161-165	150.3 2-3 161-166-169
52	135.8 3-3 142-145-149	140.9 2-3 147-150-154	143.6 2-3 151-155-159	145.9 2-3 156-161-164	147.9 2-3 161-166-169
54	134.3 3-3 142-144-149	138.7 2-3 146-149-154	141.3 2-3 151-155-159	143.6 2-3 156-161-164	145.4 2-3 161-166-169
56	132.6 3-3 141-144-148	136.5 2-3 146-149-153	139.0 2-3 151-155-158	141.2 2-3 156-160-164	143.0 2-3 161-165-168
58	130.8 3-3 141-143-147	134.2 2-3 146-148-152	136.7 2-3 151-154-158	138.8 2-3 156-159-163	140.6 2-3 161-165-168
60	129.0 2-3 140-142-146	132.0 2-3 145-148-152	134.4 2-3 150-154-157	136.4 2-3 155-159-162	138.1 2-2 159-164-167
62	126.9 2-3 140-141-145	129.7 2-3 145-147-151	132.1 2-3 150-153-157	134.1 2-3 155-158-162	135.3 2-2 158-162-165
64	124.7 2-3 139-141-145	127.5 2-3 145-147-151	129.8 2-3 150-153-156	131.7 2-3 155-158-161	132.5 2-2 157-160-163
66	122.5 2-3 139-140-144	125.2 2-3 144-146-150	127.4 2-3 149-152-155	129.3 2-3 155-157-160	129.7 2-2 156-159-161
68	120.3 2-3 139-140-143	122.9 2-3 144-146-149	125.1 2-3 149-151-155	126.9 3-3 154-157-160	127.0 2-2 153-157-160
70	118.2 2-3 138-140-143	120.7 2-3 144-145-149	122.8 2-3 149-151-154	124.2 2-2 153-155-158	124.2 2-2 151-155-158
72	116.0 2-3 138-139-142	118.4 2-3 144-145-148	120.5 2-3 149-151-154	121.4 2-2 151-154-156	121.4 2-2 149-154-156

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.008-AA.080

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40
		PAGE 7
	QUICK REFERENCE TABLES	REV 18 / SEQ 080

SLATS 15/FLAPS 15
PRESSURE ALTITUDE : 1000 FT
TREF = 40 / TMAX = 53

TEMPE-RATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	2250	2500	2750	3000	3250
–20	152.6 2-3 153-156-160	155.7 2-3 159-162-166	158.3 2-3 164-168-172	160.5 2-3 169-173-177	161.8 2-2 173-177-180
–10	151.2 2-3 151-153-158	154.4 2-3 156-160-164	157.1 2-3 161-165-169	159.4 2-3 167-171-175	161.3 2-3 172-176-179
0	149.2 3-3 149-152-156	153.2 2-3 154-158-162	155.9 2-3 159-163-167	158.2 2-3 164-169-172	160.2 2-3 169-174-177
10	146.9 3-3 147-150-155	151.9 2-3 152-156-160	154.7 2-3 157-161-165	157.1 2-3 162-167-170	159.2 2-3 167-172-175
20	144.6 3-3 146-149-154	150.7 2-3 150-154-158	153.6 2-3 155-159-163	156.0 2-3 160-165-168	158.1 2-3 164-170-173
30	142.3 3-3 145-148-153	149.0 3-3 148-152-156	152.4 2-3 153-157-161	154.9 2-3 158-163-166	157.0 2-6 162-167-171
40	140.1 3-3 143-147-152	146.8 3-3 147-151-155	150.7 2-3 151-156-160	153.2 2-3 156-161-165	155.3 2-6 160-166-169
42	138.8 3-3 143-146-151	145.6 3-3 146-150-155	149.5 2-3 151-155-159	152.0 2-3 155-160-164	154.2 2-3 160-165-169
44	137.5 3-3 142-146-150	144.2 3-3 146-149-154	147.5 2-3 150-155-159	150.0 2-3 155-160-164	152.1 2-3 160-165-168
46	136.0 3-3 142-145-149	142.7 2-2 145-149-153	145.5 2-3 150-154-158	147.9 2-3 155-160-163	149.9 2-3 160-165-168
48	134.5 3-3 141-144-149	140.7 2-3 145-148-153	143.4 2-3 150-154-158	145.8 2-3 155-159-163	147.8 2-3 159-164-168
50	133.1 3-3 141-144-148	138.7 2-3 145-148-152	141.4 2-3 150-154-158	143.7 2-3 155-159-163	145.7 2-3 159-164-167
52	131.7 3-3 140-143-147	136.7 2-3 145-148-152	139.3 2-3 150-153-157	141.6 2-3 154-159-162	143.5 2-3 159-164-167
54	130.2 3-3 140-142-146	134.8 2-3 144-147-151	137.3 2-3 149-153-157	139.5 2-3 154-158-162	141.4 2-3 159-163-166
56	128.7 3-3 139-142-146	132.8 2-3 144-147-151	135.3 2-3 149-152-156	137.4 2-3 154-158-161	139.3 2-3 159-163-166
58	127.2 3-3 139-141-145	130.8 2-3 144-146-150	133.3 2-3 149-152-156	135.4 2-3 154-157-160	137.2 2-3 158-162-165
60	125.7 3-3 138-140-144	128.9 2-3 143-146-150	131.3 2-3 148-151-155	133.4 2-3 153-157-160	135.1 2-3 158-162-165
62	124.2 2-3 138-139-143	127.0 2-3 143-145-149	129.3 2-3 148-151-154	131.3 2-3 153-156-159	132.8 2-2 157-161-163
64	122.3 2-3 137-139-143	125.0 2-3 143-145-148	127.3 2-3 148-150-154	129.2 2-3 153-156-159	130.4 2-2 156-159-162
66	120.4 2-3 137-139-142	123.1 2-3 142-144-148	125.3 2-3 147-150-153	127.2 2-3 152-155-158	128.0 2-2 155-158-160
68	118.5 2-3 137-138-142	121.1 2-3 142-144-147	123.3 2-3 147-149-153	125.1 2-3 152-155-158	125.6 2-2 153-156-159
70	116.7 2-3 136-138-141	119.2 2-3 142-144-147	121.3 2-3 147-149-152	123.1 2-3 152-154-157	123.2 2-2 151-155-157

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.007-AA.080

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40
		PAGE 8
	QUICK REFERENCE TABLES	REV 18 / SEQ 080

SLATS 15/FLAPS 15
PRESSURE ALTITUDE : 2000 FT
TREF = 36 / TMAX = 51

TEMPERATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	2250	2500	2750	3000	3250
–20	150.3 2-3 151-153-158	153.5 2-3 156-160-164	156.1 2-3 162-166-169	158.3 2-3 167-171-175	160.2 2-2 171-176-179
–10	148.6 3-3 149-152-156	152.2 2-3 154-158-162	154.9 2-3 159-163-167	157.2 2-3 164-169-172	159.1 2-3 169-174-177
0	146.1 3-3 147-150-155	150.9 2-3 152-155-160	153.7 2-3 157-161-165	156.1 2-3 162-167-170	158.1 2-3 167-172-175
10	143.8 3-3 146-149-154	149.7 2-3 150-153-158	152.5 2-3 155-159-163	154.9 2-3 160-165-168	157.0 2-3 164-169-173
20	141.5 3-3 144-148-152	148.2 3-3 148-152-156	151.4 2-3 153-157-161	153.8 2-3 157-162-166	155.9 2-3 162-167-171
30	139.3 3-3 143-146-151	146.0 3-3 147-150-155	150.1 2-3 151-155-159	152.7 2-3 155-160-164	154.8 2-6 160-165-169
36	138.0 3-3 142-146-151	144.7 3-3 146-150-154	149.4 2-3 150-154-158	152.0 2-3 154-159-163	154.1 2-6 158-164-168
38	136.9 3-3 142-145-150	143.6 3-3 145-149-153	147.9 2-3 149-154-158	150.5 2-3 154-159-163	152.7 2-3 158-164-167
40	135.6 3-3 141-145-149	142.3 3-3 145-148-153	146.2 2-3 149-153-157	148.7 2-3 154-159-162	150.9 2-3 158-164-167
42	134.3 3-3 141-144-149	141.0 3-3 144-148-152	144.5 2-3 149-153-157	146.9 2-3 154-158-162	149.0 2-3 158-163-167
44	133.0 3-3 140-143-148	139.7 3-3 144-147-151	142.7 2-3 149-153-157	145.1 2-3 153-158-162	147.2 2-3 158-163-166
46	131.7 3-3 140-143-147	138.2 2-3 144-147-151	140.9 2-3 148-152-156	143.3 2-3 153-158-161	145.3 2-3 158-163-166
48	130.4 3-3 139-142-147	136.5 2-3 143-146-150	139.1 2-3 148-152-156	141.4 2-3 153-157-161	143.4 2-3 157-162-165
50	129.1 3-3 139-142-146	134.7 2-3 143-146-150	137.4 2-3 148-152-155	139.6 2-3 153-157-160	141.5 2-3 157-162-165
52	127.8 3-3 139-141-145	133.0 2-3 143-146-150	135.6 2-3 148-151-155	137.8 2-3 152-156-160	139.7 2-3 157-161-165
54	126.4 3-3 138-140-144	131.3 2-3 142-145-149	133.9 2-3 147-150-154	136.1 2-3 152-156-159	137.9 2-3 157-161-164
56	125.1 3-3 138-140-144	129.6 2-3 142-145-148	132.2 2-3 147-150-154	134.3 2-3 152-155-159	136.1 2-3 156-160-163
58	123.8 3-3 137-139-143	128.0 2-3 142-144-148	130.5 2-3 147-150-153	132.6 2-3 151-155-158	134.3 2-3 156-160-163
60	122.5 3-3 137-138-142	126.4 2-3 141-144-147	128.8 2-3 146-149-153	130.8 2-3 151-154-158	132.6 2-3 156-159-162
62	121.2 3-3 136-138-142	124.7 2-3 141-143-147	127.1 2-3 146-149-152	129.1 2-3 151-154-157	130.8 2-3 156-159-162
64	120.0 3-3 136-137-141	123.1 2-3 141-143-146	125.4 2-3 146-148-152	127.3 2-3 150-153-156	129.0 2-2 155-158-161
66	118.7 2-3 135-137-140	121.4 2-3 141-143-146	123.7 2-3 145-148-151	125.6 2-3 150-153-156	126.9 2-2 154-157-160
68	117.1 2-3 135-136-140	119.8 2-3 140-142-145	122.0 2-3 145-147-151	123.9 2-3 150-153-155	124.9 2-2 153-156-158

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.008-AA.080

Code : 1040A

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40	
		PAGE 9	
	QUICK REFERENCE TABLES	REV 18	SEQ 080

SLATS 20/FLAPS 20
PRESSURE ALTITUDE : 0 FT
TREF = 44 / TMAX = 55

TEMPE-RATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	1500	1750	2000	2250	2500
–20	136.7 3-3 138-139-145	146.1 2-3 143-145-150	150.1 2-3 150-153-158	153.3 2-3 157-160-164	155.9 2-3 164-166-171
–10	134.1 3-3 136-137-143	144.4 3-3 142-143-148	148.8 2-3 148-150-155	152.1 2-3 155-158-162	154.7 2-3 161-164-168
0	131.5 3-3 134-136-142	142.0 3-3 140-142-147	147.6 2-3 146-148-153	150.9 2-3 152-155-160	153.7 2-3 158-162-166
10	129.1 3-3 133-135-141	139.5 3-3 139-141-146	146.4 2-3 144-146-152	149.8 2-3 150-153-158	152.6 2-3 156-160-164
20	126.8 3-3 131-134-140	137.2 3-3 137-139-145	145.1 2-3 142-145-150	148.7 2-3 148-151-156	151.5 2-3 154-158-162
30	124.6 3-3 130-132-139	134.9 3-3 136-138-144	143.8 3-3 140-143-148	147.5 2-3 146-150-154	150.4 2-3 152-156-160
40	122.4 3-3 129-131-138	132.6 3-3 134-137-143	141.6 3-3 139-142-147	146.3 2-3 144-148-153	149.3 2-3 150-154-159
44	121.5 3-3 128-131-137	131.7 3-3 134-137-142	140.6 3-3 139-141-146	145.7 2-3 144-147-152	148.7 2-3 149-153-158
46	120.0 3-3 128-130-136	130.2 3-3 133-136-141	139.1 3-3 138-141-146	143.6 2-3 144-147-152	146.5 2-3 149-153-158
48	118.5 3-3 127-129-135	128.6 3-3 133-135-141	137.5 3-3 138-140-145	141.4 2-3 143-146-151	144.3 2-3 149-153-157
50	116.9 3-3 126-129-135	127.0 3-3 132-135-140	135.7 2-3 137-139-144	139.2 2-3 143-146-151	142.0 2-3 149-152-157
52	115.4 3-3 126-128-134	125.4 3-3 132-134-139	133.6 2-3 137-139-144	137.0 2-3 143-146-150	139.7 2-3 148-152-156
54	114.0 3-3 125-127-133	123.9 3-3 131-133-138	131.5 2-3 137-139-143	134.8 2-3 143-145-150	137.4 2-3 148-152-156
56	112.5 3-3 125-127-132	122.3 3-3 131-133-137	129.4 2-3 136-138-143	132.5 2-3 142-145-149	135.1 2-3 148-151-155
58	110.8 3-3 124-126-131	120.6 3-3 130-132-137	127.2 2-3 136-138-142	130.3 2-3 142-144-149	132.8 2-3 148-151-155
60	109.2 3-3 124-125-131	118.9 3-3 130-131-136	125.1 2-3 135-137-142	128.1 2-3 142-144-148	130.5 2-3 147-150-154
62	107.7 3-3 123-124-130	117.3 3-3 129-130-135	122.9 2-3 135-137-141	125.9 2-3 141-143-147	128.2 2-3 147-149-153
64	106.2 3-3 122-124-129	115.7 3-3 128-129-134	120.8 2-3 135-136-140	123.6 2-3 141-143-147	125.9 2-3 147-149-153
66	104.7 3-3 122-123-128	114.0 3-3 128-129-133	118.7 2-3 134-136-140	121.4 2-3 141-142-146	123.6 2-3 146-148-152
68	103.2 3-3 121-122-127	112.4 3-3 127-128-132	116.5 2-3 134-135-139	119.2 2-3 140-142-146	121.3 2-3 146-148-151
70	101.8 3-3 121-122-126	110.9 3-3 127-127-131	114.3 2-3 134-135-139	116.9 2-3 140-141-145	119.0 2-3 146-147-151
72	100.4 3-3 122-122-126	109.0 2-3 126-127-131	112.2 2-3 133-134-138	114.7 2-3 140-141-144	116.5 2-2 144-146-150

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.009-AA.080

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A310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40
		PAGE 10
	QUICK REFERENCE TABLES	REV 18 / SEQ 080

SLATS 20/FLAPS 20
PRESSURE ALTITUDE : 1000 FT
TREF = 40 / TMAX = 53

TEMPE-RATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	1500	1750	2000	2250	2500
–20	133.7 3-3 136-137-143	143.9 2-3 142-143-148	148.0 2-3 148-151-156	151.2 2-3 155-158-162	153.8 2-3 161-164-169
–10	131.1 3-3 134-136-142	141.6 3-3 140-142-147	146.7 2-3 146-148-154	150.0 2-3 153-156-160	152.7 2-3 159-162-166
0	128.7 3-3 133-135-141	139.0 3-3 138-140-146	145.5 2-3 144-146-152	148.9 2-3 150-153-158	151.6 2-3 156-160-164
10	126.3 3-3 131-133-139	136.6 3-3 137-139-145	144.2 2-3 142-144-150	147.7 2-3 148-151-156	150.5 2-3 154-158-162
20	124.0 3-3 130-132-138	134.3 3-3 136-138-143	143.0 2-3 140-143-148	146.6 2-3 146-149-154	149.5 2-3 152-156-160
30	121.8 3-3 128-131-137	132.0 3-3 134-137-142	141.0 3-3 139-142-147	145.4 2-3 144-148-153	148.4 2-3 150-154-158
40	119.7 3-3 127-130-136	129.8 3-3 133-136-141	138.7 3-3 138-140-146	143.8 2-3 143-146-151	146.8 2-3 148-152-157
42	118.4 3-3 127-129-135	128.5 3-3 132-135-141	137.4 3-3 137-140-145	142.6 2-3 142-145-150	145.6 2-3 148-152-156
44	117.0 3-3 126-129-135	127.1 3-3 132-135-140	136.0 3-3 137-139-144	140.7 2-3 142-145-150	143.6 2-3 147-151-156
46	115.7 3-3 126-128-134	125.7 3-3 131-134-139	134.5 3-3 136-139-144	138.8 2-3 142-145-150	141.6 2-3 147-151-155
48	114.3 3-3 125-127-133	124.2 3-3 131-133-138	133.0 3-3 136-138-143	136.8 2-3 142-144-149	139.6 2-3 147-151-155
50	112.9 3-3 124-127-133	122.8 3-3 130-133-138	131.5 2-3 135-137-142	134.8 2-3 141-144-149	137.5 2-3 147-150-155
52	111.7 3-3 124-126-132	121.5 3-3 130-132-137	129.6 2-3 135-137-142	132.9 2-3 141-144-148	135.5 2-3 146-150-154
54	110.3 3-3 123-126-131	120.0 3-3 129-131-136	127.7 2-3 135-137-141	130.9 2-3 141-143-148	133.5 2-3 146-150-154
56	108.8 3-3 123-125-130	118.5 3-3 129-131-135	125.8 2-3 134-136-141	129.0 2-3 140-143-147	131.5 2-3 146-149-153
58	107.5 3-3 122-124-130	117.0 3-3 128-130-135	124.0 2-3 134-136-140	127.1 2-3 140-142-147	129.5 2-3 145-148-152
60	106.1 3-3 122-123-129	115.6 3-3 128-129-134	122.2 2-3 134-135-139	125.1 2-3 140-142-146	127.5 2-3 145-148-152
62	104.8 3-3 121-123-128	114.2 3-3 127-129-133	120.3 2-3 133-135-139	123.2 2-3 139-141-145	125.5 2-3 145-147-151
64	103.5 3-3 121-122-127	112.7 3-3 127-128-132	118.4 2-3 133-134-138	121.3 2-3 139-141-145	123.5 2-3 145-147-151
66	102.2 3-3 121-122-127	111.3 3-3 126-127-132	116.6 2-3 132-134-138	119.3 2-3 139-140-144	121.6 2-3 144-146-150
68	100.9 3-3 121-122-126	110.0 3-3 126-127-131	114.7 2-3 132-133-137	117.4 2-3 138-140-144	119.6 2-3 144-146-149
70	99.7 3-3 121-122-125	108.7 3-3 125-126-130	112.9 2-3 132-133-137	115.5 2-3 138-140-143	117.6 2-3 144-145-149

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.010.AA.080

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SLATS 20/FLAPS 20
PRESSURE ALTITUDE : 2000 FT
TREF = 36 / TMAX = 51

TEMPERATURE (°C)	CORRECTED RUNWAY LENGTH (meters)				
	1500	1750	2000	2250	2500
–20	130.6 3-3 134-136-142	141.0 3-3 140-141-147	145.8 2-3 146-149-154	149.0 2-3 153-156-160	151.6 2-3 159-162-166
–10	128.0 3-3 133-134-140	138.4 3-3 138-140-145	144.5 2-3 144-146-151	147.9 2-3 150-153-158	150.5 2-3 156-160-164
0	125.6 3-3 131-133-139	135.9 3-3 137-139-144	143.2 2-3 142-144-149	146.7 2-3 148-151-156	149.5 2-3 154-158-162
10	123.2 3-3 130-132-138	133.5 3-3 135-138-143	142.0 2-3 140-143-148	145.5 2-3 146-149-154	148.4 2-3 152-156-160
20	121.0 3-3 128-131-137	131.2 3-3 134-136-142	140.1 3-3 139-141-146	144.4 2-3 144-147-152	147.4 2-3 150-154-158
30	118.8 3-3 127-130-136	128.9 3-3 133-135-141	137.8 3-3 137-140-145	143.3 2-3 142-146-150	146.2 2-3 148-152-156
36	117.5 3-3 126-129-135	127.6 3-3 132-135-140	136.5 3-3 137-139-144	142.6 2-3 141-145-149	145.6 2-3 147-151-155
38	116.5 3-3 125-128-134	126.5 3-3 131-134-140	135.3 3-3 136-139-144	141.1 2-3 141-144-149	144.1 2-3 146-150-155
40	115.3 3-3 125-128-134	125.3 3-3 131-134-139	134.1 3-3 136-138-143	139.5 2-3 141-144-149	142.4 2-3 146-150-154
42	114.1 3-3 125-127-133	124.0 3-3 131-133-138	132.8 3-3 135-138-143	137.8 2-3 141-144-148	140.7 2-3 146-150-154
44	112.8 3-3 124-127-133	122.7 3-3 130-132-138	131.4 3-3 135-137-142	136.1 2-3 140-143-148	138.9 2-3 146-149-154
46	111.6 3-3 124-126-132	121.4 3-3 130-132-137	130.1 3-3 134-137-141	134.4 2-3 140-143-147	137.1 2-3 145-149-153
48	110.4 3-3 123-125-131	120.1 3-3 129-131-136	128.8 3-3 134-136-141	132.6 2-3 140-142-147	135.4 2-3 145-149-153
50	109.2 3-3 123-125-131	118.9 3-3 129-131-136	127.5 3-3 134-136-140	130.9 2-3 139-142-146	133.6 2-3 145-148-152
52	108.0 3-3 122-124-130	117.6 3-3 128-130-135	126.0 2-3 133-135-140	129.3 2-3 139-142-146	131.8 2-3 144-148-152
54	106.8 3-3 122-124-129	116.3 3-3 128-129-134	124.4 2-3 133-135-139	127.6 2-3 139-141-145	130.2 2-3 144-147-151
56	105.6 3-3 121-123-129	115.0 3-3 127-129-134	122.8 2-3 132-134-138	126.0 2-3 138-141-145	128.5 2-3 144-147-151
58	104.4 3-3 120-122-128	113.7 3-3 127-128-133	121.3 2-3 132-134-138	124.3 2-3 138-140-144	126.8 2-3 143-146-150
60	103.3 3-3 120-122-127	112.5 3-3 126-128-132	119.7 2-3 132-133-137	122.7 2-3 138-140-144	125.1 2-3 143-146-150
62	102.1 3-3 121-122-127	111.2 3-3 126-127-132	118.1 2-3 131-133-137	121.1 2-3 137-139-143	123.4 2-3 143-145-149
64	101.0 3-3 121-122-126	110.0 3-3 125-126-131	116.5 2-3 131-132-136	119.4 2-3 137-139-143	121.7 2-3 143-145-148
66	99.9 3-3 121-122-125	108.9 3-3 125-126-130	115.0 2-3 130-132-136	117.8 2-3 137-138-142	120.0 2-3 142-144-148
68	98.8 3-3 121-122-125	107.7 3-3 124-125-130	113.4 2-3 130-131-135	116.2 2-3 136-138-142	118.4 2-3 142-144-147

MAX WEIGHT(1000KG) CODES
V1(IAS.KT) - VR(IAS.KT) - V2(IAS.KT)

FB2.1040.011-AA.080

Code : 1040A

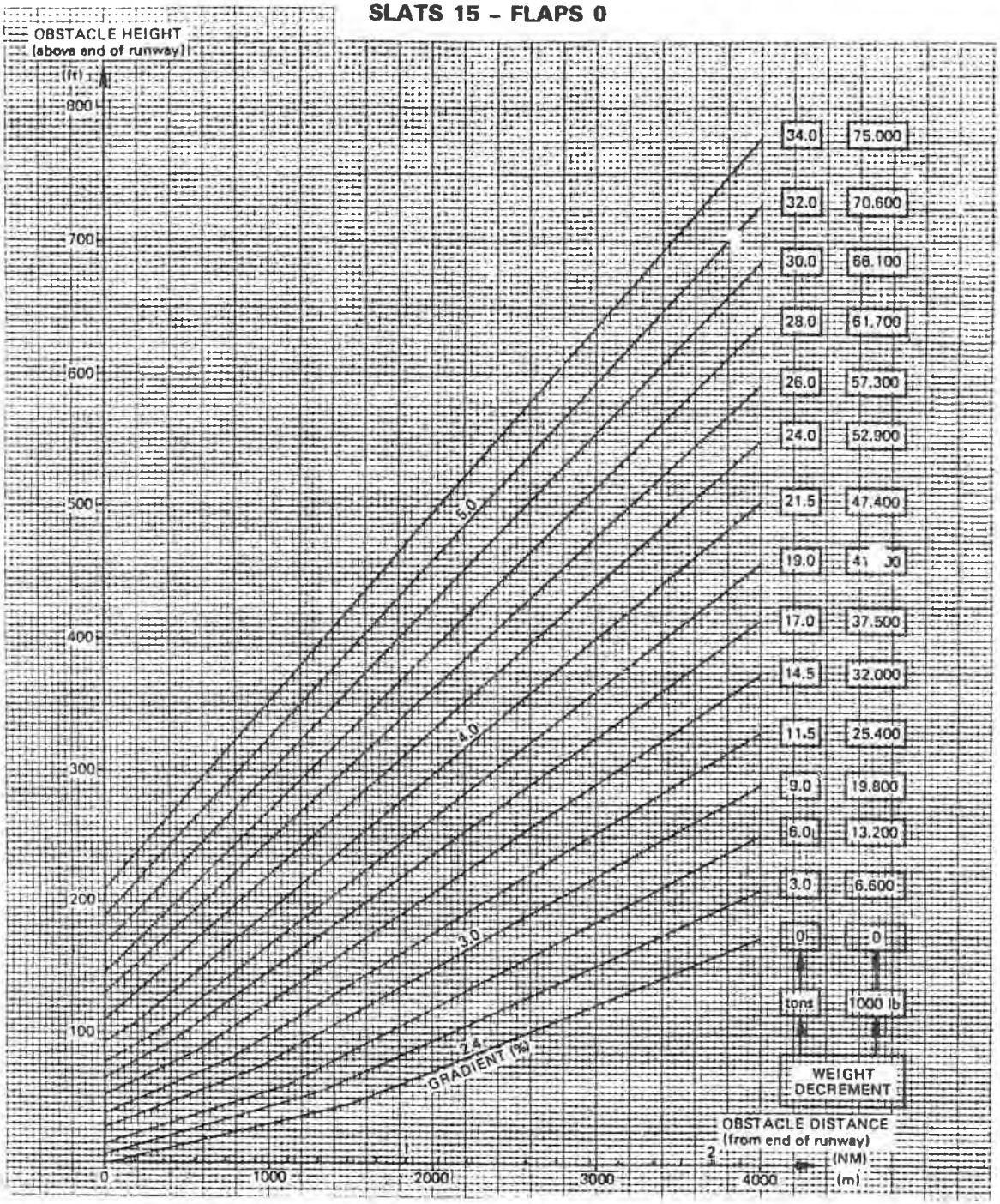
GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	TAKE OFF	2.10.40
		PAGE 13
	QUICK REFERENCE TABLES	REV 12 / SEQ 530

NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 0



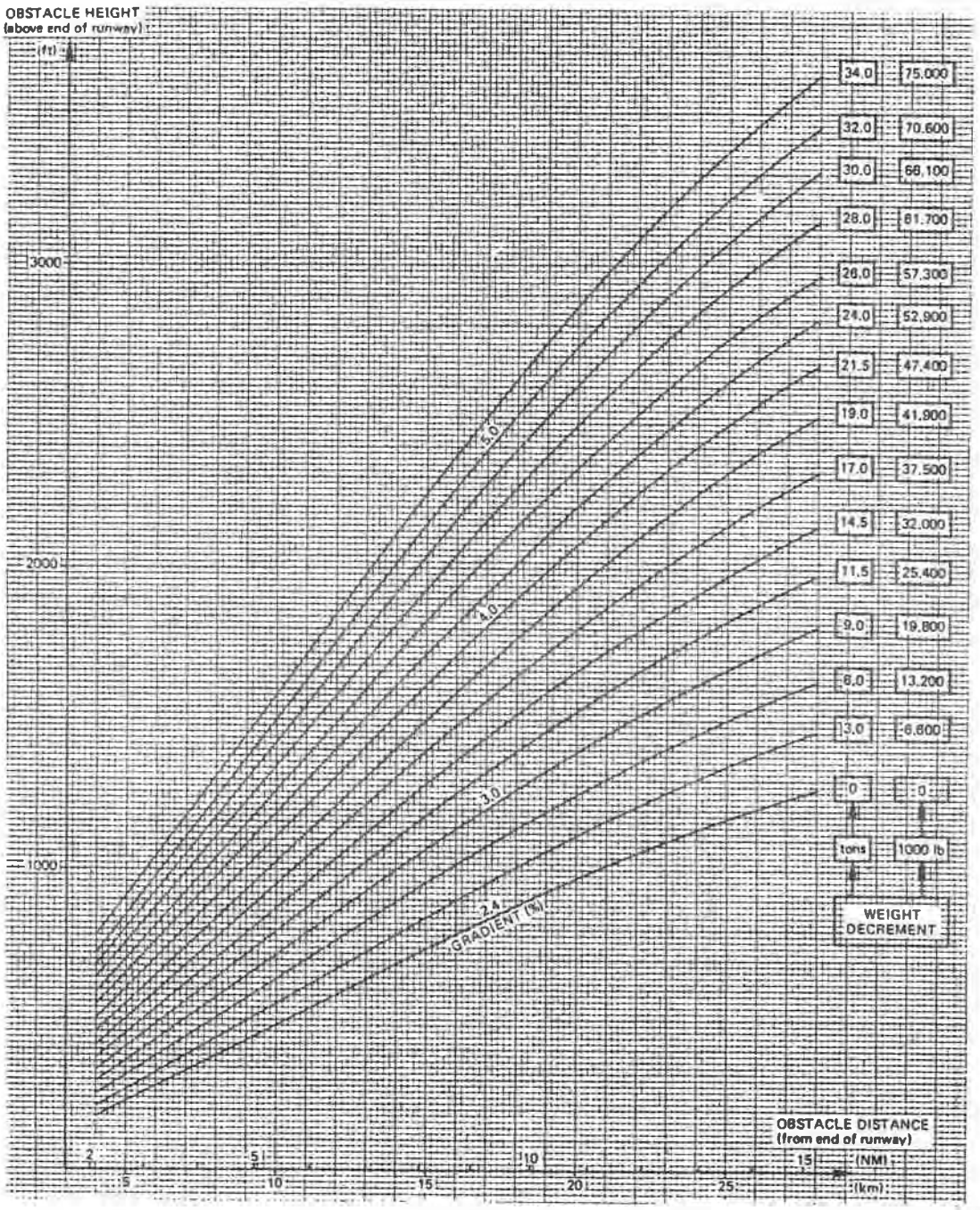
Notes :
- *The above graph must not be used in case of tail wind.*
- *In case of ascending runway slope, increase obstacle height by 58 ft per 1 % slope.*
- *Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.*

GE Eng : 80A3 – 80C2A2

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NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 0



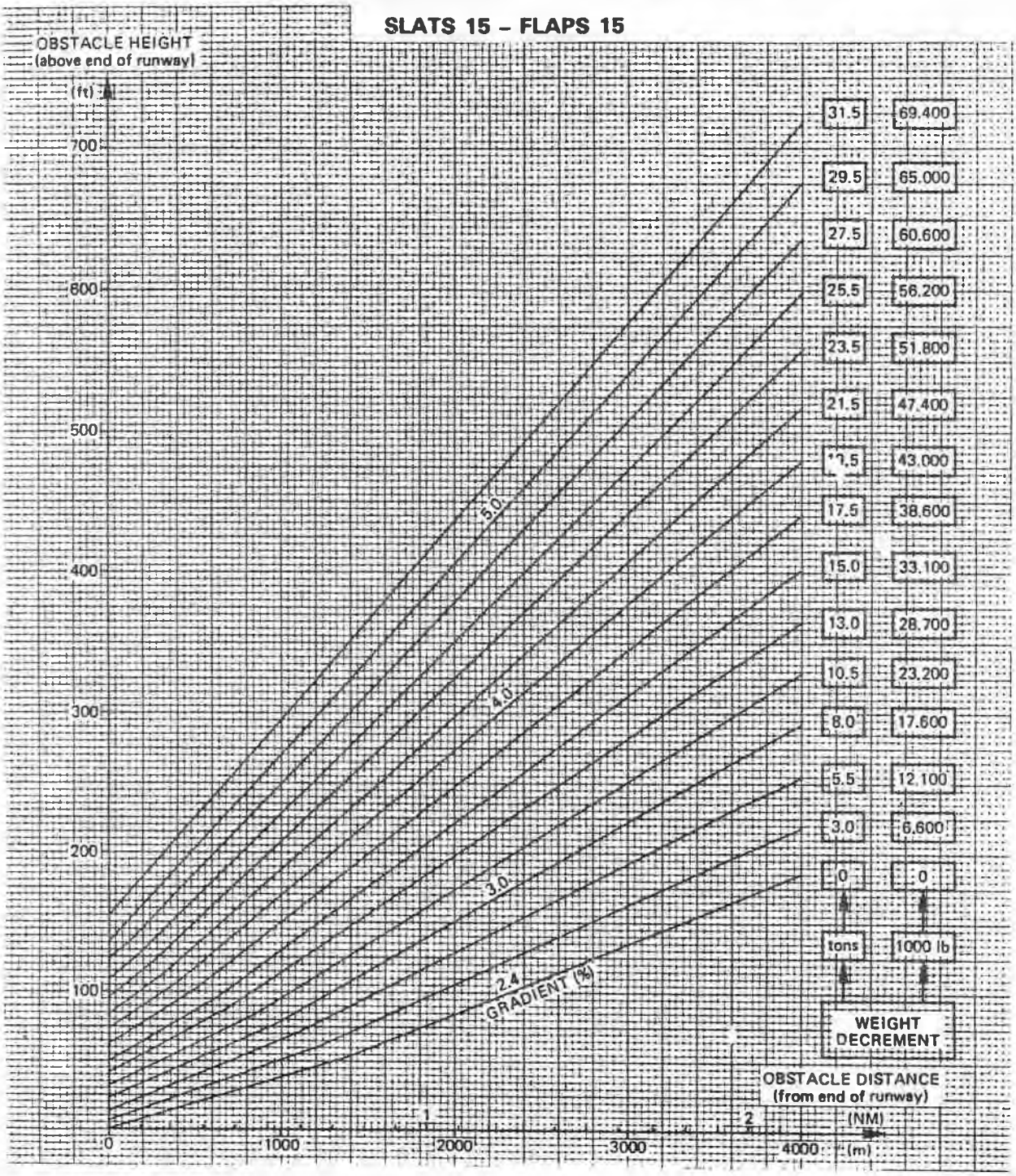
Notes : – *The above graph must not be used in case of tail wind.*
– *In case of ascending runway slope, increase obstacle height by 58 ft per 1 % slope.*
– *Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.*

GE Eng : 80A3 – 80C2A2

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NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 15

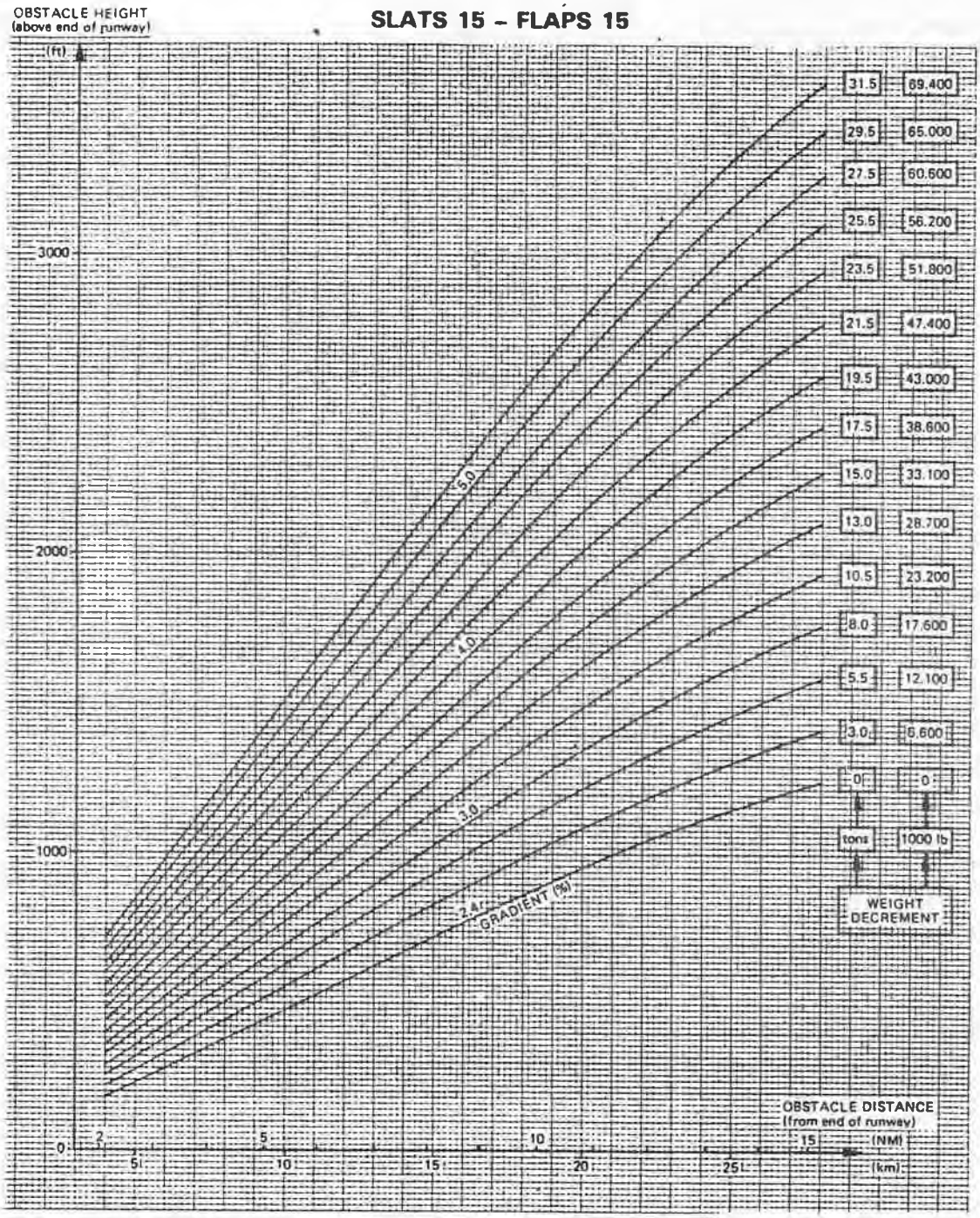


Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 42 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

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NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE

SLATS 15 – FLAPS 15



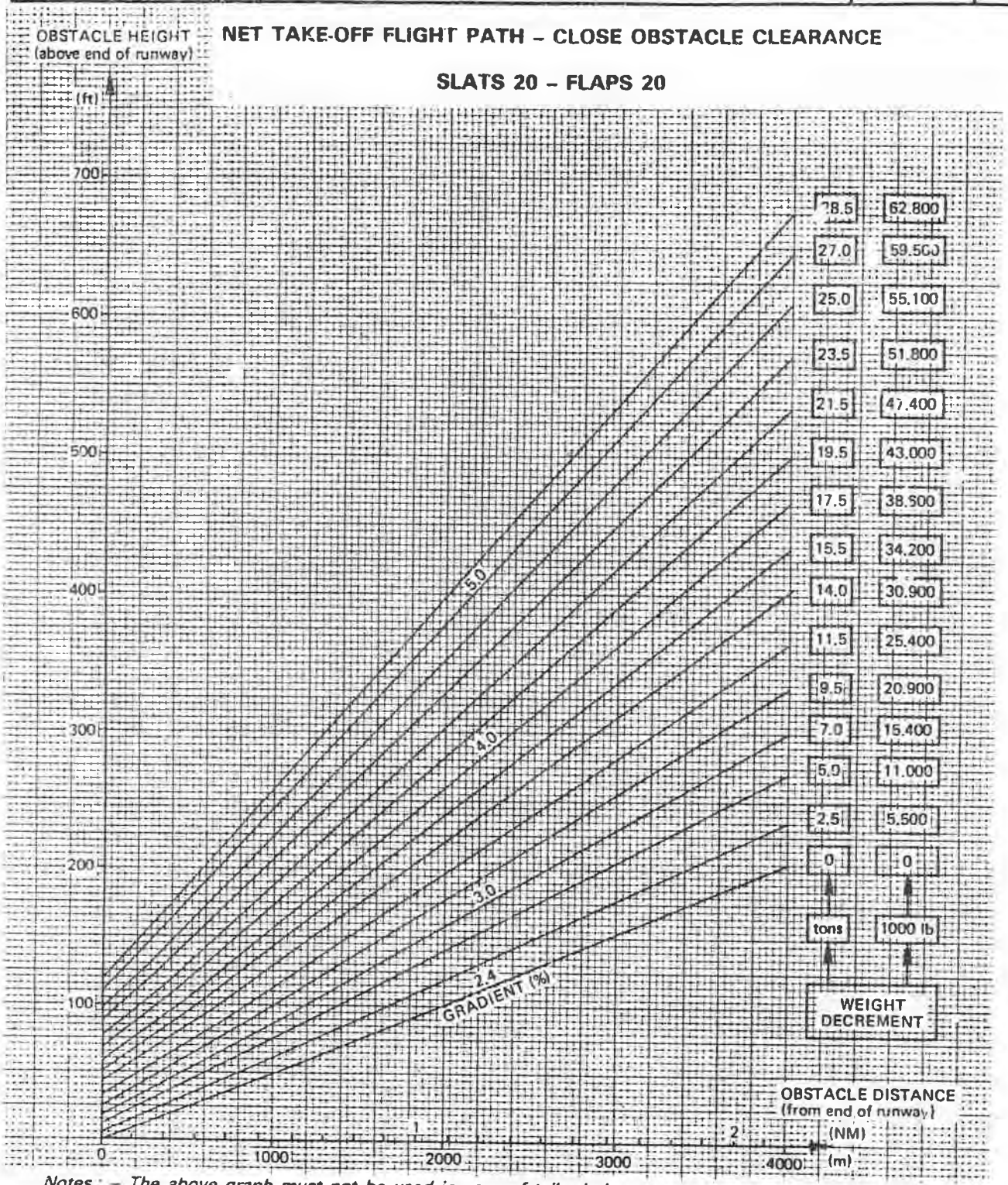
Notes : – *The above graph must not be used in case of tail wind.*
– *In case of ascending runway slope, increase obstacle height by 42 ft per 1 % slope.*
– *Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.*

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NET TAKE-OFF FLIGHT PATH – CLOSE OBSTACLE CLEARANCE

SLATS 20 – FLAPS 20

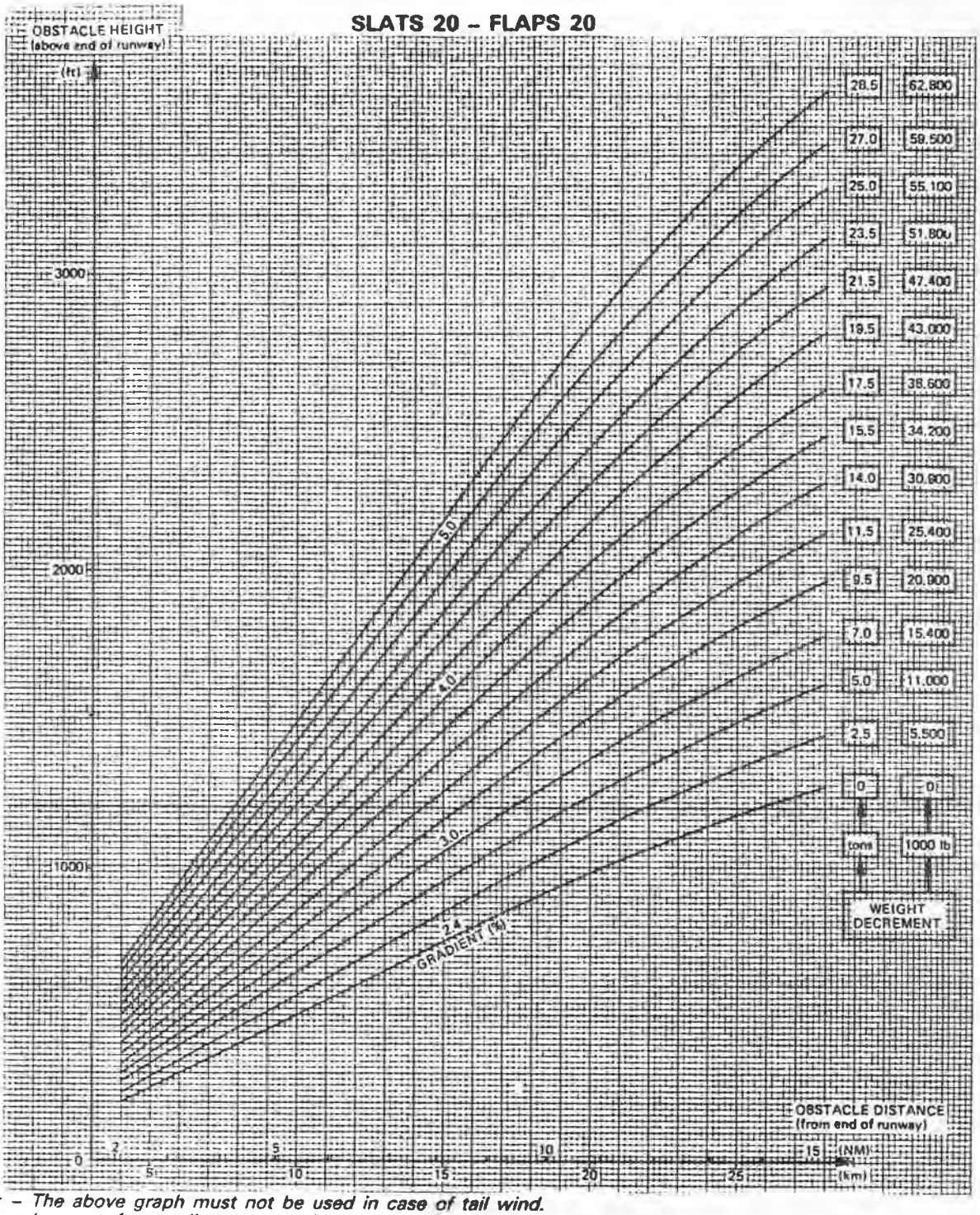


Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 31 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

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NET TAKE-OFF FLIGHT PATH – REMOTE OBSTACLE CLEARANCE

SLATS 20 – FLAPS 20



Notes : – The above graph must not be used in case of tail wind.
– In case of ascending runway slope, increase obstacle height by 31 ft per 1 % slope.
– Decrease take-off speeds by 0.4 % per 1 ton (0.2 % per 1000 lb) weight decrement.

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Pages

2.11.10 CLIMB CHART 2 ENGINES

Introduction 1

Normal Climb – Max Climb Thrust-250/300 KT/M 0.79

. ISA 2-3

. ISA + 10 4-5

. ISA + 15 6-7

. ISA + 20 ..... 8-9/10

GE Eng. : AM

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	CLIMB CLIMB CHART 2 ENGINES	2.11.10 PAGE 1 REV 14 / SEQ 001

INTRODUCTION

Climb Charts are established at MAX CLIMB THRUST with air conditioning in economic mode.
When using normal air conditioning, increase fuel
R consumption by 0.8 %.

All tables are established with a center of gravity location corresponding to 27 %

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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG)							
	90	95	100	105	110	115	120	125
410	12 1839 75 377	13 1973 80 378	14 2116 87 380	15 2269 94 382	16 2439 103 384	18 2634 114 388		
390	11 1743 66 369	12 1865 71 370	12 1993 76 371	13 2126 82 373	14 2265 88 375	15 2411 94 376	16 2571 102 378	18 2755 111 381
370	10 1657 59 361	11 1771 63 362	11 1888 68 363	12 2009 72 365	13 2134 77 366	13 2260 82 367	14 2394 88 368	15 2538 94 370
350	9 1580 54 353	10 1687 57 355	10 1796 61 356	11 1909 65 357	12 2024 69 358	12 2139 73 359	13 2260 78 360	14 2387 83 361
330	8 1509 49 346	9 1610 52 347	10 1713 55 348	10 1819 59 349	11 1927 62 350	11 2034 66 351	12 2145 70 352	13 2262 74 353
310	8 1439 44 337	8 1535 47 339	9 1633 50 340	9 1733 53 341	10 1835 57 342	11 1935 60 342	11 2039 64 343	12 2147 67 344
290	7 1357 40 327	8 1447 42 328	8 1539 45 329	9 1634 48 330	9 1729 50 331	10 1822 53 332	10 1918 56 332	11 2018 60 333
270	7 1266 35 315	7 1350 37 316	7 1435 39 317	8 1523 42 318	8 1611 44 319	9 1696 47 319	9 1785 49 320	10 1876 52 321
250	6 1179 31 303	6 1257 32 304	7 1337 34 305	7 1418 36 306	8 1499 39 307	8 1578 41 307	8 1659 43 308	9 1742 45 309
240	6 1137 29 297	6 1212 30 298	6 1289 32 299	7 1367 34 300	7 1446 36 301	8 1521 38 301	8 1598 40 302	8 1678 42 303
220	5 1056 25 285	6 1125 27 286	6 1197 28 287	6 1269 30 288	7 1341 32 289	7 1411 33 290	7 1481 35 290	8 1554 37 291
200	5 977 22 273	5 1041 23 275	5 1107 25 276	6 1174 26 277	6 1241 28 278	6 1304 29 278	7 1369 31 279	7 1435 32 279
180	4 900 19 261	5 959 20 263	5 1020 21 264	5 1082 23 265	5 1143 24 266	6 1201 25 266	6 1260 27 267	6 1321 28 267
160	4 825 16 249	4 880 17 250	4 935 18 251	5 992 19 252	5 1049 21 253	5 1101 22 254	5 1155 23 254	6 1209 24 255
140	4 751 14 236	4 801 15 237	4 852 16 238	4 904 17 240	4 956 18 241	5 1003 19 241	5 1051 20 242	5 1101 21 242
120	3 678 12 222	3 724 13 223	4 771 13 225	4 818 14 226	4 864 15 227	4 907 16 227	4 950 16 228	5 994 17 229
100	3 556 9 197	3 595 9 198	3 634 10 200	3 673 10 201	3 711 11 202	3 746 11 203	4 780 12 203	4 816 13 204
50	2 378 5 163	2 405 5 164	2 433 5 165	2 460 6 166	2 486 6 167	2 508 6 168	2 530 7 168	2 552 7 169
15	1 250 2 117	1 269 2 118	1 288 3 118	1 307 3 119	1 325 3 120	1 337 3 120	2 350 3 121	2 363 3 121

FROM BRAKES RELEASE TIME . (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. . (NM) MEAN SPEED TAS (KT)

A304-FB2.1110.002-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG) 125	130	135	140	145	150	155	160
410								
390	18 2755 111 381	19 2982 124 384						
370	15 2538 94 370	16 2698 101 372	17 2879 109 374	19 3087 119 377	21 3346 132 381			
350	14 2387 83 361	15 2524 88 362	16 2674 94 364	16 2833 100 365	18 3009 107 367	19 3199 116 369	20 3419 126 372	22 3692 140 376
330	13 2262 74 353	13 2387 79 354	14 2521 84 355	15 2662 89 356	16 2813 94 357	17 2967 100 358	18 3133 107 360	19 3317 114 362
310	12 2147 67 344	12 2263 71 345	13 2387 75 346	14 2516 79 347	15 2652 84 348	15 2789 89 349	16 2934 94 350	17 3090 100 351
290	11 2018 60 333	11 2125 63 334	12 2239 67 335	13 2357 70 335	13 2482 74 336	14 2605 78 337	15 2734 83 338	15 2872 87 339
270	10 1876 52 321	10 1974 55 321	11 2078 58 322	11 2186 61 323	12 2298 64 324	13 2409 68 324	13 2524 71 325	14 2645 75 326
250	9 1742 45 309	9 1832 48 309	10 1928 50 310	10 2026 53 311	11 2128 56 311	11 2228 59 312	12 2331 62 313	12 2439 65 313
240	8 1678 42 303	9 1764 45 303	9 1856 47 304	10 1949 49 305	10 2047 52 305	11 2142 55 306	11 2240 57 307	12 2342 60 307
220	8 1554 37 291	8 1633 39 292	8 1717 41 292	9 1803 43 293	9 1892 45 293	10 1978 48 294	10 2066 50 295	11 2158 52 295
200	7 1435 32 279	7 1508 34 280	8 1585 36 280	8 1663 37 281	8 1744 39 282	9 1822 41 282	9 1902 43 283	10 1985 45 283
180	6 1321 28 267	7 1387 29 268	7 1457 31 269	7 1529 32 269	8 1603 34 270	8 1673 36 270	8 1745 37 271	9 1820 39 271
160	6 1209 24 255	6 1269 25 256	6 1333 27 256	7 1399 28 257	7 1466 29 257	7 1529 31 258	7 1594 32 258	8 1661 33 259
140	5 1101 21 242	5 1155 22 243	6 1213 23 243	6 1273 24 244	6 1333 25 244	6 1390 26 245	7 1448 27 245	7 1508 29 246
120	5 994 17 229	5 1043 18 229	5 1096 19 230	5 1149 20 230	5 1204 21 231	6 1254 22 231	6 1306 23 232	6 1360 24 232
100	4 816 13 204	4 855 13 205	4 899 14 205	4 943 15 206	4 988 15 206	5 1028 16 207	5 1069 17 207	5 1112 17 208
50	2 552 7 169	3 578 7 170	3 607 8 170	3 637 8 171	3 666 8 171	3 691 9 171	3 715 9 172	3 740 9 172
15	2 363 3 121	2 379 3 122	2 398 4 122	2 417 4 122	2 436 4 122	2 449 4 122	2 462 4 121	2 474 4 121

FROM BRAKES RELEASE TIME . (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. . (NM) MEAN SPEED TAS (KT)

A304 FB2.1110.003-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA + 10	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG)							
	90	95	100	105	110	115	120	125
410	12 1936 78 385	13 2077 84 387	14 2227 91 388	15 2388 99 391	16 2567 108 393	18 2774 120 396		
390	11 1835 69 377	12 1964 74 378	13 2097 80 380	13 2237 86 381	14 2384 92 383	15 2539 99 384	17 2710 107 386	18 2906 117 389
370	10 1745 62 369	11 1864 66 370	11 1987 71 371	12 2114 76 373	13 2245 81 374	14 2381 86 375	15 2524 92 376	16 2678 99 378
350	9 1663 56 361	10 1775 60 362	11 1890 64 363	11 2008 68 365	12 2130 72 366	13 2253 77 367	13 2382 82 368	14 2518 87 369
330	9 1588 51 353	9 1694 55 354	10 1802 58 356	10 1914 62 357	11 2027 66 358	12 2142 69 358	12 2261 74 359	13 2385 78 360
310	8 1514 47 345	9 1614 50 346	9 1717 53 347	10 1823 56 348	10 1930 59 349	11 2037 63 350	11 2148 67 350	12 2264 71 351
290	7 1428 42 334	8 1522 44 335	8 1619 47 336	9 1717 50 337	9 1818 53 338	10 1918 56 339	10 2021 59 339	11 2128 63 340
270	7 1332 36 322	7 1420 39 323	8 1509 41 324	8 1601 44 325	9 1694 46 326	9 1786 49 326	9 1880 52 327	10 1979 55 328
250	6 1241 32 309	7 1322 34 310	7 1405 36 311	7 1490 38 313	8 1576 40 313	8 1661 43 314	9 1748 45 315	9 1838 48 315
240	6 1197 30 303	6 1275 32 304	7 1355 34 305	7 1437 36 307	7 1520 38 308	8 1601 40 308	8 1685 42 309	9 1771 45 309
220	5 1111 26 292	6 1184 28 293	6 1258 30 294	6 1334 31 295	7 1411 33 296	7 1485 35 296	7 1562 37 297	8 1641 39 298
200	5 1028 23 280	5 1096 24 281	5 1165 26 282	6 1234 27 283	6 1305 29 284	6 1374 30 284	7 1444 32 285	7 1516 34 286
180	4 948 20 267	5 1010 21 269	5 1074 22 270	5 1138 24 271	6 1203 25 272	6 1266 26 272	6 1330 28 273	6 1396 29 274
160	4 869 17 255	4 926 18 256	5 985 19 257	5 1044 20 258	5 1104 22 259	5 1161 23 260	6 1220 24 261	6 1279 25 261
140	4 792 15 242	4 844 16 243	4 898 17 244	4 952 17 245	4 1007 18 246	5 1059 20 247	5 1112 21 248	5 1166 22 248
120	3 716 12 228	3 764 13 229	4 813 14 230	4 862 15 232	4 911 16 233	4 958 17 233	4 1006 17 234	5 1054 18 235
100	3 588 9 203	3 629 10 204	3 669 10 205	3 711 11 207	3 751 11 208	3 790 12 209	4 828 13 209	4 868 13 210
50	2 403 5 169	2 431 5 170	2 460 6 171	2 489 6 172	2 517 6 174	2 542 7 174	2 567 7 175	3 593 8 176
15	1 269 3 125	1 289 3 125	1 309 3 126	1 329 3 127	1 348 3 128	2 364 3 129	2 380 3 129	2 396 4 130

FROM BRAKES RELEASE . TIME (MIN) FUEL (KG)
FROM BRAKES RELEASE . DIST. (NM) MEAN SPEED TAS (KT)

A304 FB2.1110.004-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA + 10	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

	WEIGHT AT BRAKES RELEASE (1000KG)							
FL	125	130	135	140	145	150	155	160
410								
390	18 2906 117 389	20 3146 130 393						
370	16 2678 99 378	17 2847 106 380	18 3037 114 382	19 3257 125 385	21 3529 139 389			
350	14 2518 87 369	15 2663 93 370	16 2821 99 372	17 2989 105 373	18 3174 113 375	19 3375 122 377	21 3609 132 381	23 3899 147 385
330	13 2385 78 360	14 2518 83 361	15 2659 88 362	15 2808 93 364	16 2967 99 365	17 3131 105 366	18 3308 112 368	19 3503 120 370
310	12 2264 71 351	13 2387 75 352	13 2518 79 353	14 2653 83 354	15 2797 88 355	16 2943 93 356	17 3098 99 358	18 3263 105 359
290	11 2128 63 340	12 2242 66 341	12 2362 70 342	13 2486 74 343	14 2617 78 344	14 2749 82 345	15 2887 87 346	16 3033 92 347
270	10 1979 55 328	11 2083 58 328	11 2192 61 329	12 2306 64 330	12 2424 67 331	13 2542 71 332	13 2665 75 332	14 2794 79 333
250	9 1838 48 315	10 1933 50 316	10 2034 53 317	11 2137 56 317	11 2245 59 318	12 2352 62 319	12 2463 65 320	13 2578 68 321
240	9 1771 45 309	9 1862 47 310	10 1958 49 311	10 2057 52 311	11 2160 55 312	11 2262 57 313	12 2367 60 314	12 2476 63 314
220	8 1641 39 298	8 1725 41 298	9 1813 43 299	9 1903 45 299	10 1997 48 300	10 2090 50 301	10 2185 52 302	11 2283 55 302
200	7 1516 34 286	7 1593 36 286	8 1674 37 287	8 1757 39 287	9 1842 41 288	9 1926 43 289	9 2012 45 289	10 2101 48 290
180	6 1396 29 274	7 1466 31 274	7 1540 32 275	7 1616 34 275	8 1694 36 276	8 1770 37 277	8 1847 39 277	9 1928 41 278
160	6 1279 25 261	6 1343 27 262	6 1411 28 262	7 1480 29 263	7 1551 31 264	7 1619 32 264	8 1690 34 265	8 1763 35 266
140	5 1166 22 248	5 1224 23 249	6 1285 24 250	6 1348 25 250	6 1412 26 251	7 1474 28 251	7 1537 29 252	7 1603 30 253
120	5 1054 18 235	5 1107 19 235	5 1162 20 236	5 1219 21 237	6 1277 22 237	6 1332 23 238	6 1389 24 238	6 1447 26 239
100	4 868 13 210	4 911 14 211	4 957 15 212	4 1004 15 212	5 1052 16 213	5 1096 17 214	5 1141 18 214	5 1188 19 215
50	3 593 8 176	3 622 8 177	3 653 8 177	3 684 9 178	3 716 9 179	3 744 10 179	3 772 10 180	3 801 10 181
15	2 396 4 130	2 414 4 131	2 435 4 131	2 456 4 132	2 476 4 132	2 492 5 133	2 508 5 133	2 524 5 134

FROM BRAKES RELEASE TIME (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. (NM) MEAN SPEED TAS (KT)

R304 FB2.1110.005-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA + 15	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

R R R

A310 FLIGHT CREW OPERATING MANUAL	CLIMB	2.11.10
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	CLIMB CHART 2 ENGINES	REV 15 / SEQ 080

MAX CLIMB THRUST ISA + 15	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG)							
	125	130	135	140	145	150	155	160
410								
390	20 3113 134 398							
370	17 2842 112 386	19 3032 121 388	20 3251 131 391	22 3513 145 394				
350	16 2663 98 377	17 2823 104 378	18 2997 112 380	19 3185 120 381	20 3396 129 384	22 3633 140 387	24 3922 155 390	
330	14 2516 87 368	15 2660 93 369	16 2815 99 370	17 2978 105 371	18 3154 112 373	19 3339 119 375	20 3541 128 377	22 3769 138 379
310	13 2382 78 358	14 2515 83 359	15 2656 88 360	15 2803 93 361	16 2961 99 363	17 3122 105 364	18 3295 112 365	19 3481 119 367
290	12 2233 69 347	13 2355 73 348	13 2484 77 349	14 2618 82 349	15 2760 87 350	16 2905 92 352	16 3057 97 353	17 3219 103 354
270	11 2072 60 334	11 2183 64 335	12 2300 67 335	13 2422 71 336	13 2549 75 337	14 2678 79 338	15 2812 83 339	15 2954 88 340
250	10 1922 52 322	10 2023 55 322	11 2131 58 323	11 2241 61 324	12 2357 65 324	13 2472 68 325	13 2592 72 326	14 2719 76 327
240	9 1850 49 315	10 1948 52 316	10 2050 54 317	11 2155 57 317	11 2265 60 318	12 2375 63 319	13 2490 67 320	13 2609 70 321
220	8 1713 43 303	9 1802 45 304	9 1896 47 305	10 1992 50 305	10 2092 52 306	11 2192 55 307	11 2295 58 308	12 2402 61 308
200	8 1581 37 291	8 1663 39 292	8 1749 41 293	9 1836 43 293	9 1927 45 294	10 2017 48 295	10 2110 50 295	11 2207 52 296
180	7 1454 32 279	7 1529 34 280	8 1607 35 280	8 1687 37 281	8 1770 39 281	9 1851 41 282	9 1935 43 283	10 2023 45 284
160	6 1332 27 267	6 1400 29 267	7 1471 30 268	7 1544 32 268	7 1619 34 269	8 1693 35 270	8 1769 37 270	9 1847 39 271
140	6 1213 23 253	6 1275 25 254	6 1339 26 255	6 1406 27 255	7 1474 29 256	7 1540 30 257	7 1608 31 257	8 1679 33 258
120	5 1097 20 240	5 1152 21 240	5 1211 22 241	6 1270 23 242	6 1332 24 242	6 1391 25 243	7 1451 27 244	7 1515 28 244
100	4 902 14 215	4 948 15 216	4 996 16 216	5 1045 17 217	5 1095 18 218	5 1143 18 218	5 1192 19 219	6 1243 20 220
50	3 617 8 180	3 648 8 181	3 680 9 182	3 713 9 182	3 747 10 183	3 777 10 184	3 807 11 185	4 838 11 186
15	2 412 4 132	2 432 4 133	2 453 4 134	2 475 4 134	2 496 5 135	2 514 5 135	2 531 5 136	2 549 5 137
FROM BRAKES RELEASE . TIME (MIN) FROM BRAKES RELEASE . DIST. (NM)				FUEL (KG) MEAN SPEED TAS (KT)				

R304 FB2.1110.007-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CLIMB CLIMB [illegible]T 2 ENGINES	2.11.10 PAGE 8 REV 15 SEQ 080

MAX CLIMB THRUST ISA + 20	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG)							
	90	95	100	105	110	115	120	125
410	15 2167 100 401	16 2335 109 403	18 2518 119 405	19 2724 131 408	21 2971 147 411			
390	13 2040 88 392	14 2189 94 393	15 2345 102 395	17 2512 110 397	18 2691 119 399	19 2889 130 401	21 3118 143 404	
370	12 1931 78 384	13 2067 83 385	14 2208 89 386	15 2356 96 388	16 2511 103 389	17 2675 110 390	18 2852 119 392	20 3046 128 394
350	11 1835 70 376	12 1961 75 377	13 2092 80 378	14 2227 85 379	14 2368 91 380	15 2514 97 381	16 2669 104 383	17 2835 111 384
330	10 1746 63 367	11 1865 68 368	12 1988 72 370	12 2114 77 371	13 2244 82 372	14 2379 87 373	15 2520 93 374	16 2669 99 375
310	10 1660 57 358	10 1772 61 359	11 1887 65 361	11 2006 69 362	12 2127 74 363	13 2252 78 363	14 2383 83 364	14 2520 88 365
290	9 1559 51 347	9 1664 54 348	10 1771 58 349	10 1881 61 350	11 1994 65 351	12 2110 69 352	12 2230 73 352	13 2356 77 353
270	8 1450 44 334	8 1546 47 335	9 1645 50 336	9 1746 53 337	10 1850 56 338	11 1956 60 339	11 2066 63 339	12 2180 67 340
250	7 1347 39 322	8 1436 41 323	8 1527 44 323	9 1621 46 324	9 1717 49 325	10 1814 52 326	10 1914 55 327	11 2017 58 327
240	7 1297 36 315	7 1383 38 316	8 1471 41 317	8 1561 43 318	9 1653 46 319	9 1746 48 320	10 1841 51 320	10 1940 54 321
220	6 1202 31 303	7 1281 33 304	7 1363 35 305	7 1446 38 306	8 1530 40 307	8 1616 42 308	9 1703 45 308	9 1794 47 309
200	6 1110 27 291	6 1184 29 292	6 1259 31 293	7 1335 33 294	7 1413 35 295	7 1491 37 295	8 1571 39 296	8 1654 41 297
180	5 1021 24 279	5 1089 25 280	6 1158 27 281	6 1228 28 282	6 1300 30 283	7 1371 32 283	7 1444 33 284	7 1519 35 284
160	5 935 20 266	5 997 22 267	5 1060 23 268	5 1125 24 269	6 1190 26 270	6 1255 27 270	6 1322 29 271	7 1390 30 272
140	4 851 17 252	4 907 18 253	5 965 20 255	5 1024 21 256	5 1083 22 257	5 1142 23 257	6 1203 24 258	6 1264 26 259
120	4 768 15 238	4 819 15 239	4 872 16 240	4 925 17 242	5 979 18 243	5 1032 20 243	5 1086 21 244	5 1142 22 245
100	3 630 11 212	3 673 11 214	3 717 12 215	3 761 13 216	4 805 13 217	4 849 14 218	4 893 15 219	4 938 16 220
50	2 432 6 178	2 462 6 179	2 492 7 180	2 523 7 182	2 553 7 183	3 583 8 184	3 612 8 184	3 642 9 186
15	1 289 3 131	1 310 3 132	1 331 3 133	1 351 3 134	2 372 4 136	2 391 4 136	2 410 4 137	2 429 4 138

FROM BRAKES RELEASE TIME . (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. . (NM) MEAN SPEED TAS (KT)

R304 FB2.1110.008-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CLIMB CLIMB CHART 2 ENGINES	2.11.10 PAGE 9/10 REV 15 SEQ 080

MAX CLIMB THRUST ISA + 20	NORMAL CLIMB 2 ENGINES	250/300 KT/M.79

FL	WEIGHT AT BRAKES RELEASE (1000KG)							
	125	130	135	140	145	150	155	160
410								
390								
370	20 3046 128 394	21 3267 140 397	23 3531 154 400					
350	17 2835 111 384	19 3014 119 386	20 3209 128 387	21 3425 138 390	23 3673 150 392	25 3966 166 396		
330	16 2669 99 375	17 2827 105 376	18 2998 112 377	19 3180 119 379	20 3378 128 380	22 3590 137 383	23 3827 148 385	25 4100 162 388
310	14 2520 88 365	15 2664 93 366	16 2818 99 367	17 2981 105 368	18 3155 112 370	19 3337 120 371	21 3533 128 373	22 3747 137 375
290	13 2356 77 353	14 2488 82 354	15 2628 87 355	16 2774 92 356	16 2929 98 357	17 3090 104 358	18 3260 110 360	19 3443 117 361
270	12 2180 67 340	12 2299 71 341	13 2426 75 342	14 2557 79 343	15 2696 84 343	15 2838 89 344	16 2986 94 346	17 3144 99 347
250	11 2017 58 327	11 2127 61 328	12 2241 65 329	12 2360 68 330	13 2485 72 330	14 2612 76 331	15 2744 81 332	15 2883 85 333
240	10 1940 54 321	11 2045 57 322	11 2154 60 323	12 2267 64 323	12 2386 67 324	13 2506 71 325	14 2631 75 326	14 2762 79 327
220	9 1794 47 309	10 1889 50 310	10 1989 52 310	11 2091 55 311	11 2199 58 312	12 2307 61 312	12 2419 64 313	13 2537 68 314
200	8 1654 41 297	9 1741 43 297	9 1832 45 298	10 1925 48 299	10 2022 50 299	11 2120 53 300	11 2221 56 301	12 2327 58 302
180	7 1519 35 284	8 1598 37 285	8 1681 39 286	9 1766 41 286	9 1854 43 287	9 1942 45 288	10 2033 48 288	10 2128 50 289
160	7 1390 30 272	7 1462 32 272	7 1537 34 273	8 1614 35 274	8 1694 37 274	8 1774 39 275	9 1855 41 276	9 1941 43 277
140	6 1264 26 259	6 1329 27 259	7 1398 29 260	7 1468 30 260	7 1540 32 261	8 1611 33 262	8 1684 35 263	8 1761 37 264
120	5 1142 22 245	6 1200 23 245	6 1262 24 246	6 1325 25 247	6 1390 27 247	7 1453 28 248	7 1519 29 249	7 1587 31 250
100	4 938 16 220	5 986 17 220	5 1037 17 221	5 1089 18 222	5 1142 19 223	5 1193 20 224	6 1246 21 225	6 1301 22 226
50	3 642 9 186	3 674 9 186	3 708 10 187	3 743 10 188	3 778 11 189	4 810 11 190	4 843 12 191	4 877 12 193
15	2 429 4 138	2 450 4 139	2 472 5 140	2 494 5 141	2 516 5 141	2 535 5 143	2 554 6 144	2 573 6 145

FROM BRAKES RELEASE TIME (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. (NM) MEAN SPEED TAS (KT)

R304 FB2.1110.009-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	CRUISE	N	2.12.00
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Vers. : All GE Eng. : All

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INTRODUCTION

Cruise tables are established from FL 270 to FL 410 at ISA, ISA + 10, ISA + 15 and ISA + 20 for different Mach number, with air conditioning in economic mode.

R When using normal air conditioning, fuel consumption is increased by 0.8 %.

These tables are established with a center of gravity location of 37.5 %.

In addition LONG RANGE tables are given at ISA, ISA + 10, ISA + 15, ISA + 20 from FL 100 to FL 410.

The LONG RANGE tables are established with a center of gravity of 37.5 % for a flight level above 20000 ft.

For a flight level below 20000 ft, the LONG RANGE tables are established with a center of gravity location of 27 %.

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE	2.12.10
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	CRUISE TABLES 2 ENGINES	REV 15 / SEQ 110

CRUISE 2 ENGINES — FL 270

MACH	0.790				0.800				
ISA=-38C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	320 472 -9.2	320 482 2.0	320 486 7.7	320 491 13.3	324 478 -8.5	324 488 2.8	324 493 8.5	324 497 14.1	IAS (KT) TAS (KT) TAT (C)
90	585 86.1 2369 99.5	619 88.0 2437 98.8	636 89.0 2471 98.4	653 89.9 2504 98.1	593 86.8 2461 97.0	628 88.8 2531 96.3	645 89.7 2566 96.0	662 90.6 2601 95.6	EGT DG.C N1 % KG/H/ENG NM/1000K
95	587 86.3 2389 98.7	621 88.2 2458 98.0	639 89.1 2491 97.6	656 90.1 2525 97.3	595 87.0 2479 96.3	630 88.9 2550 95.6	647 89.9 2585 95.3	664 90.8 2620 94.9	
100	589 86.5 2411 97.8	624 88.4 2480 97.1	641 89.3 2514 96.7	658 90.3 2548 96.4	597 87.2 2499 95.5	632 89.1 2571 94.8	649 90.0 2606 94.5	667 91.0 2641 94.2	
105	592 86.7 2434 96.9	626 88.6 2504 96.2	643 89.6 2538 95.8	661 90.5 2573 95.5	599 87.4 2520 94.8	634 89.3 2591 94.1	651 90.2 2627 93.7	669 91.2 2662 93.4	
110	594 86.9 2461 95.8	629 88.8 2531 95.1	646 89.8 2566 94.8	663 90.7 2600 94.5	602 87.5 2542 93.9	636 89.5 2614 93.3	654 90.4 2650 92.9	671 91.4 2686 92.6	
115	597 87.2 2490 94.7	632 89.1 2561 94.0	649 90.1 2596 93.7	667 91.0 2631 93.4	604 87.8 2566 93.1	639 89.7 2639 92.4	656 90.6 2675 92.1	674 91.6 2711 91.7	
120	600 87.5 2519 93.6	635 89.4 2591 92.9	652 90.3 2627 92.6	670 91.3 2662 92.3	607 88.0 2594 92.0	642 89.9 2668 91.4	659 90.9 2704 91.1	677 91.8 2741 90.8	
125	603 87.7 2548 92.5	638 89.6 2620 91.9	656 90.6 2656 91.6	673 91.5 2692 91.3	610 88.2 2623 91.0	645 90.2 2697 90.4	662 91.1 2734 90.1	680 92.1 2771 89.8	
130	606 88.0 2579 91.4	641 89.9 2652 90.8	659 90.9 2689 90.5	676 91.8 2725 90.2	613 88.5 2652 90.0	648 90.4 2727 89.4	666 91.4 2765 89.1	683 92.4 2802 88.8	
135	610 88.3 2612 90.3	645 90.2 2686 89.6	662 91.2 2723 89.3	680 92.1 2759 89.0	616 88.8 2683 89.0	651 90.7 2759 88.4	669 91.7 2796 88.1	686 92.6 2834 87.8	
140	613 88.6 2646 89.1	648 90.5 2721 88.5	666 91.5 2758 88.2	684 92.4 2795 87.9	619 89.0 2716 87.9	655 91.0 2792 87.3	672 92.0 2831 87.0	690 92.9 2868 86.7	
145	617 88.9 2686 87.8	653 90.9 2762 87.2	670 91.8 2800 86.9	688 92.8 2837 86.6	623 89.4 2752 86.8	658 91.3 2829 86.2	676 92.3 2868 85.9	694 93.2 2906 85.6	
150	622 89.3 2728 86.4	657 91.2 2805 85.8	675 92.2 2843 85.5	693 93.2 2881 85.3	627 89.7 2792 85.5	663 91.7 2871 84.9	680 92.6 2910 84.6	698 93.6 2949 84.4	
155	626 89.7 2773 85.0	662 91.7 2851 84.4	680 92.6 2890 84.2	697 93.6 2928 83.9	631 90.1 2835 84.2	667 92.1 2915 83.6	685 93.0 2954 83.4	703 94.0 2994 83.1	
160	631 90.1 2824 83.5	667 92.1 2904 82.9	685 93.1 2943 82.6	703 94.0 2982 82.4	636 90.5 2882 82.9	672 92.5 2963 82.3	690 93.4 3003 82.0	708 94.4 3043 81.8	

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Mod. : 4801 + 4863

GE Eng. : 80C2A2

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CRUISE 2 ENGINES — FL 290

MACH	0.790				0.800				
ISA=-42C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	306 468 -13.7	306 478 -2.4	306 483 3.2	306 487 8.8	311 473 -12.9	311 484 -1.6	311 489 4.0	311 494 9.6	IAS (KT) TAS (KT) TAT (C)
90	578 85.8 2190 106.7	612 87.7 2254 105.9	630 88.6 2285 105.6	647 89.6 2317 105.2	586 86.5 2272 104.2	621 88.4 2338 103.4	638 89.4 2370 103.1	655 90.3 2403 102.7	EGT DC.C N1 % KG/H/ENG NM/1000K
95	581 86.0 2214 105.6	615 87.9 2278 104.8	632 88.9 2309 104.5	649 89.8 2341 104.1	588 86.7 2292 103.3	623 88.6 2358 102.5	640 89.6 2391 102.2	658 90.5 2424 101.8	
100	583 86.3 2239 104.4	618 88.2 2304 103.6	635 89.1 2336 103.3	653 90.1 2368 102.9	590 86.9 2313 102.3	625 88.8 2380 101.6	643 89.8 2413 101.2	660 90.7 2446 100.9	
105	586 86.5 2268 103.1	621 88.5 2333 102.3	639 89.4 2366 102.0	656 90.4 2398 101.6	593 87.1 2337 101.3	628 89.0 2405 100.6	646 90.0 2438 100.2	663 90.9 2471 99.9	
110	590 86.8 2297 101.8	625 88.8 2364 101.0	642 89.7 2396 100.7	659 90.7 2429 100.3	596 87.4 2365 100.1	631 89.3 2434 99.4	649 90.3 2467 99.0	666 91.2 2501 98.7	
115	593 87.1 2326 100.5	628 89.0 2393 99.8	645 90.0 2426 99.5	663 90.9 2459 99.1	599 87.6 2394 98.9	635 89.6 2463 98.2	652 90.5 2497 97.9	670 91.5 2531 97.5	
120	596 87.4 2357 99.2	631 89.3 2425 98.5	649 90.3 2459 98.1	667 91.3 2492 97.8	602 87.9 2423 97.7	638 89.9 2493 97.0	656 90.8 2527 96.7	673 91.8 2562 96.3	
125	600 87.7 2390 97.8	635 89.7 2459 97.1	653 90.6 2493 96.8	670 91.6 2527 96.5	606 88.2 2454 96.5	641 90.2 2525 95.8	659 91.1 2559 95.5	677 92.1 2594 95.1	
130	604 88.1 2426 96.3	639 90.0 2496 95.7	657 91.0 2530 95.4	675 91.9 2565 95.0	610 88.5 2488 95.2	645 90.5 2559 94.5	663 91.5 2594 94.2	681 92.4 2629 93.9	
135	608 88.4 2467 94.8	644 90.4 2538 94.1	662 91.4 2572 93.8	679 92.3 2607 93.5	614 88.9 2526 93.7	650 90.9 2598 93.1	667 91.8 2634 92.8	685 92.8 2670 92.4	
140	613 88.9 2510 93.1	649 90.8 2582 92.5	667 91.8 2617 92.2	685 92.8 2652 91.9	618 89.3 2567 92.2	654 91.3 2641 91.6	672 92.2 2677 91.3	690 93.2 2713 91.0	
145	618 89.3 2559 91.4	655 91.3 2632 90.7	672 92.3 2668 90.4	690 93.3 2704 90.1	623 89.7 2612 90.6	659 91.7 2687 90.0	677 92.7 2723 89.7	695 93.6 2760 89.4	
150	624 89.8 2612 89.5	661 91.8 2686 88.9	679 92.8 2723 88.6	697 93.8 2759 88.3	629 90.2 2662 88.9	665 92.2 2738 88.3	683 93.2 2775 88.0	701 94.1 2813 87.7	
155	630 90.4 2669 87.6	667 92.4 2746 87.0	685 93.4 2783 86.7	703 94.3 2821 86.4	635 90.7 2723 87.0	671 92.7 2801 86.3	690 93.7 2840 86.0	708 94.7 2878 85.8	
160	637 90.9 2733 85.5	673 92.9 2811 84.9	692 93.9 2850 84.7	710 94.9 2889 84.4	641 91.2 2787 84.9	678 93.3 2867 84.4	696 94.3 2906 84.1	715 95.2 2945 83.8	

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R R R R R R R R R R R304

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE CRUISE TABLES 2 ENGINES	2.12.10 PAGE 4 REV 15 SEQ 110

CRUISE 2 ENGINES **FL 310**

MACH	0.790				0.800				
ISA=-46C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	293 464 -18.1	293 474 -6.9	293 479 -1.2	293 484 4.4	297 469 -17.4	297 480 -6.1	297 485 -0.5	297 490 5.2	IAS (KT) TAS (KT) TAT (C)
90	572 85.5 2030 114.2	606 87.5 2090 113.3	624 88.4 2120 112.9	641 89.4 2149 112.5	579 86.1 2099 111.8	614 88.1 2160 111.0	631 89.1 2191 110.6	649 90.0 2222 110.2	EGT DG.C N1 % KG/H/ENG NM/1000K
95	575 85.8 2058 112.6	610 87.8 2119 111.8	627 88.7 2149 111.4	645 89.7 2178 111.0	582 86.4 2122 110.6	617 88.3 2184 109.8	634 89.3 2215 109.4	652 90.3 2246 109.0	
100	578 86.1 2087 111.0	614 88.1 2149 110.2	631 89.1 2179 109.8	648 90.0 2209 109.4	585 86.7 2149 109.2	620 88.6 2212 108.4	638 89.6 2244 108.0	655 90.6 2275 107.6	
105	582 86.4 2115 109.6	617 88.4 2177 108.8	635 89.4 2208 108.4	652 90.3 2239 108.0	588 87.0 2177 107.8	624 88.9 2241 107.0	641 89.9 2273 106.6	659 90.9 2304 106.2	
110	586 86.8 2147 108.0	621 88.7 2210 107.2	639 89.7 2241 106.8	656 90.7 2272 106.4	592 87.3 2207 106.4	627 89.2 2271 105.6	645 90.2 2303 105.2	663 91.2 2335 104.8	
115	590 87.1 2180 106.3	625 89.1 2244 105.6	643 90.1 2275 105.2	660 91.0 2307 104.8	595 87.6 2238 104.9	631 89.6 2303 104.1	649 90.6 2336 103.8	667 91.5 2368 103.4	
120	594 87.5 2217 104.5	630 89.5 2282 103.8	647 90.5 2314 103.4	665 91.4 2346 103.1	599 87.9 2272 103.3	635 89.9 2338 102.6	653 90.9 2371 102.2	671 91.9 2403 101.9	
125	599 87.9 2258 102.6	635 89.9 2324 101.9	653 90.9 2357 101.6	671 91.9 2389 101.2	604 88.3 2311 101.6	640 90.3 2378 100.8	658 91.3 2412 100.5	676 92.3 2445 100.1	
130	604 88.4 2303 100.6	640 90.4 2370 99.9	658 91.4 2403 99.6	676 92.4 2436 99.2	609 88.8 2354 99.7	645 90.8 2422 99.0	664 91.8 2456 98.7	682 92.8 2490 98.3	
135	610 88.9 2354 98.5	647 90.9 2422 97.8	665 91.9 2456 97.4	683 92.9 2489 97.1	615 89.3 2401 97.8	651 91.3 2470 97.1	670 92.3 2505 96.7	688 93.3 2539 96.4	
140	617 89.5 2408 96.2	653 91.5 2479 95.5	672 92.5 2514 95.2	690 93.5 2548 94.9	621 89.8 2457 95.5	658 91.8 2529 94.8	676 92.9 2565 94.5	694 93.8 2600 94.2	
145	624 90.1 2472 93.8	660 92.1 2544 93.1	679 93.1 2579 92.8	697 94.1 2614 92.5	628 90.4 2521 93.1	665 92.4 2594 92.5	683 93.5 2631 92.1	702 94.5 2667 91.8	
150	631 90.7 2538 91.3	668 92.8 2612 90.7	686 93.8 2649 90.4	705 94.8 2685 90.1	635 91.0 2585 90.8	672 93.1 2660 90.2	691 94.1 2698 89.8	709 95.1 2735 89.5	
155	639 91.4 2612 88.7	676 93.5 2688 88.1	695 94.5 2725 87.8	713 95.5 2762 87.5	642 91.7 2656 88.4	680 93.7 2733 87.8	699 94.8 2771 87.5	717 95.8 2809 87.2	
160	647 92.1 2693 86.1	685 94.2 2770 85.5	704 95.2 2809 85.2	723 96.3 2847 84.9	651 92.4 2739 85.7	689 94.5 2817 85.1	707 95.5 2857 84.8	726 96.5 2896 84.6	

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A304 FB2.1210.004-AA.110

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE CRUISE TABLES 2 ENGINES	2.12.10 PAGE 5 REV 15 SEQ 110

CRUISE 2 ENGINES **FL 330**

MACH	0.790				0.800				
ISA=-50C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	281 459 -22.6	281 470 -11.3	281 475 -5.7	281 480 -0.1	284 465 -21.9	284 476 -10.6	284 481 -4.9	284 486 0.7	IAS (KT) TAS (KT) TAT (C)
90	567 85.4 1889 121.6	602 87.4 1946 120.7	619 88.3 1973 120.3	637 89.3 2001 119.9	573 85.9 1945 119.6	608 87.9 2003 118.7	626 88.9 2032 118.3	644 89.9 2060 117.9	EGT DC. C N1 % KG/H/ENG NM/1000K
95	570 85.7 1917 119.9	606 87.7 1974 119.0	623 88.7 2002 118.5	641 89.6 2030 118.1	577 86.2 1973 117.9	612 88.2 2032 117.0	630 89.2 2061 116.6	648 90.2 2090 116.2	
100	574 86.1 1948 117.9	610 88.1 2006 117.1	627 89.0 2034 116.7	645 90.0 2063 116.3	580 86.6 2002 116.2	616 88.6 2062 115.3	634 89.6 2091 114.9	652 90.5 2120 114.5	
105	579 86.4 1980 116.0	614 88.4 2039 115.2	632 89.4 2068 114.8	650 90.4 2097 114.4	584 86.9 2033 114.4	620 88.9 2093 113.6	638 89.9 2123 113.2	656 90.9 2153 112.8	
110	583 86.9 2018 113.9	619 88.9 2078 113.0	637 89.9 2107 112.6	655 90.8 2136 112.3	589 87.3 2067 112.5	625 89.3 2129 111.7	643 90.3 2159 111.3	661 91.3 2189 111.0	
115	589 87.3 2059 111.6	625 89.4 2120 110.8	643 90.4 2150 110.4	661 91.3 2180 110.0	594 87.8 2107 110.4	630 89.8 2169 109.6	648 90.8 2200 109.3	666 91.8 2231 108.9	
120	595 87.9 2106 109.1	631 89.9 2168 108.3	649 90.9 2198 108.0	667 91.9 2229 107.6	599 88.2 2150 108.2	636 90.3 2213 107.5	654 91.3 2244 107.1	672 92.3 2275 106.7	
125	602 88.5 2157 106.5	638 90.5 2221 105.7	656 91.5 2252 105.4	675 92.5 2283 105.0	606 88.8 2199 105.8	643 90.8 2265 105.0	661 91.8 2297 104.6	679 92.8 2329 104.3	
130	609 89.1 2216 103.7	646 91.1 2282 102.9	664 92.2 2314 102.6	682 93.2 2347 102.2	613 89.4 2261 102.9	650 91.5 2328 102.1	668 92.5 2361 101.8	687 93.5 2394 101.4	
135	616 89.8 2281 100.7	653 91.8 2348 100.0	672 92.8 2381 99.7	690 93.8 2414 99.3	620 90.1 2324 100.1	658 92.1 2393 99.4	676 93.2 2427 99.0	695 94.2 2461 98.7	
140	624 90.5 2351 97.7	662 92.6 2420 97.0	681 93.6 2454 96.7	699 94.6 2488 96.4	628 90.8 2393 97.2	666 92.8 2463 96.5	685 93.9 2498 96.2	703 94.9 2532 95.9	
145	634 91.3 2430 94.6	672 93.4 2501 93.9	690 94.4 2536 93.6	709 95.4 2571 93.3	637 91.5 2471 94.1	675 93.7 2544 93.5	694 94.7 2579 93.2	713 95.7 2615 92.9	
150	642 92.1 2515 91.3	680 94.2 2588 90.7	699 95.2 2625 90.4	718 96.3 2661 90.1	646 92.4 2561 90.8	684 94.5 2636 90.2	703 95.6 2673 89.9	722 96.6 2709 89.6	
155	652 93.0 2616 87.8	691 95.2 2692 87.2	710 96.2 2730 87.0	729 97.3 2767 86.7	656 93.4 2667 87.2	695 95.5 2745 86.6	714 96.6 2783 86.4	734 97.7 2821 86.1	
160	664 94.3 2732 84.1	703 96.4 2811 83.5	722 97.5 2850 83.3	741 98.6 2889 83.0	668 94.7 2792 83.3	707 96.9 2873 82.8	727 98.0 2913 82.5	746 99.0 2953 82.3	

A304 FB2.1210.005-AA.110

R R R R R R R R

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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	CRUISE TABLES 2 ENGINES	REV 15 / SEQ 110

CRUISE 2 ENGINES — **FL 350**

MACH	0.790				0.800				
ISA=-54C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	268 455 -27.0	268 466 -15.8	268 471 -10.2	268 476 -4.5	272 461 -26.3	272 472 -15.1	272 477 -9.4	272 482 -3.8	IAS (KT) TAS (KT) TAT (C)
90	562 85.3 1759 129.4	598 87.3 1812 128.5	616 88.3 1839 128.0	633 89.3 1866 127.5	568 85.8 1809 127.5	604 87.8 1864 126.5	622 88.8 1891 126.0	640 89.8 1918 125.6	EGT DG.C N1 % KG/H/ENG NM/1000K
95	567 85.7 1791 127.1	603 87.7 1845 126.2	620 88.7 1873 125.7	638 89.7 1899 125.2	572 86.2 1839 125.4	608 88.2 1894 124.5	627 89.2 1922 124.0	645 90.2 1950 123.5	
100	572 86.2 1828 124.6	608 88.2 1883 123.6	626 89.2 1911 123.2	644 90.2 1938 122.7	577 86.6 1873 123.1	613 88.6 1929 122.2	632 89.6 1957 121.8	650 90.6 1985 121.3	
105	578 86.7 1869 121.8	614 88.7 1925 120.9	632 89.7 1953 120.5	650 90.7 1981 120.1	583 87.1 1912 120.6	619 89.1 1970 119.7	638 90.2 1998 119.3	656 91.2 2027 118.8	
110	584 87.3 1916 118.9	621 89.3 1973 118.0	639 90.4 2002 117.6	658 91.4 2031 117.1	589 87.6 1955 117.9	626 89.7 2014 117.1	644 90.7 2043 116.6	662 91.7 2072 116.2	
115	592 87.9 1969 115.7	629 90.0 2028 114.8	647 91.0 2058 114.4	665 92.0 2088 113.9	596 88.2 2008 114.8	633 90.3 2069 114.0	651 91.3 2099 113.5	670 92.4 2129 113.1	
120	600 88.6 2030 112.2	637 90.7 2091 111.4	655 91.7 2121 110.9	674 92.7 2152 110.5	604 88.9 2070 111.4	641 91.0 2133 110.5	660 92.1 2164 110.1	678 93.1 2195 109.7	
125	608 89.4 2095 108.7	646 91.5 2158 107.9	664 92.5 2190 107.5	683 93.5 2221 107.1	612 89.7 2135 108.0	650 91.8 2199 107.2	668 92.8 2231 106.8	687 93.8 2262 106.5	
130	618 90.2 2170 104.9	656 92.3 2235 104.2	674 93.4 2267 103.8	693 94.4 2299 103.5	621 90.5 2206 104.5	659 92.6 2272 103.8	678 93.6 2305 103.4	697 94.7 2338 103.0	
135	627 91.1 2251 101.1	665 93.2 2318 100.4	684 94.3 2352 100.1	703 95.3 2385 99.7	631 91.4 2291 100.6	669 93.5 2359 99.9	688 94.5 2393 99.6	707 95.6 2427 99.2	
140	638 92.1 2347 97.0	676 94.2 2417 96.3	695 95.3 2452 96.0	715 96.3 2486 95.7	641 92.4 2390 96.5	680 94.5 2461 95.8	699 95.6 2497 95.5	718 96.7 2532 95.1	
145	649 93.3 2460 92.6	689 95.5 2533 91.9.	708 96.6 2569 91.6	727 97.7 2605 91.3	654 93.8 2513 91.7	693 96.0 2588 91.1	713 97.1 2625 90.8	732 98.2 2661 90.5	
150	663 94.9 2592 87.8	703 97.1 2668 87.3	723 98.2 2706 87.0	743 99.3 2744 86.7	667 95.3 2644 87.2	707 97.6 2722 86.6	727 98.7 2760 86.3		
155	677 96.5 2732 83.3	717 98.7 2812 82.8	737 99.9 2852 82.5		682 97.1 2804 82.2	723 99.4 2887 81.7	743 100.6 2928 81.4		
160	690 98.6 2901 78.5	731 101.0 2986 78.0							

R R R R R R R R R R R A304 FB2.1210.006-AA.110

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE
A 310
FLIGHT CREW OPERATING MANUAL

CRUISE

CRUISE TABLES 2 ENGINES

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CRUISE 2 ENGINES FL 370

MACH	.790				.800				
ISA=-56C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	256 453 -29.5	256 463 -18.2	256 469 -12.6	256 474 -7.0	260 459 -28.8	260 469 -17.5	260 474 -11.8	260 480 -6.2	IAS (KT) TAS (KT) TAT (C)
85	561 85.3 1621 139.7	597 87.3 1671 138.6	614 88.3 1696 138.1	632 89.3 1720 137.6	566 85.8 1665 137.8	603 87.8 1716 136.7	621 88.8 1742 136.2	639 89.8 1767 135.7	EGT DG.C N1 % KG/H/ENG NM/1000K
90	566 85.8 1656 136.8	602 87.8 1707 135.7	620 88.8 1732 135.2	638 89.8 1757 134.8	571 86.2 1697 135.2	608 88.3 1750 134.1	626 89.3 1775 133.6	644 90.3 1801 133.2	
95	572 86.3 1697 133.5	609 88.4 1749 132.5	627 89.4 1774 132.0	645 90.4 1800 131.6	577 86.7 1736 132.1	614 88.8 1790 131.1	632 89.8 1816 130.7	651 90.8 1842 130.2	
100	580 87.0 1743 130.0	616 89.0 1797 129.0	635 90.1 1823 128.5	653 91.1 1849 128.1	584 87.3 1779 128.9	621 89.4 1834 128.0	639 90.4 1860 127.5	658 91.4 1887 127.1	
105	588 87.7 1797 126.1	625 89.8 1853 125.1	643 90.8 1880 124.6	662 91.8 1907 124.2	592 88.0 1833 125.1	629 90.1 1890 124.2	648 91.1 1918 123.7	666 92.1 1945 123.3	
110	596 88.4 1859 121.9	634 90.5 1916 121.0	652 91.6 1944 120.5	671 92.6 1971 120.1	600 88.8 1896 121.0	638 90.9 1954 120.1	657 91.9 1983 119.7	676 92.9 2011 119.2	
115	606 89.3 1926 117.6	644 91.4 1985 116.7	662 92.4 2014 116.3	681 93.5 2042 115.9	610 89.6 1961 117.0	648 91.7 2021 116.1	666 92.7 2051 115.7	685 93.8 2080 115.3	
120	616 90.2 2003 113.1	655 92.4 2064 112.3	674 93.4 2094 111.9	693 94.4 2124 111.5	620 90.5 2038 112.6	658 92.6 2100 111.8	677 93.7 2130 111.4	696 94.7 2160 111.0	
125	627 91.2 2091 108.4	665 93.4 2154 107.6	685 94.4 2185 107.2	704 95.5 2215 106.9	630 91.5 2128 107.8	669 93.7 2192 107.0	688 94.7 2224 106.7	707 95.8 2255 106.3	
130	639 92.5 2196 103.2	678 94.7 2262 102.5	698 95.8 2294 102.1	717 96.8 2326 101.8	643 92.9 2241 102.4	683 95.1 2309 101.6	702 96.2 2342 101.3	722 97.3 2375 101.0	
135	654 94.1 2321 97.6	693 96.3 2390 96.9	713 97.4 2424 96.6	733 98.5 2458 96.3	658 94.5 2367 96.9	697 96.7 2438 96.3	717 97.8 2473 95.9	737 98.9 2507 95.6	
140	668 95.8 2459 92.1	709 98.1 2532 91.5	729 99.2 2568 91.2	749 100.3 2604 90.9	673 96.4 2521 91.0	714 98.7 2596 90.4	734 99.8 2632 90.1	754 100.9 2669 89.8	
145	683 98.1 2623 86.4	724 100.4 2702 85.8	744 101.6 2740 85.5		691 99.2 2718 84.4	732 101.6 2799 83.8	752 102.7 2839 83.6		
150	703 100.6 2810 80.6	744 103.0 2894 80.1			717 102.4 2951 77.8	761 104.9 3041 77.2			

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CRUISE 2 ENGINES FL 390

MACH	.790				.800				
ISA=-56C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	244 453 -29.5	244 463 -18.2	244 469 -12.6	244 474 -7.0	248 459 -28.8	248 469 -17.5	248 474 -11.8	248 480 -6.2	IAS (KT) TAS (KT) TAT (C)
85	574 86.3 1543 146.8	610 88.3 1590 145.7	628 89.4 1614 145.2	646 90.4 1637 144.6	579 86.7 1580 145.2	615 88.8 1628 144.2	634 89.8 1652 143.6	652 90.8 1676 143.1	EGT DG.C N1 % KG/H/ENG NM/1000K
90	581 87.0 1588 142.7	618 89.0 1636 141.6	636 90.1 1660 141.1	655 91.1 1684 140.6	586 87.3 1621 141.5	623 89.4 1671 140.5	641 90.4 1695 139.9	660 91.5 1720 139.4	
95	590 87.7 1642 138.0	627 89.8 1692 137.0	646 90.9 1717 136.4	664 91.9 1742 135.9	594 88.1 1675 137.0	631 90.2 1726 136.0	650 91.2 1752 135.4	669 92.2 1777 134.9	
100	599 88.6 1703 133.0	637 90.7 1755 132.0	656 91.7 1781 131.5	675 92.8 1807 131.1	604 88.9 1737 132.1	641 91.0 1790 131.1	660 92.1 1817 130.6	679 93.1 1843 130.1	
105	610 89.5 1771 127.9	648 91.6 1825 127.0	667 92.7 1852 126.5	686 93.7 1879 126.0	614 89.8 1803 127.2	652 91.9 1858 126.3	671 93.0 1886 125.8	690 94.0 1913 125.4	
110	621 90.5 1850 122.5	660 92.7 1906 121.6	679 93.7 1934 121.1	698 94.8 1961 120.7	625 90.8 1882 121.9	663 93.0 1938 121.1	682 94.0 1967 120.6	701 95.1 1995 120.2	
115	633 91.7 1942 116.7	672 93.9 2000 115.9	692 94.9 2029 115.4	711 96.0 2058 115.0	637 92.0 1976 116.1	676 94.2 2035 115.3	695 95.2 2065 114.9	715 96.3 2094 114.5	
120	648 93.2 2053 110.3	687 95.4 2115 109.6	707 96.5 2145 109.2	726 97.6 2176 108.8	652 93.7 2098 109.3	692 95.9 2161 108.6	711 97.0 2192 108.2	731 98.1 2224 107.8	
125	664 95.1 2188 103.6	704 97.4 2253 102.9	724 98.5 2285 102.5	744 99.6 2317 102.2	669 95.6 2236 102.6	709 97.9 2302 101.9	729 99.0 2335 101.6	749 100.1 2368 101.3	
130	680 97.3 2339 96.9	721 99.6 2409 96.2	741 100.8 2444 95.9	761 101.9 2478 95.5	686 98.3 2415 95.0	727 100.7 2488 94.3	747 101.8 2524 94.0		
135	700 100.1 2522 89.8	742 102.5 2597 89.2	762 103.6 2635 88.9		710 101.5 2629 87.3	753 104.0 2709 86.6			
140									
145									
150									

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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CRUISE 2 ENGINES FL 410

MACH	.790				.800				
ISA=-56C	ISA	ISA+10	ISA+15	ISA+20	ISA	ISA+10	ISA+15	ISA+20	
WEIGHT (1000KG)	233 453 -29.5	233 463 -18.2	233 469 -12.6	233 474 -7.0	237 459 -28.8	237 469 -17.5	237 474 -11.8	237 480 -6.2	IAS (KT) TAS (KT) TAT (C)
85	590 87.7 1489 152.2	628 89.7 1535 151.0	646 90.8 1557 150.4	665 91.8 1580 149.9	595 88.0 1519 151.0	632 90.1 1566 149.8	651 91.1 1589 149.3	669 92.1 1612 148.7	EGT DC.C N1 % KG/H/ENG NM/1000K
90	601 88.6 1549 146.3	638 90.7 1597 145.1	657 91.7 1620 144.6	676 92.7 1643 144.1	605 88.9 1580 145.2	643 91.0 1629 144.0	662 92.0 1653 143.5	681 93.1 1677 143.0	
95	612 89.6 1616 140.2	650 91.7 1666 139.1	669 92.7 1690 138.6	688 93.8 1714 138.1	616 89.9 1646 139.4	654 92.0 1696 138.3	673 93.0 1721 137.8	692 94.1 1746 137.3	
100	624 90.7 1695 133.7	663 92.8 1746 132.7	682 93.9 1771 132.2	701 94.9 1797 131.8	628 90.9 1724 133.1	666 93.1 1776 132.1	686 94.2 1802 131.6	705 95.2 1828 131.2	
105	638 92.0 1788 126.7	677 94.2 1842 125.8	696 95.2 1868 125.4	716 96.3 1895 125.0	641 92.3 1821 126.0	681 94.5 1876 125.1	700 95.6 1903 124.6	720 96.7 1930 124.2	
110	654 93.8 1904 119.0	694 96.0 1962 118.1	714 97.1 1990 117.7	733 98.2 2018 117.4	658 94.2 1945 118.0	698 96.5 2004 117.1	718 97.6 2032 116.7	738 98.7 2061 116.4	
115	672 95.9 2042 111.0	712 98.1 2103 110.2	733 99.2 2133 109.8	753 100.4 2163 109.5	677 96.4 2091 109.7	718 98.7 2153 109.0	738 99.9 2184 108.6	758 101.0 2214 108.3	
120	690 98.6 2208 102.6	732 101.0 2275 101.9	752 102.2 2307 101.5		699 99.8 2289 100.2	740 102.2 2358 99.5			
125	718 102.0 2410 94.0	761 104.5 2483 93.3							
130									
135									
140									
145									
150									

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CRUISE

CRUISE TABLES 2 ENGINES

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ISA | CRUISE 2 ENGINES | LONG RANGE

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	457 0.448 62.8 271 1947 291 74.7	458 0.469 65.0 260 1785 300 83.9	468 0.511 68.6 257 1716 320 93.3	469 0.517 69.1 256 1695 323 95.2	472 0.527 69.8 255 1685 327 97.2	476 0.541 70.9 257 1691 335 99.0	480 0.554 71.9 258 1692 341 100.9	482 0.561 72.5 257 1674 345 102.9
95	462 0.453 63.6 274 2002 294 73.5	465 0.479 66.1 265 1860 306 82.2	476 0.520 69.7 262 1790 326 91.1	479 0.531 70.5 263 1785 332 92.9	483 0.546 71.5 265 1794 339 94.6	487 0.557 72.4 265 1789 345 95.4	488 0.563 72.9 263 1766 347 98.4	489 0.569 73.4 261 1742 350 100.4
100	468 0.458 64.4 278 2061 298 72.3	473 0.490 67.4 271 1947 313 80.4	486 0.535 71.1 270 1887 335 88.9	490 0.550 72.1 272 1895 343 90.5	493 0.559 72.9 272 1884 348 92.3	494 0.565 73.4 269 1859 350 94.1	496 0.571 73.9 267 1835 352 96.0	498 0.578 74.5 265 1815 355 97.8
105	474 0.465 65.4 282 2128 302 71.0	482 0.503 68.8 279 2041 321 78.7	496 0.552 72.6 279 1993 346 86.8	498 0.561 73.3 278 1979 350 88.4	500 0.567 73.8 275 1952 352 90.2	501 0.573 74.3 273 1929 355 92.0	503 0.579 74.9 271 1908 357 93.7	506 0.586 75.5 269 1888 360 95.4
110	480 0.472 66.2 286 2198 307 69.7	490 0.513 69.9 284 2124 328 77.1	504 0.562 73.7 284 2073 352 84.9	505 0.567 74.2 281 2046 354 86.6	507 0.574 74.7 279 2023 357 88.2	509 0.581 75.3 277 2002 360 89.8	511 0.588 75.9 275 1983 363 91.4	514 0.595 76.6 273 1963 365 93.0
115	486 0.480 67.2 291 2276 312 68.5	496 0.521 70.8 289 2197 333 75.7	510 0.568 74.5 287 2140 356 83.1	512 0.575 75.0 285 2117 359 84.7	514 0.581 75.6 283 2094 361 86.2	517 0.589 76.3 281 2078 365 87.7	520 0.596 77.0 279 2059 368 89.3	524 0.608 77.7 279 2056 373 90.8
120	493 0.489 68.3 297 2363 318 67.3	504 0.531 71.8 295 2286 339 74.2	517 0.575 75.3 291 2213 360 81.4	519 0.582 75.9 288 2190 363 82.9	522 0.589 76.6 287 2171 366 84.3	525 0.596 77.3 285 2153 369 85.8	529 0.609 78.0 285 2153 376 87.2	534 0.623 78.9 286 2159 383 88.7
125	500 0.500 69.5 303 2456 325 66.1	513 0.545 73.1 302 2394 348 72.7	524 0.582 76.2 294 2286 365 79.8	526 0.589 76.8 292 2265 368 81.1	529 0.596 77.5 290 2246 371 82.5	533 0.609 78.3 291 2246 377 83.9	539 0.623 79.2 292 2255 385 85.3	544 0.638 80.0 293 2260 392 86.7
130	508 0.510 70.6 309 2551 332 65.0	521 0.557 74.2 309 2489 355 71.4	531 0.589 77.1 298 2363 369 78.1	533 0.596 77.7 296 2342 372 79.5	536 0.608 78.5 296 2341 378 80.8	543 0.623 79.4 298 2351 386 82.1	548 0.638 80.3 299 2357 393 83.4	553 0.652 81.1 300 2361 400 84.8
135	513 0.517 71.4 313 2626 336 64.0	527 0.564 75.1 313 2568 360 70.1	538 0.597 78.0 302 2442 374 76.6	542 0.608 78.7 302 2436 379 77.8	547 0.622 79.6 303 2444 387 79.1	552 0.636 80.4 305 2451 394 80.4	557 0.650 81.3 305 2454 401 81.7	563 0.668 82.3 308 2471 410 83.0
140	519 0.523 72.1 318 2703 340 62.9	533 0.570 75.8 316 2638 364 68.9	546 0.607 78.9 307 2532 380 75.0	551 0.621 79.8 309 2542 388 76.3	556 0.635 80.6 310 2548 395 77.5	561 0.649 81.5 311 2552 402 78.7	567 0.666 82.4 314 2569 411 80.0	573 0.683 83.3 315 2579 419 81.3
145	525 0.532 73.0 323 2790 346 61.9	538 0.575 76.4 319 2705 367 67.8	554 0.619 79.9 314 2635 388 73.6	559 0.634 80.7 315 2644 395 74.8	565 0.648 81.6 316 2650 403 76.0	571 0.664 82.6 319 2664 411 77.2	576 0.680 83.4 320 2674 420 78.5	581 0.695 84.2 321 2678 427 79.7
150	533 0.543 74.1 330 2900 353 60.9	544 0.581 77.2 322 2781 371 66.6	563 0.632 80.8 320 2740 396 72.2	568 0.646 81.7 321 2746 403 73.4	574 0.662 82.6 324 2760 411 74.5	579 0.678 83.5 325 2772 420 75.7	584 0.693 84.3 327 2776 427 77.0	589 0.706 85.0 327 2771 434 78.3
155	540 0.553 75.0 336 2999 360 60.0	550 0.586 77.9 326 2858 374 65.5	571 0.643 81.8 326 2842 403 70.9	577 0.659 82.7 328 2855 411 72.0	582 0.675 83.6 330 2869 420 73.2	587 0.690 84.4 332 2873 427 74.4	592 0.704 85.1 332 2873 434 75.6	596 0.714 85.7 331 2853 439 76.9
160	546 0.562 76.0 341 3093 365 59.0	556 0.592 78.7 329 2936 378 64.4	579 0.655 82.7 333 2947 410 69.6	585 0.672 83.7 335 2963 419 70.7	590 0.687 84.4 336 2970 427 71.9	595 0.701 85.2 337 2973 434 73.0	599 0.712 85.8 336 2956 439 74.3	602 0.721 86.4 334 2932 443 75.6
	EGT DC.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

FB2.1210.010-AA.080
A304

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FLIGHT CREW OPERATING MANUAL

CRUISE

CRUISE TABLES 2 ENGINES

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ISA	CRUISE 2 ENGINES	LONG RANGE

WEIGHT (1000KG)	FL220	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
85	476 0.566 72.4 249 1561 345 110.4	483 0.587 74.2 243 1510 354 117.1	490 0.610 75.8 242 1501 364 121.9	501 0.642 77.6 245 1511 380 125.7	512 0.676 79.5 248 1522 396 130.3	521 0.703 80.9 247 1509 409 135.3	528 0.724 82.2 244 1484 417 140.6	539 0.735 83.4 237 1451 422 145.4	563 0.764 85.5 236 1469 438 149.2	591 0.792 87.7 234 1494 454 152.0
90	485 0.575 73.5 253 1632 351 107.4	493 0.600 75.6 248 1590 361 113.5	503 0.630 77.3 251 1601 376 117.5	514 0.663 79.2 253 1612 392 121.7	524 0.694 80.8 255 1612 407 126.3	532 0.718 82.1 253 1592 418 131.2	537 0.730 83.1 246 1544 421 136.2	551 0.749 84.5 241 1532 430 140.2	579 0.784 86.8 242 1570 450 143.3	604 0.798 88.8 236 1574 458 145.4
95	494 0.585 74.7 257 1705 356 104.5	506 0.620 77.0 257 1694 373 110.1	516 0.649 78.8 259 1699 387 114.0	527 0.683 80.6 262 1712 404 118.1	535 0.707 81.9 260 1691 415 122.7	542 0.727 83.2 256 1651 423 127.4	547 0.740 84.0 249 1620 426 131.6	565 0.772 85.7 249 1638 443 135.1	592 0.795 87.9 246 1657 456 137.5	618 0.803 90.0 238 1657 460 138.9
100	503 0.596 75.9 262 1785 363 101.7	518 0.638 78.4 265 1794 384 107.0	529 0.671 80.3 268 1807 400 110.8	538 0.698 81.7 268 1799 413 114.9	545 0.721 83.0 265 1772 423 119.3	550 0.731 83.9 258 1719 425 123.7	558 0.753 85.0 254 1704 434 127.4	578 0.787 86.9 255 1738 451 130.2	603 0.799 88.9 248 1734 456 132.2	630 0.804 91.1 238 1742 461 132.4
105	514 0.610 77.1 269 1878 372 99.0	529 0.656 79.8 273 1896 395 104.1	539 0.687 81.4 275 1900 410 107.9	547 0.711 82.8 273 1879 421 111.9	554 0.728 84.0 268 1840 427 116.1	559 0.741 84.8 261 1797 431 119.9	571 0.774 86.2 262 1811 446 123.1	590 0.796 87.9 258 1819 457 125.5	616 0.803 89.9 249 1817 460 126.7	643 0.802 92.5 237 1835 460 125.4
110	525 0.627 78.4 277 1980 382 96.5	540 0.673 81.1 281 1996 405 101.5	549 0.699 82.4 280 1981 417 105.3	557 0.722 83.8 278 1959 428 109.1	561 0.732 84.6 270 1899 429 113.1	569 0.753 85.7 266 1880 438 116.4	583 0.787 87.2 267 1905 454 119.1	600 0.800 88.7 260 1894 459 121.1	627 0.804 91.0 249 1901 461 121.3	659 0.801 94.3 237 1951 459 117.7
115	535 0.643 79.6 284 2083 392 94.1	550 0.688 82.1 287 2089 414 99.1	558 0.711 83.4 285 2066 425 102.7	565 0.729 84.6 281 2027 432 106.5	570 0.741 85.4 273 1979 435 109.9	582 0.772 86.8 274 1990 449 112.8	594 0.796 88.1 270 1992 459 115.1	611 0.803 89.7 261 1976 461 116.5	639 0.803 92.2 249 1994 460 115.5	677 0.799 96.4 236 2086 458 109.8
120	546 0.660 80.9 292 2189 402 91.8	559 0.699 83.0 292 2173 421 96.9	567 0.722 84.3 290 2148 431 100.3	572 0.733 85.2 282 2087 434 103.9	579 0.752 86.3 278 2063 441 106.9	593 0.785 87.7 279 2087 457 109.4	603 0.799 88.9 271 2065 460 111.5	622 0.804 90.7 261 2059 461 112.0	653 0.800 93.7 248 2102 459 109.2	
125	556 0.675 82.0 299 2289 411 89.8	568 0.711 83.9 297 2259 428 94.7	575 0.729 85.1 293 2217 435 98.1	579 0.740 86.0 285 2161 436 101.3	591 0.770 87.3 285 2172 452 104.0	604 0.797 88.7 283 2184 463 106.1	613 0.803 89.8 273 2147 463 107.7	632 0.803 91.7 261 2148 461 107.2	669 0.801 95.7 248 2240 459 102.5	
130	564 0.687 82.9 305 2382 419 87.9	576 0.722 84.8 302 2343 434 92.7	581 0.732 85.8 294 2279 437 95.9	588 0.749 86.7 289 2244 443 98.8	601 0.783 88.2 290 2272 459 101.1	612 0.798 89.4 284 2252 464 103.0	624 0.804 90.7 273 2230 463 103.9	644 0.801 93.0 260 2250 460 102.1	682 0.793 97.6 245 2362 455 96.2	
135	572 0.696 83.7 309 2462 424 86.2	583 0.728 85.6 305 2413 438 90.8	588 0.737 86.4 297 2347 440 93.8	598 0.763 87.6 295 2343 451 96.3	611 0.792 89.0 294 2365 465 98.3	621 0.801 90.1 285 2330 466 100.0	633 0.804 91.5 273 2313 463 100.1	659 0.801 94.6 260 2379 460 96.6		
140	580 0.707 84.5 314 2548 431 84.5	590 0.732 86.3 307 2478 441 88.9	596 0.746 87.1 300 2429 445 91.6	608 0.779 88.5 301 2455 461 93.9	620 0.797 89.7 296 2442 468 95.7	630 0.803 90.9 286 2414 467 96.8	643 0.803 92.5 273 2410 463 96.0	673 0.798 96.3 259 2510 458 91.2		
145	588 0.717 85.3 319 2635 437 82.9	596 0.735 86.8 308 2539 442 87.1	604 0.755 87.8 304 2517 451 89.5	617 0.788 89.2 305 2547 466 91.5	628 0.799 90.4 297 2518 469 93.1	640 0.804 91.7 286 2498 468 93.6	654 0.801 93.8 272 2519 461 91.6	684 0.791 98.2 256 2633 454 86.1		
150	595 0.724 86.0 322 2713 441 81.3	602 0.741 87.4 311 2615 446 85.3	614 0.771 88.7 311 2632 461 87.5	627 0.797 90.0 309 2644 471 89.1	636 0.802 91.1 298 2600 471 90.5	648 0.803 92.6 286 2585 467 90.4	669 0.801 95.4 272 2656 462 86.9			
155	601 0.730 86.7 325 2783 445 79.9	609 0.749 88.0 314 2697 451 83.5	623 0.782 89.4 316 2733 467 85.4	634 0.798 90.6 310 2711 472 87.1	645 0.804 91.8 299 2683 472 87.9	658 0.802 93.5 285 2685 466 86.9	681 0.796 97.0 271 2783 459 82.5			
	ECT DC.C N1 % KG/H/ENG NM/1000K	MACH IAS TAS								

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE	2.12.10
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	CRUISE TABLES 2 ENGINES	REV 15 / SEQ 080

ISA + 10	CRUISE 2 ENGINES	LONG RANGE

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	482 0.447 63.9 271 1989 296 74.3	483 0.469 66.2 259 1825 305 83.5	494 0.510 69.9 257 1757 326 92.7	496 0.517 70.5 255 1737 329 94.6	499 0.527 71.3 255 1726 334 96.6	503 0.540 72.3 257 1733 341 98.4	508 0.554 73.4 258 1736 348 100.3	510 0.561 74.0 257 1718 351 102.3
95	487 0.452 64.8 274 2046 299 73.1	491 0.478 67.4 265 1903 311 81.7	502 0.519 71.0 262 1830 331 90.6	506 0.531 71.9 262 1829 338 92.3	511 0.545 73.0 265 1838 345 94.0	515 0.557 73.9 265 1834 351 95.8	516 0.563 74.4 263 1810 354 97.8	518 0.569 75.0 261 1788 357 99.7
100	493 0.458 65.7 277 2108 303 71.9	499 0.490 68.7 271 1994 319 79.9	513 0.535 72.5 270 1932 341 88.3	518 0.549 73.6 272 1942 349 90.0	520 0.558 74.4 271 1929 354 91.7	522 0.564 74.9 269 1904 356 93.6	524 0.571 75.4 267 1882 359 95.4	526 0.578 76.1 265 1863 362 97.2
105	499 0.465 66.6 282 2180 308 70.5	508 0.503 70.2 279 2089 327 78.3	524 0.552 74.1 279 2044 352 86.2	526 0.560 74.8 277 2027 356 87.9	528 0.566 75.3 275 2000 359 89.7	530 0.572 75.8 273 1977 361 91.4	532 0.579 76.4 270 1954 364 93.1	535 0.586 77.1 268 1936 367 94.8
110	505 0.472 67.5 286 2250 312 69.3	516 0.512 71.2 284 2171 333 76.7	532 0.562 75.1 284 2125 358 84.4	533 0.567 75.6 281 2097 361 86.0	535 0.574 76.2 279 2074 364 87.7	538 0.580 76.8 277 2051 366 89.3	540 0.587 77.5 275 2032 369 90.9	543 0.594 78.2 273 2014 372 92.5
115	512 0.480 68.5 291 2329 317 68.1	523 0.520 72.1 288 2248 338 75.2	538 0.568 76.0 287 2193 363 82.6	540 0.575 76.6 285 2172 366 84.2	543 0.581 77.2 282 2147 368 85.7	546 0.588 77.8 281 2129 371 87.2	549 0.595 78.5 279 2109 374 88.7	553 0.607 79.3 278 2105 380 90.2
120	518 0.489 69.6 296 2418 324 66.9	531 0.531 73.2 294 2341 345 73.8	545 0.575 76.9 291 2268 367 80.9	548 0.582 77.5 288 2246 370 82.4	551 0.589 78.1 286 2226 373 83.8	554 0.596 78.8 284 2206 376 85.3	558 0.607 79.6 284 2203 382 86.7	564 0.622 80.5 286 2211 390 88.1
125	525 0.499 70.8 303 2511 330 65.7	541 0.546 74.6 303 2454 355 72.3	552 0.582 77.7 294 2343 371 79.3	555 0.589 78.4 292 2324 375 80.6	558 0.596 79.1 290 2304 378 82.0	563 0.608 79.9 291 2303 384 83.4	568 0.623 80.8 292 2311 392 84.7	574 0.637 81.7 293 2316 399 86.1
130	534 0.510 71.9 309 2609 337 64.6	549 0.557 75.7 309 2550 362 70.9	559 0.589 78.6 298 2421 376 77.6	563 0.596 79.3 296 2401 379 79.0	567 0.608 80.1 296 2399 385 80.3	573 0.622 81.0 298 2409 393 81.6	578 0.637 81.9 299 2416 401 82.9	584 0.650 82.8 299 2417 407 84.3
135	539 0.516 72.7 313 2686 342 63.6	555 0.564 76.5 313 2629 367 69.7	567 0.596 79.5 301 2498 380 76.1	571 0.607 80.3 301 2496 386 77.3	577 0.621 81.2 303 2504 394 78.6	582 0.636 82.1 304 2514 402 79.9	588 0.649 83.0 305 2517 408 81.2	594 0.667 84.0 307 2532 418 82.5
140	545 0.523 73.5 317 2764 346 62.6	560 0.569 77.2 316 2698 370 68.5	575 0.605 80.4 307 2590 387 74.6	580 0.620 81.3 308 2601 394 75.8	586 0.634 82.2 310 2610 402 77.0	592 0.648 83.1 311 2616 409 78.2	598 0.665 84.1 313 2632 419 79.5	604 0.682 85.0 315 2643 427 80.8
145	552 0.532 74.4 323 2857 352 61.6	566 0.574 77.9 319 2770 373 67.4	584 0.619 81.5 313 2699 395 73.2	589 0.633 82.3 315 2709 403 74.3	595 0.646 83.2 316 2713 410 75.5	601 0.663 84.2 318 2728 419 76.7	607 0.680 85.1 320 2742 428 78.0	613 0.695 85.9 321 2747 435 79.2
150	560 0.543 75.5 330 2967 359 60.5	572 0.580 78.7 322 2848 377 66.2	593 0.631 82.4 320 2807 403 71.8	598 0.645 83.3 321 2813 410 72.9	604 0.661 84.3 323 2825 419 74.1	610 0.677 85.2 325 2841 428 75.3	616 0.692 86.0 326 2846 435 76.5	621 0.705 86.7 326 2841 442 77.8
155	567 0.553 76.5 336 3070 366 59.6	578 0.586 79.4 326 2926 381 65.1	601 0.642 83.4 326 2909 410 70.5	607 0.658 84.3 328 2923 418 71.6	613 0.674 85.3 330 2937 427 72.7	619 0.690 86.1 331 2945 435 73.9	624 0.703 86.8 332 2944 442 75.1	628 0.714 87.5 330 2927 447 76.4
160	574 0.561 77.4 341 3163 371 58.7	584 0.592 80.2 329 3007 385 64.0	609 0.654 84.3 332 3017 418 69.2	616 0.671 85.3 335 3034 427 70.3	622 0.686 86.1 336 3044 435 71.4	627 0.701 86.9 337 3048 442 72.6	631 0.712 87.6 336 3033 448 73.8	635 0.721 88.2 334 3007 452 75.1
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

A304 FB2.1210.012-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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A310
FLIGHT CREW OPERATING MANUAL

CRUISE

CRUISE TABLES 2 ENGINES

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ISA + 10	CRUISE 2 ENGINES	LONG RANGE

HEIGHT (1000KG)	FL220	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
85	504 0.565 73.9 248 1599 351 109.8	512 0.587 75.9 243 1552 361 116.3	521 0.611 77.5 243 1545 372 120.5	532 0.641 79.3 244 1551 387 124.8	544 0.675 81.3 247 1564 405 129.4	554 0.702 82.8 247 1552 417 134.4	562 0.723 84.1 243 1527 426 139.7	574 0.736 85.4 237 1496 432 144.3	599 0.763 87.5 235 1512 448 148.1	628 0.791 89.8 234 1537 464 150.9
90	513 0.574 75.0 253 1673 357 106.8	523 0.600 77.2 248 1634 368 112.7	534 0.631 79.1 251 1646 384 116.7	545 0.663 81.0 253 1659 401 120.9	557 0.693 82.6 255 1658 416 125.4	566 0.717 84.0 252 1636 426 130.3	571 0.728 85.0 245 1588 429 135.2	586 0.749 86.5 241 1579 439 139.1	616 0.784 88.9 242 1618 460 142.2	642 0.797 90.9 236 1621 468 144.3
95	523 0.584 76.2 257 1750 363 103.9	536 0.619 78.7 257 1737 380 109.4	547 0.649 80.5 259 1746 395 113.3	559 0.683 82.4 261 1759 413 117.3	568 0.708 83.8 260 1741 424 121.8	576 0.727 85.1 256 1709 432 126.5	582 0.739 86.0 249 1667 436 130.6	601 0.771 87.8 249 1686 452 134.1	629 0.795 90.0 246 1709 466 136.4	656 0.803 92.1 237 1702 471 137.9
100	532 0.595 77.5 262 1831 370 101.0	548 0.636 80.1 264 1838 391 106.4	560 0.669 82.0 267 1851 407 110.1	570 0.698 83.6 268 1848 422 114.1	579 0.721 84.9 265 1824 432 118.5	584 0.731 85.8 258 1769 435 122.8	593 0.752 87.0 254 1753 443 126.4	615 0.786 88.9 255 1783 461 129.3	641 0.799 91.0 248 1788 469 131.2	669 0.804 93.3 238 1794 471 131.4
105	543 0.610 78.7 269 1927 379 98.4	560 0.655 81.5 272 1944 402 103.5	571 0.686 83.2 275 1952 416 107.2	580 0.710 84.6 273 1931 429 111.2	588 0.728 85.9 268 1892 436 115.3	594 0.741 86.8 262 1851 441 119.0	607 0.773 88.2 262 1865 456 122.2	627 0.795 89.9 258 1873 467 124.6	654 0.803 92.1 249 1872 471 125.8	682 0.802 94.7 237 1890 471 124.5
110	555 0.627 80.0 277 2032 390 95.8	572 0.673 82.8 281 2052 414 100.8	582 0.700 84.3 281 2043 427 104.5	590 0.722 85.6 278 2012 436 108.4	595 0.732 86.5 270 1953 439 112.3	604 0.753 87.7 266 1938 448 115.5	620 0.787 89.2 267 1962 464 118.2	638 0.799 90.8 259 1951 469 120.2	665 0.804 93.2 249 1959 472 120.4	699 0.801 96.6 237 2010 470 116.9
115	566 0.642 81.3 284 2136 399 93.5	582 0.687 83.9 287 2146 422 98.4	591 0.711 85.3 285 2125 434 102.1	599 0.728 86.5 280 2082 440 105.8	604 0.740 87.3 273 2033 444 109.1	617 0.773 88.8 274 2050 459 112.0	631 0.796 90.2 270 2052 469 114.3	649 0.803 91.8 261 2036 471 115.7	678 0.803 94.4 249 2054 471 114.6	717 0.799 98.7 236 2148 469 109.1
120	577 0.658 82.5 291 2242 409 91.3	591 0.699 84.8 292 2230 429 96.2	600 0.722 86.2 290 2206 440 99.7	606 0.732 87.1 282 2144 443 103.2	614 0.751 88.2 277 2120 450 106.2	629 0.785 89.7 279 2148 467 108.7	641 0.799 91.0 271 2127 471 110.7	660 0.804 92.8 261 2121 472 111.2	692 0.801 96.0 248 2165 470 108.4	
125	587 0.674 83.7 299 2346 419 89.2	600 0.710 85.7 297 2318 436 94.1	608 0.728 87.0 293 2278 444 97.5	614 0.739 87.9 285 2222 447 100.6	626 0.769 89.2 285 2231 461 103.3	641 0.796 90.7 283 2246 473 105.3	651 0.803 91.9 273 2212 473 106.9	671 0.803 93.9 261 2212 471 106.5	709 0.801 97.9 248 2302 470 101.8	
130	596 0.688 84.7 305 2442 427 87.3	609 0.721 86.6 302 2404 443 92.1	615 0.732 87.6 294 2340 446 95.3	622 0.749 88.6 289 2307 453 98.1	637 0.783 90.1 290 2336 469 100.4	649 0.798 91.4 284 2317 474 102.3	662 0.804 92.8 273 2297 474 103.2	684 0.801 95.2 260 2318 470 101.4	723 0.793 99.9 245 2433 465 95.6	
135	604 0.696 85.4 309 2527 433 85.6	617 0.727 87.4 305 2477 447 90.2	622 0.737 88.3 296 2412 449 93.1	633 0.763 89.5 295 2409 461 95.7	648 0.792 91.0 294 2431 475 97.7	658 0.801 92.2 285 2398 476 99.3	671 0.804 93.7 273 2383 474 99.4	699 0.801 96.9 260 2450 470 95.9		
140	612 0.706 86.3 314 2615 439 84.0	623 0.732 88.1 307 2544 450 88.4	630 0.745 89.0 300 2495 454 91.0	644 0.778 90.4 301 2523 470 93.2	656 0.797 91.7 296 2514 478 95.0	668 0.803 93.0 286 2484 477 96.1	682 0.803 94.7 273 2481 473 95.3	713 0.798 98.6 259 2584 468 90.5		
145	620 0.716 87.1 319 2703 445 82.4	629 0.734 88.6 308 2606 451 86.6	638 0.754 89.7 304 2584 460 89.0	653 0.787 91.2 305 2618 476 90.9	665 0.800 92.4 297 2591 479 92.5	677 0.804 93.8 286 2570 478 93.0	694 0.801 96.0 272 2593 472 91.0	725 0.791 100.6 256 2712 464 85.5		
150	628 0.724 87.8 322 2784 450 80.8	636 0.741 89.2 311 2687 455 84.7	649 0.771 90.6 311 2703 470 86.9	663 0.796 92.0 309 2719 481 88.5	673 0.802 93.2 298 2676 481 89.9	686 0.803 94.7 286 2660 478 89.8	708 0.801 97.7 272 2735 472 86.3			
155	634 0.729 88.5 325 2855 453 79.4	644 0.749 89.9 315 2774 460 83.0	658 0.782 91.4 316 2808 477 84.9	670 0.798 92.6 310 2789 482 86.5	682 0.804 93.9 299 2761 482 87.3	697 0.802 95.7 285 2763 477 86.3	721 0.796 99.2 271 2866 469 81.9			
	EGT .DG.C N1 % KG/H/ENG NM/1000K	MACH IAS TAS								

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Mod. : 4801 + 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE	2.12.10
		PAGE 16
	CRUISE TABLES 2 ENGINES	REV 15 SEQ 080

ISA + 20	CRUISE 2 ENGINES	LONG RANGE

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	506 0.447 65.1 271 2033 301 73.9	509 0.468 67.4 259 1866 310 83.0	520 0.510 71.3 257 1799 332 92.2	522 0.516 71.9 255 1776 334 94.1	526 0.526 72.7 255 1768 340 96.0	531 0.539 73.7 257 1774 347 97.8	536 0.553 74.8 258 1778 354 99.7	538 0.560 75.4 256 1758 358 101.7
95	511 0.452 65.9 274 2090 304 72.7	516 0.477 68.6 264 1944 316 81.3	529 0.519 72.4 262 1875 338 90.0	533 0.531 73.3 262 1874 344 91.7	538 0.545 74.4 264 1882 352 93.4	542 0.556 75.4 265 1878 358 95.3	544 0.563 75.9 263 1855 361 97.2	546 0.568 76.5 260 1831 363 99.1
100	518 0.458 66.9 277 2155 308 71.4	525 0.490 70.0 271 2040 324 79.5	540 0.535 73.9 270 1979 348 87.8	545 0.549 75.0 272 1988 356 89.4	548 0.558 75.8 271 1976 360 91.2	550 0.564 76.4 269 1952 363 93.0	552 0.571 76.9 267 1928 366 94.8	555 0.577 77.6 264 1908 369 96.6
105	524 0.464 67.9 281 2227 313 70.2	534 0.503 71.5 279 2139 333 77.8	551 0.551 75.5 278 2090 358 85.7	554 0.559 76.2 277 2073 362 87.4	556 0.566 76.8 275 2048 365 89.1	558 0.572 77.3 273 2025 368 90.8	561 0.579 78.0 271 2004 371 92.5	564 0.586 78.7 268 1986 374 94.2
110	530 0.471 68.7 285 2299 317 68.9	542 0.512 72.5 284 2221 339 76.3	559 0.561 76.6 283 2174 365 83.9	561 0.566 77.1 281 2145 367 85.5	563 0.573 77.7 279 2123 370 87.1	566 0.580 78.3 276 2101 373 88.7	569 0.587 79.0 275 2083 376 90.3	573 0.594 79.8 272 2064 379 91.9
115	537 0.479 69.8 290 2379 322 67.7	549 0.520 73.5 288 2298 344 74.8	566 0.567 77.4 287 2246 369 82.1	569 0.574 78.1 285 2223 372 83.7	571 0.580 78.6 282 2197 374 85.2	574 0.587 79.4 280 2179 378 86.7	578 0.595 80.1 278 2161 381 88.2	583 0.606 80.9 276 2158 387 89.7
120	544 0.489 70.9 297 2475 329 66.5	558 0.531 74.6 294 2394 351 73.3	573 0.575 78.3 290 2323 374 80.4	576 0.581 79.0 288 2299 376 81.9	579 0.588 79.7 286 2278 380 83.3	583 0.595 80.4 284 2259 383 84.7	588 0.607 81.2 284 2256 389 86.2	594 0.622 82.1 286 2266 397 87.6
125	552 0.499 72.1 303 2569 336 65.4	568 0.545 76.0 302 2508 361 71.9	581 0.582 79.3 294 2401 378 78.8	584 0.588 79.9 292 2378 381 80.1	587 0.595 80.6 290 2358 384 81.5	592 0.607 81.4 290 2355 390 82.9	598 0.622 82.3 291 2364 398 84.2	604 0.636 83.3 293 2372 406 85.6
130	560 0.509 73.2 309 2665 343 64.3	576 0.557 77.2 309 2612 368 70.5	588 0.589 80.2 298 2481 383 77.2	592 0.596 80.9 296 2458 386 78.5	596 0.607 81.7 296 2455 392 79.8	602 0.621 82.6 297 2463 399 81.1	608 0.635 83.5 298 2470 407 82.4	614 0.649 84.4 299 2474 414 83.8
135	566 0.516 74.0 313 2744 347 63.2	583 0.564 78.0 313 2692 373 69.3	596 0.596 81.1 301 2560 387 75.6	600 0.606 81.8 301 2554 393 76.9	607 0.621 82.8 303 2567 401 78.1	612 0.635 83.7 304 2572 408 79.4	618 0.648 84.6 305 2575 416 80.7	625 0.666 85.6 307 2593 425 82.0
140	572 0.522 74.8 317 2823 351 62.2	588 0.569 78.7 316 2762 376 69.1	604 0.605 82.0 307 2654 394 74.2	610 0.619 82.9 308 2663 401 75.4	616 0.634 83.8 309 2674 409 76.6	622 0.648 84.7 310 2678 417 77.8	629 0.664 85.8 313 2694 426 79.0	635 0.681 86.7 315 2707 435 80.3
145	579 0.531 75.8 322 2920 358 61.2	594 0.574 79.4 319 2836 380 67.0	613 0.618 83.0 313 2760 402 72.7	619 0.632 83.9 315 2773 410 73.9	625 0.646 84.8 315 2778 417 75.1	632 0.663 85.9 318 2794 426 76.3	639 0.679 86.8 320 2810 435 77.5	645 0.694 87.6 321 2813 443 78.8
150	587 0.543 76.9 330 3036 365 60.2	600 0.580 80.2 322 2914 384 65.8	622 0.630 84.0 319 2870 410 71.4	628 0.644 84.9 321 2879 417 72.5	635 0.660 85.9 323 2893 426 73.6	642 0.677 86.9 325 2910 435 74.8	648 0.692 87.7 326 2915 443 76.0	653 0.705 88.5 326 2910 450 77.3
155	595 0.553 77.9 336 3141 372 59.2	607 0.586 80.9 325 2994 388 64.7	631 0.642 85.0 326 2978 417 70.1	637 0.657 85.9 327 2990 426 71.2	644 0.674 86.9 330 3008 435 72.3	650 0.689 87.8 331 3017 443 73.5	656 0.702 88.5 331 3015 450 74.7	661 0.713 89.2 330 2999 456 75.9
160	601 0.561 78.8 341 3235 378 58.4	613 0.592 81.7 329 3076 392 63.6	640 0.654 86.0 332 3091 425 68.8	647 0.670 87.0 334 3106 434 69.9	653 0.686 87.8 336 3117 443 71.0	659 0.700 88.6 337 3120 450 72.2	663 0.711 89.3 336 3106 456 73.4	668 0.721 89.9 334 3082 460 74.7
	EGT DG.C N1 % KG/H/ENG N1/1000KG	MACH IAS TAS						

R304 FB2.1210.016-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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A310
FLIGHT CREW OPERATING MANUAL

CRUISE

CRUISE TABLES 2 ENGINES

ISA + 15 | CRUISE 2 ENGINES | LONG RANGE

WEIGHT (1000KG)	FL 50	FL100	FL150	FL160	FL170	FL180	FL190	FL200
90	494 0.447 64.5 271 2011 298 74.1	496 0.469 66.8 259 1847 307 83.2	507 0.510 70.6 257 1777 329 92.4	509 0.517 71.2 255 1757 332 94.4	512 0.526 72.0 255 1747 336 96.3	517 0.540 73.0 257 1755 344 98.1	522 0.554 74.1 258 1758 352 100.0	524 0.560 74.7 256 1738 355 102.0
95	499 0.452 65.4 274 2068 302 72.9	504 0.478 68.0 264 1924 313 81.5	515 0.519 71.7 262 1853 335 90.3	519 0.531 72.6 262 1852 341 92.0	524 0.545 73.7 264 1859 348 93.7	528 0.556 74.6 265 1856 355 95.5	530 0.563 75.2 263 1833 357 97.5	532 0.569 75.7 260 1809 360 99.4
100	505 0.458 66.3 277 2133 306 71.6	512 0.490 69.4 271 2018 322 79.7	526 0.535 73.2 270 1956 344 88.1	531 0.549 74.3 272 1964 352 89.7	534 0.558 75.1 271 1952 357 91.5	536 0.564 75.6 269 1928 360 93.3	538 0.571 76.2 267 1905 362 95.1	541 0.578 76.8 265 1887 366 96.9
105	512 0.465 67.2 282 2204 310 70.3	521 0.503 70.8 279 2114 330 78.0	537 0.552 74.8 278 2067 355 86.0	540 0.560 75.5 277 2050 359 87.7	542 0.566 76.0 275 2023 362 89.4	544 0.572 76.6 273 2001 365 91.1	546 0.579 77.2 271 1980 367 92.8	549 0.586 77.9 268 1961 371 94.5
110	518 0.471 68.1 286 2275 315 69.1	529 0.512 71.9 284 2195 336 76.5	545 0.561 75.9 283 2149 362 84.1	547 0.567 76.4 281 2121 364 85.8	549 0.573 77.0 279 2099 367 87.4	552 0.580 77.6 276 2075 369 89.0	555 0.587 78.3 275 2057 373 90.6	558 0.594 79.0 273 2039 376 92.2
115	524 0.479 69.1 291 2355 320 67.9	536 0.520 72.8 288 2271 341 75.0	552 0.568 76.7 287 2220 366 82.4	555 0.574 77.3 285 2198 369 83.9	557 0.581 77.9 282 2174 371 85.4	560 0.587 78.6 280 2152 374 87.0	563 0.595 79.3 278 2135 378 88.5	568 0.607 80.1 278 2132 384 90.0
120	531 0.489 70.3 297 2447 326 66.7	544 0.531 73.9 294 2368 348 73.5	559 0.575 77.6 291 2296 371 80.7	562 0.582 78.2 288 2274 373 82.1	565 0.588 78.9 286 2252 376 83.6	568 0.595 79.6 284 2232 379 85.0	573 0.607 80.4 284 2229 385 86.4	579 0.622 81.3 286 2238 393 87.9
125	539 0.499 71.4 303 2540 333 65.6	554 0.545 75.3 302 2481 358 72.1	567 0.582 78.5 294 2372 375 79.0	570 0.589 79.2 292 2353 378 80.4	573 0.596 79.9 290 2331 381 81.8	577 0.607 80.6 290 2327 387 83.1	583 0.622 81.6 292 2337 395 84.5	589 0.636 82.5 293 2343 402 85.9
130	547 0.509 72.6 309 2636 340 64.4	562 0.557 76.4 309 2580 365 70.7	574 0.589 79.4 298 2451 379 77.4	577 0.596 80.1 296 2430 383 78.7	582 0.607 80.9 295 2428 389 80.0	588 0.622 81.8 297 2436 390 81.3	593 0.636 82.7 299 2443 404 82.7	599 0.649 83.6 299 2445 411 84.0
135	553 0.516 73.4 313 2714 344 63.4	569 0.564 77.3 313 2661 370 69.5	581 0.596 80.3 301 2529 384 75.9	586 0.607 81.1 301 2527 390 77.1	592 0.621 82.0 303 2536 397 78.4	597 0.636 82.9 304 2544 405 79.6	603 0.649 83.8 305 2547 412 80.9	610 0.667 84.8 307 2564 422 82.2
140	559 0.523 74.1 317 2794 349 62.4	574 0.569 78.0 316 2730 373 68.3	589 0.605 81.2 307 2623 390 74.4	595 0.620 82.1 308 2634 398 75.6	601 0.634 83.0 309 2641 406 76.8	607 0.648 83.9 310 2646 413 78.0	613 0.665 84.9 313 2662 422 79.3	620 0.682 85.8 315 2677 431 80.6
145	566 0.531 75.1 322 2887 355 61.4	580 0.574 78.7 319 2803 377 67.2	599 0.618 82.2 313 2730 398 72.9	604 0.632 83.1 315 2740 406 74.1	610 0.646 84.1 316 2747 414 75.3	617 0.663 85.1 318 2763 423 76.5	623 0.679 86.0 320 2775 431 77.7	629 0.694 86.8 321 2780 439 79.0
150	574 0.543 76.2 330 3002 362 60.4	586 0.580 79.4 322 2880 380 66.0	608 0.631 83.2 320 2839 406 71.6	613 0.644 84.1 321 2844 414 72.7	620 0.661 85.1 323 2861 423 73.9	626 0.677 86.1 325 2875 432 75.0	632 0.692 86.9 326 2880 439 76.3	637 0.705 87.6 326 2875 446 77.5
155	581 0.553 77.2 336 3106 369 59.4	592 0.586 80.2 325 2959 384 64.9	616 0.642 84.2 326 2945 414 70.3	622 0.658 85.2 328 2959 422 71.4	629 0.674 86.1 330 2974 431 72.5	635 0.689 86.9 331 2981 439 73.7	640 0.703 87.7 332 2980 446 74.9	644 0.713 88.3 330 2962 451 76.2
160	587 0.561 78.1 341 3198 374 58.5	599 0.592 80.9 329 3041 388 63.8	625 0.654 85.2 332 3055 422 69.0	631 0.671 86.2 335 3072 431 70.1	637 0.686 87.0 336 3082 439 71.2	643 0.700 87.8 337 3084 446 72.4	647 0.711 88.4 336 3069 452 73.6	651 0.721 89.0 334 3045 456 74.9
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

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Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	CRUISE	2.12.10
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ISA + 15	CRUISE 2 ENGINES	LONG RANGE

WEIGHT (1000KG)	FL220	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
85	518 0.564 74.6 248 1619 354 109.4	527 0.588 76.7 243 1573 365 115.9	536 0.610 78.3 242 1564 376 120.1	547 0.640 80.2 244 1570 391 124.4	560 0.674 82.1 247 1584 409 128.9	570 0.701 83.7 246 1574 422 133.9	579 0.724 85.1 243 1549 431 139.2	591 0.736 86.4 237 1518 436 143.8	617 0.768 88.5 235 1533 452 147.5	646 0.790 90.8 233 1558 469 150.4
90	527 0.574 75.8 252 1693 360 106.4	538 0.600 78.0 248 1656 372 112.4	550 0.631 79.9 251 1668 388 116.4	562 0.662 81.9 253 1679 405 120.5	573 0.693 83.5 254 1679 420 125.0	582 0.717 84.9 253 1658 431 129.8	588 0.728 85.9 245 1610 434 134.8	604 0.749 87.5 242 1603 444 138.6	634 0.784 89.9 242 1641 465 141.7	660 0.797 91.9 236 1644 472 143.8
95	537 0.584 77.0 257 1771 367 103.5	551 0.619 79.5 257 1761 384 109.1	563 0.649 81.4 259 1769 399 112.9	575 0.683 83.3 262 1784 417 116.9	585 0.708 84.7 260 1766 429 121.4	593 0.726 86.0 256 1732 436 126.0	599 0.739 86.9 249 1690 440 130.2	619 0.771 88.8 249 1711 457 133.6	648 0.794 91.0 246 1733 471 136.0	675 0.802 93.2 237 1732 476 137.4
100	547 0.595 78.2 262 1854 373 100.7	563 0.636 80.9 264 1852 395 105.0	576 0.669 82.9 267 1876 412 109.7	587 0.698 84.5 268 1873 426 113.7	596 0.721 85.9 265 1849 437 118.1	601 0.731 86.8 256 1794 439 122.4	610 0.751 88.0 254 1777 448 126.0	633 0.786 89.9 255 1810 466 128.8	660 0.799 92.0 246 1813 474 130.7	688 0.804 94.4 238 1820 477 130.9
105	558 0.609 79.5 269 1950 383 98.1	575 0.654 82.3 272 1966 406 103.2	587 0.686 84.1 274 1977 422 106.8	597 0.710 85.5 273 1956 434 110.8	605 0.728 86.8 268 1919 441 114.9	611 0.741 87.7 261 1877 445 118.6	625 0.773 89.2 262 1890 461 121.8	646 0.795 91.0 258 1900 472 124.1	673 0.803 93.1 249 1900 476 125.3	702 0.802 95.8 237 1918 476 124.1
110	570 0.626 80.8 277 2058 393 95.5	588 0.673 83.7 280 2077 417 100.5	598 0.700 85.2 280 2068 431 104.2	607 0.721 86.5 277 2038 441 108.1	612 0.732 87.5 270 1982 443 111.9	622 0.753 88.7 266 1964 452 115.1	638 0.787 90.2 267 1989 469 117.8	656 0.799 91.9 259 1979 474 119.7	685 0.804 94.2 249 1987 477 119.9	719 0.801 97.7 237 2039 475 116.5
115	581 0.642 82.1 284 2162 403 93.2	598 0.688 84.8 287 2174 427 98.1	608 0.711 86.2 285 2153 438 101.7	615 0.728 87.4 280 2109 445 105.4	622 0.740 88.3 273 2062 449 108.8	635 0.773 89.8 274 2079 464 111.7	650 0.795 91.2 270 2081 474 113.9	668 0.803 92.9 261 2065 476 115.3	697 0.803 95.4 249 2084 476 114.2	
120	592 0.655 83.4 291 2270 413 91.0	607 0.699 85.7 292 2260 433 95.9	617 0.722 87.1 290 2235 444 99.4	622 0.731 88.0 282 2171 447 102.9	631 0.750 89.2 277 2146 455 105.9	647 0.785 90.7 279 2178 472 100.3	659 0.799 92.0 271 2158 476 110.3	679 0.804 93.9 261 2152 477 110.8	712 0.801 97.1 248 2197 475 108.1	
125	602 0.673 84.5 298 2375 423 89.0	617 0.710 86.6 297 2349 441 93.8	625 0.728 87.9 293 2308 448 97.1	631 0.739 88.8 285 2252 451 100.2	643 0.768 90.2 284 2259 465 103.0	659 0.796 91.7 283 2277 478 105.0	670 0.803 92.9 273 2244 478 106.5	690 0.803 94.9 261 2244 476 106.1	729 0.801 99.1 248 2340 475 101.4	
130	612 0.687 85.5 305 2476 431 87.1	626 0.721 87.5 302 2436 447 91.8	632 0.732 88.6 294 2371 451 95.0	640 0.748 89.6 289 2338 457 97.8	655 0.782 91.1 290 2367 474 100.1	667 0.797 92.4 284 2350 479 102.0	681 0.804 93.8 273 2330 479 102.8	703 0.801 96.3 260 2351 475 101.0		
135	620 0.696 86.3 309 2559 437 85.4	633 0.727 88.3 305 2509 451 89.9	639 0.737 89.2 296 2445 454 92.8	650 0.762 90.5 295 2441 466 95.4	666 0.792 92.0 294 2463 480 97.3	677 0.801 93.2 285 2432 481 98.9	690 0.804 94.7 273 2417 479 99.1	719 0.801 98.0 260 2485 475 95.6		
140	628 0.705 87.2 314 2649 444 83.7	640 0.731 89.0 306 2575 454 88.1	647 0.745 89.9 300 2529 459 90.7	661 0.776 91.4 301 2557 475 92.9	675 0.797 92.7 296 2549 483 94.7	687 0.803 94.0 286 2519 483 95.8	701 0.803 95.8 273 2517 478 95.0	733 0.798 99.7 259 2621 473 90.3		
145	637 0.716 88.0 319 2739 450 82.1	646 0.734 89.5 308 2639 456 86.3	655 0.755 90.7 304 2619 465 88.7	671 0.787 92.2 305 2654 481 90.6	683 0.799 93.4 297 2627 484 92.2	696 0.804 94.9 286 2606 483 92.7	713 0.801 97.1 272 2630 477 90.7			
150	644 0.724 88.7 322 2820 454 80.6	653 0.741 90.2 311 2722 460 84.5	656 0.770 91.5 311 2738 474 86.6	681 0.796 93.0 309 2755 486 88.3	692 0.802 94.2 298 2713 486 89.6	705 0.803 95.7 286 2692 483 89.5	728 0.801 98.8 272 2774 477 86.1			
155	651 0.729 89.4 325 2893 458 79.1	661 0.749 90.8 314 2809 465 82.7	676 0.782 92.3 316 2845 481 84.6	689 0.798 93.6 310 2827 487 86.2	701 0.804 95.0 299 2799 487 87.0	716 0.802 96.8 285 2801 482 86.0	741 0.796 100.4 271 2906 475 81.7			
	ECT DG.C N1 % KG/H/ENG NM/1000K	MACH IAS TAS								

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Mod. : 4801 + 4863

GE Eng. : 80C2A2

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ISA + 20	CRUISE 2 ENGINES	LONG RANGE

WEIGHT (1000KG)	FL220	FL250	FL270	FL290	FL310	FL330	FL350	FL370	FL390	FL410
85	533 0.564 75.4 249 1640 358 109.1	541 0.587 77.4 243 1592 368 115.5	550 0.609 79.1 242 1582 379 119.7	562 0.639 81.0 244 1590 394 124.0	576 0.673 83.0 247 1603 412 128.5	586 0.701 84.6 246 1595 426 133.5	596 0.724 86.0 244 1571 436 138.7	608 0.735 87.3 237 1539 441 143.2	635 0.762 89.5 235 1554 457 147.0	665 0.790 91.8 233 1580 474 149.9
90	542 0.574 76.6 252 1715 364 106.1	553 0.600 78.8 248 1679 376 112.0	565 0.630 80.7 251 1689 392 116.0	577 0.661 82.7 253 1699 408 120.1	589 0.692 84.4 254 1700 424 124.6	599 0.716 85.9 252 1679 435 129.4	605 0.728 86.9 245 1633 439 134.3	621 0.749 88.5 241 1625 449 138.1	652 0.784 90.9 242 1663 470 141.2	679 0.797 93.0 236 1667 478 143.3
95	551 0.584 77.8 257 1792 370 103.2	566 0.619 80.3 257 1784 388 108.7	578 0.649 82.2 259 1792 403 112.5	591 0.682 84.1 261 1806 421 116.6	601 0.707 85.6 260 1789 433 121.0	609 0.726 86.9 256 1754 441 125.6	616 0.739 87.9 249 1714 445 129.7	637 0.771 89.8 249 1736 462 133.2	666 0.794 92.0 246 1752 476 135.5	694 0.802 94.2 237 1756 481 136.9
100	562 0.594 79.0 262 1875 377 100.4	579 0.636 81.8 264 1882 399 105.7	592 0.669 83.8 267 1903 416 109.3	603 0.698 85.3 268 1898 430 113.4	612 0.720 86.8 265 1873 441 117.7	618 0.730 87.7 257 1818 443 121.9	628 0.751 88.9 254 1800 452 125.6	651 0.786 90.9 255 1836 471 128.4	679 0.799 93.1 248 1839 479 130.2	707 0.804 95.4 236 1846 482 130.5
105	573 0.609 80.3 266 1972 386 97.8	591 0.654 83.2 272 1992 410 102.8	603 0.685 84.9 274 2001 426 106.5	613 0.710 86.4 273 1983 438 110.5	622 0.728 87.7 268 1944 445 114.6	628 0.740 88.6 261 1902 450 118.2	643 0.772 90.1 262 1915 465 121.4	664 0.795 92.0 258 1927 477 123.7	692 0.803 94.2 249 1927 481 124.9	
110	585 0.626 81.6 276 2082 397 95.3	603 0.672 84.5 280 2101 421 100.2	614 0.699 86.1 280 2094 435 103.8	623 0.721 87.5 277 2066 445 107.7	629 0.732 88.4 270 2009 448 111.5	639 0.752 89.6 266 1990 457 114.8	656 0.786 91.2 267 2016 473 117.4	675 0.799 92.9 259 2007 479 119.3	704 0.804 95.3 249 2016 482 119.5	
115	596 0.642 82.9 284 2189 407 92.9	614 0.687 85.6 287 2202 431 97.8	624 0.711 87.0 285 2180 442 101.4	632 0.728 88.3 280 2137 449 105.1	639 0.741 89.3 273 2092 453 108.4	653 0.772 90.7 274 2106 469 111.3	668 0.795 92.2 270 2109 479 113.5	687 0.803 93.9 261 2094 481 114.9	717 0.803 96.5 249 2113 481 113.8	
120	607 0.658 84.2 291 2298 417 90.7	624 0.699 86.5 292 2289 438 95.6	633 0.721 88.0 290 2264 449 99.1	639 0.731 89.0 282 2199 451 102.6	649 0.751 90.1 277 2178 460 105.5	665 0.785 91.7 279 2209 477 107.9	678 0.798 93.0 271 2188 481 109.9	698 0.804 94.9 261 2182 482 110.4		
125	618 0.673 85.4 298 2407 427 88.7	633 0.710 87.5 297 2379 445 93.5	642 0.728 88.9 293 2338 453 96.8	648 0.739 89.7 285 2281 456 99.9	661 0.768 91.1 284 2291 470 102.6	677 0.796 92.7 283 2309 483 104.6	689 0.802 93.9 273 2276 483 106.2	710 0.803 96.0 261 2276 481 105.8		
130	628 0.686 86.3 305 2505 435 86.8	642 0.721 88.4 302 2467 452 91.5	648 0.731 89.5 294 2401 455 94.7	657 0.748 90.5 289 2368 462 97.5	673 0.782 92.1 290 2399 479 99.8	686 0.798 93.4 284 2383 484 101.6	700 0.804 94.9 273 2363 484 102.4	723 0.801 97.4 260 2384 480 100.7		
135	637 0.698 87.3 310 2602 443 85.0	650 0.727 89.2 304 2540 455 89.6	656 0.737 90.1 296 2477 458 92.5	667 0.762 91.4 294 2472 470 95.1	684 0.791 93.0 294 2496 484 97.0	695 0.801 94.2 285 2466 486 98.6	709 0.804 95.8 273 2451 484 98.7			
140	645 0.706 88.0 314 2681 448 83.5	657 0.731 89.9 306 2608 458 87.8	664 0.745 90.8 300 2562 463 90.4	679 0.778 92.4 301 2591 480 92.6	693 0.797 93.7 296 2583 488 94.4	706 0.803 95.1 286 2554 488 95.5	720 0.803 96.8 273 2552 483 94.7			
145	653 0.716 88.9 319 2773 454 81.9	663 0.734 90.4 309 2672 460 86.0	673 0.755 91.5 304 2654 469 88.4	689 0.787 93.2 305 2669 486 90.3	701 0.799 94.4 297 2662 489 91.9	715 0.804 95.9 286 2642 488 92.4	733 0.801 98.2 272 2667 482 90.4			
150	660 0.724 89.6 322 2855 459 80.3	670 0.741 91.1 311 2756 464 84.2	684 0.771 92.5 311 2775 479 86.3	700 0.796 94.0 309 2793 491 88.0	711 0.802 95.2 298 2749 491 89.3	725 0.803 96.8 286 2735 488 89.2				
155	667 0.729 90.3 325 2929 462 78.9	678 0.749 91.8 314 2845 469 82.4	694 0.782 93.3 316 2882 486 84.3	707 0.798 94.6 309 2864 492 85.9	720 0.804 96.0 299 2836 492 86.7	735 0.802 97.8 285 2840 487 85.7				
	EGT DG.C N1 % KG/H/ENG NM/1000K	MACH IAS TAS								

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Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	HOLDING	R 2.13.00
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Introduction 1

R Clean Configuration – 210 KTS 2

R R Clean Configuration – Green Dot 3

R R Slats 15 – Flaps up 170 KTS 4

R R Slats 15 – Flaps up S 5

Vers. : All Eng. : All

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	HOLDING HOLDING CHART 2 ENGINES	2.13.10	
		PAGE 1	
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INTRODUCTION

Holding charts are established for 2 different configurations :

- clean configuration at 210 kt and at « Green Dot » speed
- slats 15/Flaps 0 at 170 kt and at « S » speed

« Green Dot » in clean configuration and « S » in 15/0 are speeds situated between minimum fuel speed and minimum drag speed.

These charts are established with air conditioning in economic mode. When using normal air conditioning, fuel
R consumption is increased by 0.8 %.

All charts are established with a center of gravity location corresponding to 27 %.

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		PAGE 2
	HOLDING CHART 2 ENGINES	REV 15 / SEQ 080

CLEAN CONFIGURATION
ISA

HOLDING 2 ENGINES **210 KT**

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	
90	53.1 1550 210	55.4 1510 210	59.4 1468 210	60.9 1449 210	62.5 1426 210	64.1 1410 210	65.8 1395 210	67.5 1384 210	N1 KG/H/ENG IAS
95	53.9 1596 210	56.3 1557 210	60.3 1514 210	61.8 1494 210	63.4 1474 210	65.0 1459 210	66.8 1444 210	68.4 1435 210	
100	54.7 1645 210	57.3 1608 210	61.2 1562 210	62.8 1542 210	64.4 1527 210	66.0 1512 210	67.7 1499 210	69.4 1490 210	
105	55.5 1697 210	58.3 1660 210	62.1 1613 210	63.7 1595 210	65.3 1582 210	67.1 1567 210	68.7 1557 210	70.5 1549 210	
110	56.5 1753 210	59.3 1718 210	63.1 1669 210	64.7 1657 210	66.4 1644 210	68.1 1631 210	69.9 1622 210	71.7 1615 210	
115	57.6 1817 210	60.4 1782 210	64.2 1735 210	65.9 1726 210	67.7 1714 210	69.3 1703 210	71.1 1694 210	72.9 1688 210	
120	58.7 1886 210	61.4 1851 210	65.3 1809 210	67.1 1801 210	68.8 1790 210	70.5 1780 210	72.3 1772 210	74.1 1767 210	
125	59.9 1959 210	62.5 1923 210	66.5 1885 210	68.3 1878 210	70.0 1869 210	71.8 1859 210	73.5 1852 210	75.5 1848 210	
130	61.0 2035 210	63.6 1998 210	67.7 1965 210	69.5 1960 210	71.2 1952 210	73.0 1943 210	74.8 1936 210	76.7 1934 210	
135	62.0 2113 210	64.8 2076 210	68.9 2049 210	70.6 2045 210	72.5 2037 210	74.2 2029 210	76.1 2023 210	77.9 2024 210	
140	63.1 2194 210	65.8 2160 210	70.1 2136 210	71.9 2133 210	73.7 2126 210	75.5 2119 210	77.3 2116 210	79.2 2117 210	
145	64.2 2277 210	66.9 2245 210	71.2 2223 210	73.1 2221 210	74.8 2215 210	76.7 2209 210	78.5 2210 210	80.4 2212 210	
150	65.3 2365 210	68.1 2337 210	72.5 2321 210	74.3 2320 210	76.1 2315 210	77.9 2311 210	79.8 2311 210	81.6 2309 210	
155	66.4 2458 210	69.3 2431 210	73.7 2418 210	75.4 2419 210	77.4 2414 210	79.1 2413 210	81.1 2414 210	82.7 2407 210	
160	67.5 2553 210	70.4 2529 210	74.8 2519 210	76.7 2520 210	78.5 2519 210	80.4 2519 210	82.1 2513 210	83.8 2507 210	

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R R R R R R R

Per degree above (below) ISA add (subtract) 5 kg/h/eng.

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A310
FLIGHT CREW OPERATING MANUAL

HOLDING

HOLDING CHART 2 ENGINES

2.13.10
PAGE 3
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CLEAN CONFIGURATION ISA	HOLDING 2 ENGINES	GREEN DOT SPEED

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	FL250	FL290	N1 KG/H/ENG IAS
85	50.7 1407 185	52.8 1370 185	56.5 1321 185	58.3 1306 185	59.7 1290 185	61.4 1274 185	63.0 1263 185	64.7 1254 185	69.7 1256 195	73.8 1272 203	
90	51.9 1478 190	54.1 1437 190	58.1 1391 190	59.6 1375 190	61.1 1358 190	62.8 1344 190	64.5 1336 190	66.3 1324 190	71.2 1329 200	75.1 1345 208	
95	53.0 1548 195	55.4 1505 195	59.4 1461 195	60.9 1444 195	62.6 1426 195	64.2 1417 195	65.9 1406 195	67.7 1395 195	72.6 1403 205	76.5 1420 213	
100	54.2 1615 200	56.7 1575 200	60.7 1531 200	62.2 1512 200	63.9 1499 200	65.6 1489 200	67.3 1476 200	69.0 1467 200	74.0 1476 210	77.9 1498 218	
105	55.3 1683 205	58.0 1646 205	61.9 1600 205	63.5 1582 205	65.2 1573 205	66.9 1559 205	68.6 1548 205	70.4 1540 205	75.3 1550 215	79.1 1574 223	
110	56.5 1753 210	59.3 1718 210	63.1 1669 210	64.7 1657 210	66.4 1644 210	68.1 1631 210	69.9 1622 210	71.7 1615 210	76.4 1625 220	80.3 1650 228	
115	57.7 1825 215	60.5 1790 215	64.3 1741 215	65.9 1731 215	67.7 1715 215	69.3 1704 215	71.1 1696 215	72.9 1690 215	77.6 1701 225	81.4 1727 233	
120	58.8 1898 220	61.5 1862 220	65.4 1817 220	67.1 1802 220	68.8 1788 220	70.5 1778 220	72.3 1771 220	74.1 1766 220	78.7 1780 230	82.5 1805 238	
125	60.0 1972 225	62.6 1933 225	66.5 1890 225	68.3 1873 225	69.9 1862 225	71.7 1853 225	73.4 1847 225	75.3 1843 225	79.9 1859 235	83.6 1886 243	
130	61.1 2046 230	63.6 2004 230	67.6 1963 230	69.3 1948 230	71.0 1937 230	72.8 1929 230	74.6 1924 230	76.4 1920 230	80.9 1938 240	84.6 1972 248	
135	62.0 2118 235	64.7 2075 235	68.8 2035 235	70.3 2023 235	72.1 2012 235	73.8 2006 235	75.7 2002 235	77.4 1997 235	81.9 2017 245	85.6 2066 253	
140	62.9 2191 240	65.7 2152 240	69.7 2110 240	71.4 2098 240	73.2 2090 240	74.9 2084 240	76.8 2079 240	78.4 2074 240	82.9 2096 250	86.5 2161 258	
145	63.9 2265 245	66.6 2229 245	70.7 2186 245	72.4 2175 245	74.2 2168 245	75.9 2163 245	77.7 2156 245	79.3 2152 245	83.8 2177 255	87.5 2259 263	
150	64.9 2339 250	67.6 2304 250	71.7 2262 250	73.5 2253 250	75.1 2247 250	77.0 2241 250	78.6 2235 250	80.3 2230 250	84.8 2260 260	88.5 2360 268	
155	65.8 2414 255	68.5 2379 255	72.6 2341 255	74.4 2332 255	76.1 2327 255	77.9 2319 255	79.5 2313 255	81.2 2312 255	85.7 2348 265	89.4 2460 273	

R310304 FB2.1310.003-AA.080

Per degree above (below) ISA add (subtract) 5 kg/h/eng.

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	HOLDING	2.13.10
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SLATS 15 – FLAPS UP
ISA

HOLDING 2 ENGINES **170 KT**

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	
90	54.9 1648 170	57.6 1613 170	61.5 1570 170	63.1 1553 170	64.7 1539 170	66.4 1528 170	68.2 1521 170	70.0 1516 170	N1 KG/H/ENG IAS
95	56.1 1720 170	59.0 1684 170	62.8 1643 170	64.3 1627 170	66.0 1614 170	67.8 1604 170	69.5 1598 170	71.4 1594 170	
100	57.4 1795 170	60.2 1760 170	64.0 1720 170	65.7 1705 170	67.4 1693 170	69.1 1685 170	71.0 1680 170	72.8 1677 170	
105	58.7 1874 170	61.4 1840 170	65.3 1802 170	67.0 1787 170	68.7 1777 170	70.5 1770 170	72.3 1766 170	74.2 1763 170	
110	60.1 1957 170	62.6 1925 170	66.7 1888 170	68.4 1876 170	70.1 1868 170	72.0 1862 170	73.8 1859 170	75.8 1860 170	
115	61.4 2054 170	64.1 2023 170	68.2 1987 170	69.9 1978 170	71.7 1971 170	73.5 1967 170	75.4 1965 170	77.3 1970 170	
120	62.7 2156 170	65.4 2125 170	69.6 2094 170	71.4 2086 170	73.2 2080 170	75.1 2076 170	77.0 2079 170	78.9 2085 170	
125	64.1 2259 170	66.8 2229 170	71.1 2203 170	72.9 2195 170	74.7 2190 170	76.6 2188 170	78.5 2195 170	80.5 2197 170	
130	65.4 2365 170	68.2 2336 170	72.5 2314 170	74.3 2308 170	76.2 2303 170	78.1 2308 170	80.1 2315 170	81.8 2305 170	
135	66.7 2474 170	69.6 2447 170	73.9 2430 170	75.7 2425 170	77.6 2425 170	79.6 2432 170	81.4 2431 170	83.1 2417 170	
140	68.0 2587 170	70.9 2565 170	75.3 2551 170	77.2 2545 170	79.1 2553 170	81.1 2561 170	82.7 2546 170	84.5 2533 170	
145	69.4 2703 170	72.3 2686 170	76.7 2674 170	78.6 2676 170	80.6 2684 170	82.3 2679 170	84.0 2663 170	85.8 2665 170	
150	70.7 2823 170	73.6 2808 170	78.1 2801 170	80.0 2810 170	82.0 2815 170	83.5 2798 170	85.3 2783 170	87.0 2804 170	
155	71.9 2949 170	74.9 2936 170	79.5 2939 170	81.4 2949 170	83.1 2939 170	84.8 2923 170	86.5 2926 170	88.3 2949 170	
160	73.2 3079 170	76.2 3069 170	80.9 3083 170	82.8 3085 170	84.4 3068 170	86.1 3054 170	87.8 3074 170	89.7 3098 170	

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Per degree above (below) ISA add (subtract) 5 kg/h/eng.

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SLATS 15 – FLAPS O ISA	HOLDING 2 ENGINES	S

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	N1 KG/H/ENG
90	63.4 2209	66.1 2175	70.3 2142	72.0 2131	73.8 2122	75.6 2116	77.5 2116	79.4 2119	
95	64.9 2320	67.6 2288	71.8 2257	73.5 2247	75.3 2240	77.2 2237	79.1 2240	80.9 2234	
100	66.3 2445	69.2 2414	73.4 2385	75.1 2377	77.0 2371	78.8 2374	80.8 2375	82.3 2358	
105	67.6 2561	70.5 2535	74.8 2506	76.6 2498	78.4 2498	80.3 2501	82.0 2490	83.7 2472	
110	69.0 2679	71.8 2655	76.2 2628	78.0 2623	79.8 2627	81.7 2625	83.3 2606	85.0 2588	
115	70.5 2813	73.3 2789	77.7 2765	79.5 2767	81.4 2770	83.0 2754	84.7 2734	86.3 2734	
120	71.5 2926	74.5 2900	78.9 2882	80.7 2886	82.5 2882	84.1 2861	85.8 2843	87.4 2856	
125	72.9 3063	75.8 3040	80.3 3030	82.2 3033	83.7 3015	85.4 2993	87.0 2994	88.7 3005	
130	74.0 3177	76.9 3155	81.4 3151	83.2 3146	84.8 3124	86.4 3105	88.0 3118	89.8 3128	
135	75.2 3305	78.1 3285	82.7 3288	84.3 3270	85.9 3247	87.5 3245	89.1 3257	91.0 3271	
140	76.3 3436	79.3 3418	83.8 3418	85.3 3394	87.0 3371	88.5 3386	90.3 3397	92.1 3418	
145	77.4 3569	80.5 3557	84.8 3544	86.4 3520	88.0 3515	89.6 3528	91.4 3542	93.3 3568	
150	78.4 3689	81.5 3685	85.7 3658	87.3 3633	88.9 3645	90.6 3657	92.4 3677	94.4 3704	
155	79.5 3826	82.6 3828	86.7 3787	88.3 3775	89.9 3790	91.6 3802	93.5 3829	95.5 3864	
160	80.5 3949	83.6 3956	87.6 3902	89.2 3907	90.8 3921	92.6 3939	94.5 3967	96.5 4014	

FB2.1310.005-AA.080

R R R R R R R A304

Per degree above (below) ISA add (subtract) 5 kg/h/eng.

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GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	DESCENT APPROACH	N	2.14.00
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2.14.10 DESCENT CHART 2 ENGINES

Descent 2 Engines 1

Emergency Descent 2

2.14.20 APPROACH CLIMB

Requirements 1

Limiting weight – Slats 15 – Flaps 15 2

Limiting weight – Slats 20 – Flaps 20 3

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INTRODUCTION

Descent charts are established with air conditioning in economic mode.

R When using normal air conditioning, increase fuel consumption by 0.8 %.

All tables are established with a center of gravity location corresponding to 27 %.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	DESCENT APPROACH	2.14.10	
		PAGE 1	
	DESCENT CHART 2 ENGINES	REV 13	SEQ 580

ISA	DESCENT 2 ENGINES	M.79/300/250 KT

MAX CABIN RATE OF DESCENT 350 FT/MIN

WEIGHT (1000KG)	100				130				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
410	18.6	313	115	IDLE					
390	17.8	300	108	IDLE	19.8	334	121	IDLE	244
370	16.9	287	102	IDLE	19.0	322	115	IDLE	256
350	16.2	275	96	IDLE	18.3	310	109	IDLE	268
330	15.5	265	91	IDLE	17.6	300	104	IDLE	281
310	14.9	257	87	IDLE	16.9	290	99	IDLE	293
290	14.3	248	82	IDLE	16.1	280	93	IDLE	300
270	13.5	237	76	IDLE	15.2	267	86	IDLE	300
250	12.7	225	70	IDLE	14.3	253	79	IDLE	300
240	12.3	219	67	IDLE	13.8	246	76	IDLE	300
220	11.5	206	61	IDLE	12.9	231	69	IDLE	300
200	10.6	193	56	IDLE	11.9	215	63	IDLE	300
180	9.8	179	50	IDLE	10.9	199	56	IDLE	300
160	9.0	165	45	IDLE	9.9	183	50	IDLE	300
140	8.1	150	40	IDLE	8.9	166	44	IDLE	300
120	7.2	135	34	IDLE	7.9	148	38	IDLE	300
100	6.3	118	29	IDLE	6.9	129	32	IDLE	300
50	2.3	46	10	IDLE	2.5	50	11	IDLE	250
15	0.0	0	0	IDLE	0.0	0	0	IDLE	250

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	DESCENT APPROACH DESCENT CHART 2 ENGINES EMERGENCY DESCENT	2.14.10 PAGE 2 REV 12 SEQ 620

ISA	EMERGENCY DESCENT	M.84/340 kt

AIRBRAKES EXTENDED

WEIGHT (1000KG)	100				130				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
410	6.0	105	42	60.0					
390	5.7	100	40	IDLE	6.8	121	48	IDLE	255
370	5.4	95	38	IDLE	6.5	115	46	IDLE	267
350	5.1	91	35	IDLE	6.2	111	43	IDLE	279
330	4.8	87	33	IDLE	5.9	106	41	IDLE	292
310	4.6	83	32	IDLE	5.7	102	39	IDLE	306
290	4.4	80	30	IDLE	5.4	99	37	IDLE	319
270	4.2	77	28	IDLE	5.2	95	35	IDLE	333
250	3.9	73	26	IDLE	4.9	91	33	IDLE	340
240	3.8	71	25	IDLE	4.7	88	31	IDLE	340
220	3.5	66	23	IDLE	4.3	82	28	IDLE	340
200	3.2	61	21	IDLE	4.0	75	26	IDLE	340
180	2.9	55	18	IDLE	3.6	69	23	IDLE	340
160	2.6	50	16	IDLE	3.2	62	20	IDLE	340
140	2.3	44	14	IDLE	2.8	55	17	IDLE	340
120	2.0	39	12	IDLE	2.4	48	15	IDLE	340
100	1.6	33	10	IDLE	2.0	40	12	IDLE	340
50	.8	17	5	IDLE	1.0	21	6	IDLE	340

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In the approach configuration corresponding to the all engine procedure, the steady gradient one engine inoperative required by the regulations is equal to 2,1 %.

The following graph allows to determine the approach climb limiting weight which satisfies the required gradient with the certified approach configurations 20/20 and 15/15.

The required gradient of 2,1 % is considered at the airport reference altitude. The power setting to « GO AROUND » thrust with the air conditioning ON. The speed is 1.3 Vs of the specified configuration.

PROCEDURE

According to airport pressure altitude and temperature determine if the slats/flaps setting must be restricted as a function of the landing weight, in order to meet the approach climb gradient requirement of 2,1 %.
Establish the final approach configuration with one more step of flaps. If the approach is interrupted, retract the flaps by one step during the go-around.

Notes : 1. If circumstances dictate, landing may be made at a weight corresponding to the maximum structural take off wieght.
At this weight maximum vertical speed should not exceed 6 ft/s.
Air conditioning should be shut off.
If slats 20/flaps 20 approach climb limited, the approach shall be performed in slats 15/flaps 15 and landing in slats 20/flaps 20.

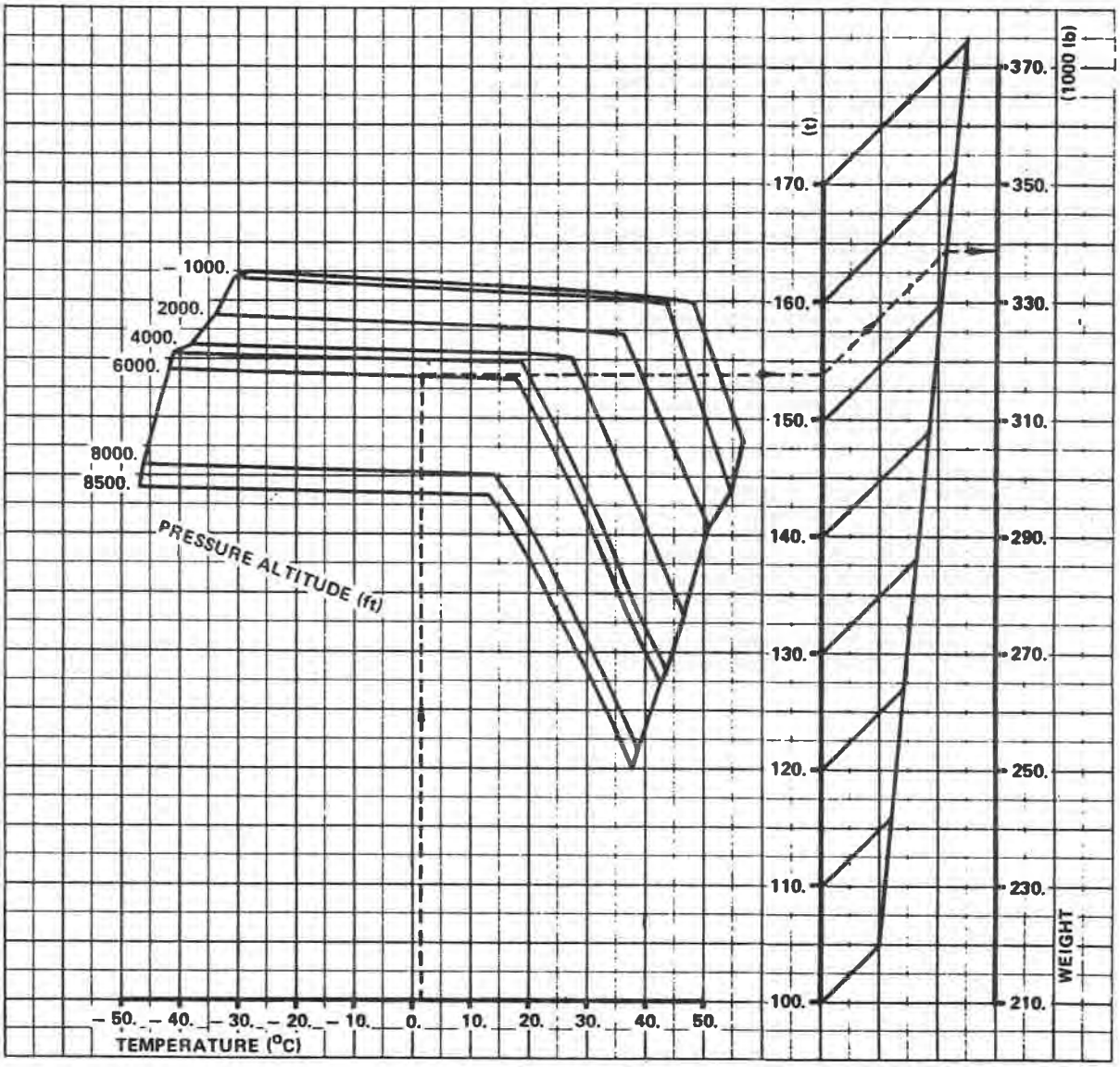
R *2. When icing conditions are predicted during the*
R *flight and the predicted landing temperature is below 20°C, reduce the approach climb*
R *limiting weight by 3%. Increase the approach*
R *speed by 5 kt if there are visual indications of*
R *significant ice accumulation.*

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	DESCENT APPROACH APPROACH CLIMB LIMITING WEIGHT SLATS 15 – FLAPS 15	2.14.20 PAGE 2 REV 14 SEQ 050

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



R *Notes : 1. If air conditioning is OFF, an additional 1.5 tons (3500 lb) may be added to the limiting weight.*
R *2. If nacelle anti-ice is ON, subtract 2 tons (4500 lb) to the limiting weight.*
R *3. If total anti-ice is ON, subtract 4.5 tons (10000 lb) to the limiting weight.*

Mod. : 4863

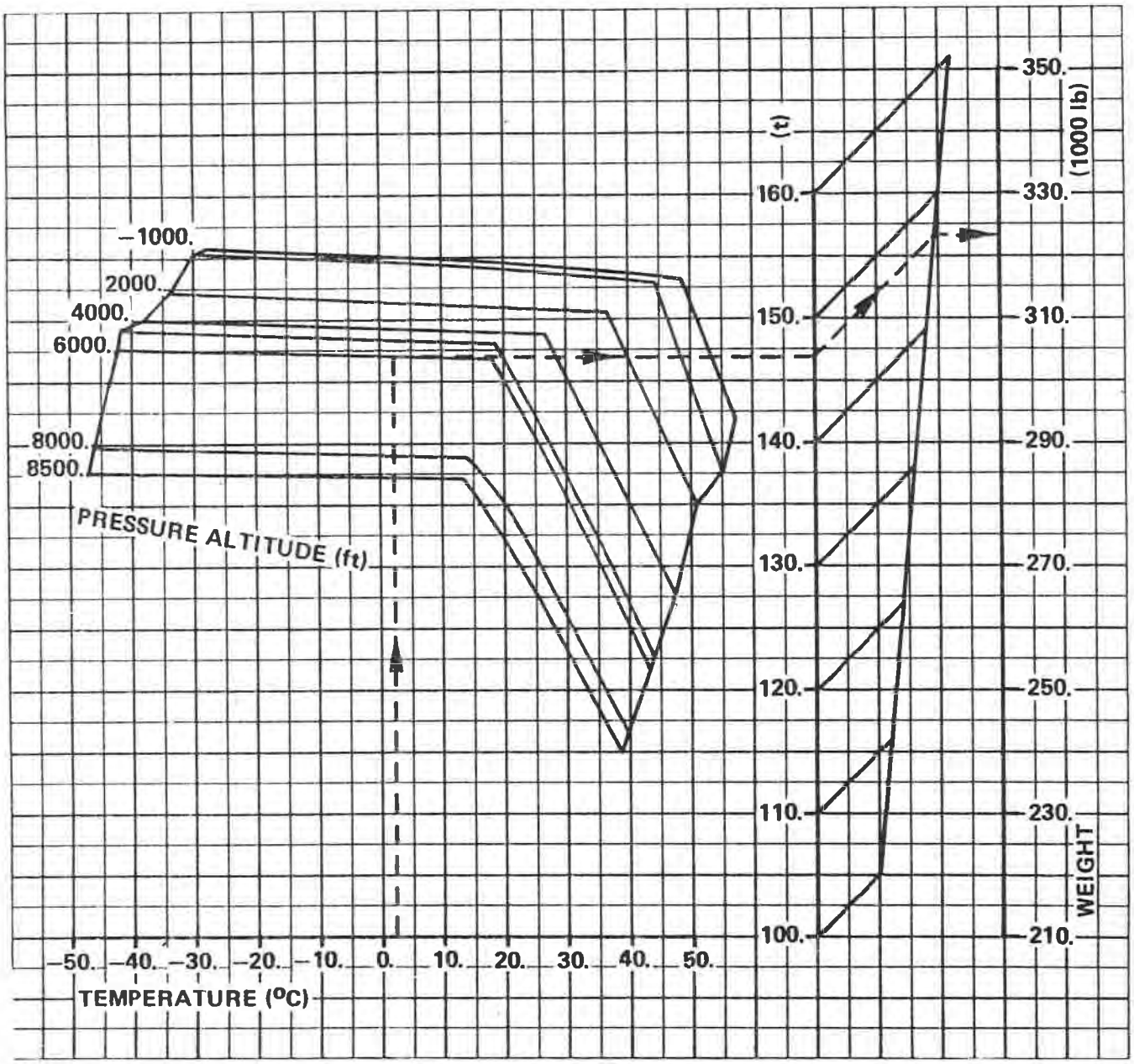
GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	DESCENT APPROACH APPROACH CLIMB LIMITING WEIGHT SLATS 20 – FLAPS 20	2.14.20	
		PAGE 3/4	
		REV 14	SEQ 050

ONE ENGINE OUT
ONE ENGINE AT GO AROUND THRUST

GRADIENT 2.1 %
AIR CONDITIONING ON
ANTI ICING OFF



R *Notes : 1. If air conditioning is OFF, an additional 1.5 tons (3500 lb) may be added to the limiting weight.*
R *2. If nacelle anti-ice is ON, subtract 2 tons (4500 lb) to the limiting weight.*
R *3. If total anti-ice is ON, subtract 4.5 tons (10000 lb) to the limiting weight.*

Mod. : 4863

GE Eng. : 80C2A2

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2.15.10 LANDING OPERATING SPEEDS 1/2

2.15.20 LANDING DISTANCES

– General 1

– Landing Distance ISA . . . . . 1 to 3

R – Configuration correction
R for failures 4

2.15.30 USE OF THE AUTOBRAKE SYSTEM

– General 1/2

– Landing on dry or contaminated runway 1/2

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A310 FLIGHT CREW OPERATING MANUAL	LANDING LANDING OPERATING SPEEDS	2.15.10 PAGE 1 / 2 REV 15 SEQ 040

LANDING CONFIGURATION ▶	SLATS 20°/FLAPS 20°	SLATS 30°/FLAPS 40°	
SPEED WEIGHT (1000 tons)	F (Kt IAS) 1.25 Vs 15°/0°	1.3 Vs 20°/20° (Kt IAS) VREF + 10	VREF (Kt IAS) 1.3 Vs 30°/40°	R
80	128	121	111	R
82	129	122	112	R
84	130	124	114	R
86	132	125	115	R
88	133	126	116	R
90	134	127	117	R
92	135	128	118	R
94	137	129	119	R
96	138	130	120	R
98	140	131	121	R
100	141	133	123	R
102	142	134	124	R
104	144	135	125	R
106	145	136	126	R
108	147	137	127	R
110	148	139	129	R
112	149	141	131	R
114	151	142	132	R
116	152	143	133	R
118	153	145	135	R
120	154	146	136	R
122	156	147	137	R
124	157	148	138	R
126	158	149	139	R
128	159	150	140	R
130	161	151	141	R
132	162	152	142	R
134	163	153	143	R
136	164	154	144	R
138	166	155	145	R
140	167	156	146	R
142	167	157	147	R
144	169	158	148	R
146	170	160	150	R
148	171	161	151	R
150	172	162	152	R
152	173	163	153	R
154	174	164	154	R
156	175	165	155	R
158	177	166	156	R

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A310 FLIGHT CREW OPERATING MANUAL	LANDING LANDING DISTANCES	2.15.20 PAGE 1 REV 18 SEQ 080

1. GENERAL :

The actual distance to land an aircraft and come to a complete stop, as demonstrated during the certification programme, is measured from a point 50 ft above the landing surface. This point is supposed to be situated above the threshold. Regulations have defined the legal landing distance (FAR) as the actual landing distance divided by 0.6.

In normal landing configuration approach speed is 1.3 Vs of the configuration. The deceleration means are the brakes supplied by the green hydraulic system and the ground spoilers. Antiskid system is operative.
It must be checked before departure that available runway length at destination with forecasted landing weight is at least equal to actual landing distance on dry runway divided by 0.6.
In case of forecasted wet runway increase this value by 15 %.

2. ACTUAL LANDING DISTANCE – ISA

SLATS 30°/FLAPS 40°

LANDING DISTANCE (METERS)								
WEIGHT (tons)			150	140	130	120	110	100	90
V_{REF} (KT IAS)			152	146	141	136	129	123	117
RUNWAY CONDITION	DRY		1145	1025	950	880	820	760	705
	WET		1525	1435	1345	1255	1170	1085	1000
	COVERED WITH	6.3 mm (1/4 in.) WATER	2605	2365	2140	1910	1690	1500	1360
		12.7 mm (1/2 in.) WATER	2480	2255	2040	1825	1625	1445	1310
		6.3 mm (1/4 in.) SLUSH	2335	2120	1915	1735	1595	1460	1320
		12.7 mm (1/2 in.) SLUSH	2240	2040	1845	1680	1545	1415	1285
		COMPACT SNOW	1725	1625	1525	1430	1330	1230	1135
		ICE	3720	3525	3330	3140	2950	2765	2595

SLATS 20°/FLAPS 20°

LANDING DISTANCE (METERS)								
WEIGHT (TONS)			150	140	130	120	110	100	90
1.3 Vs (KT IAS)			162	156	151	144	139	133	127
RUNWAY CONDITION	DRY		1270	1120	1020	950	890	830	770
	WET		1710	1605	1500	1400	1300	1200	1105
	COVERED WITH	6.3 mm (1/4 in.) WATER	3390	3075	2765	2455	2165	1880	1650
		12.7 mm (1/2 in.) WATER	3185	2885	2595	2305	2040	1780	1570
		6.3 mm (1/4 in.) SLUSH	3010	2715	2445	2175	1910	1715	1550
		12.7 mm (1/2 in.) SLUSH	2850	2570	2320	2065	1830	1645	1490
		COMPACT SNOW	1960	1845	1735	1620	1505	1390	1280
		ICE	4440	4200	3970	3740	3510	3290	3075

CORRECTION ON LANDING DISTANCES

- **Wind :** per 5 Kts tailwind add 10 %
  per 5 Kts headwind subtract 2 %
  } (valid only for dry and wet runway)
- **Airport Elevation :** per 1000 ft above sea level add 3.5 %
- **With two reverses :** Landing distances are decreased by :
  5 % on dry runway
  10 % on wet runway
  10 % on runway covered with water or slush
  18 % on runway covered with compact snow
  26 % on icy runway

Code : 1520A

GE Eng. : 80C2A2

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CONFIGURATION CORRECTION FOR FAILURES – LANDING SPEED / LANDING DISTANCES –

FAILURE		LDG SPD INCREMENT		LDG DIST MULTIPLY BY
		VLS	VREF	REV INOP
BRK	— A/SKID → ALTN	–	–	1.1
	— A/SKID → OFF	–	–	1.5
SPLR	ROLL SPLR (more than 3 per wing affected)	10	20	1.8
	GRND SPLR (more than 2 per wing affected)	–	–	1.3
SLATS	— LESS THAN 15	–	20	1.3
	— BETWEEN 15 AND 30 → KRUG EXT	–	5	1.1
	— BETWEEN 15 AND 30 → KRUG RET	10	15	1.2
FLAPS	— LESS THAN 20 → SLATS EXT	–	20	1.3
	— LESS THAN 20 → SLATS LESS THAN 15	–	60	1.8
	— BETWEEN 20 and 40	–	5	1.1
KRUG	— RETRACTED	10	10	1.1
HYD SINGLE FAIL	— BLUE or YELLOW LOST	–	–	1.3
	— GREEN LOST	10	10	1.2
HYD DUAL FAIL	— YELLOW REMAINING → SLATS LESS THAN 15	–	20	2.1*
	— YELLOW REMAINING → SLATS BETWEEN 15 and 30 → KRUG EXT	–	5	1.8
	— YELLOW REMAINING → SLATS BETWEEN 15 and 30 → KRUG RET	10	15	2.0
	— BLUE REMAINING → FLAPS LESS THAN 20 → KRUG EXT	–	20	2.9*
	— BLUE REMAINING → FLAPS LESS THAN 20 → KRUG RET	10	30	3.1*
	— BLUE REMAINING → FLAPS BETWEEN 20 and 40 → KRUG EXT	–	5	2.5*
	— BLUE REMAINING → FLAPS BETWEEN 20 and 40 → KRUG RET	10	15	2.7*
	— GREEN REMAINING	10	20	1.8
REV UNLK	ENG SHUT DOWN → SPLRS recovered	–	10	1.1
	ENG SHUT DOWN → SPLRS not recovered	–	10	1.4

* With reverse operative, multiply the landing distance coefficient in abnormal condition by 0.8 to take benefit of both reversers.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	LANDING USE OF THE AUTOBRAKE SYSTEM	2.15.30 PAGE 1 T REV 14 SEQ 001

1. GENERAL

The autobrake system is designed to help the pilot in case of :

- aborted take-off or
- landing on short runways or
- operation with low visibility weather conditions

Furthermore, it allows to obtain a straight roll out and an optimized landing distance on contaminated runways. The table has been established for :

- dry runway
- wet runway
- runway covered with water, slush or compact snow.

2. ABORTED TAKE-OFF

The selection of the MAX mode before take-off improves safety in case of an aborted take-off.

3. LANDING

The braking mode has to be selected according to :

- runway length
- configuration
- runway condition

A correction is necessary when landing is not performed at sea level.

Recommendations

- On a dry runway, the use of the autobrake system is not necessary
- In order to save the brakes, the use of the reverse is recommended.

WEIGHT (TONS)				LANDING DISTANCE (meters)												CORRECTION ON LANDING DISTANCE
				SLATS 30°/FLAPS 40°						SLATS 20°/FLAPS 20°						
RUNWAY CONDITION		MODE		90	100	110	120	130	140	90	100	110	120	130	140	
DRY		MAX	NR	760	810	870	930	1020	1100	810	870	940	1010	1110	1200	3 %
			R	710	760	820	880	960	1030	750	810	880	940	1030	1110	
		MED	NR	990	1110	1140	1170	1250	1320	1020	1110	1200	1280	1370	1450	
			R	920	1000	1080	1150	1230	1310	1010	1090	1180	1270	1360	1440	
		LOW	NR	1510	1630	1760	1880	2010	2130	1680	1820	1970	2110	2250	2390	
			R	1330	1450	1580	1700	1830	1960	1480	1620	1760	1900	2050	2190	
WET		MAX	NR	1050	1130	1220	1300	1390	1470	1150	1240	1340	1440	1540	1640	4 %
			R	920	1000	1080	1160	1240	1320	990	1080	1170	1260	1430	1440	
		MED	NR	1050	1130	1220	1300	1390	1470	1150	1240	1340	1440	1540	1640	
			R	970	1050	1140	1220	1300	1380	1060	1150	1240	1330	1430	1520	
		LOW	NR	1510	1630	1760	1880	2010	2130	1690	1830	1970	2110	2250	2390	
			R	1330	1450	1580	1700	1830	1960	1480	1620	1760	1900	2000	2190	
COVERED WITH	6.3 MM (¼ INCH) WATER (or GREATER)	MAX or MED	NR	1410	1540	1730	1910	2140	2370	1640	1830	2100	2360	2640	2910	6 %
			R	1125	1250	1390	1520	1680	1840	1250	1400	1580	1760	1950	2140	
		LOW	NR	1560	1700	1860	2010	2200	2390	1780	1950	2170	2390	2670	2940	
			R	1310	1430	1570	1700	1850	1990	1450	1600	1760	1920	2100	2270	
	6.3 MM (¼ INCH) SLUSH (or GREATER)	MAX or MED	NR	1360	1490	1630	1760	1925	2090	1550	1700	1890	2070	2330	2590	7 %
			R	1090	1210	1330	1440	1570	1700	1210	1340	1480	1620	1790	1960	
		LOW	NR	1520	1650	1790	1920	2070	2220	1720	1870	2040	2210	2420	2620	
			R	1270	1390	1520	1640	1770	1900	1400	1540	1690	1840	2000	2150	
	COMPACT SNOW	MAX or MED	NR	1190	1280	1380	1470	1570	1660	1310	1420	1530	1630	1740	1850	4 %
			R	1000	1090	1180	1270	1360	1440	1090	1190	1290	1390	1490	1590	
		LOW	NR	1470	1590	1720	1840	1960	2080	1650	1780	1920	2060	2200	2330	
			R	1340	1410	1530	1650	1780	1900	1430	1570	1710	1840	1980	2120	

Note 1 : NR = without reverse
R = with reverse

Note 2 : Correction on landing distance : add (%) per 1000 ft above sea level.

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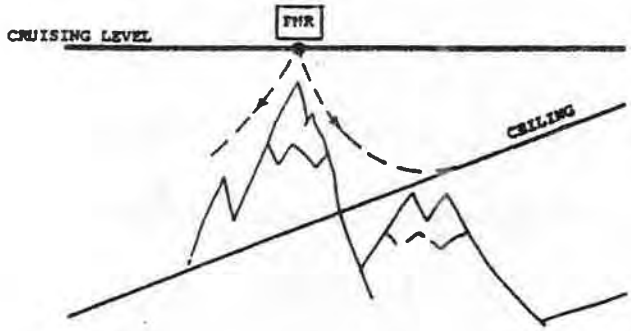
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INTRODUCTION

This chapter gives information to the crew in case of engine failure occurring during the flight. It is in all cases necessary to check, prior to departure, on legs over mountains, that, with one engine out, the net flight path clears the obstacle on the climb part by 1000 ft and on the drift down part by 2000 ft using the « EN ROUTE NET FLIGHT PATH » (2.16.10 p. 3) and « DRIFT DOWN NET CEILING » (2.16.10 p.2) graphs.

If the flight level and gross weight selected do not allow to clear the en route obstacles a point of no return (PNR) must be determined.



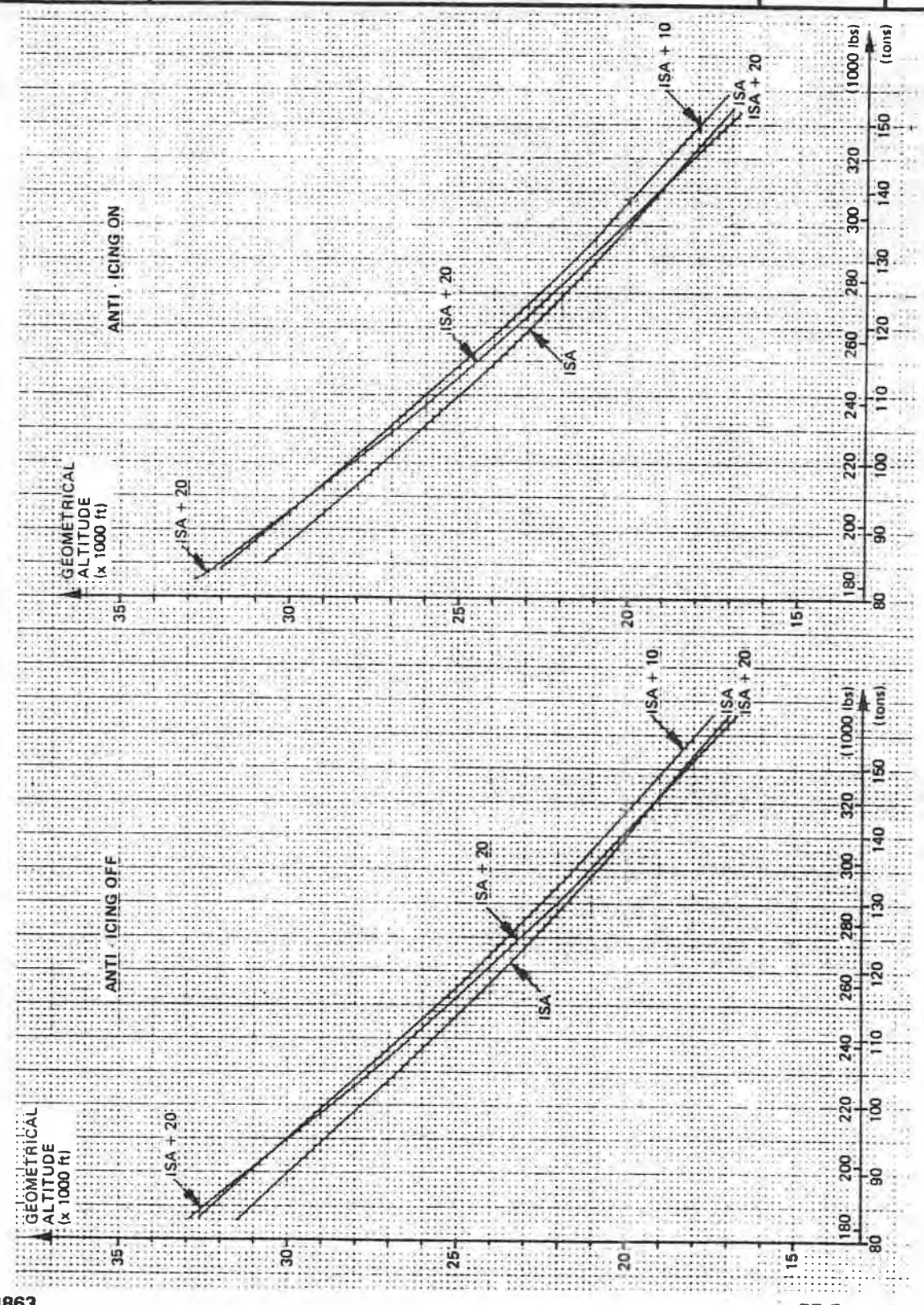
If an engine failure occurs after the PNR, the aircraft will drift down on course. If the failure occurs before the PNR, the aircraft will have to turn back.

R *Notes : 1. In case of engine failure, fuel consumption for the flight will not be greater than with both engines operative + 20 %.*

R *2. If severe icing conditions are encountered, ice*
R *formation may build up on non heated*
R *structure and therefore the ceiling will be*
R *reduced by 2000 ft.*

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE	2.16.10	
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In the event of an engine failure during the cruise a descent to a lower altitude must be expected.

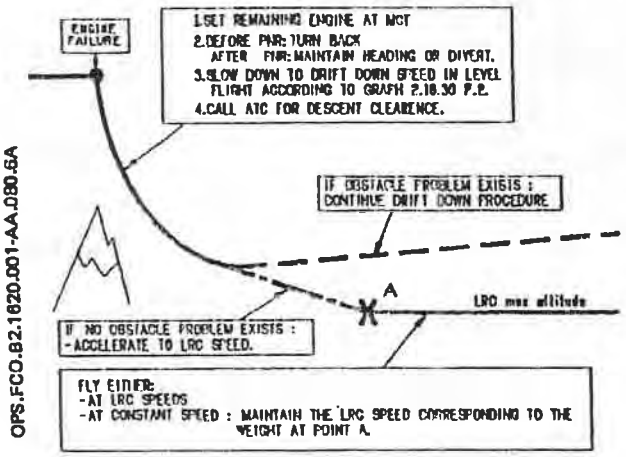
1. IF OBSTACLE PROBLEM EXISTS

In order to maintain the highest level possible, the drift down procedure should be used.

The drift down procedure requires maximum continuous thrust on the remaining engine at a speed close to best lift over drag ratio dependant upon aircraft weight and altitude (see graph 2.16.30 p. 2).

- If, having reached drift down ceiling altitude, obstacle problem persists, the drift down procedure is continued to make an ascending cruise.
- If, after drift down, obstacles are cleared, the subsequent cruise should be made using either, the long range cruise (LRC) by adjusting speed as a function of aircraft weight, or, by maintaining the speed given at the start of the LRC.

Note : Due to the fact that the LRC speed is higher than the drift down speed the cruise will be made at an altitude lower than the drift down ceiling. (See graph « ONE ENGINE GROSS CEILINGS » 2.16.30 p. 3).

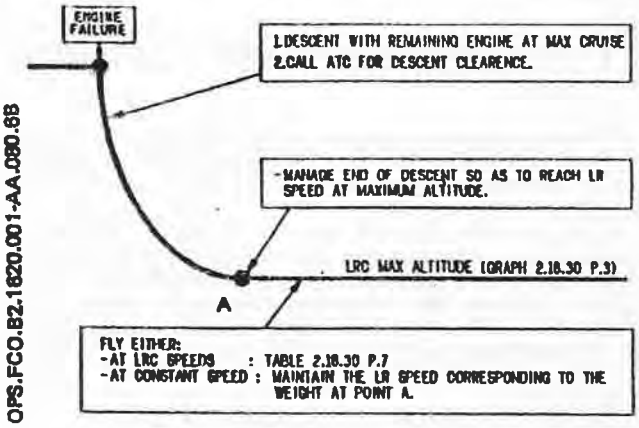


2. IF NO OBSTACLE PROBLEM EXISTS

Drift down procedure is not necessary, a descent at maximum cruise thrust is recommended in order to save time.

As soon as a possible altitude for LRC will be acquired (see graph « ONE ENGINE CEILINGS » 2.16.30 p. 3) the cruise will be made using either, the LRC, or, by maintaining the speed given at the start of the LRC.

It should be noted that in order to maintain the aircraft to the higher level possible during cruise, the beginning of the LRC may be performed with the remaining engine at maximum continuous.



EXAMPLE

ASSUMED DATA :

DRIFT DOWN PROCEDURE IS SELECTED

Gross weight at engine failure = 150 t
Flight level at engine failure = 330
Temperature = ISA
Distance to selected airport = 560 NM
No wind, ISA

FIND FROM :

2.16.30 p. 1 : Initial drift down speed = 276 kt
Drift down distance = 333 NM
Drift down fuel = 4.01 t
Drift down time = 52.9 mn
Gross ceiling = 23200 ft

2.16.30 p. 2 : During drift down adjust the speed according to graph. Final drift down speed will be 252 kt.

2.16.30 p. 3 : After drift down continue cruise either at drift down speed to maintain the level off altitude, or, if no terrain problem clearance exists, accelerate to the LRC speed. This of course requires a further loss in altitude. New max altitude for gross weight 146 t is 21000 ft. R

2.16.30 p. 4 : From :
- Initial LRC gross weight = 146 t
- LRC level = 210
- Remaining cruise distance : 560 – 333 = 227 NM

Find fuel and time to landing at LRC :
- Fuel = 2.4 t R
- Time = 0 h 43 mn R

SUMMARY :

For the total distance from point of engine failure to the selected airport 6.4 t of fuel are required, total flight time is 1 h 36 mn. R R

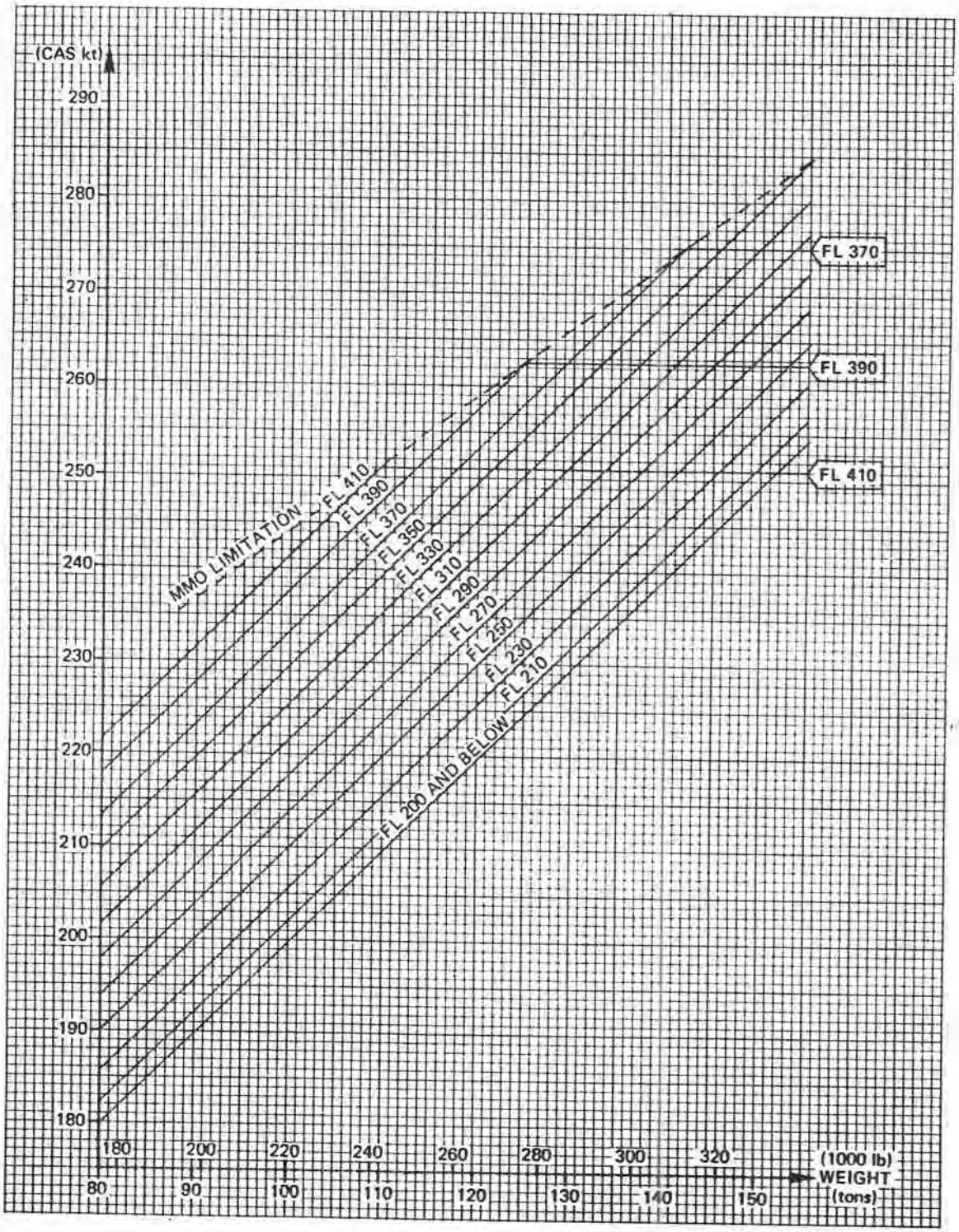
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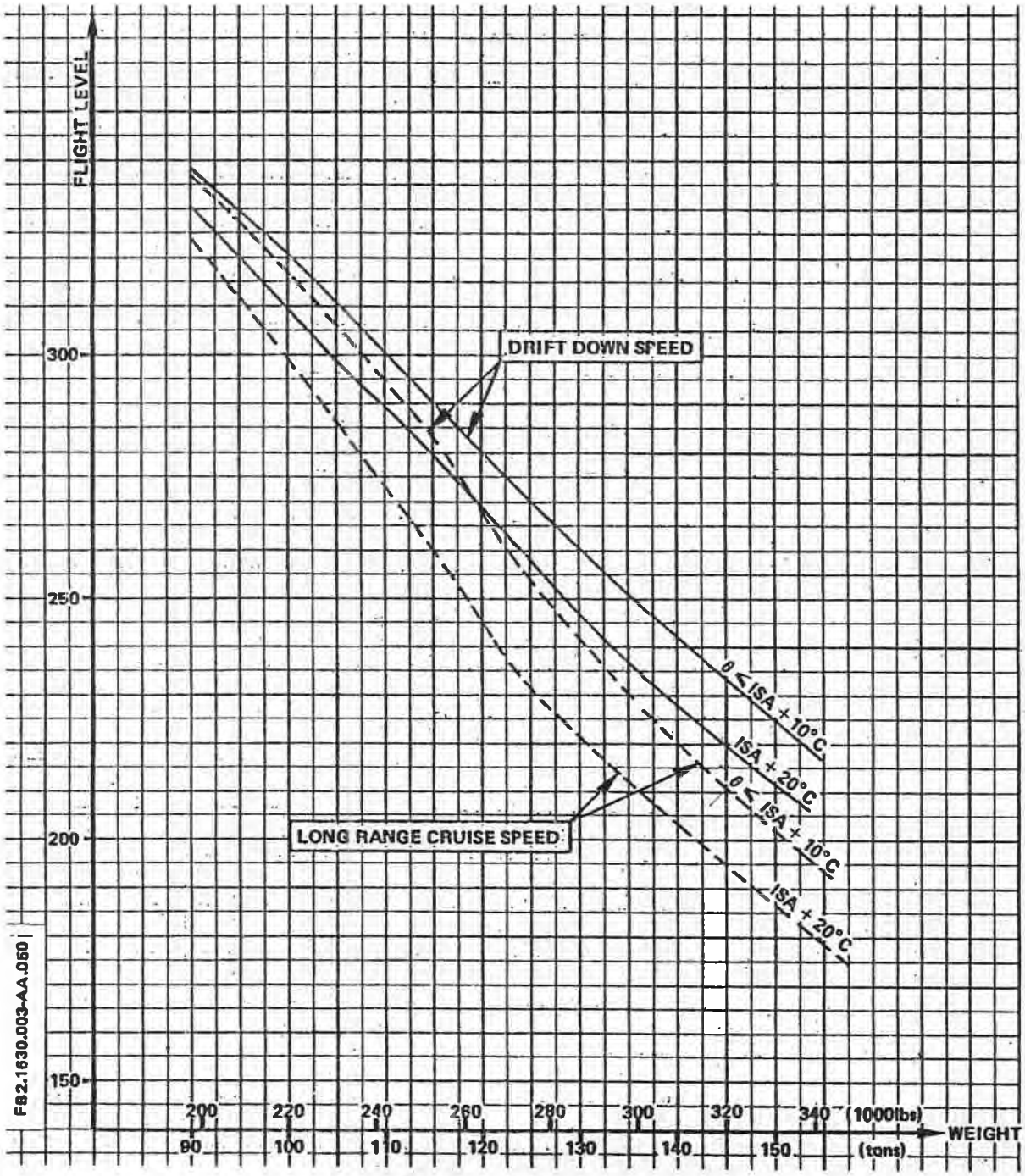
CLIMB – DRIFT DOWN SPEEDS
1 ENGINE AT MAXIMUM CONTINUOUS



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ONE ENGINE GROSS CEILINGS
ANTI-ICING OFF – AIR CONDITIONING ON



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GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE IN FLIGHT PERFORMANCE ON ONE ENGINE	2.16.30 PAGE 4 REV 15 SEQ 050

FUEL AND TIME TO LANDING
ONE ENGINE LONG RANGE CRUISE
ISA – C.G. = 27.0 %
INITIAL WEIGHT : 115 TONS
200 NM TO 800 NM

AIR-DIST NM	TIME (h.mn) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 100		150		200		220		240		250		270		* AFC (kg/t) FL 100 150	FL 200 220	FL 240 250	FL 270
800	2.33	9.3	2.30	8.5	2.30	7.9	2.29	7.8	2.12	7.8	2.12	7.7	2.08	7.8				
	2.29	9.1	2.26	8.3	2.27	7.7	2.25	7.6	2.09	7.6	2.09	7.5	2.05	7.4	41	52	49	53
	2.26	8.9	2.23	8.1	2.23	7.5	2.22	7.4	2.06	7.4	2.05	7.3	2.02	7.2				
	2.22	8.8	2.19	7.9	2.18	7.3	2.18	7.2	2.03	7.2	2.02	7.1	1.59	7.0				
	2.18	8.4	2.15	7.7	2.15	7.1	2.14	7.0	1.59	7.0	1.59	6.9	1.56	6.8				
700	2.14	8.2	2.11	7.4	2.12	6.9	2.10	6.8	1.56	6.8	1.56	6.7	1.52	6.6				
	2.10	7.9	2.08	7.2	2.08	6.7	2.07	6.6	1.53	6.5	1.52	6.5	1.49	6.4	36	44	42	45
	2.06	7.7	2.04	7.0	2.01	6.5	2.03	6.4	1.50	6.3	1.49	6.3	1.46	6.2				
	2.02	7.5	2.00	6.8	2.00	6.3	1.59	6.2	1.46	6.1	1.46	6.1	1.43	6.0				
	1.58	7.2	1.57	6.6	1.57	6.1	1.55	6.0	1.43	5.9	1.42	5.9	1.40	5.8				
600	1.55	7.0	1.53	6.3	1.53	5.9	1.52	5.8	1.40	5.7	1.39	5.7	1.36	5.8				
	1.51	6.7	1.49	6.1	1.49	5.7	1.48	5.6	1.36	5.5	1.36	5.5	1.33	5.4	30	37	34	37
	1.47	6.5	1.45	5.9	1.45	5.5	1.44	5.4	1.33	5.3	1.33	5.2	1.30	5.2				
	1.43	6.3	1.42	5.7	1.42	5.3	1.41	5.2	1.30	5.1	1.29	5.0	1.27	5.0				
	1.39	6.0	1.38	5.5	1.38	5.0	1.37	5.0	1.27	4.9	1.26	4.8	1.24	4.8				
500	1.35	5.8	1.34	5.2	1.34	4.8	1.33	4.8	1.23	4.7	1.23	4.6	1.21	4.6				
	1.31	5.6	1.30	5.0	1.30	4.6	1.29	4.5	1.20	4.5	1.20	4.4	1.17	4.4	24	29	27	29
	1.28	5.3	1.27	4.8	1.27	4.4	1.26	4.3	1.17	4.3	1.16	4.2	1.14	4.2				
	1.24	5.1	1.23	4.6	1.23	4.2	1.22	4.1	1.14	4.1	1.13	4.0	1.11	3.9				
	1.20	4.8	1.19	4.3	1.19	4.0	1.18	3.9	1.10	3.8	1.10	3.8	1.08	3.7				
400	1.16	4.6	1.15	4.1	1.15	3.8	1.14	3.7	1.07	3.6	1.07	3.6	1.05	3.5				
	1.12	4.4	1.12	3.9	1.12	3.6	1.11	3.5	1.04	3.4	1.03	3.4	1.02	3.3	18	22	19	20
	1.09	4.1	1.08	3.7	1.08	3.4	1.07	3.3	1.00	3.2	1.00	3.2	0.59	3.1				
	1.05	3.9	1.04	3.5	1.04	3.1	1.03	3.1	0.57	3.0	0.57	3.0	0.55	2.9				
	1.01	3.6	1.00	3.2	1.00	2.9	0.60	2.9	0.54	2.8	0.54	2.8	0.52	2.7				
300	0.57	3.4	0.57	3.0	0.57	2.7	0.56	2.7	0.51	2.6	0.50	2.5	0.49	2.5				
	0.53	3.2	0.53	2.8	0.53	2.5	0.52	2.4	0.47	2.4	0.47	2.3	0.46	2.3	12	14	12	12
	0.50	2.9	0.49	2.6	0.49	2.3	0.49	2.2	0.44	2.2	0.44	2.1	0.43	2.1				
	0.46	2.7	0.46	2.3	0.45	2.1	0.45	2.0	0.41	2.0	0.41	1.9	0.40	1.9				
	0.42	2.4	0.42	2.1	0.42	1.9	0.41	1.8	0.38	1.7	0.37	1.7	0.37	1.7				
200	0.38	2.2	0.38	1.9	0.38	1.7	0.37	1.6	0.34	1.5	0.34	1.5	0.33	1.4				

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* CORRECTION FOR DEVIATION FROM REFERENCE :

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE
TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

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FUEL AND TIME TO LANDING
ONE ENGINE LONG RANGE CRUISE
ISA – C.G. = 27.0 %
INITIAL WEIGHT : 115 TONS
700 NM TO 1400 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) — FLIGHT LEVEL 100		150		200		220		240		250		270		* ΔFC (kg/t) FL 100 150	FL 200 220	FL 240 250	FL 270
1400	4.31	16.3	4.22	15.0	4.23	14.0	4.22	13.8	3.60	13.7	3.51	13.6	3.46	13.5				
	4.27	16.0	4.18	14.8	4.19	13.8	4.18	13.6	3.58	13.5	3.48	13.4	3.42	13.3	68	92	99	98
	4.23	15.8	4.15	14.5	4.15	13.6	4.14	13.4	3.52	13.3	3.44	13.2	3.39	13.1				
	4.19	15.6	4.11	14.3	4.11	13.4	4.10	13.2	3.48	13.1	3.41	13.0	3.36	12.9				
	4.15	15.3	4.07	14.1	4.08	13.2	4.07	13.0	3.44	12.9	3.38	12.9	3.32	12.7				
1300	4.11	15.1	4.04	13.9	4.04	13.0	4.03	12.8	3.40	12.7	3.34	12.7	3.29	12.5				
	4.07	14.9	3.60	13.7	4.00	12.8	3.59	12.6	3.36	12.5	3.31	12.5	3.26	12.3				
	4.04	14.7	3.56	13.5	3.56	12.6	3.55	12.4	3.32	12.3	3.28	12.3	3.23	12.1	63	85	91	91
	3.60	14.4	3.52	13.3	3.53	12.4	3.52	12.2	3.29	12.2	3.24	12.1	3.19	11.9				
	3.56	14.2	3.49	13.1	3.49	12.2	3.48	12.0	3.25	12.0	3.21	11.9	3.16	11.8				
1200	3.52	14.0	3.45	12.8	3.45	12.0	3.44	11.8	3.22	11.8	3.18	11.7	3.13	11.6				
	3.48	13.7	3.41	12.6	3.41	11.8	3.40	11.6	3.18	11.6	3.15	11.5	3.10	11.4				
	3.44	13.5	3.37	12.4	3.38	11.6	3.37	11.4	3.15	11.4	3.11	11.3	3.06	11.2	60	79	83	84
	3.40	13.3	3.34	12.2	3.34	11.4	3.33	11.2	3.11	11.2	3.08	11.1	3.03	11.0				
	3.36	13.1	3.30	12.0	3.30	11.2	3.29	11.0	3.08	11.0	3.05	10.8	2.60	10.8				
1100	3.32	12.8	3.26	11.8	3.26	11.0	3.25	10.8	3.04	10.8	3.01	10.7	2.57	10.6				
	3.29	12.6	3.22	11.6	3.23	10.8	3.22	10.6	3.01	10.6	2.58	10.5	2.53	10.4				
	3.25	12.4	3.19	11.3	3.19	10.6	3.18	10.5	2.57	10.4	2.55	10.3	2.50	10.2	56	72	76	77
	3.21	12.1	3.15	11.1	3.15	10.4	3.14	10.3	2.54	10.2	2.51	10.1	2.47	10.0				
	3.17	11.9	3.11	10.9	3.11	10.2	3.10	10.1	2.50	10.0	2.48	9.9	2.44	9.8				
1000	3.13	11.7	3.08	10.7	3.08	10.0	3.07	9.9	2.47	9.8	2.45	9.7	2.41	9.6				
	3.09	11.4	3.04	10.5	3.04	9.8	3.03	9.7	2.43	9.6	2.42	9.5	2.37	9.4				
	3.05	11.2	3.00	10.3	3.00	9.8	2.59	9.5	2.40	9.4	2.38	9.3	2.34	9.2	51	65	67	69
	3.01	11.0	2.56	10.1	2.56	9.4	2.55	9.3	2.36	9.2	2.35	9.1	2.31	9.0				
	2.57	10.7	2.53	9.8	2.53	9.2	2.52	9.1	2.33	9.0	2.32	8.9	2.28	8.8				
900	2.53	10.5	2.49	9.6	2.49	9.0	2.48	8.9	2.30	8.8	2.28	8.7	2.24	8.8				
	2.49	10.3	2.45	9.4	2.45	8.8	2.44	8.6	2.26	8.6	2.25	8.5	2.21	8.4				
	2.45	10.0	2.41	9.2	2.41	8.6	2.40	8.4	2.23	8.4	2.22	8.3	2.18	8.2	46	59	58	61
	2.41	9.8	2.38	9.0	2.38	8.4	2.37	8.2	2.19	8.2	2.18	8.1	2.15	8.0				
	2.37	9.6	2.34	8.7	2.34	8.1	2.33	8.0	2.16	8.0	2.15	7.9	2.12	7.8				
800	2.33	9.3	2.30	8.5	2.30	7.9	2.29	7.8	2.12	7.8	2.12	7.7	2.08	7.6				
	2.29	9.1	2.26	8.3	2.27	7.7	2.25	7.6	2.09	7.6	2.09	7.5	2.05	7.4				
	2.26	8.9	2.23	8.1	2.23	7.5	2.22	7.4	2.06	7.4	2.05	7.3	2.02	7.2	41	52	49	53
	2.22	8.6	2.19	7.9	2.19	7.3	2.18	7.2	2.03	7.2	2.02	7.1	1.59	7.0				
	2.18	8.4	2.15	7.7	2.15	7.1	2.14	7.0	1.59	7.0	1.59	6.9	1.56	6.8				
700	2.14	8.2	2.11	7.4	2.12	6.9	2.10	6.8	1.56	6.8	1.56	6.7	1.52	6.6				

FB2.1630.005-AA.060

* CORRECTION FOR DEVIATION FROM REFERENCE :

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE
TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE IN FLIGHT PERFORMANCE ON ONE ENGINE	2.16.30 PAGE 6 REV 15 | SEQ 070

MAX CRUISE THRUST CLEAN CONFIGURATION ISA	DESCENT 1 ENGINE – M.82/320 KT

R ONE AIR CONDITIONING PACK ON

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390	410
85								16 2.0 267 107 35000	32 4.1 255 207 35000	47 6.0 243 290 35000
90							8 1.0 279 54 34000	23 3.0 267 160 34000	39 5.0 255 258 34000	53 6.8 243 336 34000
95							15 1.9 279 108 33000	31 3.9 267 213 33000	46 5.8 255 307 33000	59 7.5 243 380 33000
100						7 0.9 292 55 32000	22 2.8 279 162 32000	37 4.7 267 264 32000	52 6.6 255 353 32000	64 8.1 243 420 32000
105						14 1.8 292 110 31000	29 3.6 279 216 31000	43 5.5 267 314 31000	57 7.2 255 397 31000	68 8.6 243 458 31000
110					7 0.9 306 56 30000	21 2.6 292 166 30000	35 4.4 279 269 30000	49 6.2 267 362 30000	62 7.8 255 438 30000	72 9.1 243 494 30000
115					14 1.7 306 113 29000	28 3.4 292 221 29000	41 5.2 279 321 29000	54 6.8 267 406 29000	66 8.3 255 478 29000	75 9.4 243 527 29000
120				21 2.7 319 187 27000	35 4.3 306 300 27000	49 6.1 292 406 27000	62 7.7 279 502 27000	74 9.3 267 583 27000	84 10.6 255 646 27000	92 11.6 243 690 27000
125			13 1.7 320 121 26000	34 4.3 319 308 26000	48 6.0 306 419 26000	61 7.7 292 523 26000	73 9.2 279 613 26000	85 10.7 267 686 26000	94 11.8 255 746 26000	101 12.7 243 785 26000
130			27 3.5 320 257 25000	48 6.1 319 443 25000	61 7.8 306 553 25000	74 9.4 292 653 25000	86 10.9 279 739 25000	96 12.2 267 807 25000	105 13.2 255 859 25000	111 14.0 243 894 25000
135		16 2.1 320 158 24000	42 5.4 320 409 24000	63 8.0 319 593 24000	76 9.7 306 701 24000	88 11.2 292 797 24000	99 12.6 279 877 24000	108 13.8 267 940 24000	116 14.8 255 987 24000	122 15.5 243 1018 24000
140		33 4.3 320 339 23000	58 7.6 320 582 23000	78 10.2 319 764 23000	91 11.8 306 870 23000	103 13.2 292 962 23000	113 14.5 279 1036 23000	122 15.6 267 1093 23000	129 16.5 255 1135 23000	134 17.1 243 1163 23000
145	20 2.7 320 225 22000	51 6.9 320 549 22000	76 10.1 320 787 22000	96 12.6 319 965 22000	109 14.1 306 1067 22000	120 15.5 292 1154 22000	129 16.7 279 1223 22000	137 17.7 267 1275 22000	143 18.5 255 1313 22000	148 19.1 243 1339 22000
150	42 5.8 320 482 21000	72 9.7 320 792 21000	96 12.8 320 1024 21000	116 15.3 319 1199 21000	128 16.8 306 1298 21000	138 18.1 292 1380 21000	147 19.2 279 1444 21000	154 20.1 267 1491 21000	159 20.8 255 1526 21000	164 21.4 243 1550 21000
155	66 9.2 320 785 20000	95 13.0 320 1083 20000	118 16.0 320 1309 20000	138 18.4 319 1480 20000	149 19.9 306 1575 20000	159 21.1 292 1653 20000	167 22.1 279 1711 20000	173 22.9 267 1754 20000	179 23.6 255 1787 20000	183 24.1 243 1810 20000

DISTANCE (NM) TIME (MIN)
INITIAL SPEED (KT) FUEL (KG)
LEVEL OFF (FT)

R304 FB2.1630.006-AA.070

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL

ONE ENGINE INOPERATIVE

IN FLIGHT PERFORMANCE ON ONE ENGINE

2.16.30 | PAGE 7 | REV 15 | SEQ 080

ISA | CRUISE 1 ENGINE | LONG RANGE

ONE AIR CONDITIONING PACK ON

WEIGHT (1000KG)	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	574 0.447 79.3 242 2959 285 96.3	592 0.488 83.3 245 2922 306 104.6	609 0.513 86.1 234 2764 315 113.9	606 0.515 86.9 226 2672 314 117.5	611 0.520 87.9 218 2602 314 120.7	615 0.522 88.5 215 2571 314 122.2	623 0.525 89.8 207 2525 313 124.1	639 0.538 91.8 203 2554 318 124.6
90	585 0.456 80.7 252 3113 291 93.6	603 0.501 84.8 252 3090 314 101.5	612 0.514 87.0 235 2864 316 110.3	617 0.518 88.0 227 2787 316 113.3	623 0.523 89.2 220 2721 316 116.1	627 0.524 89.7 215 2692 315 117.1	639 0.532 91.4 210 2692 317 117.9	685 0.611 96.0 232 3056 362 118.3
95	596 0.468 82.2 259 3285 299 90.9	613 0.506 85.8 255 3214 317 98.6	622 0.517 88.0 236 2976 317 105.6	627 0.521 89.1 228 2902 317 109.4	635 0.524 90.3 220 2845 317 111.4	640 0.526 91.1 217 2839 318 111.8	688 0.607 95.9 241 3248 362 111.5	703 0.622 97.4 237 3246 368 113.4
100	608 0.479 83.7 265 3458 306 89.4	622 0.511 86.9 257 3335 320 95.9	631 0.519 89.0 237 3092 319 103.2	638 0.523 90.2 229 3022 319 105.5	649 0.529 91.7 222 2998 319 106.6	657 0.536 92.7 221 3021 322 106.7	702 0.612 97.0 243 3399 365 107.5	724 0.633 99.3 241 3455 375 108.4
105	619 0.492 85.1 274 3548 314 86.1	630 0.513 87.7 259 3443 322 93.4	641 0.522 90.0 238 3208 320 99.9	649 0.525 91.3 230 3151 320 101.5	665 0.537 93.2 226 3184 324 101.9	704 0.611 97.0 253 3518 368 101.7	720 0.625 98.5 248 3518 373 103.3	744 0.648 101.5 247 3700 384 103.7
110	629 0.502 86.3 278 3611 320 84.0	637 0.514 88.4 259 3539 322 91.0	652 0.524 91.1 239 3392 322 96.6	663 0.530 92.6 232 3319 323 97.3	712 0.612 97.5 259 3802 370 97.4	716 0.614 98.0 255 3758 370 98.4	739 0.635 100.2 253 3823 379 99.1	760 0.654 103.6 250 3892 387 99.5
115	637 0.506 87.2 280 3697 323 82.1	645 0.515 89.3 260 3651 323 88.5	662 0.525 92.1 240 3463 323 93.2	678 0.538 94.1 236 3508 328 93.4	723 0.615 98.4 260 3939 372 94.3	733 0.627 99.4 260 3979 377 94.8	758 0.650 102.3 259 4077 388 95.1	
120	645 0.510 88.0 283 4050 325 80.2	653 0.518 90.1 261 3769 325 86.2	675 0.530 93.4 242 3637 326 89.6	724 0.612 98.2 270 4161 373 89.7	739 0.627 99.7 266 4160 379 91.1	751 0.635 100.9 264 4189 382 91.3	774 0.657 104.3 262 4285 392 91.6	
125	652 0.513 89.0 284 4173 327 78.4	662 0.521 91.0 262 3887 326 83.9	703 0.568 96.0 260 4042 349 86.3	735 0.616 99.1 272 4307 375 87.1	755 0.635 101.1 269 4365 384 87.9	769 0.649 102.8 270 4440 390 87.9		
130	659 0.514 89.5 285 4279 328 76.7	670 0.522 91.8 263 4005 327 81.7	733 0.609 98.7 280 4500 374 83.2	749 0.625 100.2 276 4515 381 84.4	773 0.648 103.0 275 4519 391 84.7			
135	654 0.515 90.1 285 4375 329 75.1	679 0.524 92.7 264 4135 329 79.5	745 0.617 99.7 283 4587 379 80.0	764 0.633 101.5 280 4723 386 81.7				
140	671 0.516 90.8 286 4484 329 73.5	687 0.525 93.5 265 4260 329 77.2	756 0.622 100.6 286 4859 382 78.6	780 0.644 103.1 285 4954 392 79.0				
145	678 0.518 91.5 287 4504 331 71.8	698 0.529 94.5 267 4425 331 74.8	771 0.632 101.8 291 5006 389 76.3					
150	685 0.520 92.2 288 4726 332 70.2	709 0.534 95.6 269 4611 334 72.5	786 0.639 103.1 294 5303 399 74.0					
155	692 0.521 92.9 289 4839 333 68.7	754 0.606 99.7 307 5432 379 69.8						
	EGT DG C N1 % KG/H/ENG KG/1000KG	FOB1 TRS TRS						

FB2.1630.007-AA.080

R004

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE IN FLIGHT PERFORMANCE ON ONE ENGINE	2.16.30 PAGE 8 REV 15 SEQ 080

ISA + 10	CRUISE 1 ENGINE	LONG RANGE

ONE AIR CONDITIONING PACK ON

WEIGHT (1000KG)	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	603 0.446 80.8 246 3027 290 95.7	623 0.488 85.0 246 2997 312 103.9	636 0.512 87.9 234 2836 321 113.2	640 0.515 88.7 226 2745 320 116.7	646 0.520 89.8 216 2674 321 119.9	650 0.522 90.4 215 2642 321 121.3	658 0.525 91.7 207 2592 320 123.3	676 0.538 93.9 203 2630 325 123.7
90	614 0.456 82.3 252 3188 296 93.0	635 0.500 86.5 252 3168 319 100.8	645 0.514 88.8 234 2938 322 109.6	651 0.518 89.8 227 2862 322 112.6	658 0.522 91.1 220 2795 322 115.3	662 0.524 91.6 215 2766 322 116.3	675 0.531 93.4 210 2765 324 117.1	724 0.610 98.1 232 3137 369 117.5
95	627 0.468 83.8 259 3364 304 90.3	644 0.506 87.5 255 3294 323 98.0	655 0.516 89.8 236 3053 324 106.0	662 0.521 91.0 226 2980 324 108.7	670 0.524 92.2 220 2923 323 110.7	676 0.527 93.1 217 2917 324 111.1	726 0.607 98.1 241 3343 370 110.7	743 0.622 99.6 237 3340 376 112.5
100	639 0.479 85.4 265 3546 312 87.9	654 0.511 88.6 257 3418 326 95.4	665 0.519 90.9 237 3173 325 102.5	673 0.523 92.1 229 3102 325 104.8	684 0.529 93.6 222 3080 326 105.8	693 0.535 94.7 220 3103 329 106.0	741 0.612 99.2 243 3494 378 106.7	764 0.683 101.5 241 3554 382 107.6
105	650 0.492 86.8 272 3740 320 85.6	663 0.513 89.5 259 3529 328 92.9	676 0.522 91.9 238 3293 327 99.2	684 0.525 93.2 230 3236 326 100.9	701 0.537 95.2 226 3272 331 101.2	742 0.610 99.1 252 3709 375 101.0	759 0.624 100.7 248 3713 381 102.5	786 0.649 103.9 248 3812 392 102.9
110	660 0.501 87.9 278 3904 326 83.5	670 0.514 90.2 259 3628 328 90.5	686 0.523 92.9 239 3416 328 96.0	699 0.530 94.6 232 3408 330 96.7	749 0.611 99.5 259 3898 377 96.7	754 0.612 100.0 254 3851 376 97.7	779 0.634 102.4 252 3927 387 98.4	802 0.653 105.9 249 4000 395 98.7
115	668 0.506 88.9 280 4032 329 81.6	678 0.516 91.1 260 3744 329 88.0	697 0.525 94.0 240 3553 329 92.6	714 0.538 96.1 236 3601 334 92.8	761 0.613 100.4 260 4039 378 93.7	772 0.625 101.5 259 4082 384 94.1	798 0.649 104.6 259 4185 395 94.5	
120	676 0.510 89.7 282 4156 331 79.7	687 0.518 91.9 261 3864 331 85.6	710 0.530 95.3 242 3731 332 89.0	762 0.612 100.3 270 4274 381 89.1	778 0.626 101.8 265 4270 386 90.4	791 0.635 103.1 264 4301 390 90.7	814 0.655 106.6 261 4390 399 90.9	
125	684 0.513 90.6 284 4275 333 78.0	696 0.520 92.8 262 3984 332 83.4	725 0.536 96.7 246 3928 337 85.8	773 0.615 101.1 271 4418 382 86.5	796 0.634 103.3 269 4485 391 87.2	809 0.648 105.1 270 4563 398 87.3		
130	691 0.514 91.2 285 4301 334 76.3	704 0.522 93.7 263 4105 333 81.2	720 0.607 100.6 279 4605 381 82.6	788 0.625 102.3 276 4536 389 83.8	814 0.648 105.2 275 4748 399 84.1			
135	697 0.515 91.8 285 4400 335 74.7	713 0.524 94.5 264 4238 335 79.0	783 0.615 101.7 283 4600 386 80.3	803 0.632 103.7 279 4845 393 81.1				
140	704 0.516 92.5 286 4595 335 73.0	722 0.525 95.4 265 4368 335 76.7	795 0.621 102.6 286 4985 389 78.1	821 0.643 105.3 284 5095 400 78.5				
145	711 0.518 93.2 287 4717 337 71.4	733 0.528 96.4 266 4537 337 74.4	810 0.631 103.9 290 5220 395 75.8					
150	718 0.520 94.0 288 4841 338 69.8	745 0.533 97.5 269 4726 341 72.1	826 0.639 105.2 294 5443 400 73.5					
155	726 0.521 94.7 289 4962 339 68.3	791 0.605 101.7 306 5566 386 69.4						
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

R304 FB2.1630.008-AA.080

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GE Eng. : 80C2A2

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A310
FLIGHT CREW OPERATING MANUAL

ONE ENGINE INOPERATIVE

IN FLIGHT PERFORMANCE ON ONE ENGINE

ISA + 15	CRUISE 1 ENGINE	LONG RANGE

ONE AIR CONDITIONING PACK ON

WEIGHT (1000KG)	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	618 0.446 81.6 246 3064 292 95.4	638 0.488 85.8 245 3033 314 103.6	652 0.512 88.8 234 2873 324 112.9	656 0.515 89.6 226 2780 323 116.3	663 0.520 90.7 218 2709 324 119.5	667 0.522 91.4 215 2675 324 121.0	676 0.525 92.7 207 2630 323 122.9	694 0.538 94.9 203 2664 329 123.3
90	629 0.456 83.0 252 3224 299 92.7	650 0.500 87.3 252 3207 322 100.5	661 0.514 89.7 234 2977 325 109.2	667 0.518 90.8 227 2899 325 112.2	675 0.522 92.0 219 2829 325 115.0	679 0.524 92.6 215 2803 325 115.9	693 0.532 94.4 210 2804 327 116.8	743 0.609 99.1 232 3177 372 117.1
95	642 0.467 84.6 258 3402 306 90.1	660 0.506 88.4 255 3335 326 97.7	672 0.516 90.7 236 3092 327 105.6	679 0.521 91.9 228 3019 327 108.3	687 0.524 93.2 220 2960 327 110.3	694 0.527 94.0 217 2954 327 110.7	745 0.607 99.1 241 3386 374 110.3	763 0.621 100.7 236 3384 379 112.1
100	654 0.479 86.2 265 3586 314 87.6	670 0.511 89.5 257 3461 329 95.1	682 0.519 91.8 237 3214 329 102.2	690 0.523 93.0 229 3142 328 104.5	702 0.528 94.6 222 3119 329 105.5	711 0.535 95.7 220 3144 332 105.7	760 0.611 100.2 243 3538 376 106.4	784 0.632 102.6 241 3601 386 107.2
105	666 0.492 87.6 272 3784 323 85.3	679 0.518 90.4 259 3573 331 92.6	693 0.522 92.9 238 3335 330 98.9	702 0.525 94.2 230 3279 330 100.5	719 0.537 96.2 226 3314 334 100.9	761 0.610 100.1 253 3763 379 100.7	779 0.624 101.8 248 3764 384 102.1	806 0.648 105.0 248 3863 396 102.5
110	676 0.501 88.8 278 3951 329 83.2	686 0.514 91.1 259 3673 331 90.2	703 0.523 93.9 239 3459 331 95.7	717 0.530 95.6 232 3454 333 96.4	768 0.611 100.5 258 3946 380 96.4	773 0.612 101.0 254 3899 380 97.4	799 0.634 103.5 252 3983 391 98.0	
115	684 0.506 89.7 280 4081 332 81.3	695 0.516 91.9 260 3789 332 87.7	714 0.525 94.9 240 3598 332 92.3	732 0.538 97.1 236 3648 338 92.6	780 0.613 101.4 259 4089 382 93.4	792 0.625 102.5 259 4134 388 93.8	819 0.649 105.7 259 4243 399 94.1	
120	692 0.510 90.6 282 4206 334 79.5	703 0.518 92.8 261 3910 334 85.4	728 0.530 96.3 242 3777 335 88.8	781 0.612 101.3 270 4330 384 88.8	798 0.626 102.9 265 4325 390 90.1	811 0.634 104.2 263 4357 394 90.3		
125	700 0.512 91.4 284 4325 336 77.7	712 0.520 93.7 262 4034 335 83.1	743 0.537 97.7 246 3976 340 85.5	792 0.614 102.1 271 4471 386 86.3	816 0.634 104.4 269 4543 395 86.9			
130	707 0.514 92.1 285 4432 337 76.1	721 0.522 94.6 263 4156 336 80.9	758 0.607 101.6 278 4657 384 82.4	808 0.625 103.4 276 4700 393 83.5				
135	713 0.515 92.7 285 4534 337 74.4	730 0.524 95.5 264 4288 336 78.7	802 0.615 102.7 282 4857 389 80.1	823 0.632 104.7 279 4907 397 80.9				
140	720 0.516 93.4 286 4651 338 72.8	739 0.525 96.3 265 4420 338 76.5	815 0.621 103.7 286 5051 393 77.8					
145	728 0.518 94.1 287 4774 340 71.2	750 0.528 97.3 266 4592 340 74.1	830 0.631 105.0 290 5283 399 75.5					
150	735 0.520 94.9 288 4900 341 69.6	762 0.533 98.5 269 4784 344 71.8	846 0.638 106.3 294 5510 404 73.3					
155	742 0.521 95.6 289 5019 342 68.1	809 0.605 102.6 306 5632 390 69.2						
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE	2.16.30
		PAGE 10
	IN FLIGHT PERFORMANCE ON ONE ENGINE	REV 15 / SEQ 080

ISA + 20	CRUISE 1 ENGINE	LONG RANGE

ONE AIR CONDITIONING PACK ON

WEIGHT (1000KG)	FL100	FL150	FL200	FL220	FL240	FL250	FL270	FL290
85	632 0.446 82.4 246 3100 295 95.2	654 0.488 86.7 245 3070 317 103.3	669 0.512 89.7 234 2909 327 112.5	673 0.515 90.5 226 2816 327 116.0	680 0.519 91.7 216 2743 327 119.1	684 0.522 92.3 215 2710 327 120.6	693 0.525 93.7 207 2664 326 122.5	712 0.538 95.9 203 2698 332 123.0
90	644 0.456 83.8 252 3262 301 92.4	666 0.500 88.1 252 3245 325 100.2	678 0.514 90.6 235 3015 328 108.9	684 0.518 91.7 227 2936 328 111.9	692 0.522 92.9 219 2865 328 114.6	697 0.523 93.5 215 2838 328 115.6	712 0.532 95.4 210 2844 331 116.4	762 0.606 100.2 231 3216 375 116.7
95	657 0.467 85.4 258 3443 309 89.8	676 0.506 89.2 255 3373 329 97.4	688 0.516 91.6 236 3132 330 105.3	696 0.521 92.8 228 3058 330 108.0	705 0.524 94.1 220 2998 330 110.0	711 0.527 95.0 217 2993 330 110.4	764 0.606 100.1 241 3428 377 110.0	782 0.621 101.7 236 3427 383 111.7
100	670 0.479 87.0 265 3626 317 87.3	687 0.511 90.3 257 3502 332 94.8	699 0.519 92.7 237 3254 332 101.9	707 0.523 93.9 229 3181 331 104.2	720 0.528 95.6 222 3159 332 105.2	729 0.535 96.7 220 3182 335 105.4	779 0.611 101.2 243 3582 380 106.0	805 0.632 103.7 241 3650 390 106.8
105	681 0.492 88.4 272 3827 325 85.0	695 0.518 91.2 259 3616 334 92.3	710 0.522 93.8 238 3376 333 98.6	719 0.525 95.1 230 3320 333 100.2	737 0.536 97.2 226 3355 337 100.6	780 0.610 101.2 253 3812 382 100.3	799 0.624 102.8 248 3811 388 101.8	
110	691 0.501 89.6 278 3998 332 83.0	703 0.514 92.0 259 3718 334 89.9	720 0.523 94.8 239 3501 334 95.4	734 0.530 96.5 232 3496 336 96.1	787 0.611 101.6 258 3998 384 96.1	793 0.612 102.1 254 3954 384 97.1	820 0.635 104.7 253 4040 395 97.7	
115	700 0.506 90.5 280 4129 335 81.1	711 0.516 92.8 260 3837 336 87.4	732 0.525 95.9 240 3643 335 92.0	750 0.538 98.0 236 3694 341 92.3	799 0.612 102.4 259 4136 385 93.1	812 0.625 103.6 259 4186 391 93.5		
120	708 0.510 91.4 282 4256 337 79.2	720 0.518 93.7 261 3959 337 85.1	746 0.530 97.2 242 3822 338 88.5	800 0.612 102.3 270 4381 388 88.5	817 0.625 103.9 265 4376 393 89.8			
125	716 0.512 92.3 284 4376 339 77.5	729 0.520 94.6 262 4082 338 82.9	761 0.537 98.6 246 4026 343 85.2	811 0.614 103.1 271 4524 389 86.0				
130	723 0.514 93.0 285 4485 340 75.8	738 0.522 95.5 263 4207 339 80.7	805 0.606 102.6 278 4708 387 82.2	827 0.625 104.4 276 4758 396 83.2				
135	729 0.515 93.6 285 4508 340 74.2	747 0.524 96.3 264 4337 340 78.5	821 0.614 103.7 282 4916 392 79.8					
140	737 0.516 94.3 286 4705 341 72.6	756 0.525 97.2 265 4474 341 76.3	834 0.621 104.7 285 5113 397 77.6					
145	744 0.518 95.0 287 4830 343 71.0	767 0.528 98.3 266 4645 343 73.9	849 0.630 106.0 290 5346 402 75.3					
150	752 0.520 95.8 288 4957 344 69.4	780 0.533 99.4 269 4838 347 71.6						
155	759 0.521 96.5 289 5077 345 67.9	828 0.605 103.6 306 5701 393 69.0						
	EGT DG.C N1 % KG/H/ENG NH1/1000KG	MACH IAS TAS						

R304 FB2.1630.010-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE IN FLIGHT PERFORMANCE ON ONE ENGINE	2.16.30 PAGE 11 REV 15 SEQ 080

FLIGHT IDLE THRUST ISA	DESCENT 1 ENGINE	M 0.82/320 kt

ONE AIR CONDITIONING PACK ON

WEIGHT (1000KG)	100				130				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
410	12.9	115	89	IDLE					
390	12.3	110	84	IDLE	14.6	130	99	IDLE	255
370	11.7	105	79	IDLE	14.0	126	94	IDLE	267
350	11.1	100	75	IDLE	13.4	121	90	IDLE	279
330	10.6	97	71	IDLE	12.9	117	85	IDLE	292
310	10.2	93	67	IDLE	12.3	113	81	IDLE	306
290	9.8	90	64	IDLE	11.8	109	77	IDLE	319
270	9.2	86	59	IDLE	11.1	104	72	IDLE	320
250	8.6	81	54	IDLE	10.4	98	66	IDLE	320
240	8.3	79	52	IDLE	10.0	95	63	IDLE	320
220	7.6	73	47	IDLE	9.3	89	57	IDLE	320
200	7.0	68	43	IDLE	8.5	82	52	IDLE	320
180	6.3	62	38	IDLE	7.7	76	46	IDLE	320
160	5.7	57	34	IDLE	6.9	69	41	IDLE	320
140	5.0	51	29	IDLE	6.1	61	36	IDLE	320
120	4.4	44	25	IDLE	5.3	54	31	IDLE	320
100	3.7	38	21	IDLE	4.5	46	25	IDLE	320
50	1.9	20	11	IDLE	2.3	24	13	IDLE	320
15	0.6	6	3	IDLE	0.7	8	4	IDLE	320
0	0.0	0	0	IDLE	0.0	0	0	IDLE	320

R304 FB2.1630.011-AA.080

Mod. : 4863

GE Eng. : 80C2A2

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CLEAN CONFIGURATION ISA	HOLDING 1 ENGINE	– GREEN DOT SPEED

ONE AIR CONDITIONING PACK ON

HEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200	FL250	FL290	N1 KG/H/ENG
85	65.5 2391	68.3 2363	72.7 2387	74.4 2332	76.3 2329	78.2 2334	80.2 2340	81.8 2328	86.5 2369	91.8 2552	
90	67.0 2526	70.0 2497	74.3 2477	76.1 2474	78.0 2476	79.9 2483	81.7 2478	83.4 2462	88.1 2518	93.6 2744	
95	68.6 2661	71.5 2636	75.9 2619	77.8 2618	79.6 2625	81.6 2630	83.2 2611	84.9 2598	89.7 2678	95.3 2925	
100	70.1 2795	73.0 2776	77.5 2763	79.3 2768	81.3 2775	82.9 2763	84.6 2747	86.3 2751	91.3 2854	96.9 3125	
105	71.5 2935	74.5 2917	79.0 2912	80.8 2919	82.7 2918	84.3 2898	86.0 2868	87.6 2906	93.1 3057	98.9 3335	
110	72.8 3076	75.8 3061	80.4 3063	82.3 3070	83.9 3052	85.6 3036	87.2 3044	89.0 3060	95.0 3280	101.0 3554	
115	74.2 3218	77.2 3206	81.8 3215	83.6 3210	85.1 3189	86.9 3182	88.5 3201	90.3 3217	96.7 3493	103.8 3811	
120	75.5 3362	78.5 3353	83.2 3368	84.7 3345	86.4 3329	88.0 3339	89.7 3356	91.6 3383	98.1 3700		
125	76.7 3508	79.9 3502	84.3 3505	85.9 3483	87.5 3476	89.2 3496	91.0 3513	92.9 3553	99.7 3910		
130	77.9 3656	81.1 3657	85.4 3642	87.0 3624	88.6 3634	90.3 3653	92.2 3681	94.2 3728	101.6 4131		
135	79.1 3805	82.3 3813	86.4 3782	88.1 3773	89.7 3794	91.5 3810	93.4 3852	95.6 3926	103.4 4358		
140	80.3 3956	83.4 3969	87.5 3925	89.1 3933	90.8 3953	92.6 3978	94.6 4029	97.2 4158			
145	81.5 4114	84.6 4122	88.6 4072	90.1 4094	91.9 4112	93.8 4151	96.0 4231	98.7 4397			
150	82.5 4274	85.6 4256	89.5 4235	91.1 4255	92.9 4278	94.9 4333	97.4 4467	100.0 4628			
155	83.6 4435	86.5 4409	90.5 4398	92.2 4415	94.0 4452	96.2 4539	98.9 4708	101.4 4844			

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A310
FLIGHT CREW OPERATING MANUAL

ONE ENGINE INOPERATIVE

IN FLIGHT PERFORMANCE FOR MINIMUM DIVERSION TIME

MAX CONTINUOUS THRUST
ISA

DESCENT 1 ENGINE

M 0.79/340 KT

WEIGHT (1000KG)	100				120				140				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
410	0.0	0	0	102.1	0.0	0	0	102.1					
390	2.0	86	15	102.9	1.3	58	10	102.9	0.0	0	0	102.9	244
370	4.4	201	33	103.0	3.1	140	23	103.0	1.2	55	9	103.0	255
350	7.1	339	59	103.1	5.1	245	38	103.1	2.6	131	20	103.1	268
330	9.9	497	75	103.0	7.3	370	55	103.0	4.3	227	33	103.0	281
310	12.7	671	96	103.0	9.7	517	74	103.0	6.3	345	48	103.0	293
290	15.5	855	118	102.8	12.2	681	93	102.8	8.4	485	64	102.8	306
270	18.0	1032	139	102.1	14.5	846	111	102.1	10.5	635	81	102.1	320
250	20.2	1198	155	101.3	16.6	1004	128	101.3	12.5	786	97	101.3	333
220	24.3	1527	188	101.3	20.8	1338	161	101.3	16.6	1109	128	101.3	340
210	26.3	1692	203	100.3	22.8	1503	176	100.6	18.4	1268	143	101.2	340
200	28.3	1856	218	99.3	24.8	1669	191	99.6	20.4	1437	158	100.1	340
190	30.3	2019	233	98.8	26.8	1833	206	98.6	22.4	1604	173	99.1	340
180	32.3	2180	248	97.5	28.8	1996	221	97.7	24.4	1770	188	98.2	340
170	34.3	2340	262	96.7	30.8	2157	235	96.9	26.4	1934	202	97.4	340
160	36.3	2499	276	96.0	32.8	2317	249	96.2	28.4	2097	216	96.7	340

F82.1640.001-AA.062
R904

Example :
Initial cruise FL : 370
One engine inoperative cruise FL : 190
A/C weight : 120 t.
R Descent duration : 26.8 – 3.1 = 23.7 MIN
R Fuel burn : 1833 – 140 = 1693 KG
R Distance flown : 206 – 23 = 183 NM

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE	2.16.40
		PAGE 2
	IN FLIGHT PERFORMANCE FOR MINIMUM DIVERSION TIME	REV 15 / SEQ 062

MAX CONTINUOUS THRUST ISA | **CRUISE 1 ENGINE** | **MCT/340 KT**

WEIGHT (1000KG)	FL100	FL160	FL170	FL180	FL190	FL200	FL210	FL220
100	722 0.612 95.7 340 5446 390 71.7	764 0.681 100.2 340 5573 425 76.3	772 0.694 101.0 340 5602 431 77.0	780 0.707 101.9 340 5651 438 77.4	779 0.710 102.1 335 5526 438 79.3	774 0.709 101.9 328 5305 435 82.0	772 0.711 102.0 322 5163 435 84.2	771 0.711 102.1 316 5007 433 86.5
105	724 0.612 95.9 340 5494 390 71.0	766 0.681 100.4 340 5622 425 75.6	774 0.694 101.3 340 5650 431 76.3	782 0.707 102.2 340 5703 438 76.7	780 0.708 102.2 334 5537 437 78.9	775 0.706 102.0 326 5319 434 81.5	773 0.707 102.1 321 5169 433 83.7	772 0.707 102.2 314 5013 431 86.0
110	727 0.612 96.1 340 5539 390 70.5	769 0.681 100.7 340 5675 425 74.9	777 0.694 101.6 340 5709 431 75.6	785 0.707 102.5 340 5760 438 76.0	781 0.705 102.3 333 5549 435 78.4	776 0.703 102.1 325 5334 432 80.9	775 0.703 102.2 319 5178 430 83.1	773 0.703 102.3 312 5020 428 85.3
115	729 0.612 96.3 340 5583 390 69.9	772 0.681 101.0 340 5732 425 74.2	781 0.694 101.9 340 5771 431 74.7	787 0.705 102.6 339 5786 436 75.4	782 0.702 102.4 331 5562 433 77.9	778 0.700 102.2 323 5347 430 80.4	776 0.699 102.3 317 5187 428 82.5	774 0.698 102.5 310 5026 425 84.6
120	732 0.612 96.6 340 5633 390 69.3	776 0.681 101.3 340 5790 425 73.4	784 0.694 102.2 340 5837 431 73.9	788 0.702 102.7 337 5798 434 74.9	783 0.699 102.5 330 5576 431 77.3	779 0.695 102.3 321 5354 427 79.8	777 0.694 102.5 314 5193 425 81.8	776 0.692 102.6 307 5033 422 83.8
125	734 0.612 96.8 340 5687 390 68.6	779 0.681 101.6 340 5850 425 72.7	787 0.694 102.5 340 5901 431 73.1	789 0.699 102.8 336 5808 433 74.5	784 0.695 102.6 328 5583 429 76.8	780 0.691 102.5 319 5364 424 79.1	779 0.688 102.7 312 5202 421 81.0	778 0.684 102.8 304 5040 417 82.7
130	738 0.612 97.1 340 5749 390 67.9	782 0.681 101.9 340 5917 425 71.8	791 0.694 102.8 340 5970 431 72.3	790 0.695 102.9 334 5817 430 74.0	785 0.690 102.8 325 5590 426 76.2	782 0.685 102.7 316 5375 421 78.3	781 0.681 102.9 308 5214 417 79.9	781 0.676 103.1 300 5050 412 81.6
135	741 0.612 97.4 340 5813 390 67.2	786 0.681 102.3 340 5992 425 71.0	794 0.694 103.1 340 6043 431 71.4	790 0.690 103.0 332 5822 427 73.4	787 0.685 102.9 323 5599 422 75.5	784 0.678 102.9 313 5391 417 77.3	784 0.674 103.1 305 5227 412 78.8	783 0.666 103.3 295 5060 406 80.2
140	744 0.612 97.7 340 5880 390 66.4	790 0.681 102.6 340 6070 425 70.0	796 0.690 103.3 338 6061 429 70.8	792 0.685 103.2 329 5829 424 72.8	789 0.678 103.2 319 5611 418 74.6	786 0.671 103.2 310 5408 412 76.2	787 0.664 103.4 300 5245 407 77.5	786 0.654 103.7 289 5070 399 78.6
145	748 0.612 98.1 340 5949 390 65.6	794 0.681 103.0 340 6153 425 69.1	796 0.685 103.4 335 6064 426 70.2	793 0.678 103.4 326 5838 420 72.0	791 0.671 103.4 316 5625 414 73.6	790 0.663 103.5 306 5431 407 75.0	790 0.653 103.8 295 5261 400 76.0	788 0.642 104.0 284 5078 391 77.0
150	751 0.612 98.4 340 6023 390 64.8	798 0.681 103.4 340 6240 425 68.1	798 0.679 103.6 332 6069 422 69.5	795 0.671 103.6 322 5847 416 71.1	794 0.664 103.6 312 5643 409 72.5	794 0.652 103.8 301 5454 401 73.5	792 0.642 104.1 290 5275 393 74.5	791 0.626 104.5 276 5086 381 74.9
155	755 0.612 98.8 340 6103 390 64.0	802 0.679 103.8 339 6306 424 67.2	799 0.672 103.8 329 6076 418 68.7	798 0.664 103.8 319 5861 411 70.2	798 0.653 104.0 307 5667 403 71.1	796 0.642 104.2 296 5475 395 72.1	795 0.628 104.6 283 5291 384 72.6	793 0.601 105.2 265 5091 366 71.9
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

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R304

Code : 1640 A

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	ONE ENGINE INOPERATIVE	2.16.40
		PAGE 3
	IN FLIGHT PERFORMANCE FOR MINIMUM DIVERSION TIME	REV 15 / SEQ 062

MAX CONTINUOUS THRUST ISA + 10	CRUISE 1 ENGINE	MCT/340 KT

R R R

MAX CONTINUOUS THRUST ISA + 20	CRUISE 1 ENGINE	MCT/340 KT

WEIGHT (1000KG)	FL100	FL160	FL170	FL180	FL190	FL200	FL210	FL220
100	792 0.612 99.4 340 5724 405 70.7	840 0.681 104.3 340 5869 441 75.2	842 0.687 104.6 337 5777 444 76.8	839 0.687 104.5 330 5572 442 79.3	835 0.686 104.4 323 5373 439 81.8	831 0.685 104.3 316 5185 437 84.3	828 0.683 104.2 309 5004 435 86.9	824 0.682 104.0 302 4825 432 89.6
105	794 0.612 99.6 340 5774 405 70.1	843 0.681 104.5 340 5920 441 74.6	843 0.684 104.7 335 5782 442 76.4	839 0.684 104.6 328 5579 440 78.8	836 0.683 104.5 321 5385 437 81.2	832 0.681 104.4 315 5198 435 83.7	829 0.680 104.3 308 5016 432 86.2	826 0.677 104.2 300 4836 429 88.8
110	797 0.612 99.9 340 5821 405 69.5	846 0.681 104.8 340 5977 441 73.9	843 0.681 104.8 334 5787 440 76.0	840 0.680 104.7 327 5587 438 78.3	837 0.679 104.6 320 5397 435 80.7	834 0.678 104.5 313 5213 433 83.0	830 0.676 104.4 306 5029 430 85.5	827 0.672 104.3 298 4849 426 87.9
115	799 0.612 100.1 340 5867 405 69.0	847 0.679 104.9 339 5996 440 73.4	844 0.678 104.9 332 5793 438 75.6	841 0.677 104.8 325 5597 436 77.8	838 0.676 104.7 318 5411 433 80.1	835 0.674 104.7 311 5230 430 82.3	832 0.671 104.6 303 5046 427 84.6	828 0.666 104.5 295 4862 422 86.9
120	802 0.612 100.3 340 5919 405 68.4	848 0.676 105.0 337 6000 436 73.0	845 0.675 105.0 330 5799 436 75.2	842 0.674 104.9 323 5610 433 77.2	839 0.672 104.9 316 5426 431 79.3	836 0.669 104.8 309 5248 427 81.4	833 0.665 104.8 301 5063 423 83.6	830 0.659 104.7 292 4879 418 85.6
125	805 0.612 100.6 340 5975 405 67.7	848 0.673 105.1 336 6004 436 72.6	845 0.671 105.1 328 5809 433 74.6	843 0.670 105.0 321 5623 431 76.6	840 0.667 105.0 314 5443 428 78.6	838 0.664 105.0 306 5269 424 80.5	835 0.658 105.0 297 5083 419 82.4	832 0.651 104.9 288 4892 412 84.3
130	808 0.612 100.9 340 6040 405 67.0	849 0.669 105.2 334 6009 433 72.1	846 0.667 105.2 326 5820 431 74.0	844 0.665 105.2 319 5638 428 75.9	842 0.662 105.2 311 5462 424 77.7	840 0.658 105.2 303 5295 420 79.3	837 0.651 105.2 294 5102 414 81.2	836 0.640 105.3 283 4914 405 82.5
135	812 0.612 101.2 340 6107 405 66.3	849 0.664 105.3 331 6015 431 71.6	847 0.662 105.3 324 5832 428 73.3	845 0.660 105.3 316 5655 424 75.0	844 0.656 105.4 308 5484 420 76.6	842 0.651 105.5 300 5319 416 78.2	842 0.641 105.6 289 5131 408 79.5	841 0.629 105.6 278 4935 398 80.7
140	816 0.612 101.6 340 6177 405 65.5	850 0.660 105.4 329 6025 427 71.0	848 0.657 105.4 321 5846 424 72.6	847 0.653 105.5 313 5675 420 74.0	846 0.649 105.6 305 5508 416 75.6	847 0.642 105.8 296 5353 410 76.6	846 0.631 105.9 284 5157 401 77.8	845 0.615 106.0 271 4957 390 78.7
145	819 0.612 101.9 340 6250 405 64.7	851 0.654 105.5 326 6036 424 70.2	850 0.651 105.6 318 5863 420 71.6	849 0.647 105.7 310 5697 416 73.1	849 0.641 105.9 301 5543 411 74.1	851 0.634 106.2 291 5384 405 75.1	851 0.620 106.3 279 5185 394 76.1	849 0.596 106.6 263 4977 378 75.9
150	823 0.612 102.2 340 6328 405 63.9	853 0.648 105.7 323 6052 420 69.4	852 0.645 105.8 315 5886 416 70.7	852 0.639 106.0 306 5732 411 71.8	854 0.632 106.2 297 5572 405 72.7	856 0.624 106.6 287 5418 398 73.5	856 0.605 106.8 272 5216 385 73.7	
155	827 0.612 102.6 340 6411 405 63.1	854 0.642 105.9 320 6073 416 68.5	855 0.637 106.0 311 5916 411 69.5	856 0.631 106.3 302 5762 406 70.5	858 0.623 106.6 292 5602 399 71.3	861 0.611 107.1 281 5456 390 71.5		
	EGT DG.C N1 % KG/H/ENG NM/1000KG	MACH IAS TAS						

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NAUTICAL GROUND MILES TO AIR MILES CONVERSION
CRUISE SPEED : 340 KT CAS
ONE ENGINE FAILED

DIST TO GO	+120	+80	+40	0	-40	-80	-120
300	236	254	275	300	329	365	411
350	275	296	321	350	384	426	479
400	314	338	366	400	439	487	548
450	354	381	412	450	494	548	616
500	393	423	458	500	549	609	685
550	432	466	504	550	604	670	753
600	472	508	550	600	659	731	822
650	511	550	596	650	714	792	890
700	551	593	642	700	769	853	959
750	590	635	688	750	824	914	1027
800	629	677	733	800	879	975	1096
850	669	720	779	850	934	1036	1164
900	708	762	825	900	989	1097	1233
950	747	804	871	950	1044	1158	1301
1000	787	847	917	1000	1099	1219	1370
1050	826	889	963	1050	1153	1280	1438
1100	865	932	1009	1100	1208	1341	1507
1150	905	974	1054	1150	1263	1402	1575
1200	944	1016	1100	1200	1318	1463	1644
1250	984	1059	1146	1250	1373	1524	1712
1300	1023	1101	1192	1300	1428	1585	1781
1350	1062	1143	1238	1350	1483	1646	1850
1400	1102	1186	1284	1400	1538	1707	1918
1450	1141	1228	1330	1450	1593	1768	1987
1500	1180	1270	1376	1500	1648	1829	2055

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FUEL AND TIME FROM CRITICAL POINT TO LANDING
ONE ENGINE FAILURE

R ISA – C.G. = 27 %

REFERENCE ALTITUDE : 35 000 FT – REFERENCE WEIGHT AT CRITICAL POINT : 130 TONS
INCLUDING, FIRST DESCENT : M 0.79/340 KT – CRUISE : MCT/340 KT
SECOND DESCENT : 300 KT/250 KT – APPROACH AND LANDING : 200 KG (4 MN)
300 NM TO 1300 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 170		180		190		200		210		220	
1300	3.06	16.7	3.07	16.2	3.08	15.8	3.10	15.4	3.11	15.1	3.12	14.8
	3.03	16.4	3.01	16.0	3.05	15.6	3.07	15.2	3.09	14.9	3.09	14.6
	3.01	16.1	3.01	15.7	3.03	15.3	3.04	14.9	3.05	14.6	3.06	14.3
	2.59	15.8	2.59	15.4	3.00	15.1	3.02	14.7	3.03	14.4	3.04	14.1
	2.56	15.6	2.56	15.2	2.59	14.8	2.59	14.4	2.60	14.1	3.01	13.9
1200	2.54	15.3	2.53	14.9	2.55	14.5	2.56	14.2	2.57	13.9	2.58	13.6
	2.50	15.0	2.50	14.6	2.52	14.3	2.53	13.9	2.54	13.6	2.55	13.4
	2.47	14.7	2.48	14.4	2.49	14.0	2.50	13.7	2.51	13.4	2.52	13.2
	2.45	14.5	2.45	14.1	2.47	13.8	2.48	13.4	2.49	13.2	2.50	12.9
	2.42	14.2	2.43	13.8	2.44	13.5	2.45	13.2	2.46	12.9	2.47	12.7
1100	2.39	13.9	2.40	13.6	2.41	13.2	2.42	12.9	2.43	12.7	2.44	12.4
	2.36	13.6	2.37	13.3	2.38	13.0	2.39	12.7	2.40	12.4	2.41	12.2
	2.33	13.4	2.34	13.0	2.35	12.7	2.36	12.4	2.37	12.2	2.38	12.0
	2.31	13.1	2.32	12.8	2.33	12.5	2.34	12.2	2.34	11.9	2.36	11.7
	2.28	12.8	2.29	12.5	2.30	12.3	2.31	11.9	2.31	11.7	2.33	11.5
1000	2.25	12.5	2.26	12.2	2.27	11.9	2.28	11.7	2.29	11.4	2.30	11.2
	2.22	12.2	2.23	11.9	2.24	11.7	2.25	11.4	2.25	11.2	2.27	11.0
	2.19	12.0	2.20	11.7	2.21	11.4	2.22	11.2	2.22	10.9	2.24	10.8
	2.17	11.7	2.18	11.4	2.19	11.2	2.20	10.9	2.20	10.7	2.21	10.5
	2.14	11.4	2.15	11.1	2.16	10.9	2.17	10.6	2.17	10.4	2.18	10.3
900	2.11	11.1	2.12	10.9	2.13	10.6	2.14	10.4	2.14	10.2	2.15	10.0
	2.09	10.9	2.09	10.6	2.10	10.4	2.11	10.1	2.11	10.0	2.12	9.8
	2.06	10.6	2.06	10.3	2.07	10.1	2.08	9.9	2.08	9.7	2.09	9.5
	2.03	10.3	2.04	10.1	2.05	9.9	2.06	9.6	2.06	9.5	2.07	9.3
	2.01	10.0	2.01	9.8	2.02	9.6	2.03	9.4	2.03	9.2	2.04	9.1
800	1.58	9.7	1.58	9.5	1.58	9.3	2.00	9.1	2.00	9.0	2.01	8.8
	1.55	9.5	1.55	9.3	1.58	9.1	1.57	8.9	1.57	8.7	1.58	8.6
	1.52	9.2	1.52	9.0	1.53	8.8	1.54	8.6	1.54	8.5	1.55	8.3
	1.50	8.9	1.50	8.7	1.51	8.5	1.51	8.4	1.52	8.2	1.53	8.1
	1.47	8.6	1.47	8.5	1.48	8.3	1.48	8.1	1.49	8.0	1.50	7.9
700	1.44	8.3	1.44	8.2	1.45	8.0	1.45	7.9	1.46	7.7	1.47	7.6
	1.41	8.1	1.41	7.9	1.42	7.8	1.42	7.6	1.43	7.5	1.44	7.4
	1.38	7.8	1.38	7.6	1.39	7.5	1.39	7.3	1.40	7.2	1.41	7.1
	1.36	7.5	1.36	7.4	1.37	7.2	1.37	7.1	1.38	7.0	1.38	6.9
	1.33	7.2	1.33	7.1	1.34	7.0	1.34	6.8	1.35	6.7	1.35	6.6
600	1.30	7.0	1.30	6.8	1.31	6.7	1.31	6.6	1.32	6.5	1.32	6.4
	1.27	6.7	1.27	6.6	1.28	6.4	1.28	6.3	1.29	6.2	1.29	6.1
	1.24	6.4	1.24	6.3	1.25	6.2	1.25	6.1	1.28	6.0	1.26	5.9
	1.22	6.1	1.22	6.0	1.23	5.9	1.23	5.8	1.23	5.7	1.24	5.7
	1.19	5.8	1.19	5.8	1.20	5.7	1.20	5.6	1.20	5.5	1.21	5.4
500	1.16	5.6	1.16	5.5	1.17	5.4	1.17	5.3	1.17	5.2	1.18	5.2
	1.13	5.3	1.13	5.2	1.14	5.1	1.14	5.0	1.14	5.0	1.15	4.9
	1.10	5.0	1.10	4.9	1.11	4.9	1.11	4.8	1.11	4.7	1.12	4.7
	1.08	4.7	1.08	4.7	1.09	4.6	1.09	4.5	1.09	4.5	1.09	4.4
	1.05	4.4	1.05	4.4	1.06	4.3	1.06	4.3	1.06	4.2	1.06	4.2
400	1.02	4.2	1.02	4.1	1.03	4.1	1.03	4.0	1.03	4.0	1.03	3.9
	0.59	3.9	0.59	3.9	0.60	3.8	0.60	3.8	1.00	3.7	1.00	3.7
	0.57	3.6	0.58	3.6	0.57	3.5	0.57	3.5	0.57	3.5	0.57	3.5
	0.54	3.3	0.54	3.3	0.54	3.3	0.54	3.3	0.55	3.2	0.55	3.2
	0.52	3.0	0.51	3.0	0.51	3.0	0.51	3.0	0.52	3.0	0.52	3.0
300	0.49	2.8	0.48	2.8	0.48	2.8	0.48	2.7	0.49	2.7	0.49	2.7

* ΔFC (kg/t)	FL 170 180	FL 180 200	FL 210 220
	23	23	34
	21	22	32
	18	23	30
	17	22	27
	16	19	23
	15	16	20
	14	13	17
	11	11	14
	8	9	11
	7	7	8

ΔFC (kg/1000ft)	FL 170 180	FL 180 200	FL 210 220
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35
	45	40	35

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* CORRECTION FOR DEVIATION FROM REFERENCE :

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE
ALTITUDE – ADD (SUB) ΔFC PER 1000 FT BELOW (ABOVE) REFERENCE
TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

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NAUTICAL GROUND MILES TO AIR MILES CONVERSION
CRUISE SPEED : 340 KT CAS
DEPRESSURIZATION AND ENGINE FAILURE

DIST TO GO	+120	+80	+40	0	-40	-80	-120
300	229	248	272	300	334	377	433
350	267	290	317	350	389	440	505
400	305	331	362	400	445	503	577
450	344	373	408	450	501	565	649
500	382	414	453	500	557	628	721
550	420	456	498	550	612	691	794
600	458	497	544	600	668	754	866
650	497	539	589	650	724	817	938
700	535	580	634	700	779	880	1010
750	573	622	680	750	835	943	1082
800	611	663	725	800	891	1006	1155
850	650	705	770	850	947	1069	1227
900	688	746	816	900	1002	1131	1299
950	726	788	861	950	1058	1194	1371
1000	764	829	907	1000	1114	1257	1443
1050	803	871	952	1050	1169	1320	1516
1100	841	912	997	1100	1225	1383	1588
1150	879	954	1043	1150	1281	1446	1660
1200	917	995	1088	1200	1336	1509	1732
1250	956	1037	1133	1250	1392	1572	1804
1300	994	1078	1179	1300	1448	1635	1876
1350	1032	1120	1224	1350	1504	1697	1949
1400	1070	1161	1269	1400	1559	1760	2021
1450	1109	1203	1315	1450	1615	1823	2093
1500	1147	1244	1360	1500	1671	1886	2165

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	IN FLIGHT PERFORMANCE FOR MINIMUM DIVERSION TIME	REV 15 / SEQ 062

FUEL AND TIME FROM CRITICAL POINT TO LANDING
DEPRESSURIZATION AND ENGINE FAILURE

R ISA – C.G. = 27.0 %

REFERENCE WEIGHT AT CRITICAL POINT : 100 TONS

INCLUDING, FIRST DESCENT : M 0.79/340 KT – CRUISE : MCT/340 KT. FL 100

SECOND DESCENT : 250 KT – APPROACH AND LANDING : 200 KG (4 MN)

300 NM TO 1300 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		410		* ΔFC(kg/t) FL 290/310	FL 330/350	FL 370/390	FL 410
1300	3.24	17.6	3.24	17.6	3.24	17.5	3.23	17.5	3.23	17.4	3.23	17.4	3.23	17.3				
	3.21	17.3	3.21	17.3	3.21	17.2	3.20	17.2	3.20	17.1	3.20	17.1	3.20	17.0				
	3.18	17.0	3.18	17.0	3.17	17.0	3.17	16.9	3.17	16.9	3.17	16.8	3.17	16.8	17	16	16	16
	3.15	16.8	3.14	16.7	3.14	16.7	3.14	16.6	3.14	16.6	3.14	16.5	3.14	16.5				
	3.11	16.5	3.11	16.5	3.11	16.4	3.11	16.4	3.11	16.3	3.11	16.3	3.11	16.2				
1200	3.08	16.2	3.08	16.2	3.08	16.1	3.08	16.1	3.08	16.0	3.08	16.0	3.08	15.9				
	3.05	15.9	3.05	15.9	3.05	15.9	3.05	15.8	3.05	15.8	3.05	15.7	3.05	15.7				
	3.02	15.7	3.02	15.8	3.02	15.8	3.02	15.5	3.02	15.5	3.02	15.4	3.02	15.4	15	15	14	14
	2.59	15.4	2.59	15.3	2.59	15.3	2.59	15.3	2.59	15.2	2.59	15.2	2.59	15.1				
	2.56	15.1	2.56	15.1	2.56	15.0	2.56	15.0	2.56	14.9	2.56	14.9	2.55	14.8				
1100	2.53	14.8	2.53	14.8	2.53	14.8	2.53	14.7	2.53	14.7	2.53	14.6	2.52	14.6				
	2.50	14.6	2.50	14.5	2.50	14.5	2.50	14.4	2.50	14.4	2.49	14.3	2.49	14.3				
	2.47	14.3	2.47	14.2	2.47	14.2	2.47	14.2	2.47	14.1	2.46	14.1	2.46	14.0	14	13	12	13
	2.44	14.0	2.44	14.0	2.44	13.9	2.44	13.9	2.43	13.8	2.43	13.8	2.43	13.7				
	2.41	13.7	2.41	13.7	2.41	13.8	2.40	13.8	2.40	13.8	2.40	13.5	2.40	13.4				
1000	2.38	13.4	2.38	13.4	2.37	13.4	2.37	13.3	2.37	13.3	2.37	13.2	2.37	13.2				
	2.35	13.2	2.35	13.1	2.34	13.1	2.34	13.0	2.34	13.0	2.34	12.9	2.34	12.9				
	2.32	12.9	2.31	12.9	2.31	12.8	2.31	12.8	2.31	12.7	2.31	12.7	2.31	12.8	12	11	11	11
	2.28	12.6	2.28	12.6	2.28	12.5	2.28	12.5	2.28	12.4	2.28	12.4	2.28	12.3				
	2.25	12.3	2.25	12.3	2.25	12.3	2.25	12.2	2.25	12.2	2.25	12.1	2.25	12.1				
900	2.22	12.1	2.22	12.0	2.22	12.0	2.22	11.9	2.22	11.9	2.22	11.8	2.22	11.8				
	2.19	11.8	2.19	11.7	2.19	11.7	2.19	11.7	2.19	11.6	2.19	11.6	2.19	11.5				
	2.16	11.5	2.16	11.5	2.16	11.4	2.16	11.4	2.16	11.3	2.16	11.3	2.16	11.2	10	9	9	9
	2.13	11.2	2.13	11.2	2.13	11.1	2.13	11.1	2.13	11.1	2.13	11.0	2.12	10.9				
	2.10	10.9	2.10	10.9	2.10	10.9	2.10	10.8	2.10	10.8	2.10	10.7	2.09	10.7				
800	2.07	10.7	2.07	10.6	2.07	10.6	2.07	10.5	2.07	10.5	2.06	10.4	2.06	10.4				
	2.04	10.4	2.04	10.4	2.04	10.3	2.04	10.3	2.03	10.2	2.03	10.2	2.03	10.1				
	2.01	10.1	2.01	10.1	2.01	10.0	2.01	10.0	2.00	9.9	2.00	9.9	2.00	9.8	8	8	7	7
	1.58	9.8	1.58	9.8	1.58	9.8	1.57	9.7	1.57	9.7	1.57	9.6	1.57	9.6				
	1.55	9.6	1.55	9.5	1.54	9.5	1.54	9.4	1.54	9.4	1.54	9.3	1.54	9.3				
700	1.52	9.3	1.52	9.2	1.51	9.2	1.51	9.2	1.51	9.1	1.51	9.0	1.51	9.0				
	1.49	9.0	1.48	9.0	1.48	8.9	1.48	8.9	1.48	8.8	1.48	8.8	1.48	8.7				
	1.45	8.7	1.45	8.7	1.45	8.6	1.45	8.6	1.45	8.5	1.45	8.5	1.45	8.4	6	6	5	5
	1.42	8.4	1.42	8.4	1.42	8.4	1.42	8.3	1.42	8.3	1.42	8.2	1.42	8.2				
	1.39	8.2	1.39	8.1	1.39	8.1	1.39	8.0	1.39	8.0	1.39	7.9	1.39	7.9				
600	1.36	7.9	1.36	7.8	1.36	7.8	1.36	7.8	1.36	7.7	1.36	7.7	1.36	7.6				
	1.33	7.6	1.33	7.6	1.33	7.5	1.33	7.5	1.33	7.4	1.33	7.4	1.33	7.3				
	1.30	7.3	1.30	7.3	1.30	7.2	1.30	7.2	1.30	7.1	1.30	7.1	1.29	7.0	4	4	3	3
	1.27	7.0	1.27	7.0	1.27	7.0	1.27	6.9	1.27	6.8	1.26	6.8	1.26	6.8				
	1.24	6.8	1.24	6.7	1.24	6.7	1.24	6.6	1.24	6.6	1.23	6.5	1.23	6.5				
500	1.21	6.5	1.21	6.4	1.21	6.4	1.21	6.4	1.20	6.3	1.20	6.3	1.20	6.2				
	1.18	6.2	1.18	6.2	1.18	6.1	1.18	6.1	1.17	6.0	1.17	6.0	1.17	5.9				
	1.15	5.9	1.15	5.9	1.15	5.8	1.14	5.8	1.14	5.7	1.14	5.7	1.14	5.8	2	2	1	1
	1.12	5.6	1.12	5.6	1.11	5.6	1.11	5.5	1.11	5.5	1.11	5.4	1.11	5.4				
	1.09	5.4	1.09	5.3	1.09	5.3	1.09	5.2	1.09	5.2	1.09	5.1	1.09	5.1				
400	1.06	5.1	1.06	5.0	1.06	5.0	1.06	5.0	1.05	4.9	1.05	4.9	1.05	4.8				
	1.02	4.8	1.02	4.8	1.02	4.7	1.02	4.7	1.02	4.6	1.02	4.6	1.02	4.5				
	0.59	4.5	0.59	4.5	0.59	4.4	0.59	4.4	0.59	4.3	0.59	4.3	0.59	4.2	0	0	-1	0
	0.56	4.2	0.56	4.2	0.56	4.2	0.56	4.1	0.56	4.1	0.56	4.0	0.56	4.0				
	0.53	4.0	0.53	3.9	0.53	3.9	0.53	3.8	0.53	3.8	0.53	3.7	0.53	3.7				
300	0.50	3.7	0.50	3.6	0.50	3.6	0.50	3.6	0.50	3.5	0.50	3.4	0.50	3.4				

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* CORRECTION FOR DEVIATION FROM REFERENCE :

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

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1. MINIMUM RECOMMENDED FUEL REQUIREMENTS

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

A. Taxi Fuel

Quantity required for start up and TAXI. Fuel calculation will be based on a consumption of **20 kg/min.**

Note : Average quantity (12 min) → **240 kg**

B. Trip Fuel

Fuel required from departure to destination includes the following quantities :

- Take-off and climb at selected speed.
- Cruise at selected speed.
- Descent from cruising level to 1,500 ft above destination airport.
- Approach and landing. Fuel calculation will be based on a **60 kg/min** consumption.

Note : Average quantity (6 min IFR) → **360 kg**

C. Reserve Fuel

This quantity includes :

(1) « En Route » Reserve Fuel

According to national regulations and company policy (generally based on a percentage of TRIP FUEL).

(2) Alternate Fuel

Fuel required to fly from destination to alternate airport. It includes go-around (300 kg), climb to cruising level, cruise at long range speed, descent and approach procedure (240 kg for 4 minutes VFR).

(3) Holding Fuel

Holding fuel should be calculated taking into account actual alternate altitude and landing weight at alternate, using holding charts of chapter 2.13.

Note : A conservative quantity corresponding to 30 min holding at 1,500 ft above alternate airport elevation and optimum holding speed (see 2.13.10 page 2) can be taken in a general manner.
Average quantity
CLEAN CONFIGURATION → **2,000 kg**
(1,500 ft above SL)

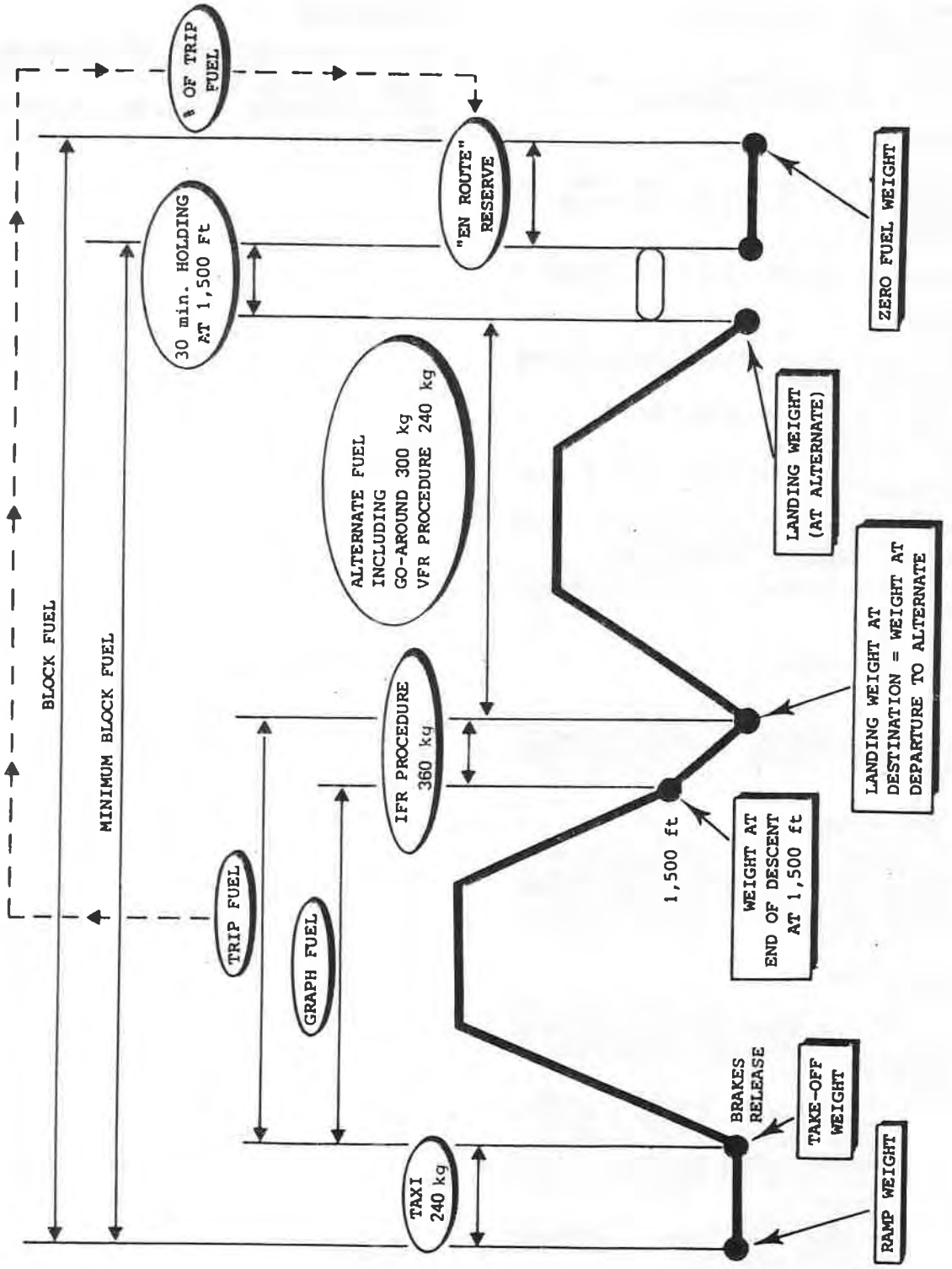
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2. FLIGHT PLAN

When no precalculated flight plan is available, flight planning can be determined by using the graph or tables given in this chapter.
Fuel policy will be the same as for precalculated flight plan.

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STANDARD FUEL PLAN PROFILE
FUEL AND WEIGHT DEFINITIONS

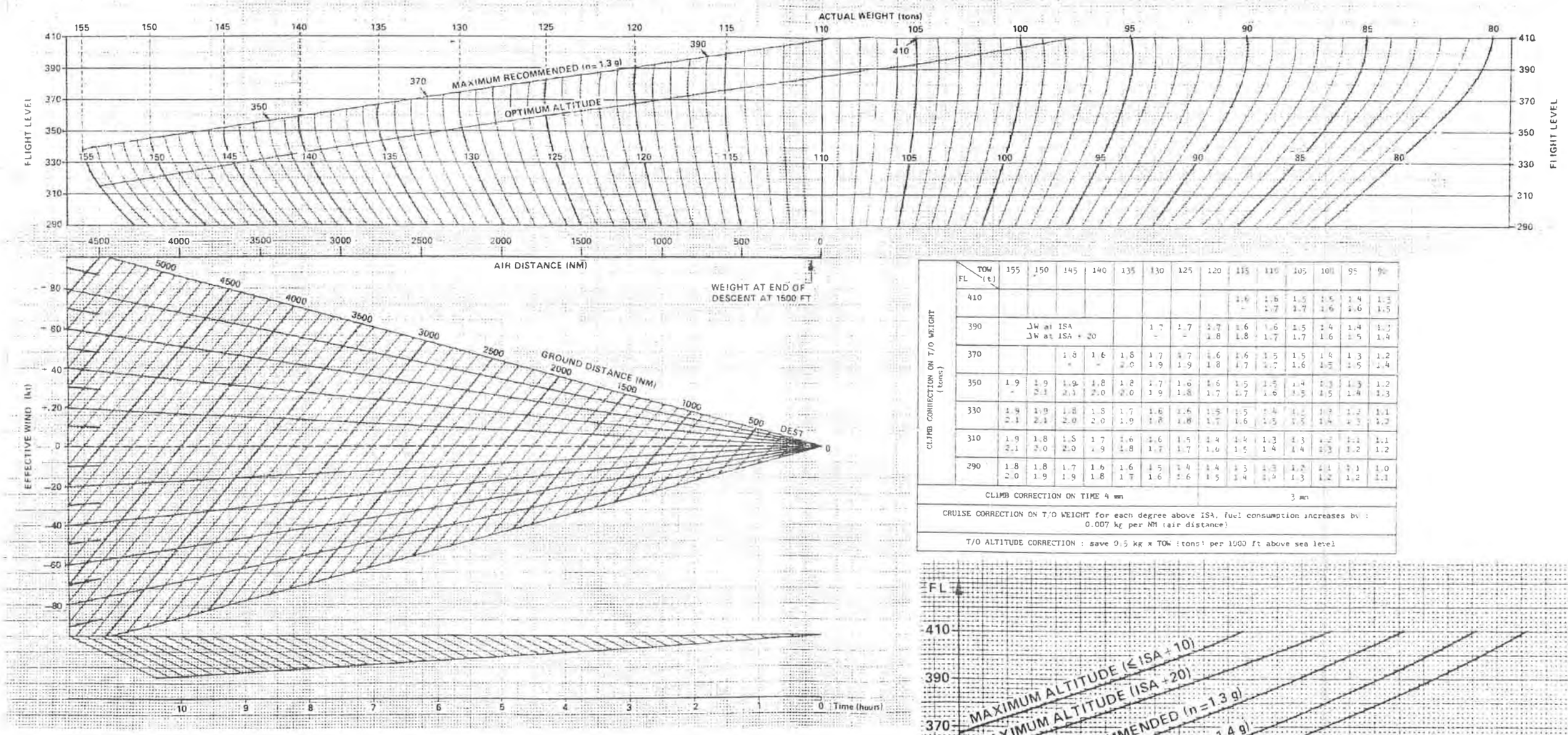


Vers. : All Eng. : All

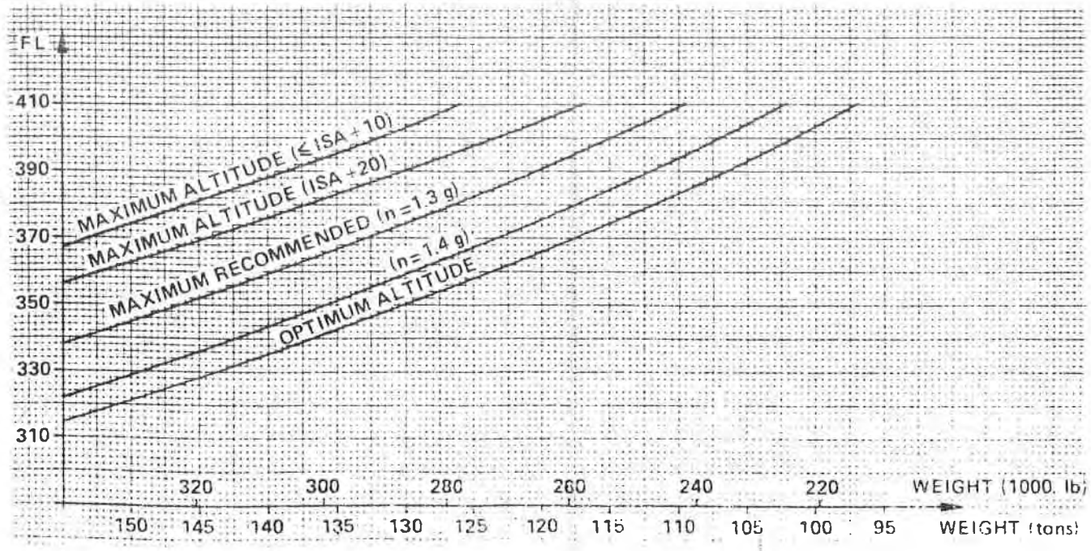
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	GRAPHICAL CALCULATION	PAGE 3	
	M = 0.79	REV 13	SEQ 085

Climb : 250/300 KT/M 0.79 – Descent M 0.79/300/250 KT



CLIMB CORRECTION ON T/O WEIGHT (tons) FL \ TOW (t)	155	150	145	140	135	130	125	120	115	110	105	100	95	90
410									1.6 –	1.6 1.7	1.5 1.7	1.5 1.6	1.4 1.6	1.3 1.5
390	ΔW at ISA ΔW at ISA + 20					1.7 –	1.7 –	1.7 1.8	1.6 1.8	1.6 1.7	1.5 1.7	1.4 1.6	1.4 1.5	1.2 1.4
370			1.8 –	1.6 –	1.8 2.0	1.7 1.9	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.7	1.5 1.6	1.4 1.5	1.3 1.5	1.2 1.4
350	1.9 –	1.9 2.1	1.9 2.1	1.8 2.0	1.8 2.0	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.7	1.5 1.6	1.4 1.5	1.3 1.5	1.3 1.4	1.2 1.3
330	1.9 2.1	1.9 2.1	1.8 2.0	1.8 2.0	1.7 1.9	1.6 1.8	1.6 1.8	1.5 1.7	1.5 1.6	1.4 1.5	1.3 1.5	1.3 1.4	1.2 1.3	1.1 1.2
310	1.9 2.1	1.8 2.0	1.8 2.0	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.7	1.4 1.6	1.4 1.5	1.3 1.4	1.3 1.4	1.2 1.3	1.1 1.2	1.1 1.2
290	1.8 2.0	1.8 1.9	1.7 1.9	1.6 1.8	1.6 1.7	1.5 1.6	1.4 1.6	1.4 1.5	1.3 1.4	1.3 1.4	1.2 1.3	1.1 1.2	1.1 1.2	1.0 1.1
CLIMB CORRECTION ON TIME 4 mn											3 mn			
CRUISE CORRECTION ON T/O WEIGHT for each degree above ISA, fuel consumption increases by : 0.007 kg per NM (air distance)														
T/O ALTITUDE CORRECTION : save 0.5 kg x TOW (tons) per 1000 ft above sea level														



Note : Time is based on TAS 450 kt (SAT – 60°C)
Per kt above 450 kt or per °C above – 60°C subtract 1.3 mn per hour flight time.

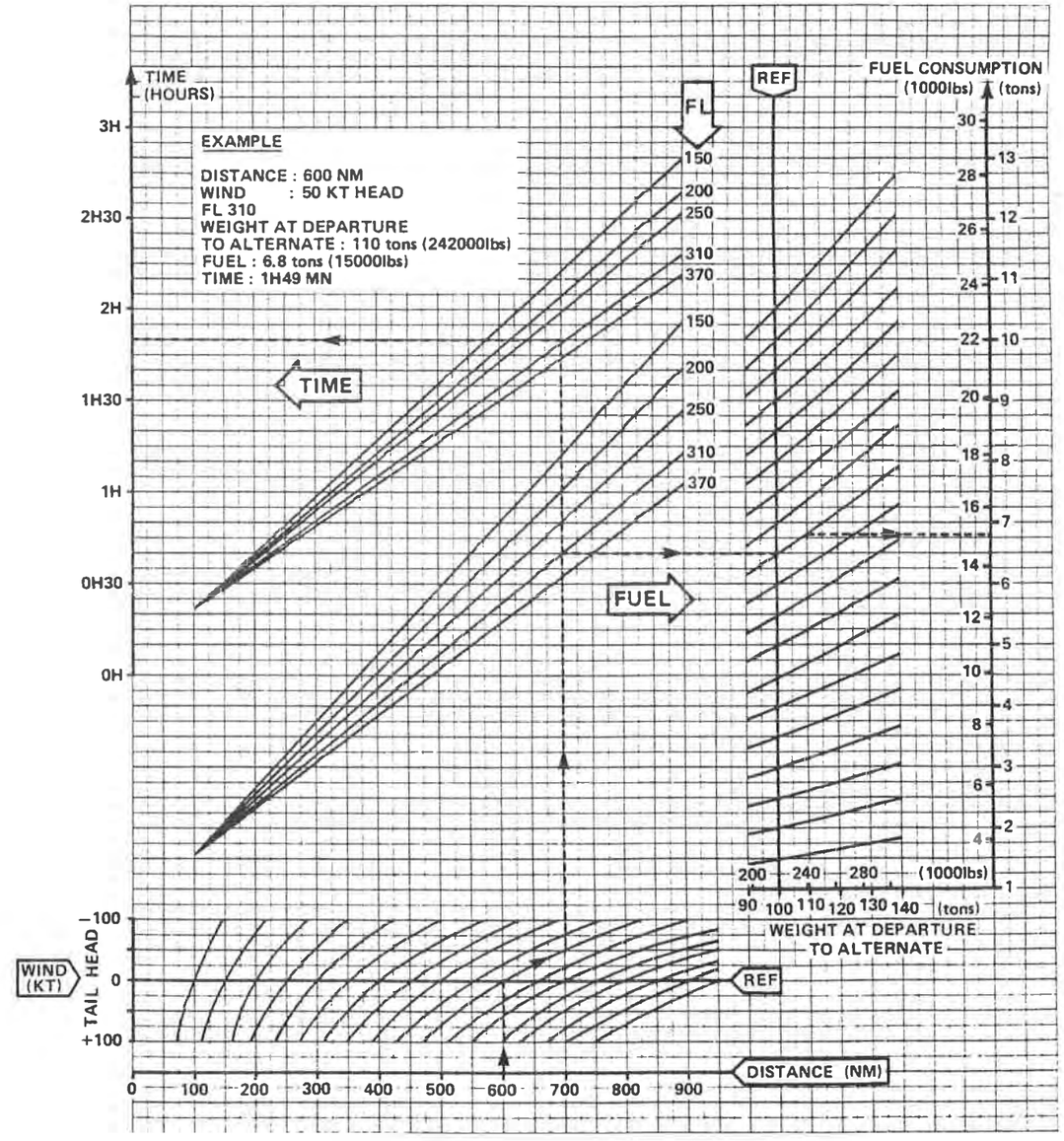
Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING GRAPHICAL CALCULATION FUEL AND TIME TO ALTERNATE	2.17.20 PAGE 4 REV 14 SEQ 070

R **FLIGHT PLANNING FROM GO AROUND TO LANDING**
R **INCLUDING : GO AROUND = 300 KG (670 lb), CLIMB 250/270 Kt/M 0.65**
R **CRUISE AT LONG RANGE, DESCENT M 0.65/270/250 KT**
R **VMC PROCEDURE = 240 KG (530 lb) and 4 MN**



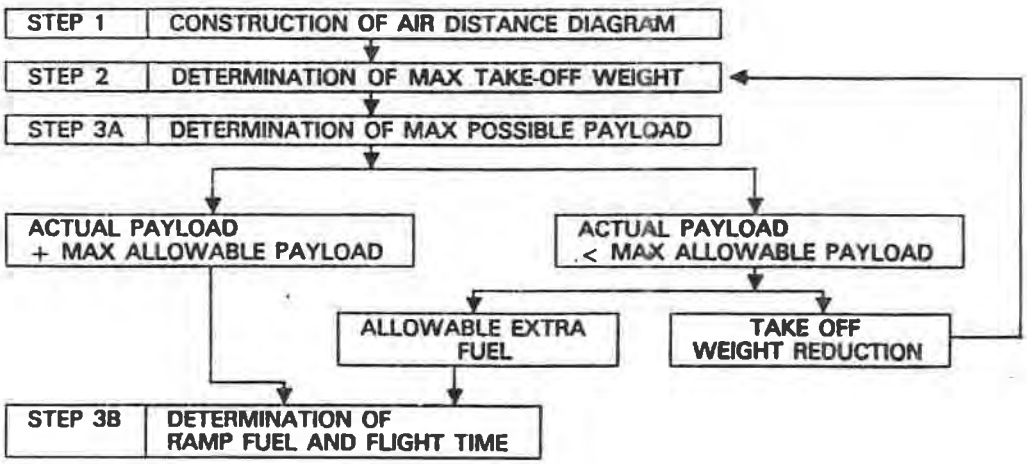
Mod. : 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING	2.17.20
		PAGE 5
R	GRAPHICAL CALCULATION	REV 11 / SEQ 501

D. STEPS FOR PREPARATION OF FUEL/TIME PLAN



(1) STEP 1 : AIR DISTANCE

(a) Explanations

- Prepare navigation log (distance between points and wind components) from which remaining ground distance will be extracted.
- Plot these distances on ground distance scale, starting from destination and working back to departure point.
- Draw parallel oblique lines at each of these points.
- From destination (point 0) follow the wind line of the last leg until intersection with oblique line of next point. This intersection represents air position of last point.
- From air position of last, draw the parallel to effective wind line of preceeding leg until intersection with next oblique line.
- Proceed in a similar way until air position of departure point is determined.
- Draw vertical lines through air positions of check points to upper and lower air distance scale. Flight time will be read at the intersection of this line with the horizontal line of TAS.

(b) Example data : Airport A → Airport B (See page 6)

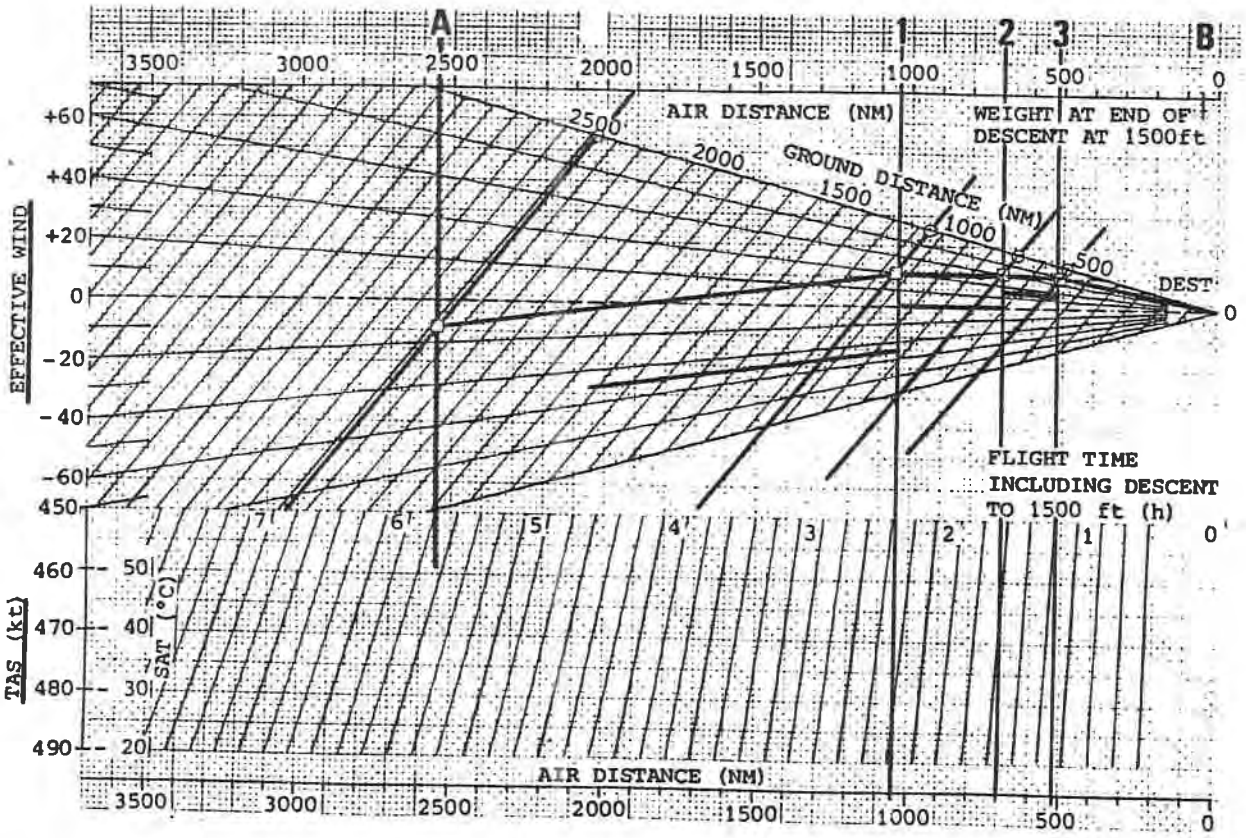
	DISTANCE	EFFECT WIND
AIRPORT A → POINT 1	1330 NM	— 50 kt
POINT 1 → POINT 2	350 NM	0 kt
POINT 2 → POINT 3	200 NM	+ 30 kt
POINT 3 → AIRPORT B	600 NM	+ 80 kt

- Prepare navigation log.
- Plot remaining ground distances.
- Draw oblique lines corresponding to remaining distances 600, 800, 1150, 2480.
- From point 0 follow the line + 80, until intersection with oblique line 600 NM.
- From air position of last point, draw the parallel to wind + 30 until intersection with oblique line 800 NM.
- Proceed in the same way for all points.
- Draw vertical lines through air positions.

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EXTRACT FROM NAVIGATION LOG

CHECK POINTS	DISTANCE BETWEEN POINTS	WIND COMPONENT	REMAINING DISTANCES
AIRPORT A DEPARTURE			2480
	1330	— 50	
POINT 1			1150
	350	0	
POINT 2			800
	200	+ 30	
POINT 3			600
	600	+ 80	
AIRPORT B DESTINATION	Total 2480		0



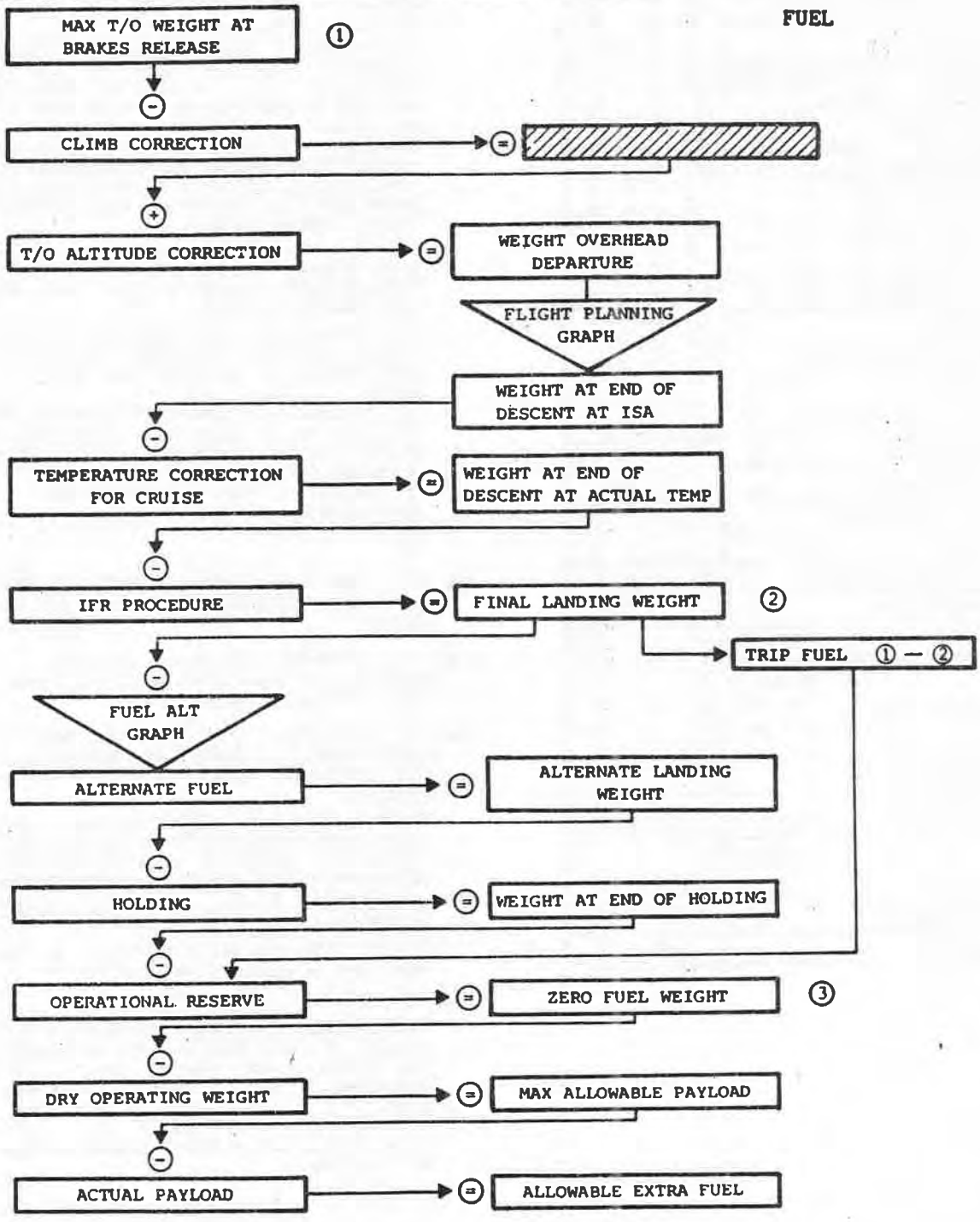
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(2) Step 2 : Determination of max take off weight

Use RTOLW charts, quick reference tables (refer to 2.09) or Flight Manual.

(3) Step 3 : Determination of payload, trip fuel, ramp fuel and flight time



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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING	2.17.20	
		PAGE 8	
R	GRAPHICAL CALCULATION	REV 11	SEQ 501

CALCULATION TABLE

1	① MAX T/O WEIGHT at brakes release	▶					
2	– CLIMB CORRECTION	–					
3		=					
4	+ T/O ALTITUDE CORRECTION	+					
5	= O/DEPT WEIGHT	=					
6	Flight planning graph END OF DESC. WEIGHT (at ISA)	▶					
7	– CRUISE CORRECTION	–					
8	= END OF DESC WEIGHT	=					
9	– IFR PROCEDURE	–					
10	② LANDING WEIGHT AT DESTINATION	=					
11	– ALTERNATE FUEL	–					
12	= ALTERNATE LANDING WEIGHT	=					
13	– HOLDING	–					
14	= WEIGHT AT END OF HOLDING	=					
15	TRIP FUEL ① - ②						
16	– «EN ROUTE» RESERVE	–					
17	③ = ZERO FUEL WEIGHT (≤MZFW) (if no extra fuel)	=					
18	– DOW	–					
19	MAX ALLOWABLE PAYLOAD	=					
20	– ACTUAL PAYLOAD	–					
21	= POSSIBLE EXTRA FUEL	=					
22	RAMP FUEL CALCULATION						
23	REQUIRED FUEL ① - ③	▶					
24	+ TAXI	+					
25	+ EXTRA FUEL	+					
26	= RAMP FUEL	=					
27	FLIGHT TIME CALCULATION						
28	GRAPH TIME	▶					
29	+ CLIMB CORRECTION	+					
30	FLIGHT TIME	=					

(4) Comments on calculation table:

Line 6: determination of WEIGHT AT END OF DESCENT AT ISA.

Use flight planning graph (A).

. Take a strip of paper and plot the distance between « WEIGHT AT END OF DESCENT INDEX » on upper air distance scale and departure air position vertical line (observe that this index is not at 0 point of the scale).

. Transfer this strip of paper into the weight/distance diagram on the horizontal line corresponding to the first selected cruise level (refer § 2.C) with departure point on the 0/DEPT. WEIGHT calculated above.

If end of descent point plotted on strip of paper is more then 2.000 ft under optimum altitude, a level change en route to the next flight level is desirable.

In the former case, plot on the strip of paper the distance where the intermediate step will be made. (Ideally at the point indicated by an arrow).

Transfer the strip of paper vertically, keeping the step point on the same weight curve to final possible cruise level. Read gross weight at end of descent point and subtract 100 kg (200 lb) to take into account the additional fuel for climbing to a higher level.

This gives WEIGHT AT END OF DESCENT AT ISA.

Line 10: *CHECK THAT LANDING WEIGHT AT DESTINATION IS LOWER THAN MAXIMUM LANDING WEIGHT.*

Line 11: ALTERNATE FUEL is determined by considering the weight at destination equal to the weight at departure to alternate.

Line 17: *CHECK THAT THE ZERO FUEL WEIGHT IS LOWER THAN MAX ZERO FUEL WEIGHT.*

STEP 3B/RAMP FUEL and FLIGHT TIME calculation.

. RAMP FUEL CALCULATION (line 22 to 26): obtained by adding REQUIRED FUEL (= MAX T/O WEIGHT - ZERO FUEL WEIGHT), TAXI FUEL (20 kg or 45 lb per min) and EXTRA FUEL (if any).

CHECK THAT IT IS LOWER THAN TANKS MAXIMUM CAPACITY.

. FLIGHT TIME CALCULATION (line 27 to 30).

Flight time = time found in graph (C)
+ climb correction (in table (D))

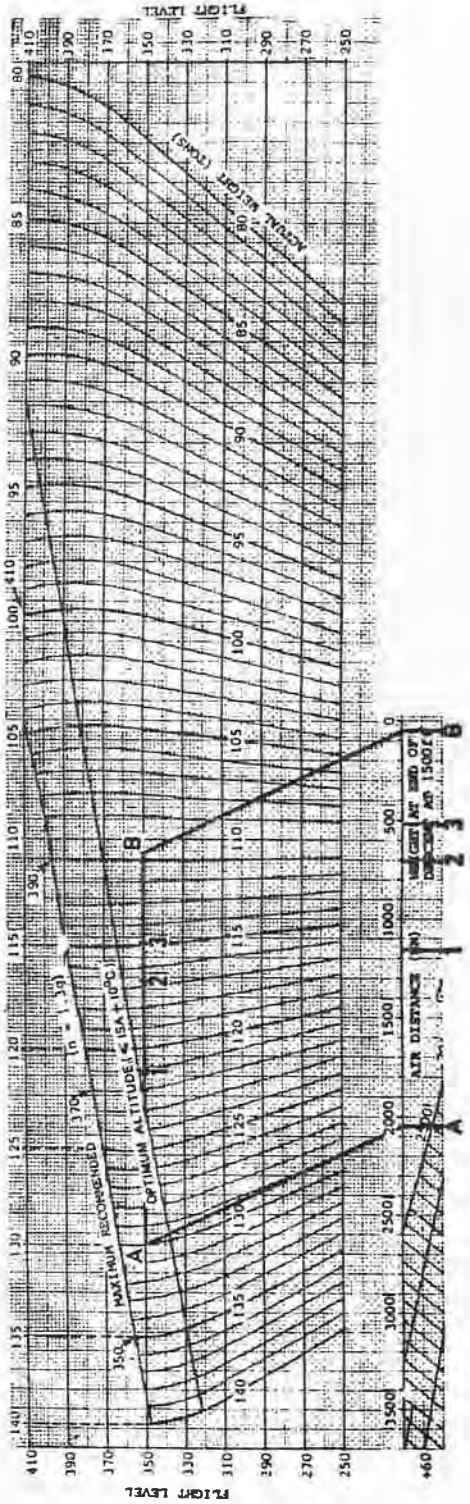
Time is found in graph (C) at the intersection of vertical line drawn from departure air position and horizontal line drawn from TAS as determined by static temperature at cruising level.

In case of level change en route, take temperature at intermediate level between initial and final levels.

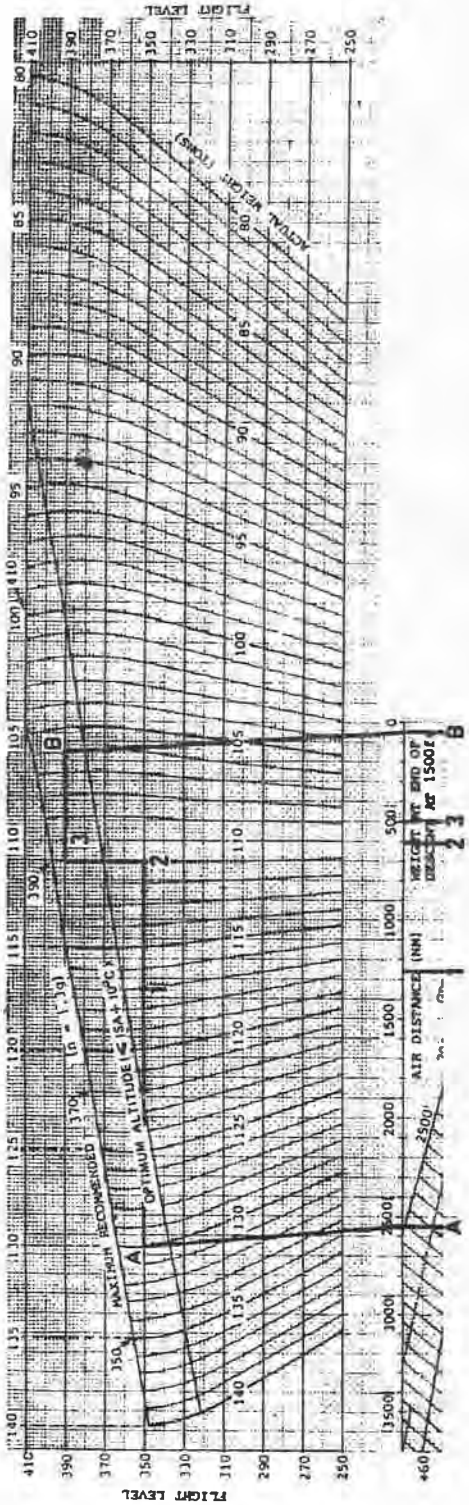
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Example 1 : NO STEP CLIMB



Example 2 : STEP CLIMB



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		PAGE 10	T
	GRAPHICAL CALCULATION	REV 12	SEQ 501

3. EXAMPLE

Continuation of example 2 page 5 and 6 Air distance 2550 NM.

DATA : Airport elevation : 1,500 ft
Max T/O weight (RTOLW charts) : 131.7 tons
Temperature : ISA + 10 along the whole flight profile
Odd flight level

A. Fill in MAX T/O WEIGHT → 131.7 tons

B. Choose first flight level : FL 350 and subtract CLIMB CORRECTION : 1.8 T → 129.9 T

C. Add T/O ALTITUDE CORRECTION :
0.5 × 131.7 × 1.5 = 99 kg = 0.1 t
To obtain O/DEPT WEIGHT =
129.9 + 0.1 = 130.0 tons

D. Determination of WEIGHT AT END OF DESCENT AT ISA.
Plot on a strip of paper the air distance from graph.
First flight level : 350 departure weight 130.0 t
Level change at 111 t → FL 390
WEIGHT AT END OF DESCENT
106.1 — 0.1 t (level change) = 106 t

E. Subtract CRUISE CORRECTION :
0.006 × 10 × 2550 = 153 kg
to obtain END OF DESCENT WEIGHT
106 — 0.2 = 105.8 t

F. Subtract IFR procedure (6 min for example)
6 × 60 = 360 kg = 0.4 t
to obtain LANDING WEIGHT AT DESTINATION
105.8 — 0.4 = 105.4 t lower than MLW

G. Subtract ALTERNATE FUEL : → corresponding graph with WEIGHT AT DEPARTURE TO ALTERNATE = 105.4 t and 340 NM at FL 200 → 4.6 t
WEIGHT AT LANDING TO ALTERNATE
105.4 — 4.6 = 100.8 t

H. Subtract HOLDING FUEL : standard account for clean configuration → 2.1 t
WEIGHT AT END OF HOLDING : 100.8 — 2.1 = 98.7 t

I. TRIP FUEL = 131.7 — 105.4 = 26.3 t

J. Subtract « EN ROUTE » RESERVE : for example 5 % of trip fuel → 1.3 t
ZERO FUEL WEIGHT = 98.7 — 1.3 = 97.4 t
97.4 t lower than MZFW

K. Subtract DOW = 80 t to obtain MAX ALLOWABLE PAYLOAD 97.4 — 80 = 17.4

L. Subtract ACTUAL PAYLOAD = 13 t to obtain POSSIBLE EXTRA FUEL → 4.4 t
RAMP FUEL CALCULATION :
34.3 + 0.2 + 4.4 = 38.9 t
FLIGHT TIME CALCULATION :
ISA + 10 at FL 350 = 44.3°
ISA + 10 at FL 390 = 46.5° read at — 45.4° → 5 h 30 mn
+ CLIMB CORRECTION 4 mn → TOTAL 5 h 34 mn

① MAX T/O WEIGHT at brakes release	▶	1	3	1	7
— CLIMB CORRECTION	—			1	8
	=	1	2	9	9
+ T/O ALTITUDE CORRECTION	+			0	1
= O/DEPT. WEIGHT	=	1	3	0	0
Flight planning graph END OF DESC. WEIGHT (at ISA)	▶	1	0	6	0
— CRUISE CORRECTION	—			0	2
= END OF DESC. WEIGHT	=	1	0	5	8
— IFR PROCEDURE	—			0	4
② LANDING WEIGHT AT DESTINATION	=	1	0	5	4
— ALTERNATE FUEL	—			4	6
= ALTERNATE LANDING WEIGHT	=	1	0	0	8
— HOLDING	—			2	1
= WEIGHT AT END OF HOLDING	=		9	8	7
TRIP FUEL ① - ② 2 6 3					
— «EN ROUTE» RESERVE	—			1	3
③ = ZERO FUEL WEIGHT (≤MZFW) (if no extra fuel)	=		9	7	4
— DOW	—		8	0	0
MAX ALLOWABLE PAYLOAD	=		1	7	4
— ACTUAL PAYLOAD	—		1	3	0
= POSSIBLE EXTRA FUEL	=			4	4

RAMP FUEL CALCULATION					
REQUIRED FUEL ① - ③	▶		3	4	3
+ TAXI	+			0	2
+ EXTRA FUEL	+			4	4
= RAMP FUEL	=		3	8	9

FLIGHT TIME CALCULATION				
GRAPH TIME	▶	5	3	0
+ CLIMB CORRECTION	+	0	0	4
FLIGHT TIME	=	5	3	4

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4. IN FLIGHT USE OF GRAPHS

A. RESERVE FUEL CHECK

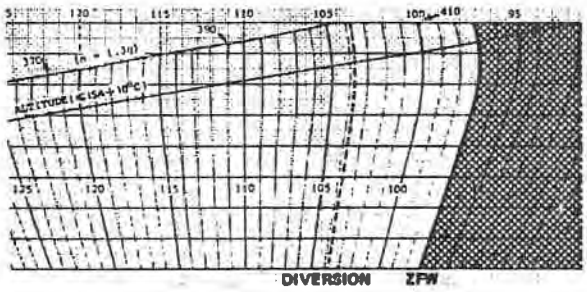
- Plot on the weight/distance diagram the curve corresponding to zero fuel weight.
  The zone located on the right side from this curve is the no-fuel zone.

- Determine diversion gross weight
  Diversion GROSS WEIGHT = ZFW + MINIMUM FUEL FOR DIVERTING

	ZFW
DIVERSION	+ ALTERNATE FUEL
GROSS WEIGHT	+ 30 mn HOLDING CLEAN

  Plot this diversion GROSS WEIGHT CURVE on the diagram.
  This curve is the « minimum reserve » curve.

  EXAMPLE: DOW = 80 tons
  Last minute load is 17 tons
  Alternate fuel: 4.6 tons
  Actual ZFW = 80 + 17 = 97 tons
  Diversion weight = 97 + 2.1 + 4.6 = 103.7 tons



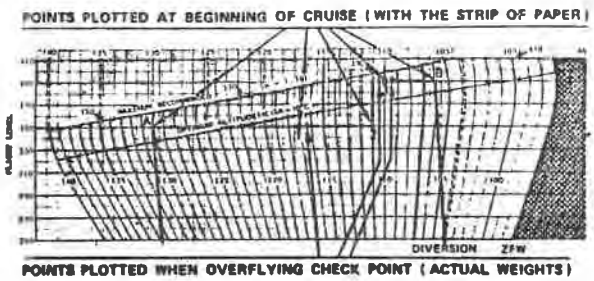
B. IN FLIGHT FOLLOW-UP

At beginning of cruise, plot the actual *weight overhead departure* (which can be different from the one taken into account for *preparation*) on actual flight level line.
Actual O/DEP W = Actual TOW — CLIMB CORRECTION (GRAPH D).
With the strip of paper, plot expected weights corresponding to check points and destination (above flight level line).

When overflying a check point, calculate actual weight and plot it opposite to expected actual weight under the flight level line. With the strip of paper, determine END DESC W corresponding to that actual weight and compare it with expected END DESC W.

EXAMPLE: Actual T.O.W. = 131.7 tons

- Plot point A at 131.7 t – CLIMB CORRECTION (1.8 tons) = 129.9 tons
- Plot actual weights of check points with the strip of paper.
- When overflying a check point plot actual weight
- With the strip of paper: determine expected END DESC W.
- Compare it with DIVERSION WEIGHT.



C. FLIGHT LEVEL CHANGE

(1) Climb at a higher level

Proceed as indicated in flight preparation.
Do not forget to subtract 100 kg at step climb.

(2) Descent at a lower level

It may be mandatory to descend at a lower level on ATC request or advisable to descend in case of turbulence.

In this case, note the actual weight at beginning of descent, plot that weight (without correction) on lower flight level line and with the strip of paper plot (above flight level line) expected weights corresponding to last check points and destination.

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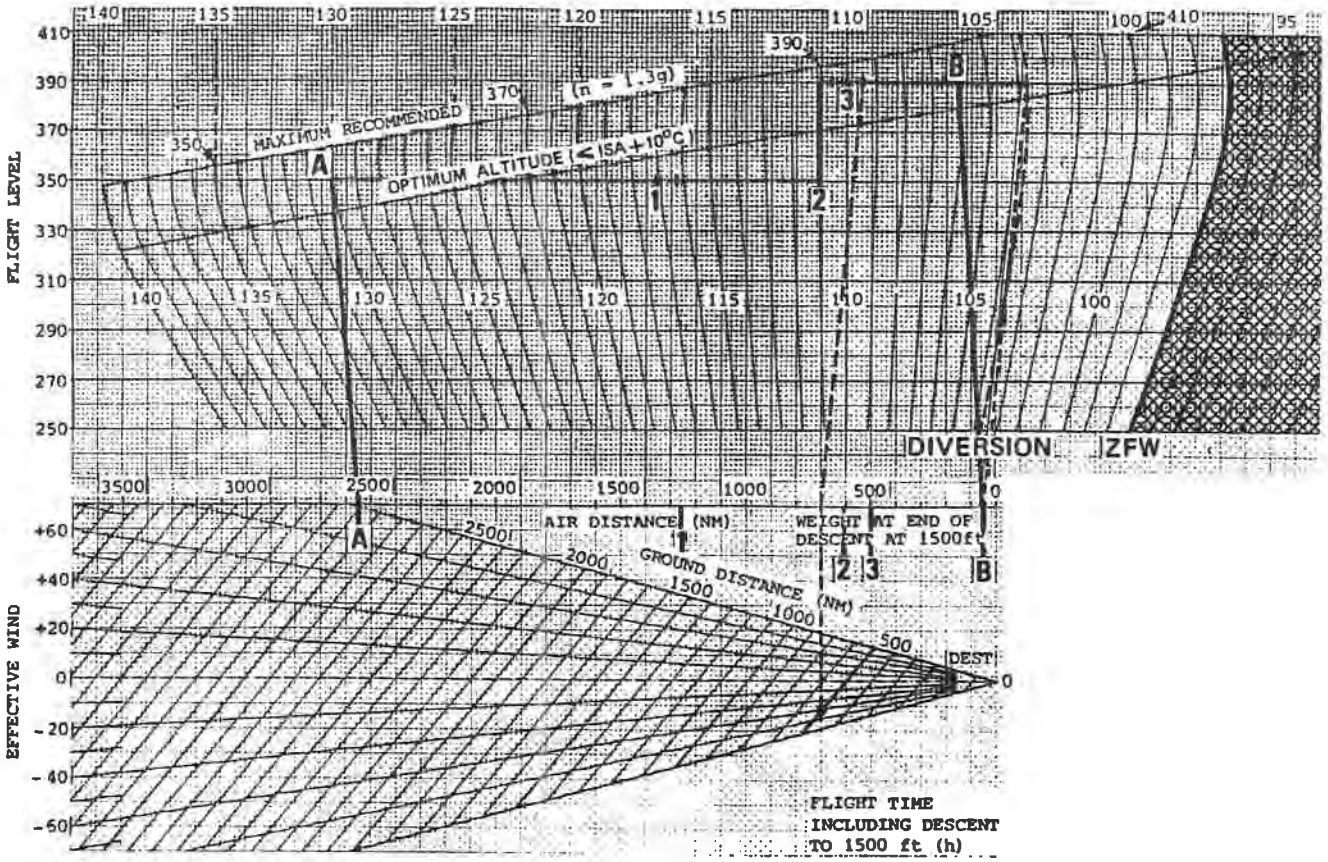
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D. MAXIMUM PERMISSIBLE WIND

Let us suppose we meet the situation shown on example, i.e., actual weights (points 1 and 2 lower marks) are lower than expected weights, because stronger winds than expected have been encountered, and the step climb is not allowed by ATC.

At point 3, we want to know which wind will allow destination to be reached. We measure (with a strip of paper) the distance between actual weight at point 3 and diversion weight curve. We transfer this distance on upper air distance scale and draw a vertical line from the extremity of the vector. The intersection with *ground distance line of* point 3 (500 NM) gives maximum permissible wind.

We can read : approximately : — 60 kt.



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A310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION	2.17.30 PAGE 1 REV 15 SEQ 001

1. GENERAL

A. FLIGHT PLANNING IS BASED UPON THE USE OF THE FOLLOWING TABLES AND GRAPH :

- Nautical ground miles to air miles conversion
- Fuel and time to destination.
- Fuel and time to alternate LRC (long range IAS or Mach numbers are given in 2.12)
- Cruise level chart

Note : In case of a flight below FL 290 for which no flight planning table is provided, the alternate table may be used by adding 120 kg to the fuel consumption and 2 minutes to the flight time given in the table (difference between IFR and VFR approaches). (The 300 kg fuel for go around will be kept since very close to the fuel consumption for take-off).

B. IN-FLIGHT CHECK :

Use IN-CRUISE QUICK CHECK, table and « Nautical Ground Miles to Air Miles Conversion » table.

Note : In case of emergency descent refer to the graphs FUEL AND TIME AT FL 100 and 140 included in chapter 2.18.20 FLIGHT WITHOUT CABIN PRESSURIZATION.

2. FLIGHT PREPARATION

A. SHORT DISTANCE CALCULATION TABLE

1	① ZERO FUEL WEIGHT	▶				
2	+ HOLDING FUEL	+				
3	= ESTIMATED LANDING WEIGHT AT ALTERNATE	=				
4	+ ALTERNATE FUEL FOR REFERENCE WEIGHT	+				
5	± CORRECTIONS FOR DEVIATION FROM REFERENCE	±				
6	= ② ESTIMATED LANDING WEIGHT AT DESTINATION	=				
7	TRIP FUEL FOR REFERENCE WEIGHT	·				
8	± CORRECTIONS FOR DEVIATION FROM REFERENCE	±				
9	= ③ TRIP FUEL	=				
10	+ "EN ROUTE" RESERVE	+				
11	+ ②	+				
12	④ = TAKE OFF WEIGHT	=				
13	− ③	−				
14	= LDG WEIGHT AT DESTINATION	=				
15	MAX PERMISSIBLE T/O WEIGHT	▶				
16	− ④					
17	= POSSIBLE EXTRA FUEL	=				

	RAMP FUEL CALCULATION					
18	REQUIRED FUEL ④−①	▶				
19	+ TAXI	+				
20	+ EXTRA FUEL	+				
21	= RAMP FUEL	=				

FB2.1730.001-AA.001

B. PREPARATION

- Use the short distance calculation table.
- Determine Zero Fuel Weight.
- Add Holding Fuel to obtain landing weight at alternate. (Refer to 2.17.10 p.1 for standard amount). R
- According to the distance between destination and alternate airport and the wind component, enter the « Nautical ground miles to air miles conversion » table at long range speed and read air distance.
- According to air distance and FL, enter the alternate table and read time and fuel required for the reference weight. Correct the fuel quantity according to the difference between the actual weight and the reference weight and for temperature deviation. This gives the alternate fuel, which, added to the landing weight at alternate, gives the landing weight at destination.
- According to the distance to go and the wind component, enter the « Nautical Ground Miles to Air Miles Conversion » table and read air distance.
- Enter the corresponding « Fuel and Time to Destination » table and read time and fuel required for the reference landing weight. Make the corrections for deviation from reference, which gives the trip fuel.
- Determine « en route » reserve : for example 5 % of trip fuel.
- Determine Take-off weight by adding landing weight at destination, trip fuel and « en route » reserve. (check it is lower than MTOW determined from RTOLW or quick reference tables).
- Determine possible extra fuel.

C. RAMP FUEL CALCULATION

This is obtained by the addition of : REQUIRED FUEL (refer to calculation table), TAXI FUEL and EXTRA FUEL.

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NAUTICAL GROUND MILES TO AIR MILES CONVERSION
M 0.79

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KTS)			HEAD WIND	
	+120	+ 80	+ 40	0	-40	-80	-120
200	158	170	184	200	219	243	272
250	198	213	230	250	274	303	339
300	237	255	276	300	329	364	407
350	277	298	322	350	384	425	475
400	317	340	368	400	439	485	543
450	356	383	414	450	493	546	611
500	396	425	460	500	548	607	679
550	435	468	506	550	603	667	747
600	475	510	552	600	658	728	815
650	514	553	598	650	713	789	883
700	554	595	643	700	767	849	950
750	594	638	689	750	822	910	1018
800	633	680	735	800	877	970	1086
850	673	723	781	850	932	1031	1154
900	712	766	827	900	987	1092	1222
950	752	808	873	950	1041	1152	1290
1000	791	851	919	1000	1096	1213	1358
1050	831	893	965	1050	1151	1274	1426
1100	871	936	1011	1100	1206	1334	1494
1150	910	978	1057	1150	1261	1395	1561
1200	950	1021	1103	1200	1316	1456	1629
1250	989	1063	1149	1250	1370	1516	1697
1300	1029	1106	1195	1300	1425	1577	1765
1350	1068	1148	1241	1350	1480	1638	1833
1400	1108	1191	1287	1400	1535	1698	1901
1450	1148	1233	1333	1450	1590	1759	1969
1500	1187	1276	1379	1500	1644	1820	2037
1550	1227	1318	1425	1550	1699	1880	2105
1600	1266	1361	1471	1600	1754	1941	2173
1650	1306	1403	1517	1650	1809	2002	2240
1700	1345	1446	1563	1700	1864	2062	2308
1750	1385	1489	1609	1750	1919	2123	2376
1800	1425	1531	1655	1800	1973	2184	2444
1850	1464	1574	1701	1850	2028	2244	2512
1900	1504	1616	1747	1900	2083	2305	2580
1950	1543	1659	1793	1950	2138	2366	2648
2000	1583	1701	1839	2000	2193	2426	2716
2050	1622	1744	1884	2050	2247	2487	2784
2100	1662	1786	1930	2100	2302	2548	2851
2150	1702	1829	1976	2150	2357	2608	2919

FLIP18A A310-304 CF6-80C2A2 2320 03751.000021 443250300 0.7900 0.000100 362 0350350220 0 420420 27 27 18590 BB

GE Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED DESTINATION	2.17.30 PAGE 3 REV 17 SEQ 030

NAUTICAL GROUND MILES TO AIR MILES CONVERSION
M 0.79

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KTS)			HEAD WIND	
	+120	+ 80	+ 40	0	-40	-80	-120
2200	1741	1871	2022	2200	2412	2669	2987
2250	1781	1914	2068	2250	2467	2730	3055
2300	1820	1956	2114	2300	2521	2790	3123
2350	1860	1999	2160	2350	2576	2851	3191
2400	1899	2041	2206	2400	2631	2911	3259
2450	1939	2084	2252	2450	2686	2972	3327
2500	1979	2126	2298	2500	2741	3033	3395
2550	2018	2169	2344	2550	2796	3093	3462
2600	2058	2211	2390	2600	2850	3154	3530
2650	2097	2254	2436	2650	2905	3215	3598
2700	2137	2297	2482	2700	2960	3275	3666
2750	2176	2339	2528	2750	3015	3336	3734
2800	2216	2382	2574	2800	3070	3397	3802
2850	2256	2424	2620	2850	3124	3457	3870
2900	2295	2467	2666	2900	3179	3518	3938
2950	2335	2509	2712	2950	3234	3579	4006
3000	2374	2552	2758	3000	3289	3639	4073
3050	2414	2594	2804	3050	3344	3700	4141
3100	2453	2637	2850	3100	3399	3761	4209
3150	2493	2679	2896	3150	3453	3821	4277
3200	2533	2722	2942	3200	3508	3882	4345
3300	2612	2807	3034	3300	3618	4003	4481
3400	2691	2892	3125	3400	3727	4125	4617
3500	2770	2977	3217	3500	3837	4246	4752
3600	2849	3062	3309	3600	3947	4367	4888
3700	2928	3147	3401	3700	4056	4489	5024
3800	3007	3232	3493	3800	4166	4610	5160
3900	3087	3317	3585	3900	4276	4731	5295
4000	3166	3402	3677	4000	4385	4852	5431
4100	3245	3487	3769	4100	4495	4974	5567
4200	3324	3572	3861	4200	4604	5095	5703
4300	3403	3657	3953	4300	4714	5216	5839
4400	3482	3743	4045	4400	4824	5338	5974
4500	3561	3828	4137	4500	4933	5459	6110
4600	3641	3913	4229	4600	5043	5580	6246
4700	3720	3998	4320	4700	5153	5702	6382
4800	3799	4083	4412	4800	5262	5823	6518
4900	3878	4168	4504	4900	5372	5944	6653
5000	3957	4253	4596	5000	5481	6066	6789
5100	4036	4338	4688	5100	5591	6187	6925

FLIP18A A310-304 CF6-80C2A2 2320 03751.000021 443250300 0.7900 0.000100 362 0350350220 0 420420 27 27 18590 BB

GE Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 4 REV 13 SEQ 092

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons
INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING
ISA
200 NM TO 900 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
900	2.08	9.8	2.09	9.3	2.10	8.9	2.10	8.6	2.11	8.4	2.11	8.3			
	2.05	9.6	2.06	9.1	2.07	8.8	2.08	8.5	2.08	8.2	2.08	8.2	29	36	53
	2.03	9.4	2.04	9.0	2.04	8.6	2.05	8.3	2.06	8.1	2.06	8.0			
	2.00	9.2	2.01	8.8	2.02	8.4	2.03	8.1	2.03	7.9	2.03	7.8			
	1.58	9.0	1.58	8.6	1.59	8.2	1.60	8.0	2.00	7.8	2.00	7.7			
800	1.55	8.8	1.56	8.4	1.57	8.1	1.57	7.8	1.58	7.6	1.58	7.5			
	1.52	8.6	1.53	8.2	1.54	7.9	1.55	7.6	1.55	7.4	1.55	7.4			
	1.50	8.4	1.51	8.0	1.51	7.7	1.52	7.4	1.52	7.3	1.52	7.2	26	33	47
	1.47	8.2	1.48	7.8	1.49	7.5	1.49	7.3	1.50	7.1	1.50	7.0			
	1.45	8.0	1.45	7.7	1.46	7.4	1.47	7.1	1.47	7.0	1.47	6.9			
700	1.42	7.8	1.43	7.5	1.43	7.2	1.44	6.9	1.44	6.8	1.44	6.7			
	1.40	7.6	1.40	7.3	1.41	7.0	1.41	6.8	1.42	6.6	1.42	6.6			
	1.37	7.4	1.38	7.1	1.38	6.8	1.39	6.6	1.39	6.5	1.39	6.4	24	29	41
	1.34	7.2	1.35	6.9	1.36	6.7	1.36	6.4	1.36	6.3	1.36	6.2			
	1.32	7.0	1.32	6.7	1.33	6.5	1.34	6.3	1.34	6.1	1.34	6.1			
600	1.29	6.8	1.30	6.5	1.30	6.3	1.31	6.1	1.31	6.0	1.31	5.9			
	1.27	6.6	1.27	6.4	1.28	6.1	1.28	5.9	1.29	5.8	1.29	5.8			
	1.24	6.4	1.25	6.2	1.25	6.0	1.26	5.8	1.26	5.7	1.26	5.6	21	26	35
	1.22	6.2	1.22	6.0	1.23	5.8	1.23	5.6	1.23	5.5	1.23	5.5			
	1.19	6.0	1.19	5.8	1.20	5.6	1.20	5.5	1.21	5.3	1.21	5.3			
500	1.16	5.8	1.17	5.6	1.17	5.4	1.18	5.3	1.18	5.2	1.18	5.1			
	1.14	5.6	1.14	5.4	1.15	5.3	1.15	5.1	1.15	5.0	1.15	5.0			
	1.11	5.4	1.12	5.2	1.12	5.1	1.12	5.0	1.13	4.9	1.13	4.8	19	22	30
	1.09	5.2	1.09	5.1	1.09	4.9	1.10	4.8	1.10	4.7	1.10	4.7			
	1.06	5.0	1.07	4.9	1.07	4.7	1.07	4.6	1.07	4.5	1.07	4.5			
400	1.04	4.8	1.04	4.7	1.04	4.6	1.04	4.5	1.05	4.4	1.05	4.4			
	1.01	4.6	1.01	4.5	1.02	4.4	1.02	4.3	1.02	4.2	1.02	4.2			
	0.58	4.4	0.59	4.3	0.59	4.2	0.59	4.1	0.59	4.1	0.59	4.1	16	19	24
	0.56	4.2	0.56	4.1	0.56	4.0	0.57	4.0	0.57	3.9	0.57	3.9			
	0.53	4.1	0.54	4.0	0.54	3.9	0.54	3.8	0.54	3.8	0.54	3.7			
300	0.51	3.9	0.51	3.8	0.51	3.7	0.51	3.6	0.51	3.6	0.51	3.6			
	0.48	3.7	0.48	3.6	0.49	3.5	0.49	3.5	0.49	3.4	0.49	3.4			
	0.46	3.5	0.46	3.4	0.46	3.3	0.46	3.3	0.46	3.3	0.46	3.3	14	16	19
	0.43	3.3	0.43	3.2	0.43	3.2	0.43	3.1	0.43	3.1	0.43	3.1			
	0.40	3.1	0.41	3.0	0.41	3.0	0.41	3.0	0.41	3.0	0.41	3.0			
200	0.38	2.9	0.38	2.9	0.38	2.8	0.38	2.8	0.38	2.8	0.38	2.8			

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* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 5 REV 13 / SEQ 592

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT: 100 tons
INCLUDING: IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 - DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % - ECONOMIC AIR CONDITIONING
ISA
800 NM TO 1500 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
1500	3.25	15.8	3.27	15.0	3.28	14.3	3.30	13.7	3.31	13.4	3.31	13.2			
	3.22	15.6	3.24	14.8	3.25	14.1	3.27	13.6	3.28	13.2	3.28	13.1	45	60	93
	3.20	15.3	3.21	14.6	3.23	13.9	3.24	13.4	3.25	13.0	3.25	12.9			
	3.17	15.1	3.19	14.4	3.20	13.7	3.22	13.2	3.23	12.9	3.23	12.7			
	3.15	14.9	3.16	14.2	3.18	13.6	3.19	13.0	3.20	12.7	3.20	12.6			
1400	3.12	14.7	3.14	14.0	3.15	13.4	3.16	12.9	3.17	12.5	3.17	12.4			
	3.10	14.5	3.11	13.8	3.12	13.2	3.14	12.7	3.15	12.4	3.15	12.2			
	3.07	14.3	3.08	13.6	3.10	13.0	3.11	12.5	3.12	12.2	3.12	12.1	42	56	86
	3.04	14.1	3.06	13.5	3.07	12.8	3.09	12.4	3.09	12.0	3.09	11.9			
	3.02	13.9	3.03	13.3	3.05	12.7	3.06	12.2	3.07	11.9	3.07	11.7			
1300	2.59	13.7	3.01	13.1	3.02	12.5	3.03	12.0	3.04	11.7	3.04	11.6			
	2.57	13.5	2.58	12.9	2.59	12.3	3.01	11.8	3.01	11.5	3.01	11.4			
	2.54	13.3	2.55	12.7	2.57	12.1	2.58	11.7	2.59	11.4	2.59	11.2	39	52	79
	2.52	13.1	2.53	12.5	2.54	12.0	2.55	11.5	2.56	11.2	2.56	11.1			
	2.49	12.9	2.50	12.3	2.51	11.8	2.53	11.3	2.53	11.0	2.53	10.9			
1200	2.46	12.7	2.48	12.1	2.49	11.6	2.50	11.2	2.51	10.9	2.51	10.8			
	2.44	12.5	2.45	11.9	2.46	11.4	2.47	11.0	2.48	10.7	2.48	10.6			
	2.41	12.3	2.42	11.8	2.44	11.2	2.45	10.8	2.45	10.5	2.45	10.4	37	48	72
	2.39	12.1	2.40	11.6	2.41	11.1	2.42	10.7	2.43	10.4	2.43	10.3			
	2.36	11.9	2.37	11.4	2.38	10.9	2.40	10.5	2.40	10.2	2.40	10.1			
1100	2.34	11.7	2.35	11.2	2.36	10.7	2.37	10.3	2.37	10.0	2.37	9.9			
	2.31	11.5	2.32	11.0	2.33	10.5	2.34	10.1	2.35	9.9	2.35	9.8			
	2.28	11.3	2.30	10.8	2.31	10.4	2.32	10.0	2.32	9.7	2.32	9.6	34	44	66
	2.26	11.1	2.27	10.6	2.28	10.2	2.29	9.8	2.30	9.6	2.30	9.4			
	2.23	11.0	2.24	10.4	2.25	10.0	2.26	9.6	2.27	9.4	2.27	9.3			
1000	2.21	10.8	2.22	10.3	2.23	9.8	2.24	9.5	2.24	9.2	2.24	9.1			
	2.18	10.6	2.19	10.1	2.20	9.6	2.21	9.3	2.22	9.1	2.22	9.0			
	2.16	10.4	2.17	9.9	2.17	9.5	2.18	9.1	2.19	8.9	2.19	8.8	31	40	59
	2.13	10.2	2.14	9.7	2.15	9.3	2.16	9.0	2.16	8.7	2.16	8.6			
	2.10	10.0	2.11	9.5	2.12	9.1	2.13	8.8	2.14	8.6	2.14	8.5			
900	2.08	9.8	2.09	9.3	2.10	8.9	2.10	8.6	2.11	8.4	2.11	8.3			
	2.05	9.6	2.06	9.1	2.07	8.8	2.08	8.5	2.08	8.2	2.08	8.2			
	2.03	9.4	2.04	9.0	2.04	8.6	2.05	8.3	2.06	8.1	2.06	8.0	29	36	53
	2.00	9.2	2.01	8.8	2.02	8.4	2.03	8.1	2.03	7.9	2.03	7.8			
	1.58	9.0	1.58	8.6	1.59	8.2	1.60	8.0	2.00	7.8	2.00	7.7			
800	1.55	8.8	1.56	8.4	1.57	8.1	1.57	7.8	1.58	7.6	1.58	7.5			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT - ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE - ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 6 REV 13 | SEQ 592

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons
INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING
ISA
1400 NM TO 2100 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
2100	4.42	21.8	4.44	20.7	4.47	19.7	4.49	19.0	4.50	18.5	4.50	18.4			
	4.40	21.6	4.42	20.5	4.44	19.5	4.46	18.8	4.47	18.3	4.47	18.2	63	87	141
	4.37	21.4	4.39	20.3	4.41	19.4	4.44	18.6	4.45	18.2	4.45	18.0			
	4.35	21.2	4.37	20.1	4.39	19.2	4.41	18.4	4.42	18.0	4.42	17.9			
	4.32	21.0	4.34	19.9	4.36	19.0	4.38	18.3	4.39	17.8	4.39	17.7			
2000	4.29	20.8	4.31	19.7	4.34	18.8	4.36	18.1	4.37	17.6	4.37	17.5			
	4.27	20.6	4.29	19.5	4.31	18.6	4.33	17.9	4.34	17.5	4.34	17.3			
	4.24	20.4	4.26	19.4	4.28	18.4	4.30	17.7	4.32	17.3	4.32	17.2	59	82	132
	4.22	20.2	4.24	19.2	4.26	18.3	4.28	17.6	4.29	17.1	4.29	17.0			
	4.19	20.0	4.21	19.0	4.23	18.1	4.25	17.4	4.26	17.0	4.26	16.8			
1900	4.17	19.8	4.18	18.8	4.20	17.9	4.22	17.2	4.24	16.8	4.24	16.6			
	4.14	19.6	4.16	18.6	4.18	17.7	4.20	17.0	4.21	16.6	4.21	16.5			
	4.11	19.4	4.13	18.4	4.15	17.5	4.17	16.9	4.18	16.4	4.18	16.3	56	78	124
	4.09	19.2	4.11	18.2	4.13	17.4	4.15	16.7	4.16	16.3	4.16	16.1			
	4.06	19.0	4.08	18.0	4.10	17.2	4.12	16.5	4.13	16.1	4.13	16.0			
1800	4.04	18.8	4.05	17.8	4.07	17.0	4.09	16.3	4.10	15.9	4.10	15.8			
	4.01	18.6	4.03	17.6	4.05	16.8	4.07	16.2	4.08	15.7	4.08	15.6			
	3.59	18.4	4.00	17.4	4.02	16.6	4.04	16.0	4.05	15.6	4.05	15.4	53	73	116
	3.56	18.2	3.58	17.2	3.59	16.4	4.01	15.8	4.02	15.4	4.02	15.3			
	3.53	18.0	3.55	17.1	3.57	16.3	3.59	15.6	3.60	15.2	3.60	15.1			
1700	3.51	17.8	3.53	16.9	3.54	16.1	3.56	15.5	3.57	15.1	3.57	14.9			
	3.48	17.6	3.50	16.7	3.52	15.9	3.53	15.3	3.54	14.9	3.54	14.8			
	3.46	17.4	3.47	16.5	3.49	15.7	3.51	15.1	3.52	14.7	3.52	14.6	51	68	108
	3.43	17.2	3.45	16.3	3.46	15.5	3.48	14.9	3.49	14.6	3.49	14.4			
	3.41	17.0	3.42	16.1	3.44	15.4	3.45	14.8	3.46	14.4	3.46	14.3			
1600	3.38	16.8	3.40	15.9	3.41	15.2	3.43	14.6	3.44	14.2	3.44	14.1			
	3.35	16.6	3.37	15.7	3.39	15.0	3.40	14.4	3.41	14.0	3.41	13.9			
	3.33	16.4	3.34	15.5	3.36	14.8	3.38	14.2	3.38	13.9	3.38	13.7	48	64	100
	3.30	16.2	3.32	15.3	3.33	14.6	3.35	14.1	3.36	13.7	3.36	13.6			
	3.28	16.0	3.29	15.2	3.31	14.5	3.32	13.9	3.33	13.5	3.33	13.4			
1500	3.25	15.8	3.27	15.0	3.28	14.3	3.30	13.7	3.31	13.4	3.31	13.2			
	3.22	15.6	3.24	14.8	3.25	14.1	3.27	13.6	3.28	13.2	3.28	13.1			
	3.20	15.3	3.21	14.6	3.23	13.9	3.24	13.4	3.25	13.0	3.25	12.9	45	60	93
	3.17	15.1	3.19	14.4	3.20	13.7	3.22	13.2	3.23	12.9	3.23	12.7			
	3.15	14.9	3.16	14.2	3.18	13.6	3.19	13.0	3.20	12.7	3.20	12.6			
1400	3.12	14.7	3.14	14.0	3.15	13.4	3.16	12.9	3.17	12.5	3.17	12.4			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 7 REV 13 | SEQ 592

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons

R INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)

CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT

R C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING

ISA

2000 NM TO 2700 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) — FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
2700	5.59	28.0	6.02	26.5	6.05	25.3	6.08	24.4	6.10	23.8	6.10	23.8			
	5.57	27.8	5.60	26.4	6.02	25.1	6.05	24.2	6.07	23.7	6.07	23.6	82	121	199
	5.54	27.6	5.57	26.2	5.60	24.9	6.03	24.0	6.04	23.5	6.04	23.4			
	5.52	27.4	5.54	26.0	5.57	24.7	6.00	23.8	6.02	23.3	6.02	23.2			
	5.49	27.2	5.52	25.8	5.55	24.6	5.57	23.6	5.59	23.1	5.59	23.1			
2600	5.47	27.0	5.49	25.6	5.52	24.4	5.55	23.5	5.56	22.9	5.56	22.9			
	5.44	26.8	5.47	25.4	5.49	24.2	5.52	23.3	5.54	22.8	5.54	22.7			
	5.41	26.6	5.44	25.2	5.47	24.0	5.50	23.1	5.51	22.6	5.51	22.5	79	114	189
	5.39	26.4	5.41	25.0	5.44	23.8	5.47	22.9	5.48	22.4	5.48	22.3			
	5.36	26.1	5.39	24.8	5.42	23.6	5.44	22.7	5.46	22.2	5.46	22.1			
2500	5.34	25.9	5.36	24.6	5.39	23.4	5.42	22.5	5.43	22.0	5.43	22.0			
	5.31	25.7	5.34	24.4	5.36	23.2	5.39	22.4	5.41	21.9	5.41	21.8			
	5.29	25.5	5.31	24.2	5.34	23.1	5.36	22.2	5.38	21.7	5.38	21.6	75	109	178
	5.26	25.3	5.28	24.0	5.31	22.9	5.34	22.0	5.35	21.5	5.35	21.4			
	5.23	25.1	5.26	23.8	5.28	22.7	5.31	21.8	5.33	21.3	5.33	21.2			
2400	5.21	24.9	5.23	23.6	5.26	22.5	5.28	21.6	5.30	21.2	5.30	21.1			
	5.18	24.7	5.21	23.4	5.23	22.3	5.26	21.5	5.27	21.0	5.27	20.9			
	5.16	24.5	5.18	23.2	5.21	22.1	5.23	21.3	5.25	20.8	5.25	20.7	72	103	168
	5.13	24.3	5.16	23.0	5.18	21.9	5.21	21.1	5.22	20.6	5.22	20.5			
	5.11	24.1	5.13	22.8	5.15	21.8	5.18	20.9	5.19	20.4	5.19	20.3			
2300	5.08	23.9	5.10	22.6	5.13	21.6	5.15	20.7	5.17	20.3	5.17	20.2			
	5.05	23.7	5.08	22.4	5.10	21.4	5.13	20.6	5.14	20.1	5.14	20.0			
	5.03	23.5	5.05	22.3	5.08	21.2	5.10	20.4	5.11	19.9	5.11	19.8	69	98	159
	5.00	23.3	5.03	22.1	5.05	21.0	5.07	20.2	5.09	19.7	5.09	19.6			
	4.58	23.1	4.60	21.9	5.02	20.8	5.05	20.0	5.06	19.6	5.06	19.4			
2200	4.55	22.9	4.57	21.7	4.60	20.7	5.02	19.9	5.03	19.4	5.03	19.3			
	4.53	22.7	4.55	21.5	4.57	20.5	4.59	19.7	5.01	19.2	5.01	19.1			
	4.50	22.4	4.52	21.3	4.54	20.3	4.57	19.5	4.58	19.0	4.58	18.9	66	92	150
	4.47	22.2	4.50	21.1	4.52	20.1	4.54	19.3	4.55	18.9	4.55	18.7			
	4.45	22.0	4.47	20.9	4.49	19.9	4.51	19.1	4.53	18.7	4.53	18.6			
2100	4.42	21.8	4.44	20.7	4.47	19.7	4.49	19.0	4.50	18.5	4.50	18.4			
	4.40	21.6	4.42	20.5	4.44	19.5	4.46	18.8	4.47	18.3	4.47	18.2			
	4.37	21.4	4.39	20.3	4.41	19.4	4.44	18.6	4.45	18.2	4.45	18.0	63	87	141
	4.35	21.2	4.37	20.1	4.39	19.2	4.41	18.4	4.42	18.0	4.42	17.9			
	4.32	21.0	4.34	19.9	4.36	19.0	4.38	18.3	4.39	17.8	4.39	17.7			
2000	4.29	20.8	4.31	19.7	4.34	18.8	4.36	18.1	4.37	17.6	4.37	17.5			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

R TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 8 REV 13 SEQ 592

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons
INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING
ISA
2600 NM TO 3300 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
3300	7.17	34.3	7.20	32.5	7.24	31.0	7.27	29.9	7.29	29.4	7.29	29.5			
	7.14	34.1	7.17	32.3	7.21	30.8	7.25	29.8	7.27	29.2	7.27	29.3	106	159	269
	7.11	33.9	7.15	32.1	7.18	30.7	7.22	29.6	7.24	29.0	7.24	29.1			
	7.09	33.7	7.12	31.9	7.16	30.5	7.19	29.4	7.21	28.8	7.21	28.9			
	7.06	33.5	7.10	31.7	7.13	30.3	7.17	29.2	7.19	28.7	7.19	28.7			
3200	7.04	33.2	7.07	31.5	7.11	30.1	7.14	29.0	7.16	28.5	7.16	28.5			
	7.01	33.0	7.04	31.3	7.08	29.9	7.11	28.8	7.13	28.3	7.13	28.4			
	6.59	32.8	7.02	31.1	7.05	29.7	7.09	28.6	7.11	28.1	7.11	28.2	102	153	259
	6.56	32.6	6.59	30.9	7.03	29.5	7.06	28.4	7.08	27.9	7.08	28.0			
	6.53	32.4	6.57	30.7	7.00	29.3	7.03	28.2	7.05	27.7	7.05	27.8			
3100	6.51	32.2	6.54	30.5	6.57	29.1	7.01	28.1	7.03	27.5	7.03	27.6			
	6.48	32.0	6.52	30.3	6.55	28.9	6.58	27.9	7.00	27.3	7.00	27.4			
	6.46	31.8	6.49	30.1	6.52	28.7	6.56	27.7	6.57	27.2	6.57	27.2	98	146	247
	6.43	31.6	6.46	29.9	6.50	28.5	6.53	27.5	6.55	27.0	6.55	27.0			
	6.41	31.3	6.44	29.7	6.47	28.3	6.50	27.3	6.52	26.8	6.52	26.8			
3000	6.38	31.1	6.41	29.5	6.44	28.2	6.48	27.1	6.49	26.6	6.49	26.6			
	6.35	30.9	6.39	29.3	6.42	28.0	6.45	26.9	6.47	26.4	6.47	26.4			
	6.33	30.7	6.36	29.1	6.39	27.8	6.42	26.8	6.44	26.2	6.44	26.2	94	139	235
	6.30	30.5	6.33	28.9	6.36	27.6	6.40	26.6	6.42	26.0	6.42	26.0			
	6.28	30.3	6.31	28.7	6.34	27.4	6.37	26.4	6.39	25.9	6.39	25.8			
2900	6.25	30.1	6.28	28.5	6.31	27.2	6.34	26.2	6.36	25.7	6.36	25.7			
	6.23	29.9	6.26	28.3	6.29	27.0	6.32	26.0	6.34	25.5	6.34	25.5			
	6.20	29.7	6.23	28.1	6.26	26.8	6.29	25.8	6.31	25.3	6.31	25.3	90	133	222
	6.17	29.5	6.20	27.9	6.23	26.6	6.27	25.6	6.28	25.1	6.28	25.1			
	6.15	29.3	6.18	27.7	6.21	26.4	6.24	25.5	6.26	24.9	6.26	24.9			
2800	6.12	29.0	6.15	27.5	6.18	26.3	6.21	25.3	6.23	24.8	6.23	24.7			
	6.10	28.8	6.13	27.3	6.16	26.1	6.19	25.1	6.20	24.6	6.20	24.5			
	6.07	28.6	6.10	27.1	6.13	25.9	6.16	24.9	6.18	24.4	6.18	24.3	86	127	210
	6.05	28.4	6.07	26.9	6.10	25.7	6.13	24.7	6.15	24.2	6.15	24.2			
	6.02	28.2	6.05	26.7	6.08	25.5	6.11	24.5	6.12	24.0	6.12	24.0			
2700	5.59	28.0	6.02	26.5	6.05	25.3	6.08	24.4	6.10	23.8	6.10	23.8			
	5.57	27.8	5.60	26.4	6.02	25.1	6.05	24.2	6.07	23.7	6.07	23.6			
	5.54	27.6	5.57	26.2	5.60	24.9	6.03	24.0	6.04	23.5	6.04	23.4	82	121	199
	5.52	27.4	5.54	26.0	5.57	24.7	6.00	23.8	6.02	23.3	6.02	23.2			
	5.49	27.2	5.52	25.8	5.55	24.6	5.57	23.6	5.59	23.1	5.59	23.1			
2600	5.47	27.0	5.49	25.6	5.52	24.4	5.55	23.5	5.56	22.9	5.56	22.9			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863 GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 9 REV 14 SEQ 110

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons
INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING
ISA
3200 NM TO 3900 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
3900	8.34	40.7	8.38	38.6	8.42	36.9	8.46	35.8	8.49	35.3	8.49 *	35.7			
	8.31	40.5	8.35	38.4	8.40	36.7	8.44	35.6	8.46	35.1	8.46 *	35.5	132	204	325
	8.29	40.3	8.33	38.2	8.37	36.5	8.41	35.4	8.44	34.9	8.44 *	35.3			
	8.26	40.1	8.30	38.0	8.34	36.3	8.39	35.2	8.41	34.7	8.41 *	35.1			
	8.23	39.9	8.28	37.8	8.32	36.1	8.36	35.0	8.38	34.5	8.38 *	34.9			
3800	8.21	39.6	8.25	37.6	8.29	35.9	8.33	34.8	8.36	34.3	8.36	34.7			
	8.18	39.4	8.22	37.4	8.26	35.7	8.31	34.6	8.33	34.1	8.33	34.5			
	8.16	39.2	8.20	37.2	8.24	35.5	8.28	34.4	8.30	33.9	8.30	34.2	127	196	316
	8.13	39.0	8.17	37.0	8.21	35.3	8.25	34.2	8.28	33.7	8.28	34.0			
	8.11	38.8	8.15	36.8	8.19	35.1	8.23	34.0	8.25	33.5	8.25	33.8			
3700	8.08	38.6	8.12	36.6	8.16	34.9	8.20	33.8	8.22	33.3	8.22	33.6			
	8.05	38.3	8.09	36.4	8.13	34.7	8.17	33.6	8.20	33.1	8.20	33.4			
	8.03	38.1	8.07	36.2	8.11	34.5	8.15	33.4	8.17	32.9	8.17	33.2	123	188	306
	8.00	37.9	8.04	36.0	8.08	34.4	8.12	33.2	8.14	32.7	8.14	33.0			
	7.58	37.7	8.02	35.7	8.05	34.2	8.10	33.0	8.12	32.5	8.12	32.8			
3600	7.55	37.5	7.59	35.5	8.03	34.0	8.07	32.8	8.09	32.3	8.09	32.6			
	7.53	37.3	7.56	35.3	8.00	33.8	8.04	32.6	8.06	32.1	8.06	32.4			
	7.50	37.1	7.54	35.1	7.58	33.6	8.02	32.4	8.04	31.9	8.04	32.2	118	181	297
	7.47	36.9	7.51	34.9	7.55	33.4	7.59	32.2	8.01	31.7	8.01	32.0			
	7.45	36.6	7.49	34.7	7.52	33.2	7.56	32.0	7.58	31.5	7.58	31.8			
3500	7.42	36.4	7.46	34.5	7.50	33.0	7.54	31.9	7.56	31.3	7.56	31.6			
	7.40	36.2	7.43	34.3	7.47	32.8	7.51	31.7	7.53	31.1	7.53	31.4			
	7.37	36.0	7.41	34.1	7.45	32.6	7.48	31.5	7.51	30.9	7.51	31.2	114	173	288
	7.35	35.8	7.38	33.9	7.42	32.4	7.46	31.3	7.48	30.7	7.48	30.9			
	7.32	35.6	7.36	33.7	7.39	32.2	7.43	31.1	7.45	30.5	7.45	30.7			
3400	7.29	35.4	7.33	33.5	7.37	32.0	7.40	30.9	7.43	30.4	7.43	30.5			
	7.27	35.1	7.30	33.3	7.34	31.8	7.38	30.7	7.40	30.2	7.40	30.3			
	7.24	34.9	7.28	33.1	7.31	31.6	7.35	30.5	7.37	30.0	7.37	30.1	110	166	278
	7.22	34.7	7.25	32.9	7.29	31.4	7.33	30.3	7.35	29.8	7.35	29.9			
	7.19	34.5	7.23	32.7	7.26	31.2	7.30	30.1	7.32	29.6	7.32	29.7			
3300	7.17	34.3	7.20	32.5	7.24	31.0	7.27	29.9	7.29	29.4	7.29	29.5			
	7.14	34.1	7.17	32.3	7.21	30.8	7.25	29.8	7.27	29.2	7.27	29.3			
	7.11	33.9	7.15	32.1	7.18	30.7	7.22	29.6	7.24	29.0	7.24	29.1	106	159	269
	7.09	33.7	7.12	31.9	7.16	30.5	7.19	29.4	7.21	28.8	7.21	28.9			
	7.06	33.5	7.10	31.7	7.13	30.3	7.17	29.2	7.19	28.7	7.19	28.7			
3200	7.04	33.2	7.07	31.5	7.11	30.1	7.14	29.0	7.16	28.5	7.16	28.5			

R *Note : In the table, « * » means that a step of 4000 ft has to be carried out so as to reach the corresponding FL.*

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION FUEL AND TIME TO DESTINATION M.79	2.17.30 PAGE 10 REV 14 | SEQ 100

FLIGHT PLANNING FROM BRAKES RELEASE TO LANDING

REFERENCE LANDING WEIGHT : 100 tons
INCLUDING : IMC PROCEDURE = 360 KG (6 MIN)
CLIMB = 250 KT/300 KT/M.79 – DESCENT = M.79/300 KT/250 KT
C.G. POSITION = 37.5 % – ECONOMIC AIR CONDITIONING
ISA
3800 NM TO 4500 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) — FLIGHT LEVEL 290		310		330		350		370		390	* ΔFC (kg/t) FL 290 310	FL 330 350	FL 370 390
4500	9.51	47.3	9.56	44.9	10.01	43.0	10.06	41.8	10.09	41.4	10.08 * 41.7			
	9.48	47.0	9.53	44.7	9.58	42.8	10.03	41.6	10.06	41.2	10.05 * 41.5	156	254	381
	9.46	46.8	9.51	44.5	9.55	42.6	10.00	41.4	10.03	41.0	10.03 * 41.3			
	9.43	46.6	9.48	44.3	9.53	42.4	9.58	41.2	10.01	40.8	10.00 * 41.1			
	9.41	46.4	9.45	44.0	9.50	42.2	9.55	41.0	9.58	40.6	9.58 * 40.9			
4400	9.38	46.2	9.43	43.8	9.48	42.0	9.52	40.8	9.55	40.4	9.55 * 40.7			
	9.36	45.9	9.40	43.6	9.45	41.8	9.50	40.6	9.53	40.2	9.52 * 40.5			
	9.33	45.7	9.38	43.4	9.42	41.6	9.47	40.4	9.50	40.0	9.50 * 40.3	154	245	373
	9.30	45.5	9.35	43.2	9.40	41.4	9.45	40.2	9.47	39.8	9.47 * 40.1			
	9.28	45.3	9.32	43.0	9.37	41.2	9.42	40.0	9.45	39.6	9.44 * 39.9			
4300	9.25	45.1	9.30	42.8	9.34	41.0	9.39	39.8	9.42	39.3	9.42 * 39.7			
	9.23	44.8	9.27	42.6	9.32	40.8	9.37	39.6	9.39	39.1	9.39 * 39.5			
	9.20	44.6	9.25	42.4	9.29	40.6	9.34	39.4	9.37	38.9	9.36 * 39.3	150	237	363
	9.18	44.4	9.22	42.2	9.27	40.4	9.31	39.2	9.34	38.7	9.34 * 39.1			
	9.15	44.2	9.19	41.9	9.24	40.2	9.29	39.0	9.31	38.5	9.31 * 38.9			
4200	9.12	44.0	9.17	41.7	9.21	40.0	9.26	38.8	9.29	38.3	9.28 * 38.7			
	9.10	43.8	9.14	41.5	9.19	39.7	9.23	38.6	9.26	38.1	9.26 * 38.5			
	9.07	43.5	9.12	41.3	9.16	39.5	9.21	38.4	9.23	37.9	9.23 * 38.3	146	228	353
	9.05	43.3	9.09	41.1	9.14	39.3	9.18	38.2	9.21	37.7	9.21 * 38.1			
	9.02	43.1	9.06	40.9	9.11	39.1	9.16	37.9	9.18	37.5	9.18 * 37.9			
4100	8.60	42.9	9.04	40.7	9.08	38.9	9.13	37.7	9.15	37.3	9.15 * 37.7			
	8.57	42.7	9.01	40.5	9.06	38.7	9.10	37.5	9.13	37.1	9.13 * 37.5			
	8.54	42.4	8.59	40.3	9.03	38.5	9.08	37.3	9.10	36.9	9.10 * 37.3	141	220	344
	8.52	42.2	8.56	40.1	9.00	38.3	9.05	37.1	9.07	36.7	9.07 * 37.1			
	8.49	42.0	8.53	39.9	8.58	38.1	9.02	36.9	9.05	36.5	9.05 * 36.9			
4000	8.47	41.8	8.51	39.7	8.55	37.9	8.60	36.7	9.02	36.3	9.02 * 36.7			
	8.41	41.6	8.48	39.4	8.53	37.7	8.57	36.5	8.60	36.1	8.59 * 36.5			
	8.42	41.4	8.46	39.2	8.50	37.5	8.54	36.4	8.57	35.9	8.57 * 36.3	137	212	334
	8.39	41.1	8.43	39.0	8.47	37.3	8.52	36.2	8.54	35.7	8.54 * 36.1			
	8.36	40.9	8.40	38.8	8.45	37.1	8.49	36.0	8.52	35.5	8.51 * 35.9			
3900	8.34	40.7	8.38	38.6	8.42	36.9	8.46	35.8	8.49	35.3	8.49 * 35.7			
	8.31	40.5	8.35	38.4	8.40	36.7	8.44	35.6	8.46	35.1	8.46 * 35.5			
	8.29	40.3	8.33	38.2	8.37	36.5	8.41	35.4	8.44	34.9	8.44 * 35.3	132	204	325
	8.26	40.1	8.30	38.0	8.34	36.3	8.39	35.2	8.41	34.7	8.41 * 35.1			
	8.23	39.9	8.28	37.8	8.32	36.1	8.36	35.0	8.38	34.5	8.38 * 34.9			
3800	8.21	39.6	8.25	37.6	8.29	35.9	8.33	34.8	8.36	34.3	8.36 34.7			

R *Note : In the table, « * » means that a step of 4000 ft has to be carried out so as to reach the corresponding FL.*

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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NAUTICAL GROUND MILES TO AIR MILES CONVERSION LONG RANGE

	TAIL			WIND COMPONEND – KTS			HEAD
DIST TO GO	+120	+80	+40	0	-40	-80	-120
200	148	162	179	200	226	259	305
225	167	182	201	225	254	292	343
250	185	203	224	250	282	324	382
275	204	223	246	275	310	357	420
300	222	243	268	300	339	389	458
325	241	264	291	325	367	422	496
350	260	284	313	350	395	454	534
375	278	304	336	375	423	487	573
400	297	325	358	400	452	519	611
425	315	345	381	425	480	552	649
450	334	365	403	450	508	584	687
475	352	386	425	475	536	617	726
500	371	406	448	500	565	649	764
525	390	426	470	525	593	682	802
550	408	446	493	550	621	714	840
575	427	467	515	575	649	747	878
600	445	487	537	600	678	779	917
625	464	507	560	625	706	812	955
650	483	528	582	650	734	844	993
675	501	548	605	675	762	877	1031
700	520	568	627	700	791	909	1069
725	538	589	650	725	819	942	1108
750	557	609	672	750	847	974	1146
775	575	629	694	775	875	1007	1184
800	594	650	717	800	904	1039	1222
825	613	670	739	825	932	1072	1260
850	631	690	762	850	960	1104	1299
875	650	711	784	875	988	1137	1337
900	668	731	806	900	1017	1169	1375
925	687	751	829	925	1045	1202	1413
950	705	772	851	950	1073	1234	1452
975	724	792	874	975	1102	1267	1490
1000	743	812	896	1000	1130	1299	1528

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FLIGHT PLANNING FROM GO AROUND TO LANDING INCLUDING

REFERENCE LANDING WEIGHT : 100 tons
GO AROUND = 300 KG – CLIMB = 250 KT/270 KT/M.65 – CRUISE AT LONG RANGE
DESCENT = M.65/270 KT/250 KT – VMC PROCEDURE = 240 KG (4 MIN)
ECONOMIC AIR CONDITIONING
ISA
100 NM TO 800 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 100		150		200		250		270		290		310		* ΔFC(kg/t) FL 100 150	FL 200 250	FL 270 290	FL 310
800	2.34	10.9	2.25	9.9	2.20	9.1	2.10	8.5	2.06	8.3	2.04	8.1	2.02	7.8				
	2.31	10.6	2.22	9.7	2.17	8.9	2.07	8.3	2.03	8.1	2.01	7.9	1.59	7.7	41	41	39	38
	2.27	10.3	2.18	9.5	2.13	8.7	2.04	8.1	2.00	7.9	1.58	7.7	1.56	7.5				
	2.23	10.1	2.15	9.2	2.10	8.5	2.01	7.9	1.57	7.7	1.55	7.5	1.54	7.3				
	2.20	9.8	2.11	9.0	2.07	8.3	1.58	7.7	1.54	7.5	1.52	7.3	1.51	7.1				
700	2.16	9.6	2.08	8.8	2.03	8.1	1.55	7.5	1.52	7.3	1.49	7.2	1.48	7.0				
	2.12	9.3	2.04	8.5	1.60	7.9	1.52	7.3	1.49	7.2	1.47	7.0	1.45	6.8				
	2.09	9.1	2.01	8.3	1.57	7.6	1.49	7.1	1.46	7.0	1.44	6.8	1.42	6.6	36	36	34	33
	2.05	8.8	1.58	8.1	1.53	7.4	1.46	7.0	1.43	6.8	1.41	6.6	1.40	6.5				
	2.01	8.5	1.54	7.8	1.50	7.2	1.43	6.8	1.40	6.6	1.38	6.4	1.37	6.3				
600	1.58	8.3	1.51	7.6	1.47	7.0	1.40	6.6	1.37	6.4	1.35	6.2	1.34	6.1				
	1.54	8.0	1.47	7.4	1.43	6.8	1.37	6.4	1.34	6.2	1.32	6.1	1.31	5.9				
	1.50	7.8	1.44	7.1	1.40	6.6	1.34	6.2	1.31	6.0	1.29	5.9	1.28	5.8	31	30	29	28
	1.47	7.5	1.40	6.9	1.37	6.4	1.31	6.0	1.28	5.8	1.27	5.7	1.26	5.6				
	1.43	7.3	1.37	6.7	1.33	6.2	1.28	5.8	1.25	5.7	1.24	5.5	1.23	5.4				
500	1.39	7.0	1.34	6.4	1.30	6.0	1.25	5.6	1.22	5.5	1.21	5.3	1.20	5.2				
	1.35	6.7	1.30	6.2	1.27	5.7	1.22	5.4	1.19	5.3	1.18	5.2	1.17	5.1				
	1.32	6.5	1.27	6.0	1.23	5.5	1.19	5.2	1.16	5.1	1.15	5.0	1.14	4.9	26	25	24	24
	1.28	6.2	1.23	5.7	1.20	5.3	1.15	5.0	1.13	4.9	1.12	4.8	1.11	4.7				
	1.24	6.0	1.20	5.5	1.17	5.1	1.12	4.8	1.10	4.7	1.09	4.6	1.09	4.5				
400	1.21	5.7	1.16	5.3	1.13	4.9	1.09	4.6	1.08	4.5	1.06	4.5	1.06	4.4				
	1.17	5.5	1.13	5.0	1.10	4.7	1.06	4.4	1.05	4.4	1.04	4.3	1.03	4.2				
	1.13	5.2	1.09	4.8	1.07	4.5	1.03	4.2	1.02	4.2	1.01	4.1	1.00	4.0	20	19	19	19
	1.09	5.0	1.06	4.6	1.03	4.3	1.00	4.1	0.59	4.0	0.58	3.9	0.57	3.9				
	1.06	4.7	1.02	4.4	0.60	4.1	0.57	3.9	0.56	3.8	0.55	3.7	0.54	3.7				
300	1.02	4.4	0.59	4.1	0.57	3.9	0.54	3.7	0.53	3.6	0.52	3.6	0.52	3.5				
	0.58	4.2	0.55	3.9	0.53	3.7	0.51	3.5	0.50	3.4	0.49	3.4	0.49	3.3				
	0.54	3.9	0.52	3.7	0.50	3.4	0.48	3.3	0.47	3.2	0.46	3.2	0.46	3.2	15	14	15	15
	0.51	3.7	0.48	3.4	0.47	3.2	0.45	3.1	0.44	3.1	0.43	3.0	0.43	3.0				
	0.47	3.4	0.45	3.2	0.43	3.0	0.42	2.9	0.41	2.9	0.40	2.9	0.40	2.8				
200	0.43	3.2	0.41	3.0	0.40	2.8	0.38	2.7	0.38	2.7	0.38	2.7	0.37	2.7				
	0.39	2.9	0.38	2.8	0.37	2.6												
	0.35	2.7	0.34	2.5	0.33	2.4									9	10	12	12
	0.32	2.4	0.30	2.3	0.30	2.2												
	0.28	2.2	0.27	2.1	0.26	2.0												
100	0.24	1.9	0.23	1.8	0.23	1.8												

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE
– ADD (SUB) 0.1 MINUTE PER 100 NM PER TON ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE ISA.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION IN CRUISE QUICK CHECK TABLE	2.17.30 PAGE 13 REV 12 SEQ 610

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 - DESCENT = M.79/300 KT/250 KT - APPROACH : 360 KG (6 mn)
ISA
200 NM TO 900 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) — FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
900	2.05	8.6	2.06	8.2	2.07	7.7	2.08	7.4	2.09	7.2	2.09	7.2			
	2.03	8.4	2.04	8.0	2.05	7.6	2.05	7.3	2.06	7.1	2.06	7.0	17	27	48
	2.00	8.2	2.01	7.8	2.02	7.4	2.03	7.1	2.03	6.9	2.03	6.9			
	1.58	8.0	1.58	7.6	1.59	7.2	2.00	6.9	2.01	6.6	2.01	6.7			
	1.55	7.8	1.56	7.4	1.57	7.0	1.58	6.8	1.58	6.6	1.58	6.5			
800	1.52	7.7	1.53	7.2	1.54	6.9	1.55	6.6	1.55	6.4	1.55	6.4			
	1.50	7.5	1.51	7.0	1.52	6.7	1.52	6.4	1.53	6.3	1.53	6.2			
	1.47	7.3	1.48	6.9	1.49	6.5	1.50	6.3	1.50	6.1	1.50	6.1	15	24	42
	1.45	7.1	1.46	6.7	1.46	6.3	1.47	6.1	1.47	5.9	1.47	5.9			
	1.42	6.9	1.43	6.5	1.44	6.2	1.44	5.9	1.45	5.8	1.45	5.7			
700	1.40	6.7	1.40	6.3	1.41	6.0	1.42	5.7	1.42	5.6	1.42	5.6			
	1.37	6.5	1.38	6.1	1.38	5.8	1.39	5.6	1.40	5.4	1.40	5.4			
	1.35	6.3	1.35	5.9	1.36	5.6	1.37	5.4	1.37	5.3	1.37	5.2	12	20	35
	1.32	6.1	1.33	5.7	1.33	5.5	1.34	5.2	1.34	5.1	1.34	5.1			
	1.29	5.9	1.30	5.6	1.31	5.3	1.31	5.1	1.32	4.9	1.32	4.9			
600	1.27	5.7	1.27	5.4	1.28	5.1	1.29	4.9	1.29	4.8	1.29	4.7			
	1.24	5.5	1.25	5.2	1.25	4.9	1.26	4.7	1.26	4.6	1.26	4.6			
	1.22	5.3	1.22	5.0	1.23	4.8	1.23	4.6	1.24	4.4	1.24	4.4	9	16	29
	1.19	5.1	1.20	4.8	1.20	4.6	1.21	4.4	1.21	4.3	1.21	4.3			
	1.17	4.9	1.17	4.6	1.18	4.4	1.18	4.2	1.18	4.1	1.18	4.1			
500	1.14	4.7	1.14	4.4	1.15	4.2	1.15	4.1	1.16	4.0	1.16	3.9			
	1.11	4.5	1.12	4.3	1.12	4.0	1.13	3.9	1.13	3.8	1.13	3.8			
	1.09	4.3	1.09	4.1	1.10	3.9	1.10	3.7	1.10	3.6	1.10	3.6	7	12	22
	1.06	4.1	1.07	3.9	1.07	3.7	1.08	3.5	1.08	3.4	1.08	3.4			
	1.04	3.9	1.04	3.7	1.05	3.5	1.05	3.4	1.05	3.3	1.05	3.3			
400	1.01	3.7	1.02	3.5	1.02	3.3	1.02	3.2	1.02	3.1	1.02	3.1			
	0.59	3.5	0.59	3.3	0.59	3.2	0.60	3.0	0.60	2.9	0.60	2.9			
	0.56	3.3	0.56	3.1	0.57	3.0	0.57	2.9	0.57	2.8	0.57	2.8	4	8	15
	0.54	3.1	0.54	2.9	0.54	2.8	0.54	2.7	0.55	2.6	0.55	2.6			
	0.51	2.9	0.51	2.8	0.51	2.6	0.52	2.5	0.52	2.4	0.52	2.4			
300	0.48	2.7	0.49	2.6	0.49	2.4	0.49	2.3	0.49	2.3	0.49	2.2			
	0.46	2.5	0.46	2.4	0.46	2.3	0.46	2.2	0.47	2.1	0.47	2.1			
	0.43	2.3	0.43	2.2	0.44	2.1	0.44	2.0	0.44	1.9	0.44	1.9	2	4	8
	0.41	2.1	0.41	2.0	0.41	1.9	0.41	1.8	0.41	1.8	0.41	1.7			
	0.38	1.9	0.38	1.8	0.38	1.7	0.39	1.7	0.39	1.6	0.39	1.6			
200	0.36	1.7	0.36	1.6	0.36	1.6	0.36	1.5	0.36	1.4	0.36	1.4			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT - ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE - ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION IN CRUISE QUICK CHECK TABLE	2.17.30 PAGE 14 REV 12 / SEQ 610

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 - DESCENT = M.79/300 KT/250 KT - APPROACH : 360 KG (6 mn)
ISA
800 NM TO 1500 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
1500	3.22	14.5	3.24	13.6	3.25	12.9	3.27	12.4	3.28	12.0	3.28	11.9			
	3.20	14.3	3.21	13.5	3.23	12.8	3.24	12.2	3.25	11.9	3.25	11.8	32	48	81
	3.17	14.1	3.19	13.3	3.20	12.6	3.22	12.1	3.23	11.7	3.23	11.6			
	3.15	13.9	3.16	13.1	3.18	12.4	3.19	11.9	3.20	11.8	3.20	11.5			
	3.12	13.7	3.13	12.9	3.15	12.2	3.17	11.7	3.17	11.4	3.17	11.3			
1400	3.09	13.5	3.11	12.7	3.12	12.1	3.14	11.6	3.15	11.3	3.15	11.2			
	3.07	13.3	3.08	12.6	3.10	11.9	3.11	11.4	3.12	11.1	3.12	11.0			
	3.04	13.1	3.06	12.4	3.07	11.7	3.09	11.2	3.09	10.9	3.09	10.9	29	44	76
	3.02	12.9	3.03	12.2	3.05	11.6	3.06	11.1	3.07	10.8	3.07	10.7			
	2.59	12.7	3.01	12.0	3.02	11.4	3.03	10.9	3.04	10.6	3.04	10.5			
1300	2.57	12.5	2.58	11.8	2.59	11.2	3.01	10.7	3.02	10.5	3.02	10.4			
	2.54	12.3	2.55	11.6	2.57	11.0	2.58	10.6	2.59	10.3	2.59	10.2			
	2.51	12.1	2.53	11.5	2.54	10.9	2.56	10.4	2.56	10.1	2.56	10.1	27	41	70
	2.49	11.9	2.50	11.3	2.52	10.7	2.53	10.2	2.54	10.0	2.54	9.9			
	2.46	11.8	2.48	11.1	2.49	10.5	2.50	10.1	2.51	9.8	2.51	9.8			
1200	2.44	11.6	2.45	10.9	2.46	10.4	2.48	9.9	2.48	9.7	2.48	9.6			
	2.41	11.4	2.42	10.7	2.44	10.2	2.45	9.8	2.46	9.5	2.46	9.4			
	2.39	11.2	2.40	10.5	2.41	10.0	2.42	9.6	2.43	9.3	2.43	9.3	25	38	65
	2.36	11.0	2.37	10.4	2.38	9.8	2.40	9.4	2.40	9.2	2.40	9.1			
	2.34	10.8	2.35	10.2	2.36	9.7	2.37	9.3	2.38	9.0	2.38	9.0			
1100	2.31	10.6	2.32	10.0	2.33	9.5	2.34	9.1	2.35	8.8	2.35	8.8			
	2.28	10.4	2.30	9.8	2.31	9.3	2.32	8.9	2.32	8.7	2.32	8.6			
	2.26	10.2	2.27	9.6	2.28	9.1	2.29	8.8	2.30	8.5	2.30	8.5	22	35	59
	2.23	10.0	2.24	9.4	2.25	9.0	2.27	8.6	2.27	8.4	2.27	8.3			
	2.21	9.8	2.22	9.3	2.23	8.8	2.24	8.4	2.25	8.2	2.25	8.2			
1000	2.18	9.6	2.19	9.1	2.20	8.6	2.21	8.3	2.22	8.1	2.22	8.0			
	2.16	9.4	2.17	8.9	2.18	8.4	2.19	8.1	2.19	7.9	2.19	7.8			
	2.13	9.2	2.14	8.7	2.15	8.3	2.16	7.9	2.17	7.7	2.17	7.7	20	31	53
	2.10	9.0	2.11	8.5	2.12	8.1	2.13	7.8	2.14	7.6	2.14	7.5			
	2.08	8.8	2.09	8.3	2.10	7.9	2.11	7.6	2.11	7.4	2.11	7.4			
900	2.05	8.6	2.06	8.2	2.07	7.7	2.08	7.4	2.09	7.2	2.09	7.2			
	2.03	8.4	2.04	8.0	2.05	7.6	2.05	7.3	2.06	7.1	2.06	7.0			
	2.00	8.2	2.01	7.8	2.02	7.4	2.03	7.1	2.03	6.9	2.03	6.9	17	27	48
	1.58	8.0	1.58	7.6	1.59	7.2	2.00	6.9	2.01	6.8	2.01	6.7			
	1.55	7.8	1.56	7.4	1.57	7.0	1.58	6.8	1.58	6.6	1.58	6.5			
800	1.52	7.7	1.53	7.2	1.54	6.9	1.55	6.6	1.55	6.4	1.55	6.4			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT - ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE - ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Ena. : 80C2A2

Dieser durch Airbus Industrie genehmigte Nachdruck unterliegt dem Änderungsdienst und ist nur für den internen Gebrauch bei INTERFLUG bestimmt.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION IN CRUISE QUICK CHECK TABLE	2.17.30 PAGE 15 REV 12 | SEQ 610

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 – DESCENT = M.79/300 KT/250 KT – APPROACH : 360 KG (6 mn)
ISA
1400 NM TO 2100 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
2100	4.39	20.2	4.41	19.0	4.44	18.0	4.46	17.2	4.47	16.7	4.47	16.5			
	4.37	20.0	4.39	18.9	4.41	17.9	4.43	17.1	4.45	16.6	4.45	16.4	46	65	110
	4.34	19.8	4.36	18.7	4.38	17.7	4.41	16.9	4.42	16.4	4.42	16.2			
	4.31	19.6	4.34	18.5	4.36	17.5	4.38	16.7	4.39	16.2	4.39	16.1			
	4.29	19.4	4.31	18.3	4.33	17.4	4.36	16.6	4.37	16.1	4.37	15.9			
2000	4.26	19.3	4.28	18.2	4.31	17.2	4.33	16.4	4.34	15.9	4.34	15.8			
	4.24	19.1	4.26	18.0	4.28	17.0	4.30	16.3	4.32	15.8	4.32	15.6			
	4.21	18.9	4.23	17.8	4.25	16.8	4.28	16.1	4.29	15.6	4.29	15.5	43	62	105
	4.19	18.7	4.21	17.6	4.23	16.7	4.25	15.9	4.28	15.5	4.28	15.3			
	4.16	18.5	4.18	17.4	4.20	16.5	4.22	15.8	4.24	15.3	4.24	15.2			
1900	4.13	18.3	4.16	17.3	4.18	16.3	4.20	15.6	4.21	15.2	4.21	15.0			
	4.11	18.1	4.13	17.1	4.15	16.2	4.17	15.5	4.18	15.0	4.18	14.9			
	4.08	17.9	4.10	16.9	4.12	16.0	4.14	15.3	4.16	14.9	4.16	14.7	41	59	101
	4.06	17.7	4.08	16.7	4.10	15.8	4.12	15.1	4.13	14.7	4.13	14.6			
	4.03	17.5	4.05	16.5	4.07	15.7	4.09	15.0	4.10	14.6	4.10	14.4			
1800	4.01	17.3	4.03	16.4	4.05	15.5	4.07	14.8	4.08	14.4	4.08	14.3			
	3.58	17.2	3.60	16.2	4.02	15.3	4.04	14.7	4.05	14.2	4.05	14.1			
	3.56	17.0	3.57	16.0	3.59	15.2	4.01	14.5	4.02	14.1	4.02	13.9	39	57	96
	3.53	16.8	3.55	15.8	3.57	15.0	3.59	14.3	3.60	13.9	3.60	13.8			
	3.50	16.6	3.52	15.6	3.54	14.8	3.56	14.2	3.57	13.8	3.57	13.6			
1700	3.48	16.4	3.50	15.5	3.52	14.6	3.53	14.0	3.54	13.6	3.54	13.5			
	3.45	16.2	3.47	15.3	3.49	14.5	3.51	13.8	3.52	13.5	3.52	13.3			
	3.43	16.0	3.44	15.1	3.46	14.3	3.48	13.7	3.49	13.3	3.49	13.2	38	54	91
	3.40	15.8	3.42	14.9	3.44	14.1	3.46	13.5	3.47	13.1	3.47	13.0			
	3.38	15.6	3.39	14.7	3.41	14.0	3.43	13.4	3.44	13.0	3.44	12.9			
1600	3.35	15.4	3.37	14.5	3.38	13.8	3.40	13.2	3.41	12.8	3.41	12.7			
	3.32	15.2	3.34	14.4	3.36	13.6	3.38	13.0	3.39	12.7	3.39	12.6			
	3.30	15.0	3.32	14.2	3.33	13.4	3.35	12.9	3.36	12.5	3.36	12.4	34	51	86
	3.27	14.8	3.29	14.0	3.31	13.3	3.32	12.7	3.33	12.4	3.33	12.3			
	3.25	14.7	3.26	13.8	3.28	13.1	3.30	12.5	3.31	12.2	3.31	12.1			
1500	3.22	14.5	3.24	13.6	3.25	12.9	3.27	12.4	3.28	12.0	3.28	11.9			
	3.20	14.3	3.21	13.5	3.23	12.8	3.24	12.2	3.25	11.9	3.25	11.8			
	3.17	14.1	3.19	13.3	3.20	12.6	3.22	12.1	3.23	11.7	3.23	11.6	32	48	81
	3.15	13.9	3.16	13.1	3.18	12.4	3.19	11.9	3.20	11.6	3.20	11.5			
	3.12	13.7	3.13	12.9	3.15	12.2	3.17	11.7	3.17	11.4	3.17	11.3			
1400	3.09	13.5	3.11	12.7	3.12	12.1	3.14	11.6	3.15	11.3	3.15	11.2			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

Dieser durch Airbus Industrie genehmigte Nachdruck unterliegt dem Änderungsdienst und ist nur für den internen Gebrauch bei INTERFLUG bestimmt.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION IN CRUISE QUICK CHECK TABLE	2.17.30 PAGE 16 REV 12 SEQ 610

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 - DESCENT = M.79/300 KT/250 KT - APPROACH : 360 KG (6 mn)
ISA
2000 NM TO 2700 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
2700	5.56	25.8	5.59	24.4	6.02	23.0	6.05	22.0	6.07	21.2	6.07	20.9			
	5.53	25.7	5.56	24.2	5.59	22.9	6.02	21.8	6.04	21.1	6.04	20.8	58	80	135
	5.51	25.5	5.54	24.0	5.57	22.7	5.80	21.6	6.01	20.9	6.01	20.6			
	5.48	25.3	5.51	23.9	5.54	22.6	5.57	21.5	5.59	20.8	5.59	20.5			
	5.46	25.1	5.49	23.7	5.52	22.4	5.55	21.3	5.56	20.8	5.56	20.3			
2600	5.43	24.9	5.46	23.5	5.49	22.2	5.52	21.2	5.54	20.5	5.54	20.2			
	5.41	24.7	5.43	23.3	5.46	22.1	5.49	21.0	5.51	20.3	5.51	20.0			
	5.38	24.5	5.41	23.1	5.44	21.9	5.47	20.9	5.48	20.2	5.48	19.9	56	78	131
	5.35	24.4	5.38	23.0	5.41	21.7	5.44	20.7	5.46	20.0	5.46	19.8			
	5.33	24.2	5.36	22.8	5.38	21.6	5.41	20.5	5.43	19.8	5.43	19.6			
2500	5.30	24.0	5.33	22.6	5.36	21.4	5.39	20.4	5.40	19.7	5.40	19.5			
	5.28	23.8	5.30	22.4	5.33	21.2	5.36	20.2	5.38	19.6	5.38	19.3			
	5.25	23.6	5.28	22.3	5.31	21.1	5.33	20.1	5.35	19.4	5.35	19.2	54	75	127
	5.23	23.4	5.25	22.1	5.28	20.9	5.31	19.9	5.32	19.3	5.32	19.0			
	5.20	23.2	5.23	21.9	5.25	20.7	5.28	19.8	5.30	19.1	5.30	18.9			
2400	5.18	23.0	5.20	21.7	5.23	20.5	5.26	19.6	5.27	19.0	5.27	18.7			
	5.15	22.9	5.18	21.5	5.20	20.4	5.23	19.4	5.24	18.8	5.24	18.6			
	5.12	22.7	5.15	21.4	5.18	20.2	5.20	19.3	5.22	18.7	5.22	18.4	52	73	123
	5.10	22.5	5.12	21.2	5.15	20.0	5.18	19.1	5.19	18.5	5.19	18.3			
	5.07	22.3	5.10	21.0	5.12	19.9	5.15	19.0	5.16	18.4	5.17	18.1			
2300	5.05	22.1	5.07	20.8	5.10	19.7	5.12	18.8	5.14	18.2	5.14	18.0			
	5.02	21.9	5.05	20.7	5.07	19.5	5.10	18.7	5.11	18.1	5.11	17.9			
	4.60	21.7	5.02	20.5	5.05	19.4	5.07	18.5	5.09	17.9	5.09	17.7	50	70	118
	4.57	21.5	4.59	20.3	5.02	19.2	5.05	18.3	5.06	17.8	5.06	17.6			
	4.54	21.3	4.57	20.1	4.59	19.0	5.02	18.2	5.03	17.8	5.03	17.4			
2200	4.52	21.2	4.54	19.8	4.57	18.9	4.59	18.0	5.01	17.5	5.01	17.3			
	4.49	21.0	4.52	19.8	4.54	18.7	4.57	17.9	4.58	17.3	4.58	17.1			
	4.47	20.8	4.49	19.8	4.52	18.5	4.54	17.7	4.55	17.2	4.55	17.0	48	68	114
	4.44	20.6	4.47	19.4	4.49	18.4	4.51	17.5	4.53	17.0	4.53	16.8			
	4.42	20.4	4.44	19.2	4.46	18.2	4.49	17.4	4.50	16.9	4.50	16.7			
2100	4.39	20.2	4.41	19.0	4.44	18.0	4.46	17.2	4.47	16.7	4.47	16.5			
	4.37	20.0	4.39	18.9	4.41	17.9	4.43	17.1	4.45	16.8	4.45	16.4			
	4.34	19.8	4.36	18.7	4.38	17.7	4.41	16.9	4.42	16.4	4.42	16.2	46	65	110
	4.31	19.6	4.34	18.5	4.36	17.5	4.38	16.7	4.39	16.2	4.39	16.1			
	4.29	19.4	4.31	18.3	4.33	17.4	4.36	16.6	4.37	16.1	4.37	15.9			
2000	4.26	19.3	4.28	18.2	4.31	17.2	4.33	16.4	4.34	15.9	4.34	15.8			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT - ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE - ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 – DESCENT = M.79/300 KT/250 KT – APPROACH : 360 KG (6 mn)
ISA
2600 NM TO 3300 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		• ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
3300	7.13	31.5	7.16	29.6	7.20	28.0	7.24	26.6	7.26	25.7	7.26	25.2			
	7.10	31.3	7.14	29.5	7.18	27.8	7.21	26.5	7.23	25.5	7.23	25.1	70	93	156
	7.08	31.1	7.11	29.3	7.15	27.7	7.19	26.3	7.21	25.4	7.21	24.9			
	7.05	30.9	7.09	29.1	7.12	27.5	7.16	26.2	7.18	25.2	7.18	24.8			
	7.03	30.7	7.06	28.9	7.10	27.3	7.13	26.0	7.16	25.1	7.16	24.6			
3200	7.00	30.5	7.04	28.8	7.07	27.2	7.11	25.8	7.13	24.9	7.13	24.5			
	6.57	30.3	7.01	28.6	7.05	27.0	7.08	25.7	7.10	24.8	7.10	24.3			
	6.55	30.2	6.58	28.4	7.02	26.8	7.06	25.5	7.08	24.6	7.08	24.2	68	91	153
	6.52	30.0	6.56	28.2	6.59	26.7	7.03	25.4	7.05	24.5	7.05	24.1			
	6.50	29.8	6.53	28.1	6.57	26.5	7.00	25.2	7.02	24.3	7.02	23.9			
3100	6.47	29.6	6.51	27.9	6.54	26.4	6.58	25.1	6.60	24.2	6.60	23.8			
	6.45	29.4	6.48	27.7	6.52	26.2	6.55	24.9	6.57	24.0	6.57	23.6			
	6.42	29.2	6.45	27.5	6.49	26.0	6.52	24.8	6.54	23.9	6.54	23.5	66	89	149
	6.40	29.0	6.43	27.4	6.46	25.9	6.50	24.6	6.52	23.8	6.52	23.4			
	6.37	28.9	6.40	27.2	6.44	25.7	6.47	24.5	6.49	23.6	6.49	23.2			
3000	6.34	28.7	6.38	27.0	6.41	25.5	6.45	24.3	6.46	23.5	6.46	23.1			
	6.32	28.5	6.35	26.8	6.38	25.4	6.42	24.1	6.44	23.3	6.44	22.9			
	6.29	28.3	6.33	26.7	6.36	25.2	6.39	24.0	6.41	23.2	6.41	22.8	64	87	146
	6.27	28.1	6.30	26.5	6.33	25.0	6.37	23.8	6.39	23.0	6.39	22.6			
	6.24	27.9	6.27	26.3	6.31	24.9	6.34	23.7	6.36	22.9	6.36	22.5			
2900	6.22	27.7	6.25	26.1	6.28	24.7	6.31	23.5	6.33	22.7	6.33	22.4			
	6.19	27.5	6.22	26.0	6.25	24.5	6.29	23.4	6.31	22.6	6.31	22.2			
	6.16	27.4	6.20	25.8	6.23	24.4	6.26	23.2	6.28	22.4	6.28	22.1	62	85	142
	6.14	27.2	6.17	25.6	6.20	24.2	6.23	23.1	6.25	22.3	6.25	21.9			
	6.11	27.0	6.14	25.4	6.18	24.0	6.21	22.9	6.23	22.1	6.23	21.8			
2800	6.09	26.8	6.12	25.3	6.15	23.9	6.18	22.7	6.20	22.0	6.20	21.6			
	6.06	26.6	6.09	25.1	6.12	23.7	6.16	22.6	6.17	21.8	6.17	21.5			
	6.04	26.4	6.07	24.9	6.10	23.5	6.13	22.4	6.15	21.7	6.15	21.4	60	83	138
	6.01	26.2	6.04	24.7	6.07	23.4	6.10	22.3	6.12	21.5	6.12	21.2			
	5.59	26.1	6.02	24.6	6.05	23.2	6.08	22.1	6.09	21.4	6.09	21.1			
2700	5.56	25.9	5.59	24.4	6.02	23.0	6.05	22.0	6.07	21.2	6.07	20.9			
	5.53	25.7	5.56	24.2	5.59	22.9	6.02	21.8	6.04	21.1	6.04	20.8			
	5.51	25.5	5.54	24.0	5.57	22.7	5.60	21.6	6.01	20.9	6.01	20.6	58	80	135
	5.48	25.3	5.51	23.9	5.54	22.6	5.57	21.5	5.59	20.8	5.59	20.5			
	5.46	25.1	5.49	23.7	5.52	22.4	5.55	21.3	5.56	20.8	5.56	20.3			
2600	5.43	24.9	5.46	23.5	5.49	22.2	5.52	21.2	5.54	20.5	5.54	20.2			

• CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL

FLIGHT PLANNING

TABULATED CALCULATION

IN CRUISE QUICK CHECK TABLE

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 - DESCENT = M.79/300 KT/250 KT - APPROACH : 360 KG (6 mn)
ISA
3200 NM TO 3900 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290		310		330		350		370		390		• ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
3900	8.30	37.0	8.34	34.8	8.38	32.9	8.43	31.2	8.45	30.0	8.45	29.4			
	8.27	36.8	8.31	34.7	8.36	32.7	8.40	31.0	8.43	29.8	8.43	29.2	82	106	174
	8.25	36.6	8.29	34.5	8.33	32.5	8.38	30.9	8.40	29.7	8.40	29.1			
	8.22	36.4	8.26	34.3	8.31	32.4	8.35	30.7	8.39	29.5	8.38	28.9			
	8.19	36.3	8.24	34.1	8.28	32.2	8.32	30.6	8.35	29.4	8.35	28.8			
3800	8.17	36.1	8.21	34.0	8.25	32.1	8.30	30.4	8.32	29.3	8.32	28.7			
	8.14	35.9	8.18	33.8	8.23	31.9	8.27	30.3	8.30	29.1	8.30	28.5			
	8.12	35.7	8.16	33.6	8.20	31.7	8.25	30.1	8.27	29.0	8.27	28.4	80	104	171
	8.09	35.5	8.13	33.5	8.18	31.6	8.22	30.0	8.24	28.8	8.24	28.3			
	8.07	35.3	8.11	33.3	8.15	31.4	8.19	29.8	8.22	28.7	8.22	28.1			
3700	8.04	35.2	8.08	33.1	8.12	31.3	8.17	29.7	8.19	28.5	8.19	28.0			
	8.01	35.0	8.06	32.9	8.10	31.1	8.14	29.5	8.16	28.4	8.16	27.8			
	7.59	34.8	8.03	32.8	8.07	30.9	8.11	29.4	8.14	28.3	8.14	27.7	79	102	168
	7.56	34.6	8.00	32.6	8.05	30.8	8.09	29.2	8.11	28.1	8.11	27.6			
	7.54	34.4	7.58	32.4	8.02	30.6	8.06	29.1	8.08	28.0	8.08	27.4			
3600	7.51	34.2	7.55	32.3	7.59	30.4	8.03	28.9	8.06	27.8	8.06	27.3			
	7.49	34.0	7.53	32.1	7.57	30.3	8.01	28.8	8.03	27.7	8.03	27.1			
	7.46	33.9	7.50	31.9	7.54	30.1	7.58	28.6	8.01	27.5	8.01	27.0	76	100	165
	7.44	33.7	7.47	31.7	7.51	30.0	7.56	28.5	7.58	27.4	7.58	26.9			
	7.41	33.5	7.45	31.6	7.49	29.8	7.53	28.3	7.55	27.2	7.55	26.7			
3500	7.38	33.3	7.42	31.4	7.46	29.6	7.50	28.1	7.53	27.1	7.53	26.6			
	7.36	33.1	7.40	31.2	7.44	29.5	7.48	28.0	7.50	27.0	7.50	26.5			
	7.33	32.9	7.37	31.0	7.41	29.3	7.45	27.8	7.47	26.8	7.47	26.3	73	98	162
	7.31	32.8	7.35	30.9	7.38	29.1	7.42	27.7	7.45	26.7	7.45	26.2			
	7.28	32.6	7.32	30.7	7.36	29.0	7.40	27.5	7.42	26.5	7.42	26.0			
3400	7.26	32.4	7.29	30.5	7.33	28.8	7.37	27.4	7.39	26.4	7.39	25.9			
	7.23	32.2	7.27	30.3	7.31	28.6	7.35	27.2	7.37	26.2	7.37	25.8			
	7.21	32.0	7.24	30.2	7.28	28.5	7.32	27.1	7.34	26.1	7.34	25.6	71	98	159
	7.18	31.8	7.22	30.0	7.25	28.3	7.29	26.9	7.31	25.9	7.31	25.5			
	7.15	31.6	7.19	29.8	7.23	28.2	7.27	26.8	7.29	25.8	7.29	25.3			
3300	7.13	31.5	7.16	29.6	7.20	28.0	7.24	26.6	7.26	25.7	7.26	25.2			
	7.10	31.3	7.14	29.5	7.18	27.8	7.21	26.5	7.23	25.5	7.23	25.1			
	7.08	31.1	7.11	29.3	7.15	27.7	7.19	26.3	7.21	25.4	7.21	24.9	70	93	156
	7.05	30.9	7.09	29.1	7.12	27.5	7.16	26.2	7.18	25.2	7.18	24.8			
	7.03	30.7	7.06	28.9	7.10	27.3	7.13	26.0	7.16	25.1	7.16	24.6			
3200	7.00	30.5	7.04	28.8	7.07	27.2	7.11	25.8	7.13	24.9	7.13	24.5			

• CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT - ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE - ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING TABULATED CALCULATION IN CRUISE QUICK CHECK TABLE	2.17.30 PAGE 19 REV 12 SEQ 600

REFERENCE INITIAL WEIGHT : 115 TONS
FUEL AND TIME TO DESTINATION FROM ANY POINT IN CRUISE TO LANDING
INCLUDING CRUISE = M.79 – DESCENT = M.79/300 KT/250 KT – APPROACH : 360 KG (6 mn)
ISA
3800 NM TO 4500 NM

AIR-DIST NM	TIME (h.min) / FUEL CONSUMED (1000 kg) FLIGHT LEVEL 290	310	330	350	370	390	* ΔFC(kg/t) FL 290 310	FL 330 350	FL 370 390
4500			9.57 37.7	10.02 35.7	10.05 34.2	10.05 33.4			
			9.54 37.5	9.59 35.5	10.02 34.1	10.02 33.3	0	124	194
			9.51 37.3	9.57 35.4	9.60 33.9	9.60 33.1			
			9.49 37.2	9.54 35.2	9.57 33.8	9.57 33.0			
			9.46 37.0	9.51 35.1	9.54 33.7	9.54 32.9			
4400			9.44 36.9	9.49 34.9	9.52 33.5	9.52 32.7			
			9.41 36.7	9.46 34.8	9.49 33.4	9.49 32.6			
			9.38 36.6	9.43 34.6	9.46 33.2	9.46 32.5	0	122	187
			9.36 36.4	9.41 34.5	9.44 33.1	9.44 32.3			
			9.33 36.2	9.38 34.3	9.41 33.0	9.41 32.2			
4300			9.31 36.1	9.36 34.2	9.38 32.8	9.38 32.1			
			9.28 35.9	9.33 34.0	9.36 32.7	9.36 31.9			
			9.25 35.8	9.30 33.9	9.33 32.5	9.33 31.8	94	119	184
			9.23 35.6	9.28 33.7	9.30 32.4	9.30 31.7			
			9.20 35.4	9.25 33.6	9.28 32.2	9.28 31.5			
4200		9.13 37.4	9.18 35.3	9.22 33.4	9.25 32.1	9.25 31.4			
		9.10 37.2	9.15 35.1	9.20 33.3	9.23 32.0	9.23 31.3			
		9.08 37.1	9.12 35.0	9.17 33.1	9.20 31.8	9.20 31.1	93	113	182
		9.05 36.9	9.10 34.8	9.15 33.0	9.17 31.7	9.17 31.0			
		9.02 36.7	9.07 34.6	9.12 32.8	9.15 31.5	9.15 30.8			
4100		8.60 36.5	9.04 34.5	9.09 32.7	9.12 31.4	9.12 30.7			
		8.57 36.4	9.02 34.3	9.07 32.5	9.09 31.3	9.09 30.6			
		8.55 36.2	8.59 34.2	9.04 32.4	9.07 31.1	9.07 30.4	88	111	179
		8.52 36.0	8.57 34.0	9.01 32.2	9.04 31.0	9.04 30.3			
		8.49 35.9	8.54 33.8	8.59 32.1	9.01 30.8	9.01 30.2			
4000	8.42 37.9	8.47 35.7	8.51 33.7	8.56 31.9	8.59 30.7	8.59 30.0			
	8.40 37.7	8.44 35.5	8.49 33.5	8.53 31.8	8.56 30.5	8.56 29.9			
	8.37 37.5	8.42 35.3	8.46 33.3	8.51 31.6	8.53 30.4	8.53 29.8	84	109	177
	8.35 37.4	8.39 35.2	8.44 33.2	8.48 31.5	8.51 30.3	8.51 29.6			
	8.32 37.2	8.37 35.0	8.41 33.0	8.46 31.3	8.48 30.1	8.48 29.5			
3900	8.30 37.0	8.34 34.8	8.38 32.9	8.43 31.2	8.45 30.0	8.45 29.4			
	8.27 36.8	8.31 34.7	8.36 32.7	8.40 31.0	8.43 29.8	8.43 29.2			
	8.25 36.6	8.29 34.5	8.33 32.5	8.38 30.9	8.40 29.7	8.40 29.1	82	106	174
	8.22 36.4	8.26 34.3	8.31 32.4	8.35 30.7	8.38 29.5	8.38 28.9			
	8.19 36.3	8.24 34.1	8.28 32.2	8.32 30.6	8.35 29.4	8.35 28.8			
3800	8.17 36.1	8.21 34.0	8.25 32.1	8.30 30.4	8.32 29.3	8.32 28.7			

* CORRECTION FOR DEVIATION FROM REFERENCE:

WEIGHT – ADD (SUB) ΔFC PER TONS ABOVE (BELOW) REFERENCE

TEMPERATURE – ADD 0.20 % FUEL CONSUMPTION PER DEG. C ABOVE STD.

Mod. : 4801 + 4863

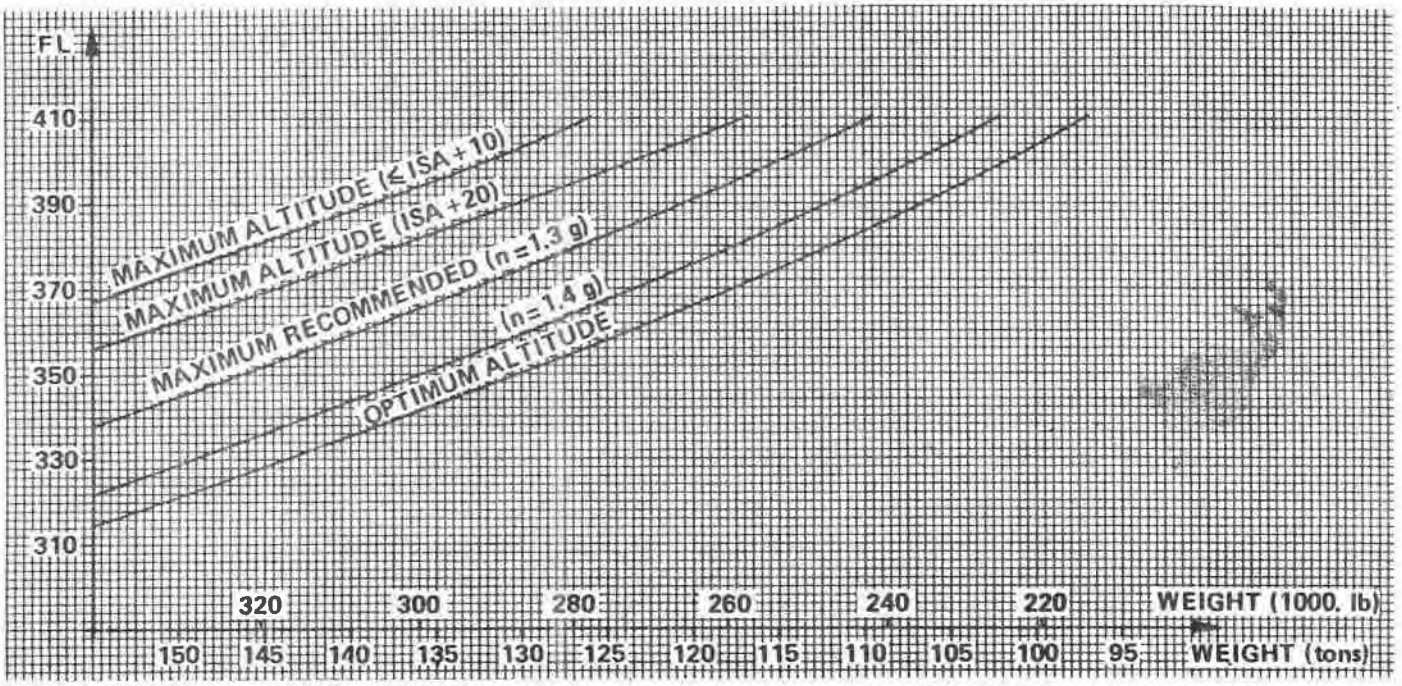
GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT PLANNING	2.17.30
		PAGE 20
	CRUISE LEVEL CHART	REV 13 / SEQ 610

R

M = 0.79
C.G. POSITION : 37.5 %



Mod. : 4801 + 4863

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS	2.18.00
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Flight Planning And Execution	1	
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Mod. : 4863

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FOREWORD	N	2.18.10
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This chapter contains information or/and recommendations applicable whenever there is a deviation from the usual flight configuration or when significant environmental conditions have to be taken into account.

The circumstances envisaged in this chapter may have an effect on performance or/and lead to consider an appropriate flight profile for planning purpose.

Vers. : All Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS	2.18.20	
		PAGE 1	
	FLIGHT WITHOUT CABIN PRESSURIZATION	REV 18	SEQ 001

1. GENERAL

A flight without cabin pressurization can be necessary due to aircraft system deficiency (see MEL) or after a decompression in flight. Depending on the cause of the pressure loss or absence, the distance to fly, the topographic conditions and the meteorological conditions the flight level and airspeed will be chosen.

The ram air inlet will be opened to insure the cabin ventilation. In addition, the pack(s), if available, will permit a convenient air conditioning.

2. OXYGEN REQUIREMENTS (FAR 121.329)

A. CREW MEMBERS

At cabin pressure altitude above 10.000 ft, up to and including 12.000 ft, oxygen must be provided for and used by each member of the flight crew on flight compartment duty and must be provided for other crew members for that part of the flight at those altitudes, that is of more than 30 minutes duration.

At cabin pressure altitudes above 12.000 ft oxygen must be provided for and used by, each member of the flight crew on flight compartment duty, and must be provided for other crew members during the entire flight at those altitudes. When a flight crew member is required to use oxygen, he must use it continuously except when necessary to remove the oxygen mask or other dispenser in connection with his regular duties.

B. PASSENGER

For flights at cabin pressure altitudes above 10.000 ft, up to and including 14.000 ft, enough oxygen for that part of the flight at those altitudes, that is of more than 30 minutes duration, for 10 % of the passengers.

For flights at cabin pressure altitudes above 14.000 ft, up to and including 15.000 ft, enough oxygen for that part of the flight at those altitudes for 30 % of the passengers.

For flights at cabin pressure altitudes above 15.000 ft, enough oxygen for each passenger, is carried during the entire flight at those altitudes.

3. FLIGHT PLANNING AND EXECUTION

A. ALTITUDE

Flight route planning should consider the above stated restriction in cabin altitude. When ascending above 9.550 ± 350 ft, the CAB ALT warning on WLDP will come on and ECAM will be activated. When ascending above 14.000 ft, the passenger oxygen masks will be provided automatically. Therefore the maximum altitude for prolonged flight is recommended as FL 100. The minimum altitude should be selected by respecting :

- the MSA (minimum safe altitude),
- the turbulence which is uncomfortable for passengers and,
- the low OAT which can be a discomfort to passengers when the cabin is ventilated by ram air only.

B. LONG RANGE CRUISE DATA

The normal climb charts will be used for the flight planning, along with the long range cruise chart. Take into account a slight increase in specific fuel consumption over the published figures during climb. In case of loss of pressurization, after an emergency descent, use graphs « LRC at FL 100 or 140 ».

C. AIRSPEED

In case structural damage was the cause of the decompression, airspeed should be limited to the minimum ; using slats and flaps as necessary to established low speed conditions. On the other hand, turbulent conditions are uncomfortable for passengers and gust response should be minimized by reducing airspeed.

D. CLIMB AND DESCENT

Take-off shall be performed normally, climb thrust adjusted to limit the rate of climb to about 500 ft/mn to ease pressure change imposed directly on passengers and crew.

Descent shall be performed likewise, the rate of descent limited to about 500 ft/mn except for the final approach which be performed normally. Notify ATC of this deficiency of performance by a remark in the flight plan.

E. SYSTEMS

Following a decompression in flight the pressure and air conditioning system will be set as demanded by the appropriate emergency or abnormal procedure. System set up for a planned flight without pressurization will be as for normal flight except that the RAM AIR INLET is opened.

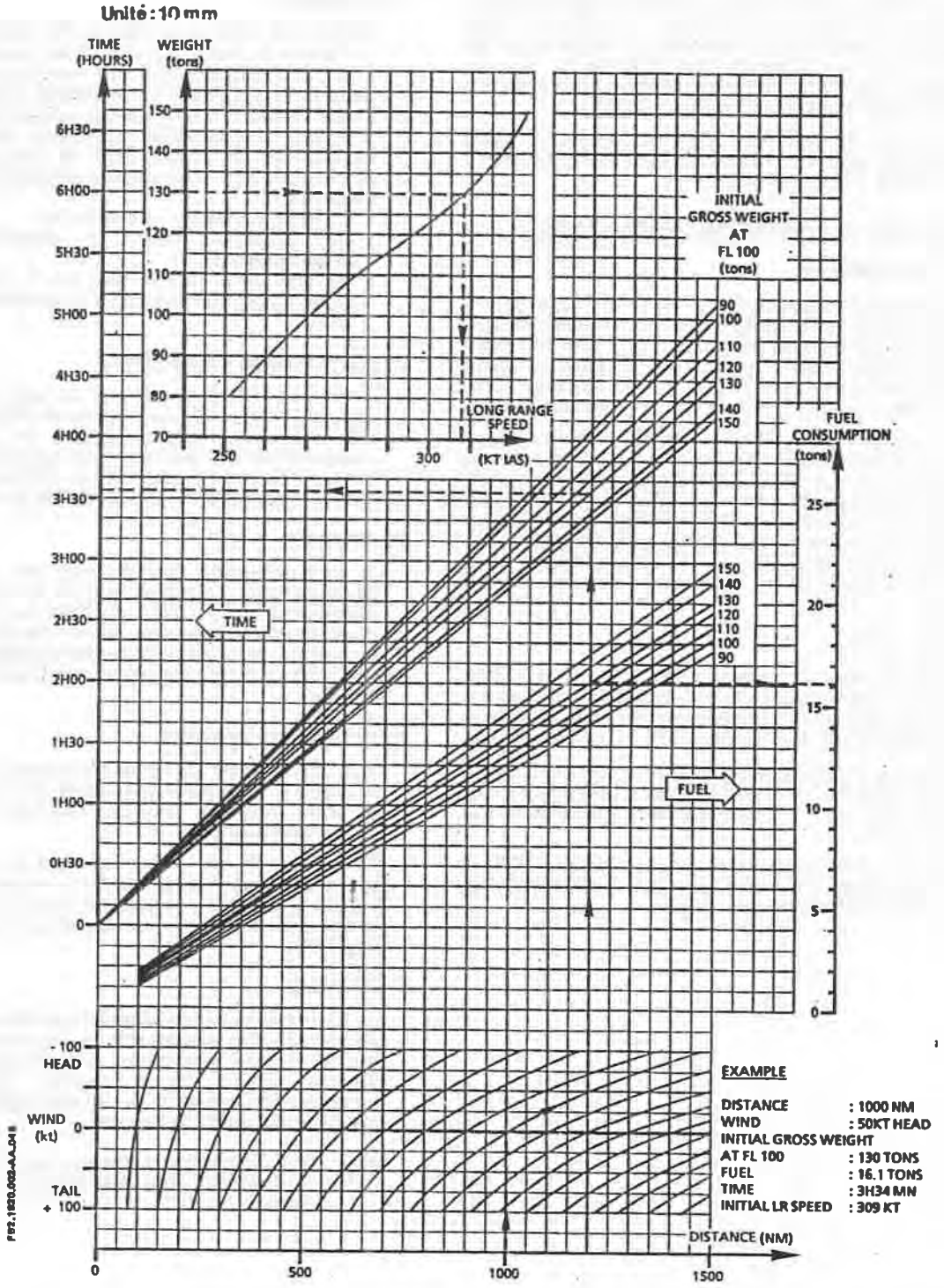
Note : In flight, lavatory smoke warning can be triggered by heating of material deposited in the drain mast. R R R

Vers. : All Eng. : All

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS	2.18.20	
		PAGE 2	
	FLIGHT WITHOUT CABIN PRESSURIZATION	REV 12	SEQ 045

FUEL AND TIME TO DESTINATION AT FL 100 – 2 ENGINES FROM ANY POINT IN CRUISE TO LANDING – LONG RANGE INCLUDING LANDING PROCEDURE = 360 KG



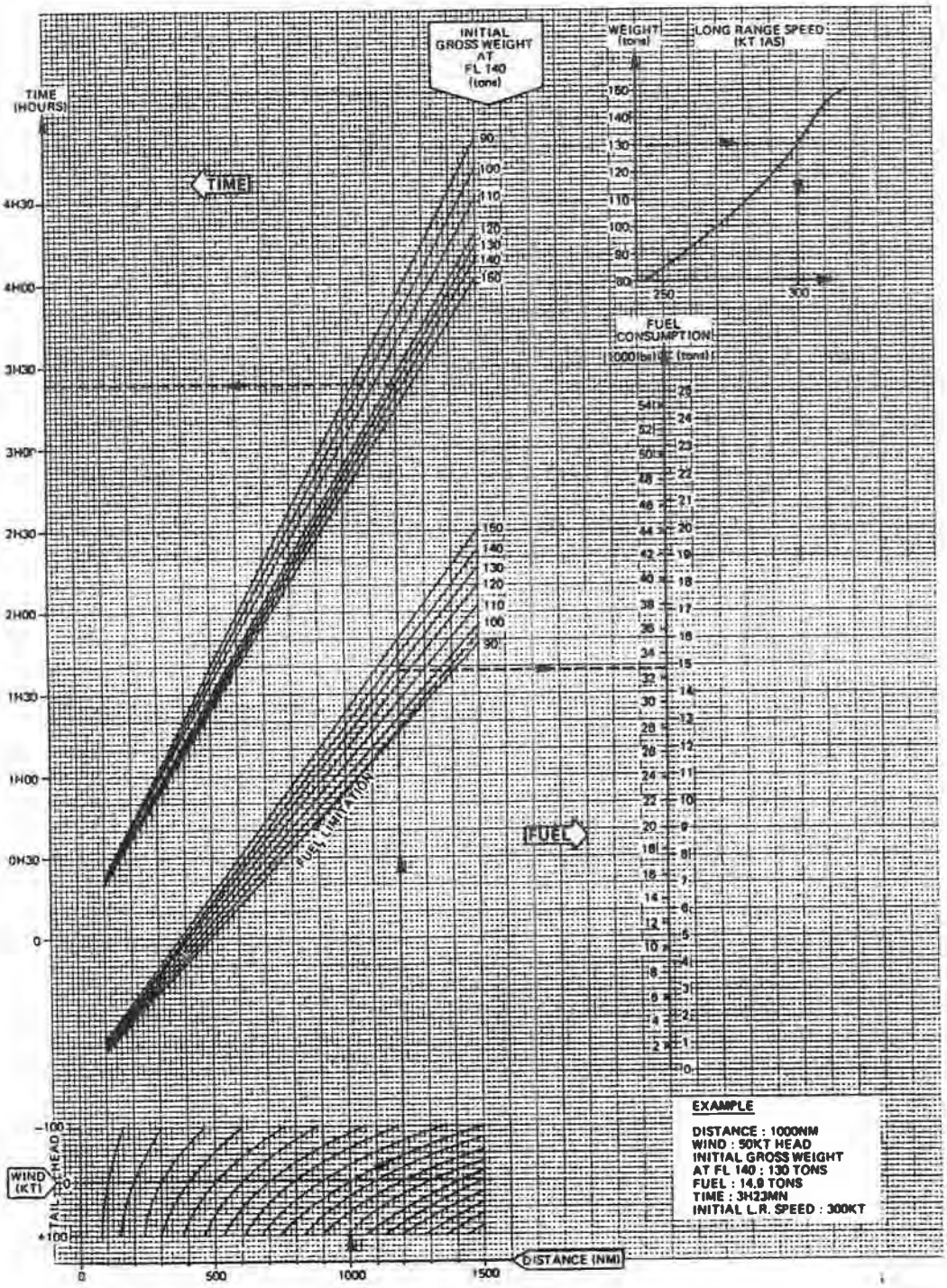
Mod. : 4863

GE Eng. : 80C2A2

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AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS	2.18.20
		PAGE 3/4
	FLIGHT WITHOUT CABIN PRESSURIZATION	REV 12 / SEQ 550

FUEL AND TIME TO DESTINATION AT FL 140 – 2 ENGINES FROM ANY POINT IN CRUISE TO LANDING – LONG RANGE INCLUDING LANDING PROCEDURE = 360 KG



Mod. : 4863

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FERRY FLIGHT WITH SLATS FAILED IN THE RETRACTED POSITION	2.18.30 PAGE 1 REV 18 SEQ 062

1. GENERAL

With the slats failed in the fully retracted position, the airplane may be ferried in the conditions stated below.

Note : check that kruger flaps have been secured in the retracted position.

2. MAX T.O. WEIGHT DETERMINATION

- Take-off must be performed under no wind or headwind conditions.
- Take-off will be performed with flaps 20°.
- Take-off will be performed with full thrust.
- Using the graphs on next page, enter with runway slope, airport temperature and pressure altitude and determine on one hand the weight limited by the runway and on the other hand the weight limited by second segment, brake energy and tire speed.
- Retain the lowest one as Max T.O. weight.
- No obstacle has been taken into account. In case of obstacles on the climb out flight path, take-off weather conditions will be restricted to VMC.

3. TAKE-OFF SPEEDS

T/O weight (tons)	90	100	110	120	130	140	150
V2 (kt IAS)	137	144	152	158	164	170	176

V1 = V2 − 10 kt
VR = V2 − 4 kt
Safe pitch attitude : 8°
Minimum flaps retraction speed : F

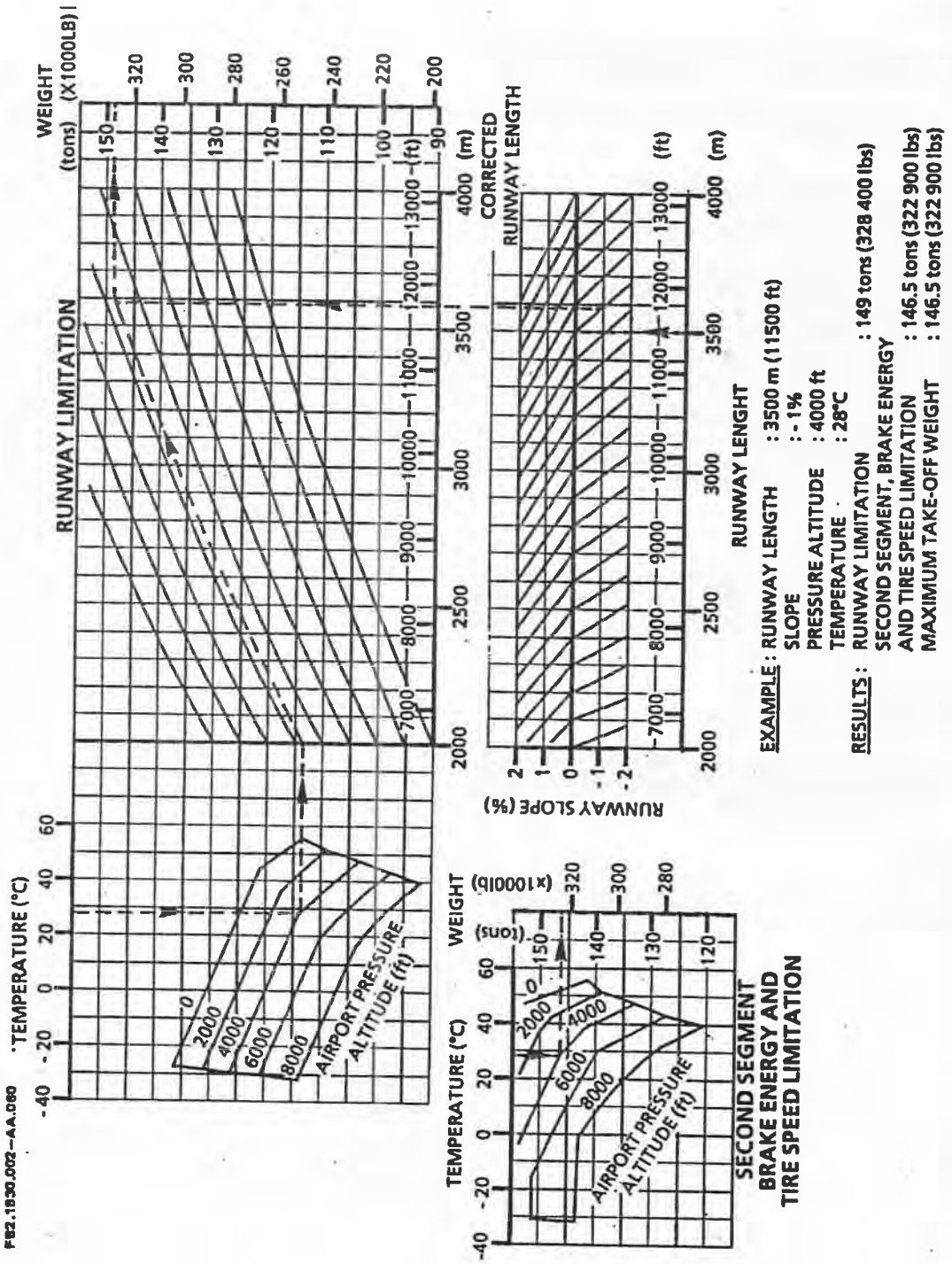
Note : The F speed displayed on the speed scale is the minimum flaps retraction speed corresponding to the aircraft configuration.

4. LANDING

Refer to abnormal procedure DUAL FLAPS OR SLATS SYS FAULT.

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FERRY FLIGHT WITH SLATS FAILED IN THE RETRACTED POSITION	2.18.30
		PAGE 2
		REV 18 / SEQ 060



Code : 1830A

GE Eng. : 80C2A2

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FLIGHT WITH GEAR DOWN AND LANDING GEAR DOORS CLOSED	2.18.40 PAGE 1 T REV 15 SEQ 310

1. GENERAL

Revenue flight is permitted with the landing gear in the down position and the gear doors closed providing icing conditions are not expected. Extended overwater flight (more than 50 NM from the nearest shoreline) is not allowed. DFA (if available) and vertical mode of FMS must not be used. Dispatch with flap track fairing missing or with kruger inoperative is not allowed.

- If trim tank installed :
  Do not fly with fuel in trim tank. Trim tank pumps 1 and 2 and trim tank isol valve must be selected OFF.
- If auxiliary tank installed :
  Do not fly with fuel in auxiliary tank.

VMO/MMO with landing gear extended : 255 kt/MO.65.
The L/G DOWN VMO/MMO SELECTION switch in the avionics compartment must be activated.

R *Note : VMO/MMO values are different from VLE because*
R *airworthiness requirements are different for VLE*
R *and VMO determination.*

It is necessary to take into account the increased drag to determine the take off weight and fuel consumption.
It is recommended to use slats 15/flaps 0 as take-off configuration.

Note : take-off with tail wind is not recommended.

2. DETERMINATION OF MAX TAKE OFF WEIGHT :

Penalties on performance affect :
- 2nd segment gradient condition
- Final take off condition

A. 2ND SEGMENT GRADIENT CONDITION :

The RTOLW charts or the quick reference tables give the basic information necessary for normal take off. In view of simplification, a constant weight reduction is applied whatever is the limitation. This weight reduction covers the most critical case presented by obstacle overflying.

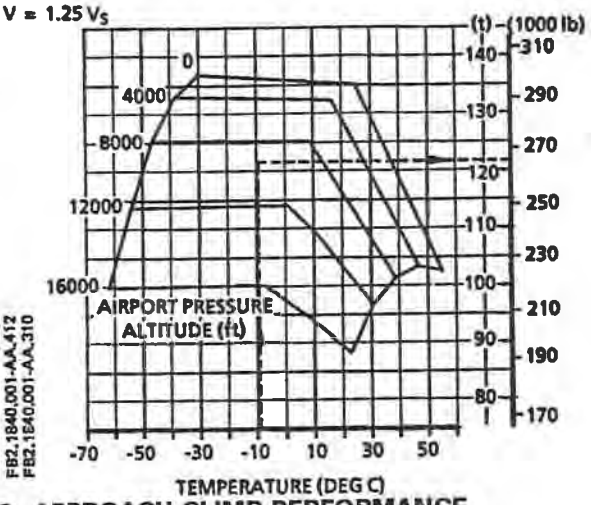
Take-off configuration	15/0	15/15	20/20
Weight reduction	19 %	15 %	11 %

method : define for the prevailing conditions on the airport (temperature, pressure, wind runway...) the max take off weight using the RTOLW chart or the quick reference graphs, then apply the above weight reduction.

B. FINAL TAKE OFF CONDITION :

- Determine with the following graph the max take off weight associated with the final take off condition.
- Retain the lowest weight according to the most limiting condition (2nd segment or final take off) and read the speeds corresponding to this weight in the RTOLW chart or in the quick reference tables.

CLEAN CONFIGURATION
AIR CONDITIONING ON
ANTI ICING OFF
V = 1.25 V_S



3. APPROACH CLIMB PERFORMANCE

Refer to 2.14 for approach climb requirements.
Further decrease the basic limiting weight by :
- 14 % in configuration 15/15
- 12 % in configuration 20/20

4. FLIGHT PLANNING

A. CLIMB

Climb at 240 kt with both engines at maximum climb power setting. The table page 2 gives the time, distance and fuel consumption according to take-off weight.

B. CRUISE

The recommended cruise speed is 240 kt. Page 4 gives cruise table at this speed.
Obviously, the ceiling on one engine may be a limiting factor, and the choice of the route should reflect this concern.

C. ENGINE FAILURE

In case of engine failure, the airplane will drift down to the ceiling shown on page 5.
The power setting for drift down will be Max Continuous.
The drift down speed below 15 000 ft pressure altitude will be :

Weight (tons)	90	95	100	105	110	115	120	125	130	135	140
Drift Down Speed (kt)	170	175	180	185	190	195	200	205	210	215	220

This speed shall be increased by 2 kt per 1 000 ft from pressure altitude above 15 000 ft.

5. HOLDING

Page 6 gives the holding parameters with slats out. This configuration being the less penalizing for holding.

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FLIGHT WITH GEAR DOWN AND LANDING GEAR DOORS CLOSED	2.18.40 PAGE 2 REV 18 SEQ 060

R

ISA	CLIMB 2 ENGINES GEAR DOWN	240 KT

FL	WEIGHT AT BRAKES RELEASE (1000KG)												
	95	100	105	110	115	120	125	130	135	140	145	150	155
270	11 2049 54 288	12 2202 58 289	13 2364 62 290	14 2536 67 292	15 2714 73 293	16 2907 78 294	17 3120 85 295	19 3361 92 297	20 3633 101 298	22 3947 110 300			
250	10 1822 44 277	10 1953 48 278	11 2090 51 279	12 2233 55 280	13 2379 59 281	13 2535 63 282	14 2702 68 283	15 2888 73 284	16 3091 78 285	18 3318 84 286	19 3567 91 288	21 3845 100 289	23 4178 110 291
230	8 1632 37 267	9 1747 40 268	10 1865 43 269	10 1989 46 270	11 2113 49 271	11 2243 52 271	12 2382 55 272	13 2535 59 273	14 2700 63 274	15 2880 68 275	16 3074 73 276	17 3283 78 277	18 3521 85 279
210	7 1466 32 258	8 1567 34 259	8 1672 36 260	9 1780 38 261	9 1886 41 261	10 1998 43 262	11 2116 46 263	11 2246 49 263	12 2385 52 264	13 2535 56 265	13 2694 60 266	14 2861 64 267	15 3048 68 268
190	6 1315 27 249	7 1405 28 250	7 1496 30 251	8 1591 32 251	8 1684 34 252	9 1781 36 253	9 1881 39 253	10 1992 41 254	10 2111 44 255	11 2238 46 256	12 2372 49 256	12 2509 52 257	13 2661 56 258
170	6 1176 23 240	6 1255 24 241	6 1336 26 242	7 1419 27 243	7 1500 29 243	8 1584 31 244	8 1671 32 244	8 1766 34 245	9 1869 36 246	9 1977 39 246	10 2091 41 247	10 2206 43 248	11 2331 46 249
150	5 1045 19 231	5 1115 20 232	6 1187 21 233	6 1260 23 234	6 1330 24 234	7 1402 25 235	7 1477 27 236	7 1560 29 236	8 1648 30 237	8 1741 32 238	9 1839 34 238	9 1935 36 239	10 2040 38 240
140	5 982 17 226	5 1048 18 227	5 1115 20 228	5 1184 21 229	6 1249 22 230	6 1316 23 230	6 1385 25 231	7 1462 26 232	7 1544 28 232	8 1630 29 233	8 1720 31 234	8 1809 33 234	9 1904 34 235
120	4 861 14 217	4 919 15 218	4 978 16 219	5 1037 17 220	5 1093 18 220	5 1150 19 221	6 1210 20 222	6 1275 22 222	6 1346 23 223	6 1419 24 224	7 1496 25 224	7 1571 27 225	8 1650 28 226
100	3 744 12 206	4 794 13 207	4 845 13 209	4 896 14 210	4 943 15 210	4 992 16 211	5 1041 17 212	5 1097 18 212	5 1157 19 213	5 1219 20 214	6 1284 21 214	6 1345 22 215	6 1411 23 216
80	3 630 9 194	3 672 10 195	3 716 11 197	3 758 11 198	4 797 12 198	4 837 12 199	4 878 13 200	4 924 14 200	4 974 15 201	5 1026 15 202	5 1079 16 202	5 1129 17 203	5 1181 18 204
60	2 517 7 179	2 552 7 180	3 588 8 182	3 623 8 183	3 654 9 183	3 685 9 184	3 718 10 185	3 754 10 186	4 795 11 186	4 836 12 187	4 879 12 188	4 917 13 188	4 957 13 189
50	2 461 6 170	2 493 6 171	2 525 7 172	2 556 7 173	3 583 7 174	3 610 8 175	3 638 8 176	3 670 9 176	3 706 9 177	3 743 10 178	3 780 10 178	4 813 11 179	4 847 11 180
15	1 260 2 109	1 279 2 110	1 298 2 111	1 315 3 111	1 328 3 112	1 340 3 112	2 353 3 113	2 369 3 113	2 388 3 114	2 407 3 114	2 426 3 114	2 439 4 114	2 451 4 113

FROM BRAKES RELEASE TIME (MIN) FUEL (KG)
FROM BRAKES RELEASE DIST. (NM) MEAN SPEED TAS (KT)

FB2.1840.002-AA.060

Per 10° C above ISA add :
- 12 % to time
- 11 % to fuel consumption
- 15 % to distance.

Mod. : 4863

GE Eng. : 80C2A2

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ISA	CRUISE 2 ENGINES GEAR DOWN	240 KT

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL150	FL170	FL190	FL210	FL230	FL250	FL270
85	556 0.373 73.7 240 3169 245 38.7	569 0.396 76.7 240 3149 258 40.9	587 0.434 80.8 240 3111 277 44.6	604 0.477 84.8 240 3073 299 48.6	612 0.496 86.5 240 3062 308 50.3	621 0.516 87.9 240 3051 318 52.1	631 0.536 89.5 240 3038 328 54.0	644 0.558 91.1 240 3041 339 55.7	657 0.581 92.8 240 3058 350 57.1	672 0.605 94.6 240 3081 361 58.6
90	558 0.373 74.0 240 3195 245 38.4	571 0.396 75.9 240 3177 258 40.6	589 0.434 81.1 240 3140 277 44.2	607 0.477 85.1 240 3101 299 48.2	615 0.496 86.7 240 3092 308 49.9	623 0.516 88.2 240 3082 318 51.6	634 0.536 89.8 240 3069 328 53.5	647 0.558 91.4 240 3077 339 55.0	661 0.581 93.1 240 3096 350 56.4	675 0.605 94.9 240 3121 361 57.8
95	560 0.373 74.3 240 3226 245 38.0	573 0.396 77.2 240 3209 258 40.2	592 0.434 81.6 240 3173 277 43.7	609 0.477 85.4 240 3135 299 47.7	617 0.496 87.0 240 3126 308 49.3	626 0.516 88.5 240 3118 318 51.0	637 0.536 90.1 240 3106 328 52.8	650 0.558 91.8 240 3118 339 54.3	664 0.581 93.5 240 3138 350 55.7	679 0.605 95.3 240 3163 361 57.1
100	562 0.373 74.6 240 3250 245 37.6	576 0.396 77.5 240 3243 258 39.7	595 0.434 81.8 240 3209 277 43.2	612 0.477 85.7 240 3168 299 47.2	620 0.496 87.3 240 3164 308 48.7	629 0.516 88.8 240 3154 318 50.4	641 0.536 90.4 240 3143 328 52.2	654 0.558 92.1 240 3159 339 53.6	668 0.581 93.9 240 3181 350 54.9	683 0.605 95.7 240 3208 361 56.3
105	565 0.373 75.0 240 3296 245 37.2	579 0.396 77.9 240 3280 258 39.3	598 0.434 82.1 240 3248 277 42.7	615 0.477 86.0 240 3207 299 46.6	623 0.496 87.6 240 3205 308 48.1	633 0.516 89.2 240 3195 318 49.8	644 0.536 90.8 240 3189 328 51.4	658 0.558 92.5 240 3206 339 52.8	672 0.581 94.3 240 3229 350 54.1	688 0.605 96.1 240 3256 361 55.4
110	568 0.373 75.3 240 3335 245 36.8	582 0.396 78.2 240 3320 258 38.8	601 0.434 82.5 240 3289 277 42.2	619 0.477 86.4 240 3246 299 46.0	626 0.496 88.0 240 3247 308 47.5	636 0.516 89.5 240 3237 318 49.1	648 0.536 91.2 240 3236 328 50.7	662 0.558 92.9 240 3253 339 52.0	676 0.581 94.7 240 3277 350 53.3	692 0.605 96.5 240 3308 361 54.6
115	571 0.373 75.7 240 3375 245 36.3	584 0.396 78.6 240 3360 258 38.4	605 0.434 82.9 240 3331 277 41.6	622 0.477 86.8 240 3287 299 45.5	630 0.496 88.3 240 3291 308 46.8	640 0.516 89.9 240 3282 318 48.4	652 0.536 91.6 240 3285 328 49.9	666 0.558 93.3 240 3303 339 51.3	681 0.581 95.1 240 3328 350 52.5	698 0.605 97.0 240 3366 361 53.6
120	574 0.373 76.1 240 3417 245 35.9	588 0.396 79.0 240 3403 258 37.9	608 0.434 83.3 240 3375 277 41.1	625 0.477 87.2 240 3330 299 44.9	633 0.496 88.7 240 3336 308 46.2	644 0.516 90.3 240 3327 318 47.8	656 0.536 92.0 240 3336 328 49.2	670 0.558 93.7 240 3356 339 50.4	686 0.581 95.6 240 3384 350 51.6	704 0.605 97.4 240 3432 361 52.6
125	577 0.373 76.4 240 3461 245 35.4	591 0.396 79.4 240 3447 258 37.4	612 0.434 83.7 240 3421 277 40.5	629 0.477 87.5 240 3379 299 44.2	637 0.496 89.1 240 3385 308 45.5	648 0.516 90.7 240 3377 318 47.1	661 0.536 92.4 240 3392 328 48.4	675 0.558 94.2 240 3413 339 49.6	691 0.581 96.1 240 3445 350 50.7	711 0.605 98.0 240 3500 361 51.6
130	580 0.373 76.8 240 3509 245 34.9	594 0.396 79.9 240 3496 258 36.9	615 0.434 84.1 240 3468 277 40.0	633 0.477 87.9 240 3432 299 43.6	641 0.496 89.5 240 3436 308 44.8	652 0.516 91.2 240 3433 318 46.3	666 0.536 92.9 240 3451 328 47.5	680 0.558 94.7 240 3473 339 48.7	697 0.581 96.6 240 3508 350 49.8	718 0.605 98.6 240 3577 361 50.4
135	583 0.373 77.2 240 3558 245 34.4	598 0.396 80.3 240 3547 258 36.3	618 0.434 84.4 240 3516 277 39.4	637 0.477 88.3 240 3487 299 42.9	645 0.496 89.9 240 3493 308 44.1	657 0.516 91.6 240 3495 318 45.5	671 0.536 93.4 240 3514 328 46.7	686 0.558 95.2 240 3540 339 47.8	703 0.581 97.1 240 3578 350 48.8	726 0.605 99.4 240 3659 361 49.3
140	586 0.373 77.7 240 3612 245 33.9	602 0.396 80.7 240 3604 258 35.8	622 0.434 84.8 240 3569 277 38.9	641 0.477 88.7 240 3545 299 42.2	650 0.496 90.4 240 3551 308 43.4	662 0.516 92.1 240 3559 318 44.7	676 0.536 93.9 240 3578 328 45.8	691 0.558 95.7 240 3608 339 46.9	710 0.581 97.7 240 3656 350 47.8	735 0.605 100.2 240 3745 361 48.2
145	590 0.373 78.1 240 3667 245 33.4	606 0.396 81.2 240 3661 258 35.2	626 0.434 85.3 240 3622 277 38.3	645 0.477 89.2 240 3605 299 41.5	655 0.496 90.9 240 3611 308 42.7	667 0.516 92.6 240 3627 318 43.8	681 0.536 94.4 240 3648 328 45.0	698 0.558 96.3 240 3681 339 46.0	718 0.581 98.2 240 3740 350 46.7	742 0.605 101.1 240 3836 361 47.0
150	594 0.373 78.6 240 3725 245 32.9	610 0.396 81.6 240 3722 258 34.6	630 0.434 85.7 240 3680 277 37.7	650 0.477 89.7 240 3672 299 40.7	660 0.496 91.4 240 3679 308 41.9	673 0.516 93.2 240 3702 318 42.9	687 0.536 95.0 240 3724 328 44.0	704 0.558 96.9 240 3763 339 45.0	726 0.581 98.9 240 3834 350 45.6	750 0.605 102.1 240 3937 361 45.8
	ECT DC C N1 % KG/H/ENG NM/1000K	MACH IAS TAS								

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R R R

Per 10 °C above ISA subtract 0.2 NM/t to specific range.

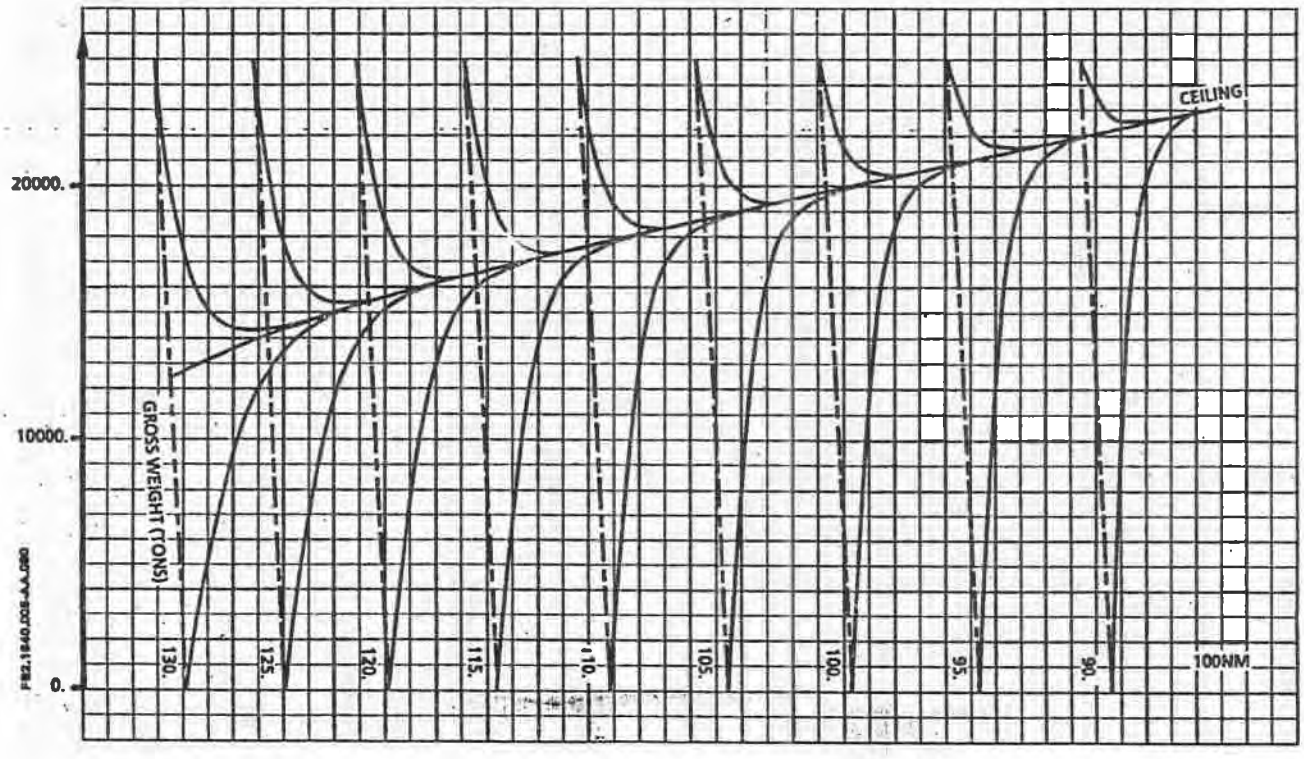
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R « EN ROUTE » GROSS FLIGHT PATH
AIR CONDITIONING ON – ANTI ICING OFF
1 ENGINE OUT – 1 ENGINE AT MAX CONTINUOUS THRUST
C.G. POSITION = 27 %
ISA



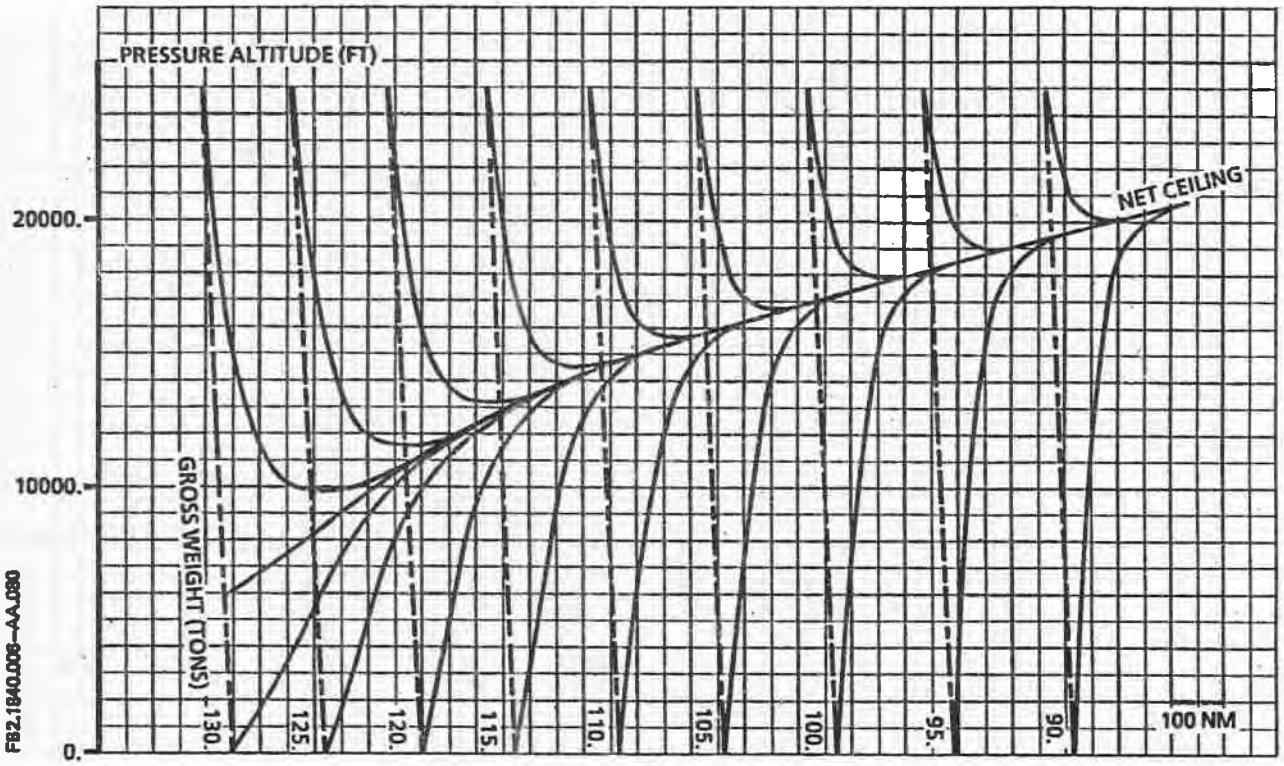
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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS FLIGHT WITH GEAR DOWN AND LANDING GEAR DOORS CLOSED	2.18.40 PAGE 6 REV 15 SEQ 080

« EN ROUTE » NET FLIGHT PATH
AIR CONDITIONING ON – ANTI ICING OFF
1 ENGINE OUT – 1 ENGINE AT MAX CONTINUOUS THRUST
C.G. POSITION = 18 %
ISA



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SLATS 15 FLAPS 0 ISA	HOLDING 2 ENGINES GEAR DOWN	S

WEIGHT (1000 KG)	FL15	FL50	FL100	FL120	FL140	FL160	FL180	FL200	N1 KG/H/ENG
150	78.3 3678	81.4 3673	85.6 3648	87.3 3623	88.8 3634	90.5 3647	92.3 3666	94.3 3693	
145	77.2 3544	80.3 3531	84.6 3521	86.2 3497	87.8 3490	89.4 3504	91.2 3517	93.1 3542	
140	76.3 3439	79.4 3421	83.8 3421	85.4 3398	87.0 3375	88.6 3390	90.3 3401	92.2 3422	
135	75.1 3295	78.0 3275	82.6 3277	84.2 3260	85.8 3238	87.4 3235	89.1 3248	90.9 3261	
130	73.9 3167	76.8 3145	81.3 3141	83.1 3136	84.7 3115	86.4 3094	87.9 3109	89.7 3119	
125	72.6 3041	75.6 3017	80.0 3006	81.9 3009	83.6 2993	85.2 2972	86.8 2971	88.5 2983	
120	71.4 2916	74.4 2890	78.8 2872	80.6 2876	82.4 2873	84.0 2852	85.7 2834	87.3 2847	
115	70.4 2802	73.2 2779	77.6 2755	79.4 2757	81.3 2760	82.9 2745	84.6 2726	86.2 2725	
110	69.0 2682	71.9 2658	76.2 2631	78.0 2626	79.9 2630	81.7 2627	83.3 2608	85.0 2591	
105	67.7 2563	70.5 2538	74.8 2508	76.6 2500	78.4 2501	80.4 2504	82.1 2492	83.7 2474	
100	66.2 2436	69.1 2405	73.3 2376	75.0 2368	76.9 2361	78.7 2365	80.7 2367	82.3 2349	
95	64.8 2312	67.5 2279	71.7 2248	73.4 2238	75.2 2231	77.1 2228	79.0 2231	80.8 2226	
90	63.3 2200	66.0 2166	70.2 2133	71.9 2122	73.7 2114	75.5 2107	77.4 2108	79.3 2110	
85	61.9 2091	64.6 2056	68.6 2019	70.3 2009	72.1 1999	73.9 1992	75.8 1985	77.6 1989	
80	60.5 1984	63.0 1984	67.0 1907	68.7 1898	70.4 1887	72.3 1878	74.0 1872	75.9 1869	

Per degree above (below) ISA add (subtract) 6 kg/h/eng.

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS OPERATIONS FROM FLUID CONTAMINATED RUNWAY	2.18.50 PAGE 1 REV 17 SEQ 040

1. GENERAL

This section presents the recommandations of Airbus Industrie for operations from wet runways or from runways which are covered with contaminants such as standing water, slush, or snow.
The performance data are not certified and shall be considered as guidance only.

CAUTION : Do not take off on icy runway.

2. DEFINITION

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

. Wet : A runway is considered as wet when it has a shiny appearance due to a thin layer of water on it, but when this layer does not exceed 3 mm depth, not leading to a risk of hydroplaning.

. Standing water : is caused by heavy rainfall and/or insufficient runway drainage. Its depth is more than 3 mm.

. Slush : is water saturated with snow, which spatters when stepping firmly on it. It is encountered at temperatures around 5° C and its density is approximately 0.85 Kg/liter (7.1 lbs/US GAL.)

. Wet snow : is a condition where, if compacted by hand, snow will stick together and tend to form a snowball. Its density is approximately 0.4 Kg/liter (3.35 lbs/US GAL)

. Dry snow : is a condition where snow can be blown if loose, or if compacted by hand, will fall apart again upon release. Its density is approximately 0.2 Kg/liter (1.7 lbs/US GAL)

. Compacted snow : is a condition where snow has been compressed (a typical friction coefficient is 0.2)

The performance given in this chapter have been divided into two categories which are distincted by the depth of the contaminant. For each of these categories it has been defined an equivalent depth of contaminant for which the performance deterioration is the same.

(1) WET RUNWAY and EQUIVALENT (see performance in paragraph 4).

Equivalent of wet runway is runway corered with less than :

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

(2) CONTAMINATED RUNWAY (see performance in paragraph 5)

A linear equivalence between depth of slush and snow has been defined :

- 12.7 mm (1/2 inch) wet snow are equivalent to 6.3 mm (1/4 inch) slush
- 50.8 mm (2 inch) dry snow are equivalent to 6.3 mm (1/4 inch) slush.

Note : On a damp runway we consider that there is no performance limitation.

3. OPERATIONAL CONDITIONS

A. Performance data are based on the following assumptions :

- one engine failed at V_1
- uniform depth and density of the contaminant layer over the complete length of the runway
- antiskid and spoilers are operative
- friction coefficient based on studies and checked by actual tests
- 15 ft screen height instead of 35 ft at the end of TOD

and in addition for contaminated runways only :

- drag due to rolling resistance of the wheels
- drag due to spray on airframe and gears
- one engine with reverse thrust for deceleration phase
- maximum take off thrust is used.
- V_1 at least equal to 121 kt IAS (limitation due to V_{MCG}).

B. Take off conditions

- Antiskid serviceable
- Ground spoilers serviceable
- On contaminated runway thrust reversers serviceable R R

Note : In case of obstacle the net flight path overflies them by 15 ft instead of 35 ft.

4. TAKE OFF PERFORMANCE DETERMINATION ON WET RUNWAY AND EQUIVALENT

The determination of maximum take off weight or flex temperature is based on the use of the RTOLW charts. Apply the corresponding instructions given in the following table.

Notes : 1. Apply all the corrections (QNH, bleed) as usual.

2. The method is based on the use of the RTOLW charts established at optimum V_2/V_S. In case of fix V_2/V_S, the results may be slightly different.

GE Eng. : 80C2A2

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WET RUNWAY – USE OF RTOLW CHART

A. Determine maximum take-off weight or flexible temperature and associated take-off speeds on dry runway.

B. Apply the following decrements to maximum take-off weight or flexible temperature and to take-off speeds versus take-off configuration and runway length :

1. Braking with reverse thrust:

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 8000 and above
FLEX T/0 : Temperature decrement (° C)	6	4	0	9	6	2	8	6	2
MAX T/0 : Weight decrement (t)	3.5	2.5	0	4.5	4.0	1.5	4.5	4.5	1.5
V_1 decrement (kt)	8	7	3	12	10	9	13	10	9
V_R and V_2 decrement (kt)	2	2	0	2	2	2	2	2	2

2. Braking without reverse thrust:

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	1500 5000	2000 6500	2500 8000 and above
FLEX T/0 : Temperature decrement (° C)	10	6	1	9	8	2	9	9	3
MAX T/0 : Weight decrement (t)	5.0	4.5	0.5	6.0	5.5	2.0	6.0	6.0	2.5
V_1 decrement (kt)	10	8	6	15	12	12	14	13	12
V_R and V_2 decrement (kt)	3	3	1	3	3	3	3	3	3

Note : Minimum V_1 value due to V_{MCG} limitation : 119 kt IAS in 15/0, 117 kt IAS in 15/15 and 118 kt IAS in 20/20.
1. Actual TOW = Maximum TOW.
If V_1 is lower than minimum V_1 take this last value as V_1 and further decrease weight by 2 tons per kt difference between both values.
2. Actual TOW lower than maximum TOW.
If V_1 corresponding to actual TOW is lower than minimum V_1 :
If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and decrease flexible temperature by 3°C per kt difference between both values.
In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and decrease flexible temperature by 3°C per kt difference between this last value and V_1 corresponding to the actual TOW.

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5. TAKE-OFF PERFORMANCE DETERMINATION ON CONTAMINATED RUNWAY

A. 6.3 mm (1/4 inch) Water

– Determine maximum take-off weight on dry runway.

– Apply the following decrement versus take-off configuration and runway length :

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (tons)	22.5	20.5	15.5	28.0	26.0	21.5	24.0	20.0

– Determine the take-off speeds versus take-off configuration and weight

SLATS 15/FLAPS 0

WEIGHT (tons)	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	131	134	138	142	145	148	152	155	158	161	164	167	170	173	176	177

$V_1 = V_2 - 25$ kt
$V_R = V_2 - 4$ kt

SLATS 15/FLAPS 15

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	125	129	132	135	138	142	144	147	150	153	156	159	161	164	165

$V_1 = V_2 - 27$ kt
$V_R = V_2 - 5$ kt

SLATS 20/FLAPS 20

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	123	126	129	132	135	139	141	145	147	150	152	155	158	160	161

$V_1 = V_2 - 26$ kt
$V_R = V_2 - 5$ kt

Note : Minimum V_1 value due to V_{MCG} limitation :121 kt IAS.

1. *Actual TOW = Maximum TOW.*
   If V_1 is lower than minimum V_1 take this last value as V_1 and further decrease weight by 2 tons per kt difference between both values.
   Take V_R and V_2 corresponding to the weight found after the decrease due to V_{MCG} limitation.
2. *Actual TOW lower than maximum TOW.*
   If V_1 corresponding to actual TOW is lower than minimum V_1 :
   If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and take V_R and V_2 corresponding to the actual TOW.
   In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and V_R and V_2 corresponding to the actual TOW.

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B. 12.7 mm (1/2 inch) Water

- Determine maximum take-off weight on dry runway.
- Apply the following decrement versus take-off configuration and runway length :

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (tons)	22.5	21.5	17.0	25.5	23.5	21.0	24.0	20.0

- Determine the take-off speeds versus take-off configuration and weight

SLATS 15/FLAPS 0

WEIGHT (tons)	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	131	134	138	142	145	148	152	155	158	161	164	167	170	173	176	177

$V_1 = V_2 - 22$ kt
$V_R = V_2 - 3$ kt

SLATS 15/FLAPS 15

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	125	129	132	135	138	142	144	147	150	153	156	159	161	164	165

$V_1 = V_2 - 24$ kt
$V_R = V_2 - 5$ kt

SLATS 20/FLAPS 20

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	123	126	129	132	135	139	141	145	147	150	152	155	158	160	161

$V_1 = V_2 - 23$ kt
$V_R = V_2 - 5$ kt

Note : Minimum V_1 value due to V_{MCG} limitation :121 kt IAS.

1. *Actual TOW = Maximum TOW.*
   If V_1 is lower than minimum V_1 take this last value as V1 and further decrease weight by 2 tons per kt difference between both values.
   Take V_R and V_2 corresponding to the weight found after the decrease due to V_{MCG} limitation.
2. *Actual TOW lower than maximum TOW.*
   If V_1 corresponding to actual TOW is lower than minimum V_1 :
   If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and take V_R and V_2 corresponding to the actual TOW.
   In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and V_R and V_2 corresponding to the actual TOW.

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C. 6.3 mm (1/4 inch) Slush

- Determine maximum take-off weight on dry runway.
- Apply the following decrement versus take-off configuration and runway length :

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (tons)	21.0	19.0	14.5	26.5	22.5	17.5	23.0	18.0

- Determine the take-off speeds versus take-off configuration and weight

SLATS 15/FLAPS 0

WEIGHT (tons)	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	131	134	138	142	145	148	152	155	158	161	164	167	170	173	176	177

$V_1 = V_2 - 21$ kt
$V_R = V_2 - 3$ kt

SLATS 15/FLAPS 15

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	125	129	132	135	138	142	144	147	150	153	156	159	161	164	165

$V_1 = V_2 - 25$ kt
$V_R = V_2 - 5$ kt

SLATS 20/FLAPS 20

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	123	126	129	132	135	139	141	145	147	150	152	155	158	160	161

$V_1 = V_2 - 21$ kt
$V_R = V_2 - 5$ kt

Note : Minimum V_1 value due to V_{MCG} limitation :121 kt IAS.

1. *Actual TOW = Maximum TOW.*
   If V_1 is lower than minimum V_1 take this last value as V_1 and further decrease weight by 2 tons per kt difference between both values.
   Take V_R and V_2 corresponding to the weight found after the decrease due to V_{MCG} limitation.
2. *Actual TOW lower than maximum TOW.*
   If V_1 corresponding to actual TOW is lower than minimum V_1 :
   If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and take V_R and V_2 corresponding to the actual TOW.
   In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and V_R and V_2 corresponding to the actual TOW.

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D. 12.7 mm (1/2 inch) Slush

- Determine maximum take-off weight on dry runway.
- Apply the following decrement versus take-off configuration and runway length :

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (tons)	25.0	23.0	20.0	26.0	26.0	22.5	26.0	22.5

- Determine the take-off speeds versus take-off configuration and weight

SLATS 15/FLAPS 0

WEIGHT (tons)	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	131	134	138	142	145	148	152	155	158	161	164	167	170	173	176	177

$V_1 = V_2 - 16$ kt
$V_R = V_2 - 2$ kt

SLATS 15/FLAPS 15

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	125	129	132	135	138	142	144	147	150	153	156	159	161	164	165

$V_1 = V_2 - 19$ kt
$V_R = V_2 - 4$ kt

SLATS 20/FLAPS 20

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	123	126	129	132	135	139	141	145	147	150	152	155	158	160	161

$V_1 = V_2 - 17$ kt
$V_R = V_2 - 4$ kt

Note : Minimum V_1 value due to V_{MCG} limitation :121 kt IAS.

1. *Actual TOW = Maximum TOW.*
   If V_1 is lower than minimum V_1 take this last value as V_1 and further decrease weight by 2 tons per kt difference between both values.
   Take V_R and V_2 corresponding to the weight found after the decrease due to V_{MCG} limitation.
2. *Actual TOW lower than maximum TOW.*
   If V_1 corresponding to actual TOW is lower than minimum V_1 :
   If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and take V_R and V_2 corresponding to the actual TOW.
   In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and V_R and V_2 corresponding to the actual TOW.

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E. compacted snow

- Determine maximum take-off weight on dry runway.
- Apply the following decrement versus take-off configuration and runway length :

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0			SLATS 15/FLAPS 15			SLATS 20/FLAPS 20	
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above	2000 6500	2500 8000	3000 10000 and above	2000 6500	2500 8000 and above
Weight decrement (tons)	7.0	5.0	8.0	10.0	9.0	8.0	11.5	7.0

- Determine the take-off speeds versus take-off configuration and weight

SLATS 15/FLAPS 0

WEIGHT (tons)	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	131	134	138	142	145	148	152	155	158	161	164	167	170	173	176	177

$V_1 = V_2 - 16$ kt
$V_R = V_2 - 3$ kt

SLATS 15/FLAPS 15

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	125	129	132	135	138	142	144	147	150	153	156	159	161	164	165

$V_1 = V_2 - 21$ kt
$V_R = V_2 - 4$ kt

SLATS 20/FLAPS 20

WEIGHT (tons)	90	95	100	105	110	115	120	125	130	135	140	145	150	155	157
V_2 (kt IAS)	123	126	129	132	135	139	141	145	147	150	152	155	158	160	161

$V_1 = V_2 - 20$ kt
$V_R = V_2 - 5$ kt

Note : Minimum V_1 value due to V_{MCG} limitation :121 kt IAS.

1. *Actual TOW = Maximum TOW.*
   If V_1 is lower than minimum V_1 take this last value as V_1 and further decrease weight by 2 tons per kt difference between both values.
   Take V_R and V_2 corresponding to the weight found after the decrease due to V_{MCG} limitation.
2. *Actual TOW lower than maximum TOW.*
   If V_1 corresponding to actual TOW is lower than minimum V_1 :
   If maximum TOW has a V_1 equal to or above minimum V_1, retain minimum V_1 as V_1 and take V_R and V_2 corresponding to the actual TOW.
   In some seldom cases where V_1 corresponding to maximum TOW falls below minimum V_1, decrease maximum TOW by 2 tons per kt difference between both values. Limit the actual TOW to the value found after this decrement. Take V_1 equal to minimum V_1 and V_R and V_2 corresponding to the actual TOW.

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6. SPRAY PATTERN

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

During power setting and initial acceleration, a small ingestion is possible, which should disappear when the aircraft speed is over 60 kt.

7. CROSSWIND

In order to minimize directional control problems during the low speed phase of the take off roll on contaminated runway, it is not recommended to take off with a crosswind component above 15 kt.

8. TAXIING

When taxiing on slippery surfaces, maintain an adequate distance to the preceeding aircraft. Taxy at a maximum speed of 10 kt. Note that antiskid is not operating at low speed.

Nose wheel steering should be used in small but progressive movements supported by differential power when necessary in small radius turns.

Retract slats and flaps in slush conditions to avoid contamination of the mechanism and subsequent damage by frozen slush.

Extend the high lift devices for T/O configuration and perform the taxi checklist at the end of taxiing.

9. TAKE OFF

Set the thrust as symmetrically as possible to avoid yawing moments in the first part of the take off roll.

For contaminated runway use full engine thrust.

Hold the nose wheel steering wheel in the center position up to V1 to avoid yawing of the nose wheel when aerodynamic directional control is used. Avoid large or rapid rudder inputs.

Hold the control column firmly but not excessively in the forward position to increase nose wheel contact. Do not lift the nose wheel in an attempt to avoid contamination of the aircraft, since this will produce additional drag.

Rotate, lift off, retract gear and high lift devices in the normal manner.

Take off should not be aborted for minor deficiencies even at low speeds.

Keep the nose wheel centered, maintain directional control with the rudder and small inputs of the nose wheel. Regain center line with differential braking when stopping distance permits.

10. LANDING

Landing on contaminated runways without anti-skid should be avoided.

Approach at normal speed. Use maximum reverse thrust as soon as possible after touch down.

Apply brakes normally with steady pressure. Maintain directional control with the rudder as long as possible, use nose wheel steering with care.

The use of auto-braking is strongly recommended provided the contaminant is evenly distributed.

In crosswind conditions do not decrab completely as the aircraft will yaw on the slippery runway due to its weathercock stability.

When landing distance permits the centerline can be regained by using differential braking. Use the reversers in the usual way, knowing that if it becomes necessary, the full reverse could be maintained until the aircraft is fully stopped. When the aircraft is at taxiing speed, follow the taxiing recommendations.

CAUTION : It is recommended not to use single reverser when landing on wet or contaminated runways when cross winds exceed 20 kt.

11. AFTER LANDING AND PARKING

If the approach was made in icing condition or snow, or if the runway was covered by snow or slush do not retract the slats and flaps to the fully retracted position to avoid damage to the structure by frozen slush and/or snow. Shut down the engines, have the ground crew check that there is no significant amount of ice, slush or snow in the flap and slat mechanism.

When the mechanisms are clean, retract slats and flaps using the green system electro-hydraulic pumps.

When the mechanisms are contaminated, keep slats and flaps extended.

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12. EXAMPLE

a. Take-off performance on dry runway

Data :
runway length : 3500 m. (11500 ft)
OAT = 50°C
No wind
S15°/FO°
Determination of take-off performance from RTOLW chart :

WEIGHT 1000 KG	-10	-5	0
132.0	43 4-4 .6 **** 147-147-152	46 4-4 .6 **** 148-148-152	48 4-4 1.0 **** 151-151-155
130.0	45 4-4 .8 **** 146-146-151	48 4-4 .4 **** 147-147-152	50 4-4 .2 **** 149-149-154
128.0	47 4-4 .8 **** 145-145-150	49 4-4 1.1 **** 146-146-151	51 4-4 .7 **** 148-148-153
126.0	49 4-4 .4 **** 144-144-149	51 4-4 .3 **** 145-145-150	52 4-4 1.3 **** 148-148-152
124.0	50 4-4 1.0 **** 143-143-148	52 4-4 .8 **** 144-144-149	54 4-4 .4 **** 146-146-150
122.0	52 4-4 .2 **** 142-142-146	54 4-4 .0 **** 143-143-147	55 4-4 1.2 **** 146-146-150

Maximum TOW = 130.2 tons, V_1 = 149 kt, V_R = 149 kt, V_2 = 154 kt.

b. Take-off performance determination on wet runway braking with reverse thrust (see page 2).

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above
FLEX T/O : Temperature decrement (°C)	6	4	0
MAX T/O : Weight decrement (t)	3.5	2.5	0
V_1 decrement (kt)	8	7	3
V_R and V_2 decrement (kt)	2	2	0

Maximum TOW on wet runway = 130.2 - 2.5 = 127.7 tons.
V_1 = 149 - 7 = 142 kt above limitation due to V_{MCG}
V_R = 149 - 2 = 147 kt
V_2 = 154 - 2 = 152 kt
actual take-off weight : 124 tons
Flexible temperature = 54 - 4 = 50°C
V_1 = 146 - 7 = 139 kt (above limitation due to V_{MCG})
V_R = 146 - 2 = 144 kt
V_2 = 150 - 2 = 148 kt

c. Take-off performance determination on runway covered with 1/2 inch water (see page 4)

- Maximum take-off weight

TAKE-OFF CONFIGURATION	SLATS 15/FLAPS 0		
RUNWAY LENGTH (m) (ft)	3000 10000	3500 11500	4000 13000 and above
Weight decrement (TONS)	22.5	21.5	17.0

Max TOW = 130.2 - 21.5 = 108.7 tons

- Take-off speeds on contaminated runway

95	100	105	110	115	120	125
138	142	145	148	152	155	158

$V_1 = V_2 - 22$ kt
$V_R = V_2 - 3$ kt

V_2 = 147 kt
V_1 = 147 - 22 = 125 kt
V_R = 147 - 3 = 144 kt

- Actual TOW = 95 tons

V_2 = 138 kt
V_R = 138 - 3 = 135 kt
V_1 = 138 - 22 = 116 kt below limitation due to V_{MCG}.
Apply note 2 :
V_1 = 121 kt.

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A310 FLIGHT CREW OPERATING MANUAL	SPECIAL OPERATIONS EXTENDED RANGE OPERATIONS	2.18.70 PAGE 1 REV 18 SEQ 001

1. GENERAL

The system design and engine installation reliability of this airplane comply with the capability criteria for ETOPS flights of CTC 20 (DGAC) or AC 120–42 A (FAA) or CAP 513 (CAA UK) when configured maintained and operated in accordance with the provisions of the appropriate Airbus Industrie document « Standard for Extended Range Operations » at the latest approved revision.

R This statement of capability does not constitute an
R approval to conduct Extended Range Operations.

R The supplement 13 in section 6 of the Flight Manual gives
R the reference of the approved Standard for Extended
R Range Operations, the applicable limitations when necessary,
R and the required information.

R The operator has the responsability to show compliance
R with his national regulation and to obtain operational
R approval from his national Authorities.

R The airplane must be configured in accordance with the
R Airbus Industrie standard for Extended Range Operations.

R However, the Authorities may allow under certain conditions
R ETOPS flights without showing full compliance with these
R standards for operations with limited maximum diversion
R time (for example 75 minutes diversion time within benign
R area operations).

2. OPERATOR PROPULSION RELIABILITY, MODIFICATIONS STATUS AND MAINTENANCE

The operational approval will be granted by the operator's National Authorities after assessment of the propulsion system reliability achieved by the applicant.

The operator's Authorites will also require evidence that the appropriate engineering modifications and SB's have been embodied and that maintenance practices, procedures and training are compatible with ETOPS.

R In general one year experience with the aircraft type is
R required before starting ETOPS flights up to 120 minutes
R diversion time. However for 75 minutes this may not be
R required depending of the area of operation. An additional
R year of experience in ETOPS is required for flight up to 180
R minutes diversion time.

3. DISPATCH CONSIDERATION

3.1. MMEL

The MMEL has been reviewed to take into consideration R
longer average duration flight and the maximum diversion R
time. R

The result of this review was the introduction in the MMEL R
of additional conditions or withdrawal of certain relieve R
cases for ETOPS flights. R

The MMEL published by Airbus Industrie and approved by R
french DGAC can be used to establish the airline MEL R
which must be approved by the national Authorities of the R
operator. This MEL will be most probably adapted to each R
ETOPS route and the determining parameters will be : R

. The maximum and the average diversion time on the R
route. R
. The equipment of the enroute alternates. R
. The navigation and communication means. R
. The average meteorological conditions. R

3.2. Communication and navigation facilities

Airbus COM system design has provision to install 3VHF and 2HF insuring full compliance with ETOPS requirements on any kind of routes.

The NAV system meets the ETOPS requirements for enroute or approach navigation.

2 IRS in conjunction with 2 FMS comply with MNPS R
criteria and is approved as sole means of navigation for flight up to the maximum aircraft autonomy.

Above 73°N heading information will be lost or become R
unreliable depending on aircraft equipment. R

3.3. Fuel and oil supply

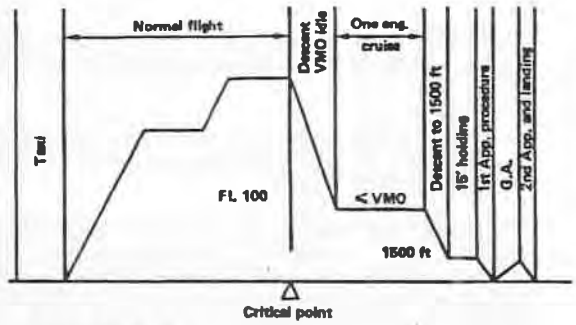
Fuel and oil supply must be determined taking into account engine failure or pressurization failure at the critical point on the route. Forecasted wind and temperature conditions must be considered and as well, if needed, icing conditions.

Three critical scenarios must be considered and compared to the normal fuel calculation (non-ETOPS).

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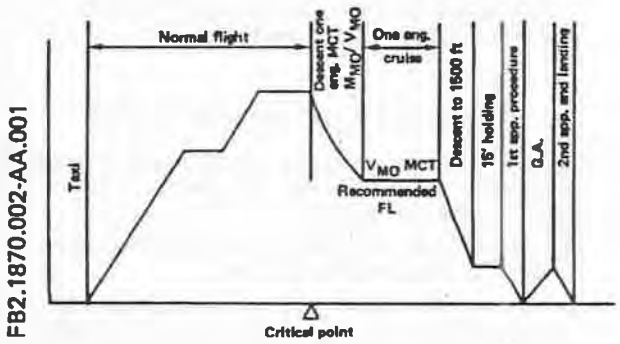
3.4. Critical scenarios for ETOPS

1° Pressurization failure + engine failure



2° Pressurization failure
Same flight profile but with 2 engines operative.

3° Engine failure



Critical scenario, fuel reserve

The critical fuel scenario should incorporate :

- a contingency figure of 5 percent added to the calculated fuel burn from the critical point to take into account errors in wind forecasts,
- a 5 percent penalty in fuel mileage (instead of an established value for in service deterioration in cruise fuel mileage),
- any CDL items,
- both airframe and engine anti-icing and account for ice accumulation on unheated surfaces if icing conditions are likely to be encountered during the diversion.

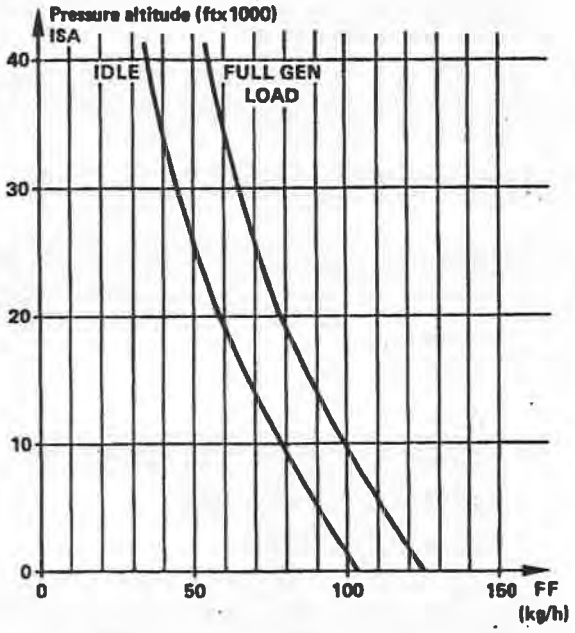
R 9 percent fuel penalty due to drag effect on unheated surfaces is to be considered for severe icing conditions during 3 hours diversion. This figure can be reduced in proportion for shorter probable exposure time and divided by 2 for moderate icing conditions.

R *Note : Fuel reserves must take into consideration the most critical failure scenario with use of minimum diversion time procedure. However in case of pressurization failure with two engines operative, a cruise at FL100 and LRC speed can be assumed.*

If APU is a required power source, then its fuel consumption should be accounted for during the appropriate phase(s) of the flight.

APU fuel consumption

If APU is used as power source, for example in case of dispatch with one generator inoperative, its fuel consumption can be determined with following graph.



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3.5. Weather minima

Weather forecasts for enroute alternates must meet the applicable operator's weather minima requirements. If this applicable requirement is AC120-42 or CAP513, the following applies :

An airplane cannot be dispatched unless the meteorological forecasts, at enroute alternate airports for a period starting one hour before the earliest expected time of landing and ending one hour after the latest expected time of landing, meet the hereunder weather minima.

AIRPORT EQUIPMENT	Ceiling (ft)	Visibility (m)
1 ILS/MLS	600 or 400*	3200 or 1600*
2 ILS/MLS on separate runways	400 or 200*	2400 or 1600*
Non precision approach	800 or 400*	3200 or 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	
* Or above lower published minima whichever is higher.		

Note : Minima lower than above ones can be established taking into consideration the peculiarities of a specific route provided these minima have been agreed by the responsable operational Authorities and reported in the route specification.

4. OPERATIONAL LIMITATION

4.1. General

R For the purpose of AC 120-42 A and CAA CAP 513, Extended Range Operations are those intended to be conducted over a route that contains a point further than 60 minutes from an adequate airport at one-engine-inoperative speed in still air and ISA conditions.

Definition :

An adequate airport is an airport large enough and sufficiently equipped to be used. In particular it should be expected that at the anticipated time of use it will be available and equipped with the necessary services including meteorology and at least one let down aid for an instrument approach.

4.2. Area of operation

Determination of the diversion time

To determine any diversion time, a one-engine-inoperative speed must be defined.
According to interpretation of CAA CAP 513 and FAA AC 120-42 A this speed is a level flight speed, under ISA conditions at a reference weight with one engine shut down, the other at the power recommended, equal to or below MCT. R

CAA CAP 513 defines the reference weight as follows :

- Take-off at the maximum authorized TOW.
- Climb to the initial optimum cruise flight level in ISA conditions.
- Continue the flight at long range cruise to complete two hours from take-off.
- The resulting A/C weight is the reference weight which must be used in the determination of the one-engine-inoperative speed.

R

Authorities may require to consider one engine inoperative performance with total anti-ice « ON » for specific routes.
For a given route, the diversion distances to an adequate airport are determined by examination of the navigation charts.
The greatest of these distances must be flown within the maximum diversion time approved for the aircraft or the operator.

A maximum one-engine-inoperative speed will be approved, a sample of which is given below in function of the reference weight and associated to recommended one engine inoperative flight altitudes.

There are special routes for which a lower one engine inoperative speed must be considered, for example when drift down procedure at green dot speed is required for obstacle clearance. R R R R

The one engine inoperative speed, agreed by the National Operational Authorities, should be mentioned in the route specification. For Operations according to the UK CAA requirement (CAP 513) this speed cannot be higher than the speed specified in the Flight Manual section 6. R R R R R

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A/C MODEL	REF WEIGHT (t)	RECOMMENDED FL	ONE ENGINE INOPERATIVE SPEEDS TAS (kt)	
			Anti-ice off	Anti-ice on
A310-203	125 (1) 115 (2)	180-190 190-200	414 418	405 411
A310-221	125 (1) 115 (2)	180-190 190-200	424 429	414 420
A310-222	130 (1) 120 (2)	180-190 190-200	430 432	420 422
A310-322	140 (1) 125 (2)	180-190 190-200	430 435	414 421
A310-304	140 (1) 125 (2)	170-180 170-180	424 431	412 421
A310-324	140 (1) 125 (2)	170-180 180-190	416 429	406 420
R R A310-204	125 (1) 115 (2)	180-190 190-200	429 430	417 422

(1) Reference weight close to CAA definition.
(2) Mean reference weight.

4.3. Flight dispatch limitation

The extended range operation is limited to flights where
R a maximum diversion time to a suitable airport can be met.

Definition :

A suitable airport is an adequate airport where at the anticipated time of use weather reports, or forecasts indicate that the weather conditions are likely to be at or above the operating minima at the time of the intended
R operation using the criteria of appendix 3 of AC-120-42 A or appendix B of CAA CAP 513 (See weather minima detailed in paragraph 3.5 above).

R For 120 minutes diversion time to an adequate airport, under specified conditions, a 15 % increase of maximum diversion time to a suitable airport can be granted by the authorities. It must be clearly understood that this allowance does not change the 120 minutes diversion time limitation to an adequate airport. The purpose of the 15 % is to offer additional dispatch flexibility without changing the possible area of operation.

This flexibility does not exist for 180 minutes diversion time.

5. DIVERSION DURING EXTENDED RANGE OPERATIONS R

5.1 Failure cases requiring diversion to the nearest airport R

These cases are those for which the FM and the Check list procedures require LAND ASAP. No other case for ER operations needs to be added. R

- Summary of procedures requiring LAND ASAP : R

IN FLT ENG FIRE R
APU FIRE R
SINGLE ENG OPERATION R
LOSS OF BOTH ENG. GENERATORS R
AVIONICS SMOKE R
BAT SMOKE R
CARGO COMPT SMOKE (included only in the US AFM) R
DUAL HYD. SYS LO PR. R

Comments and recommendations R

- Electrical Generation R

	AVAILABLE GENERATORS AT DISPATCH	AFTER 1st GEN FAILURE	AFTER 2nd GEN FAILURE or APU not available	AFTER 3rd GEN FAILURE
NORMAL DIS.	2 ENG. GEN 1 APU GEN 1 STBY GEN	START APU (d) NO DIVERSION	NO DIVERSION REQUIRED (c)	DIVERSION REQUIRED
MEL OR NORMAL	2 ENG GEN 1 APU GEN(a)	NO DIVERSION REQUIRED (c)	DIVERSION REQUIRED	NOT APPLICABLE
MEL DISPATCH	2 ENG GEN 1 STBY GEN (b)			
	1 ENG GEN 1 APU GEN(a) 1 STBY GEN(b)			

(a) APU must run continuously ;
(b) STBY GEN must be checked before the flight ;
(c) Crew may choose to divert after evaluation of the overall situation.
Aircraft status in the present failure case, and if a subsequent generator failure occurs, must be considered taking into account actual meterological conditions, available airport characteristics and approach facilities or any pertinent operational condition.
(d) Number of APU start attempts is not limited. R

- Fire Protection R

In case of CARGO SMOKE warning, even if the Flight Manual does not require LAND ASAP, a diversion must be initiated, the nearest suitable airport should be selected whatever is the fire suppression system protection time. Refers also to FCOM 2.04.10 page 1 on this subject. R

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- Fuel System

  Some failure cases may lead to fuel gravity feeding which implies unusable fuel quantity and flight at lower altitude. Due consideration of fuel remaining available and fuel consumption may ask for diversion.

- Hydraulic system

  In case of green system failure STBY GEN is lost. After first electrical ENG GEN subsequent failure : Start APU. Diversion decision is identical to the dispatch without STBY GEN.

5.2 Guidelines for Diversion Procedure

- If altitude can be maintained :
  - Complete the related failure Check List procedure
  - Inform ATC
  - Determine nearest suitable airport (method to be developed by airline)
  - Divert to the choosen enroute alternate

- If altitude cannot be maintained
  - Complete the related failure Check List procedure
  - Inform ATC
  - Determine the nearest suitable alternate (method to be developed by airline)
  - Divert to the choosen enroute alternate
  - Initiate the descent

  - If time is critical
    - Select MCT
    - Descent at cruise Mach number then VMO*
    - Level off at FL180/220 or FL100 if pressurization failed.
    - Maintain MCT or VMO*.

    * VMO or any IAS as determined by the airline specification

  - If time is not critical
    - Maintain MCR thrust
    - Descent at cruise Mach then 320 kt.
    - Level off at the maximum altitude to obtain LRC speed or FL100 if pressurization failed
    - Select MCT and maintain LRC speed.

5.3 Diversion Strategy following engine failure

Whatever is the one engine inoperative speed assumed in the route specification, the crew is free to adopt the strategy they consider the most appropriate to the present situation, in case of diversion.

FCOM section 2.16.20 gives three single engine descent and cruise procedures :

1. The drift down procedure when obstacles problems exist.
2. The descent without obstacle constraint and cruise at LRC speed.
3. A minimum diversion time procedure which asks for MCT and cruise at or close to VMO.

During an ER operation, the minimum diversion time procedure is not necessarily required. It must be used only when a time dependent situation occurs. Crew has to consider the overall situation, and not only the fact that one engine has failed, to choose his diversion strategy.

Some failure cases which lead to unusable fuel or fuel loss may require diversion at LRC speed.

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	OEB N° /ISSUE	DATE	SUBJECT	REMARKS
R	01/03	Apr 83	General recommendations for Take-off and Landing	Cancelled
	02/01	Feb 83	Emergency/Abnormal drills Task sharing ECAM crew coordination	Cancelled
R	03/02	Mar 83	Recommendations for use of FMS	Cancelled
R	04/03	Mar 84	Low speed information display	Cancelled
	05/01	**Mar 83**	**Power management control (PMC)**	
	06/01	**Mar 83**	**Electronic engine control (EEC)**	
	07/03	Oct 85	Overiding systems protections by use of circuit breakers	Cancelled
	08/02	**Mar 84**	**Aerodynamic design and flying qualities**	
	09/04	**Oct 87**	**Blowers flow warning**	
	10/01	May 83	Ice detection system	Cancelled
R	11/02	Nov 84	Cabin pressurization : rate of change	Cancelled
	12/02	Dec 84	Engine flame out during descent	Cancelled
	13/03	**Feb 84**	**Flaps and slats control lever**	
	14/04	Feb 85	Fuel pumps – Control logic	Cancelled
	15/01	**June 83**	**AFS behaviour following cut off (greater than 5 seconds) of the total electrical network of the aircraft.**	
	16/02	May 84	Cabin pressure – Landing elevation setting	Cancelled
	17/01	June 83	Flight director behaviour following non reception of the LOC or GLIDE signal	Cancelled
	18/03	**Jan 84**	**Loss of spoilers with land recovery-ON**	
	19/03	**Oct 87**	**Cabin pressure – High cabin rate of change without warning**	
	20/05	**Feb 84**	**Engine air bleed failure**	
	21/01	**Aug 83**	**Oil Quantity Variation**	
	22/01	Sep 83	Operations on wet and contaminated Runway	Cancelled
	23/03	**Mar 88**	**Engine failure compensation on A 310**	
	24/05	**Oct 87**	**VLS (amber strip) indication on PFD's when airbrakes are extended**	
R	25/02	Jan 84	Idle thrust information on ECAM	Cancelled
	26/02	**Oct 87**	**Engine Oil press Hi**	
R	27/07	Sep 84	Flight warning computer failure	Cancelled
	28/01	**Dec 83**	**Engine trim system failure at take off**	
R	**29/03**	**Jun 88**	**ATS switching in flight**	

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	30/01	Dec 83	Recommendation for use of SMITHS FMS	Cancelled
	31/01	Jan 84	General recommendations for monitoring of flight parameters during automatic approach and landing	Cancelled
	32/03	**Dec 84**	**Circuit breaker use in flight**	
R	33/01	Jan 84	ECAM – ENG TRIM FAULT warning	Cancelled
	34/02	**Feb 84**	**APU air conditioning on ground**	
	35/04	Oct 86	Servo control jam warning on ground	Cancelled
	36/03	**Oct 87**	**ECAM – AC Bus 1 or 2 failure**	
	37/02	**Apr 84**	**Primary servo control units – jamming detection cam roller failure**	
	38/02	**June 84**	**Autothrottle behaviour following engine failure**	
	39/01	May 84	Primary servo control units – jamming detection cam roller failure	Cancelled
	40/01	June 84	Operations in windshear/downbursts conditions	Cancelled
	41/02	**Mar 86**	**Pressurization systems – automatic changeover**	
	42/02	June 84	Stator anti-icing valve removal	Cancelled
R	**43/02**	**June 89**	**Compatibility problem between « OP^{++} STANDARD » FMS and « BATCH B » FCC**	
	44/01	July 84	180° turn on runway	Cancelled
R	45/02	Oct 87	Throttle jamming	Cancelled
	46/02	**Apr 88**	**Recommendation for use of « OP^{++} » standard SPERRY FMS**	
	47/01	Sep 84	FMS behaviour in case of over temperature condition	Cancelled
R	48/02	Oct 87	Local jam warning without indication on CRT or WLDP	Cancelled
R	49/02	Oct 87	Fuel isolation valves indication	Cancelled
R	50/01	Dec 84	Utilization of the Autobrake system	Cancelled
	51/01	Dec 84	Interface between SMITHS FMC's and IRS's	Cancelled
	52/01	**Dec 84**	**Autopilot engagement**	
	53/02	**Oct 87**	**Access door 134 R and 136 R – Display and warning**	
R	54/01	Dec 84	FLAPS JAMMINGS ON GROUND	Cancelled
R	55/01	Jan 85	Pitch Trim Switches Failure	Cancelled
R	56/01	Apr 85	Recommendations for directional/lateral trimming procedures in cruise	Cancelled

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	57/02	Jul 86	**APU relight in flight at or close to 25 000 ft**	
	58/01	Apr 85	**SPERRY FMS with OP + + standard incorporated – Use of profile mode with OF altitude capture or HOLD**	
	59/2	Oct 87	**False « Landing Gear Not Down » warning**	
	60/1	May 85	**Trading a part of the engine derating for use of air conditioning at take off**	
	61/1	Jun 85	**Discrepancy between speeds F, S and O displayed on PFD at take-off and those given in FCOM**	
	62/2	Oct 87	**Temperature inversion effects on electronic engine controls (EEC)**	
	63/1	Jun 85	**Auto pilot override**	
	64/1	Jul 85	Display of ILS/DME distance on PFD with SMITHS FMS	Cancelled
	65/2	Jun 87	**Outflow valve runaway**	
	66/3	May 87	Dispatch with one FAC failed	Cancelled
	67/2	Oct 87	**Engine trim – OFF control**	
	68/2	May 86	**Autothrottle Behaviour in case of engine failure**	
	69/2	Oct 87	**Autothrottle Behaviour in case of engine failure**	
	70/2	Nov 86	**Fuel pump hydraulic stage malfunction**	
R	71/3	Jun 88	**General recommendations for FMS use**	
R	72/2	Apr 88	General recommendations for FMS use	Cancelled
R	73/2	Apr 88	General recommendations for FMS use	Cancelled
R	74/2	Jun 86	Recovery from stall warning-stick shaker	Cancelled
R	75/2	May 86	**Slow or hung ground start**	
R	76/2	Aug 86	ETOPS related modifications and their link with ECAM messages	Cancelled
	77/3	Oct 87	**Engine stall protection – selection of approach idle**	
R	78/1	Jun 86	Presentation of the new « SMITHS » FMS PERF 1 software	Cancelled
R	79/2	Dec 86	How does the reverse participate in stopping the airplane	Cancelled
R	80/1	Jul 86	Cabin pressurization system behaviour in case of landing elevation lower than take off elevation	Cancelled
R	81/4	Jul 88	**Manual override of stand-by generator**	
	82/4	Feb 88	**ATS Behaviour after engine failure**	
	83/2	Nov 86	ATS Behaviour after engine failure	Cancelled
	84/2	Nov 86	ATS Behaviour after engine failure	Cancelled
R	85/1	Nov 86	Diversion during extended range operations	Cancelled
R	86/4	Oct 87	Low altitude engine surge	Cancelled
	87/1	Jan 87	Operations in wind shear/down burst conditions.	Cancelled
R	88/1	Apr 87	Airbus Industrie recommendations for use of Take Off chart and flexible Take Off thrust	Cancelled

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	89/1	Jun 87	Low pressure turbine burn through	
	90/1	Jun 87	Approach idle requirement with one engine bleed off	
R	91/2	Jun 89	Compatibility between FMS « SMITHS » PERF 2 and FAC ST5	
	92/1	Jul 87	Loc capture	
R	93/1	Oct 87	Rejected Take-Off	Cancelled
R	94/2	Oct 88	Trim Tank System	Cancelled
R	95/1	Nov 87	Pilot induced oscillation (P.I.O)	Cancelled
R	96/1	Dec 87	Throttle reduction at profile engagement with FMS SMITHS PERF 1 +	Cancelled
	97/1	Feb 88	FAC Failure	
	98/1	Apr 88	General recommendations for FMS use	
R	99/2	Apr 88	N1 Shortfall during take off	
R	100/1	Jun 88	Overspeed in descent with profile mode	
R	101/1	Oct 88	Trim Tank System	Cancelled
R	102/1	Sep 88	APU Starting procedure	Cancelled
R	103/1	Jun 88	Overspeed in descent with profile mode	
R	104/2	Sep 88	Window heat fault during APU start	
R	105/2	Jan 89	All pitot lights after take-off	
R	106/1	Feb 89	Throttle reduction during take-off	
R R	107/1	Mar 89	PW 4000 – FADEC, EPR and N1 Modes associated operational aspects	
R	108/1	May 89	Oil Pressure Indication	

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