CHAPTER 2 - LIMITATIONS

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LIST OF ILLUSTRATIONS

1. GENERAL

The limitations included in this chapter contain items peculiar to the CL600, model 2B16 Challenger airplane (Serial No. 5701 and subsequent).

Observance of these limitations is mandatory.

2. KINDS OF AIRPLANE OPERATION

The airplane is certified for operations in the following conditions, when the equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition:

- Day and night
- VFR and IFR
- Flight in icing conditions

The airplane is certified for ditching when the safety equipment, specified by the applicable regulations, is installed.

The airplane is certified capable of RVSM operations in accordance with FAA “Interim guidance material on the approval of operations/aircraft for RVSM operations” 91–RVSM, dated March 14, 1994.

NOTE

Compliance with the standard noted above does not constitute an operational approval.

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1. STRUCTURAL WEIGHT LIMITATION

Maximum taxi and ramp weight:	21,909 kg (48,300 lb)
Maximum take-off weight:	21,863 kg (48,200 lb)
Maximum landing weight:	17,237 kg (38,000 lb)
Maximum zero fuel weight:	14,515 kg (32,000 lb)
Minimum flight weight:	11,794 kg (26,000 lb)
Minimum operating empty weight:	10,047 kg (22,150 lb)

NOTE

1. The maximum take-off weight (MTOW) and/or maximum landing weight (MLW) may be further limited due to performance considerations.
2. The maximum landing weight (MLW) is further limited when landing at airport elevations above 10,000 feet (Refer to Chapter 6; SUPPLEMENT 19 – OPERATIONS AT HIGH AIRPORT ELEVATIONS) .

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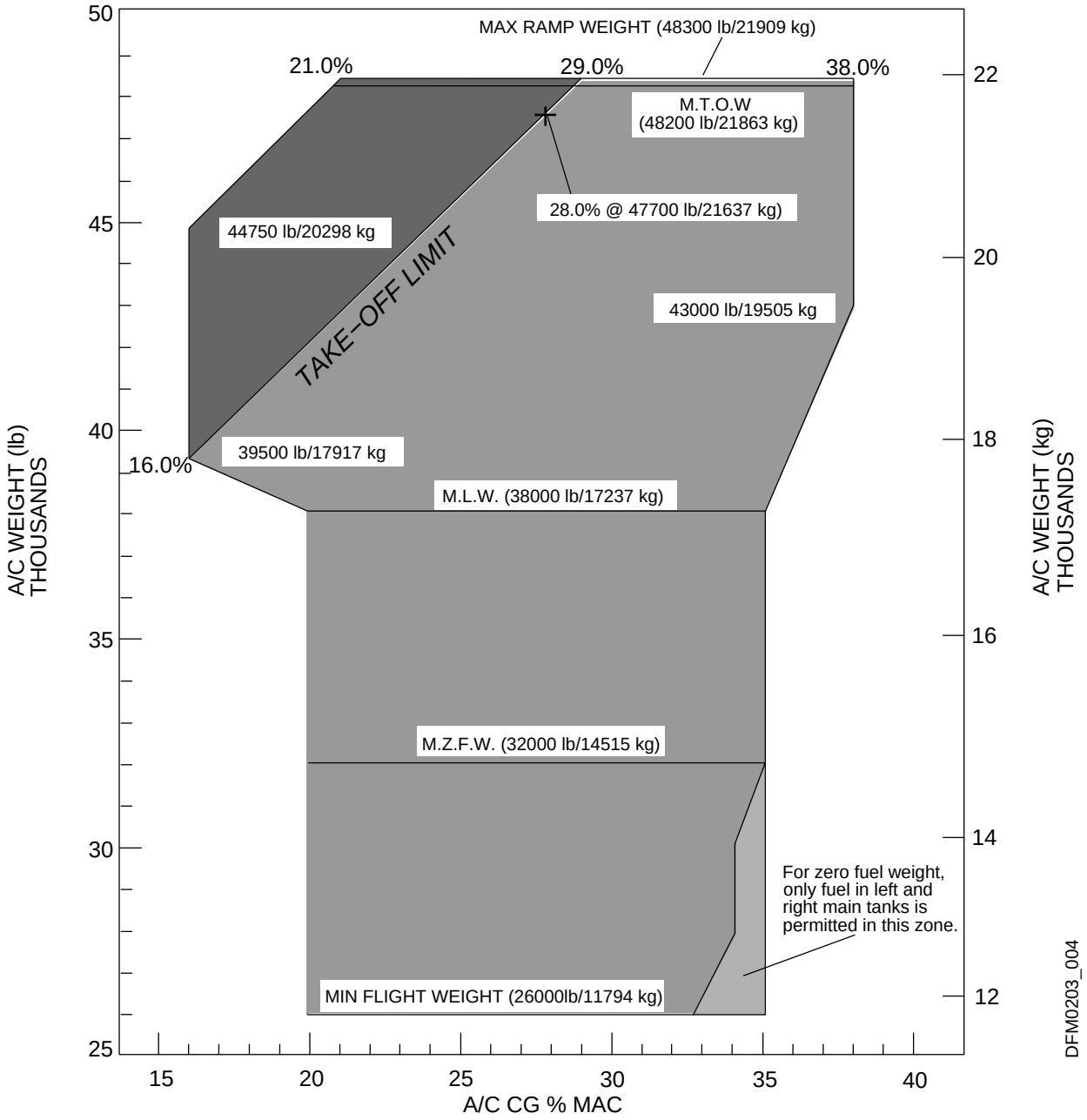
1. CENTRE OF GRAVITY LIMITS (MTOW 48,200 LB)

The maximum permissible centre of gravity (CG) limits are as shown in Figure 02−03−1.

The airplane including interior payload, passengers and fuel (refer to Figure 02–05–2) must be loaded such that the airplane weight and centre of gravity are maintained within the specified limits (including variations due to fuel consumption, passenger movement, retraction of landing gear, etc.).

The stabilizer trim setting must be in accordance with Chapter 4; NORMAL PROCEDURES – TAXIING AND TAKE-OFF – Taxi Check.



Centre of Gravity Limits (MTOW 48,200 lb)
Figure 02−03−1

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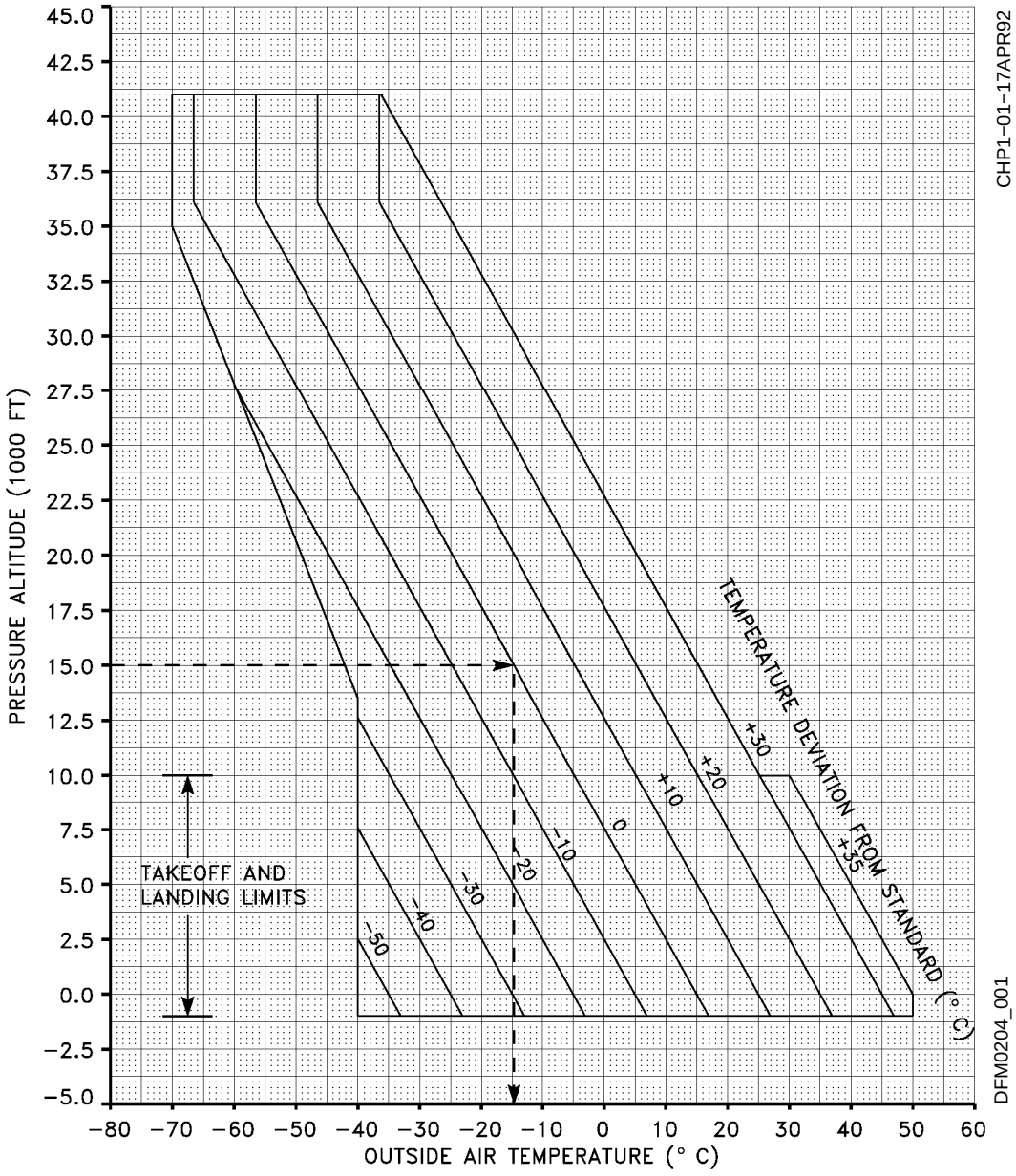
1. ALTITUDE AND TEMPERATURE OPERATING LIMIT

The altitude and temperature operating limit is as shown in Figure 02−04−1.

- Maximum airport pressure altitude for take-off and landing is 10,000 feet.
- Maximum operating altitude is 41,000 feet.
- Maximum ambient air temperature approved for take-off and landing is ISA + 35°C.
- Minimum ambient temperature approved for take-off is –40°C (–40°F).
- At altitudes above 25,000 feet, a safety harness must be worn by at least one pilot.



Altitude and Temperature Operating Limits
Figure 02−04−1

2. COLD WEATHER OPERATIONS

Take-off is prohibited with frost, ice, snow or slush adhering to any critical surface (wings, horizontal stabilizer, vertical stabilizer, control surfaces, engine inlets and upper surface of the fuselage).

WARNING

Even small amounts of frost, ice, snow or slush on the wing leading edges and forward upper wing surface may adversely change the stall speeds, stall characteristics and the protection provided by the stall protection system, which may result in loss of control on take-off.

NOTE

1. Comprehensive procedures for operating in cold weather are provided in Chapter 6; SUPPLEMENTARY PROCEDURES – COLD WEATHER OPERATION .
2. Take-off is permitted with frost adhering to the underside of the wing that is caused by cold soaked fuel, in accordance with the instructions provided in Chapter 6; SUPPLEMENTARY PROCEDURES – COLD WEATHER OPERATION – PRE-FLIGHT PREPARATION – External Safety Inspection .

In addition to a visual check, a tactile check of the wing leading edge, wing forward upper surface and wing rear upper surface is required during the External Walkaround inspection to determine that the wing is free from frost, ice, snow or slush when the outside air temperature (OAT) is 5°C (41°F) or less, or it cannot be determined that the wing fuel temperature is above 0°C (32°F); and:

- There is visible moisture (rain, drizzle, sleet, snow, fog, etc); or
- Water is present on the wings; or
- The difference between the dew point temperature and the OAT is 3°C (5°F) or less; or
- The atmospheric conditions have been conducive to frost formation.

NOTE

Ice and frost may continue to adhere to wing surfaces for some time even at outside air temperatures above 5°C (41°F).

3. OPERATION IN ICING CONDITIONS

During cold weather operations, the flight crew must ensure that the airplane fuselage, wings and tail surfaces are free from ice, snow or frost.

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WARNING

Even small accumulations of ice on the wing leading edge can change the stall speed, stall characteristics or the warning margin provided by the stall protection computer.

A. Cowl Anti-ice System

(1) Ground Operations

The engine cowl anti-ice system must be on when the OAT is 10°C (50°F) or below and visible moisture in any form is present (such as fog with visibility of one mile or less, rain, snow, sleet and ice crystals).

The engine cowl anti-ice system must also be on when the OAT is 10°C (50°F) or below when operating on runways, ramps, or taxiways where surface snow, ice, standing water or slush is present.

(2) Flight Operations

NOTE

Icing conditions exist in flight at a TAT of 10°C (50°F) or below and visible moisture in any form is encountered (such as clouds, rain, snow, sleet or ice crystals), except when the SAT is –40°C (–40°F) or below.

The engine cowl anti-ice system must be on:

At or above 22,000 feet:

- when ice is indicated by the ice detection system, or
- when in icing conditions, if an ice detector has failed.

Below 22,000 feet:

- when in icing conditions, or
- when ice is indicated by the ice detection system.

B. Wing Anti-ice System

(1) Ground Operations

The wing anti-ice system must be on for take-off when the OAT is 5°C (41°F) or below and visible moisture in any form is present (such as fog with visibility of one mile or less, rain, snow, sleet and ice crystals).

The wing anti-ice system must also be on for take-off when the OAT is 5°C (41°F) or below and the runway is contaminated with surface snow, slush or standing water.

When Type II, III or IV anti-icing fluids have been applied, the wing anti-ice system must only be selected on, if required, just prior to thrust increase for take-off.

3. OPERATION IN ICING CONDITIONS (CONT'D)

B. Wing Anti-ice System (Cont'd)

(2) Flight Operations

NOTE

Icing conditions exist in flight at a TAT of 10°C (50°F) or below and visible moisture in any form is encountered (such as clouds, rain, snow, sleet or ice crystals), except when the SAT is –40°C (–40°F) or below.

The wing anti-ice system must be on:

At or above 22,000 feet:

- when ice is indicated by the ice detection system, or
- when in icing conditions, if an ice detector has failed.

Below 22,000 feet:

- when in icing conditions, or
- when ice is indicated by the ice detection system.

C. Super-Cooled Large Droplet Icing

Continued operation in areas where super-cooled large droplet (SLD) icing conditions exist is prohibited.

SLD icing conditions are indicated by ice accretion on the flight compartment side windows.

- The wing anti-icing system must be ON in SLD icing conditions.
- The cowl anti-icing system must be ON in SLD icing conditions.
- Leave icing conditions when side window icing occurs.

4. RUNWAY SLOPES

The maximum runway slopes approved for take-off and landing are:

+2% (uphill)

–2% (downhill)

5. TAILWIND CONDITIONS

The maximum tailwind component approved for take-off and landing is 10 knots.

6. MINIMUM FLIGHT CREW

The minimum flight crew is one pilot and one copilot.

7. MAXIMUM OCCUPANTS

The total number of occupants, including no more than nineteen passengers, must not exceed the lesser of the following:

- Twenty-two or,
- The number for which seating accommodation approved for take-off and landing is provided.

8. MAXIMUM CROSSWIND COMPONENT

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The maximum crosswind component for take-off and landing is 24 knots (12 meters/sec).

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The maximum crosswind component for take-off and landing on a dry runway is 24 knots (12 meters/sec).

The maximum crosswind component for take-off and landing on a wet runway with water depth no more than 3.00 mm (0.125 inch) is defined in the following table for different values of the coefficient of friction:

REPORTED COEFFICIENT OF FRICTION	MAXIMUM CROSSWIND COMPONENT
0.3 (poor braking)	10 knots (5 meters/sec)
0.4 (average braking)	15 knots (8 meters/sec)
0.5 (good braking, equivalent to dry)	24 knots (12 meters/sec)

The maximum crosswind component for take-off and landing on a contaminated runway is 10 knots (5 meters/sec).

Operation on runways with a coefficient of friction less than 0.3 is prohibited.

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9. GROUND OPERATIONS IN HIGH WIND CONDITIONS

In the event that the airplane is parked and sustains winds or gust loads in excess of 27 meters/second, an inspection and functional check of the aileron, elevator and rudder power control units is required.

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10. MINIMUM ENROUTE CLEARANCE

It is recommended that all terrain and/or obstacles be cleared by at least 1,300 feet along the enroute flight path.

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11. MINIMUM GO-AROUND ALTITUDE

Demonstrated minimum altitude for all engines go-around without touching the ground is 50 feet and for single engine go-around is 100 feet.

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1. ENGINES

Type: General Electric CF34–3B, quantity two.

2. ENGINE INDICATIONS

The engine limit display markings on EICAS must be used to determine compliance with the maximum/minimum Limits and precautionary ranges. If EICAS markings show more conservative Limits than those specified below, the limit markings on the EICAS must be used.

INDICATION	RED (MAX/MIN LIMITS)	AMBER (CAUTION RANGE)	GREEN (NORMAL RANGE)
N_1 % RPM	98.6	–	0 to 98.5
ITT °C:			
– APR not operating	900 (for first 2 min.)	–	0 to 900
	884 (for next 3 min.)	–	0 to 884
– APR operating	928 (for first 2 min.)	–	0 to 928
	900 (for next 3 min.)	–	0 to 900
– Maximum Continuous Thrust (MCT)	900	–	0 to 900
N_2 % RPM:			
– wing anti-ice on	99.3	0 to 77.9	78 to 99.2
– wing anti-ice off	99.3	–	0 to 99.2
OIL TEMP °C	163	155 to 162	–40 to 154
OIL PRESS psi	0 to 25	116 to 156	26 to 115

3. ENGINE OPERATING LIMITS

A. Engine Operating Limits Table

CONDITION	CORE RPM N_2 %	FAN RPM N_1 %	ITT °C
Start	20		903 (50 seconds)
Acceleration			930 (5 seconds)
Max Continuous	99.2	98.6	899
Normal Take-Off	98.3	96.2	884 (5 minutes)* 900 (2 minutes out of 5 total transient)*
Maximum Take-Off (APR operating)	99.4	98.6	899 (5 minutes)* 928 (2 minutes out of 5 total transient)*
* Transient limits			

NOTE

1. The take-off, go-around and maximum continuous thrust N_1 values for the CF34-3B engine are presented on the appropriate engine thrust setting charts contained in Chapter 6; PERFORMANCE – THRUST SETTINGS of the Airplane Flight Manual .
2. If above 40,000 feet, one air-conditioning unit or cowl anti-ice must be selected on for each engine.

B. Airplane Cold Soak

Before the first flight of a day, when the airplane is cold-soaked at an ambient temperature of –30°C (–22°F) or below for more than 8 hours, the engines must be motored for 60 seconds, and fan rotation must be verified, before the engine start is initiated.

Thrust reversers must be actuated until the deploy and stow cycles are less than 5 seconds.

C. Oil Temperature

Minimum for starting	–40°C
Maximum Continuous	+155°C
Maximum Permissible	+163°C (15 minutes maximum)

D. Oil Pressure

Steady state idle	25 psi minimum
Take-off power	45 psi minimum
Maximum continuous	110 psi maximum
Maximum transient	
After cold start	115 psi (transmitter limit)
(10 minutes maximum)	**NOTE:** Engine must remain at idle until oil pressure returns to normal range.

4. CONTINUOUS ENGINE IGNITION

Continuous engine ignition must be used during the following:

- Take-offs and landings on contaminated runways;
- Take-offs with high crosswind components;
- Flight through moderate or heavier intensity rain;
- Flight through moderate or heavier intensity turbulence;
- Flight in the vicinity of thunderstorms.

5. AUTOTHROTTLE (ATS)

- ATS operation is restricted to two-engine operation only.
- ATS operation is prohibited during category II approach operations.
- Crew must confirm engine power is set to appropriate take-off N_1 limit prior to reaching 80 KIAS during take-off.
- At first indication of stall (stall buffet, stick shaker, or stick pusher), the crew must disengage the ATS and set thrust levers as required.
- ATS operation with APR selected on FMS performance thrust limit page is prohibited.
- If a **DISENG'D** or **FAIL** message occurs on the ATS MSD, the crew must position the thrust levers as required. Press either thrust lever ATS DISC switch to cancel ATS message.
- Selection of AFCS FLC mode following go-around mode is prohibited, unless the altitude preselector is set higher than current altitude when ATS is engaged.
- The AFM engine limits must not be exceeded when manually entering FMS thrust target (TGT) limit. The ATS will set engine thrust to this target without regard to engine operating limits.
- ATS operation during take-off with thrust target (TGT) selected on FMS performance thrust limit page is prohibited.
- ATS operation with maximum continuous thrust (MCT) selected as the FMS performance thrust limit is prohibited.
- If both mode status displays (MSDs) fail, the crew must disengage the ATS and consider the system inoperative.
- N_1 thrust limit data is required and must be available from the FMS for ATS operation.
- The radio altimeter must be valid for the ATS retard mode operation. If radio altitude is unavailable or invalid, the ATS must be disengaged prior to reaching 100 feet AGL.
- Use of the ATS during touch and go landings is prohibited. ATS must be disengaged if system engages during touch and go landings.
- Use of the ATS during go-around is prohibited. Pilot must manually set thrust to override ATS. ATS may be used to trim final N_1, once manually set.
- If flaps are selected to less than 45° for landing, ATS must be disengaged prior to reaching 100 feet AGL.

6. AUTOMATIC PERFORMANCE RESERVE (APR)

If take-off performance is predicated upon the use of APR, the APR system must be verified operative prior to take-off.

The APR system must be selected off, if an **APR INOP** caution message is displayed on EICAS.

APR OFF Performance must be used if an **APR INOP** caution message is displayed.

7. STARTER CRANKING LIMITS (GROUND AND AIR)

The starter must not be used if indicated N_2 rpm exceeds 55%.

A. Engine Start

Normal engine start – Three consecutive engine start cycles with 5 minutes cooling between additional cycles.

B. Associated Conditions

At initiation of thrust lever movement from SHUT OFF to IDLE:

(1) ITT must be 120°C or less for all ground starts.

(2) ITT must be 90°C or less for all air starts.

C. Dry Motoring Cycle

Dry motoring is performed with ignition OFF and thrust levers at SHUT OFF.

Dry motoring may be used for engine ground starts and engine airstarts.

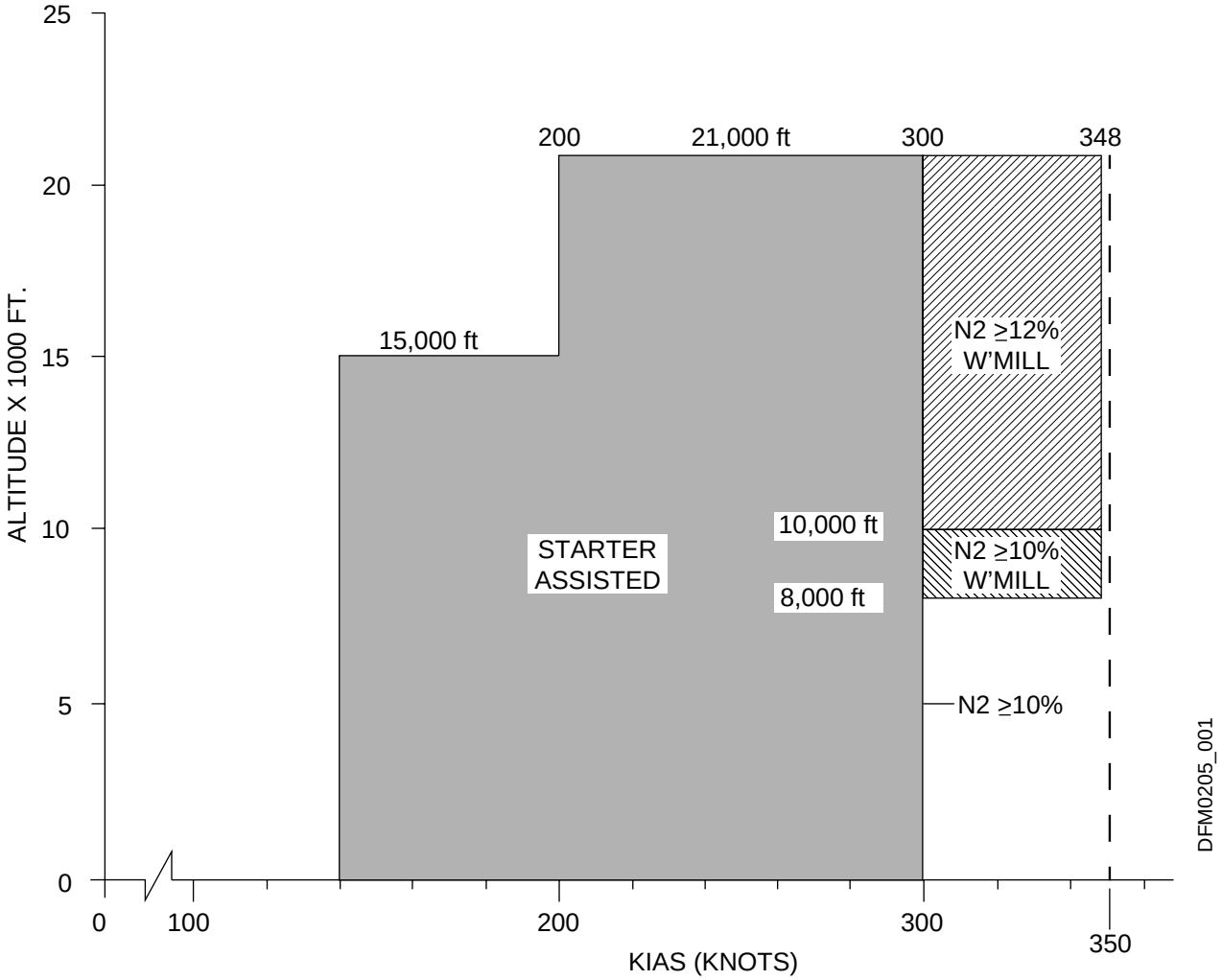
START	MAXIMUM TIME ON	FOLLOWED BY
1	90 seconds	5 minutes off
2 and subsequent	30 seconds	5 minutes off

8. ENGINE RELIGHT

Engine starting in-flight is only permitted within the envelope defined in Figure 02−05−1:

8. ENGINE RELIGHT (CONT'D)

RELIGHT TYPE	ENVELOPE (FIGURE 02–05–1)
Windmilling	**Altitude from 21,000 to 10,000 feet:** Airspeed from 300 to 348 KIAS, and from 12 to 55% N_2. **Altitude from 10,000 to 8,000 feet:** Airspeed from 300 to 348 KIAS, and from 10 to 55% N_2. **Altitude from sea level to 8,000 feet:** Airspeed 300 KIAS, and from 10 to 55% N_2. **NOTE** N_2 should be stable or increasing.
Starter-assisted Cross Bleed	**Altitude from 21,000 feet to 15,000 feet:** Airspeed from 200 KIAS up to 300 KIAS, and from 0 to 55% N_2. **Altitude from 15,000 feet to sea level:** Airspeed from 140 KIAS up to 300 KIAS, and from 0 to 55% N_2.



Engine Air Start Envelope (In Flight)
Figure 02−05−1

9. FUEL

The maximum permissible fuel imbalance between the contents of the main left tank and the main right tank is 182 kg (400 lb) for take-off and taxi.

The maximum permissible fuel imbalance between the contents of the main left tank and the main right tank is 363 kg (800 lb) in flight.

The maximum permissible fuel imbalance between the contents of the main left tank and the main right tank is 182 kg (400 lb) for landing.

Fuel remaining in a tank when the appropriate fuel quantity indicator reads zero is not usable.

Based upon a fuel density of 6.75 lb/US gallon, the maximum usable fuel load achieved by pressure refueling for each tank is given below:

Left main tank	2,205 kg (4,860 lb)
Right main tank	2,205 kg (4,860 lb)
Auxiliary tank	3,251 kg (7,168 lb)
Tail tank	1,411 kg (3,112 lb)
Total	9,072 kg (20,000 lb)

To determine approximate maximum usable fuel load achieved by gravity refueling, reduce weight by 7%.

Take-off with up to 230 kg (500 lb) of fuel in the auxiliary tank is permitted, provided that there is at least 690 kg (1,500 lb) of fuel in each wing tank and no fuel in the tail tank.

Take-off with more than 230 kg (500 lb) of fuel in the auxiliary tank is permitted, provided that there is at least 1,996 kg (4400 lb) of fuel in each wing tank.

The minimum fuel quantity for go-around is 230 kg (500 lb) per wing (with the airplane level) and assuming a maximum airplane climb attitude of 10° nose up.

Normal AUX/TAIL Fuel Distribution for Take-Off:

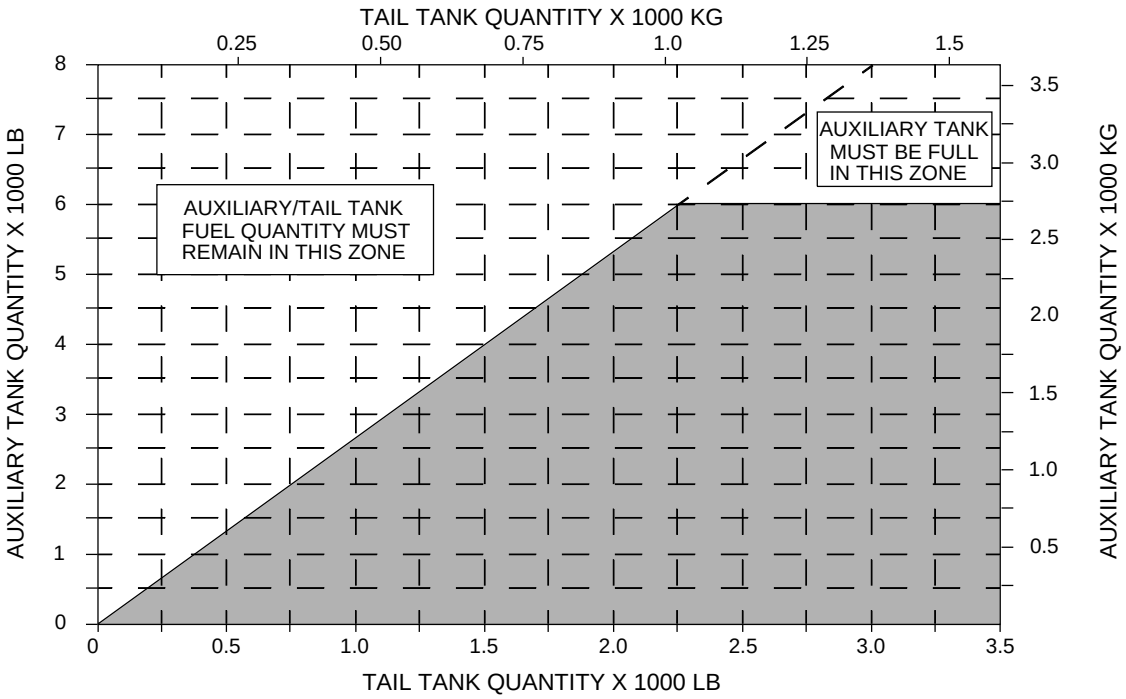
- Auxiliary tank quantity must be full, or at least 2.65 times the tail tank quantity, for take-off (as shown in Figure 02−05−2, Detail A, Normal Fuel Distribution for Take-Off).

OR

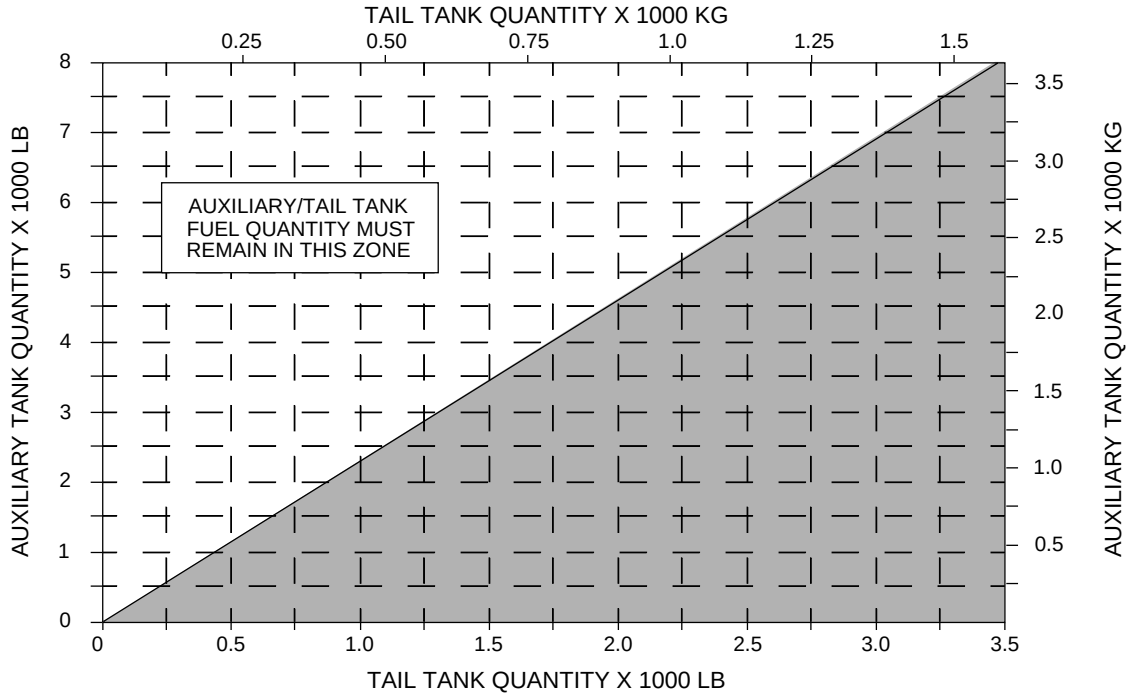
Provisional AUX/TAIL Fuel Distribution for Forward CG Limit Take-Off:

- Where the normal fuel distribution would cause the airplane centre of gravity to fall ahead of the forward limit for take-off, the provisional fuel distribution may be applied to bring the airplane centre of gravity within the permissible forward CG limit (as shown in Figure 02−05−2, Detail B, Provisional Fuel Distribution for Take-Off). This fuel distribution is permitted only if the resulting CG remains ahead of 34% MAC.

9. FUEL (CONT'D)



Detail A − Normal Fuel Distribution for Take-Off



Detail B − Provisional Fuel Distribution for Take-Off

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Auxiliary Tank Quantity/Tail Tank Quantity – Relation Versus Centre of Gravity
Figure 02−05−2

9. FUEL (CONT'D)

A. Fuel Temperature

Take-off with engine fuel temperature indications below 5°C (41°F) is prohibited.

Take-off with bulk fuel temperature indications below the limits stated is prohibited.

During flight, bulk fuel temperature must remain above the applicable bulk fuel freezing point.

FUEL	BULK FUEL TAKE-OFF LIMIT	BULK FUEL FREEZING POINT
ASTM D 1655 JET A	–30°C	–40°C
ASTM D 1655 JET A1	–37°C	–47°C
ASTM D 6615 JET B	–40°C	–50°C
MIL–DTL–5624 JP 4	–48°C	–58°C
MIL–DTL–5624 JP 5	–36°C	–46°C
MIL–DTL–83133 JP 8	–40°C	–50°C
GB 6537 No. 3 JET	–37°C	–47°C
Russian TS-1	–43°C	[†]
Russian RT	–40°C	[†]

[†] Russian TS-1 and RT fuels with a freeze point of not higher than –50°C are approved for use when the ground level OAT is not below –30°C during the 24 hours before departure.

TS-1 fuel with a freeze point of not higher than –60°C and RT fuel with a freeze point of not higher than –55°C, for use in low temperature regions, are available at the operator's request.

9. FUEL (CONT'D)

B. Fuel Grades

- Fuels conforming to any of the following specifications are approved for use.

  Mixing of fuels is permitted.

CANADIAN	AMERICAN	BRITISH	CHINESE	RUSSIAN
KEROSENE TYPE				
CAN 2 - 3.23	ASTM D1655 JET A	–	–	–
CAN 2 - 3.23	ASTM D1655 JET A1	DEF STAN 91–91	No. 3 JET	TS-1 [††] or RT
–	MIL–DTL–83133 JP 8	DEF STAN 91–87	–	–
–	MIL–DTL–5624 JP 5	DEF STAN 91–86	–	–
WIDE CUT TYPE				
CAN 2 - 3.22	ASTM D6615 JET B	D. ENG. RD. 2486	–	–
CAN 2 - 3.22	MIL–DTL–5624 JP 4	D. ENG. RD. 2454	–	–

[††] When using Russian TS-1 fuel, engine fuel system components must be inspected in compliance with SB 604–73–003.

9. FUEL (CONT'D)

C. Fuel Additives

The following additives, used individually or in combination, are approved:

(1) ANTI-ICING

Anti-icing additives to the latest revision of specifications MIL−I−27686E or MIL−DTL−85470B or any direct equivalent at a concentration of 0.10 to 0.15% by volume.

CAUTION

Do not add unblended PRIST additive directly into the fuel tank, as this may damage fuel tank components.

Anti-icing Methyl Cellosolve at concentrations of 0.10 to 0.15% by volume.

Anti-icing additives for Russian fuels:

- Ethylene glycol monoethyl ether (liquid I),
- 1:1 mixture of ethylene glycol monoethyl ether with methyl alcohol (liquid I–M),
- Tetrahydrofurfuryl alcohol (TGF),
- 1:1 mixture of tetrahydrofurfuryl alcohol (TGF) with methyl alcohol (liquid TGF–M).

(2) BIOCIDE

SOHIO Biobor JF biocide additive at a concentration not in excess of 270 parts per million (20 parts per million elemental boron) for the initial dose to prevent the growth of micro-organisms. A maintenance dose of 135 parts per million should be used thereafter.

Kathon FP 1.5 biocide additive at a concentration not in excess of 100 parts per million for the initial dose to prevent the growth of micro-organisms. A maintenance dose of 50 parts per million should be used thereafter.

(3) ANTI-STATIC

Stadis 450 anti-static additive at a concentration of 5 mg/L.

For Russian fuels, Sigbol static dissipater additive may be used in concentrations of less than 0.0005% by weight.

(4) CORROSION INHIBITOR

Corrosion inhibitors listed below are approved, by the concentrations indicated, for hydro-treated fuels only. It is recommended that corrosion inhibitors, conforming to MIL−I−25017, be blended with the fuel to provide lubricity. The corrosion inhibitor must be added after water removal and downstream of any clay filters (these processes remove the inhibitor).

- Appollo PRI−19, at a maximum concentration of 0.0227 g/l;
- Octel DCI−4A or DCI−6A, at a maximum concentration of 0.0227 g/l;
- Hitec E−515, at a maximum concentration of 0.0457 g/l;
- Hitec E−580, at a maximum concentration of 0.0227 g/l;
- Nalco 5403 or 5405, at a maximum concentration of 0.0227 g/l;
- Tolad 245, at a maximum concentration of 0.0340 g/l;

9. FUEL (CONT'D)

D. Fuel Jettison

Fuel jettison must only be carried out with flaps set to 0.

Jettisoning of fuel in known lightning conditions is prohibited.

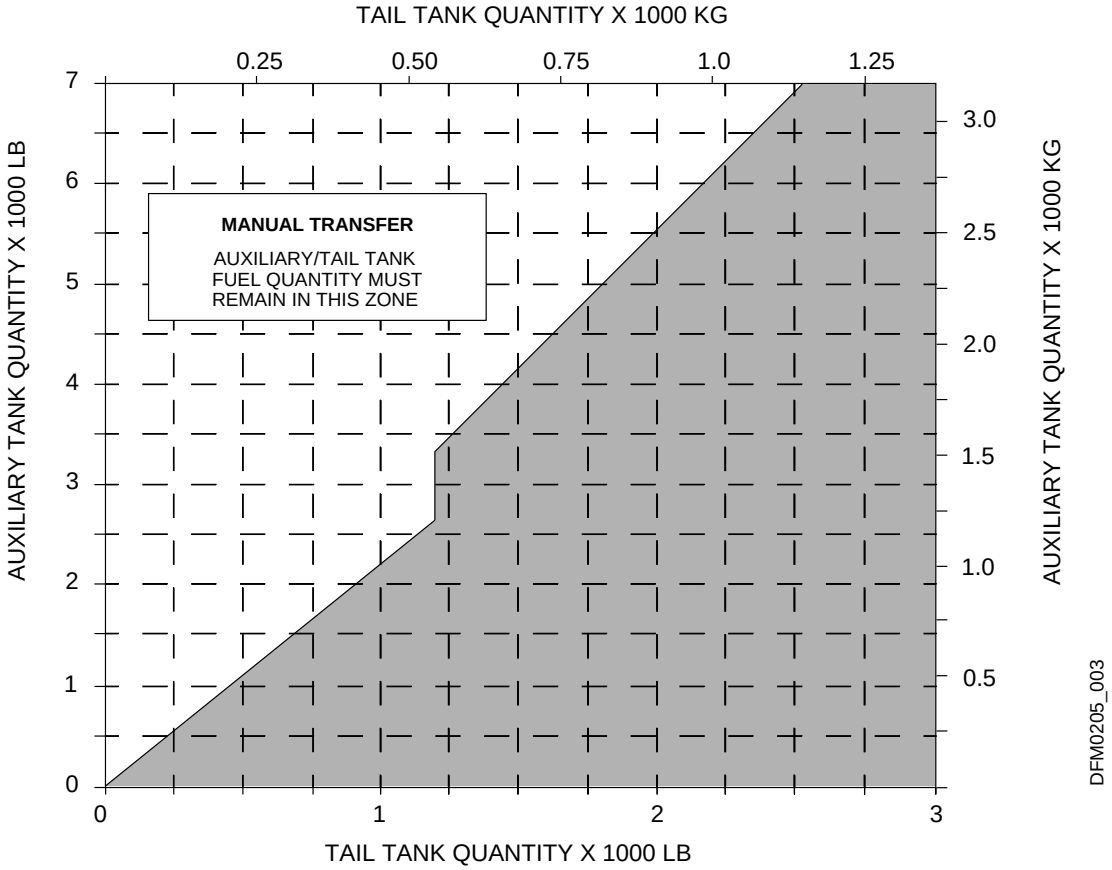
E. Fuel Transfer

Fuel transfer (left or right tank to auxiliary tank/gravity) must be off for take-off.

During normal operation, the tail tank transfer system must not be used as a centre of gravity control device; it must remain selected to automatic mode.

During manual transfer operation – Refer to Figure 02−05−3:

- Auxiliary tank quantity must be at least 2.75 times the tail tank quantity, if tail tank quantity is equal to or greater than 544 kg (1,200 lb).
- Auxiliary tank quantity must be at least 2.2 times the tail tank quantity, if tail tank quantity is less than 544 kg (1,200 lb).
- Manual tail tank fuel transfer is not permitted with more than 3,175 kg (7,000 lb) of fuel in auxiliary tank.
- Auxiliary tank quantity must be continuously monitored for overfill during manual tail tank fuel transfer.



Manual Fuel Transfer − Auxiliary Tank Quantity vs Tail Tank Quantity
Figure 02−05−3

10. OIL GRADES

Refer to appropriate maintenance or servicing manual for approved oil grades.

11. OIL CONSUMPTION

Maximum oil consumption, on each engine, is 189 cubic centimeters per hour (6.4 ounces per hour/0.05 US gallons per hour).

12. OIL REPLENISHMENT SYSTEM

The engine oil level should be checked between 15 minutes to 2 hours after engine shutdown. The engines must be motored if the replenishment period is exceeded. Maximum refill allowable is 1,890 cubic centilitres (2 US quarts) without dry motoring the engine.

13. AUXILIARY POWER UNIT

A. Type

36–150 (CL)

B. Maximum RPM: 110%

The APU overspeed control will automatically shutdown the APU at 107% rpm.

C. Maximum EGT: 731°C

D. Starting:

(1) Minimum ambient temperature for starting a cold soaked APU on the ground is –40°C.

(2) The following APU start cycles are permitted:

(a) Using airplane batteries on the ground, or for normal in-flight start:

- Three start attempts, each of 30 seconds continuous cranking
- Followed by a 20-minute off-time
- Followed by two further attempts each of 30 seconds continuous cranking.

(b) Using ground power:

- Two start attempts, each of 15 seconds continuous cranking
- Followed by a 20-minute off-time
- Followed by two further attempts each of 15 seconds continuous cranking.

(c) If, in either case (2)(a) or (2)(b), a successful start is not obtained, a further start must not be attempted for a period of at least 35 minutes.

(3) Maximum EGT:

974°C (not to be exceeded under any operating conditions).

(4) Hung start:

If not greater than 30% rpm, within 60 seconds.

13. AUXILIARY POWER UNIT (CONT'D)

D. Starting: (Cont'd)

(5) APU starting and operation is permitted within the following operating envelope:

- Temperature – Refer to Figure 02–04–1.
- Altitude and Airspeed – Refer to Figure 02−05−4.

(6) In-flight start:

In-flight starting is guaranteed at altitudes up to 20,000 feet.

E. APU Bleed Air

(1) Engine-start during ground operations up to 15,000 feet:

(a) No bleed air extraction limitation. Each engine may be started using the APU as a bleed air source.

(b) If both engines are to be started using the APU bleed air, then the operating engine's thrust must not exceed 70% N_2.

(2) Engine-start during flight:

(a) During single engine operations, APU bleed air extraction for an engine start is not permitted.

(b) During double engine failure conditions, APU bleed air extraction for engine starts is permitted.

Inflight APU main engine starts have been demonstrated to 15,000 feet.

(3) Air Conditioning:

(a) Bleed air extraction from the APU is not permitted above 15,000 feet.

F. APU Generator

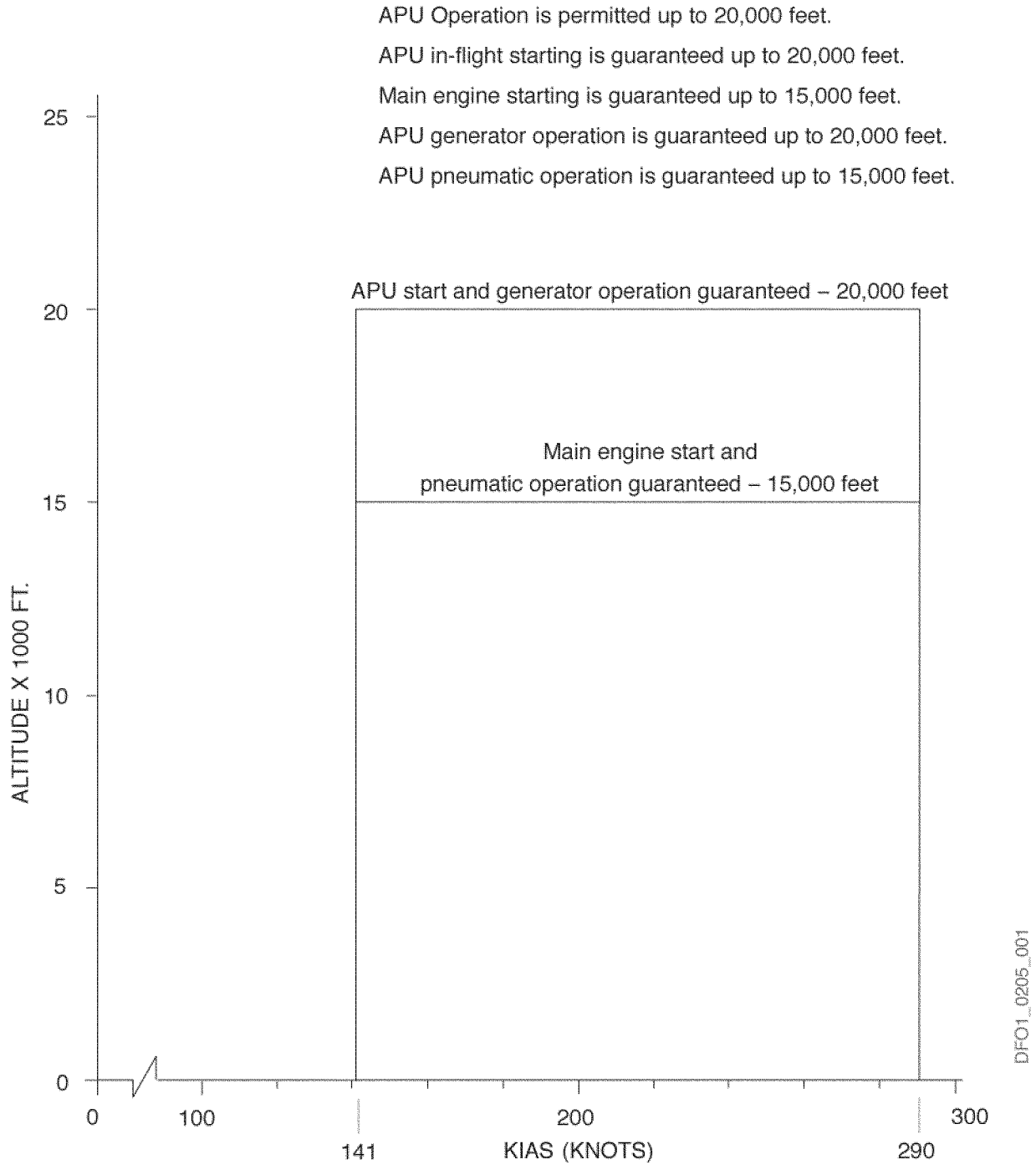
The maximum permissible load on the APU generator in flight is 30kVA.

G. APU Indications

The APU limit display markings on the EICAS must be used to determine compliance with the maximum/minimum limits and precautionary ranges. If EICAS markings show more conservative limits than those specified below, the limit markings on the EICAS should be used.

INDICATION		RED (MAX LIMITATIONS)	AMBER (CAUTION RANGE)	GREEN (NORMAL RANGE)
APU EGT °C	start scale	974 and above	–	0 to 973
	normal scale	731 and above	680 to 730	0 to 679
APU RPM %		110 and above	105 to 109	0 to 104

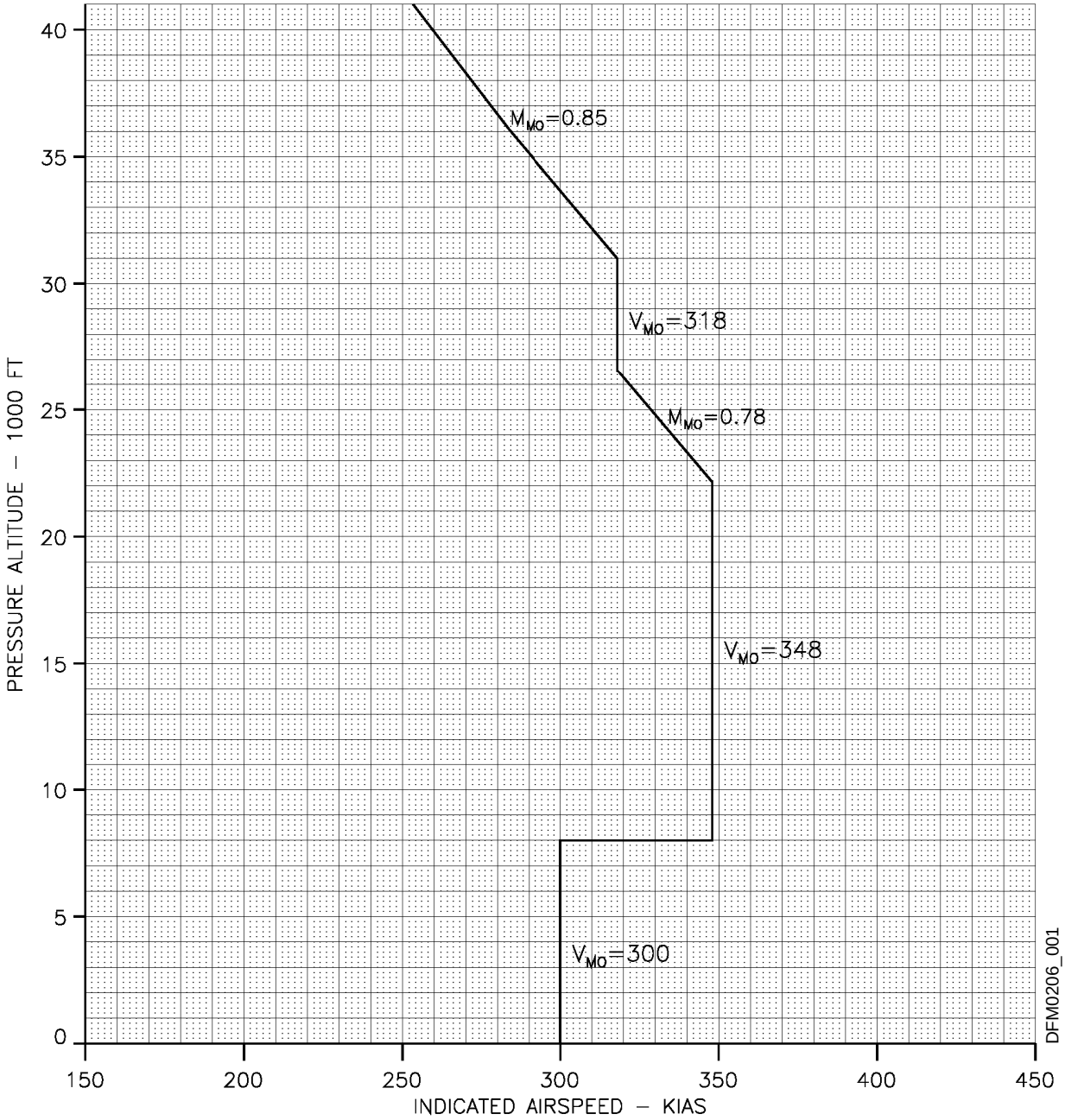
13. AUXILIARY POWER UNIT (CONT'D)



APU In-Flight Envelope
Figure 02−05−4

1. MAXIMUM OPERATING SPEED AND MACH NUMBER

Maximum operating limit speeds as given in Figure 02−06−1, must not be deliberately exceeded in any regime of flight (climb, cruise or descent), unless a higher speed is specifically authorized for flight test or training operations.



Maximum Operating Speed and Mach Number
Figure 02−06−1

2. RVSM MAXIMUM OPERATING SPEED

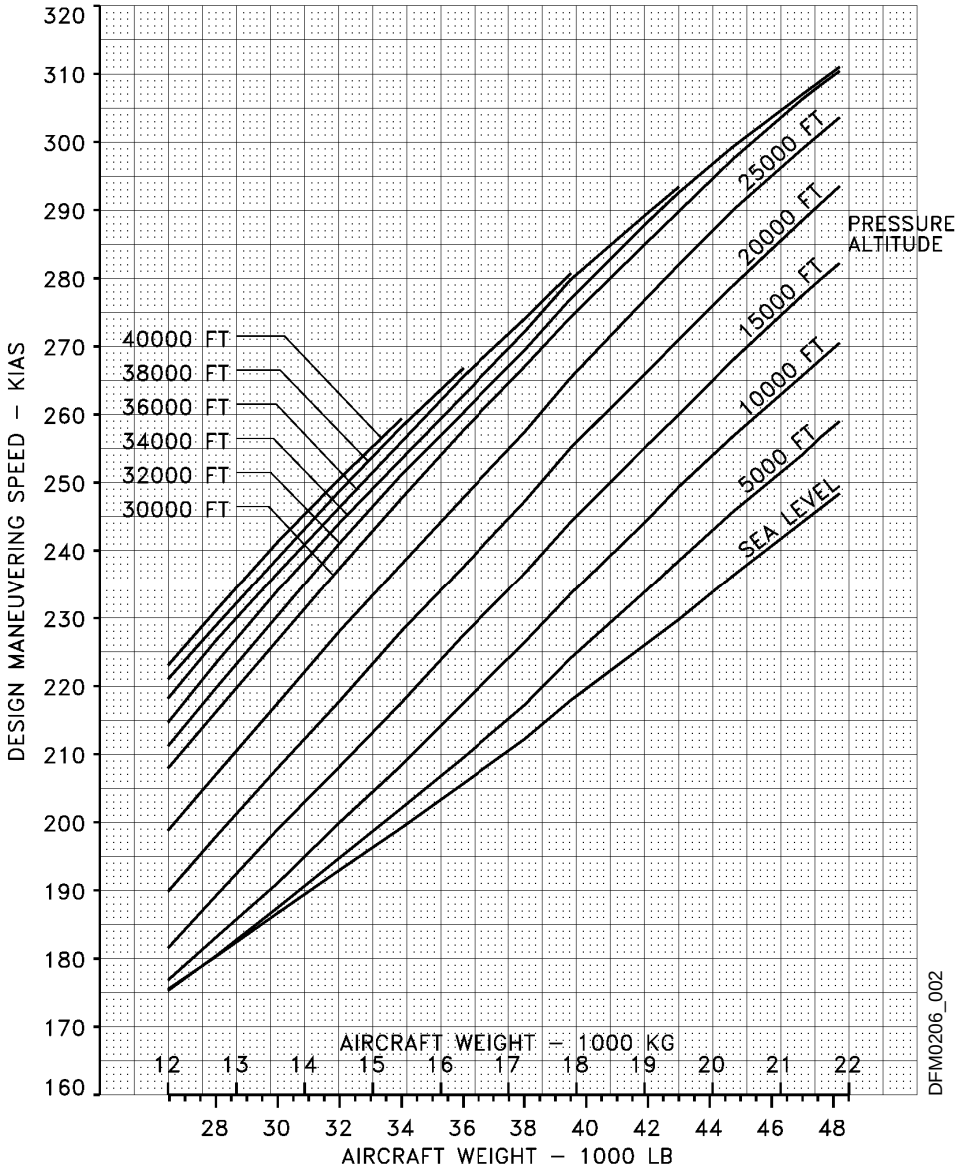
The maximum cruise mach number during flight in RVSM airspace is 0.83.

3. DESIGN MANEUVERING SPEED

Full application of rudder and aileron controls as well as maneuvers that involve angles of attack near the stall, must be confined to speeds below V_A. Values of V_A are given in Figure 02−06−2, for varying pressure altitudes and airplane weights.

CAUTION

Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles), as they may cause structural failure at any speed, including below V_A .



Design Maneuvering Speeds
Figure 02−06−2

4. FLAPS EXTENDED SPEED

The maximum speeds at which the flaps may be extended are:

Flaps to 20 degrees: 231 KIAS

Flaps to 30 degrees: 197 KIAS

Flaps to 45 degrees: 189 KIAS

5. MAXIMUM LANDING GEAR OPERATING SPEED

The maximum airspeed at which it is safe to extend the landing gear is 197 KIAS / 0.6 MI.

The maximum airspeed at which it is safe to retract the landing gear is 197 KIAS / 0.6 MI.

6. MAXIMUM LANDING GEAR EXTENDED SPEED

The maximum airspeed at which the airplane may be flown with the landing gear extended and locked is 250 KIAS / 0.7 MI.

Flight at altitudes above 20,000 feet with the landing gear extended is prohibited.

7. TIRE LIMIT SPEED

The tire limit speed is 182 knots ground speed.

8. TURBULENCE PENETRATION SPEED

Maximum air speed for turbulence penetration is 280 KIAS or 0.75 Mach, whichever is lower.

9. MINIMUM OPERATING LIMIT SPEED

Intentional speed reduction below the onset of stall warning, as defined by stick shaker operation, is prohibited unless a lower speed is specifically authorized for flight test or training operations.

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1. MANEUVERING LIMIT LOAD FACTORS

These load factors limit the permissible angles of bank in turns and the severity of pull-up and push-over maneuvers:

- Flaps up: −1.0 G to 2.5 G.
- Flaps down: 0.0 G to 2.0 G.

2. SIDE SLIP MANEUVERS

Avoid unnecessary and large side-slip maneuvers during low speed high altitude cruise.

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1. AIR-CONDITIONING AND PRESSURIZATION

The maximum relief differential pressure is 9.2 psi.

The maximum negative differential pressure is –0.5 psi.

During taxi, take-off and landing, the pressure differential must not exceed 0.2 psi.

The airplane must be completely depressurized prior to opening any of the airplane doors.

2. AUTOMATIC FLIGHT CONTROL SYSTEM

The minimum autopilot engage height after take-off is 320 feet AGL.

The minimum autopilot use height for visual and non-precision approaches is 320 feet AGL.

The minimum autopilot use height for precision approaches (ILS) is 80 feet AGL.

Operations with an ILS glidepath angle that exceeds 3.5 degrees are prohibited.

3. BLEED AIR SYSTEMS

The bleed air 10th stage valves must be closed for take-off and landing if the engine cowl and/or wing anti-ice systems have been selected on.

If above 40,000 feet, one air-conditioning unit or cowl anti-ice system must be selected on for each engine.

4. ELECTRICAL SYSTEMS

A. Permissible Loads on AC System

Individual AC generator loading must not exceed the following values:

ALTITUDE (FEET)	LOAD LIMITATION (KVA)	
	MAIN GENERATOR (EACH)	APU GENERATOR
0 to 20,000	30	30
20,001 to 35,000	30	0
35,001 and above	25	0

B. Permissible Loads on DC Systems

The maximum permissible continuous load on each TRU is 100 amps.

5. FLIGHT CONTROLS – LIFT/DRAG DEVICES

A. Flaps

Enroute use of flaps is prohibited.

Flight with flaps extended at altitudes above 15,500 feet is prohibited.

B. Flight Spoilers

Flight below an altitude of 300 feet AGL with flight spoilers extended is prohibited.

To ensure adequate maneuver margins, flight spoilers must not be extended in flight at airspeeds below the recommended approach speed plus 10 KIAS (refer to Chapter 6; PERFORMANCE – LANDING PERFORMANCE of the Airplane Flight Manual).

6. STALL PROTECTION SYSTEM

Both stall protection system pusher switches must remain on for all phases of flight.

The stall protection test indicator must only be used for stall protection system functional test purposes.

The PFD normalized AOA indicator is advisory only, it does not replace the airspeed indicator as primary speed instrument, and it does not replace the stick shaker as primary stall warning.

The PFD normalized AOA indicator shall not be used during take-off.

7. THRUST REVERSERS

Thrust reversers are approved for ground use only.

The thrust reversers are intended for use during full stop landings. Do not attempt a go-around maneuver after deployment of the thrust reversers.

Backing the airplane with the use of reverse thrust is prohibited.

Take-off with any of the following thrust reverser icons or EICAS messages displayed is prohibited:

- REV icon on N_1 gauge,
- **L (R) REV UNLOCKED** caution message, and
- **L (R) REV UNSAFE** caution message.

During landing, application of maximum reverse thrust is not permitted at airspeeds below 60 KIAS. Below 60 KIAS, reverse thrust must be reduced to 60% N_1 or less.

The maximum demonstrated crosswind component approved for use of reverse thrust is 24 knots [at 33 feet (10 meters) tower height]. This value was demonstrated on a dry runway, and is considered limiting.

8. TAXI LIGHTS

The taxi lights must be selected off whenever the airplane is stationary in excess of 10 minutes.

9. WHEEL BRAKE COOLING LIMITATIONS

Brake cooling times (established in accordance with the procedures in Chapter 6; PERFORMANCE – TURN-AROUND TIME of the Airplane Flight Manual) must be observed between a landing or a low-energy rejected take-off (RTO) and a subsequent take-off, to ensure that sufficient brake energy is available to bring the airplane to a complete stop, if the subsequent take-off is rejected.

If a fusible plug releases, the wheels, brakes and tires and the anti-skid speed sensors must be inspected in accordance with the procedure in the time limits/maintenance checks, provided in the CL–605 Airplane Maintenance Manual, and any damage rectified before the next take-off.

10. TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

The TCAS installation is in accordance with JAA TGL No. 8.

Pilots are authorized to deviate from their Air Traffic Control (ATC) clearance in order to comply with a TCAS resolution advisory (RA) command.

AR Certified Airplanes

Pilots are authorized to deviate from their Air Traffic Control (ATC) clearance in order to comply with a TCAS resolution advisory (RA) command. The pilots shall inform ATC of the deviation from the ATC clearance following the response to the RA.

Maneuvers must not be based solely on information presented on the traffic display.

11. CONFIGURATION DEVIATION LIST

If the aircraft is to be operated with certain secondary airframe and/or any nacelle parts missing, operation must be in accordance with the limitations specified in the basic Airplane Flight Manual, and as amended by the Configuration Deviation List (Appendix 1).

12. ELECTRICAL/AVIONICS EQUIPMENT

During ground operation at ambient temperatures above 40°C (104°F), operation of electrical/avionics equipment must be limited to 30 minutes, unless at least one air conditioning pack is operating and the passenger door is closed.

AR Certified Airplanes

13. AIRSPACE OPERATIONAL LIMITATIONS

The airplane can fly in the former USSR airspace only on routes covered by ATC ground facilities using RBS mode. If the airplane is to fly in areas that are not completely covered by VHF stations and if the interruptions between VHF covered zones exceeds one flight hour, two HF radios must be installed on the airplane.

AR Certified Airplanes

14. LONG RANGE NAVIGATION ACCURACY

When airplanes, not equipped with GPS, operate on routes, having a width of ±5 kilometers, not covered by VOR/DME, it is recommended that the airplane position be confirmed by ATC after 1 hour 30 minutes.

When airplanes, not equipped with GPS, operate on routes, having a width of ±10 kilometers, not covered by VOR/DME, it is recommended that the airplane position be confirmed by ATC after 3 hours.

AR Certified Airplanes

15. GROUND OPERATIONS IN HIGH WIND CONDITIONS

In the event that the airplane is parked and sustains winds or gust loads in excess of 27 meters/second, an inspection and functional check of the aileron, elevator and rudder power control units is required.

AR Certified Airplanes

16. OPERATIONS FROM GRAVEL RUNWAYS

Operations from gravel runways are prohibited.

1. FLIGHT MANAGEMENT SYSTEM

The flight management system (FMS) must be operated in accordance with the latest edition of the following;

- Airplane Flight Manual, and
- Flight Management System FMS–6000 Pilot's Guide, part number 523–08007938–001117 or later applicable revision.

The FMS is approved for use only with the SCID 832–4117–094 (no SAR) or SCID 832–4117–095 (with SAR) software program versions or later applicable revisions.

FMS database information must be verified as being current. Waypoints must be checked for accuracy prior to use.

Use of pilot defined FMS approaches, in instrument meteorological conditions, is prohibited.

The FMS must not be used for navigation unless it is receiving suitable navigation information from the following sources;

- One VOR/DME, or
- Two DMEs, or
- One inertial reference system (IRS), or
- GPS, if GPS is the only available sensor. Use of FMS for navigation is not approved unless the Collins prediction program 832–3443–008, or later applicable version, has been run.

Airplane operation must not be predicated upon performance data; ETE/ETA and fuel remaining.

FMS flight plans must be identical when conducting dual FMS approach operations.

Use of FMS instrument approaches past the Final Approach Fix is prohibited, unless APPR is annunciated on the PFD.

Errors to VNAV defined paths may occur because of coding errors in the navigation data base and because of altimetry errors. The actual VNAV path may deviate significantly below the intended VNAV path in very cold temperatures, unless an approved temperature compensation function (if equipped) is used to correct for non-standard temperatures.

Database coding of VNAV altitudes for approach waypoints may result in VNAV paths continuing below Minimum Descent Altitude (MDA), Decision Altitude (DA), or Decision Height (DH), or ending at an altitude too high to continue a safe descent to landing. VNAV paths (often called pseudo-glide paths) are not equivalent to an ILS glideslope.

Position along an approach must be verified prior to commencement of VNAV descent, as displayed by the FMS. The required visual reference must be obtained prior to commencing descent below published MDAs, DAs, or DHs.

Use of VNAV vertical guidance for a V-MDA type approach between the final approach fix and the missed approach fix is prohibited.

The FMS, with inputs from GPS, may only be used for approach guidance if the reference coordinate data system for the instrument approach is WGS–84 or NAD–83.

1. FLIGHT MANAGEMENT SYSTEM (CONT'D)

The FMS thrust setting data is the primary means of information, provided two air data computers are available.

The FMS V speed data is the primary means of information, provided two flight management computers are available.

AR Certified Airplanes

The FMS V speed data is advisory only.

The following performance database, part number 815–9079–001, must be verified to be current and valid.

The following V speed database, part number 815-9174-001, must be verified to be current and valid.

On FAA Certified Airplanes incorporating SB 605–34–007:

The following V speed database, part number 815–9082–001, must be verified to be current and valid.

The FMS does not reduce available runway lengths for runways with displaced thresholds. When using FMS approach performance data for a runway with a displaced threshold, the pilot must manually enter the RWY LENGTH value with the actual available landing distance from a published chart.

When RWY LENGTH is manually entered, the FMS does not compute headwind/crosswind; these must be manually entered on the CDU.

2. NAVIGATION OPERATIONAL APPROVALS

The FMS has been demonstrated capable of, and has been shown to meet the requirements for, the following operation:

Oceanic and remote

- Use of the FMS with the GPS is approved for supplemental means of navigation source for oceanic and remote operations.
- Use of the FMS with GPS has been found to comply with the requirements for GPS primary means of navigation in oceanic and remote airspace, when used in conjunction with the Collins prediction program 832–3443–008, or later applicable version, and with two operational GPS receivers and with two operational FMS systems. This does not constitute an operational approval.

North Atlantic (NAT) Minimum Navigational Performance Specification (MNPS) Airspace

- Provided two FMS installations are operating with each receiving information from at least two inertial reference systems (IRS), the FMS has been demonstrated capable of flight into North Atlantic (NAT) minimum navigational performance specification (MNPS) airspace, and has been shown to meet the accuracy specification in accordance with AC 120–33 or AC 91–49.

NOTE

Compliance with the standards noted above does not constitute an operational approval.

Enroute and Terminal Navigation

- Use of the FMS with the GPS is approved for supplemental means of navigation source for enroute and terminal operations.
- The FMS installation meets the performance/accuracy criteria of AC 20–130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, for enroute and terminal area navigation.

2. NAVIGATION OPERATIONAL APPROVALS (CONT'D)

Compliance with AC 90−100 US Terminal and Enroute Area Navigation (RNAV) Operations

- When equipped with an operating FMS that is receiving valid signals from either:
  - GPS, or
  - DME and IRS

  the aircraft meets the functional and accuracy requirements of AC 90−100, US Terminal and Enroute Area Navigation (RNAV) Operations for Type A (RNAV-2) and Type B (RNAV-1) routes, provided that:

  1) None of the following messages are displayed:
     - FMS DR (PFD, MFD or CDU)
     - IRS ONLY (PFD, MFD or CDU)
     - VOR/DME ONLY (CDU) or V/D ONLY (PFD)
     - VOR/DME DIST > 40.0 NM (CDU)
     - CHK POS (PFD or CDU)

  and,

  2) For procedures that specifically require GPS, or when GPS is the only available sensor, none of the following messages are posted on the CDU:
     - NO GPS RAIM
     - GPS NOT AVAILABLE
     - GPS-FMS DISAGREE

  and,

  3) The crew has entered NOTAMed navaids on the CDU VOR/DME CONTROL page.

NOTE

1. Pre-flight GPS (GNSS) predictive RAIM checks are not required unless the procedure specifically requires GPS (GNSS), or when GPS is planned to be the only available FMS position sensor.
2. For Type B (RNAV–1) procedures, VOR SENSOR USAGE must be selected to ON on each CDU VOR/DME CONTROL page, unless GPS is available and RAIM availability is confirmed during pre−flight planning.
3. If pre-flight planning requires the pilot to confirm availability of RAIM along the intended flight (route and time), this confirmation should be accomplished using the Collins prediction program 832–3443–008 or later applicable version.
4. Compliance with the standards noted above does not constitute an operational approval.

2. NAVIGATION OPERATIONAL APPROVALS (CONT'D)

BRNAV/RNP–5

- The FMS installation meets the requirements of RNP–5 in accordance with AC90–96, Approval of US Operators and Aircraft to Operate under Instrument Flight Rules (IFR) in European Airspace Designated for Basic Area Navigation (BRNAV/RNP–5), and JAA Temporary Guidance Leaflet No. 2, rev. 1, AMJ 20X2, JAA Guidance Material on Airworthiness Approval and Operational Criteria for the use of Navigation Systems in European Airspace Designated for Basic RNAV Operations.

NOTE

Compliance with the standards noted above does not constitute an operational approval.

RNP–10

- The FMS installation with the IRS has been demonstrated to meet the criteria of FAA Order 8400.12A “Required Navigation Performance 10 (RNP–10) Operational Approval” as a primary means of navigation without time limitation and without updating, based on compliance with the IRS accuracy requirements of FAR 121, Appendix G.
- The FMS with the GPS with RAIM has been demonstrated to meet the criteria of FAA Order 8400.12A “Required Navigation Performance 10 (RNP–10) Operational Approval” as a means of navigation for flights without time limitations.

NOTE

Compliance with the standards noted above does not constitute an operational approval.

VNAV

- The FMS installation meets the performance/accuracy criteria for enroute, terminal and approach VNAV operation as per AC 20-129, titled Airworthiness Approval of Vertical Navigation (VNAV) Systems for use in the US National Airspace System (NAS) and Alaska.

PRNAV

- The FMS installation meets the airworthiness certification requirements of JAA Temporary Guidance Leaflet No. 10, Airworthiness and Operational Approval for Precision RNAV Operations in Designated European Airspace.
- Precision RNAV operations must not be conducted unless all of the required equipment specified below is operational.

PRNAV REQUIRED EQUIPMENT LIST	
EQUIPMENT	**REQUIREMENTS FOR PRNAV**
FLIGHT MANAGEMENT COMPUTER	ONE (1) MUST BE OPERATIONAL.
FMS CONTROL DISPLAY UNIT	ONE (1) MUST BE OPERATIONAL.
VHF NAV, DME, GPS	ONE (1) VHF NAV and ONE (1) DME MUST BE OPERATIONAL OR ONE (1) GPS MUST BE OPERATIONAL.
IRS	IRS ONLY message must not be displayed.

3. TERRAIN AWARENESS AND WARNING SYSTEM (TAWS)

Navigation must not be predicated upon the use of the terrain awareness display.

TAWS TERRAIN OFF should be selected when using QFE operations, and GPS is not available.

4. MODE S SURVEILLANCE

A. Mode S Elementary Surveillance

The Mode S transponder has been certified to meet the requirements of Elementary Mode S Surveillance as defined by JAA TGL 13.

B. Mode S Enhanced Surveillance

The installed Mode S system satisfies the data requirements of ICAO Doc 7030/4, Regional Supplementary Procedures for SSR Mode S Enhanced Surveillance in designated European airspace. The capability to transmit data parameters is shown in the following table:

PARAMETER	AVAILABLE/NOT AVAILABLE
MAGNETIC HEADING	AVAILABLE
INDICATED AIRSPEED	AVAILABLE
MACH NUMBER	AVAILABLE
VERTICAL RATE	AVAILABLE (SEE NOTE 1)
ROLL ANGLE	AVAILABLE
TRACK ANGLE RATE	AVAILABLE
TRUE TRACK ANGLE	AVAILABLE (SEE NOTE 2)
GROUND SPEED	AVAILABLE (SEE NOTE 2)
SELECTED ALTITUDE	AVAILABLE
BAROMETRIC PRESSURE SETTING	AVAILABLE

NOTE

1. Barometric rate of climb/descent as well as Inertial Rate of climb/descent are available as the aircraft is equipped with IRS.
2. Aircraft must be equipped with at least one functioning Flight Management Computer and FMS Control Display Unit.

5. INTEGRATED FLIGHT INFORMATION SYSTEM (IF INSTALLED)

Adequate back-up documentation for IFIS must be immediately available to the flight crew.

IFIS functions must not be used unless the related databases (i.e., charts, airspace, airways, geographic, political, graphical weather) incorporate the current update cycle.

The IFIS does not include enroute charts.

The use of the aircraft symbol on the electronic charts for navigation is prohibited.

The use of the aircraft symbol for guidance during taxi operations is prohibited.

The display of geo-political boundaries, airspace and airways on the MFD (enhanced map overlays) is for enhanced situational awareness only, and use for navigation is prohibited.

All weather products data linked to the aircraft are advisory.

6. DATA LINK

Use of OCEANIC CLEARANCE function is prohibited.

The DATALINK is approved for the transmission and receipt of messages that will not create an unsafe condition if the message is improperly received. An unsafe condition may exist if:

- The message, or part of the message, is delayed or not received,
- The message is delivered to the wrong recipient, or
- The message content is corrupted.

Crew action-based messages, such as pre-departure clearance, oceanic clearance, digital automatic terminal information service, weight and balance, take-off data (speeds, trim settings, runway distances) are prohibited, unless the approved operational procedures are used to verify that the message is received by the intended recipient, that the message is valid, and that the content is not corrupted.

All weather products data linked to the aircraft are advisory.

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