

A330 LIMITATIONS & TOLERANCES

A330-201, A330-203 & A330-301
GE CF6-80 FADEC engines

APPROACH TOLERANCES & PNF CALLS

Speed	..... < TARGET - 5 kts or > TARGET + 10 kts (at 500' or lower)	"SPEED"
Pitch Attitude.....	< 0° or > 10°	"PITCH"
Bank Angle.....	> 7°	"BANK"
Descent Rate.....	> 1000 FPM (below 1000' HAT)	"SINK RATE"
Localiser	..... > 1 dot deviation (above 300' HAT) > half dot deviation (below 300' HAT)	"TRACKING"
Glideslope	..... > 1 dot deviation	"GLIDE"
VASIS / PAPI	..... Signif deviation from expected indications	
VOR	..... > 5° deviation from nominated track	"TRACKING"
NDB	..... > 5° deviation from nominated track	"TRACKING"
DME	..... > 2 DME deviation from nominated arc	"TRACKING"

AIRBUS FLIGHT OPERATIONS GOLDEN RULES

1. The aircraft can be flown like any other aircraft
2. Fly, navigate and communicate - in that order
3. One head up at all times
4. Cross-check the accuracy of the FMS
5. Know your FMA at all times
6. When things don't go as expected - TAKE OVER
7. Use the proper level of automation for the task
8. Practice task-sharing and back each other up

CAO FLIGHT TOLERANCES

Reference: CAO 40.2.1 (Issue 3) pp 18-20 (Instrument Rating)
3.1 "Flight within the tolerances specified is necessary for the applicant to be judged proficient in the required flying manoeuvres. There shall be no **sustained** errors in excess of the specified tolerances."

NORMAL FLIGHT TOLERANCES

HDG	+/- 5° of nominated HDG
IAS	+/- 10 kts (+/- M0.02) of nominated speed. Not below minimum approach speed for the configuration.
ALT	+/- 100 feet, at minimum altitudes +100 feet and -0 feet

ASSYMETRIC FLIGHT TOLERANCES

HDG	+/- 20° initially then +/- 5°
IAS	Initial climb - engine inop - V2: +5 to -0 kts. Subsequent operations +/- 10 kts (+/- M0.02) and not below minimum approach speed for the configuration
ALT	+/- 100 feet, at minimum altitudes +100 feet and -0 feet

NAVIGATION AID TOLERANCES

NDB	+/- 5° of nominated track. Descent not commenced until established within tolerance.
VOR	+/- half scale deflection. Descent not commenced until established within tolerance.
ILS & LLZ	+/- half scale deflection. Able to land from minimum without undue manoeuvring.
DME ARC	+/- 2 nm
DME ARRIVAL	- Tracking within NDB or VOR tolerances when on defined track, or, if not on a defined track, stay within the defined sector at all times. Descent below LSALT or limiting altitude not before distance specified in the arrival procedure.

CAT C LIMITATIONS

References: AIP/ENR chapter 1.5 and AD 1.1-25
FAM VOL 2 para 5.24 "Circling Approach" (pg 2.5.15)

Aircraft performance categories determine landing minima for aircraft among other things.

CAT C DETERMINATION

Base on 'at threshold' speed. Vat

CAT C: Vat = 121 to 140 kts

VLS (minimum selectable speed) = 1.23 Vso
The A330 has VLS as Vat reference speed (granted because of the efficiencies and safety of fly-by-wire) rather than 1.3 Vso

Vat normally = 1.3 times the stall speed (Vso) at maximum landing weight in landing configuration. Also equals 1.23 times Vs1g (if higher than Vso)

Note: CofG not considered for this calculation (actually does affect stall speed)

Alpha-max (less than Vls) is very close to actual stall speed
Vso = stall speed, straight & level, gear down, landing flap, idle power
Vs1g = stall speed clean

A330-200 (180,000 kg) Vls = 136 kts = Vat
(note ∴ Vso = 110 kts)

A330-300 (187,000 kg) Vls = 140 kts = Vat
(note ∴ Vso = 106 kts)

* Minimum obstacle clearance in circling approach: 400'

* Circling Area (day and night): 4.2 nm (7.778 km)

HANDLING SPEEDS

Initial & Intermediate Approach:	160-240 KIAS
Final Approach:	115-160 KIAS
Max For Circling:	180 KIAS
Max For Missed Approach:	240 KIAS

TIMING

CAT C/D 45/180 procedure turn: 1 min 15 sec

LAND & HOLD SHORT OPERATIONS

LAHSO is approved for CAT C aircraft.

CIRCLING MINIMA

The circling minima is published on the applicable approach chart. The aircraft must not descend below 1000' HAT (day) or MDA (night) until intercepting the 3 degree final approach path (see FAM extract below). There is no 50' buffer applied to the circling minima. Note: CAT C/D MDA's should all be above 1,000' AGL

CIRCLING APPROACH

Extract (FAM 21)

A Circling Approach will be flown as a visual flight manoeuvre. It is used when an instrument approach is completed, to align the aircraft with the landing runway.

When an Instrument Approach Procedure specifies a visual segment from the point where the MDA is reached to the circling area of the airport of intended landing, a Missed Approach shall be executed unless the visual segment can be flown clear of cloud and in sight of the ground or water at not less than the altitude and with not less than the flight visibility for circling.

Compliance with Visual Circling procedures, as laid down in relevant documentation, is mandatory when accomplishing this manoeuvre.

A minimum altitude of 1,000ft above the landing threshold is maintained until intercept of a 3° visual approach path.

Note: At night, descent below the circling MDA is permitted only when intercepting a 3° visual approach path.

During a Circling Approach, at or prior to the MAP, inside the circling area with the required visual reference established, the PF will announce "Circling". During circling, both pilots shall be Head Free.

Once "Circling" is nominated, the PNF should continue with monitoring applicable to the circling manoeuvre. Any remaining Instrument Procedure calls are cancelled. Only Standard Approach calls need be made.

During Circling Approaches, it is accepted that under some circumstances, a change of control while circling may be required due to airport or environment limitations. This is only permitted when the Captain has to be the landing pilot (such as when First Officer crosswind limits are exceeded) and where circling restrictions exist that make it more practical for the First Officer to fly the circling approach.

Due to the specific altitude and tracking restrictions associated with circling approaches, Visual Procedures are not to be nominated while circling.

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from the point where the MDA is reached to the circling area of the airport of intended landing, a Missed Approach shall be executed unless the visual segment can be flown clear of cloud and in sight of the ground or water at not less than the altitude and with not less than the flight visibility for circling. Compliance with Visual Circling procedures, as laid down in relevant documentation, is mandatory when accomplishing this manoeuvre.

AEROPLANE LIMITATIONS

All variants, as listed.

Certification

Public transport category (passengers and freight)

- Day and night operations
- VFR and IFR
- Extended over water
- Icing conditions

Maximum Number of Seats

375 (-200)
440 (-300)

Weight Limitations

(201 EBA-EBD)

Maximum Taxi Weight **202,900 kg**
Maximum Takeoff Weight **202,000 kg**
(at brakes release)
Maximum Landing Weight **180,000 kg**
Maximum Zero Fuel Weight **168,000 kg**
Minimum Weight **116,000 kg**

(203 EBG)

Maximum Taxi Weight **233,900 kg**
Maximum Takeoff Weight **233,000 kg**
(at brakes release)
Maximum Landing Weight **182,000 kg Δ**
Maximum Zero Fuel Weight **170,000 kg Δ**
Minimum Weight **116,000kg**

(203 EBH-EBI)

Maximum Taxi Weight **233,900 kg**
Maximum Takeoff Weight **233,000 kg**
(at brakes release)
Maximum Landing Weight **180,000 kg**
Maximum Zero Fuel Weight **168,000 kg**

(203 EBJ-EBK)

Maximum Taxi Weight **202,900 kg ***
Maximum Takeoff Weight **202,000 kg ***
(at brakes release)
Maximum Landing Weight **182,000 kg Δ**
Maximum Zero Fuel Weight **170,000 kg Δ**

* QF operational applied limits due domestic traffic charges containment (these a/c in the domestic config)

(301)

Maximum Taxi Weight **233,900 kg**
Maximum Takeoff Weight **233,000 kg**
(at brakes release)
Maximum Landing Weight **187,000 kg**
Maximum Zero Fuel Weight **175,000 kg**
Minimum Weight **121,000 kg**

Note: In exceptional circumstances (in-flight turnback or diversion) an immediate landing above the maximum landing weight is permitted, provided the pilot follows the overweight landing procedure.

Flight Manoeuvring Load Acceleration Limits

Clean configuration **-1g to +2.5g** (normal law)
Slats extended **0g to +2g** (normal law)

Minimum Flight Crew Component **2 pilots**

Maximum Aircraft Altitude **41,450'**

Environmental Operating Envelope

0' **55 °C**
Up to 16,600' **ISA+40 deg C**
From 16,600 to 41,000' **ISA+35 deg C**
Lower temperature limits apply (below -54 deg C and proportional to altitude)(See chart in limitations section)

Airport Operations

Runway slope (mean) **±2%**

Runway altitude **12,500'**

Wind Limitations

Maximum demonstrated crosswind - **32 kt** with gusts up to **40 kt** (dry or damp runway)

Maximum tailwind **15 kt** (manual landing)

Note: The maximum crosswind values have been demonstrated with flight controls in normal law as well as in direct law with and without the yaw damper.

Other crosswind limits:

Wet runway (not damp) **32 kts (no gusts)**

XWC limits: Contaminated runway:

Braking action	GOOD	32 kts
	GOOD/MEDIUM	27 kts
	MEDIUM	20 kts
	MEDIUM/POOR	20 kts
	POOR	15 kts

(don't land unless a greater emergency exists)

Maximum wind for passenger door operation **40 kt**

(**50 kt** if aircraft nose oriented into wind)

Maximum wind for cargo door operation **40 kt**

(**60 kt** if aircraft nose oriented into wind and cargo door is on the leeward side)

The passenger and cargo doors must be closed when the wind exceeds **60 kt**.

Maximum Operating Speeds

Vmo **330 kt** up to FL300 (CAS)

Mmo **0.86M**

The maximum operating limit speed must not be exceeded deliberately in any regime of flight.

Manoeuvring Speeds (all A/C)

Va: **263 to 308 kts** (altitude 0' to 27,000') then **M0.78** (where turbulence penetration speed comes from – why is -200 turb-pen-speed different?)

If alternate or direct law is active, full ailerons and rudder application should be confined to speeds below VA.

If alternate or direct law is active, manoeuvres involving angle of attack near stall should be confined to speeds below VA.

CAUTION

Rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large sideslip angles) may result in structural failures at any speed, even below VA.

Best Turbulence Penetration Speed (not a limitation)

(200)
240kts below 10,000'
260kts above 10,000'
M0.8
(300)
240kts below 10,000'
260kts above 10,000'
M0.78

Maximum Flap / Slat Speeds

Lever Position	ECAM Indication	Max Speed	Flight Phase
1	1 (slats only)	240	Holding
1+F	1	215	Takeoff
2	2(a)	205	Approach
2	2	196	Takeoff/App
3	3	186	T/O, APP, Land
FULL	FULL	180	Landing

Maximum Altitude with flaps / slats extended **20,000'**

Maximum Gear Down Speeds

Landing gear extended (V_{LE}) **250 kt / 0.55M**
Landing gear operation (ext and retract) (V_{LO}) **250 kt / 0.55M**
Gravity extension (V_{LE}, V_{LO}) **200 kt**

Note: different limitations apply for gear down dispatch (FCOM 2 "Special Operations")

Maximum Altitude at which gear may be extended **21,000'**

Miscellaneous Speeds

Maximum tyre speed **204 kt**

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Maximum speed for windshield wiper use **230 kt**
 Maximum speed for cockpit window open **230 kt**

Note: Cockpit window opening is not possible with the packs on.

Speed Brake Extension

No limitations apply.

Minimum Speeds

(201)
 Minimum control speed 119 kt (IAS)
 Vmca at 0' pressure altitude 103 kt (CAS)
 VMCG at 0' pressure altitude 105.5 kt (IAS) CONF 1+F
 106 kt CONF 2
 106 kt CONF 3

(203)
 Minimum control speed 118 kt (IAS)
 Vmca at 0' pressure altitude 108.5 kt (CAS)
 VMCG at 0' pressure altitude 112 kt (IAS)
(301) QPA, QPB, QPC
 Minimum control speed 123 kt (IAS)
 Vmca at 0' pressure altitude 117 kt (CAS)
 VMCG at 0' pressure altitude 118 kt (IAS) CONF 1+F
 118 kt CONF 2
 119 kt CONF 3

(301) QPA, QPE, QPF, QPG
 VMCA ~128 kts

Cabin Pressure

Maximum positive differential pressure **9.25 psi**
 Maximum negative differential pressure **-1 psi**
 Safety relief valve setting **8.85 +/-1 psi**

Note: Tolerances +/-7 hPa (0.1psi)

RAM Air inlet opens only if differential pressure is lower than 1 psi.
 Do not use conditioned air simultaneously from packs and low pressure ground units. Air supplied by 2 ground carts should not exceed 2 X 1.6 kg/sec (2 X 3.53 lb/sec).

Do not use high pressure ground unit when APU supplies bleed air (to avoid bleed system damage).

Fuel Capacity

(not limitations – can "fill 'er up!")
 (these figures based on SG = 0.8 kg / litre)
 2 inner tanks 67,200 kg
 2 outer tanks 5,840 kg
 Centre tank (-200) 33,248 kg
 Trim tank (in horizontal tail) 4,984 kg
 Total Fuel (varies with S.G.)
 (-200) 111,272 kg
 (-300) 78,024 kg

Minimum Fuel Quantity for Takeoff

5,200 kg (WING TK LO LVL must not be displayed on ECAM for takeoff)

Fuel Types

JET A1, JET A, JP 5 and JP 8

Maximum Fuel Imbalances

Inner tanks full **2,900 kg**
 (advisory occurs – any fuel level)
 Inner tanks half **4,800 kg**
 Inner tanks at 7,500 kg **7,500 kg**
 Outer tanks full **1,480 kg**
 Outer tanks at 2,400 kg **1,580 kg**
 Outer tanks at 1,730 kg **1,730 kg**

If, in a fuel emergency (eg. fuel leak), the a/c can land with one wing tank full and the other empty (QRH 2.08 – fuel leak procedure)

Maximum Fuel Temperature +55 °C

Minimum Fuel Temperature

INNER TANK: fuel **freezing point +3 deg C** or **-54 deg C** whichever is higher.

OUTER TANK: fuel freezing point.

Freezing points:

JET A1	-47 deg C
JET A	-40 deg C (eg., LAX)
JP 5	-46 deg C
JP 8	-47 deg C

Fuel Management

Tanks must be emptied in the following order: Centre tank, then wing tanks.

In case of a trim tank forward transfer pump failure, do not select the trim tank forward when the pitch attitude is above 3° to avoid inadvertent fuel aft transfer.

Typical Cargo Capacities

(-200) 36,400 kg
 (-300) 45,900 kg

Engines

General Electric CF6-80E1A2 (-200) -FADEC
 Thrust: **72,000 lbs**

EGT limits

Takeoff and go-around **975 °C 5 min**
 (or **10 min** in the case of engine failure)
 MCT **940 °C** (unlimited)
 Starting **750 °C (975 °C for air start)**

Oil System

Maximum continuous temperature **160 °C**
 Maximum transient temperature **175 °C** (max 15 min)
 Minimum starting temperature **-40 °C**
 Minimum oil quantity **12 qtz + 0.56 q/hr** of planned flight

RPM

N1 max **115.5%**
 (a lower limit may apply depending on ambient conditions and bleed configuration)
 N2 max **113%**

Starter

Maximum continuous operation **5 min**
 Between each cycle, wait **30 seconds** per minute of operation for cooling.
 After **2 consecutive 5 minute** duty cycles, wait **10 minutes** to allow starter cooling before each subsequent 5 minute duty cycle.
 Starter not to be engaged when N2 > **30%**

Reverse Thrust

Not to be selected in flight.
 Backing the a/c with reverse thrust not permitted.
Maximum reverse thrust not to be used below **70 kt**. Not applicable in the case of loss of braking and unable to decelerate and RTO or landing on contaminated runway where unable to decelerate.
 Idle reverse permissible to a/c stop.

Reduced Thrust Takeoff

Thrust reduction not to exceed 25% of full rated takeoff thrust.
 FLEX assumed temperature not to exceed ISA+43 deg C.
Reduced thrust takeoff not permitted on contaminated runways.

Dispatch with one reverser inop is not permitted on contaminated runways.

Aircraft Size

Wingspan: **60.3m**
 Length: **58m (-200)**
64m (-300)

Autopilot Function

Minimum weight for autoland **123,000 kg**
 Minimum height for use of A/P on takeoff with SRS mode **100' AGL**
 (internal logic prevents A/P engagement during first 5 seconds after T/O)

Autopilot Disconnect/Re-engage Limits

Straight-in approach **MDA(H)**
 Circling approach **MDA(H) - 100'**
 ILS with CAT 1 displayed on FMA **160' AGL**
 Autocoupled approach with manual landing intended (at least CAT 2 on FMA) **80' AGL**
 All other phases (including visual approach) **500' AGL**

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Use of the A/P or F/D in OPEN DES or DES mode is not permitted in approach unless the FCU altitude is set to, or above MDA or 500', whichever is highest.

Go-around engage not below **100' AGL**

Autothrust Function

Use of the autothrust is approved with, or without, AP/FD in selected or managed mode.

Autoland Wind Limits - Aircraft

Headwind **35 kt**

Tailwind **10 kt**

Crosswind **20 kt**

Wind is based on surface wind as reported by the tower.

The AP may remain engaged if the ND wind reading is greater during the approach.

Autoland certified in **CONF FULL** and **CONF 3**.

Certified up to **229,000 kg** (all series a/c) in case of emergency

Any autoland requires at least **CAT 2** to be displayed on the PFD. 1 or 2 APs OK depending on WX (see below).

AutoLand Wind Limits – Procedural When Below CAT 1

(ie. proper low viz ops)

CAT II/III

HWC **25 kt**

XWC **10 kt**

Further Autoland Limitations

CAT 2 – minimum design height 100' AGL

At least 1 AP engaged in APPR mode at least CAT 2 displayed on FMA (CAT 2, CAT 3 SINGLE or CAT 3 DUAL)

CAT 3 FAIL PASSIVE – minimum design height 50' AGL

At least 1 AP engaged in APPR mode at least CAT 2 displayed on FMA (CAT 2, CAT 3 SINGLE or CAT 3 DUAL)

A/THR must be used in selected or managed speed

CAT 3 FAIL OPERATIONAL – minimum design height 0' AGL,

minimum RVR 75m all zones

Alert height 200' AGL

2 APs engaged in APPR mode and CAT 3 DUAL on FMA

Autoland With Unprotected Beams

Autoland to CAT 1 facility or CAT 2/3 facility with unprotected beams allowed in weather equal or better than CAT 1 – with the following conditions:

- airline checked the facility (beam quality, terrain effects on beam near touchdown)
- pilot is ready to disconnect if beam fluctuations or aircraft tracking problems occur
- at least CAT 2 displayed on FMA
- Low Vis procedures used
- go round required if wx unsatisfactory at CAT 1 minima

Engine Out Autoland

CAT 2 and **CAT 3 fail-passive** in **CONF 3** only

Engine out procedures must be completed by 1000' AGL

Other Autoland Design/Demonstrated Features (not limitations)

- slope 2.5 to 3.15 deg
- elevations below 9200'
- speed VLS + 5 to 15 kts
- demonstrated to MLW only
- dry and wet runways (snow covered or icy runways not demonstrated)
- CAT 2 and 3 beams (no limit for CAT 1 beam with precautions above taken)

Hydraulic System

Normal operating pressure is **3,000 psi +/-200**

Brake System

Maximum brake temperature for takeoff (brake fans off) **300 °C**
(brake fans on or having been on during taxi) **150 °C**

Taxi with deflated/damaged tyres:

1, 2 or 3 tyres deflated (no damage) **max 7 kts in turns.**

2 tyres deflated on same bogie, speed limit to **3 kts** and **max 30 degrees tiller angle.**

Miscellaneous Limitations

Do not set N1 above **80%** with the parking brake ON

Nosewheel steering is limited to:

(-200) **72 deg** (**65 deg** during tow or pushback)

(-300) **65 deg** (**60 deg** during tow or pushback)

Differential braking not permitted to fully stop one main gear in a turn.

Asymmetric thrust permitted in a tight turn (5 to 10 kts best) to keep the turn going but not to tighten the turn.

APU

Minimum oil quantity: not specified except with APU oil quantity indication there is no "ADD" label and there is no "LOW OIL LEVEL" on the ECAM APU page.

Max N1 **107%**

Max EGT (starting) **1250 °C**

Max EGT (operating) **650 °C**

APU Starter: After **3** consecutive start attempts without cool-down, allow a **60 minute** interval before next start attempt.

Pack Operation By APU (only)

1 pack operating maximum altitude **22,500'**

2 packs operating maximum altitude **17,500'**

APU bleed for engine start (no packs operating) maximum alt **20,000'**

Note: all altitudes are *pressure altitudes*.

Takeoff in GPS Primary

For certain airports, where the difference between the local coordinate system and WGS 84 (geodesic standard used by GPS, FMS) is not negligible, an incorrect NAV guidance may occur after takeoff. GPS must be deselected for takeoff from these airports, until a safe altitude is reached.

Use of NAV and FINAL APP Modes For Non-Precision Approach

See page in Limitations section (many conditions).

Inertial Reference System

Limitations apply for Polar Navigation - Refer to the Polar Navigation section in the FCOM 4.04.40.

Enhanced Ground Proximity Warning System (EGPWS)

A/C not to be navigated based on EGPWS display (SA tool only). EGPWS algorithm does not take into account man-made objects.

TERR pushbutton to OFF (inhibits GPWS enhanced function)

when the aircraft position is less than 15 NM from the airfield AND:

* For operations to/from runways not incorporated in the EGPWS database.

* For specific approach procedures, which have previously been identified as potentially producing false terrain alerts.

ISIS (installed on -300)

When both PFDs are lost, the ISIS speed bugs function must not be used.

IRS Drift Error

Max position error of **5 nm** for up to **1.5 hours** of flight. For flight greater than 1.5 hours consult FCOM 3.03

Residual groundspeed check to be below **15 kts**. If above then check on next flight. If above **21 kts** anytime - IRU to be removed. Perform Residual GS check within **2 minutes** after stopping.

APU BATTERY at preflight

If a/c has been electrically powered for **6 hours** or more: above **25.5V** (if below charge min **20 mins** with external power)

For APU start battery must be above **23.5V**

Electrical Outlets

It is forbidden to use the electrical outlets during takeoff and landing.

CREW OXYGEN PRESSURE (preflight)

If less than **1330 psi** check chart 03.01.35 (worst case: hot temp and 4 pilots - minimum 1000 PSI. OR minimum ETOPS requirement per MEL.

Info from the FCOM LIMS here FYI.

MINIMUM BOTTLE PRESSURE TO COVER :

- * Preflight checks
- * Usage of oxygen when only one pilot is in the cockpit (*not applicable as applies above FL430*)
- * Unusable quantity (to ensure regulator functioning with minimum pressure)
- * Normal system leakage
- * Protection after loss of cabin pressure with mask regulator on NORMAL (diluted oxygen) :
- * During emergency descent for all cockpit members for 15 minutes (22 minutes EBG, EBH, EBI) (refer to cabin fixed oxygen system)
- * During cruise at FL 100 for 2 crew members for 105 minutes (98 minutes EBG, EBH, EBI)
- or * Protection against smoke with 100% oxygen for all cockpit members during 15 minutes at 8000 feet cabin altitude.

Note: The above times are based on the use of a sealed mask, may be shorter for bearded crew (in terms of performance, pressure or duration).

Radar

(applicable **203** eg. EBG) Not to be operated in AUTO mode. Use MAN. Manual mode to be used only pending radar system update.