

PERFORMANCE REQUIREMENTS AND LIMITATIONS

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PERFORMANCE REQUIREMENTS AND LIMITATIONS

OVERVIEW: The following list of items have been accumulated from the aircraft manufacturers published limitations and requirements for operating the 737 aircraft. Limitations that vary by specific airframe type are listed according to their airframe version (600, 700, etc.) This body of knowledge is brought together in this section in order to condense the various aircraft requirements and performance limitations to a single reference for crew use.

The following list of items is not considered to be conclusive of all operating conditions, and crews should use sound judgment and Standard Operating Principles to ensure the safe operation of the aircraft.

OPERATING LIMITATIONS

Operation	Limitation
Maximum Takeoff and Landing Tailwind:	15 Knots
Maximum Crosswind – No Winglets	36 Knots
Maximum Crosswind – Winglets	33 Knots
Maximum Speeds	Observe gear and flap placard speeds
Maximum Operating Altitude	41,000 feet MSL
Maximum takeoff and Landing Altitude	12,000 (if equipped with hi alt system) else 8,400 MSL

Autoland - Maximum Wind Component

Maximum Wind Component	Wind Speed
True Headwind Component	25 Knots
True Tailwind Component	15 Knots
Maximum Crosswind Component	20 Knots
Maximum One Engine-Out Crosswind	5 Knots
Maximum CAT III Autoland Crosswind	15 Knots

Narrow Runway (100 Feet or less) Crosswind Limitations:

Model	Dry Runway	Wet Runway	Snow	Standing Water	Icy Runway
737-600	26 knots	16 knots	12 knots	6 knots	4 knots
737-700	24 knots	13 knots	11 knots	4 knots	N/A
737-800/900	27 Knots	16 Knots	15 knots	10 knots	4 knots

Runway Slope Limitations

Maximum	+/- 2%
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AVIONICS

Autopilot - Minimum Altitude to Engage

After Takeoff Autopilot Engagement	400ft AGL or greater
Non-Precision Approach	No Lower Than 360ft AGL
ILS Approach, Single Autopilot	Usable to 50 below DA/DH but not lower than 50' AGL when single autopilot in use.

Inertial Reference System (IRS) – Without Polar Navigation Option:

- The inertial Reference System is capable of providing magnetic heading and track information between 82° North Latitude and 82° South Latitude. Between 80° West and 130° West Longitude the maximum operating latitude is 70° North. Between 120° East and 160° East longitude, the maximum operating latitude is 60° South.

Autoland - Flap Setting Limits

- Autoland is only approved for settings of flap 25, flap 30 or flap 40.

Autoland - Approach Glideslope Slope Limits

Minimum Glideslope Angle	2.50°
Maximum Glideslope Angle	3.50°

EMERGENCY EQUIPMENT

Emergency Escape Slides - Door Mounted

- Whenever passengers are carried, all door mounted evacuation slides must be armed and engaged prior to taxi, and must remain so until the aircraft is being prepared for passenger deplaning.
- Installation of overwing exit handle covers must be verified prior to departure whenever passengers are carried.
- Photo Illuminescent Floor Emergency Lighting must be charged in accordance with approved procedures.

Oxygen Pressure - Correct Range

Crew Oxygen System	1,650 psi
Passenger Oxygen System	1,600 psi
Portable Oxygen Bottles	1,600 psi

Oxygen Pressure Reading Adjustments:

- Temperature > 70°F: Add 3 psi per 1°F above 70°F
 [Temperature > 21°C: Add 6 psi per 1°C above 21°C]
- Temperature < 70°F: Subtract 3 psi per 1° below 70°F
 [Temperature < 21°C: Subtract 6 psi per 1°C below 21°C]

ENGINES

EICAS Engine Instrument Setting Indicators

Maximum N1 Engine Operating Limitation	RED
Maximum Allowable Thrust (Cautionary)	AMBER
Current/Normal Thrust Settings	WHITE/GREEN

Continuous Engine Ignition

- Continuous Ignition should be selected **ON** during inflight encounters with heavy precipitation, and during severe turbulence. Continuous Ignition should be **ON** as a safety concern during takeoff and landing if birds are present in the airport vicinity.

Reverse Thrust

Flight Condition	Permissible Use of Reverse Thrust
In Flight	Prohibited
On Landing Rollout while still >70kts	Full Reverse until 80kts, then reduce to idle.
On Landing Rollout <70kts.	Idle only.
Power Back from Gate or Parking	Prohibited per engine manufacturer.

RPM - Maximum Allowable

N1	As per EICAS display
N2	As per EICAS display

Starter Engagement Limitations

Starter Engagement Activity	Total of 15 minutes without cooling period.
Starter Engagement <=5 Minutes	Until Engine De-spools to 0 RPM N2
Starter Engagement =>5 Minutes	Time Equal to Starter ON time (ex 6min=6min)

FIRE PROTECTION

Cargo Fire Protection Envelope

Maximum Recommended Flight Time from Suitable Airport to ensure Cargo Fire protection.	120 Min
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FUEL

Fuel Capacity	Pounds
Left Wing Tank	8,630 lbs
Right Wing Tank	8,630 lbs
Center Wing Tank	28,803 lbs
TOTAL FUEL	46,063 lbs

- These are structurally limited fuel quantities that can only be achieved with extremely high density fuel.
- MSFS LIMITATION: If the airplane is drawing fuel from the center wing tank and the user sets the CWT fuel quantity to 0 in the MSFS FUEL MENU, the engines will flame out. If you plan to change the center wing tank fuel level, PMDG recommends turning off the CWT Fuel Pumps FIRST.

Fuel Loading

- Load Wing tanks FIRST when boarding fuel.
- After wing tanks are full, load center tank.

Fuel Temperature

Fuel Type	Minimum	Maximum
Jet A	-37	+49
JP5	-43	+49
Jet A-1	-44	+49

- If fuel temperature approaches minimum temperature in flight, crews should consider a flight level change to warmer altitudes, or increasing speed to increase TAT.
- After bringing fuel temperature up to, or above minimum temperatures, crews should carefully assess the use of higher, colder altitudes for flight.
- In cases where the fuel temperature indicator is inoperative, the fuel tank temperature should be considered to equal True Air Temperature.

Fuel Usage

Fuel Tank Condition	Required Crew Action
<u>All Tanks Full</u>	Select All Pump switches ON . (Fuel will draw from center wing tank)
<u>Center Wing Tank Empty.</u>	Confirm Tank quantities. Select both CENTER WING TANK pumps to OFF .
<u>Fuel Imbalance between Wing Tanks</u>	All Wing Tank Pumps ON Open Fuel Crossfeed Valve. Wing Tanks on lower quantity tank: OFF (Reverse procedure to turn off fuel crossfeed)

Landing Fuel - Minimum Allowable

Fuel On Board at Touchdown (Ensures adequate boost pump coverage.)	2,000lb
Fuel to Execute a Go-Around	3,000lb

- Minimum Desired Landing Fuel Total: Ensures a safe quantity of fuel on board at the time the aircraft crosses the runway threshold. This is a worst-case scenario considered with maximum fuel quantity indicator error. Does not include fuel minimums required by Federal Aviation Regulations and sound flight planning.

HYDRAULICS

Auto-Brake System

- Use manual braking when anti-skid is inoperative or upon any indication of system fault.

Flaps/Slats Extension Altitude - Maximum

Maximum Allowable Extension Altitude	20,000ft [6,100 M]
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Hydraulic Quantity - Minimum

Minimum Hydraulic Quantity at Dispatch Time	72% of system capacity
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Inflight Spoilers

Visual Meteorological Conditions	Not permitted below 1,000ft AGL.
Instrument Meteorological Conditions	Use not recommended after FAF
Maximum Speed for use of spoilers	Never at speed greater than 320KIAS or extreme vibration made damage horizontal stabilizer

Tire Pressure

Nose Gear Tires	195 - 205 psi
Main Gear Tires	205 - 215 psi

- Tire mounted pressure indicators are only valid for pressure readings after tires, brakes and wheels have cooled to ambient temperature (allow approximately 1hr after parking for a normal landing, 2hrs after a hard braking condition.)
- Tire pressure requirements are based upon the design structural limit weight of the aircraft.

Tire Pressure Adjustments

- Temperature >70°F: Add 1 psi per 3°F above 70°F
[Temperature >21°C: Add 2 psi per 3°C above 21°C]
- Temperature <70°F: Subtract 1 psi per 3°F below 70°F
[Temperature <21°C: Subtract 2 psi per 3°C below 21°C]

ICE AND RAIN

Known Icing Conditions

- Icing conditions are said to exist for taxi, takeoff and landing operations when:

Outside Air Temperature	10°C (50°F) or below
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and/or:

- Visible moisture of any form is present (clouds, fog, visibility of 1 mile or less, snow rain, sleet or ice crystals).
- Standing water, snow, slush or ice accumulations are present in a form which may be ingested by the engines or freeze to nacelles, blades or sensors.
- Icing conditions are said to exist in flight when:

Total Air Temperature	10°C (50°F) or below
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and:

Visible moisture of any form is present (clouds, fog, visibility of 1 mile or less, snow rain, sleet or ice crystals). **Engine Anti-Ice**

- Engine and Wing Anti-Ice systems should not be operated when OAT >10°C during ground operations, or when TAT >=10°C during flight.
- Engine anti-ice must be selected **ON** during all ground and flight operations when icing conditions exist or are anticipated.
- Engine anti-ice must be activated prior to, and operated during a descent in icing conditions. During ground operations lasting more than ten minutes in icing conditions, engine anti-ice capabilities must be reinforced by momentarily selected a thrust setting of 50% N1 for each engine (separately). *Use caution for jet blast and FOD dangers associated with accumulated ice or snow on taxiways and runways.*
- Wing Anti Ice should not be used to decontaminate wings while on ground.

Ground Based De-Ice Operations:

After any ground deicing/anti-icing of the horizontal stabilizer, airspeed must be limited to 270 KIAS until the crew has been informed that the applicable maintenance inspection procedures have been accomplish that will allow exceedance of the 270KIAS limitation. Inspection ensures that a horizontal stabilizer imbalance conditions will not exist due to the accumulation of deice/anti-ice fluids in the stabilizer drive housing which could lead to an unmovable stabilizer trim condition.

AUXILIARY POWER UNIT

APU Starter Limitations

Time off between APU start attempts	1 Minute
APU Pneumatic and Electrical Load	Max allowed altitude 10,000ft (in flight)
APU Pneumatic and Electrical Load	15,000ft (when on ground)
APU Pneumatic System Max Altitude	17,000ft
APU Electrical System Max Altitude	41,000ft

- APU Bleed valve must be closed when Engine 1 bleed valve is open, or when engine 2 bleed valve is open and Isolation Valve is open.

PNEUMATICS

Pressurization - Cabin Differential Limits

Max Differential – Operating	9.1 psi
Max Differential - During Climb	9.1 psi

SPEEDS

V_{FE} - Flaps Extension Speeds - Maximum (KIAS)

- As per speed schedule displayed on PFD when proper weights and initialization of FMC has been accomplished.

V_{LO} / V_{LE} - Landing Gear Limit Speeds - Maximum (KIAS / Mach)

V _{LO} - Retraction	235 KIAS
V _{LO} - Extension	270 KIAS / .82M
V _{LE} - Extended	320 KIAS / .82M

Maximum Tire Limit Speed	204 Knots Ground Speed
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Maximum Turbulent Air Penetration Speed

15,000ft [4600 meters] and higher altitude	290 KIAS / .780M
15,000ft [4600 meters] and lower altitude	250 KIAS

WEIGHT LIMITATIONS

Structural Weights – 737-600

Pounds

Maximum Taxi	127,500
Maximum Takeoff	127,000
Maximum Landing	120,500
Maximum Zero Fuel	114,000

Structural Weights – 737-700

Pounds

Maximum Taxi	133,500
Maximum Takeoff	133,000
Maximum Landing	128,000
Maximum Zero Fuel	120,500

Structural Weights – 737-800

Pounds

Maximum Taxi	174,700
Maximum Takeoff	174,200
Maximum Landing	144,000
Maximum Zero Fuel	138,300

Structural Weights – 737-900

Pounds

Maximum Taxi	174,700
Maximum Takeoff	174,200
Maximum Landing	146,300
Maximum Zero Fuel	140,300

GENERAL LIMITATIONS

Certification Status

The 737-600/700/800/900 aircraft are certified under the 737 Type Certificate, in the Transport Category, US FAR Parts 25 and 36.

Flight Load Acceleration Limitations

Flaps Up	+2.5 g to -1.0 g
Flaps Down	+2.0 g to 0.0 g

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