G650

LANDING GEAR

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BRAKES

SYSTEM

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Pedal Position Transducer (PPT)

L Hyd Sys

R Hyd Sys

Inboard Brakes

Outboard Brakes

Pedal deflection

Electrical signal

BCU commands amount of hydraulic power to brakes

Brake application
- The G650 has a fully retractable, tricycle-type landing gear

- Each gear incorporates a conventional oleo-pneumatic shock strut with dual wheels and tires

- Shock struts are filled with MIL-H-5606 hydraulic fluid and are pressurized with dry nitrogen

- Strut extension

- Recommended tire pressure: 216 Psi (Min 186)
The landing gear control unit (LGCU) is the brains of the system. It is located in the REER. The LGCU contains two (2) control lanes and one (1) monitor lane. Either control lane is capable of controlling the gear system.
- Extension and Retraction Requires:

1. Electrical power to operate

   ![L ESS DC and R MAIN DC]

2. Hydraulic power to actuate

- Gear Retraction and Extension is normally provided by:

   ![L Hyd Sys and Gear Position Diagram]

- In the event of a failure of the engine-driven hydraulic pump the gear can be extended or retracted using the:

   ![PTU and AUX Pumps]
- Helps retract the landing gear following left engine failure after V1 (Regulatory purpose)

- In the event of a total failure of the left hydraulic system, the landing gear can be extended via two (2) nitrogen bottles located in the nose gear wheel well.

- The alternate gear extension system ports high pressure nitrogen to the gear extension system to extend the gear. The nitrogen repositions the nose gear and main gear dump valves to a dump position.
Landing gear extension (normal)

1. L'ess DC and R. main DC and PTU available

2. \( V_{lo} \leq 225 \text{ KCAS} \)

3. Gear handle (electrical switch) selected down (illuminates \( \bullet \))

4. Gear doors open fully

5. Landing gear extends and locks

6. Three green \( \bigcirc \) (down and locked)

7. Landing gear doors close

8. Gear handle light extinguishes
- Landing Gear Retraction

1. L Hyd Sys and R Main DC available

2. \( \leq V_{LO} \) (225 kCAS)

3. Gear handle (electrical switch) selected up (illuminates \( \bullet \))

4. Gear doors open fully

5. Landing gear retracts into the uplocks

6. Landing gear doors close

7. Gear handle light extinguishes
- Landing gear extension (Alternate) - One Time Use

1. \( \leq V_{LO} \) (175 KIAS)

2. Gear handle (Electrical switch) selected down (illuminates \( \bullet \))

3. Pull EMER landing gear handle

4. Gear doors open fully and remain open

5. Landing gear extends and locks

6. Three green \( \bullet \bullet \bullet \) (down and locked)

7. Gear handle light extinguishes

8. Landing gear doors remain open
The nose gear's steering system is:

- Electrically-controlled
- Hydraulically-driven

And

by a steer-by-wire system

Nose wheel steering (NWS): 80° (± 2°)

NWS overtravel indicator: > 84° NWS maintenance req'd

Rudder pedals: Left 7°/Right 7°

Rudder pedals (NWS failure) Left 16°/Right 16°

Rudder pedal input + NWS = nose wheel deflection

NWS = Red guarded switch

* "Clunk" = NWS valve opening

× Power

ON

OFF
Limitations

Maximum altitude to operate gear or fly with the gear extended: 20,000 MSL

VLO 175 KCAS
VLO 225 KCAS
VLE 250 KCAS

Emergency gear

Speed brakes and gear down in flight prohibited

Maximum tire speed: 195 knots (ground speed)
**Landing Gear Warnings**

- **< 500` AGL** and **< 190 KCAS**
  - Voice override = Silences aural warning

- **< 350` AGL** and **near idle**
  - Gear unsafe warning horn will sound (klaxon tone)
  - Horn silence = Silences warning horn

- Flaps > 22°
  - Gear unsafe warning horn will sound (klaxon tone)
  - Horn silence = Will not silence warning horn
BRAKES

BRAKES ARE CONTROLLED BY A TWO-CHANNEL BRAKE CONTROL UNIT (BCU). BOTH CHANNELS OPERATE ON A CONTINUOUS BASIS AND BACK EACH OTHER UP. THE BCU IS LOCATED IN THE REER.

THE PURPOSE OF THE BCU IS TO PREVENT TIRE DAMAGE OR FAILURE CAUSED BY TIRE SKIDDING OR LOCKED WHEELS DURING LANDING OR A REJECTED TAKEOFF.
Rudder Pedals

Pedal deflection → Electrical signal → BCU
BCU commands amount of hydraulic power to brakes → Brake application

L Hyd Sys → BCU → R Hyd Sys

Inboard Brakes ← L Hyd Sys → BCU → R Hyd Sys → Outboard Brakes

Each of the four (4) main gear wheels has individual braking via a brake-by-wire system with:

A) full anti-skid protection (down to 10 kts)

Touchdown protection: prevents landing with brakes on

Brakes available:
- WOW (G) + 5 seconds, or
- wheel speed > 70 kts
**Locked wheel protection**: compares wheel speeds

- **Left versus Right Inboard**
- **Left versus Right Outboard**

If $30\% < \text{its paired wheel} = \text{brake pressure released}

**Wheel spin down**: decelerates main gear wheels prior to entering the wheelwells

**Autobrakes**: automatic application of brakes during a rejected takeoff or during landing

Autobrakes are armed through a four-position rotary switch

There are three (3) levels of deceleration on landing - Low, Medium and High, and a single rejected takeoff (RTO) mode
① WOR - GROUND
② THRUST LEVERS idle
③ DE-ROTATION PHASE UNTIL NLG WOR
④ THEN:

**Autobrake - Low**

TARGET DECeleration RATE = 7 ft/SEC²

**Autobrake - Medium**

TARGET DECeleration RATE = 10 ft/SEC²

**Autobrake - High**

MAXIMUM ANTI-SKID BRAKING

Autobrakes are disconnected by the application of toe brakes (rudder pedals).

Contaminated Runway = **Autobrake - Low** not authorized

① THRUST LEVERS idle

② Brake pressure application:

600 psi < 80 knots > 600 psi
B) Brake Temperature Monitoring System (BTMS)

Current brake temperatures sensed on each wheel

>600°C sensed in one or more brake assemblies

**Brake Overheat**. V speeds will not box.

c) Tire Pressure Monitoring System (TPMS)

Alerts the crew of improper tire pressures

\[
\begin{align*}
&\leq 186 \text{ psi} & \text{Tire Pressure Low} \\
&\leq 100 \text{ psi} & \text{Tire Pressure Low}
\end{align*}
\]

Recommended: \(216\) psi > 2 hours stationary

Prior to towing the nose wheel TPMS harness and the nose gear torque link must be disconnected.

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TPMS Maintenance Req'd

\[\text{Disconnected} \quad \rightarrow \quad \text{TPMS Harness} \quad \text{NG Torque Link} \quad \rightarrow \quad \text{Connected}\]
If the brake pedals are applied and inboard accumulator pressure is low, the AUX pump Auto Latch feature will command the AUX pump, if armed, to come on (ASC 902).

- **WOW GROUND** and brake pedal application

![Diagram of brake system with inboard and outboard pressure gauges and hydraulic system](image-url)
- Parking Brake System

The Parking Brake System has two (2) independent accumulators pre-charged to 700 psi with Nitrogen and hydraulically charged to 3,000 psi.
Parking brake must be set prior to checking the brake wear indicators - "Life remaining".

If pump is selected on during ground operations with no engines running only the left accumulator (inboard) is charged.

Parking brake accumulator pressure will decrease continuously over a short time. Always chock aircraft until ready for engine start. Otherwise it may roll away.
Landing Gear Control Maintenance Panel (LG CMP)

The LG CMP is located on the right side of the fuselage and is used to:

1. Change WOW mode (MX)  [LDG System Maint Mode]
2. Retract/extend landing gear while on jacks  [Maintenance Function]
3. Open/close gear doors  [Exterior Preflight Inspection]

* AUX pump is the normal source of hydraulic power for these activities
Safety Pins (8)

To make them more visible there is a "Remove Before Flight" red flag

- Three (3) gear pins are installed during post-flight inspection. The pins are removed during the pre-flight inspection in preparation for departure.

One pilot removes/stores the pins. The other pilot confirms that all pins have been removed and announces it. Failure to remove the pins will prevent the landing gear from retracting after takeoff.
- Two (2) nose gear and two (2) main gear door pins are installed before opening the gear doors via the LGCMP.

- One (1) LG mode pip pin is installed in the LGCMP when changing modes - Normal to Maintenance.

A CAS message will alert the crew that the LGCMP is set to Maintenance Mode.

Returning to Normal Mode requires that the pin be removed.
Questions, comments or errors?
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AN AVIATOR'S JOURNEY
TALES FROM A CORPORATE PILOT
IVAN LUCIANI

Thank you!