

# DC-10 FLIGHT CREW OPERATING MANUAL

## CHAPTER 14 LANDING GEAR

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# DC-10

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### LANDING GEAR

#### GENERAL

The aircraft has a tricycle landing gear comprised of four-wheel trucks on each main gear, and dual wheels on the nose gear. A supplemental dual-wheel center gear is installed on the international version only. Domestic version aircraft have provisions only for installation of the supplemental dual-wheel center gear. The landing gear and main gear wheelwell doors are hydraulically actuated. The main and nose gear can be extended without extending the center gear on aircraft that have the center gear installed. A free-fall capability is designed into the system for use if required by hydraulic failure. An electrically monitored, visual/aural indicating and warning system provides indication of gear status during various phases of flight. Dual, hydraulic powered, multi-disk wheel brakes with anti-skid control systems are provided on the main and center gear. Accumulators in the system provide reserve brake pressure in the event of normal hydraulic system pressure loss.

#### DESCRIPTION

##### LANDING GEAR SYSTEM

The landing gear and main gear doors are retracted and extended by hydraulic system 3. If system 3 has a loss of pressure, but fluid is available, hydraulic power to retract the gear can be supplied if either the (1-3) or (2-3) reversible motor-pumps are operating.

If no hydraulic pressure is available due to loss of fluid or complete system failure, or if the landing gear lever is

jammed in the up position, the main and nose gear can be mechanically unlatched by an alternate gear extension lever in the floor at the right side of the pedestal, and the center gear, if installed, can be unlatched by a center gear alternate extension handle on the floor, just forward of the lower main circuit breaker panel. This allows all gear to free-fall and mechanically latch in the down position. The main landing gear is normally held in the up position by hydraulic pressure. In the event of loss of pressure, the main gear rests on the main wheelwell doors, and the nose gear and center gear are held up by overcenter linkage.

Trim cylinders maintain the truck beams perpendicular to the main gear struts. On aircraft with Service Bulletin 32-135 incorporated or production equivalent, a trim cylinder interlock mechanism prevents moving the gear handle to up in the event of hydraulic failure in the trim system.

##### NOSE GEAR STEERING SYSTEM

Nose gear steering is powered by hydraulic systems 1 and 3. Both the nose gear steering wheel and the rudder pedals provide steering control. The nose gear steering wheel has override authority over rudder pedal steering. The nose gear steering wheel provides steering up to 68 degrees on either side of neutral, and full rudder pedal travel provides steering up to a maximum of 10 degrees on either side of the neutral position. If hydraulic system 1 or 3 fails completely, nose-wheel steering is limited to 25 degrees

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in the direction of the inoperative hydraulic system. Rudder pedal steering is not noticeably affected by loss of one hydraulic system. Rudder pedal steering is rendered inoperative by the mechanical ground sensing mechanism during nose gear strut extension at takeoff. Nose gear steering using the nose gear steering wheel while the gear is retracted is not possible as the steering bypass valve is mechanically placed in a bypass mode upon nose gear retraction. This prevents inadvertent steering and possible jamming of the nosewheels in the wheelwell while retracted.

### GROUND SENSING SYSTEM

A mechanically operated ground sensing mechanism is provided on the aircraft. It is operated by extension and compression of the nose gear strut. The system mechanically disables rudder pedal nosewheel steering, operates the gear handle antiretraction release mechanism, and cams two switches which energize or deenergize a number of ground control relays which establish a ground or flight mode of operation for various systems.

### VISUAL/AURAL INDICATING AND WARNING SYSTEM

The landing gear position indicating system consists of lights, aural warning, and mechanical indicating elements. Red and green lights are provided to give visual indication of the status of the landing gear in relation to landing gear handle, alternate gear extension lever, and throttles position for all phases of flight. Below 215 KIAS, an aural warning horn and red lights will announce a configuration in which the gear is not down and any throttle is retarded. Above 215 KIAS only the lights warn of this condition. At any speed, the horn sounds if the flaps are extended beyond the approach position with the gear not down. The horn can be silenced by use of a gear horn off button, except

when the gear is not down the flaps are extended beyond the approach flaps position.

In the event the electrical indicator system malfunctions, it is possible to confirm that the landing gear is down and locked by observing mechanical indicators. Determination that the main gear is down and locked can be made by observing a button protruding from the top surface of each wing. A viewing window in the cabin floor and through a main gear wells is also provided for checking that gear is up and doors are closed. Viewing tubes installed in the floor of the forward cabin provide means of visually checking the nose gear locks. No provisions are made for visual check of the center gear locks, however uplocking may be verified by means of the center gear alternate extension handle on aircraft with the center gear installed. On aircraft with or without the center gear installed, center gear door locking closed may be verified by means of the center gear alternate extension handle.

### BRAKE SYSTEM

There are two independent braking systems for each of the eight main wheels and two center wheels when installed. Each brake system uses a separate hydraulic power system. Brake system 1 utilizes power from hydraulic system 1, and provides pressure to brakes on all main and center gear wheels. Brake system 2 is powered by hydraulic system 3 and provides pressure to brakes on all main gear and center gear wheels independently of brake system 1. Adequate braking for all landing conditions is available with only one brake system operative. Each brake system is provided with two accumulators which will supply reserve braking pressure in the event of normal hydraulic pressure failure. Fully charged accumulators will provide approximately 6 normal manual power brake applications. Brakes are available as long as brake system

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pressure is above the red band on the respective brake system hydraulic pressure gage. Pedal forces required to actuate brakes are very low, and the brake pedals can actually be bottomed even though the system is functioning normally.

On some aircraft, brake temperatures are monitored by OVHT lights and a BRAKE TEMP gage that will selectively display the temperature of any brake. Normally the brake temperature gage indicates the temperature of the hottest brake. If the wheel is exposed to excessive brake temperature, fuse plugs in the wheel will melt causing tire pressure release.

The parking brakes are set by applying full braking pressure with the toe operated rudder pedal brakes, positioning the park brake handle fully aft, and then releasing the rudder pedals. This action traps braking pressure in the system. Adequate parking brake pressure is available if the brake system hydraulic pressure gages indicate in the white band. With parking brake set for several hours, normal hydraulic system bleed off can result in no pressure at brakes. As long as brake pressure is indicated there will be pressure at the brakes. The parking brakes may be released by fully depressing, then releasing the toe pedals. If hydraulic system(s) depressurize(s) while parking brakes are set, the brake pressure later bleeds off, then parking brakes will be repressurized automatically when hydraulic system(s) are repressurized, and this will occur without resetting parking brake handle. Two lights,

one on the pedestal and one on the overhead panel indicate when the parking brake handle is set to park position. The takeoff warning aural signal (intermittent car horn sound, identical to cabin altitude warning) sounds when the ground shift mechanism is in the ground mode and either throttle 1 or 2 is advanced for takeoff and the parking brake is not released.

### AUTOMATIC BRAKE SYSTEM (ABS) (Installed on some aircraft)

The automatic brake system (ABS) provides the means for automatically applying the brakes during the landing mode. The system consists of a control panel, indicating lights, an auto brake control unit, and a land manifold.

In the landing mode, ABS operates only from brake system 1 (hydraulic system 1) and provides selection of one of three modes of operation; minimum, medium or maximum. In minimum and medium modes of operation the system compares actual aircraft deceleration, (from flight guidance system linear accelerometer) with the mode selected and maintains a constant level of deceleration. In the maximum mode, full brake system 1 pressure is applied to the brakes (limited only by anti-skid system operation) and maximum deceleration is achieved. Landing mode is armed after gear is down prior to landing by selecting the deceleration level desired and arming the system. Arming of the ABS requires the ABS being operative, (no system failure), deceleration level selected prior to landing anti-skid armed and operational and the linear accelerometer unit-2 operative.

JL  
Feb 1/87

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The ABS landing mode is activated when spoilers are deployed (either automatically or manually) with throttle levers retarded and brake pedals released. Automatic braking is delayed after spoiler deployment for approximately 1 second in maximum mode and approximately 3 seconds in minimum or medium modes to allow for normal nose wheel touchdown. Pilot takeover can be initiated at any time and ABS system will disarm if brake pedal is depressed beyond approximately 40 percent of travel, if throttle lever 1 or 3 is advanced beyond 15 degrees, deceleration selector is moved to OFF position. The arm-disarm switch will move to DISARM and ABS lights will come on for the above conditions. (Moving AUTO BRAKE deceleration selector to OFF will not turn on ABS lights). Stowing ground spoilers will release brake pressure without disarming the ABS landing mode. The ABS lights will remain off and automatic braking will again be available if spoilers are re-deployed.

An ABS malfunction will cause the system to automatically disarm. The arm-disarm switch will move to DISARM, and indicating lights will come on. To rearm the ABS system after it has automatically disarmed, the deceleration selector must be moved to OFF and then back to the deceleration setting and the arm-disarm switch moved to ARM. If the fault has cleared, the system will rearm. In flight the ABS is disarmed when the gear handle interlock relay senses the gear handle up.

### ANTI-SKID SYSTEM

A fully automatic, pressure modulating anti-skid control system is installed in each of the two hydraulic power brake systems. the system is con-

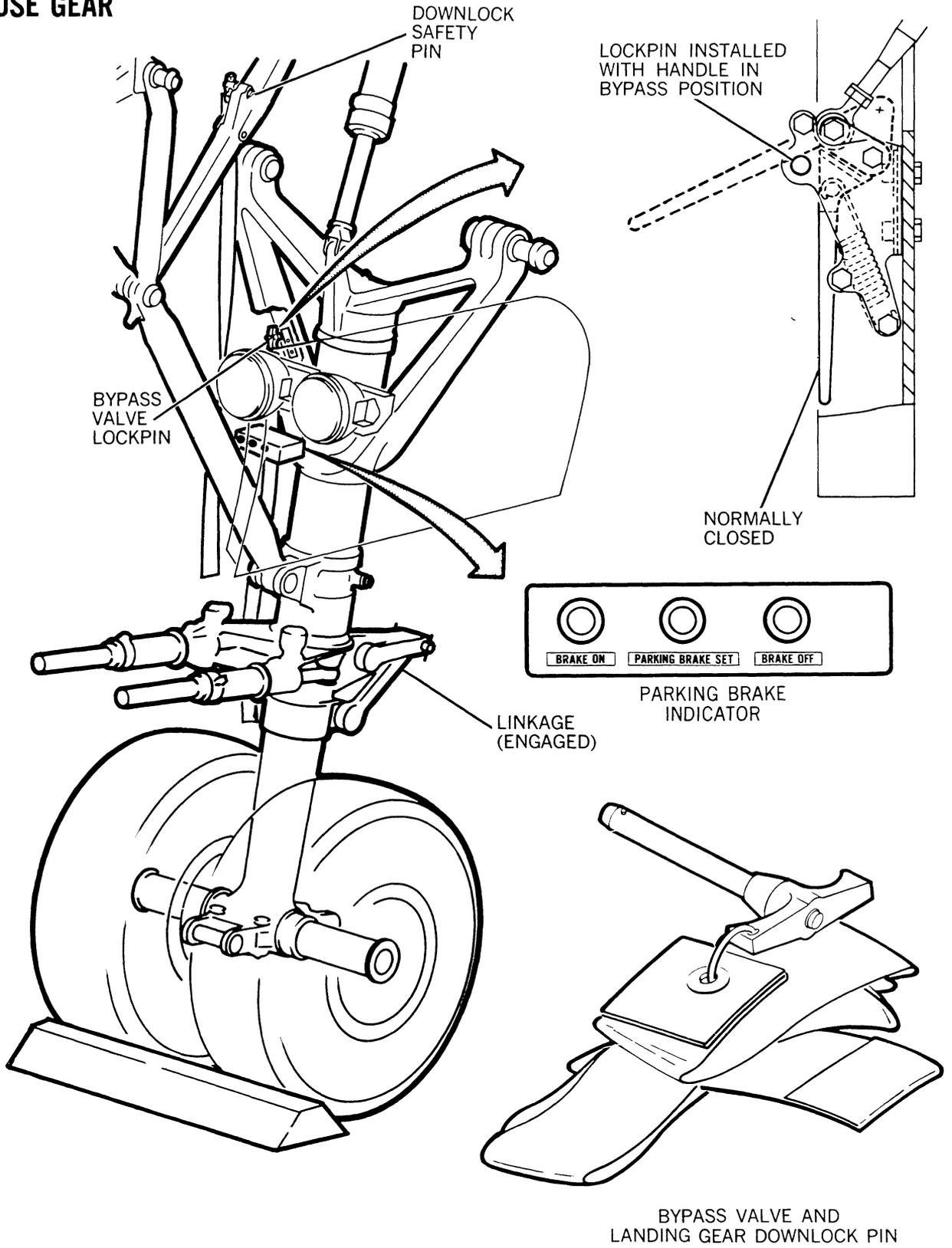
trolled by individual wheel speed transducers, anti-skid control box, and individual anti-skid control valves for each main and center wheel brake. Pilot induced manual brake valve pressure (as a result of toe-brake pedal deflection) is metered as necessary to provide efficient braking and prevent tire skidding. The anti-skid system responds most efficiently with full pedal application (pedals bottomed) or at least steady partial pedal application. The system incorporates locked wheel touchdown protection, to the rear bogie wheels only, to prevent inadvertent landing with the brakes applied. A shift from ground mode to flight mode, while on the ground, will release the rear bogie wheels at low speed leaving normal braking on forward bogie wheels. The system automatically reverts to a manual power brake system, below 10 knots for the main gear and on some aircraft 3 to 4 knots for the centerline gear, but the anti-skid lights remain off. An arming switch, test button, and indicating lights are provided to control and monitor the system.

### CONTROLS AND INDICATORS

Controls, indicators, and annunciator lights are on the pilots' instrument panels, Pedestal, Overhead Panel, and Flight Engineer's Upper Instrument Panel No. 3. The main and nose gear alternate gear extension lever is to the right of the pedestal on the floor and the center gear alternate extension handle is on the floor forward of the main circuit breaker panels. Illustrations of these major panels are in Chapter 1. Individual controls and indicators are illustrated and described in another section of this chapter.

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## NOSE GEAR



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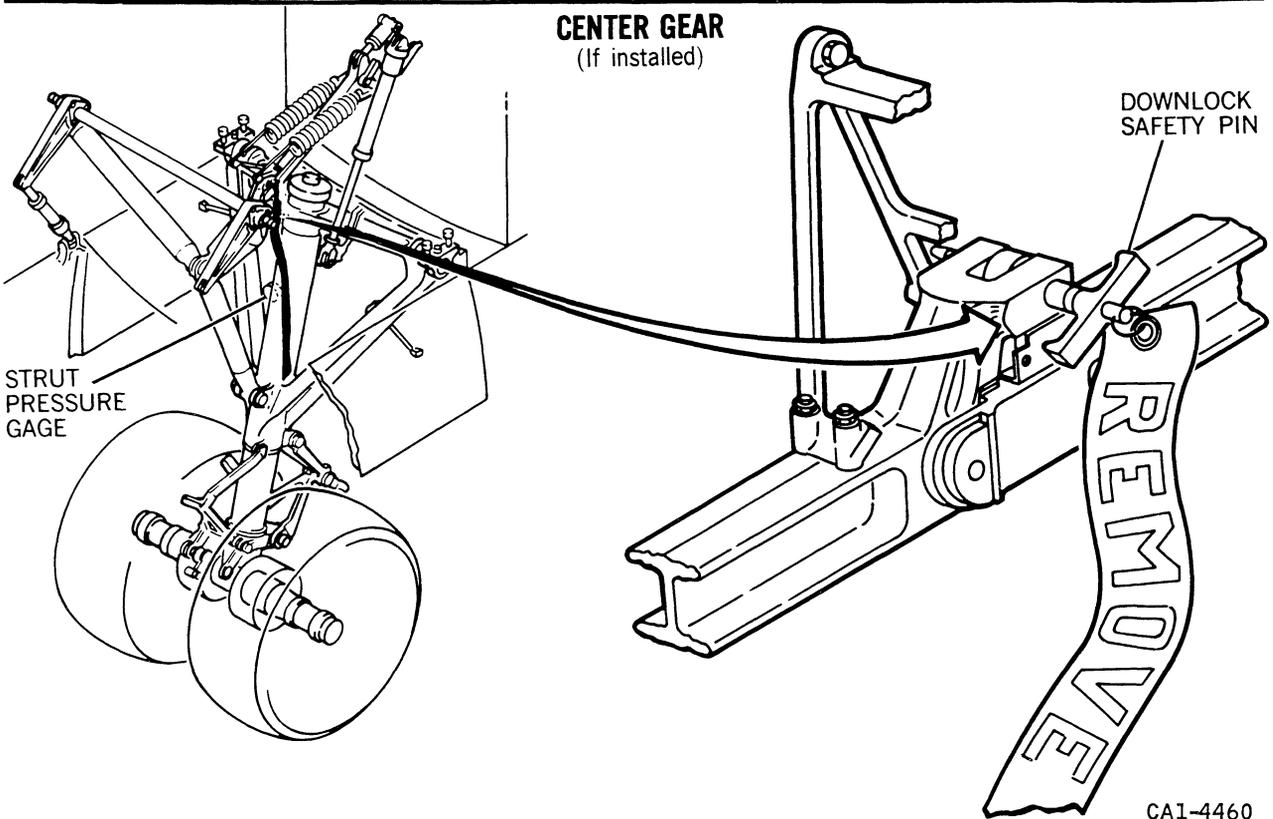
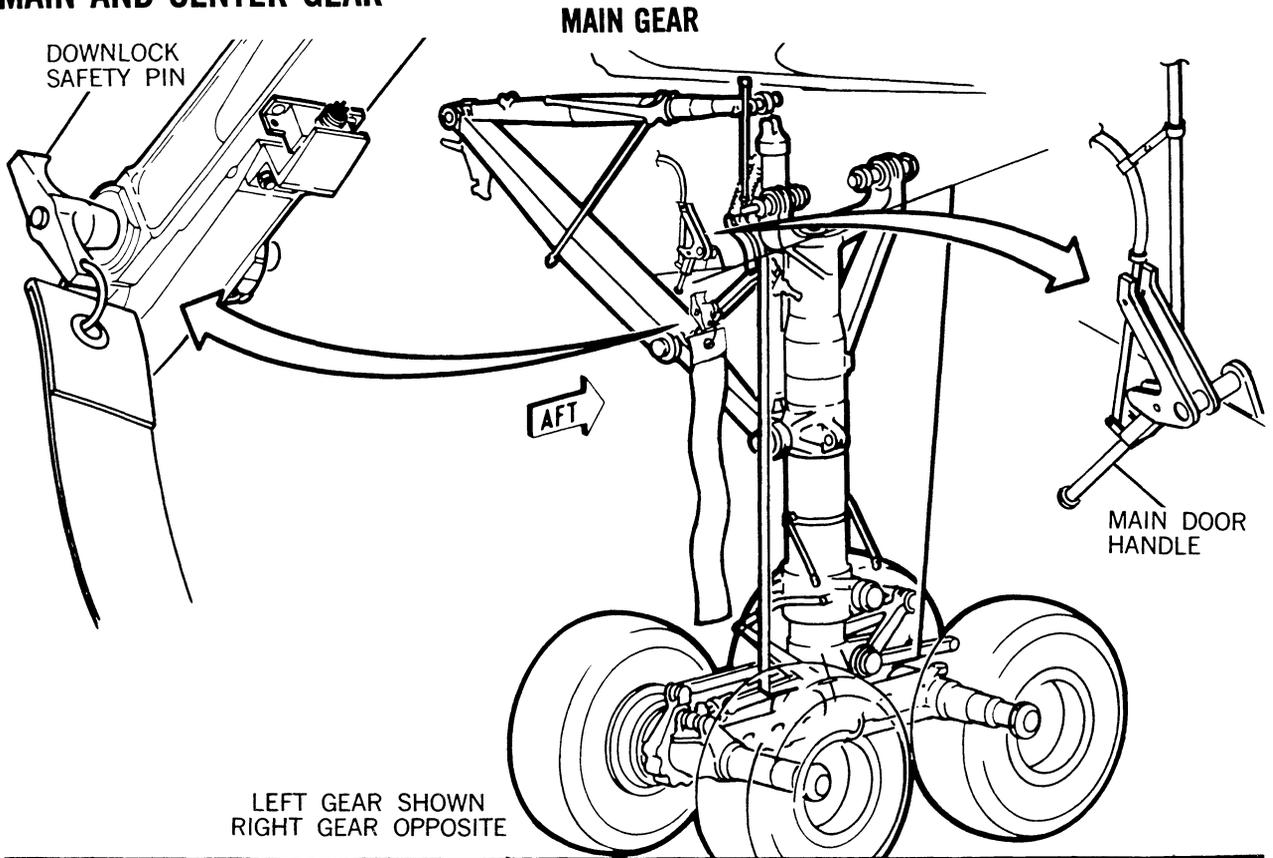
JL  
May 1/76

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14-20-01

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## MAIN AND CENTER GEAR



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## LANDING GEAR - Controls and Indicators

**GEAR Lights (Nose, Left, Right & Center)**  
(Copilot's Instrument Panel & F/E's Upper Instrument Panel No 3 An unsafe indication on one of two gear indicating systems does not require a mandatory visual inspection)

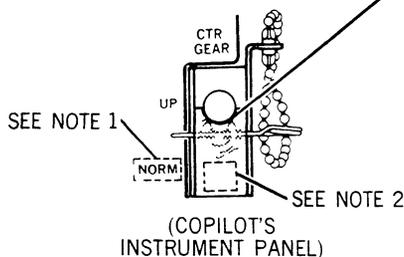
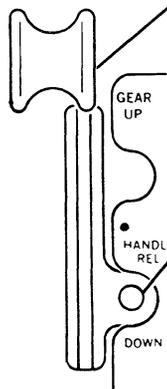
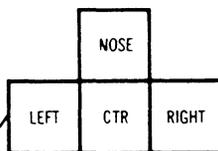
**GREEN** - Come on when gear handle is down and landing gear is down and locked. Also on when gear handle is up and landing gear is down and locked, if alternate gear extension lever is raised

**RED** - Come on when landing gear is not down and locked and handle is down or when any unsafe condition exists. Also comes on when landing gear is in transit or not in agreement with gear handle, or when gear is up and locked and any throttle is retarded to idle

**OFF** - When gear handle is up and gear is up and locked

**NOTE**

Both red and green lights for respective main gear will be on when main gear door maintenance safety hook is installed



**GEAR Handle**

Mechanically positions landing gear hydraulic control valve for retraction or extension of landing gear. To move handle from UP or DOWN, it must be pulled aft

An interlock prevents moving gear handle to UP, if hydraulic pressure to landing gear trim system fails

**GEAR HANDLE REL Button**

Releases anti-retraction mechanism and permits gear handle to be placed in UP in event of an anti retraction release mechanism malfunction

**GEAR LT TEST Button**

When pushed, red lights for nose, left, center and right gear will come on

**CTR GEAR Isolation Switch**

Permits main gear to be extended without extending center gear

**UP** - Prevents center gear from being extended when main gear is extended. Center gear warning circuits are inhibited

**NORM** - Center gear will be extended and retracted when main gear is extended and retracted by means of GEAR handle

**NOTE**

- 1 On domestic configuration NORM placard is covered to obscure
- 2 On domestic configuration center gear switch is guarded in UP by an additional guard placarded NO CTR GEAR

**GEAR HORN OFF Button**

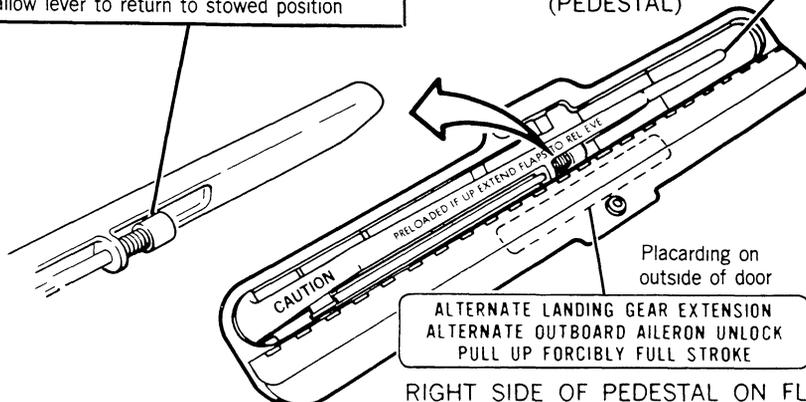
When pushed, will silence gear warning horn when flaps are not in landing range

**Lever Release Pushrod Knob**

To unlock alternate gear extension lever to return to stowed position, lift lever to relieve tension on link in detent, then press down on pushrod knob on outboard side of lever and allow lever to return to stowed position

**GEAR HORN OFF**

(PEDESTAL)



**Alternate Gear Extension Lever**

**Lifting Lever**

- Mechanically releases all uplatches except center gear
- Mechanically positions landing gear control valve to bypass and shuts off hydraulic system 3 pressure to nose gear steering
- Limits nose gear steering in this case to 25 degrees to right (pressure from hydraulic system 1) when using nose gear steering wheel
- Unlocks outboard ailerons if they are locked

**Stowing Lever** If hydraulic system 3 is operative

- Retracts gear if gear handle is at GEAR UP
- Returns nose gear steering to normal (hydraulic system 3 is restored)

**CAUTION**

Lever is preloaded when in up position when flaps are not extended. Restrain lever when stowing

**Center gear is installed on the international configuration only. Domestic configuration aircraft have provisions only for center gear.**

JL  
Aug 1/81

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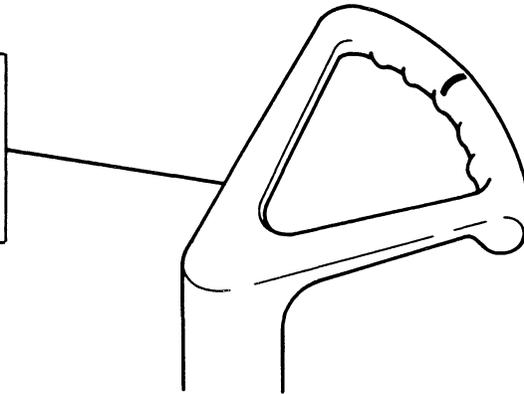
CA1-4462C

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## LANDING GEAR - Controls and Indicators

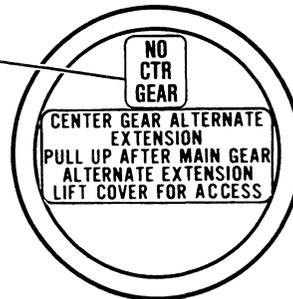
### Nose Gear Steering Wheel

Provides nosewheel steering up to 68 degrees left and right of the neutral position and overrides the rudder pedal steering. Full rudder pedal movement results in up to 10 degrees steering on either side of the neutral position as long as the ground shift mechanism is in the ground mode.



(CAPTAIN'S CONSOLE)

Placard added on domestic configuration airplanes.

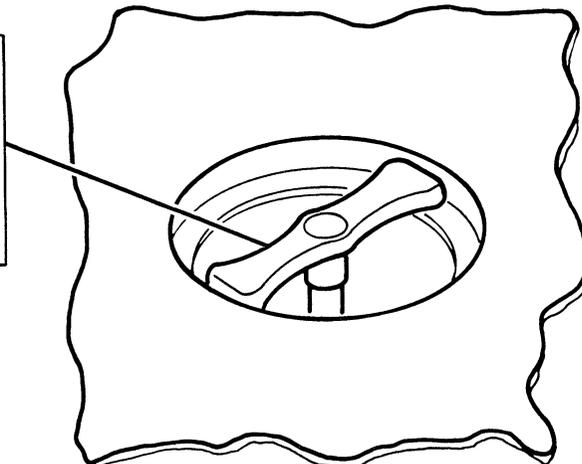


COVER PLATE

### Center Gear Alternate Extension Handle

Pulling handle up will mechanically unlatch center gear and allow it to free fall and lock in down position, providing Alternate Gear Extension Lever has been raised to position landing gear control valve to a bypass position.

Handle is also used to determine that center gear is locked in retracted position



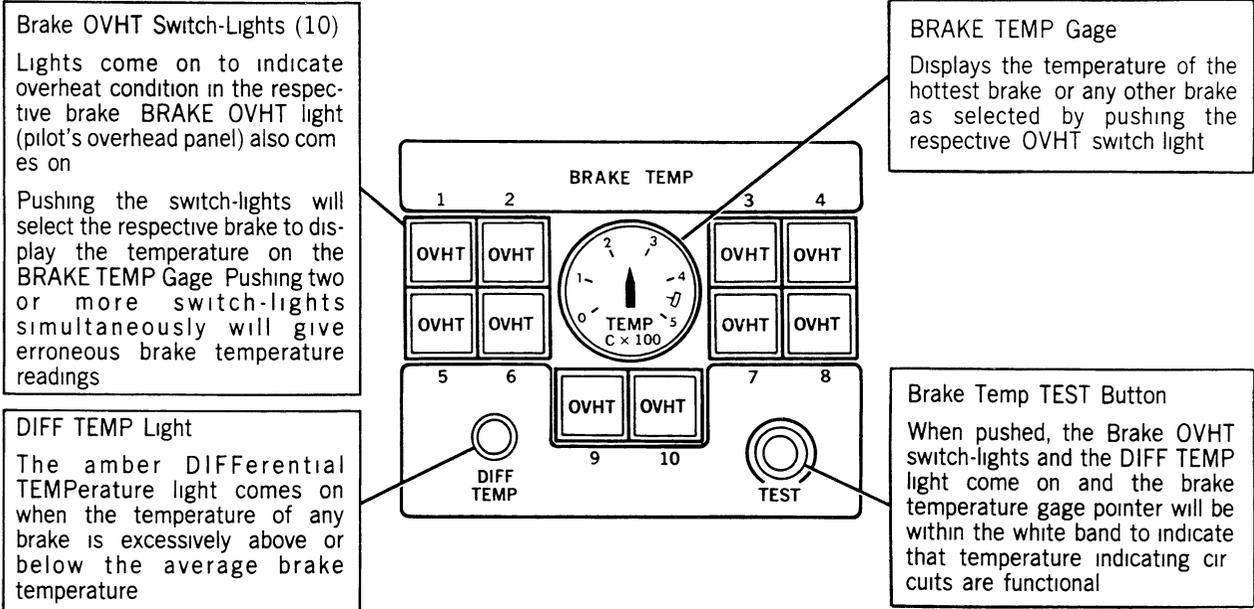
FORWARD OF MAIN CIRCUIT  
BREAKER PANELS ON FLOOR

CA1-4461C

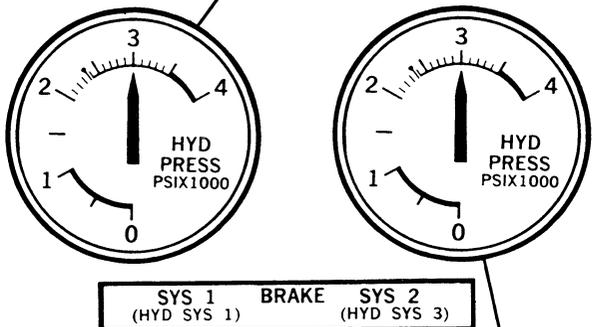
Center gear is installed on the international configuration only. Domestic configuration aircraft have provisions only for center gear.

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## LANDING GEAR - Controls and Indicators



**BRAKE Sys HYD PRESS Gage (1, 2)**  
Provide visual indication of hydraulic pressure in the respective brake system  
SYS 1 — Gage displays hydraulic pressure in brake system 1 The pressure shown at any given time will be the highest of the following  
1 Hydraulic system 1  
2 Brake system 1 accumulator



SYS 2 — Gage displays hydraulic pressure in brake system 2 The pressure shown at any given time will be the highest of the following  
1 Hydraulic system 3  
2 Brake system 2 accumulator

CAPTAIN'S INSTRUMENT PANEL

CA1-7102

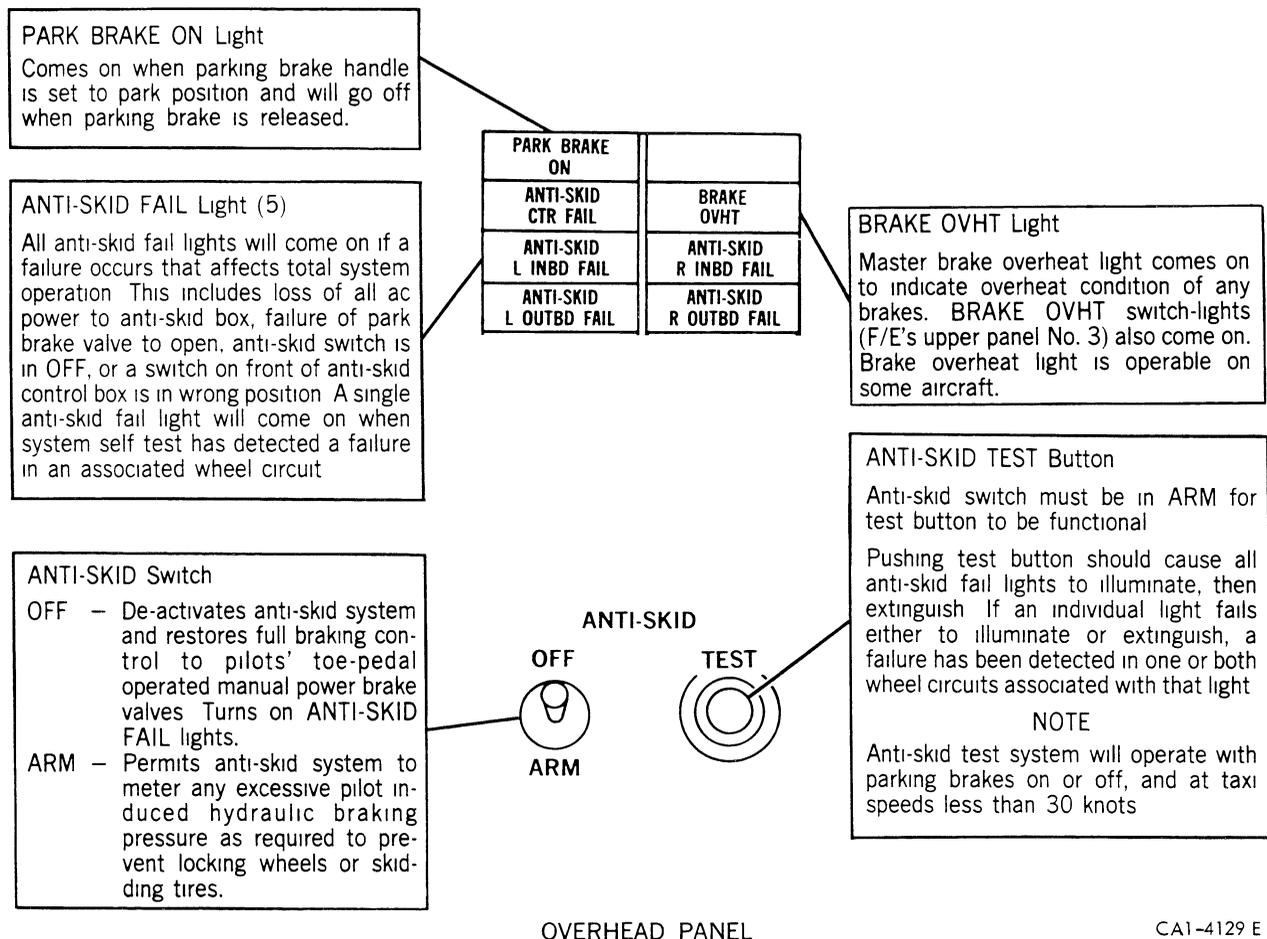
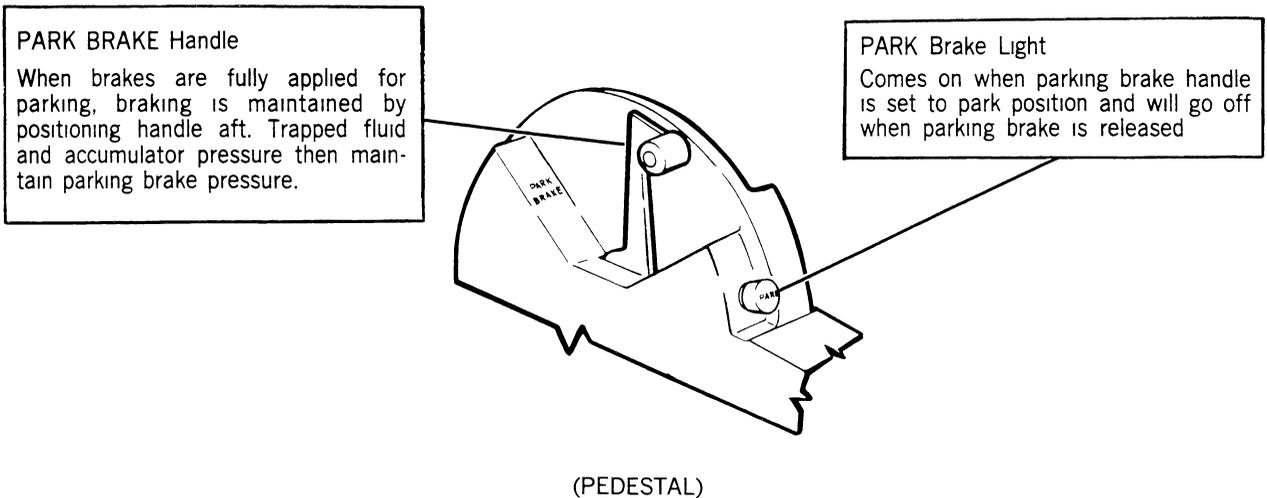
JL  
AUG 1/80

Brake temperature control panel is installed on some aircraft. Center gear is installed on the international configuration only. Domestic configuration aircraft have provisions only for center gear

11-30-03

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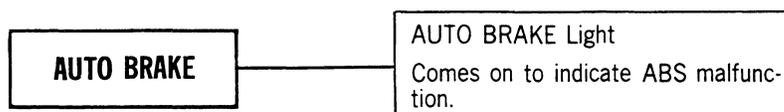
## LANDING GEAR - Controls and Indicators



Center gear is installed on international version only. Domestic version aircraft have provisions only for center gear.

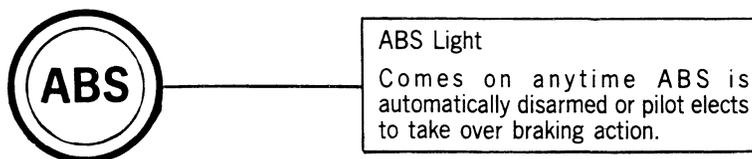
# DC-10 FLIGHT CREW OPERATING MANUAL

## LANDING GEAR - Controls and Indicators



(OVERHEAD PANEL)

NOTE: AUTO BRAKE SYSTEM IN-  
OPERATIVE IN THE DELIVERED  
CONFIGURATION, LIGHTS  
WILL COME ON WHEN  
ANNUNCIATOR TEST IS USED.



GLARESHIELD

CA1-6218 A

Effective for airplanes with lights only installed.

JL  
Nov 1/79

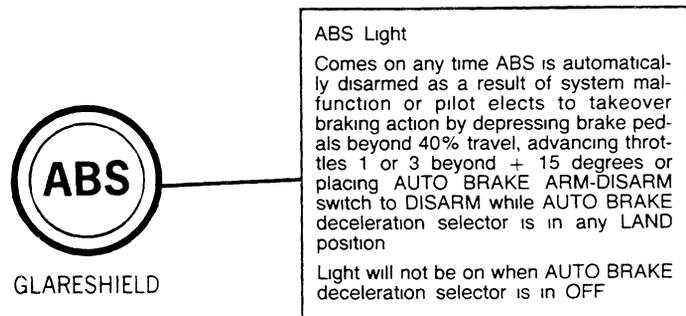
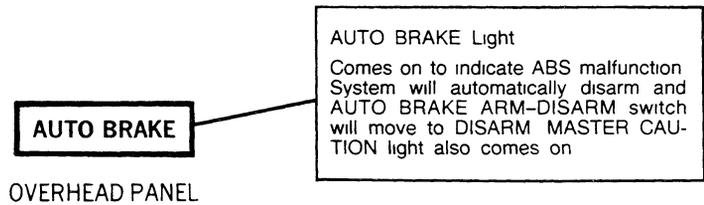
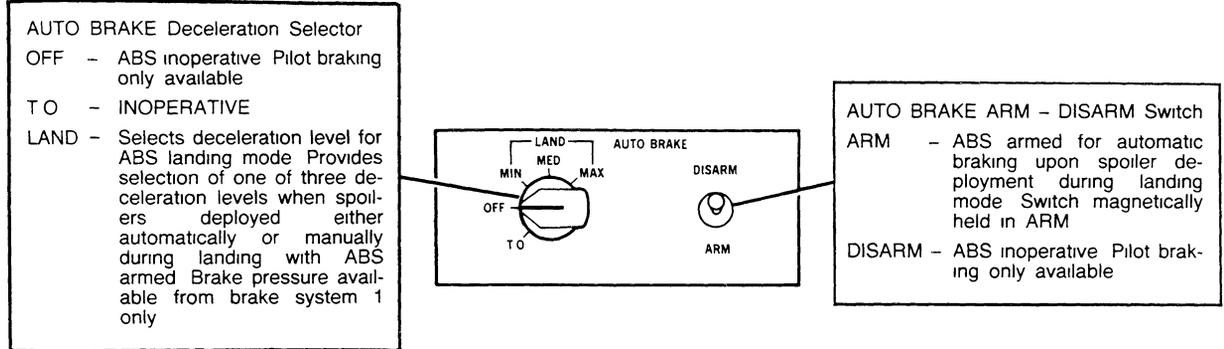
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### LANDING GEAR - Controls and Indicators



CA1-9096

Effective for aircraft with lights and control panel installed

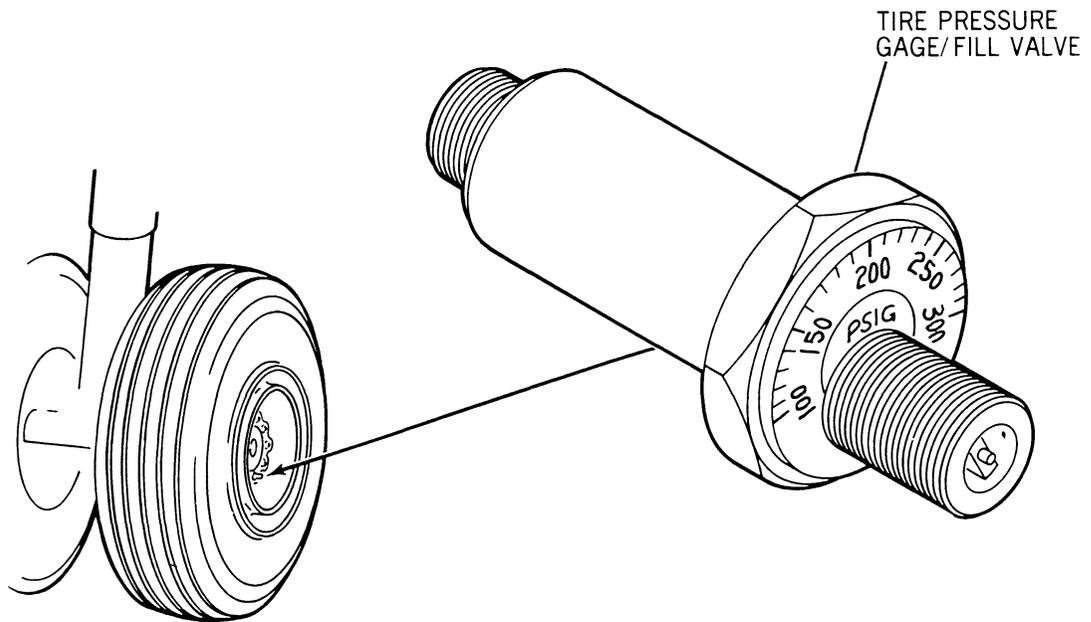
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Feb 1/87

**DC-10**  
**FLIGHT CREW OPERATING MANUAL**

**LANDING GEAR - Controls and Indicators**

**Landing Gear Combination Tire Pressure Gage/Fill Valve**



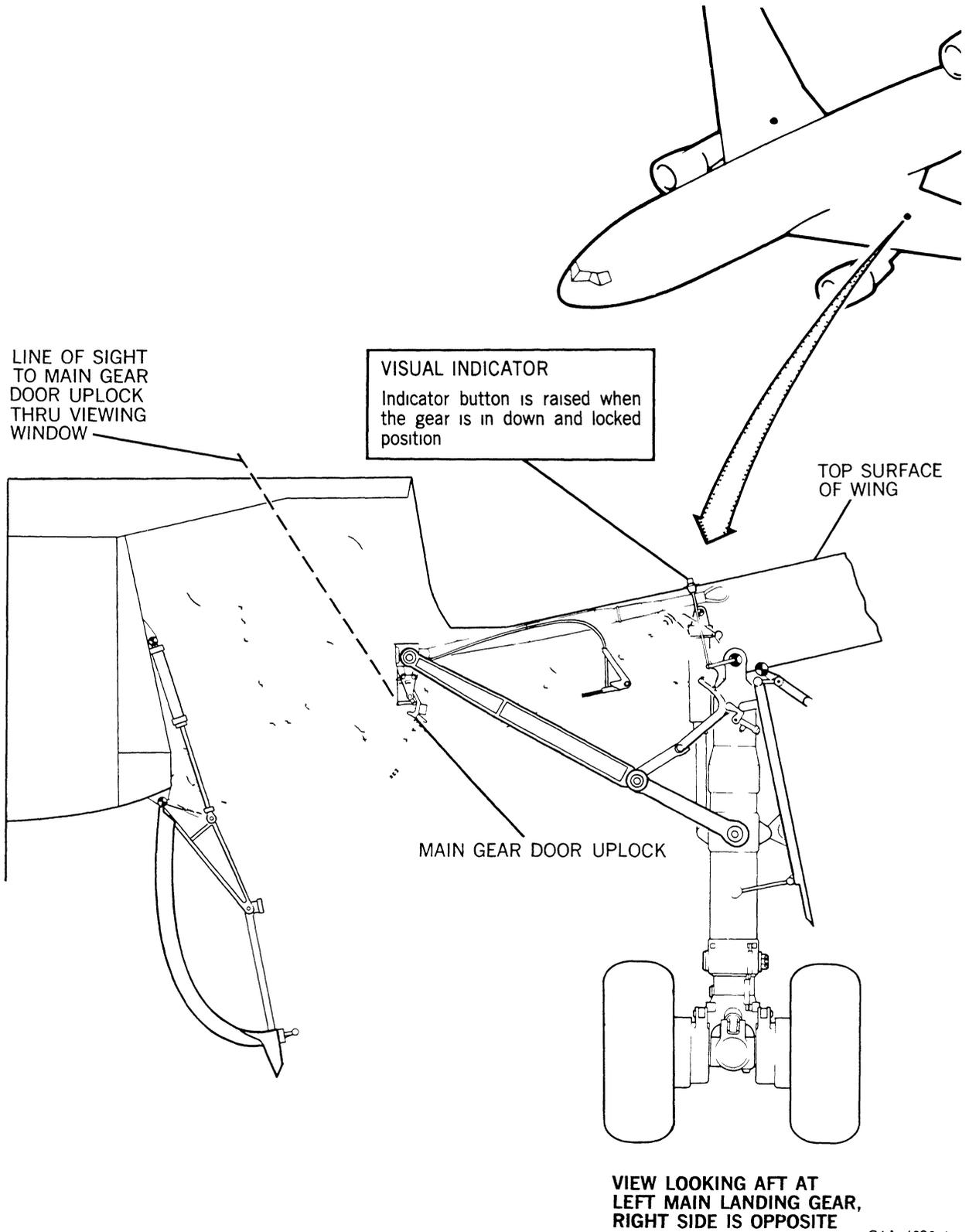
CA1-6219

Effective on some aircraft.

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## LANDING GEAR - Controls and Indicators

### Main Landing Gear Visual Downlock Indicator



CA1-4020 A

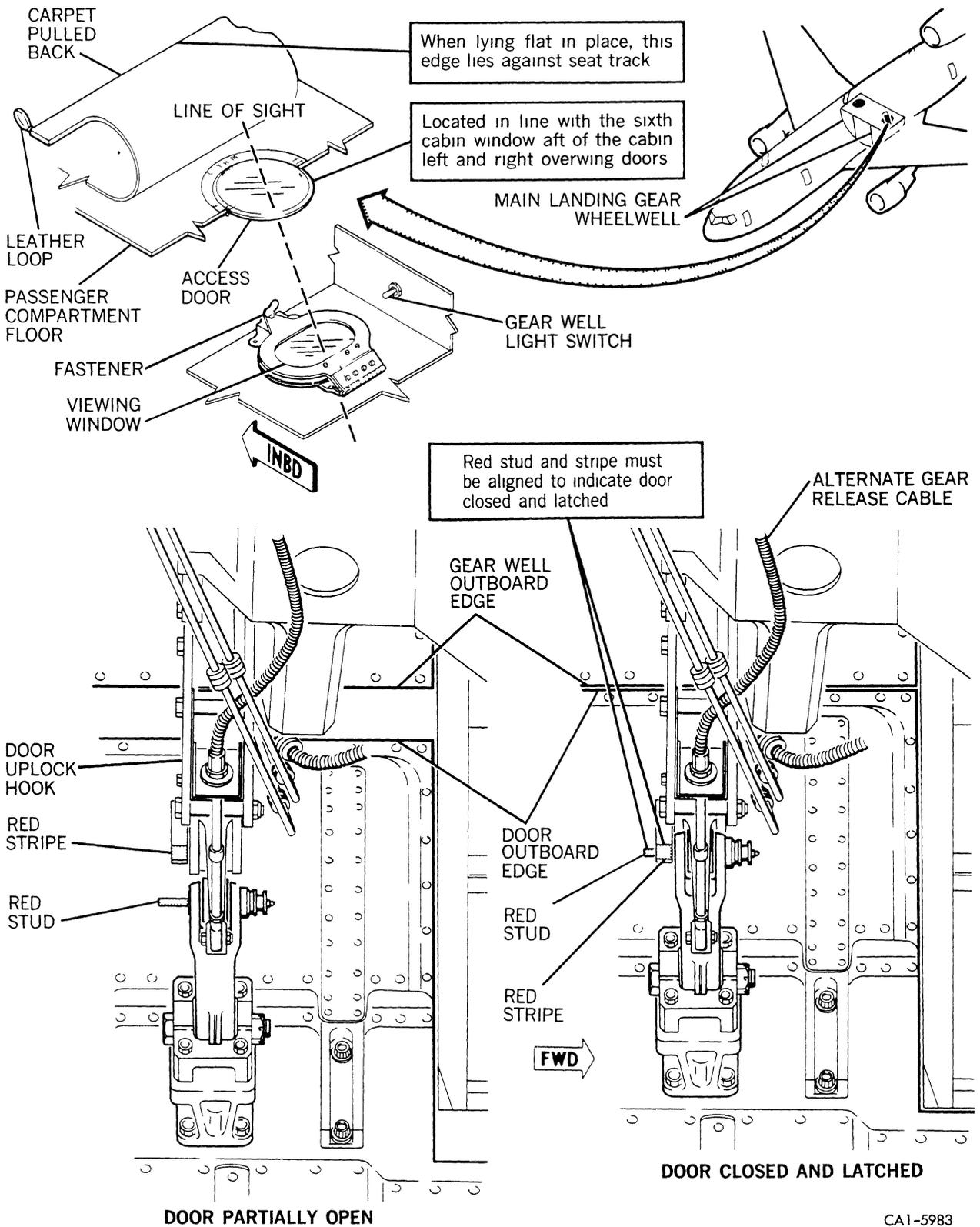
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Aug 1/81

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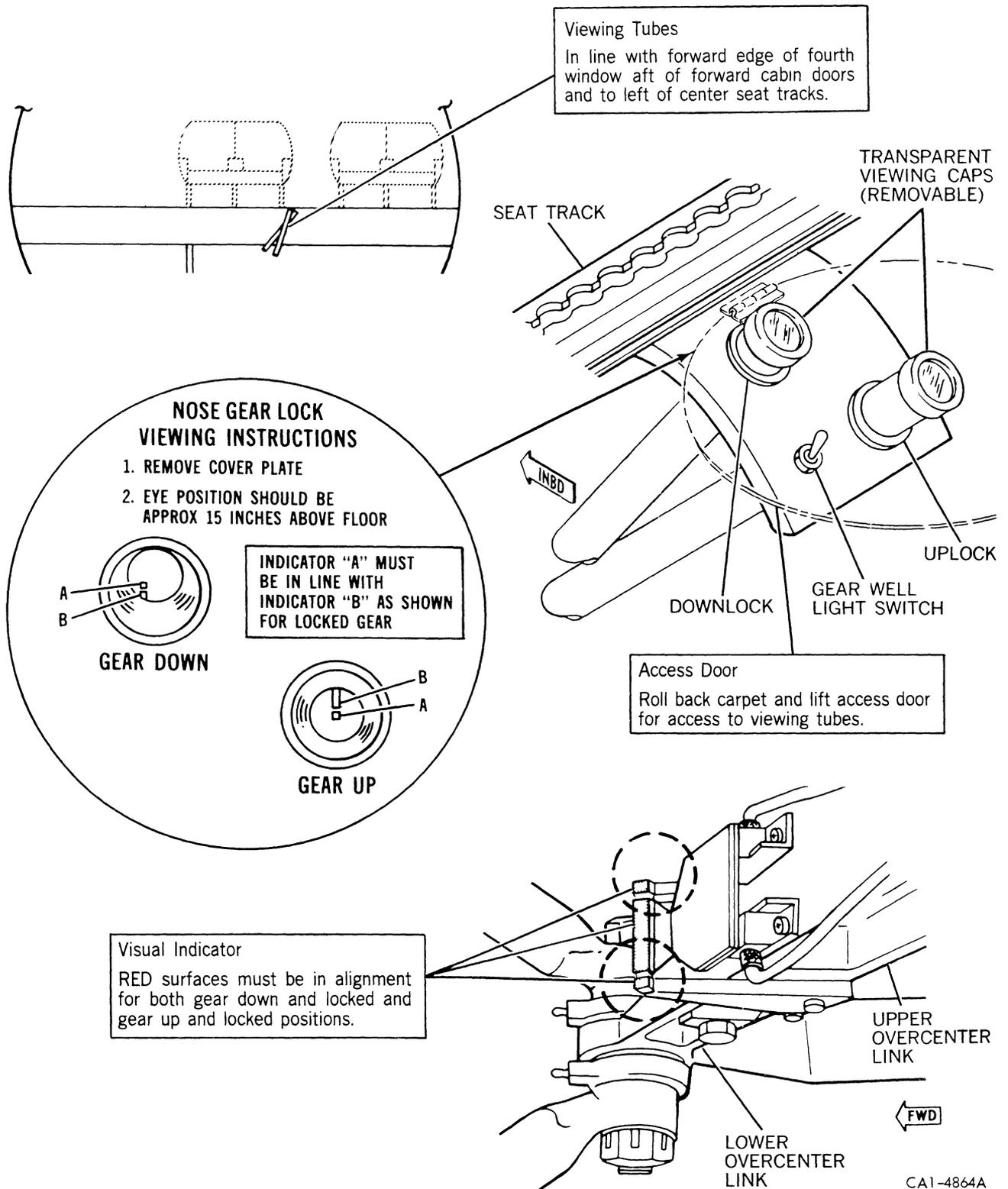
## LANDING GEAR - Controls & Indicators

Left Main Landing Gear Door Uplock Shown, Right Side Is Opposite

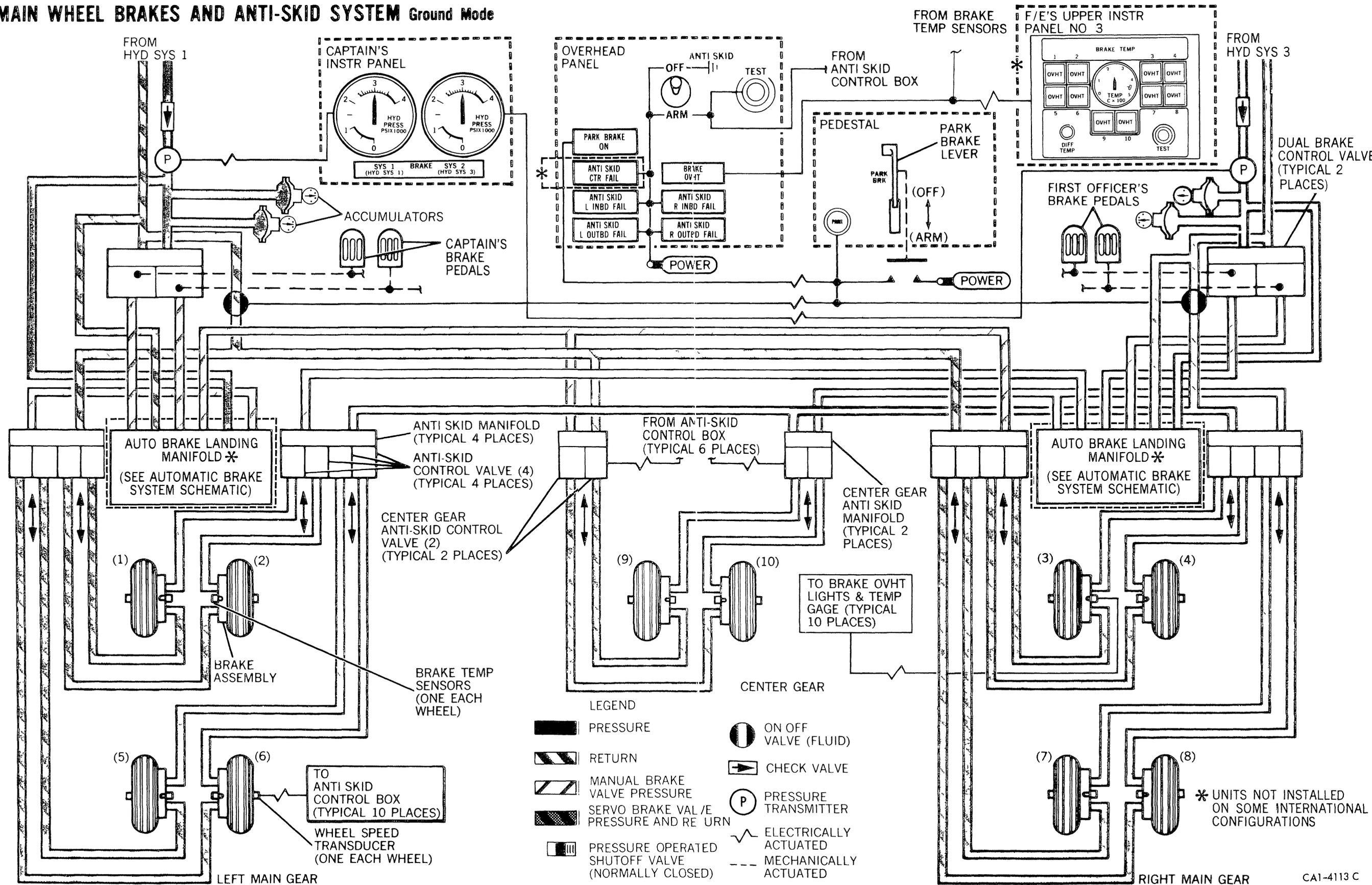


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## LANDING GEAR - Controls and Indicators Nose Gear Visual Uplock and Downlock Indicator

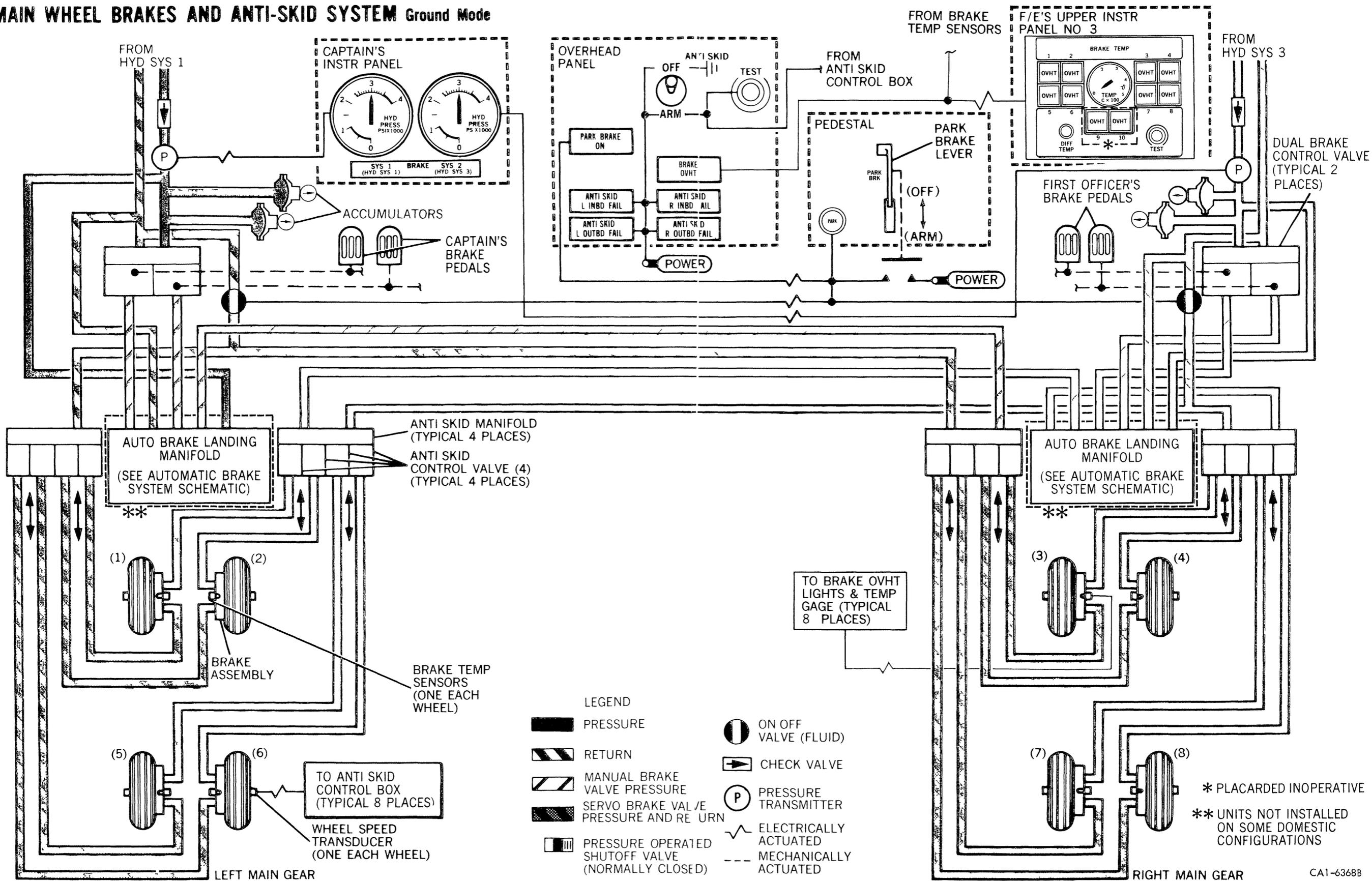


MAIN WHEEL BRAKES AND ANTI-SKID SYSTEM Ground Mode



International Configuration  
Auto Brake Takeoff Manifold installed on aircraft  
with Service Bulletin (32-152) incorporated.

**MAIN WHEEL BRAKES AND ANTI-SKID SYSTEM Ground Mode**

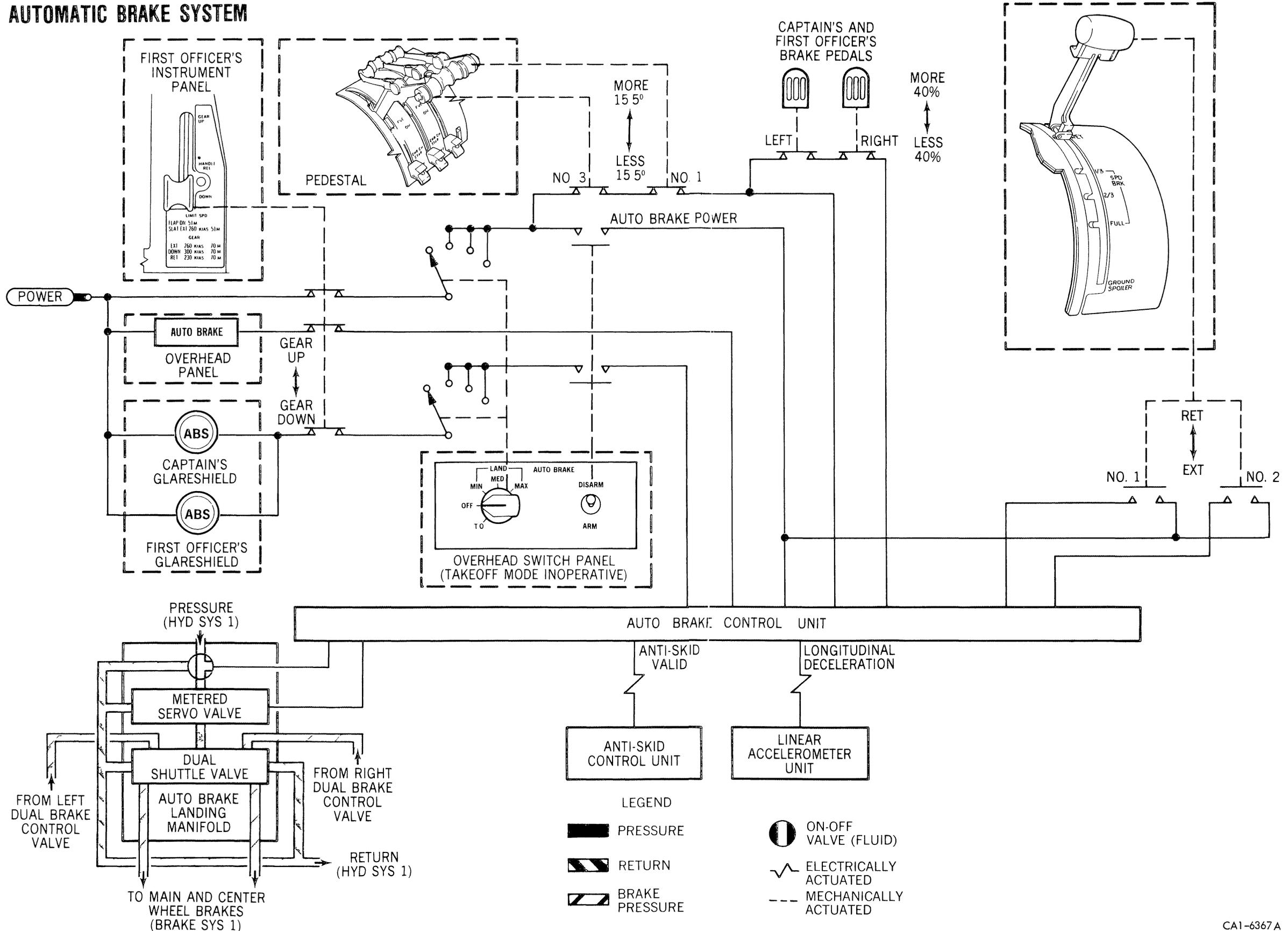


Domestic Configuration  
 Auto Brake Takeoff Manifold installed on aircraft  
 with Service Bulletin (32-152) incorporated.

- LEGEND**
- PRESSURE
  - RETURN
  - MANUAL BRAKE VALVE PRESSURE
  - SERVO BRAKE VALVE PRESSURE AND RETURN
  - PRESSURE OPERATED SHUTOFF VALVE (NORMALLY CLOSED)
  - ON OFF VALVE (FLUID)
  - CHECK VALVE
  - PRESSURE TRANSMITTER
  - ELECTRICALLY ACTUATED
  - MECHANICALLY ACTUATED

\* PLACARDED INOPERATIVE  
 \*\* UNITS NOT INSTALLED ON SOME DOMESTIC CONFIGURATIONS

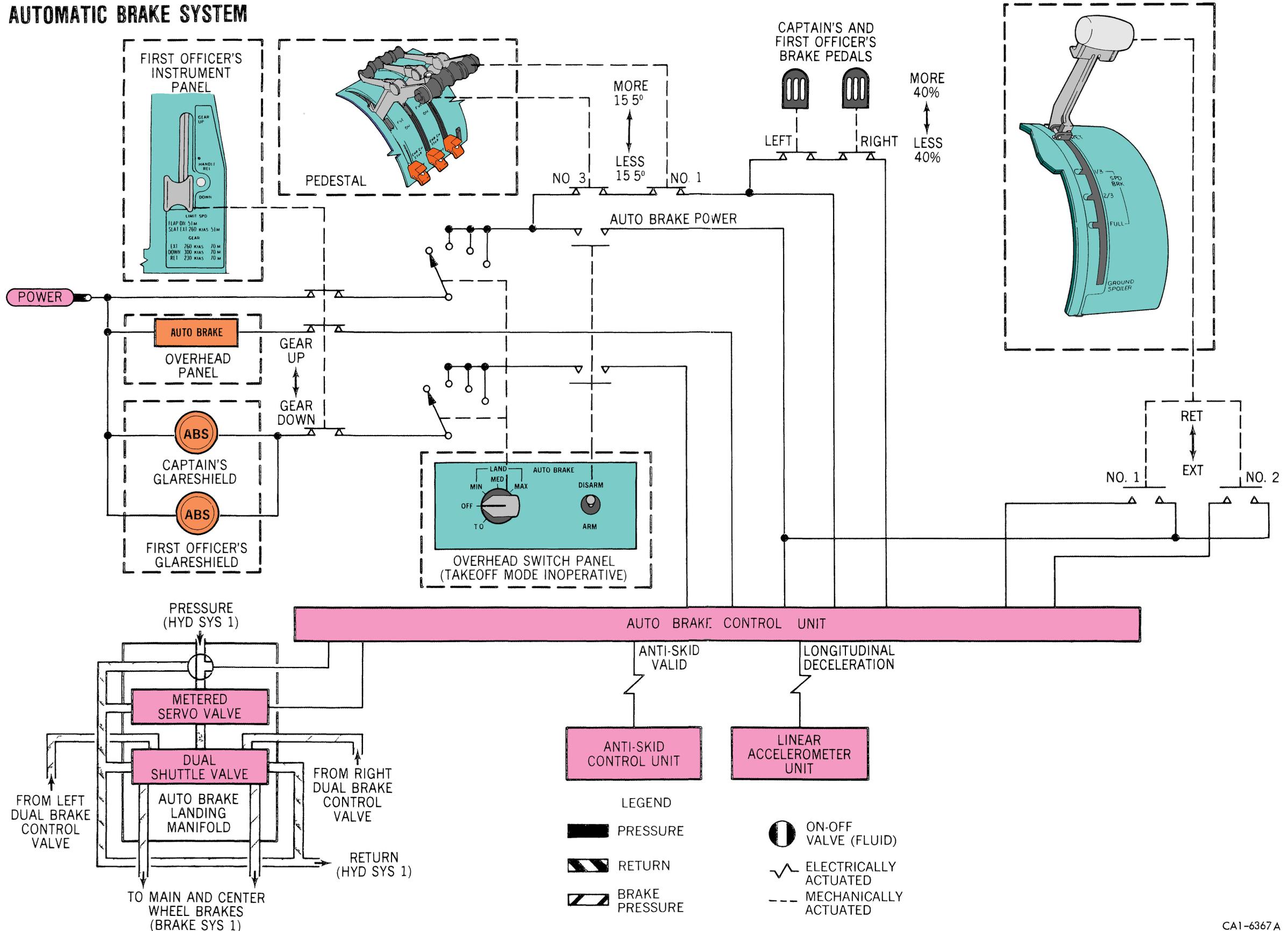
**AUTOMATIC BRAKE SYSTEM**



CA1-6367A

Effective on aircraft with Auto Brake System installed. Center gear is installed on the international configuration only. Domestic configuration aircraft have provisions only for center gear.

**AUTOMATIC BRAKE SYSTEM**



CA1-6367A

Effective on aircraft with Auto Brake System installed. Center gear is installed on the international configuration only. Domestic configuration aircraft have provisions only for center gear.