

<div> <div>AIRBUS TRAINING</div> <div>  <div> A310 SIMULATOR FLIGHT CREW OPERATING MANUAL </div> </div> </div>	LANDING GEAR			1.14.00
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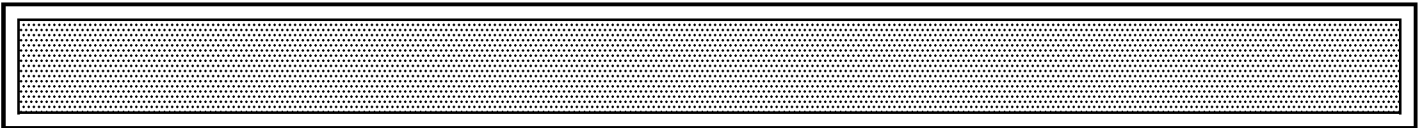
14.10 GENERAL

14.20 LANDING GEAR

14.30 NOSE WHEEL STEERING

14.40 BRAKES – ANTI SKID

R 14.50 MAINTENANCE PANEL



LANDING GEAR

GENERAL

DESCRIPTION

1.14.10

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The landing gear consists of a forward retracting nose gear and two inboard retracting main gears. They are hydraulically operated. Gear doors enclose the landing gear bays. Each main gear assembly has an hydraulic/nitrogen shock absorber, and is equipped with a four wheel, twin bogie. Each main wheel is fitted with wheel brakes with anti skid.

R A pitch damper on each bogie beam damps the movement and ensures return to neutral position, when the landing gear is free of the runway surface. A visual indicating device is fitted to each pitch damper and in case of abnormal low pressure a red pin is in view.

The two-wheel nose gear assembly includes an hydraulic/nitrogen shock strut and a nose wheel steering system.

All gear doors open during landing gear transit. The hydraulically operated doors close each time the landing gear is fully retracted or extended. The doors, which are fitted to the landing gear struts are mechanically operated by the gear and close at the end of gear retraction.

Landing gear controls and indicators are located in the cockpit on the center instrument panel and the overhead panel.

For gravity extension in case of hydraulic or electrical power supply failure, a hand crank is stowed in the RH side console and a protected fitting is provided in the cockpit floor.

Mechanical means for visual confirmation of landing gear down and locked are installed in each wing and on the nose gear strut.

A tail skid is provided to prevent or limit structural damage to the aft aircraft structure in case of takeoff or landing with excessive nose-up attitude.

NORMAL EXTENSION AND RETRACTION

System description :

Landing gear normal extension and retraction are controlled through a 3 – latched – position lever located on the center instrument panel.
Power is supplied by Green hydraulic system.

The gear electrovalve is controlled by the landing gear lever. It distributes green pressure, to retraction or extension line.

The door sequence valves are controlled by the gear uplock mechanisms and allow door opening or closing.

The gear sequence valves are controlled by the door open position and allow gear extension or retraction.

Sequence principle :

Gear retraction (or extension) :

- The landing gear lever is selected UP (or DOWN).
- The gear electrovalve supplies retraction (or extension) line with green pressure.
- The doors are unlocked.
- The door sequence valves allow door opening by actuators.
- When the doors are fully open, their actuators remain pressurized open and the gear sequence valves open, which results in :
 - gear unlocking,
 - gear retraction (or extension) by actuators.
- When fully retracted (or extended), the gears are locked and actuators no more pressurized.
- The door sequence valves allow door closing by actuators.
- When fully closed, the doors are locked and their actuators remain pressurized closed.
- The landing gear lever is selected Neutral.
- The gear electrovalve connects extension and retraction lines to reservoir return.

LANDING GEAR GRAVITY FALL EXTENSION

In the event of normal extension system failure the landing gear can be extended mechanically from the flight compartment by means of a crank handle.

Rotation of the handle controls the following sequence of events :

- Shut off of high pressure supply and connection to reservoir return upstream of the sequence valves
- Connection of actuating cylinder retraction chambers to reservoir return
- Door uplock release
- Gear uplock release

The landing gear extends under gravity action. Downlocking is assisted by locking springs for the main gear and aerodynamic forces for the nose gear. The gear doors remain open.

A procedure is provided for restoring the landing gear to normal operating condition to enable gear retraction after a gravity extension during training flights.

LANDING GEAR DOOR GROUND OPENING

For maintenance reasons, each gear door can be opened separately by means of a lever located near the door.

Operating of the lever isolates the door closing line, interconnects the actuating cylinder chambers and releases the door uplock, the door free falls to open position.

When the lever is returned to CLOSED position, door closure is achieved under Green hydraulic pressure with the landing gear normal control lever in DOWN position.

Vers. : All

Eng. : All

LANDING GEAR

LANDING GEAR

SCHEMATICS

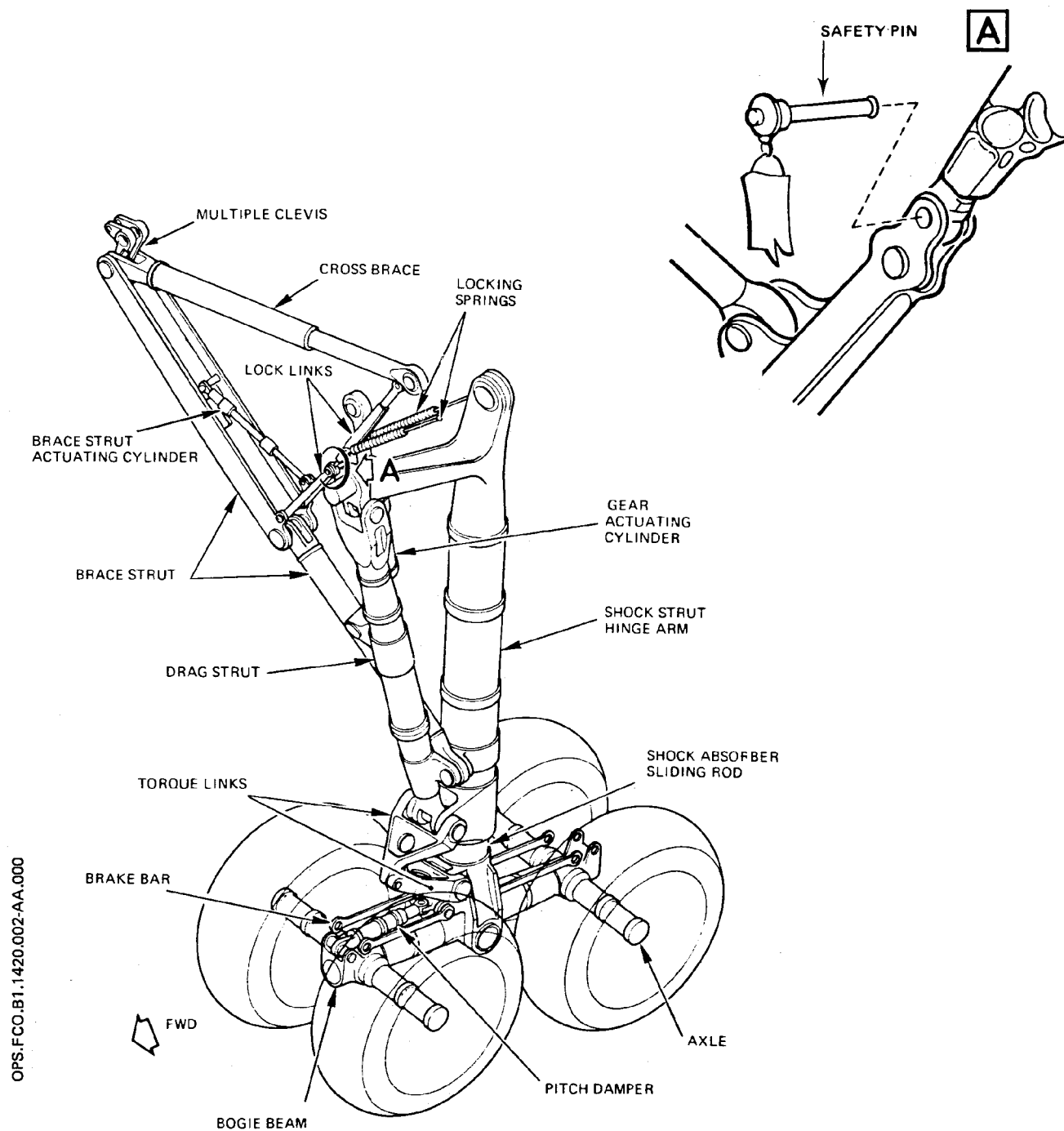
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MAIN LANDING GEAR

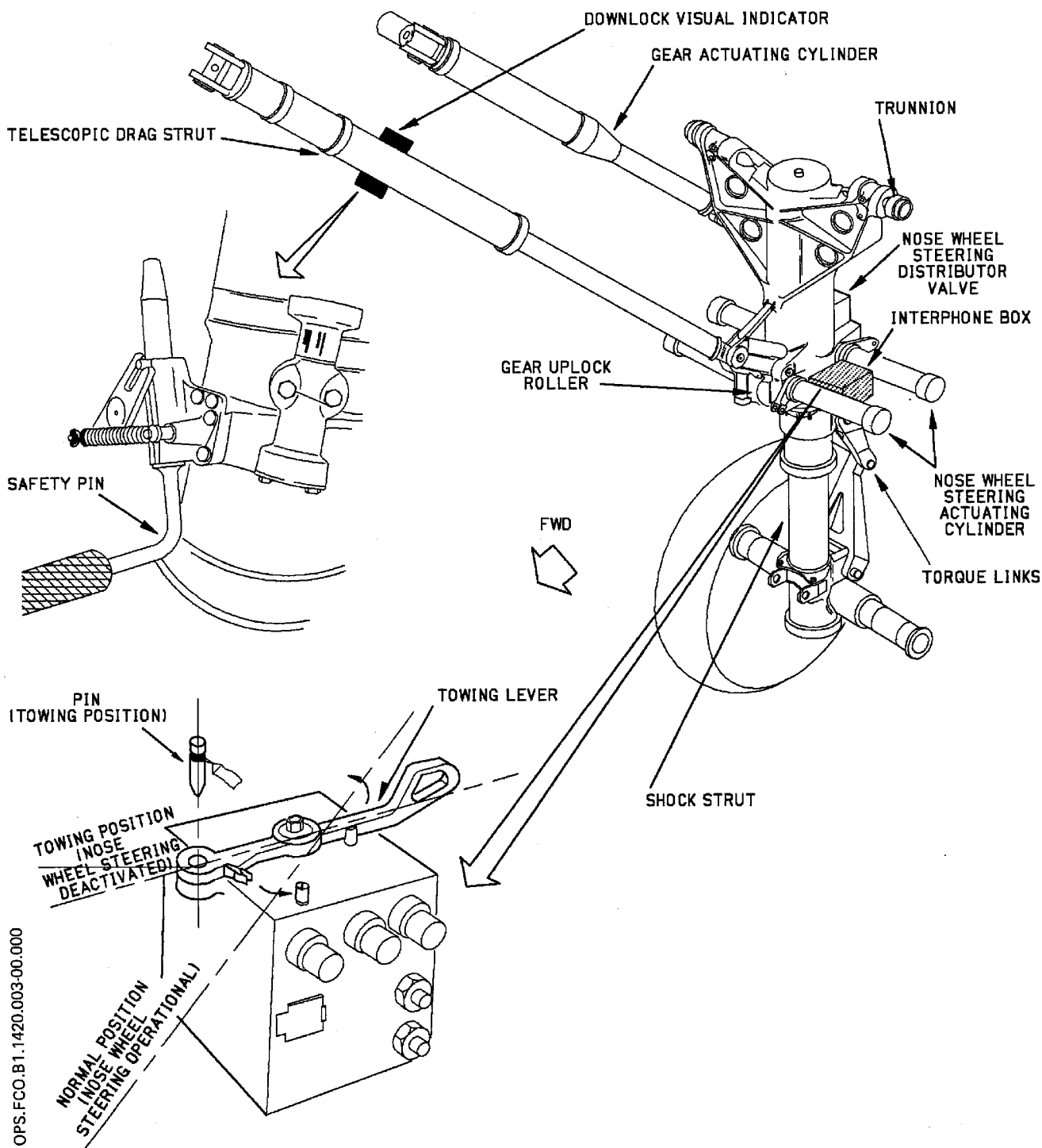


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Vers. : All

Eng. : All

NOSE LANDING GEAR

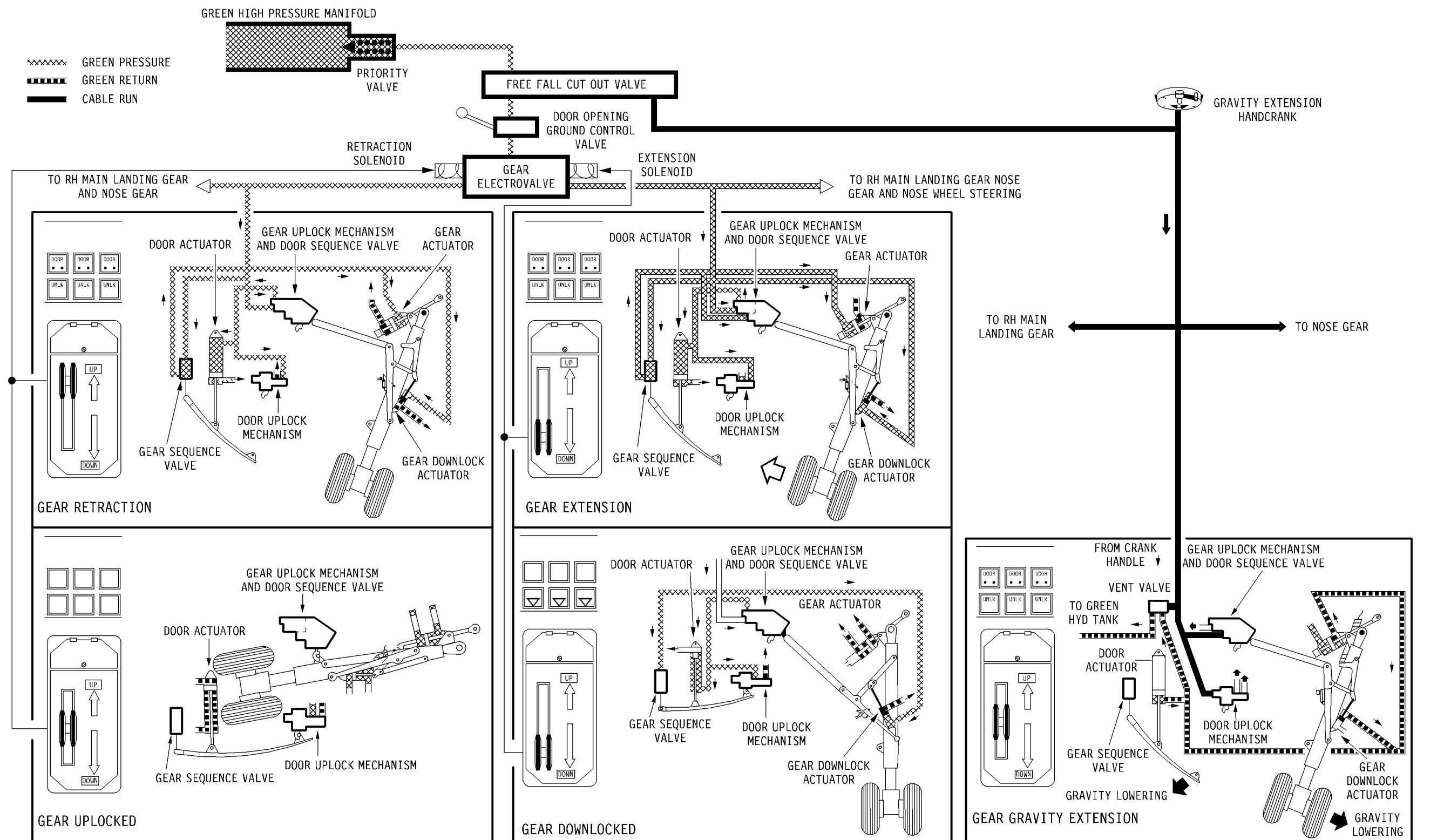


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Vers. : All

Eng. : All

LANDING GEAR OPERATION SYSTEM



LANDING GEAR

LANDING GEAR

SCHEMATICS

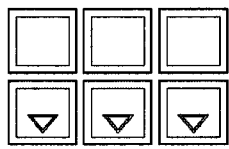
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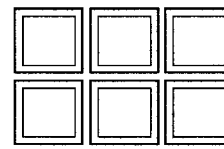
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LANDING GEAR OPERATION SEQUENCES



ON THE GROUND

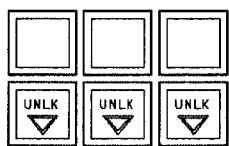
CONTROL LEVER AT DOWN
GEAR DOWN AND LOCKED
DOORS CLOSED AND LOCKED



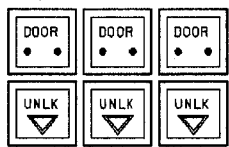
IN FLIGHT

CONTROL LEVER AT NEUTRAL
GEAR UP AND LOCKED
DOORS CLOSED AND LOCKED

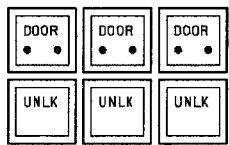
RETRACTION



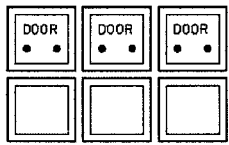
CONTROL LEVER AT UP



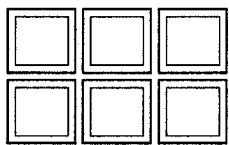
DOORS UNLOCKED



DOORS OPEN
GEAR UNLOCKED



DOORS OPEN
GEAR UP AND LOCKED

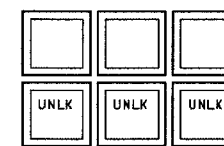


DOORS CLOSED AND LOCKED

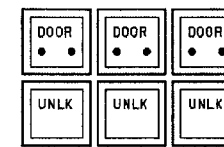
DURATION OF RETRACTION SEQUENCE
APPROX 13Sec

DURATION OF EXTENSION SEQUENCE
APPROX 15Sec

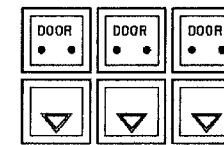
EXTENSION



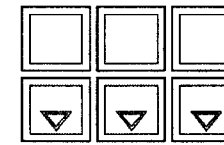
CONTROL LEVER AT DOWN



DOORS UNLOCKED AND
WHEN OPEN GEAR UNLOCKS

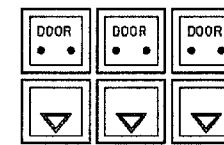


DOORS OPEN
GEAR DOWN AND LOCKED



DOORS CLOSED AND LOCKED

OR

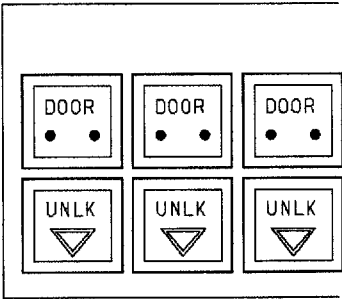


DOORS REMAIN OPEN AFTER
GEAR GRAVITY EXTENSION

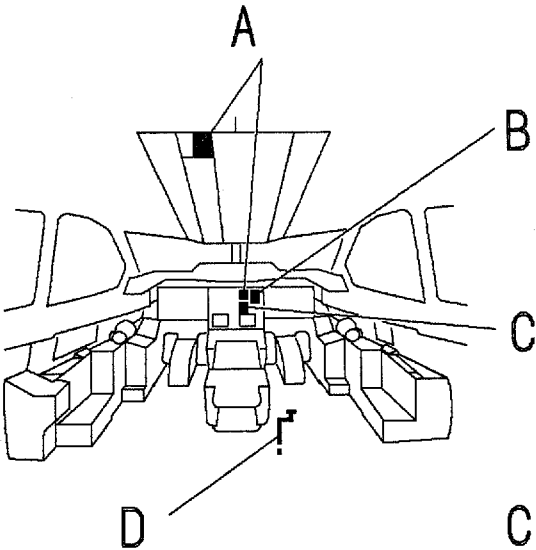
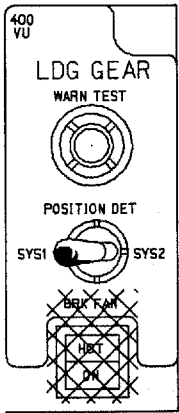
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LOCATION OF CONTROLS

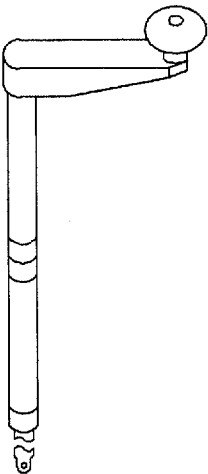
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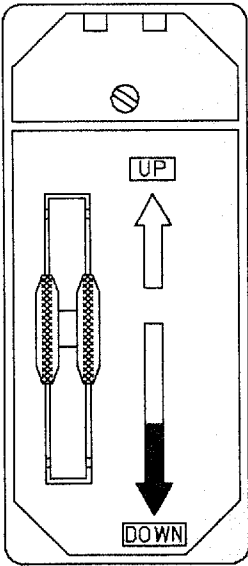
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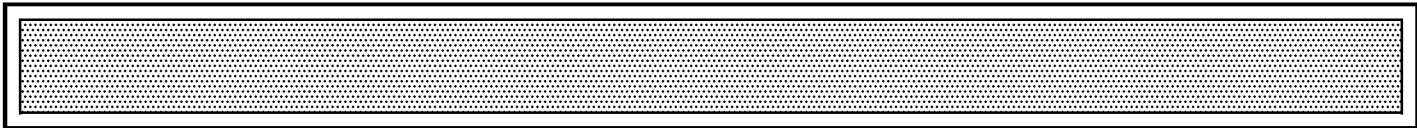
D



C



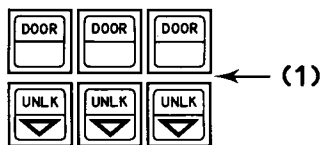
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A. LANDING GEAR INDICATING UNITS

Two independent gear/door position indicators are provided.

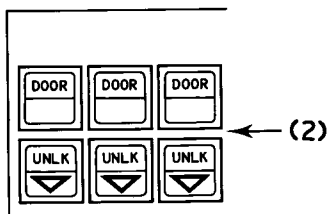
FB1.1420.007-AA.000.6A



(1) Overhead panel indicator,

energized by NORM ELEC PWR, connected to SYS 2 microswitches and proximity detectors.

FB1.1420.007-AA.000.6B



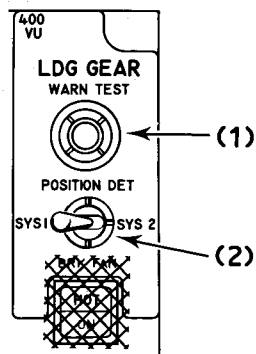
(2) Center instrument panel indicator,

energized by EMER ELEC PWR, connected to SYS 1 microswitches and proximity detectors.

- . DOOR amber light = door not unlocked
- . UNLK red light = gear not locked in selected position (or gear not unlocked with control lever in Neutral position).
- . ▽ Green light = gear down locked

B. LDG GEAR PANEL

FB1.1420.007-AA.000.6C



(1) WARN TEST Pushbutton switch :

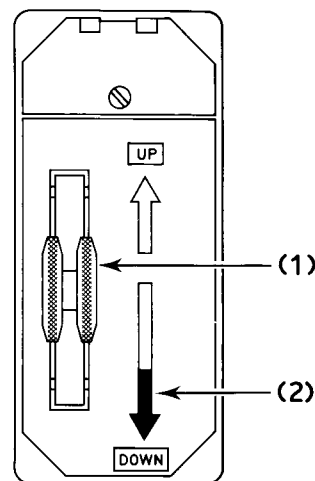
Controls the test of the gear not down and locked warning. When depressed the DOWN arrow illuminates associated with ECAM activation.

(2) POSITION DET SYS switch :

The active detection system for gear not locked down warning and for interlock safety system is determined by selector positioning.

C. LANDING GEAR LEVER PANEL

FB1.1420.007-AA.000.6D



(1) Landing gear control lever

The lever must be pulled prior to selecting one of the three possible positions. The lever controls Green hydraulic supply for normal operation.

UP : The landing gear is retracted.

- An interlock mechanism prevents unsafe retraction by locking the lever when gear position proximity detectors of selected SYS (1 or 2) are not in flight configuration :
 - . 3 shock absorbers extended
 - . nose wheel centered
 - . 2 bogie beams aligned.
- During door opening only, anti skid is deactivated and main gear wheels are braked automatically.
- At end of nose gear retraction travel, nose wheels are mechanically braked.

Neutral – Normal flight position. Hydraulic pressure to landing gear circuit is cut off.

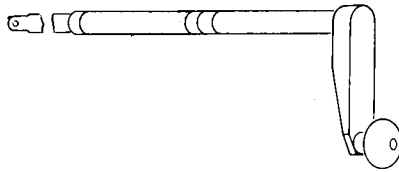
DOWN – The landing gear is extended and the system remains pressurized.

(2) Red arrow

Illuminated red if the landing gear is not down and locked while the aircraft is in approach or landing configuration. Illumination of red arrow is associated with ECAM activation.

D. GRAVITY EXTENSION HANDCRANK

FB1.1420.008-AA.000.6A



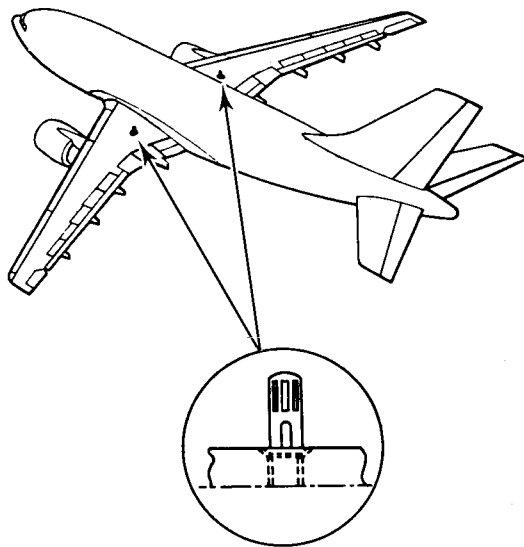
Stowed in the RH side console. For GRAVITY extension the handle must be inserted in a protected flight compartment floor fitting aft of the center pedestal on RH side, then rotated clockwise.

Green hydraulic pressure is first isolated. Then, all chambers are connected to the Green reservoir. At 17.5 turns, doors unlock. At 19.5 turns gears unlock, free fall and downlock assisted by aerodynamic forces (nose L/G) and spring assistance (main L/G). Doors will remain opened until flight or ground reconditioning.

E. VISUAL DOWN LOCK INDICATORS

MAIN GEAR Indicator

A red pin appears on each wing upper skin (above the gear bay) when the associated main gear is downlocked. It is visible from the cabin.

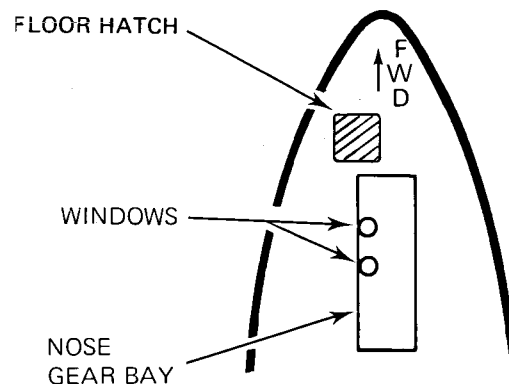


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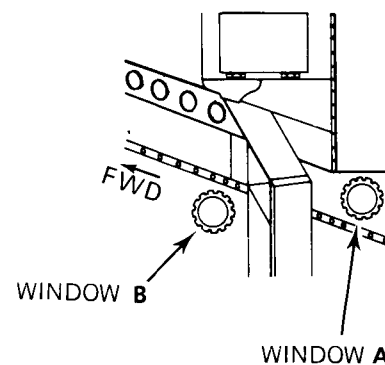
NOSE GEAR Indicator :

Two windows located in the avionics compartment on nose gear bay LH side :

- **WINDOW A** : for viewing a green mechanical indicator located on the telescopic drag strut.
- **WINDOW B** : for lighting the mechanical indicator by means of a flash light.



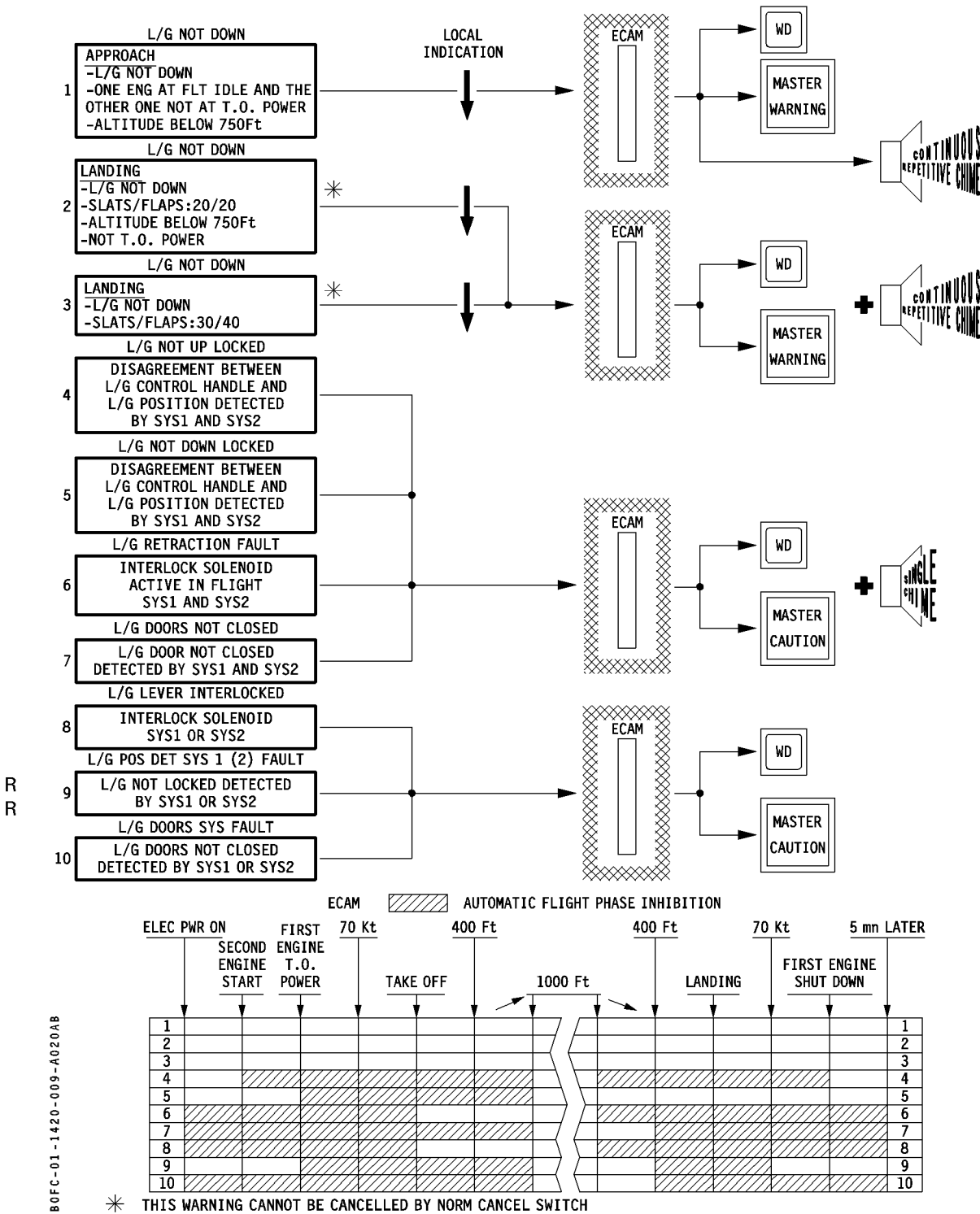
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Vers. : All

Eng. : All

WARNING LOGIC



Mod. : 5051

LANDING GEAR

NOSE WHEEL STEERING

DESCRIPTION

1.14.30

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Nose wheel steering is possible by means of a servo mechanism mechanically controlled from the flight compartment and powered by Green hydraulic pressure tapped from the landing gear extension system via a selector valve. The selector valve shuts off pressure to the steering system when the shock absorbers are extended, during ground towing or when the engines are shut down.

A towing lever on the interphone box enables the steering system to be deactivated for towing purposes. Nose wheel deflection of $\pm 95^\circ$ is possible in this configuration.

Independent control is achieved using either of the steering control handwheels located on each side of the flight compartment. Maximum nose wheel steering angle is then $\pm 65^\circ$.

A non reversible connection with the rudder pedals is achieved by means of a hydro mechanic coupler and enables nose wheel steering limited to $\pm 6^\circ$ during high speed ground roll.

An internal cam mechanism returns the wheels to centered position after take off.

In the absence of Green hydraulic pressure the aircraft can be guided using the Alternate differential braking system.

LANDING GEAR

NOSE WHEEL STEERING

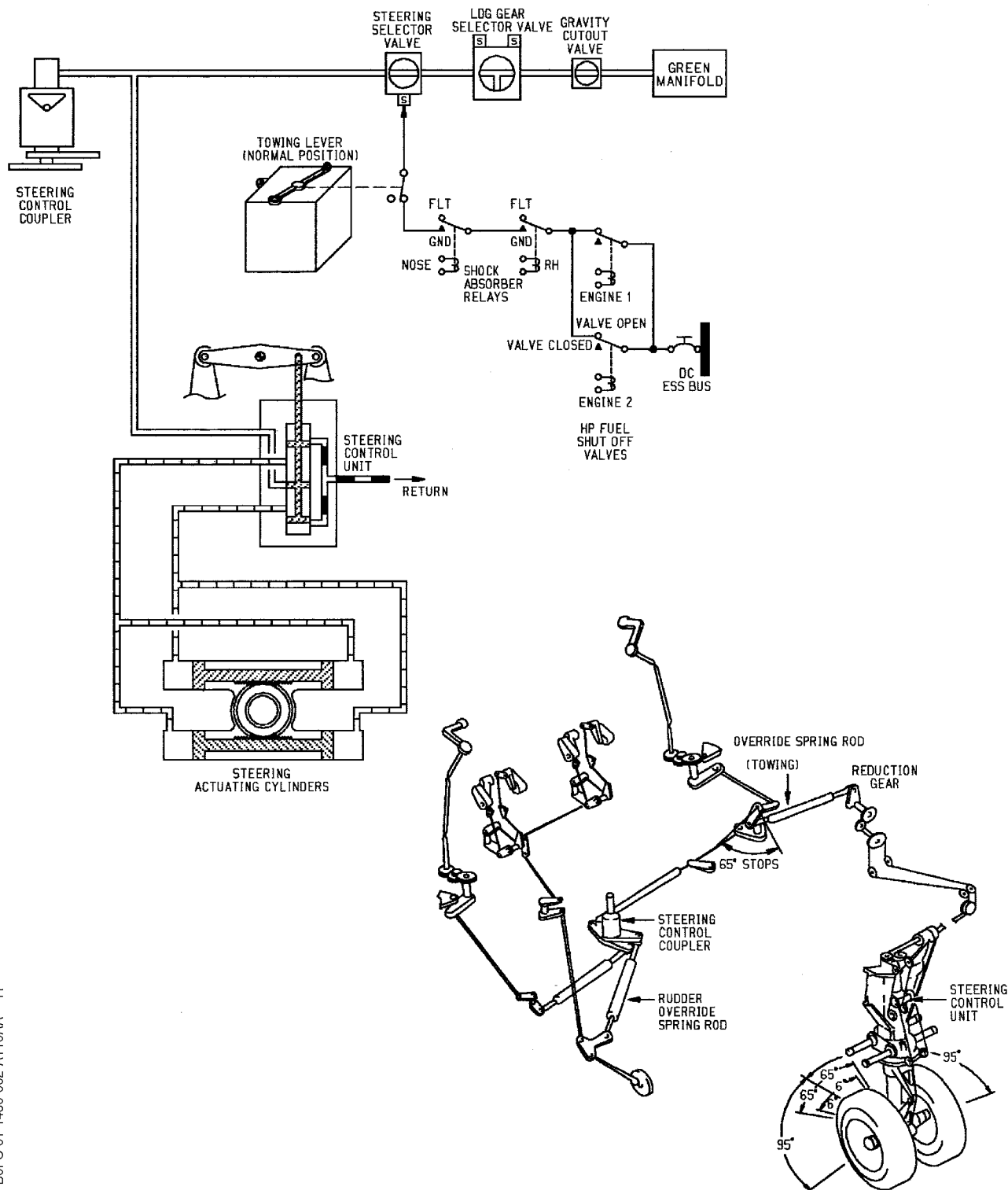
SCHEMATICS

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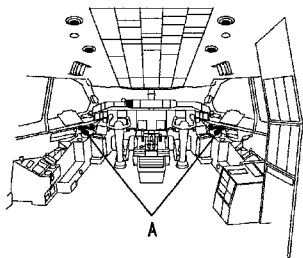
SEQ 110



B0FC-01-1430-002-A110AA - R

Mod. : 5910

A. STEERING HANDWHEELS



(1) Steering Handwheels

The steering handwheels are interconnected and control the nose wheel steering angle up to 65° in either direction. When nose wheel steering is operated by rudder pedals (up to 6° either direction) the steering handwheels rotate accordingly.

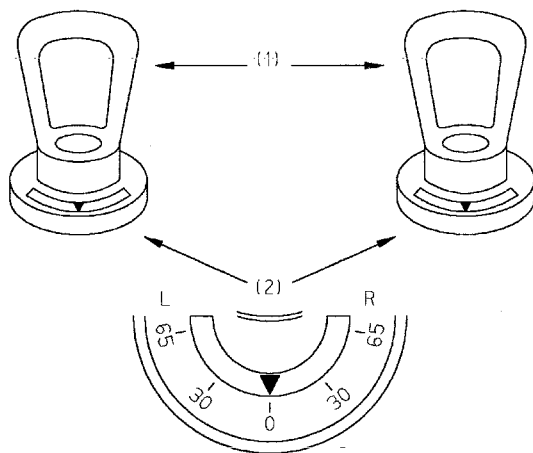
- Clockwise : Steering to the right
- Counter clockwise : Steering to the left

(2) Steering Index

The index at each steering wheel indicates the steering angle in °, up to 65° to either side – (LH or RH).

Note : Nose wheel steering is self centering after lift-off.

OPS.F.CO.B1.1430.003-AA.020



Mod. : 4803

WHEELS AND BRAKES

The eight main gear wheels are equipped with multidisc brakes each operated by two independently supplied sets of pistons ; one set supplied by the green hydraulic system, the other by the Yellow hydraulic system assisted by two brake accumulators.

Each brake is equipped with an automatic adjuster, wear indicator and temperature sensor.

The wheels are fitted with tubeless tires.

The nose gear wheels are braked by brake bands at the end of the gear retraction cycle.

The main gear wheels are fitted with fusible plugs which protect against tire and wheel burst in the event of overheating.

Fans to speed up brake cooling are available.

ANTI SKID SYSTEM

The anti skid system is based on the comparison of the rotational speed of the nose and main gear wheels. It provides maximum braking efficiency, by maintaining the wheels at the limit of an impending skid, thus preventing the wheels from locking and protecting the tires. Brake release orders are sent to the eight Normal, and to the four Alternate servovalves as well as to the ECAM system which provides CRT display of the released brakes.

The three position NORM/ON, ALTN/ON, ALTN/OFF switch on the center instrument panel serves to switch from the Green system to the Yellow system in the event of partial failure of the anti skid system or to test the Yellow system (ALTN/ON) and if necessary to deactivate the anti skid system (ALTN/OFF).

BRAKING MODES

Four braking modes are available depending on the hydraulic supply systems and the position of the BRK/A/SKID switch and the PARKING BRAKE control handle.

(1) Normal braking

Control is electrical and achieved either :

- via the pedals on the ground
- or automatically :
 - . On the ground by the auto brake system.
 - . In flight, at the beginning of the gear retraction cycle.

Normal brake pressure is not indicated. A BRK FAIL, light alerts the flight crew in the event of failures.

(2) Alternate braking with anti skid

Automatic switching between the Green and Yellow systems is achieved by a reversible hydraulic selector.

Control is achieved solely via the pedals. The orders are transmitted by an auxiliary low pressure hydraulic system. The pressure delivered to the LH and RH brakes is indicated on a Yellow pressure triple indicator located on the center instrument panel. The anti skid system and associated indicating are operative.

(3) Alternate braking without anti skid


The anti skid regulation is deactivated :

- electrically (BRK/A/SKID switch in ALTN/OFF position or power supply failure)
- or hydraulically if the brakes are supplied by the brake accumulators only, or when the parking brake handle is pulled. Hydraulic deactivation is achieved by closing the yellow return line. Switching between the yellow high pressure system and the accumulators is automatic and reversible.

The accumulators, the pressure of which is read on the brake Yellow pressure triple indicator, can be recharged by pressing the ACCU PRESS pushbutton switch controlling the Yellow electric pump. The accumulators are dimensioned to supply at least seven full brake applications.

(4) Parking braking

Operating the PARKING BRAKE control handle deactivates the other braking modes and the antiskid system and supplies the brakes with yellow high pressure or accumulator pressure limited at 2100 psi. The return lines are shut off to ensure an autonomy of at least 12 hours. The TO CONFIG warning alerts the flight crew if the PARKING BRAKE control handle is in the on (applied) position and one engine at take off power setting.

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	BRAKES – ANTI SKID		PAGE 2
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AUTO BRAKE

This system serves to reduce the delay in braking in the event of an acceleration – stop (MAX mode) or limit the deceleration upon landing to a preselected value.

System arming :

The flight crew arms the system by pressing the LO, MED or MAX pushbutton switch, provided all following arming conditions are met :

- R
- Landing gear lever selected DOWN or NEUTRAL.
 - BRK/A/SKID selector at NORM/ON
 - BRK FAIL light off.
 - Green pressure available.
 - No failure on AUTO BRK system.
- R
- Pressure transducers and master valves normally operating.
- R
- Note : If parking brake is ON, the system could be armed regardless of BRK/A/SKID selector ; but it will be automatically disarmed, at parking brake OFF selection, if BRK/A/SKID selector is not at NORM/ON position.*
- R
- R
- R
- R

System activation :

Braking is initiated by the ground spoiler extension command. Consequently, in the event of an acceleration-stop, if the deceleration is initiated with the speed below 85 Kts, the automatic braking will not be operative because the ground spoilers will not be extended.

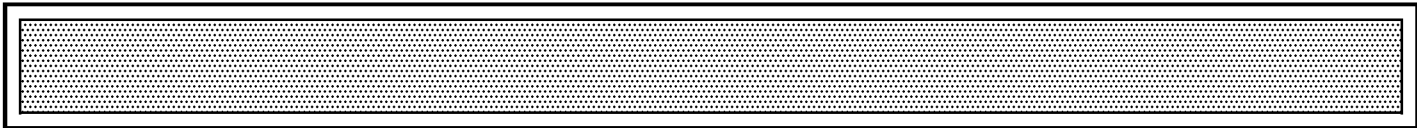
System disarming :

The system is disarmed by :

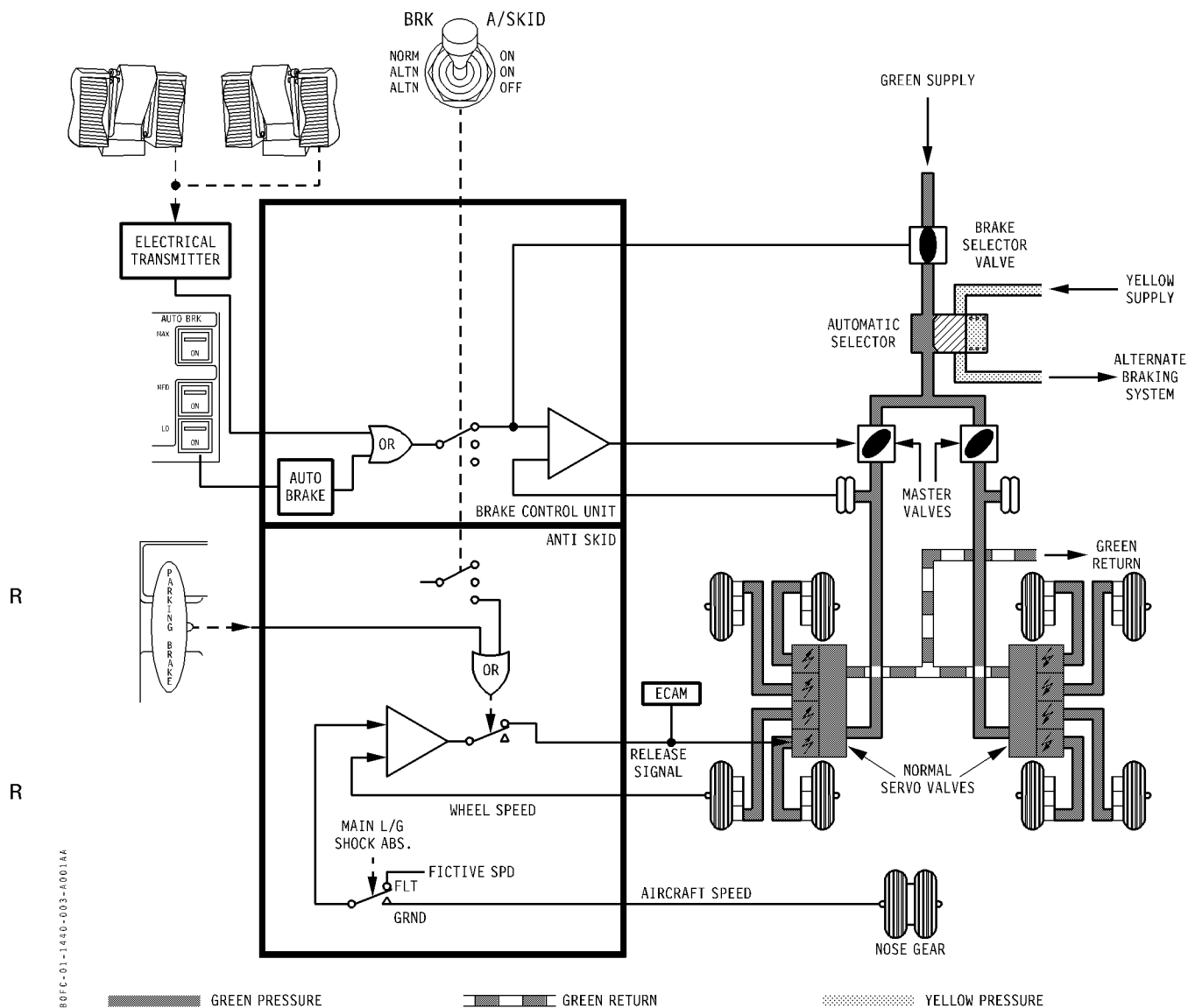
- releasing the pushbutton switch or,
 - the loss of one or more of the arming conditions or,
 - applying sufficient force to the pedals (provided the ground spoilers are commanded extended).
- (This force is : in MAX mode : 25 dN on two pedals
in LO or MED mode : 18 dN on one pedal or
15 dN on two pedals).

BRAKE TEMPERATURE SYSTEM

The system serves to measure the temperature at each of the eight brakes, provides temperature readout on the R ECAM CRT display unit, generates an overheat warning.

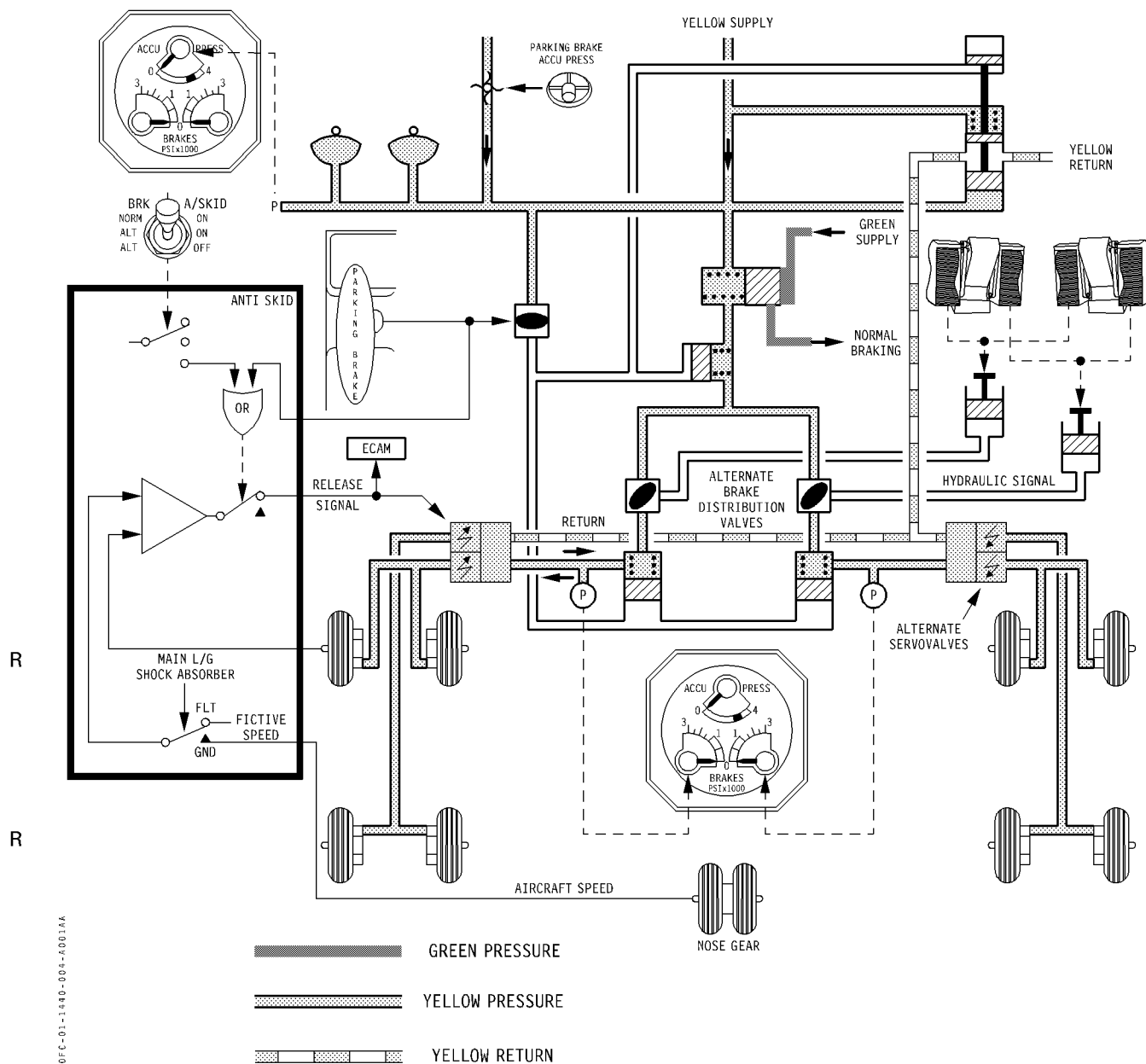


NORMAL BRAKING SYSTEM



80FC-01-1440-003-A001AA

ALTERNATE BRAKING SYSTEM



LANDING GEAR

BRAKES – ANTI SKID

CONTROLS

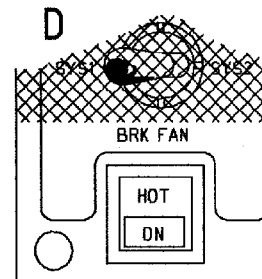
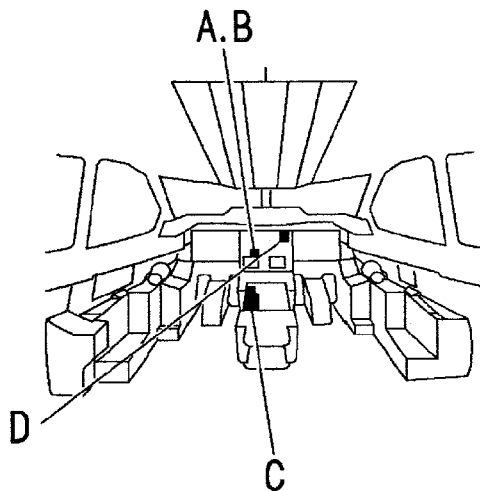
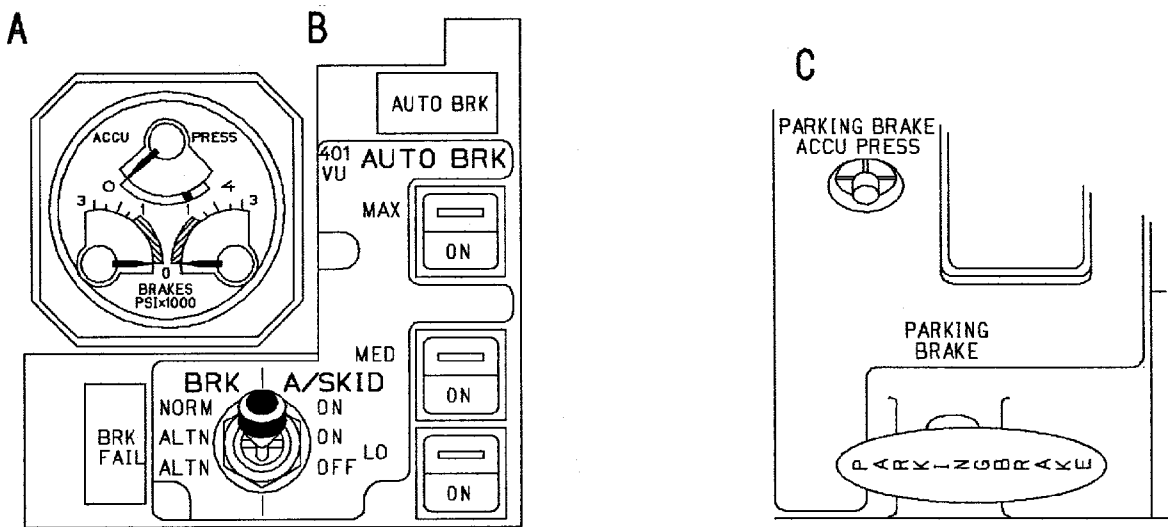
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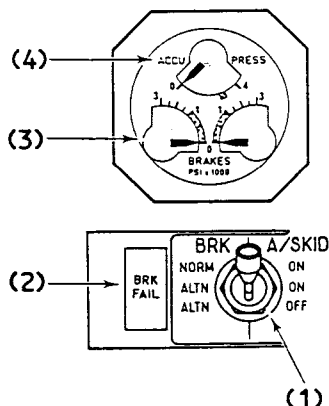
LOCATION OF CONTROLS



B0FC-01-1440-005-A300AA - R

Code : 0025

A. NORMAL/ALTERNATE SELECTION AND INDICATING



(1) BRK/A/SKID switch

■ NORM/ON :

Anti skid is controlled via 8 servovalves provided that Green hydraulic pressure is available. Control is electrical with no pressure indication.

If Green pressure drops, Yellow hydraulic pressure takes over automatically with dual BRAKES pressure indication (3) ; anti skid is still operative.

■ ALTN/ON :

Yellow hydraulic pressure is delivered to separate sets of brake pistons via separate servovalves. Control is hydraulic with BRAKES pressure indication (3) ; anti skid is operative.

■ ALTN/OFF :

Same as for ALTN/ON but anti skid system is deactivated.

(2) BRK FAIL light

The light comes on amber in flight, associated with ECAM activation, when :

- with gear up or down
 - BRK/A/SKID is selected ALTN/OFF
 - or
 - one of several REL indications on the ECAM are off
- during gear retraction, if the braking pressure is lower than 290 psi.

MP : S7212 + Mod : 5443

(3) BRAKE Pressure Indication :

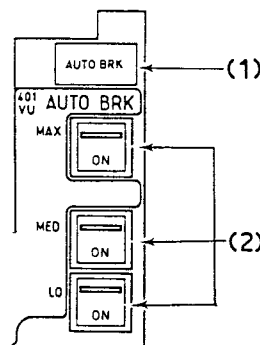
Indicates yellow pressure delivered to LH and RH brakes measured up-stream of ALTN servovalve.

- normal Parking Brake pressure is about 2100 psi.
- the scale is marked by green arc from 0 psi to 1,000 psi.

(4) ACCU PRESS Indication :

- normal pressure is between 2,800 and 3,200 psi (green zone).

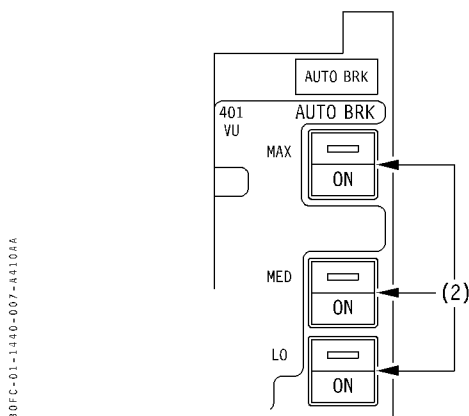
B. AUTO BRK PANEL



The panel contains the controls and indications for arming or disarming and indications for operation of the autobrake system.

(1) AUTO BRK Light

The AUTO BRK light flashes amber for 10 sec when the AUTO BRK system is disarmed except when disarming is due to LDG GEAR CTL lever Selected UP or AUTO BRK pushbutton switch released.



(2) MAX, MED, LO Pushbutton Switches

The pushbutton switches control the arming of the system with several deceleration rates.

Autobrake system is activated when armed and ground spoiler deployment order is present.

The selectable deceleration rates are,
MAX : maximum braking pressure
MED : approximately 3.00 m/s²
LO : approximately 1.70 m/s²

MAX mode is normally selected for takeoff.
In the event of an aborted takeoff, maximum pressure is sent to the brakes as soon as ground spoiler deployment order is present.

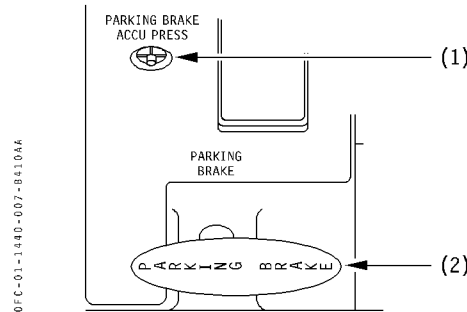
MED and LO modes are normally selected for landing.
When LO is selected, progressive pressure is sent to the brakes 8 seconds after the ground spoiler deployment order

When the ground spoilers are retracted
– either, automatically by application of forward thrust
– or, manually by action on the SPEEDBRAKE lever the autobrake system will be disarmed.

- **ON (P/B Switch pressed-in)**
The ON light illuminates blue to indicate positive arming.
The light extinguishes when actual aircraft deceleration corresponds to the selected deceleration rate.
- **Off (P/B Switch released-out)**
The autobrake system is deactivated for the associated mode.
- **Bar**
The bar integrated in the upper part of the pushbutton switch illuminates green when actual aircraft deceleration corresponds to the selected deceleration rate.

Code : 0026

C. PARKING BRAKE/ACCU PRESS PUSHBUTTON and PARKING BRAKE HANDLE



(1) PARKING BRAKE ACCU PRESS Pushbutton

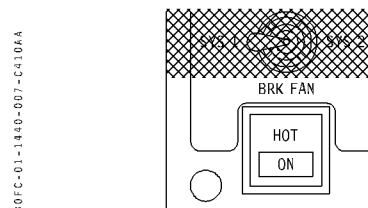
As long as pushbutton is pressed, the self regulating electric pump is activated and delivers 6 l/mn max under 3,000 psi to charge the brake accumulators.

(2) PARKING BRAKE handle

Pull handle and turn clockwise to apply parking brake.
Application of the parking brake deactivates NORM and ALTN modes.

Note : The indication « PARKING BRAKE ON » is displayed on the ECAM MEMO page.

D. BRK FAN PUSHBUTTON SWITCH



The pushbutton switch controls the operation of all brake fans simultaneously.

It is effective only when the landing gear is downlocked. R

- **ON (P/B Switch pressed-in)**
The ON light illuminates green, brake fans are activated.
- **Off (P/B Switch released-out)**
The ON light is off, brake fans are deactivated.
- **HOT**
The light illuminates amber when the temperature of any brake exceeds 300° C and extinguishes when temperature decreases below 280° C ± 5.
The light remains effective after landing gear retraction.
Illumination of the HOT light is associated with ECAM activation.

LANDING GEAR

BRAKES – ANTI SKID

ECAM

1.14.40

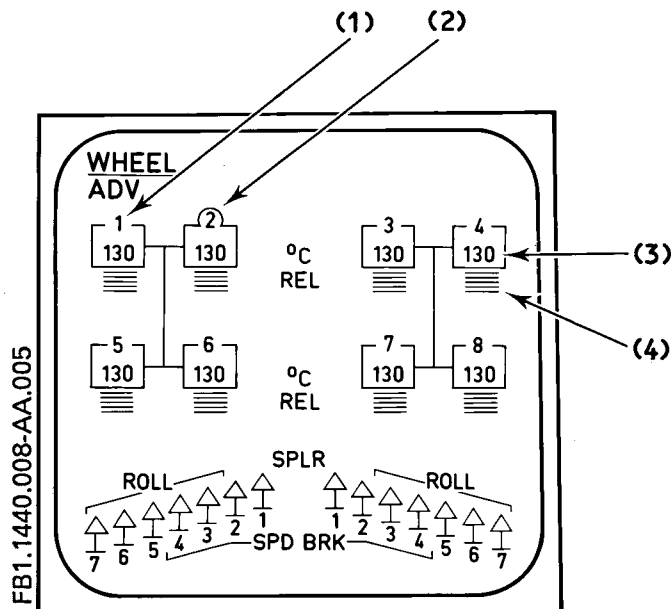
PAGE 8

REV 28

SEQ 005

SYSTEM DISPLAY

BRAKE SYSTEM PAGE



(1) Wheel identification number (white) :

Becomes amber when the corresponding brake temperature is above 300 °C.

(2) Arc around wheel identification number (green) :

Comes on around the number of the hottest wheel, only if the corresponding brake temperature is above 100 °C. It becomes amber, if the corresponding brake temperature is above 300 °C.

(3) Brake temperature (green) :

The indication becomes amber when it is greater or equal to 300 °C.

Note : Amber colour disappears as soon as temperature is below 300° C although the amber light remains on, on the LDG GEAR panel down to 280° C ± 5.

(4) Brake release indicator (green) :

Comes on, in flight when anti skid valid. After touch down, disappears and reappears, depending on anti skid release signal to the brakes. Disappears when the aircraft is stopped.

LANDING GEAR

BRAKES – ANTI SKID

ECAM

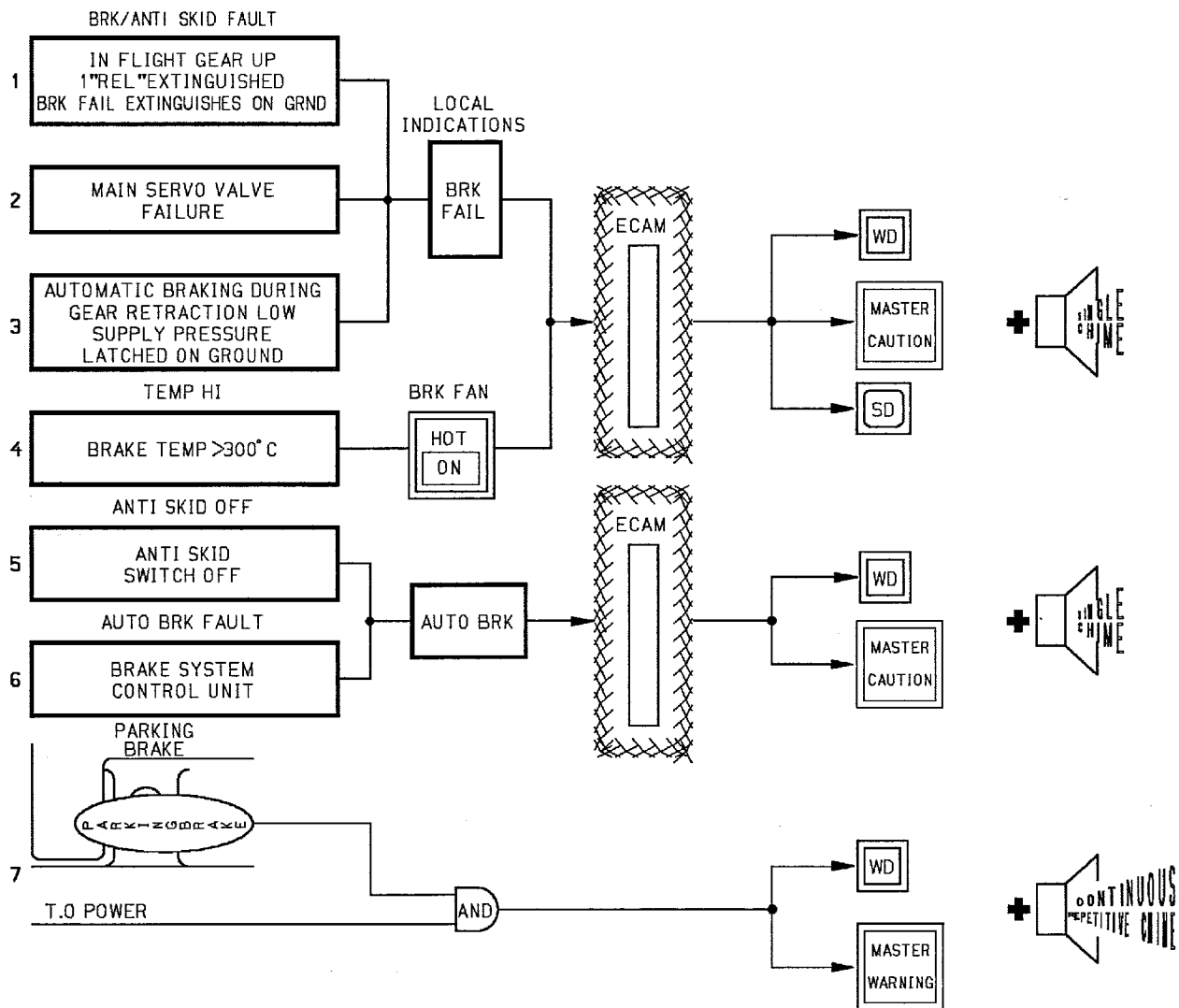
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PAGE 9

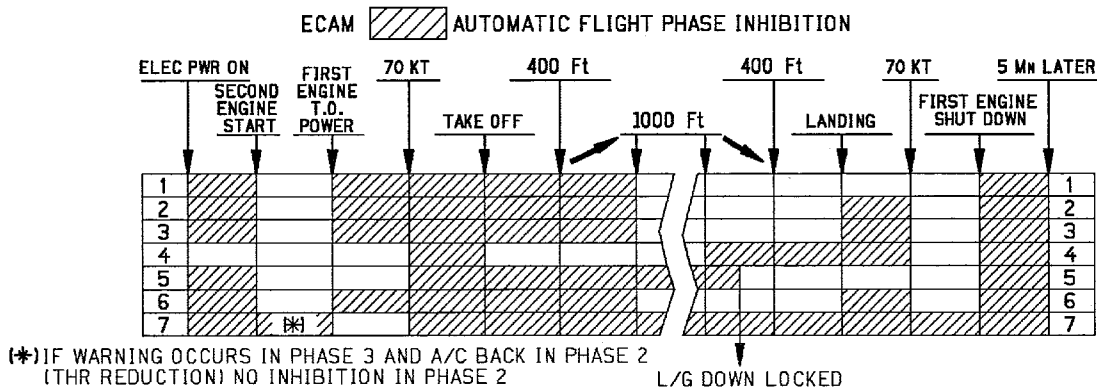
REV 28

SEQ 060


WARNING LOGIC



QPS.FCO.B1.1440.009-AA.060

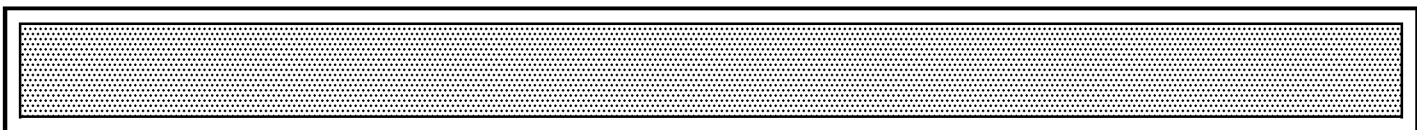


R Code : 0077

<div> <div>AIRBUS TRAINING</div> <div>  <div> A310 SIMULATOR FLIGHT CREW OPERATING MANUAL </div> </div> </div>	<div> <div>LANDING GEAR</div> <div>BRAKES – ANTI SKID</div> <div>ECAM</div> </div>		1.14.40
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R Code : 0028



LANDING GEAR

MAINTENANCE PANEL

CONTROLS

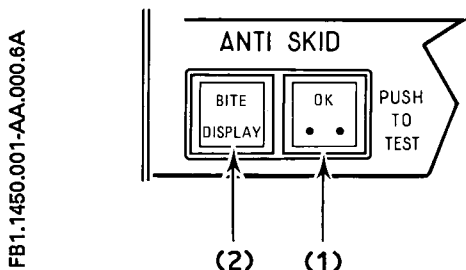
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REV 28

SEQ 000

A. ANTI SKID PANEL



(1) ANTI SKID OK TEST pb

■ Neutral (Released-out-springloaded position).

Test circuit is not energized.

■ TEST (Pushed-in)

Test circuit is energized

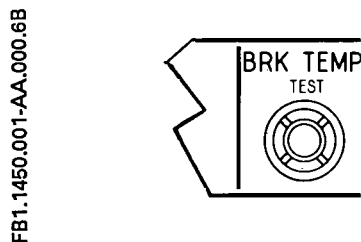
A speed of nose and main wheels is simulated. If the anti-skid system is operative, all the « REL » indications and the OK light illuminates. In case of failure, the BITE DISPLAY light illuminates.

(2) BITE DISPLAY Light

The BITE DISPLAY light comes on white and remains on if any fault is detected on normal braking electrical control and the anti skid system.

The coded failure is indicated on the face of the brake system control unit located in the avionics compartment.

B. BRK TEMP TEST PUSHBUTTON



When the pushbutton is pressed and held, a temperature equalled to 70° C (steel brakes) or 100°C (carbon brakes) plus the warning threshold plus the actual brake temperature, is simulated.

The BRK HOT light comes on amber accompanied by ECAM activation to indicate positive test.

R Code : 0029