29.00 CONTENTS

GENERAL

The aircraft has three independent continuously operating systems GREEN, BLUE, and YELLOW. Each system is supplied from its own hydraulic reservoir. Normal system operating pressure is 3000 psi (2500 psi for RAT). There is no possibility to transfer hydraulic fluid from one system to another.
The system is monitored by a Hydraulic System Monitoring Unit (HSMU).

GENERATION

GREEN SYSTEM PUMPS

Two pumps respectively driven by each engine pressurize the green system.
R In addition, an electric pump which can be manually or automatically controlled can also
R pressurize the green system.
R The electric pump runs automatically in flight for 25 seconds in the event of failure of one engine, when landing gear lever is selected up (to ensure gear retraction in a proper time).
A pump driven by a ram air turbine (RAT) pressurizes the green system in an emergency.
R When the RAT pressurizes the green system, the aileron, elevator and spoiler servo control operating speeds are reduced.

BLUE SYSTEM PUMPS

R A pump driven by engine 1 pressurizes the blue system.
R A manually controlled electric pump can also pressurize the system.

YELLOW SYSTEM PUMPS

R A pump driven by engine 2 pressurizes the yellow system.
R In addition, an electric pump which can be manually or automatically controlled can also
R pressurize the yellow system. This enables ground operations when the engines are stopped.
The electric pump runs automatically :
– in flight, in the event of engine 2 failure, if the FLAPS lever is not at 0 (to ensure flap retraction in a proper time at takeoff).

R *Note : In the event of engine 2 failure at takeoff, yellow electric pump is automatically controlled on if the green electric pump is not running for landing gear retraction.*

– on the ground during cargo door operation.

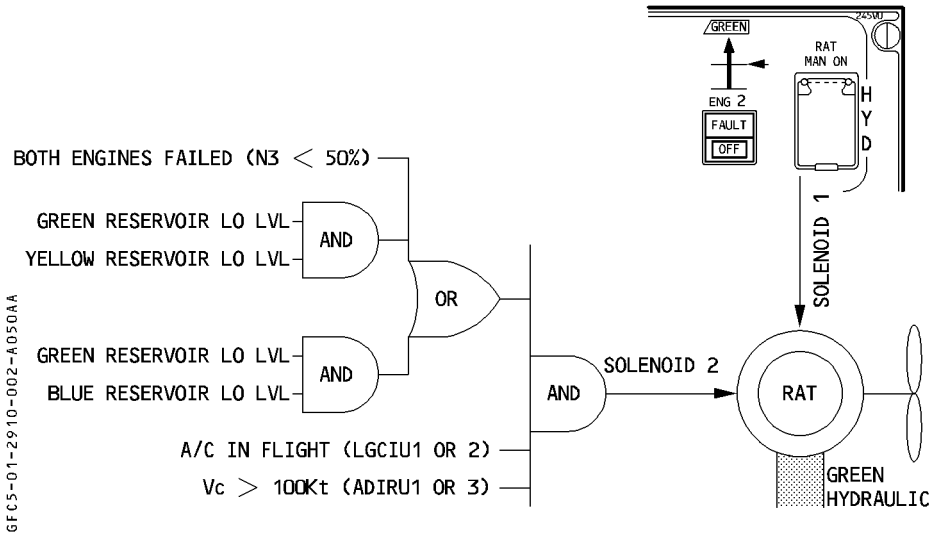
In order to operate the cargo doors when no electrical power is available, crewmembers can also use a hand pump to pressurize the yellow system.

Note : On each system, the electric pump flow is about 18 % of the engine-driven pump flow capacity.
They can be used to retract the surfaces, but should not be used to replace the engine-driven pumps.

RAM AIR TURBINE (RAT)

A drop-out RAT, coupled to a hydraulic pump, allows the green system to function.
The RAT may be extended at any time by pressing the RAT MAN ON pushbutton.
R The RAT automatically deploys, if both engines fail, or if there is a low level in the green and yellow, or green and blue reservoirs.
It can be manually deployed from the overhead panel. It can only be stowed when the aircraft is on ground.

FOR INFO



Note : Depending on the aircraft speed, the RAT flow varies between 15 % and 45 % of an engine-driven pump flow capability.

SYSTEM ACCUMULATORS

During normal operations, an accumulator in each system helps maintain a constant pressure by covering transient demands.

FIRE SHUTOFF VALVES

A fire shutoff valve is positioned upstream of each engine driven pump. It is closed by operation of the FIRE pushbutton switch.

Both engine green hydraulic fire shutoff valves are automatically closed by the HSMU in the event of green reservoir low level. This enables isolation of a possible leak in the engine
R pylon allowing restoration of the green system using the RAT, in the event of a further blue
R or yellow reservoir low level. The flight crew cannot re-open the fire shutoff valves in flight
R once they have been automatically closed.

FILTERS

FOR INFO

The hydraulic fluid is maintained clean by filters:

- *Two HP filters on green system*
- *One HP filter on blue system and one on yellow system*
- *One on the reservoir filling system*
- *One on the braking system*
- *One return line filter on each system (LP filters)*
- *One case drain filter on engine pump permits the monitoring of wear by detection of metallic particles in the filters.*

HYDRAULIC SYSTEM MONITORING UNIT (HSMU)

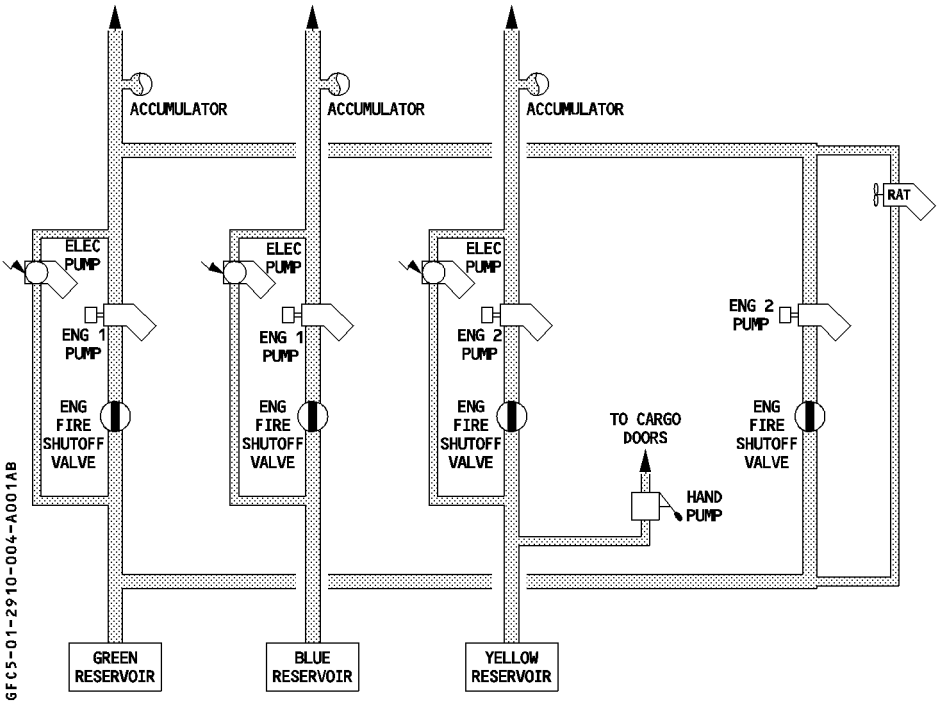
The HSMU monitors the hydraulic system.

It processes:

- Control of electric pumps
- RAT extension
- Both engine green hydraulic fire shutoff valve closure in case of green reservoir low level
- Hydraulic quantity indication correction for fluid temperature
- Tank overheat warning
- FAULT light illumination logic
- LEAK MEASUREMENT VALVE control (closure inhibited in flight, closure of yellow valve during cargo door operation).

HYDRAULIC GENERATION

R

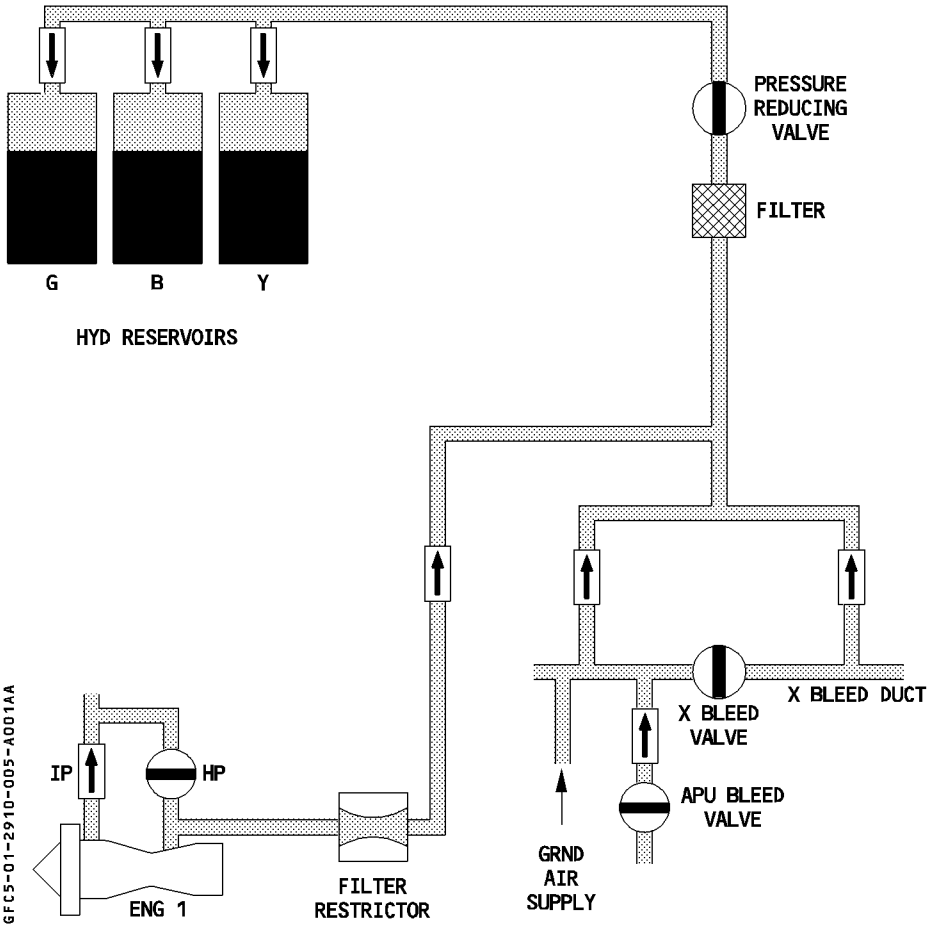


R RESERVOIR PRESSURIZATION

R Normally, HP bleed air from engine 1 pressurizes the hydraulic reservoirs automatically. If the bleed air pressure is too low, the system takes bleed air pressure from the crossbleed duct.

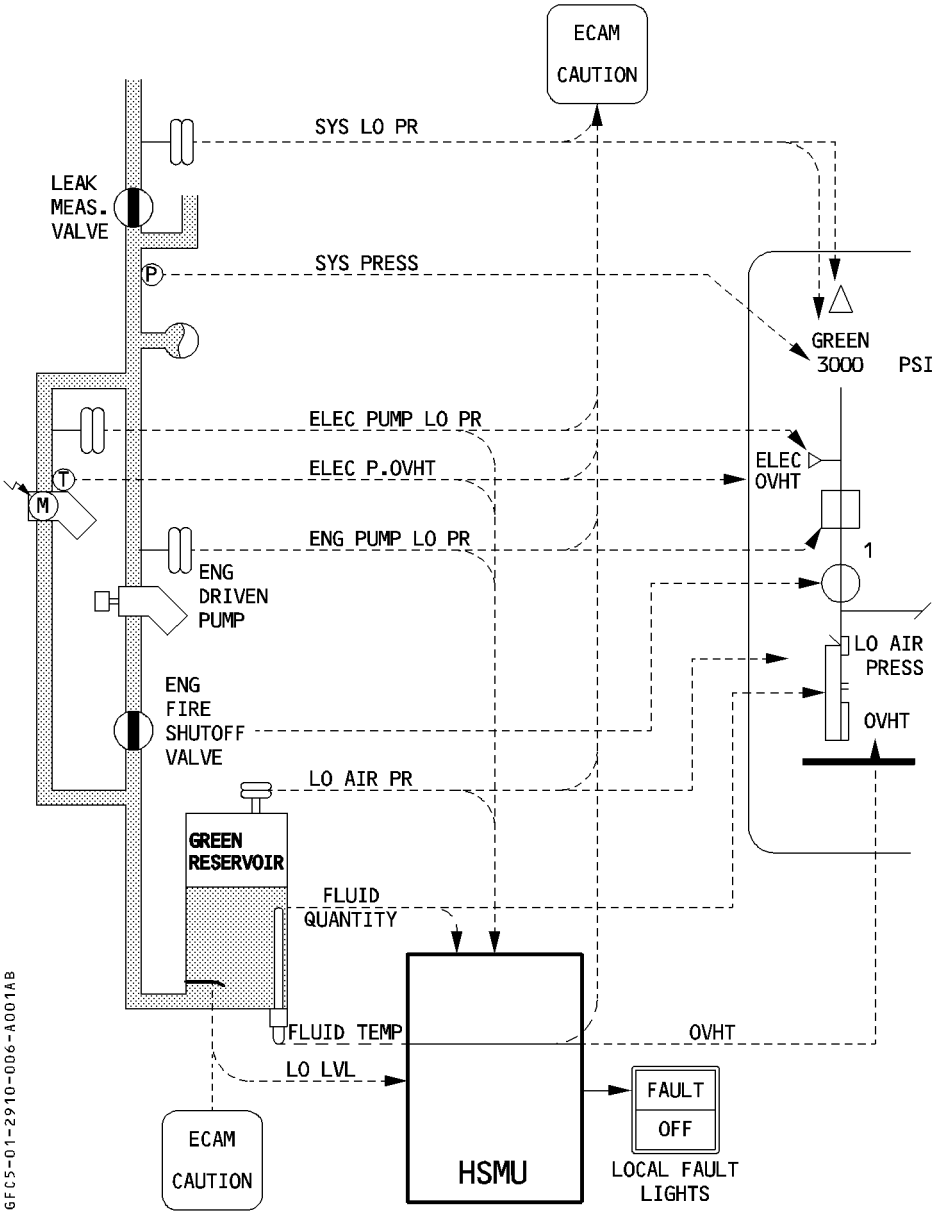
The system maintains a high through pressure to prevent their pumps from cavitating.

FOR INFO

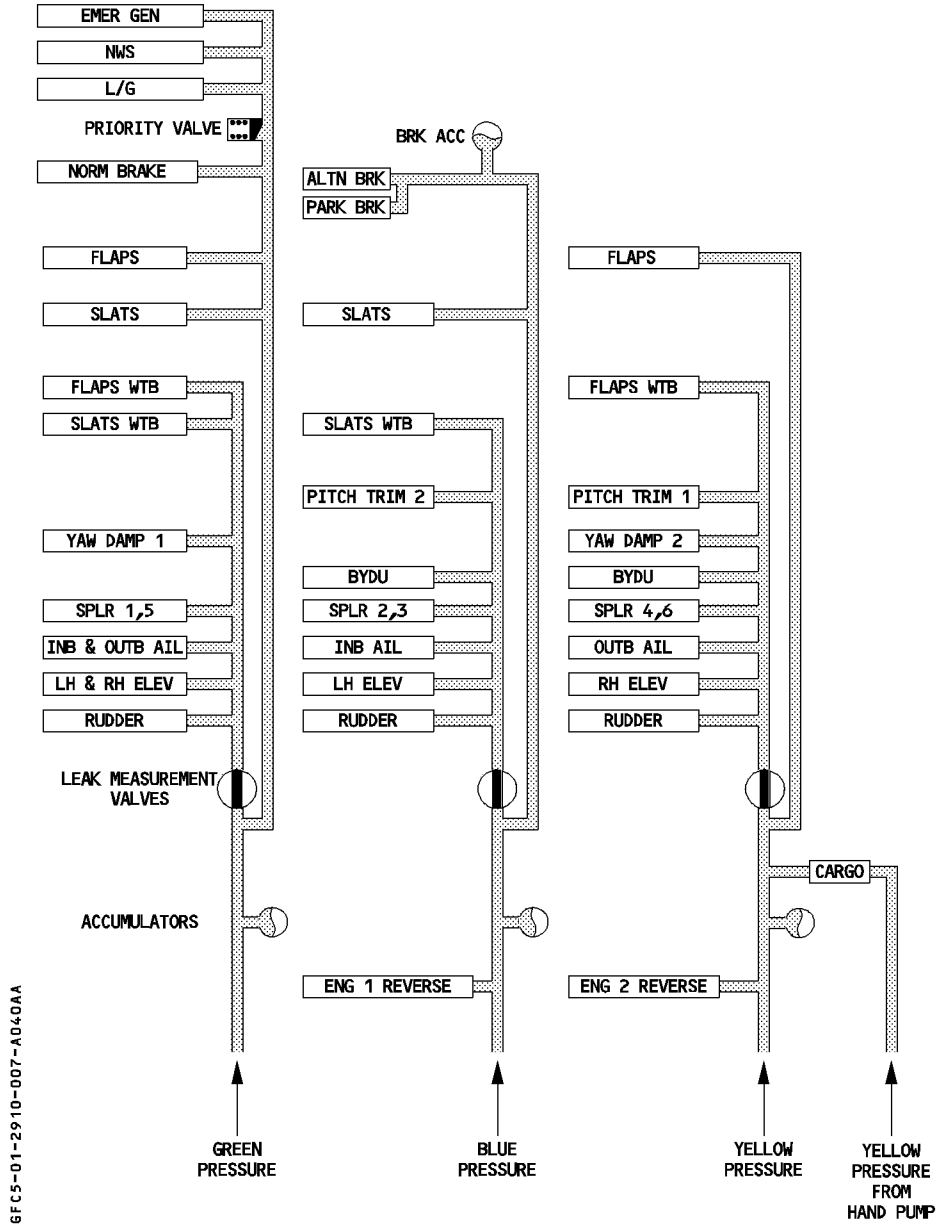


INDICATIONS

R



DISTRIBUTION



LEAK MEASUREMENT VALVES

Used only on ground.

Leak measurement valves are positioned upstream of the primary flight controls. They are used for the leak measurement of each system and may only be closed on ground, by using LEAK MEASUREMENT VALVES pushbutton on the maintenance panel. The yellow valve is automatically closed during cargo door operation.

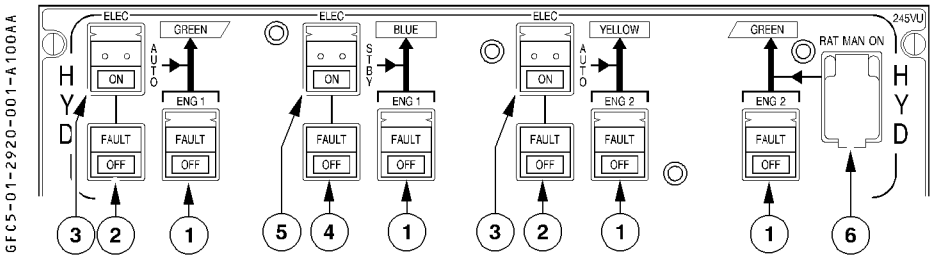
R The HSMU inhibits the closure of the green, blue and yellow hydraulic leak measurement
R valves in flight.

PRIORITY FUNCTION

In the event of low hydraulic pressure, a priority valve cuts off hydraulic power to heavy load users (emergency generator, nosewheel steering, landing gear) in order to keep the pressure for normal braking and flight controls.

R A Pressure-Off Brake system (installed on the flaps, slats and THS actuator) ensures the same function.

OVERHEAD PANEL



R (1) ENG 1 (or 2) PUMP pb sw (guarded)

On : The pump pressurizes the system when the engine is running.
OFF : The pump is depressurized. Power generation stops.
FAULT lt : Illuminates amber associated with ECAM caution in the event of :
- Reservoir low level
- Reservoir overheat
- Reservoir low air press
- Pump low press (inhibited on ground when engine stopped).

Extinguishes when OFF selected except during an overheat. (In this case, the light remains on as long as overheat is present).

(2) GREEN (or YELLOW) ELEC PUMP pushbutton

AUTO : The HSMU automatically controls the pump :
- The green electric pump runs :
  - For 25 seconds, in the event of a one-engine failure, when the landing selector lever is selected up and the aircraft speed is above 100 knots.
- The yellow electric pump runs :
  - In the event of Engine 2 failure, if the FLAPS lever is not at zero and the aircraft speed is above 100 knots, provided the green electric pump is not running for landing gear retraction. It remains running until the last engine shutdown.
  - On the ground, when the cargo door manual selector valve lever is set to the OPEN or CLOSE position. In this case, the yellow leak measurement valve closes and yellow flap motor operation is inhibited.

OFF : The pump is off.

FAULT lt : This amber light, and an associated ECAM caution come on, if :
- The reservoir level is low, or
- The reservoir overheats, or
- The air pressure in the reservoir is low, or
- The pump delivers low pressure (inhibited when the pump is not controlled on), or
- The pump overheats.

The light goes off when the crew selects OFF, except during an overheat.

R In case of a reservoir overheat, the fault light stays on, until the overheat
R stops. In case of an electrical pump overheat, the light stays on, even if the
R overheat has stopped, and until the system is reset on ground.

Note : If the yellow/green electric pump overheats, the pump automatically shuts down.

(3) GREEN (or YELLOW) ELEC PUMP ON pushbutton (springloaded-guarded)

AUTO: The electric pump is controlled by the applicable ELEC PUMP's pushbutton.

ON : The electric pump is on, provided the ELEC PUMP's pushbutton is not selected OFF.
After an electrical power interruption, the pump does not restart (ON light stays off).
The ON light comes on blue, when the pump is manually or automatically supplied.

④ BLUE ELEC PUMP pushbutton

Standby : The pump is controlled by the BLUE ELEC PUMP ON pushbuttton.
OFF : The pump is off.
FAULT lt : The amber fault light comes on (provided the blue electrical pump is running), along with an associated ECAM caution, if :
— The reservoir level is low, or
— Air pressure in the reservoir or pump pressure is low, or
— The reservoir or the pump overheat.
The light goes off when the crew selects OFF, except during an overheat. In case of a reservoir overheat, the fault light stays on, until the overheat stops. In case of an electrical pump overheat, the light stays on, even if the overheat has stopped, and until the system is reset on ground.

Note : If the blue electric pump overheats, the pump automatically shuts down.

⑤ BLUE ELEC PUMP ON pushbutton (springloaded-guarded)

ON : The pump is energized, provided the BLUE ELEC PUMP pushbutton is not selected OFF. After an electrical power interruption, the pump will not restart (ON light remains off).
STBY : The pump is off.

⑥ RAT MAN ON pushbutton

The RAT may be extended at any time by pressing the RAT MAN ON pushbutton.

Note : The RAT automatically extends in flight, if :
R *— Both engines fail, or GREEN + BLUE LO LVL, or GREEN + YELLOW LO LVL.*

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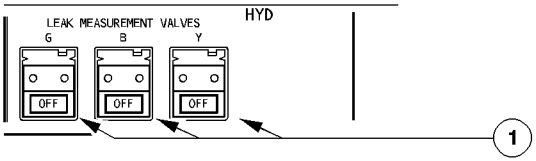
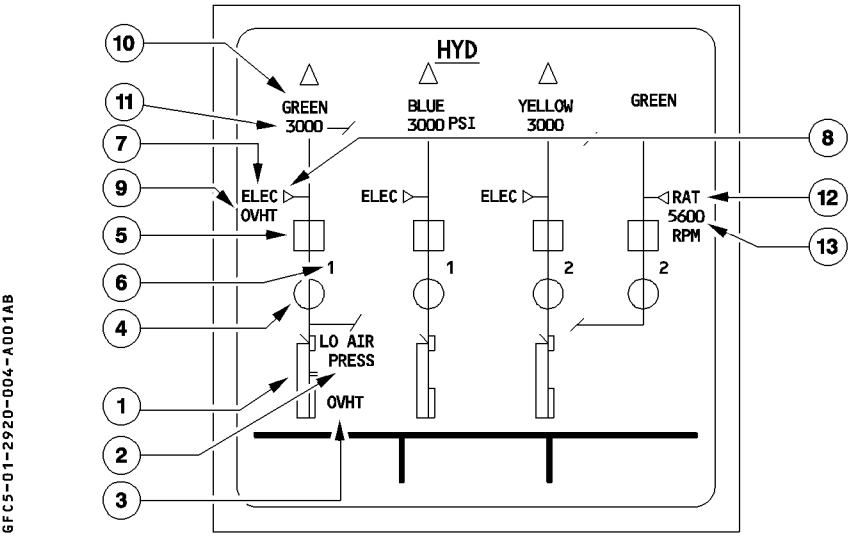


(1) LEAK MEASUREMENT VALVES pushbutton (to be used on ground only)

OFF : The corresponding electrohydraulic valve closes and shuts off hydraulic supply to the primary flight controls. This function and the OFF light are inhibited when the aircraft speed is greater than 100 knots.

Note : On ground, the yellow valve is automatically closed when the cargo door is activated (to avoid inadvertent movement of flight control surfaces). The OFF light comes on.

ECAM HYD PAGE



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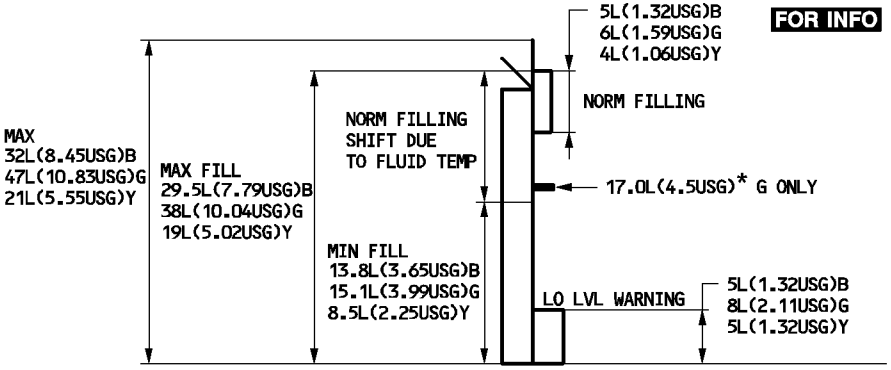
(1) Reservoir quantity

This indication is in green, unless the fluid level goes below the warning level, in which case it becomes amber.



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* A SINGLE WHITE BAR IS DISPLAYED WHEN ACTUAL FLUID LEVEL IS ABOVE 17L (4.5USG) AND IS REPLACED BY TWO AMBER BARS WHEN BELOW 17L.

R *Note : The normal filling range indication is corrected for fluid temperature effect. It is normally green. When the temperature information is not available, it is no longer corrected and the indication becomes white.*

(2) Reservoir LO AIR PRESS indication

It is amber, and an associated caution appears on the ECAM, if the respective reservoir air pressure drops below normal.

(3) Reservoir OVHT indication

It is amber, and an associated caution appears on the ECAM, if the temperature of the returning hydraulic fluid, at the inlet to its reservoir, is above normal.

(4) FIRE SHUT OFF VALVE indication

Crossline – Amber : The valve is fully closed.
In line – Green : The valve is partially closed.

(5) ENG PUMPS control and low pressure indication

In line – Green : The designated PUMP's pushbutton is on, and the hydraulic pressure is normal.
Crossline – Amber : The designated PUMP's pushbutton is off.
"LO" – Amber : The designated PUMP's pushbutton is on, and the hydraulic pressure is low.

(6) PUMP identification

It is normally white. It becomes amber when the N3 of the corresponding engine is below idle.

(7) ELEC indication

It is normally white. It becomes amber if the associated power supply fails, or if the pump is commanded on, and does not provide normal pressure.

(8) ELEC PUMP control

▷ White : – The electric pump is not commanded.
▷ Amber : – The electric pump is switched off.
▶ Green : – The electric pump is on.
▶ Amber : – The electric pump is on and the system has low pressure.

(9) Electric pumps OVHT indication

R It is amber, in case of an electric pump overheat. This indication remains displayed
R on the ECAM, even if the overheat has stopped, and until the system is reset on
R ground.

(10) System label (SYS LO PR sw)

R

	PRESS > 1750 psi (press increasing)	PRESS < 1450 PSI (press decreasing)
GREEN	white	amber
△	green	amber

(11) System pressure

R This legend, normally green, becomes amber when system pressure is below 1450 PSI

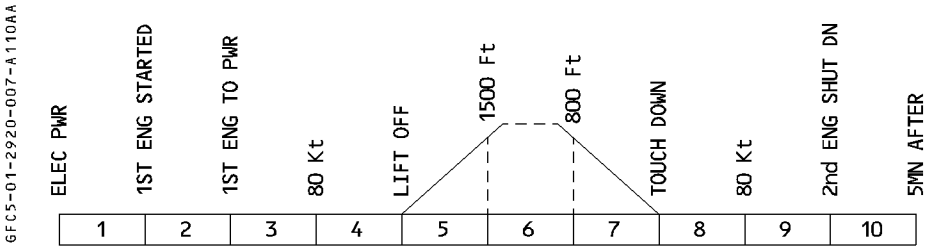
(12) RAT control

◁	RAT	MEANING
White	white	RAT stowed
Full green	white	RAT not stowed and RPM > 3000
White	amber	RAT fully stowed and stowing pressure applied
Full amber	amber	RAT not stowed and RPM < 3000

(13) RPM indication

R This appears green when the rotation speed of the RAT is above 100 RPM

WARNINGS AND CAUTIONS



R

E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
B + Y SYS LO PR or B + G SYS LO PR or Y + G SYS LO PR system pressure ≤ 1450 psi reset if pressure ≥ 1750 psi	CRC	MASTER WARN	HYD	FAULT lt on associated pump(s) pb	4, 5
G (Y)(B) RSVR LO AIR PR reservoir air pressure ≤ 22 psi reset if air pressure ≥ 25 psi	SINGLE CHIME	MASTER CAUT			3, 4, 5, 7, 8
G (Y)(B) RSVR OVHT fluid temperature ≥ 95°C					
G (Y)(B) RSVR LO LVL fluid quantity : < 8L (2.11 USG)(Green) < 5L (1.32 USG)(Blue–Yellow)					4, 5 7, 8
G ENG 1(2) PUMP LO PR or G ENG 1 + 2 PUMP LO PR or B ENG 1 PUMP LO PR or Y ENG 2 PUMP LO PR or Engine pump pressure ≤ 1450 PSI					3*, 4, 5, 7, 8 * only for G ENG 1 (2)
G (Y)(B) ELEC PUMP FAULT Elec pump LO PR or ovht					3, 4, 5, 7, 8
G (B)(Y) SYS LO PR system pressure ≤ 1450 psi reset if pressure ≥ 1750 psi					
RAT FAULT RAT not fully stowed and not running, or stowing pressure applied	NIL	NIL		NIL	3, 4, 5, 6 7, 8
MONITORING FAULT HSMU not racked			NIL		3, 4, 5, 7, 8
G RSVR UNDERFILLED on ground reservoir quantity < 17 l if temp > 0°C or reservoir quantity < QTY function of temp			HYD		3, 4, 5, 6, 7, 8
G SYS LEAK In flight only					1 to 5 7 to 10

MEMO DISPLAY

R HYD ELEC PUMP appears green when one of the three electric pumps is running (manually or automatic).
RAT OUT appears green if ram air turbine is not fully stowed. It becomes amber during flight phases 1 and 2.

BUS EQUIPMENT LIST

FOR INFO

R

		NORM			EMER ELEC		
		AC	DC	DC BAT	AC ESS	DC ESS	HOT
HSMU	B, G CONTROL		DC1				
	Y, G CONTROL		DC2				
ENGINE DRIVEN PUMP CONTROL	ENG 1 Green Pump		DC1				
	ENG 1 Blue Pump		DC1				
	ENG 2 Green Pump		DC2				
	ENG 2 Yellow Pump		DC2				
FIRE SHUTOFF VALVES	ENG 1 Green					X	
	ENG 1 Blue					X	
	ENG 2 Green		DC2			X (1)	
	ENG 2 Yellow		DC2			X (1)	
ELECTRIC PUMPS	Green	AC1	DC1				
	Blue	AC2	DC1				
	Yellow	AC1 (2)	DC2 (3)				
LEAK MEASUREMENT VALVES			DC GND/FLT				
RAT	MANUAL CONTROL						X
	AUTO CONTROL					X	

(1) DC ESS supplies the valve motor when NORM DC2 is lost.
(2) or directly from external power
(3) or from DC GND/FLT bus