


AIRBUS TRAINING  <b>A340</b> SIMULATOR FLIGHT CREW OPERATING MANUAL	<b>FUEL</b>		1.28.00	P 1
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## GENERAL

### DESCRIPTION

The fuel system :

- Stores fuel.
- Controls and monitors the correct quantity of fuel.
- Supplies fuel to the engines and the Auxiliary Power Unit (APU).
- Controls the transfer of fuel to maintain the Center of Gravity (CG) within limits.
- Circulates fuel to cool the Integrated Drive Generator (IDG).
- Maintains fuel in the outer tanks for wing bending relief.
- Allows fuel jettison for rapid weight reduction.
- Controls refueling and defueling.

## TANKS

Fuel is stored in the :

- Wings
- Center section
- Trimmable Horizontal Stabilizer (THS).

### DESCRIPTION

The wings have inner and outer tanks. Each inner tank contains two collector cells that :

- Maintain a fuel reservoir for the fuel booster pumps and provide negative 'g' protection to feed the engines.

R – Are maintained full and contain about 1000 kg (2200 lbs) of fuel.

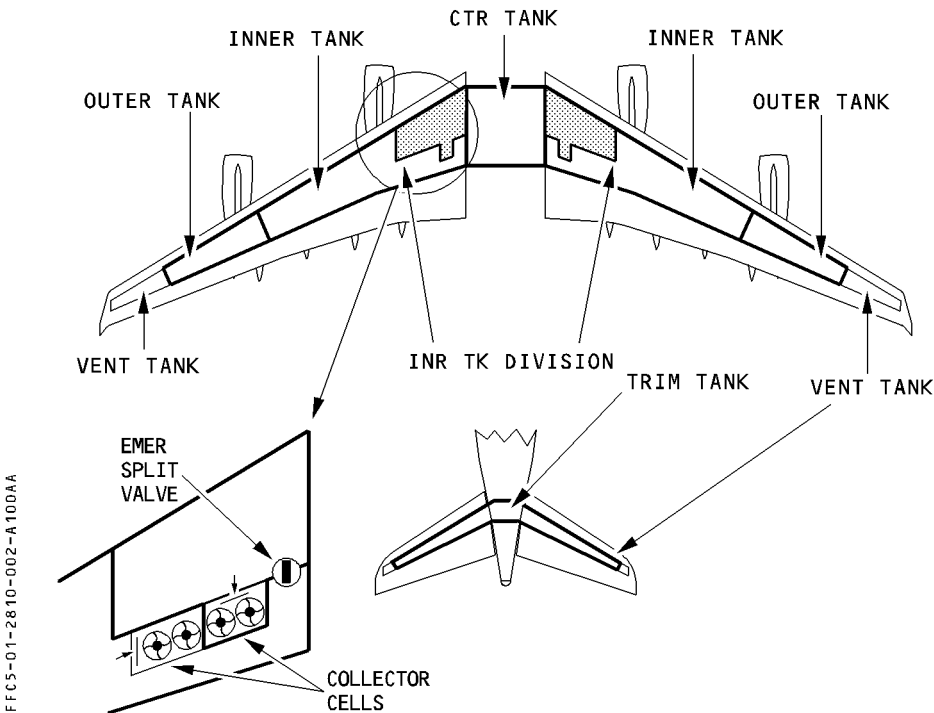
Each inner tank is divided into two parts via a SPLIT valve that normally remains open. The inner tank is used as a single tank and, if tank damage is suspected (i.e. FQI data is lost or there is a rapid FQI decrease following an engine failure), the SPLIT valve can be manually closed by using the dedicated pushbutton on the overhead panel.

In each wing, and on the right of the THS trim tank, there is a vent surge tank outboard of the outer tank.

After refueling to maximum tank capacity, fuel can expand by 2 % (20°C temperature increase) without spillage.


There is an overpressure protector in each wing surge tank, in the trim surge tank, and between the center and the right inner tanks.

TANK ARRANGEMENT



USABLE FUEL						
		OUTER TANKS	INNER TANKS	CENTER TANK	TRIM TANK	TOTAL
VOLUME	(liters)	3650 x 2	42775 x 2	42420	6230	141500
	(US gallons)	964 x 2	11301 x 2	11207	1646	37383
WEIGHT *	(KG)	2865 x 2	33578 x 2	33300	4890	111078
	(LB)	6315 x 2	74033 x 2	73417	10782	244896

\* Fuel specific gravity: 0.785 kg/l or 6.551 lbs/US Gal.

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## FUEL CONTROL AND MONITORING SYSTEM (FCMS)

### GENERAL

The fuel system is controlled by two Fuel Control and Monitoring Computers (FCMC).  
The FCMCs :

- Measure the fuel quantity and indicate it on the ECAM.
- Calculate the aircraft's Gross Weight and Center of gravity, based on the Zero Fuel Weight and the CG entered by the crew.
- Control transfer of fuel to the inner tanks for engine feed.
- Control transfer of fuel to and from the trim tank for CG control.
- Send signals to the FADEC to control the fuel recirculation system.

Magnetic level indicators are fitted in the lower surfaces of the center and wing tanks to allow the manual measurement of each tank's fuel quantity.

## FUEL QUANTITY INDICATION AND LEVEL SENSING

### FUEL QUANTITY INDICATION

One FCMC is active and the other is on standby. If the first FCMC fails, then the other FCMC takes over.

Each FCMC calculates the fuel quantity by using the :

- Fuel volume from the fuel probes.
- Fuel density from the densitometers.
- Horizontal Stabilizer angle.
- Aircraft attitude.
- Fuel electrical characteristic from the compensators

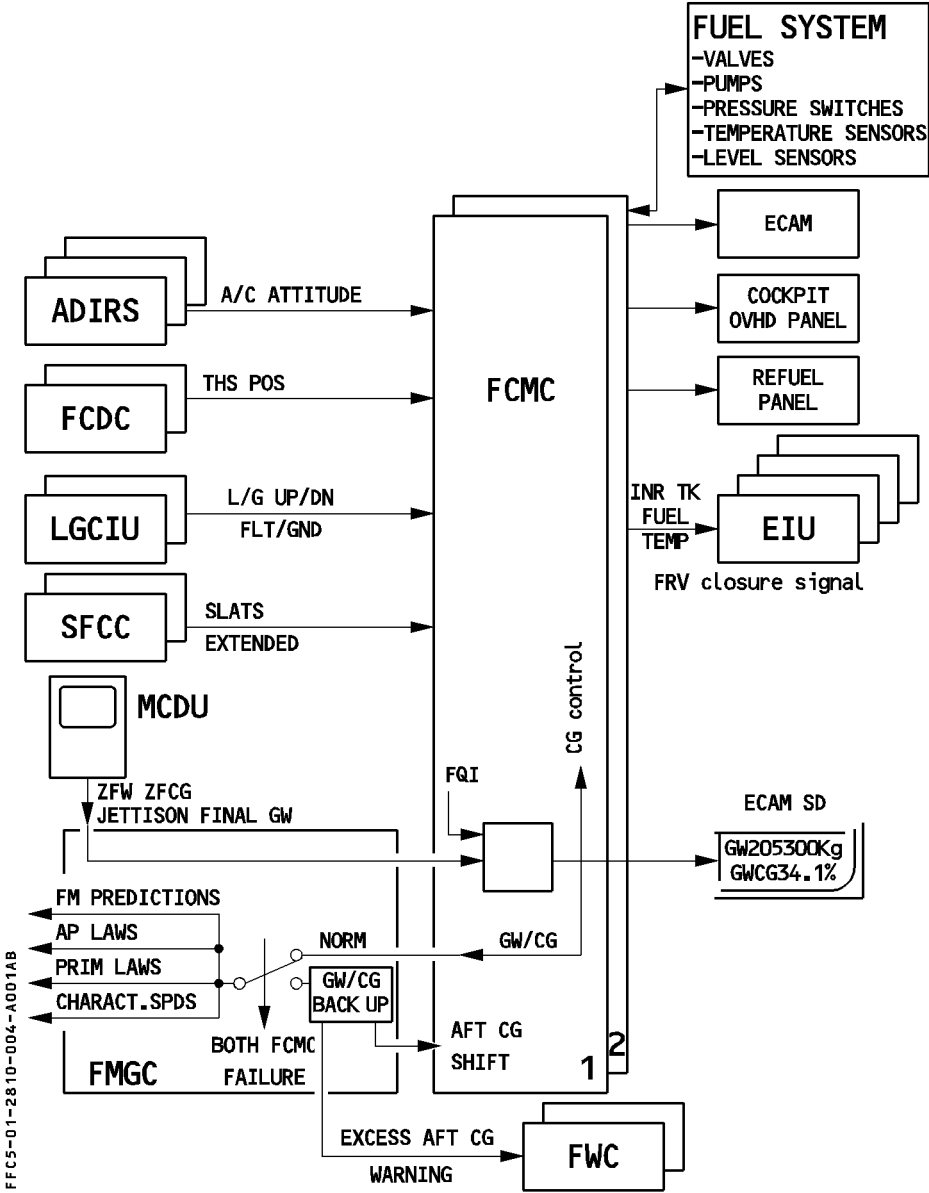
The calculated fuel quantity is indicated on both the ECAM and the refuel control panel.


### FUEL LEVEL SENSING

The FCMC also uses information from the following fuel level sensors to control transfers and to provide warnings, independently of the fuel quantity indication :

- Low level sensors :
  - To trigger low level warnings and stop jettison.
  - To control center and trim tank transfers.
- High level sensors : To stop refueling when a tank is full.
- Vent surge tank level sensor : To stop refueling, or fuel transfer, in case of tank overflow.

ARCHITECTURE



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## ENGINE FEED

### GENERAL

The main fuel pump system supplies fuel from the inner tanks to the engines. In each wing there are two collector cells, one for each engine. Each collector cell contains two fuel pumps, one main and one standby. When closed, the crossfeed valves separate the system into four parts, and their associated fuel pumps supply the engines. When open, the crossfeed valves allow any pump to supply any engine.

### MAIN COMPONENTS

#### INNER TANK PUMPS

During normal operation all main pumps run.

If a main pump fails, or is switched off, then the inner tank pump (standby pump) of that collector cell runs. With the crossfeed valves open, one pump is capable of supplying all four engines in cruise.

#### CROSSFEED VALVES

A X-FEED valve is associated with each engine. It connects the engine and its associated pumps to the X-FEED line. This enables any pump to supply any engine. All X-FEED valves automatically open :


- In electrical emergency configuration, and
- During jettison operation.

X-FEED valves 2 and 3 also open in the event of aft transfer from the inner tanks.

#### ENGINE LP VALVE

The flow of fuel to an engine can be stopped by closing its respective low pressure (LP) valve via the :

- Engine master switch, or the
- ENG FIRE pushbutton.

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**FUEL FEED WITH ALL ENGINES FLAME OUT (ELEC EMER CONFIG)**

**EMER GEN POWERED BY THE RAT**

- All crossfeed valves automatically open.
- R – Only the main pump 1 remains powered.
- If pump 1 fails, or is selected OFF, STBY pump 4 will automatically replace it.
- When the speed decreases below 260 knots, or when LAND RECOVERY is selected ON,
- R all main and STBY pumps are lost.

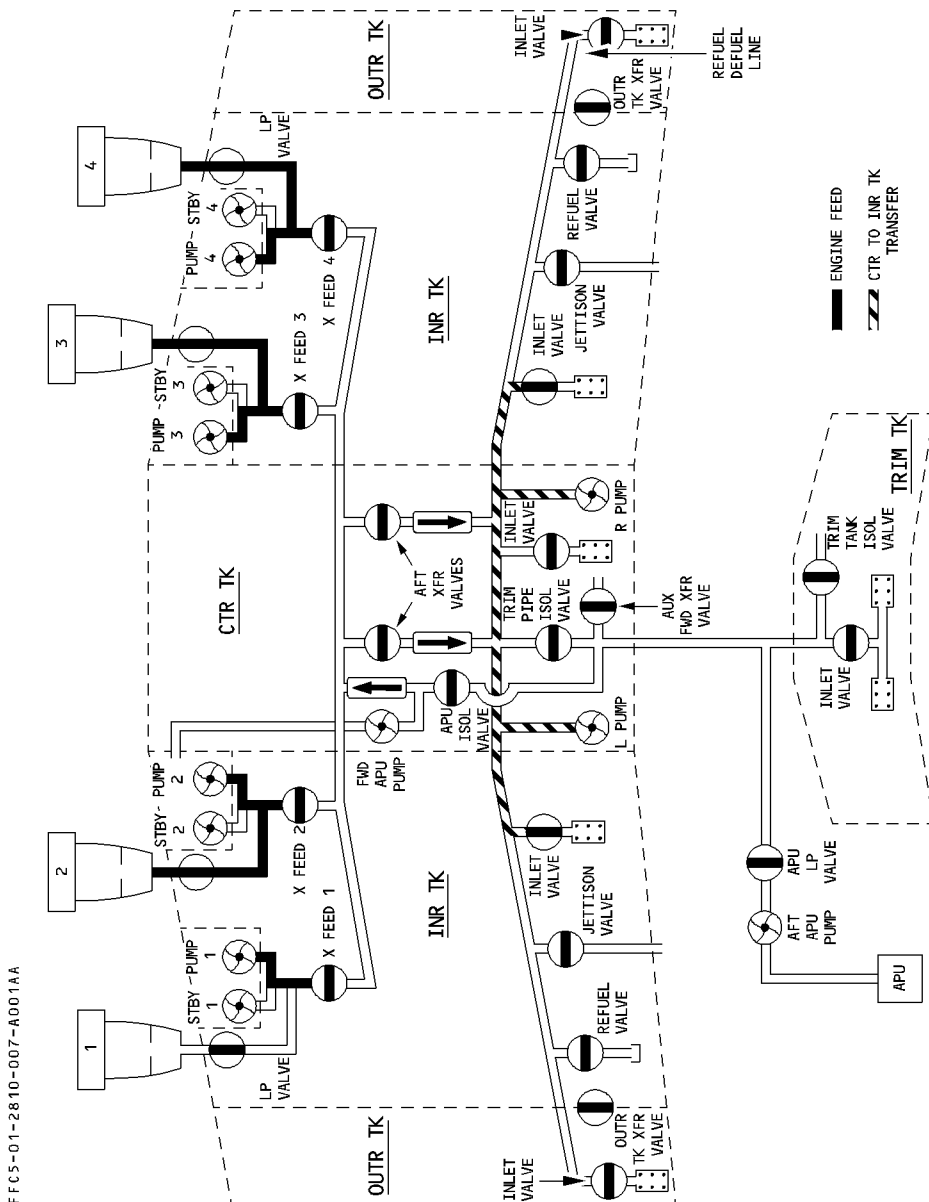
**FLIGHT ON BATTERIES**


- R – All main and STBY pumps are lost.

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## ENGINE FEED AND CENTER TO INNER TRANSFER

**FOR INFO**



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FUEL FEED SEQUENCE

NORMAL OPERATION

- Fuel is always fed to the engines from the inner tanks.  
The fuel transfer sequence is as follows :
- R
- R
1. Center tank fuel transfers to the inner tanks.
  2. Each inner tank empties down to 5000 kg (11030 lbs).
  3. Trim tank fuel transfers to the inner tanks.
  4. Each inner tank empties down to 4000 kg (8830 lbs).
  5. Outer tank fuel transfers to the inner tanks.

AUTOMATIC FUEL TRANSFERS

CENTER TO INNER TANK TRANSFER


- The center tank pumps run continuously whenever there is fuel in the center tank. Each inner tank inlet valve controls the transfer by cycling its inner tank contents between full and approximately 2000 kg (4415 lbs) below full. When the center tank is empty, both center tank pumps stop, and both inner tank inlet valves close.
- R

OUTER TO INNER TANK TRANSFER

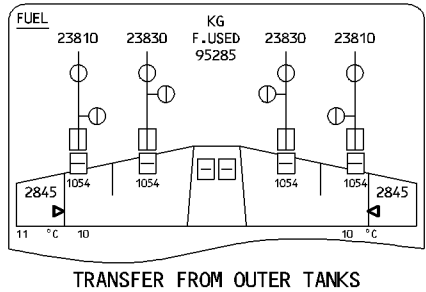
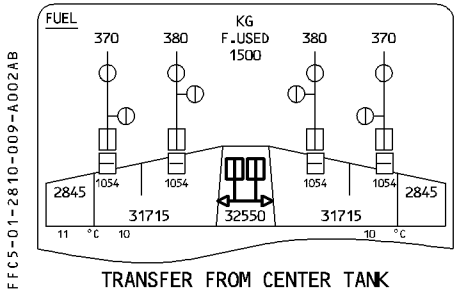
- The outer tank transfers fuel to the inner tanks by gravity. Each outer tank transfer valve controls the transfer by cycling its inner tanks contents between 4000 kg (8830 lbs) and 4500 kg (9930 lbs). When each outer tank has been empty for five minutes, its outer tank transfer valves close.
- R
- R


TRIM TANK TRANSFER

Refer to CG control.

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**R ECAM INDICATION**



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**MANUAL FUEL TRANSFERS**

**CENTER TO INNER TANK TRANSFER**

Transfer from the center to inner tanks can be manually selected with the CTR TANK XFR pushbutton. When selected MAN, the inner tank inlet valves are opened and the CTR TK pumps run.

The CTR TK pumps must be selected OFF when the :

- Inner tanks are full, to manually prevent inner tank overflow.
- Center tank is empty.

- R
- Note : 1. When the fuel quantity of each inner tank is below 17000 kg (37520 lbs), all center tank fuel can be transferred without any risk of overflow.*  
*2. When the CTR TANK XFR pushbutton is pressed, aft transfer is inhibited.*

**OUTER TO INNER TANK TRANSFER**

Transfer from the outer to inner tanks can be manually selected with the OUTR TK XFR pushbutton. When selected ON, the outer tank fuel transfer valves, and the inner and outer inlet valves are opened.

*Note : 1. During an outer to inner tank transfer, the CTR TK pumps must be selected OFF to avoid inadvertent fuel transfer from the center tank to outer tanks.*

*2. When the OUTR TK XFR pushbutton is pressed, aft transfer is inhibited.*

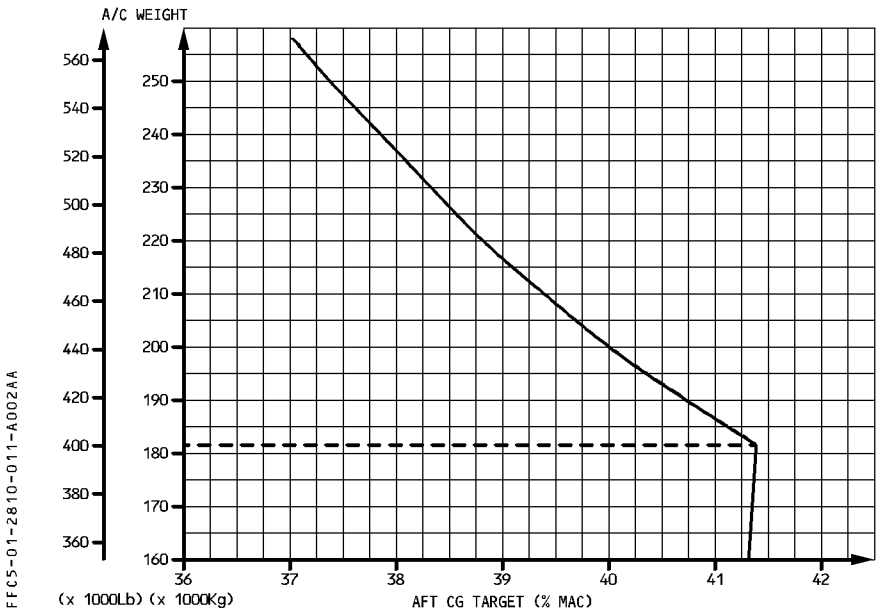
**CG CONTROL – TRIM TANK TRANSFER**

**GENERAL**

- The trim tank transfer system controls the aircraft's Center of Gravity (CG).
- The system either transfers fuel to the trim tank (aft transfer) or from the trim tank (forward transfer).
  - This movement of fuel changes the aircraft's CG.
  - When the aircraft is in cruise, the system optimizes the CG position to increase fuel economy by reducing drag.
  - Normal operation is automatic, but the crew can manually select a forward fuel transfer.
  - The Fuel Control and Management Computer (FCMC) calculates the aircraft's CG and compares it to a target value. (This target depends on the aircraft's actual weight. See AFT CG Target Graph below).
  - Based on this calculation, the FCMC determines the quantity of fuel to be moved aft or forward in flight.

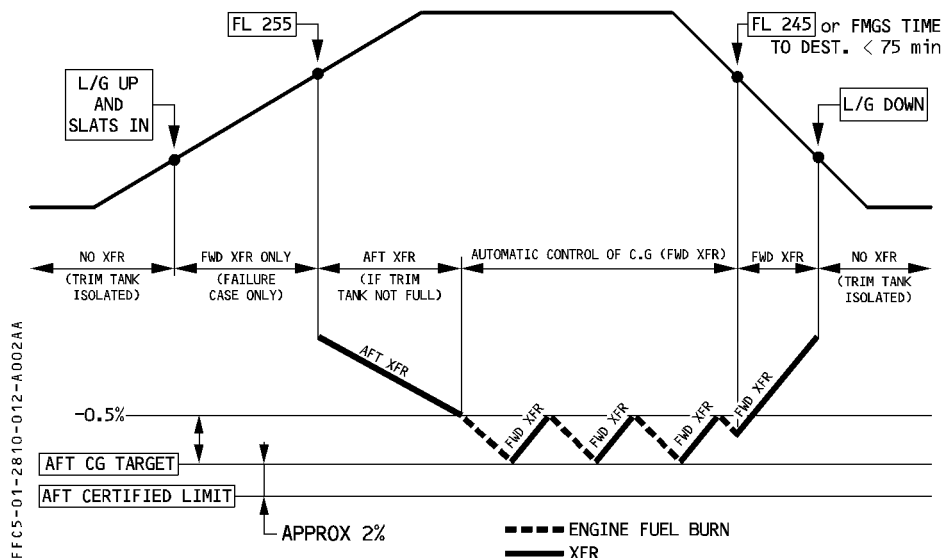
**AFT CG TARGET**

**FOR INFO**





## NORMAL OPERATION



### Automatic CG control :

- Begins during climb to FL 255.
- Ends at descent to FL 245, or when the FMGS time to destination is less than 75 minutes.

Note : 1. The trim pipe isolation valve and the trim tank isolation valve are closed during takeoff and landing. It is possible to reopen them, when the landing gear is up and the slats are retracted (or when the MODE SEL switch is set at REFUEL on the REFUEL panel).

2. If the FMGC detects a CG that is too far aft, then the target will automatically be moved forward by 1.5 %. The target also moves forward 1.5 % in the case of FQI data degradation, or if ZFCG/ZFW have not been entered or need to be reinitialized in flight (modifying CG/GW via the MCDU).

3. The above-mentioned CG target alterations should be added together.

R  
R

## AFT FUEL TRANSFER

In flight, the FCMC only starts an AFT fuel transfer, when all of the following conditions are met :

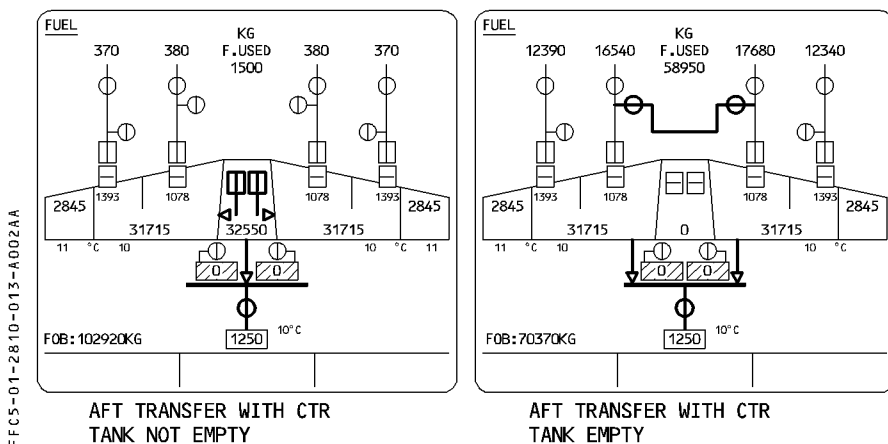
- Landing gear is retracted.
  - Slats are retracted.
  - Trim tank is not full.
- R    – Inner tank's fuel quantity is above 6250 kg (13790 lbs).
- Aircraft is above FL 255.
  - Aircraft CG is not on target.

R    Normally, only one aft fuel transfer occurs per flight. However, if the CG in cruise is ahead of the target by more than 2 %, and the trim tank quantity is below 3000 kg (6620 lbs), an additional aft transfer will occur. An aft transfer terminates when the :

- Computed CG = Target CG - 0.5 %, or
  - Trim tank high level sensor becomes wet, or
- R    – Inner tank's fuel quantity reaches 6250 kg (13790 lbs), or
- T tank pushbutton is selected FWD, or
  - Fuel transfer from the center or outer tanks to the inner tanks is manually selected.

R    Fuel for trim tank aft transfer is provided by the center TK, when it contains fuel, or by the inner tanks when the center tank is empty. In the latter case, XFEED 2 and 3 valves are open. If, during the transfer, the inner tanks are unbalanced by more than 500 kg (1100 lbs), the transfer will stop on the lightest side, and the related aft transfer valve and XFEED valve will automatically close until fuel balance is restored.

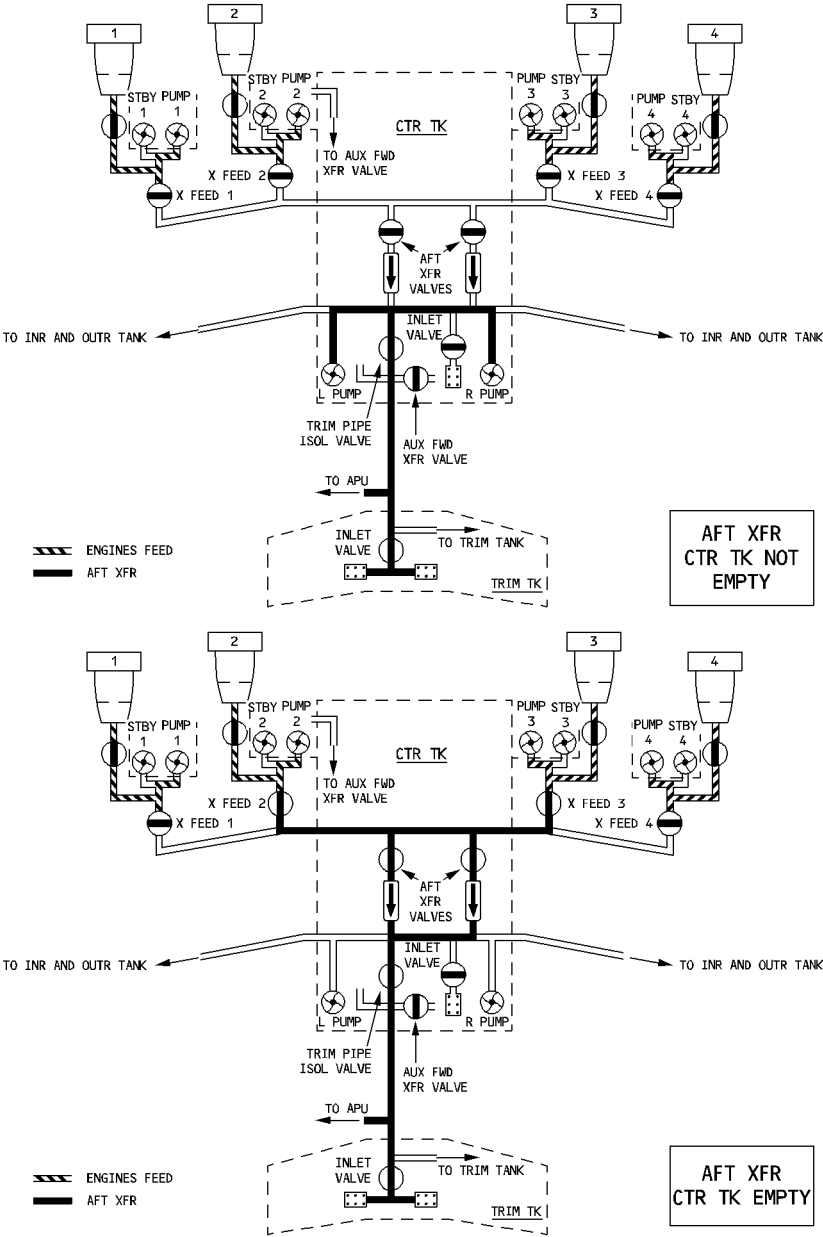
## ECAM INDICATION




AFT FUEL TRANSFER

FOR INFO

R



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## **AUTOMATIC FORWARD FUEL TRANSFER**

The FCMC triggers a forward fuel transfer, if one of the following conditions are met :

- The calculated CG = Target. Forward fuel transfer stops, when the computed CG = The target CG - 0.5 %.
- The fuel content of one of the two inner tanks decreases to 5000 kg (11030 lbs). Forward fuel transfer stops, when the fuel content reaches 6000 kg (13240 lbs).
- The FMGS sends a time-to-destination signal, or the aircraft descends below FL 245. In this case, transfer is continuous, but is controlled by the inner tank high levels to prevent overflow.
- Jettison is initiated.

- R Note : *If the center tank contains fuel and the CG is forward of 32 % MAC, the transfer will be completed in two steps :*
- *When the center tank quantity reaches 17000 kg (37520 lbs), the trim tank is decreased to 2400 kg (5290 lbs).*
  - *When the center tank is empty, the trim tank will be emptied.*

A forward transfer :

- Always occurs by gravity.
  - Is normally directed to the inner tanks, and may be directed to the center tank, if it is not empty.
  - Is directed to the lighter inner tank, if there is an imbalance of 500 kg (1100 lbs) between the two inner tanks.
- R – Is inhibited, when the aircraft pitch exceeds 3.4 degrees for more than one minute.
- R – Restarts, when the aircraft attitude is lower than 3.4 degrees for more than one minute.

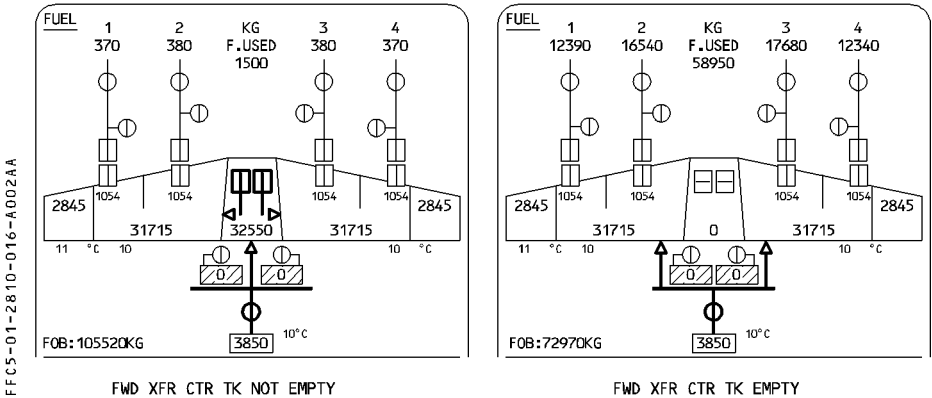
CENTER TANK EMPTY

- Fuel is transferred from the trim tank to the inner tanks.
  - If an inner tank reaches the high level, the related inlet valve closes to prevent tank overflow.
- R
- It reopens when the inner tank quantity reaches 2000 kg (4415 lbs) below high level.

CENTER TANK NOT EMPTY

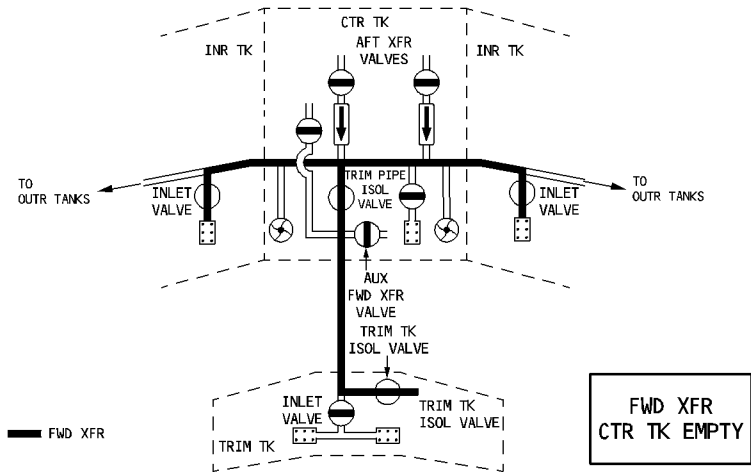
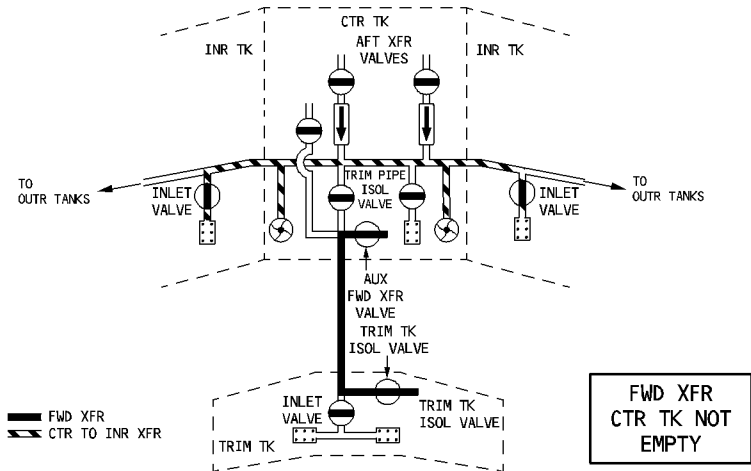
- Fuel is transferred from the trim tank to the center tank.

ECAM INDICATION



# AUTOMATIC FORWARD FUEL TRANSFER

**FOR INFO**



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## MANUAL FORWARD FUEL TRANSFER

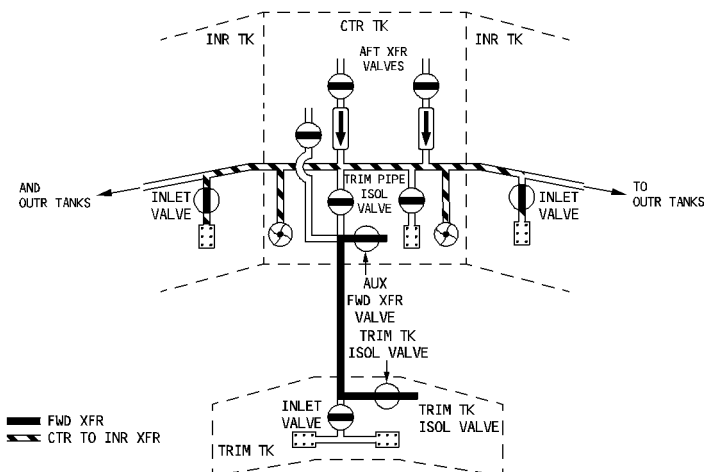
When the T. TANK pushbutton is pressed, the FWD light comes on white, and :

- The TRIM TK ISOL valve opens.
- The AUX FWD XFR valve opens.
- The two AFT XFR valves close.
- The TRIM PIPE ISOL valve closes.


Fuel transfers by gravity from the trim tank to the center tank.

Center tank overflow must be manually prevented, by releasing the pushbutton when the tank is full.

When the T. TANK pushbutton is released, the forward transfer stops.



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## APU FEED

### FWD APU PUMP FEED

The APU is fed from the Engine 2 collector cells (in the left inner tank) through the APU FWD pump and the APU ISOL valve when :

- On the ground after two minutes (except during trim tank refueling), or
- In flight below FL 255, or
- In flight above FL 255, when the trim tank is empty.

In this case, the AFT APU pump is not running.

### AFT APU PUMP FEED

The APU is fed from the trim pipe :

- The first two minutes when on the ground, or
- During trim tank refueling or,
- During an aft transfer.

The APU is fed from the trim tank :

- In flight above FL 255, as long as the trim tank is not empty, or
- During a forward transfer.

In the above cases, the :

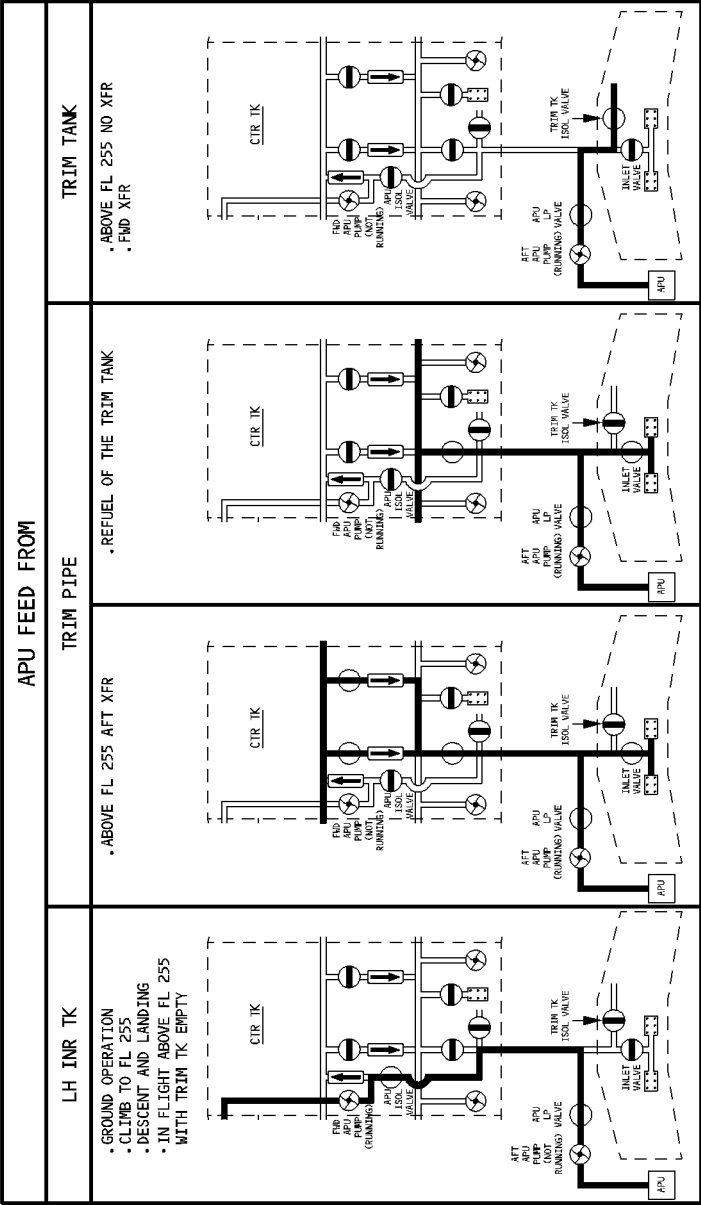
- AFT APU pump is running.
- FWD APU pump is not running.
- APU ISOL valve is closed.

Note : The AFT APU pump will automatically start, in the event of FWD APU pump failure.

**APU FEED**

**FOR INFO**

R



## REFUELING - DEFUELING

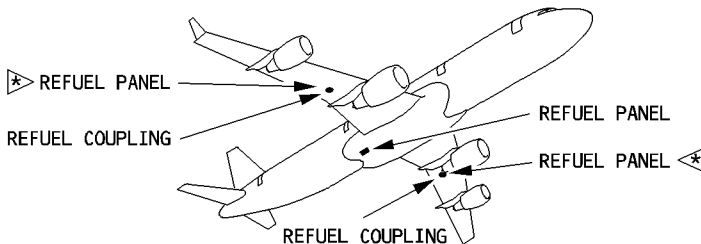
Two refuel couplings are installed under the wings. These couplings allow refueling from both the right and left sides of the aircraft.

A refuel panel is located on the fuselage side, beneath the right wing.

A second and/or third panel ◁ is installed close to the refuel couplings.

A gallery connects the refueling coupling to the fuel inlet valve of each tank.

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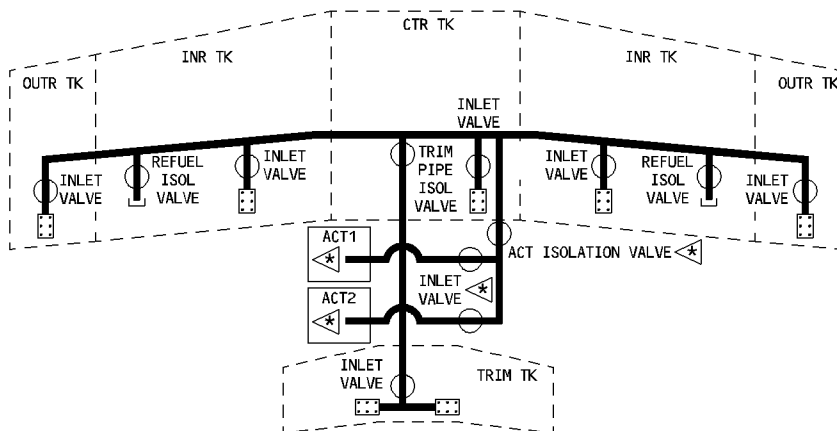


From the cockpit, refueling can be controlled with the refuel pushbutton ◁. Although manual control is possible, it is normally automatic when the required fuel load is set on the preselector. In addition, it is possible to refuel by battery power only.


Any tanks that require refueling start to be refueled simultaneously. Refuel valves automatically close either when the required quantity is reached, or when high level is detected.

Wing tank gravity refueling is achieved via overwing refueling points. If the FCMC is powered, transfer is possible from any tank (with inner or center pumps) to outer, inner or center tanks. When both side couplings are used, refueling time at nominal pressure (50 psi) is approximately 33 minutes for all tanks.

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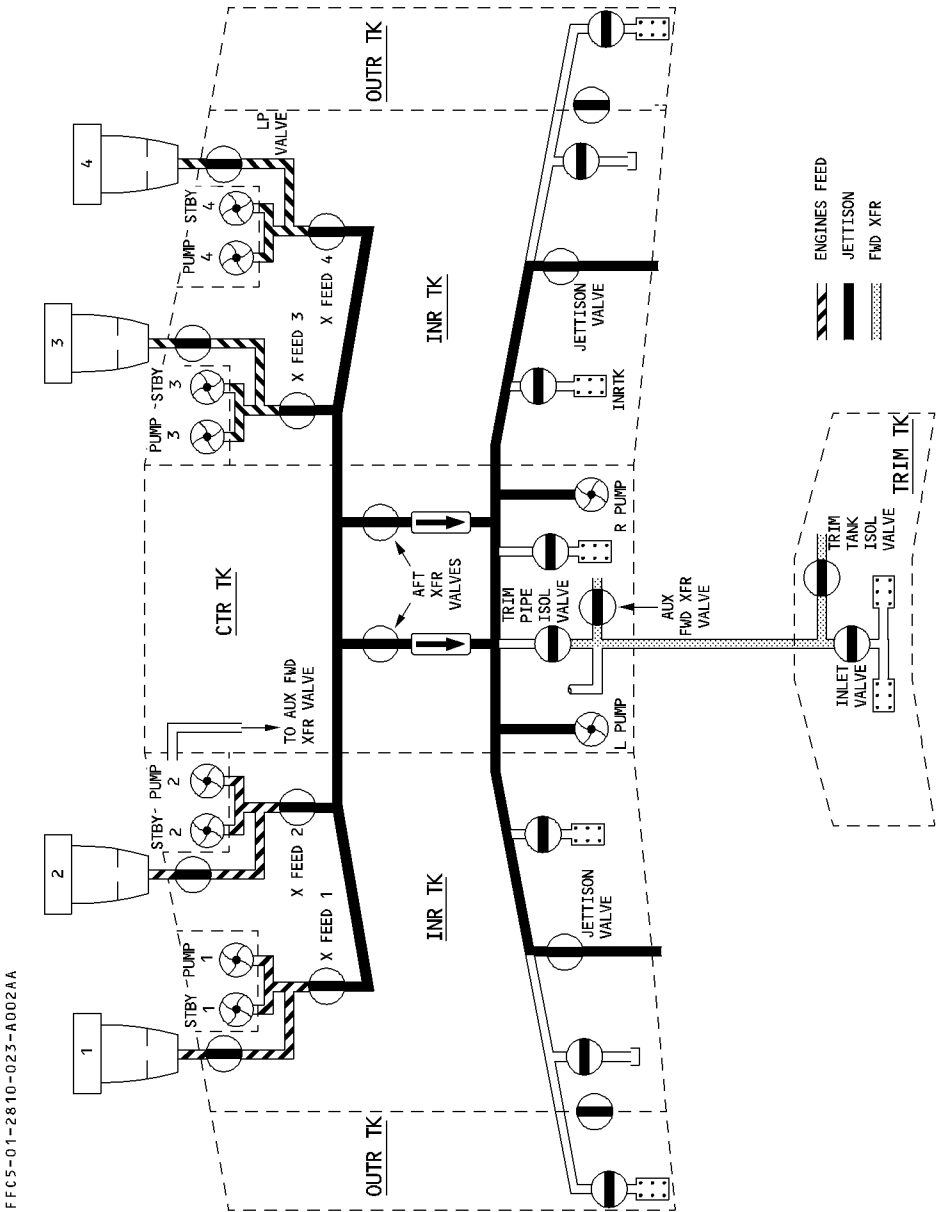




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JETTISON

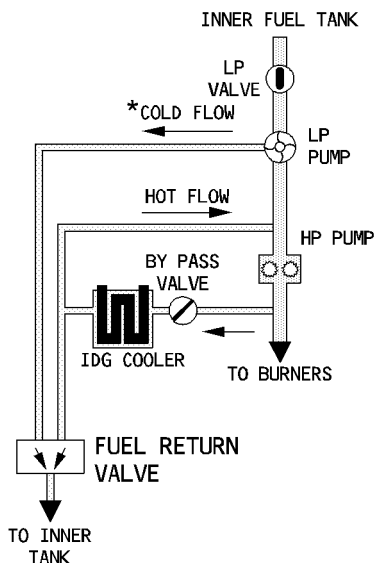
FOR INFO





## FUEL RECIRCULATION SYSTEM

- The inner fuel tanks supply fuel to the four engines.
- Some of this fuel is tapped from the high pressure fuel line of each engine. It goes through the Integrated Drive Generator (IDG) heat exchanger, where it absorbs heat, and continues to the inner fuel tank, via the fuel return valve.
- Fuel recirculation for IDG cooling moves this heated fuel, from the fuel return valve, back to the inner fuel tank. This operation ensures IDG cooling during high temperatures (or at low rates of engine fuel burn).
- The FADEC controls the fuel return valves, based on signals sent by the FCMC (refer to 1.70.40).

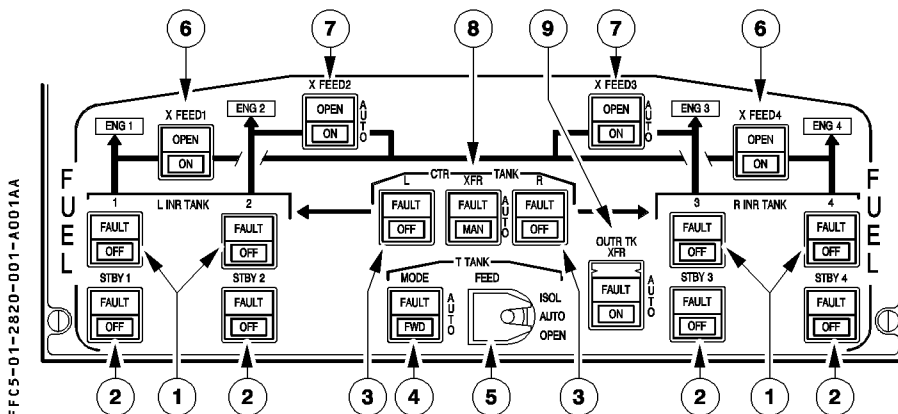


\* THIS COLD FLOW COOLS THE HOT FLOW RETURNING TO THE INNER TANK TO REDUCE RETURNING FUEL TEMPERATURE.

FFCS-01-2810-024-A001A



## OVERHEAD PANEL



## ① L (or R) INR TANK 1 (2) (3) (4) pb

On : Pump is on.

OFF : Pump is off.

FAULT It : The amber light and the ECAM caution come on, when the delivery pressure drops. It is inhibited when off is selected.

## ② L (or R) INR TANK STBY 1 (2) (3) (4) pb

On : Standby pump runs when associated main pump is failed or off.

OFF : Pump is off.

FAULT It : The amber light and the ECAM caution come on, when the delivery pressure drops. It is inhibited when off is selected, or the main pump is running.




### ③ L (or R) CTR TANK pb

- On** : The center tank pump permanently runs. Appropriate valves control the transfer. The pump automatically stops when the tank is empty.
- OFF** : Pump is off.
- FAULT It** : The amber light and the ECAM caution come on when :
- The delivery pressure drops.
  - Or, the trim pipe isolation valve is failed open.
  - Or, a manual transfer from the center tank is required (failure of automatic transfer) and both inner tank quantities are above 17000 kg (37520 lbs).
  - Or, one outer or inner inlet valve is failed open and both inner tank quantities are above 17000 kg (37520 lbs).
- Is inhibited when off is selected.

### ④ T. TANK MODE pb

- AUTO** : The FCMC controls the CG.
- FWD** : Initiates a manual forward transfer to the center tank, by opening :
- The trim tank isolation valve,
  - The auxiliary forward transfer valve,
- And by closing :
- The trim pipe isolation valve,
  - The aft transfer valves.
- Center tank overflow must be manually prevented.
- FAULT It** : The amber light and the ECAM caution come on when :
- The FMGS detects an excess aft CG, based on the THS position (independent of fuel quantity), or
  - The FCMC is unable to carry out the forward transfer.
  - The FUEL LO TEMP warning is triggered.

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### ⑤ T. TANK FEED sel

- AUTO** : Stops the forward transfer when the trim tank is at low level, to maintain the transfer line full.
- ISOL** : The transfer line is isolated as the following valves close :
- trim tank isolation valve
  - trim tank inlet valve
  - auxiliary forward transfer valve
  - trim pipe isolation valve.
- OPEN** : The valves used during a manual forward transfer, and the trim tank inlet valve open. The valves remain open, until 3 minutes after the trim tank is low, to allow drainage of the transfer pipe.

*Note : APU supply is not possible, when the pipe is drained.*

### ⑥ X FEED 1 (4) pb


- AUTO** : Both valves automatically open :
- In electrical emergency configuration
  - Or, during jettison operation.
- ON** : The valve opens.
- OPEN It** : The green light comes on when the valve is fully open.

### ⑦ X FEED 2 (3) pb

- AUTO** : Both valves automatically open :
- In electrical emergency configuration,
  - During jettison operation,
  - During aft transfer from the inner tanks.
- ON** : The valve opens.
- OPEN It** : The green light comes on when the valve is fully open.

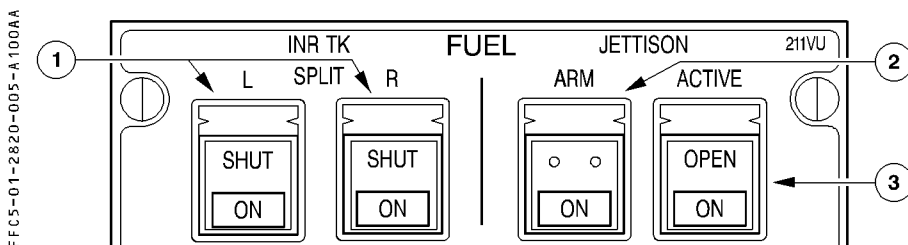
### ⑧ CTR TANK XFR pb

- AUTO** : The FCMC controls the center to inner tank transfer.
- MAN** : Initiates the center to inner tank transfer :
- By opening the inner tank inlet valves,
- To avoid inner tank overflow, the center tank pumps may be selected off.
- FAULT It** : The amber light and the ECAM caution come on when :
- The inner tank low level is reached and the center tank is not empty or,
  - The FCMC is unable to carry out the transfer to the inner tanks.

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⑨ OUTR TANK XFR pb (guarded)

- AUTO** : The FCMC controls the outer to inner tank transfer.
- ON** : Initiates the outer to inner tank transfer by opening the :
- Outer transfer valves,
  - Outer inlet valves,
  - Inner inlet valves.
- FAULT It** : The amber light and the ECAM caution come on when :
- The inner tank low level is reached and the center tank is not empty, or
  - The FCMC is unable to carry out the transfer to the inner tanks.
  - The FUEL LO TEMP warning is triggered.



① INR TK SPLIT L (or R) pb (guarded)

**Off** : The split valve (inner tank division) is open.

The inner tank is used as a single tank.

**ON** : The valve closes and the inner tank is split into two parts.

– The forward part feeds the inboard engine.

– The aft part feeds the outboard engine and receives any fuel transferred to the inner tank from the center, outer or trim tank.

The light comes on white.

**SHUT** : The light comes on blue, when the valve is shut.

– During refueling, whenever the first inner tank high level sensor becomes wet, the valve closes.

– The valve reopens at the end of refueling.

② JETTISON ARM pb (guarded in Off)

**Off** : Jettison is disarmed.

**ON** : Jettison is armed and can be activated via the ACTIVE pushbutton.

③ JETTISON ACTIVE pb (guarded in Off)

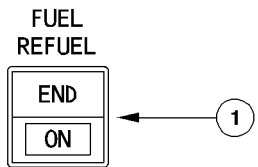
**Off** : Jettison is inactive.

**ON** : Jettison is activated, provided the ARM pushbutton is set to ON.

**OPEN It** : Comes on when the jettison valves are open.

**MAINTENANCE PANEL** 

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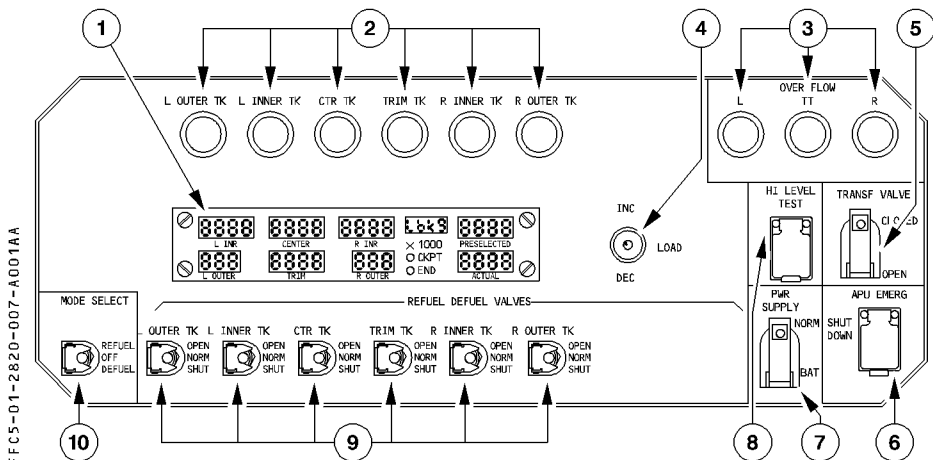


R **① REFUEL pushbutton**

- ON : Refueling is initiated according to the BLOCK FUEL quantity displayed on the FMGS MCDU INIT B page.
  - END It : Indicates that refueling is completed.
- R Flashes when refueling is aborted, or when the high level test is negative.



## REFUELING CONTROL PANEL




### ① FUEL QUANTITY indicator

Displays, in kg (or lbs)  $\times 1000$  :

- The fuel quantity of each tank.
  - The pre-selected total quantity. At electrical power up (or FCMC reset), the display shows the ACTUAL value minus 500 kg (1100 lbs). Otherwise, the last pre-selected value is displayed.
  - The actual total fuel on board.
  - The applicable units (kg or lbs).
  - The CKPT light : Comes on when a BLOCK FUEL value has been entered and confirmed on the cockpit MCDU.
  - The END light, which flashes when :
    - There is an imbalance greater than 3000 kg (6620 lbs), after refueling.
    - A failure is detected during a high level test.
    - Refueling is aborted.
- Once refueling is finished, the END light stays on.

### ② HI LVL It

- Comes on blue, when high level is detected (i.e. both high level sensors are wet).
- The corresponding refuel valve automatically closes.

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### ③ OVERFLOW It

- Comes on amber, when the associated vent tank overflow sensor is covered with fuel.

### ④ INC / DEC preselector rocker sw

- Pressing either side of the switch increases or decreases the preselected quantity.

### ⑤ TRANSF VALVE sw (guarded in CLOSED)

- CLOSED : Transfer valves are closed.  
 OPEN : If the inner tank pumps are on for ground transfer, the aft transfer valves open. The trim tank inlet valve closes.

### ⑥ APU EMER pb (guarded)

When pressed, it initiates the APU shutdown sequence.

### ⑦ POWER SUPPLY sw (guarded in NORM)

- NORM : Refueling / Defueling can be supplied either by external power or with the APU generator on line.  
 BAT : Refueling / Defueling is battery-powered.

### ⑧ HI LEVEL TEST sw (guarded)

During the test :

- Refueling stops.
- HI LEVEL and OVERFLOW lights come on, if their circuits are serviceable.
- CKPT and END lights come on.
- The PRESELECTED and ACTUAL fuel quantity display all 8s.

If a failure occurs during the high level test :

- The END light flashes and remains flashing after completion.
- The affected HI LVL light remains on.

### ⑨ REFUEL / DEFUEL VALVES sel (guarded in NORM)

- NORM : Refuel / Defuel valves are automatically controlled.  
 OPEN : Valves open when the MODE SELECT switch is set to the REFUEL or DEFUEL position. In the REFUEL position, each refuel/defuel valve closes when high level is detected in the associated tank.  
 SHUT : Valves close.



**② Total fuel used indication**

- It is normally green.
- When either “engine fuel used” is crossed, two amber bars appear across the value.
- Units may either be in KG or LB, depending on the DMC pin program.

**③ Fuel quantity indication**

- It is normally green.
- When the fuel quantity indication is inaccurate, two amber bars appear across the last two digits.
- If the fuel is unusable (trim or outer tanks only), the quantity indication is displayed in an amber box.
- A partial amber box appears, if 15 tonnes of the center tank fuel is unusable.
- The fuel quantity indication becomes amber, in case of low level (inner tank only) or overflow.
- In the event of imbalance of more than 3 000 kg (6622 lbs) between the left and right wing tanks, fuel quantity pulses in the inner and outer tanks.
- Units may either be in KG or LB, depending on the DMC pin program.

**④ Collector cell fuel quantity indication**

- It is normally green.
- When the fuel quantity indication is inaccurate, two amber bars appear across the last two digits.
- Units may either be in KG or LB, depending on the DMC pin program.

**⑤ Fuel on board quantity indication**

- It is normally green.
- In case of degraded accuracy, the last two digits are dashed.

*Note : In case any tank's fuel is partially unusable, the quantity indication is displayed in a partial amber box.*

**⑥ Gross weight indication**

- It is normally green.
- When the fuel quantity indication is inaccurate, two amber bars appear across the last two digits.
- When the gross weight is not computed on ground, blue dashes appear.
- Units may either be in KG or LB, depending on the DMC pin program.

### ⑦ Center of gravity indication

- It is normally green.
- When the FMGC (FE part) detects an excess aft CG, it comes on red.
- When the CG is not computed on ground, blue dashes appear.

### ⑧ Fuel temperature indication

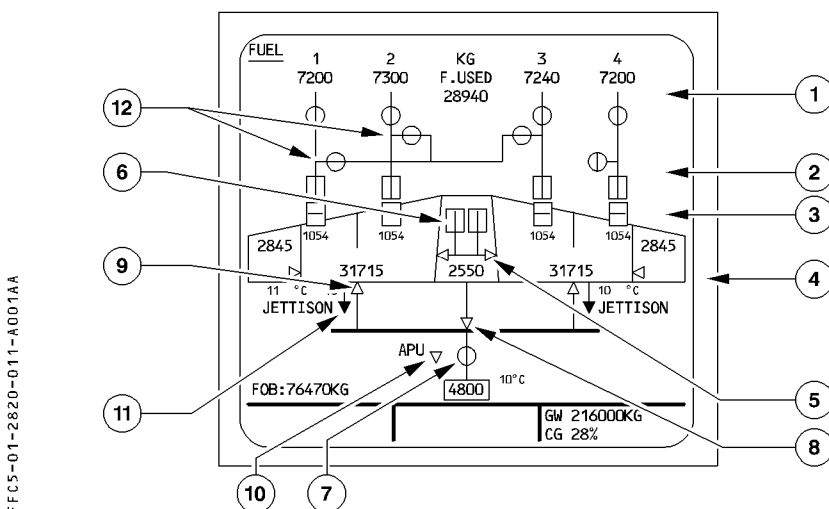
- It is normally green.
- It is amber in the following cases :
  - Inner tanks : Above 49°C in flight, or 45°C on ground.
  - Outer or trim tanks : Below – 40°C.
  - Inner tanks : Below – 35°C.
- It disappears when the tank quantity is below :
  - 1000 kg (2200 lbs) for the trim tank.
  - 1100 kg (2420 lbs) for the outer tank.

*Note : Fuel temperature is not indicated for the right outer tank.*

### ⑨ Engine number

- It is white when the engine is running.
- It is amber when the engine is not running.

## FUEL FEED, TRANSFER AND JETTISON INDICATIONS



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### ① Engine LP valves indication

- In line – Green : Valve is open.
- In line – Amber : Valve is jammed open.
- Cross line – Amber : Valve is closed.
- Transit – Amber : Valve is in transit.

### ② Engine feed pumps indication

- In line – Green : Pump is running.
- In line – Amber : Pump abnormally running.
- Cross line – Amber : Pump not running.
- "LO" – Amber : Pump pressure is low. Pump is on.

### ③ Stand-by engine feed pumps indication

Are identical to the normal pump, except for pump not running.

- Cross line – Green : Pump not running.
- Cross line – Amber : Pump abnormally not running.

### ④ Outer to inner transfer indication

- ▷ Green : Normal transfer (auto).
- ▶ Green : Manual transfer.
- ▶ Amber : Abnormal transfer.
- No display : No transfer.

### ⑤ Center to inner transfer indication

Identical to the transfer from outer tanks.


### ⑥ Center tank pumps indication

Identical to the standby wing tank pumps.

### ⑦ Trim tank isolation indication

This valve represents the trim tank isolation valve and the trim tank inlet valve.

- In line – Green : One valve is open.
- Cross line – Green : Both valves are closed.
- In line – Amber : One valve is abnormally open.
- Cross line – Amber : Both valves are jammed closed.

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⑧ Trim to center transfer indication

No display : No transfer.  
 Green : Manual forward (↑) transfer.  
 Green : Normal aft (↓) or forward (↑) transfer (auto).  
 Amber : Abnormal aft (↓) or forward (↑) transfer.

⑨ Trim to inner transfer indication

No display : No transfer.  
 Green : Normal aft (↓) or forward (↑) transfer.  
 Amber : Abnormal aft (↓) or forward (↑) transfer.  
 If fuel transfers to/from only one inner tank due to a fuel imbalance, only one arrow is displayed.

⑩ APU LP valve indication


APU (White) ▽ (White) : Valve is closed.  
 APU (White) ▽ (Green) : Fuel provided to the APU.  
 APU (Amber) ▼ (Amber) : Failed open.  
 APU (amber) : Failed closed.

⑪ Jettison indication

No display : No jettison.  
 ↓ JETTISON (Green) : Jettison normally active.  
 ↓ JETTISON (Amber) : Abnormal jettison (valve jammed open).  
 JETTISON (Amber) : Valve failed closed.

⑫ X-Feed valve

Cross line – Green : Valve is closed.  
 In line – Green : Valve is open.  
 Cross line – Amber : Valve is jammed closed.  
 In line – Amber : Valve is jammed open.  
 Transit – Amber : Valve is in transit.

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LEFT INTENTIONALLY BLANK



## ECAM UPPER DISPLAY

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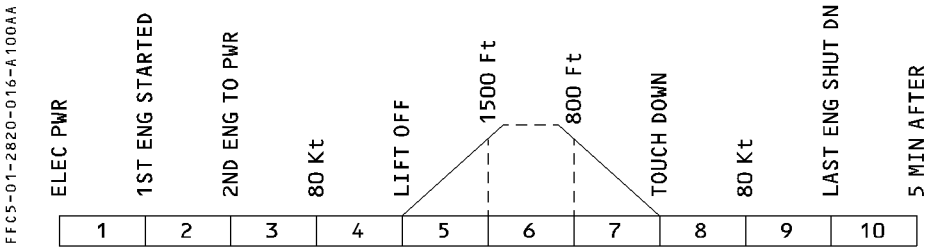
①

FOB: 80000 KG


### ① FOB - Fuel on Board indication

- It is normally green.
- An amber half box appears around FOB, when the indicated quantity is not fully usable.
- When the fuel quantity indication is inaccurate, two amber lines appear across the last two digits.
- Units may be indicated in kg or lbs.

WARNINGS AND CAUTIONS



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB	
EXCESS AFT CG	CRC	MASTER WARN	FUEL	T TK XFR FAULT It	2 to 4, 8 to 10	
PUMPS 1(2)(3)(4) + STBY LO PR Dual pump failure in one collector cell	SINGLE CHIME	MASTER CAUT		PUMP and STBY PUMP FAULT Its	1, 3, 4 5, 7, 8, 10	
L(R) WING PUMPS LO PR All pumps of the same wing low pressure				associated PUMP FAULT Its	4, 5, 7, 8	
L + R CTR PUMPS LO PR				NIL		4, 5, 7, 8
ENG 1(2)(3)(4) LP VALVE FAULT valve disagree						3 to 8
ZFW ZFCG DISAGREE Disagree between the pilot entered values and the FCMC values						4, 5, 7, 8
JETTISON NOT CLOSED valve disagree in open position						3 to 5 7 to 9
JETTISON FAULT One wing tank low level sensor is failed.	NIL	NIL			3, 4, 5, 7, 8, 9	
L(R) WING TK LO LVL Both level sensors of one inner tank have been dry for more than 60 seconds (Fuel quantity below 2700 kg/5952 lbs).	SINGLE CHIME	MASTER CAUT			3, 4, 5, 8	
L + R WING TK LO LVL All of the four level sensors in the inner tanks have been dry for more than 60 seconds (Fuel quantity in each tank below 2700 kg /5952 lbs).						
WING TK OVERFLOW One of the wing surge-tank overflow sensors has been wet for more than 25 seconds.				CTR XFR + PUMP FAULT It	3, 4, 5, 7, 8	
CTR TO INNER FAULT In case an anomaly is detected during CTR to INR XFR or an inlet valve of INR, OUTR tank is failed open					4, 5, 7, 8	
OUTR TO INR FAULT				OUTR TK XFR It	3, 4, 5 7, 8	
T TANK XFR FAULT				TRIM TK FAULT It		
APU LP VALVE FAULT Valve disagree				NIL		

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E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB	
FCMC 1 + 2 FAULT Loss of automatic control of XFR	SINGLE CHIME	MASTER CAUT	FUEL	NIL	4, 5, 8	
TRIM LINE FAULT Damage on the trim line or in case of trim tank isolation failure.				OUTR and TRIM TK FAULT It	3, 4, 5, 7, 8	
FUEL LO TEMP Inner fuel temp < -35°C Outer fuel temp < -40°C Trim fuel temp < -40°C				NIL		
L(R) INR TK HI TEMP Inner fuel temp > 49°C in flight Inner fuel temp > 45°C on ground				associated PUMP FAULT It		
PUMP 1(2)(3)(4) LO PR	NIL	NIL			NIL	
L(R) CTR PUMP LO PR						
APU AFT PUMP FAULT						
X FEED 1 (2)(3)(4) FAULT Valve disagree						
FCMC 1(2) FAULT	SINGLE CHIME	MASTER CAUT			NIL	1, 2, 3, 9,10
ABNORM MAN FWD XFR pitch attitude above 3.4° for more than 30 seconds and T TANK MODE pb selected FWD or TRIM TANK FEED sel selected OPEN						1, 3, 4, 5, 7, 8, 10
MAN XFR COMPLETED manual XFR selected ON and center or outer tank emptied						NIL
NO WEIGHT/CG DATA no data inserted on INIT B page at engine start			NIL			

MEMO DISPLAY

- REFUEL IN PROCESS message is displayed in green in phases 1 and 10, if the refuel panel switches are not set in the appropriate position for flight.
- REFUEL PNL message is displayed in amber in phase 2 (after engine start) if the refuel panel or the cockpit refuel pushbutton (◀) are not set in the appropriate position for flight.
- T TK XFRD message is displayed in flight phases 6, 7, 8, 9 when the trim tank has been emptied following a forward transfer.
- TRIM TK XFR message is displayed in green during trim tank transfer.
- OUTR TK XFRD message is displayed in green when the outer tank has been transferred into the inner tank.
- OUTR TK XFR message is displayed in green during outer tank transfer into the inner tank.
- FUEL X FEED message is displayed in green when at least two adjacent X Feed valves are open (automatically or manually). It becomes amber during takeoff (phases 3, 4, 5).

## BUS EQUIPMENT LIST

**FOR INFO**

			NORM			EMER ELEC		
			AC	DC	DC BAT	AC ESS	DC ESS	HOT
FCMC	1	Main					SHED	
		Level Sensing				SHED		
	2	Main		DC2				X (1)
		Level Sensing					SHED	
INNER TANK PUMPS	1					X (3)	X	
	2		AC1-2	DC1				
	3		AC2-3	DC2				
	4		AC2-4	DC2				
	STBY 1		AC2-3	DC2				
	STBY 2		AC2-4	DC2				
	STBY 3		AC1-2	DC1				
STBY 4			DC1 (2)		X (3)	X (2)		
TRIM TK FWD XFR PUMP ◀			AC2-3	DC2				
CTR TK TRANSFER PUMPS	1		AC1-2	DC1				
	2		AC2-3	DC2				
CROSS FEED VALVES	MOTOR 1						X	
	MOTOR 2			DC2				
ENGINE LP VALVES	MOTOR 1							X
	MOTOR 2			DC2				
AFT XFR VALVES	LH			DC1				
	RH			DC2				
TRIM TK ISOL VALVE							X	
TRIM PIPE ISOL VALVE							X	X (1)
AUX FWD XFR VALVE							X	
OUTR TK XFR VALVES							X	

(1) HOT BUS supply during refueling on batteries

(2) Normal control is from DC1.

*In emergency configuration, if the normal PUMP 1 is failed or switched OFF, then control of STBY PUMP 4 is automatically switched to DC ESS BUS.*

(3) This supply is lost in emergency configuration :

- On batteries ;
- If the EMER GEN is powered by the RAT, when LAND RECOVERY is selected, or when the speed is below 260 knots (whichever occurs first) ;
- If the EMER GEN is powered by an engine-driven pump, when LAND RECOVERY is selected.

R

		NORM			EMER ELEC		
		AC	DC	DC BAT	AC ESS	DC ESS	HOT
TANK INLET VALVES	TRIM TK					X	X (1)
	LH OUTR		DC1				
	RH OUTR		DC1				
	LH INR		DC1				
	RH INR					X	X (1)
	CTR		DC2				X (1)
APU	AFT PUMP				X (2)		X (1)
	FWD PUMP	AC1-1					
	ISOL VALVE						X
	LP VALVE			X			X
JETTISON VALVES L AND R	MOT 1		DC1				
	MOT 2		DC1				
REFUEL VALVES				X			X (1)

- (1) HOT BUS supply during refueling on batteries
- (2) This supply is lost in emergency configuration :
- On batteries ;

– If EMER GEN is powered by the RAT, when LAND RECOVERY is selected, or when the speed is below 260 knots (whichever occurs first) ;

– If EMER GEN is powered by an engine-driven pump, when LAND RECOVERY is selected.