

B777



Fuel

DO NOT USE FOR FLIGHT

Introduction

[777-200, 777-200ER, 777-200LR w/o aux tank, 777-300, and 777-300ER]

The fuel system supplies fuel to the engines and the APU. The fuel is contained in a center tank, and left and right main tanks.

[777-200LR with aux tank]

The fuel system supplies fuel to the engines and the APU. The fuel is contained in a center tank, left and right main tanks, and an auxiliary tank.

Refer to Chapter 7, Engines, APU, for a description of the engine and APU fuel systems.

Fuel Quantity

Fuel quantity is measured by sensors in each tank. Total fuel quantity is displayed on the primary EICAS display. Tank quantities and total fuel quantity are displayed on the FUEL synoptic display.

[777-200, 777-200ER, 777-200LR w/o aux tank, 777-300, and 777-300ER]

Expanded fuel indications showing the left main, center, and right main tank quantities are displayed when non-normal conditions occur.

[777-200LR with aux tank]

Expanded fuel indications showing the left main, center, right main, and auxiliary tank quantities are displayed when non-normal conditions occur.

Fuel Temperature

Fuel temperature is displayed on the primary EICAS display. The temperature is normally displayed in white. It is displayed in amber when the fuel temperature approaches the fuel freeze temperature entered on the flight management system CDU. During jettison, the TO REMAIN quantity replaces the EICAS display fuel temperature indication.

Fuel temperature and minimum fuel temperature are also displayed on the fuel synoptic display.

Fuel Pumps

Each fuel tank contains two AC-powered fuel pumps. A single pump can supply sufficient fuel to operate one engine under all conditions.

The two center tank fuel pumps are override/jettison pumps. These pumps have a higher output pressure than the left and right main tank fuel pumps. The center tank pumps override the main tank pumps so that center tank fuel is used before wing tank fuel. The center tank fuel pumps will shut off automatically after 15 seconds of continuous low pressure. The auto-shutoff feature is disabled during jettison.

[777-200, 777-200ER, 777-200LR w/o aux tank, 777-300, and 777-300ER]

When the main tank fuel pump switches are off, the switch PRESS lights illuminate and the EICAS advisory messages FUEL PUMP (L, R, FWD, or AFT) display. When the center fuel pump switches are off, the switch PRESS lights and pump pressure EICAS messages are inhibited.

[777-200LR with aux tank]

The auxiliary tank contains one AC-powered fuel pump. Air pressure is used to transfer auxiliary fuel to the center tank if the AC-powered pump is inoperative.

[777-200LR with aux tank]

When the main tank fuel pump switches are off, the switch PRESS lights illuminate and the EICAS advisory messages FUEL PUMP (L, R, FWD, or AFT) display. When the center fuel pump and auxiliary switches are off, the switch PRESS lights and pump pressure EICAS messages are inhibited.

On the ground, both center fuel pumps operate only when two electrical power sources are available. With only one power source available and the center fuel pump switches on, the switch PRESS light on the non-powered side is illuminated and the pump pressure EICAS message is inhibited.

The left main tank contains a DC-powered fuel pump. It has no controls or indicators, other than the fuel synoptic display. The DC pump operates automatically to provide fuel to the APU when AC power is not available and the APU selector is ON.

Surge tanks are provided in each wing, outboard of each main tank. Fuel in the surge tanks and fuel remaining in the refueling manifold is drained into the main tanks.

Fuel Pump Operations

Before start, the main tank pump switches should all be pushed ON.

[Option – English Units, 777-200, with pump logic revision]

Before start, with center tank quantity more than 7,500 pounds, the center tank pump switches should be pushed ON.

[Option – Metric Units, 777-200, with pump logic revision]

Before start, with center tank quantity more than 3,400 kilograms, the center tank pump switches should be pushed ON.

[Option – English Units, all models except 777-200, with pump logic revision]

Before start, with center tank quantity more than 10,500 pounds, the center tank switches should be pushed ON.

[Option – Metric Units, all models except 777-200, with pump logic revision]

Before start, with center tank quantity more than 4,800 kilograms, the center tank switches should be pushed ON.

[All models]

During flight, when the FUEL IN CENTER message displays the center tank pump switches should be pushed ON, when the FUEL LOW CENTER message displays the center tank pump switches should be pushed off. The condition statements for these messages are contained in Section 12.30, Fuel System EICAS Messages.

[All models]

If a center pump has low output pressure, the fuel pump switch PRESS light illuminates and the message FUEL PUMP CENTER (L or R) displays.

[Option – English Units, 777-200]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 20,000 pounds. Center tank quantity must be below 8,500 pounds.

[Option – Metric Units, 777-200]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 9,100 kilograms. Center tank quantity must be below 4,100 kilograms.

[Option – English Units, 777-200ER(IGW), and 777-300]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 29,000 pounds. Center tank quantity must be below 35,000 pounds.

[Option – Metric Units, 777-200ER(IGW), and 777-300]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 13,100 kilograms. Center tank quantity must be below 15,900 kilograms.

[Option – English Units, 777-200LR, and 777-300ER]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 52,600 pounds. Center tank quantity must be below 35,000 pounds.

[Option – Metric Units, 777-200LR, and 777-300ER]

With the main tank pumps ON, a scavenge system operates automatically to transfer any remaining center tank fuel to the main tanks. Fuel transfer begins when either main tank quantity is less than 23,900 kilograms. Center tank quantity must be below 15,900 kilograms.

Suction Feed

When main tank fuel pump pressure is low, each engine can draw fuel from its corresponding main tank through a suction feed line that bypasses the pumps. As the airplane climbs, dissolved air is released from the fuel in the tank due to the decrease in air pressure. This air may collect in the suction feed line and restrict fuel flow. At high altitude, thrust deterioration or engine flameout may occur as a result of the fuel flow reduction.

The dissolved air in the fuel tank will eventually deplete after reaching cruise altitude. The depletion time is dependent upon airplane altitude, fuel temperature, and type of fuel. Once the dissolved air is depleted, the engine should effectively operate on suction feed.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valve(s). Continued crossfeed use will result in a progressive fuel imbalance.

Fuel Crossfeed

The fuel manifolds are arranged so that any fuel tank pump can supply either engine. The crossfeed valves are closed during normal operations. The closed crossfeed valves isolate the left and right systems. Either valve can be opened to feed an engine from the opposite fuel tank. If the valve position does not agree with the switch position, the CROSSFEED switch VALVE light illuminates and the EICAS advisory message FUEL CROSSFEED FWD or AFT displays.

Fuel Imbalance

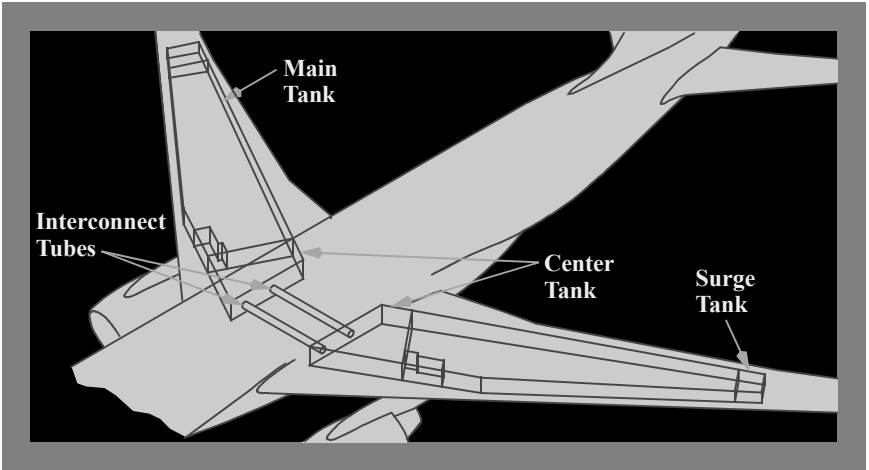
When the fuel quantity in left and right main tanks differ by an excessive quantity, the EICAS alert message FUEL IMBALANCE displays.

Fuel balancing is accomplished by opening either crossfeed valve and turning off the fuel pump switches for the fuel tank that has the lowest quantity. Fuel balancing may be done in any phase of flight.

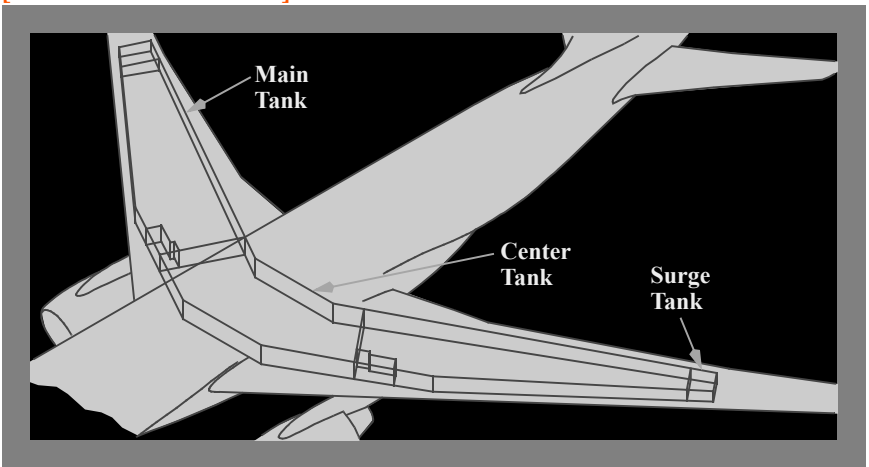
Fuel Tank Locations and Capacities

Fuel Tank Locations

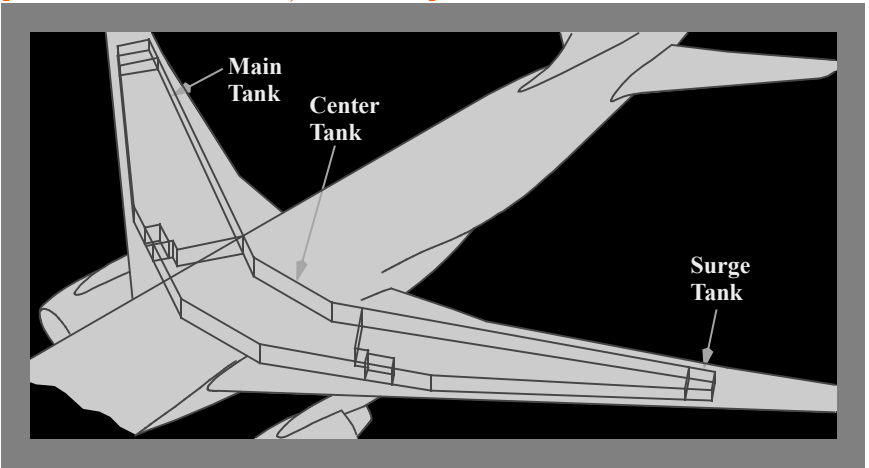
[777-200]



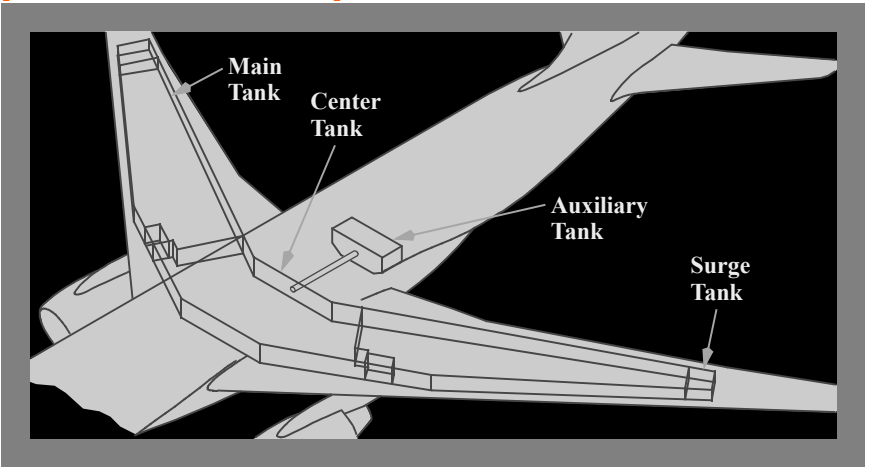
[777-200ER and 777-300]



[777-200LR w/o aux tank, 777-300ER]



[777-200LR with one aux cell]



Fuel Tank Capacities

[Option – English Units, 777-200]

Tank	Gallons	Pounds *
Left Main	9,300	62,300
Right Main	9,300	62,300
Center	12,400	83,100
Total	31,000	207,700

* Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.

[Option – Metric Units, 777-200]

Tank	Liters	Kilograms *
Left Main	35,200	28,300
Right Main	35,200	28,300
Center	46,900	37,700
Total	117,300	94,300

* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.

[Option – English Units, 777-200ER and 777-300]

Tank	Gallons	Pounds *
Left Main	9,560	64,100
Right Main	9,560	64,100
Center	26,100	174,900
Total	45,220	303,100

*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.

[Option – Metric Units, 777-200ER and 777-300]

Tank	Liters	Kilograms *
Left Main	36,200	29,100
Right Main	36,200	29,100
Center	98,790	79,300
Total	171,190	137,500

* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.

[Option – English Units, 777-200LR w/o aux tank, 777-300ER]

Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Total	47,890	320,800
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[Option – Metric Units, 777-200LR w/o aux tank, 777-300ER]

Tank	Liters	Kilograms *
Left Main	38,990	31,300
Right Main	38,990	31,300
Center	103,290	82,900
Total	181,270	145,500
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

[Option – English Units, 777-200LR, one aux cell]

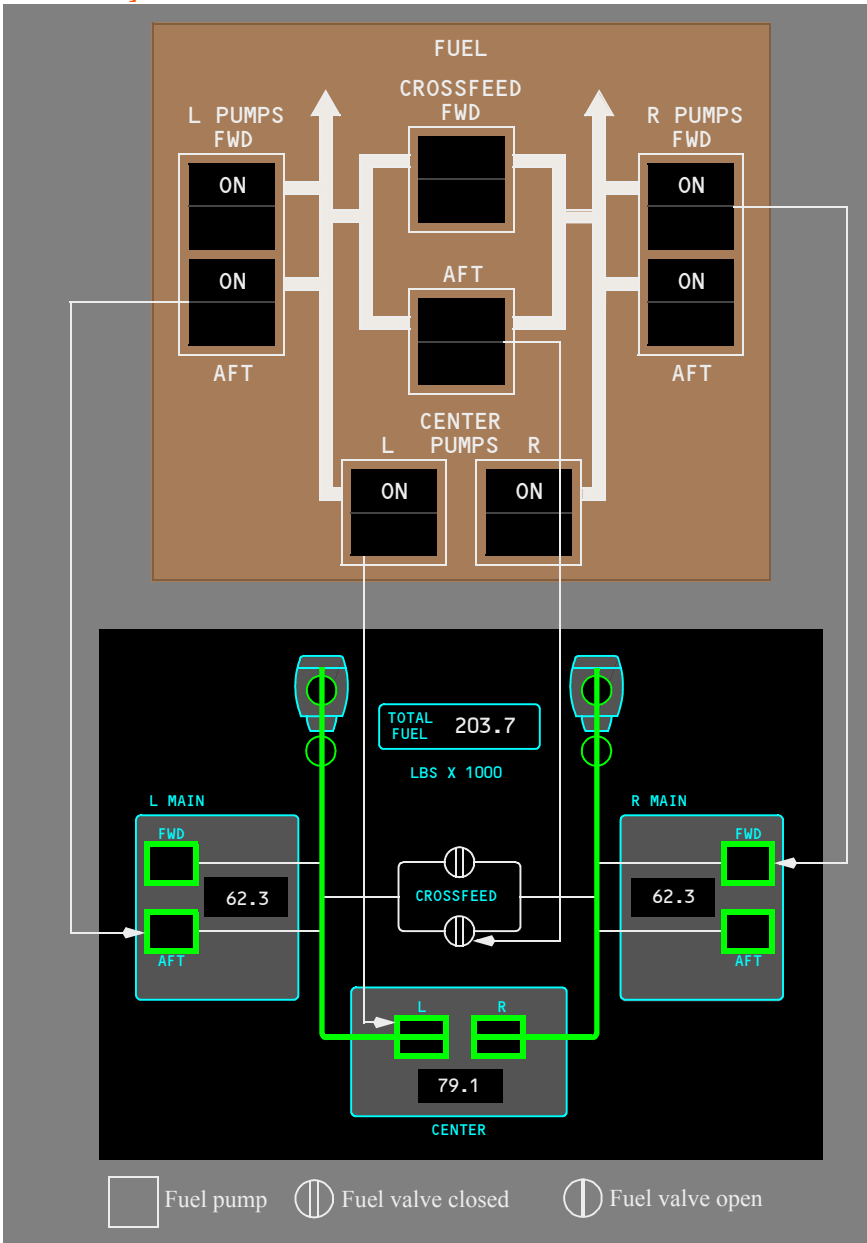
Tank	Gallons	Pounds *
Left Main	10,300	69,000
Right Main	10,300	69,000
Center	27,290	182,800
Auxiliary	1,875	12,600
Total	49,765	333,400
*Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon.		

[Option – Metric Units, 777-200LR, one aux cell]

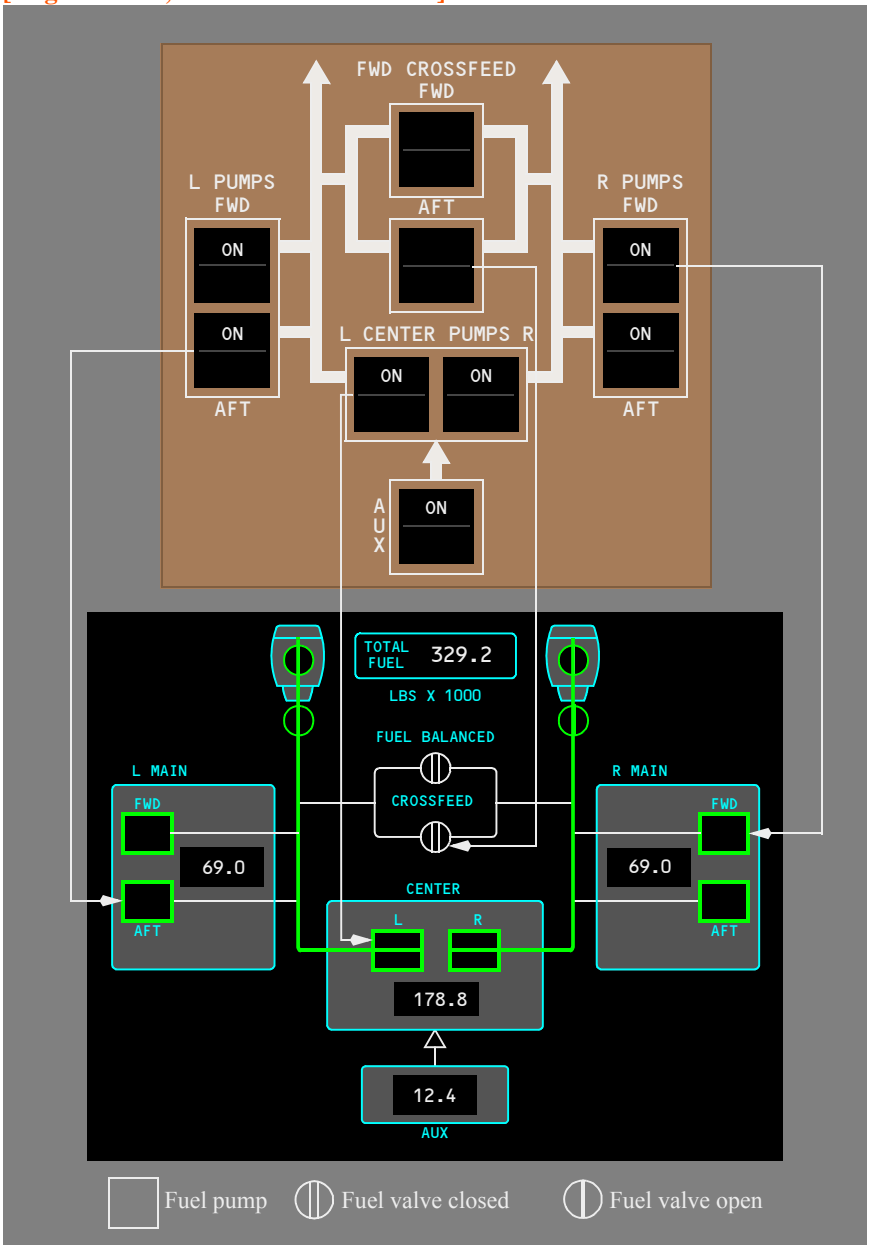
Tank	Liters	Kilograms *
Left Main	38,990	31,300
Right Main	38,990	31,300
Center	103,290	82,900
Auxiliary	7,100	5,700
Total	188,370	151,200
* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter.		

Fuel System Schematic

[English Units, 777-200, 777-200ER, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[English Units, 777-200LR w aux tank]



APU Fuel Feed

APU fuel is supplied from the left fuel manifold. APU fuel can be provided by any AC fuel pump supplying fuel to the left fuel manifold or by the left main tank DC fuel pump.

On the ground, with the APU switch ON and no AC power available, the DC pump runs automatically. With AC power available, the left forward AC fuel pump operates automatically, regardless of fuel pump switch position, and the DC fuel pump turns off.

In flight, the DC fuel pump operates automatically for quick left engine relight with the loss of both engines and all AC power.

Fuel Jettison

The fuel jettison system allows jettison from all fuel tanks. Fuel is jettisoned through jettison nozzle valves inboard of each aileron. Jettison pumps in the main tanks and override/jettison pumps in the center tank pump fuel overboard through the jettison nozzle valves.

Fuel jettison is initiated by pushing the FUEL JETTISON ARM switch to select ARMED. The jettison system automatically sets the fuel-to-remain to the maximum landing weight (MLW) fuel quantity. The TO REMAIN quantity replaces fuel temperature on the EICAS display.

Pull on and rotate the FUEL TO REMAIN selector to manually decrease or increase the TO REMAIN quantity.

Main tank jettison begins when:

- the FUEL JETTISON NOZZLE switches are pushed ON
- the jettison nozzle valves open, and
- the main tank jettison pumps operate.

If the center tank override/jettison pumps are on, center tank fuel also jettisons. Center tank fuel will not jettison if the center tank override/jettison pumps are off.

The nozzles cannot open on the ground, regardless of switch positions.

In flight, jettison time is displayed in minutes on the fuel synoptic when the jettison arm switch is positioned on while in the air. Jettison automatically stops when a value just above the TO REMAIN quantity is reached. The system shuts off the main tank jettison pumps and closes the center tank jettison isolation valves.

[777-200ER, 777-300, 777-200LR, and 777-300ER]

When the airplane is heavy and loaded near the forward CG, fuel is jettisoned from the center tank first to keep CG within limits; main tank jettison pump operation is delayed. The computed jettison time is automatically adjusted to reflect the increased jettison time.

[Option – English Units]

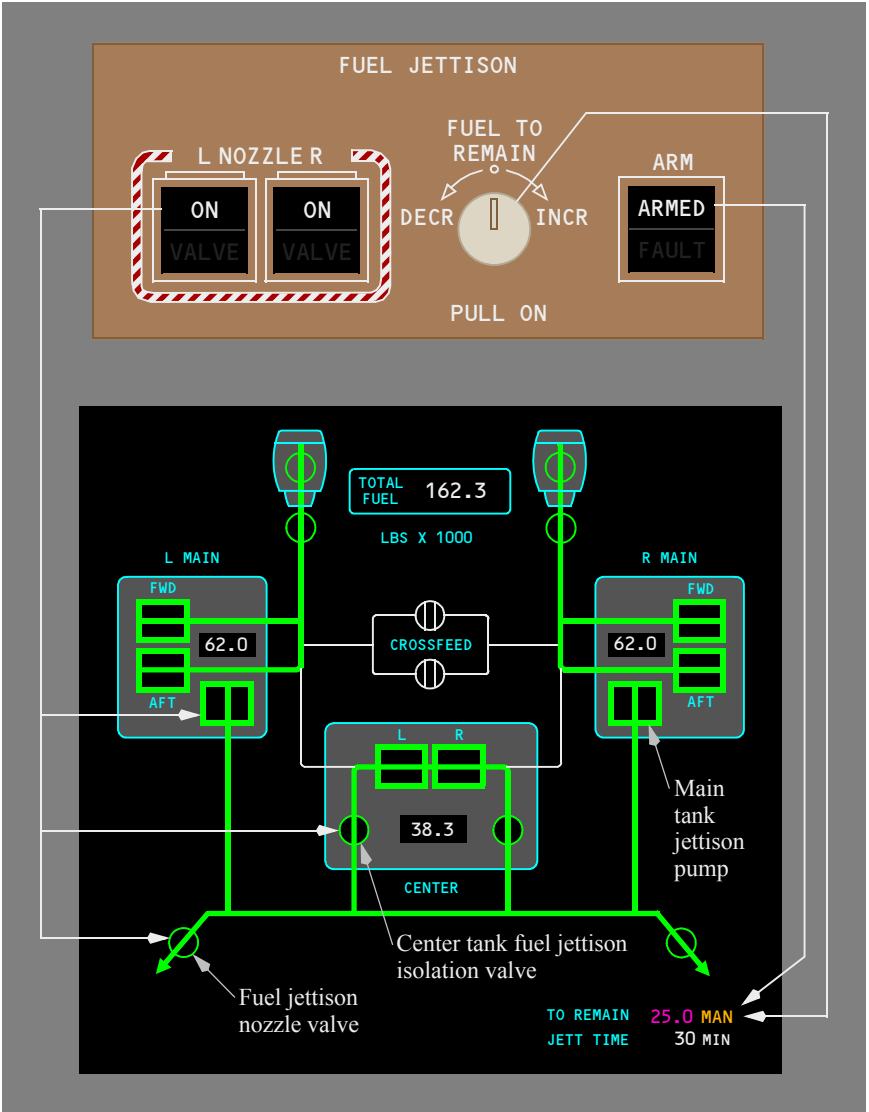
At least 11,500 pounds of fuel remains in each main tank after jettison is complete.

[Option – Metric Units]

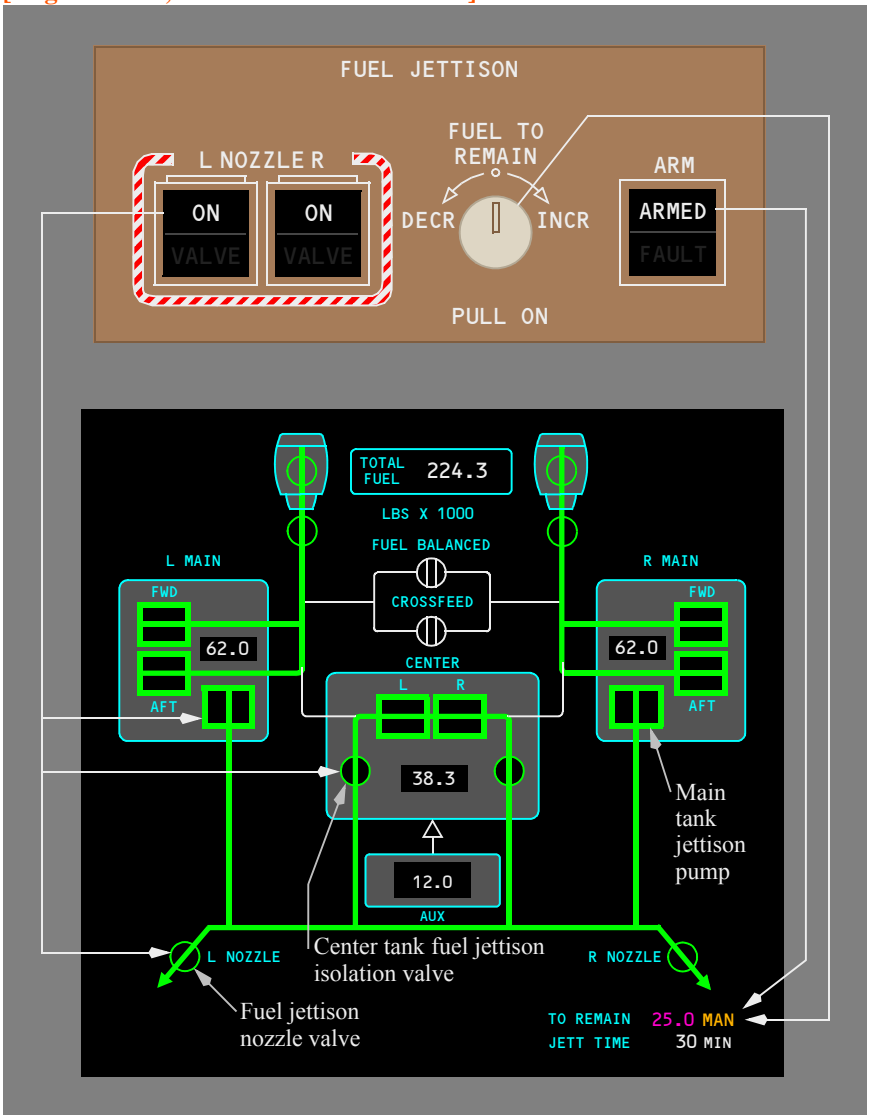
At least 5,200 kilograms of fuel remains in each main tank after jettison is complete.

Fuel Jettison Schematic

[English Units, 777-200, 777-200ER, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[English Units, 777-200LR with aux tank]



Fuel System FMS CDU Messages

The CDU can display the following messages.

INSUFFICIENT FUEL – Predicted fuel at destination is less than the FMC pilot-entered or uplinked reserves.

Fuel System EICAS Messages

The following EICAS messages can be displayed.

Message	Level	Aural	Condition
FUEL AUTO JETTISON	Caution	Beeper	Fuel jettison automatic shutoff has failed, or total fuel quantity is less than selected TO REMAIN quantity and a nozzle valve is open.
FUEL CROSSFEED AFT, FWD	Advisory		Crossfeed valve is not in the commanded position.

[AIMS05 installed]

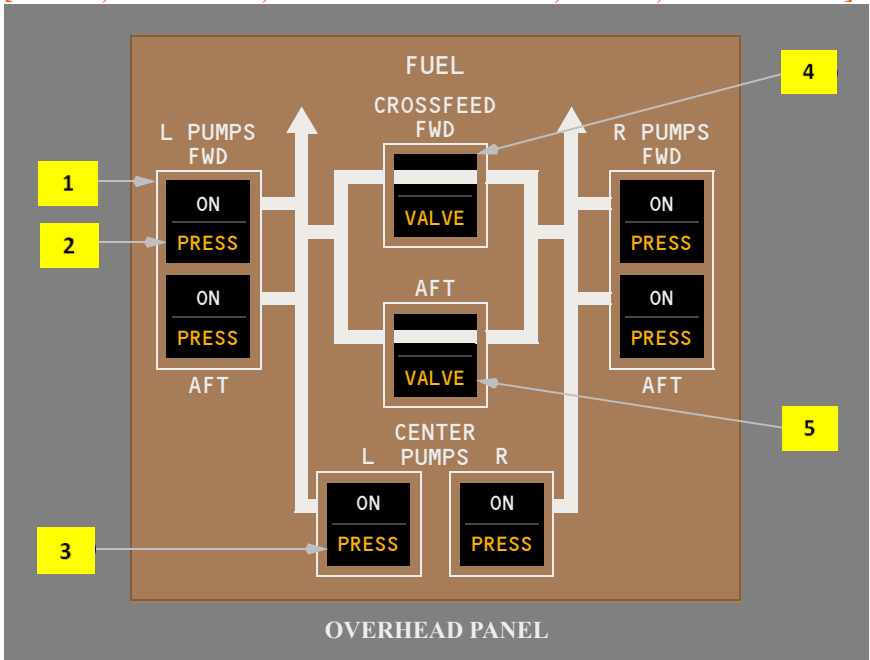
FUEL DISAGREE	Advisory		Totalizer fuel quantity and FMC calculated fuel quantity disagree.
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FUEL IMBALANCE	Advisory		Fuel imbalance between the main tanks is excessive.
FUEL IN CENTER	Advisory		Both center fuel pump switches are OFF with fuel in the center tank.
FUEL JETT NOZZLE L, R	Advisory		Jettison nozzle valve in not in the commanded position.
FUEL JETTISON MAIN	Advisory		Fuel jettison from the main tanks is inoperative.
FUEL JETTISON SYS	Caution	Beeper	Fuel jettison system is inoperative.
FUEL LOW CENTER	Advisory		One or both center fuel pump switches are ON and center tank quantity is low.

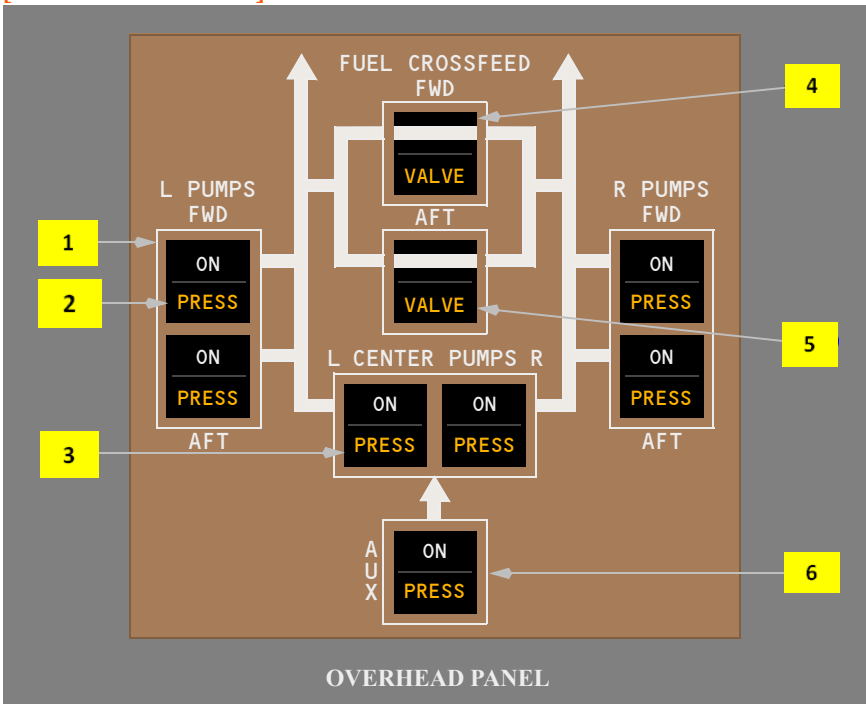
Message	Level	Aural	Condition
FUEL PRESS ENG L, R	Caution	Beeper	Engine is on suction feed.
FUEL PRESS ENG L+R	Advisory		All fuel pump output pressures are low.
FUEL PUMP CENTER L, R	Advisory		Center fuel pump output pressure is low.
FUEL PUMP L AFT, FWD	Advisory		Left aft or forward fuel pump output pressure is low.
FUEL PUMP R AFT, FWD	Advisory		Right aft or forward fuel pump output pressure is low.
FUEL QTY LOW	Caution	Beeper	Fuel quantity is low in either main tank.
FUEL TEMP LOW	Advisory		Fuel temperature is approaching minimum.
FUEL VALVE APU	Advisory		APU fuel valve is not in the commanded position.

Fuel System

[777-200, 777-200IGW, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[AUX TANK installed]



1 Fuel Pump Switches

ON – the fuel pump is selected ON.

Off (ON not visible) – the fuel pump is selected off.

2 Forward and Aft Fuel Pump Pressure (PRESS) Lights

Illuminated (amber) – fuel pump output pressure is low.

3 Center Fuel Pump Pressure (PRESS) Lights

Illuminated (amber) –

- fuel pump output pressure is low with the pump selected ON
- illumination is inhibited when the center tank fuel pump switch is selected off.

4 CROSSFEED Switches

On (bar visible) – the crossfeed valve is selected open.

Off (bar not visible) – the crossfeed valve is selected closed.

5 Crossfeed VALVE Lights

Illuminated (amber) – the crossfeed valve is not in the selected position.

6 Auxiliary (AUX) Tank Switch

[AUX TANK installed]

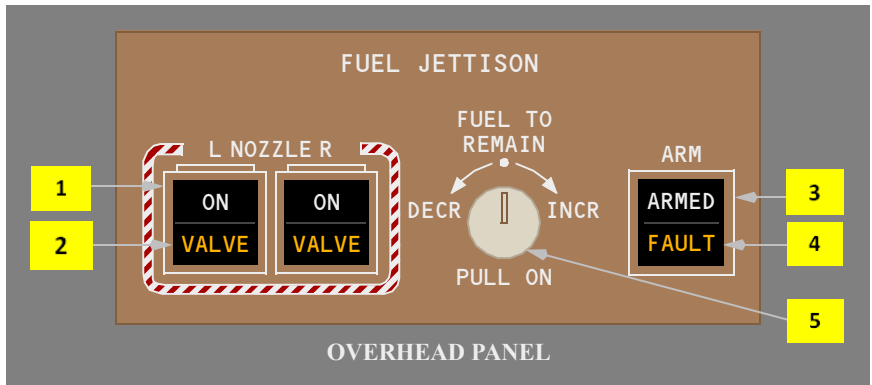
ON – fuel transfer is selected ON.

Off (ON not visible) – fuel transfer is selected off.

PRESS light illuminated (amber) –

- fuel pressure is low with transfer selected ON
- illumination is inhibited when the auxiliary tank switch switch is selected off.

Fuel Jettison System



1 Fuel Jettison NOZZLE Switches

ON –

- the jettison nozzle valve is selected open in flight
- if in flight and jettison is armed, turns on both main tank jettison pumps and opens both center tank jettison isolation valves.

Off (ON not visible) – the jettison nozzle valve is selected closed.

2 Fuel Jettison Nozzle VALVE Lights

Illuminated (amber) – the jettison nozzle valve is not in the selected position.

3 Fuel Jettison ARM Switch

ARMED –

- arms the jettison system
- initializes fuel-to-remain at the MLW fuel quantity.

Off (ARMED not visible) – disarms the jettison system.

4 Fuel Jettison FAULT Light

Illuminated (amber) –

- a system fault has occurred
- fuel jettison is inoperative.

5 FUEL TO REMAIN Selector

PULL ON– changes the mode from MLW (maximum landing weight) to MAN (manual).

Rotate –

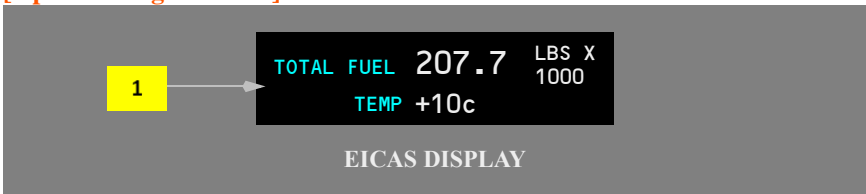
- rotate CW to increase, CCW to decrease the MANUAL fuel-to-remain quantity
- sets the manual (MAN) fuel-to-remain quantity selection at the slow rate (first detent) or fast rate (second detent).

Push – automatically selects the MLW fuel-to-remain quantity.

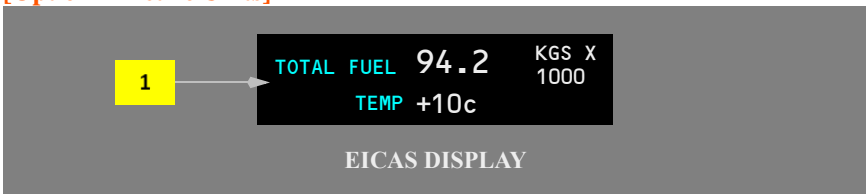
Fuel Indications

Normal Fuel Indications

[Option – English Units]



[Option – Metric Units]



1 Normal Fuel Indications

[Option – English Units]

Total fuel quantity (pounds x 1000).

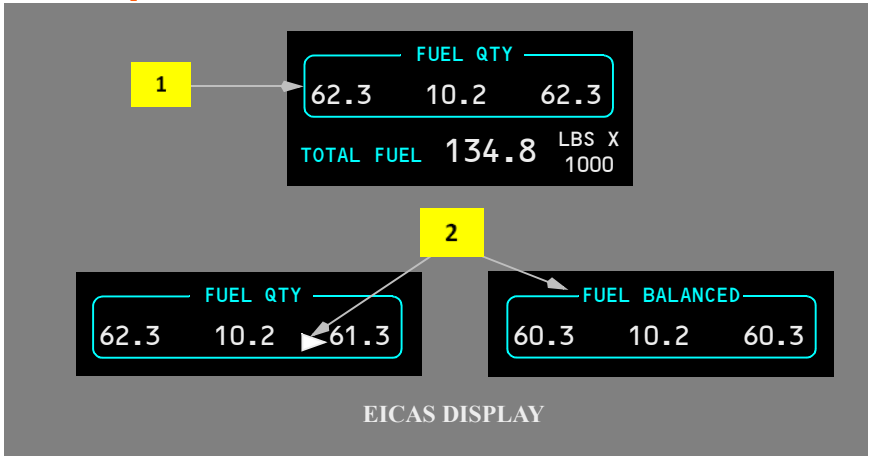
[Option – Metric Units]

Total fuel quantity (kilograms x 1000).

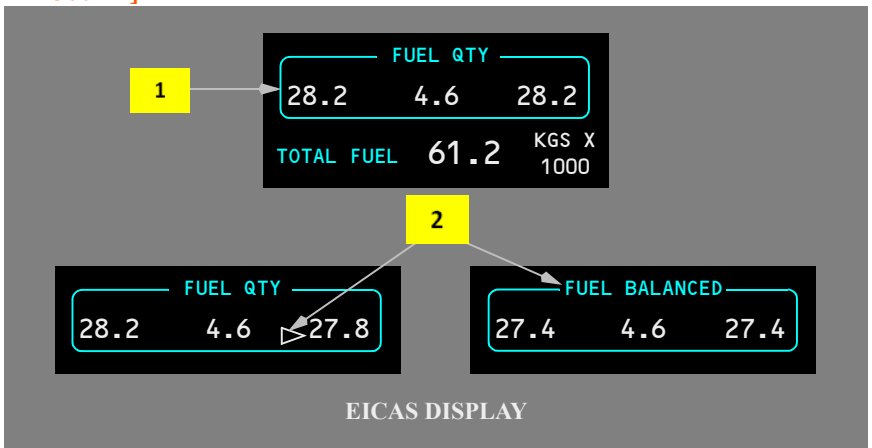
Fuel temperature (degrees Celsius).

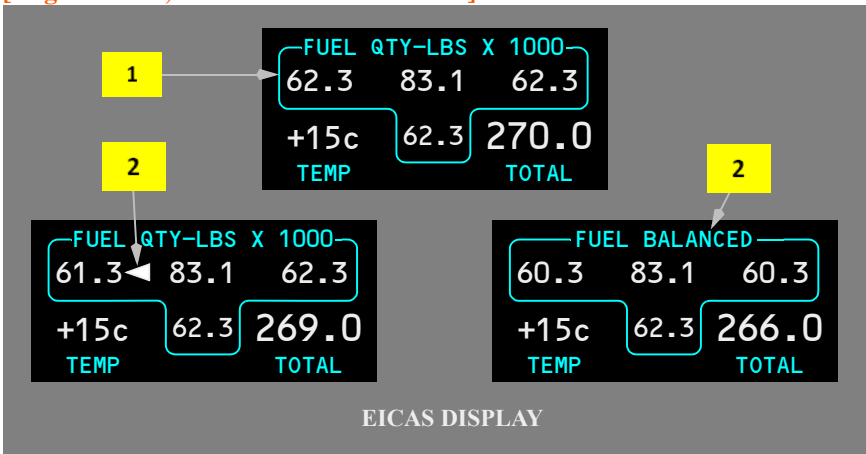
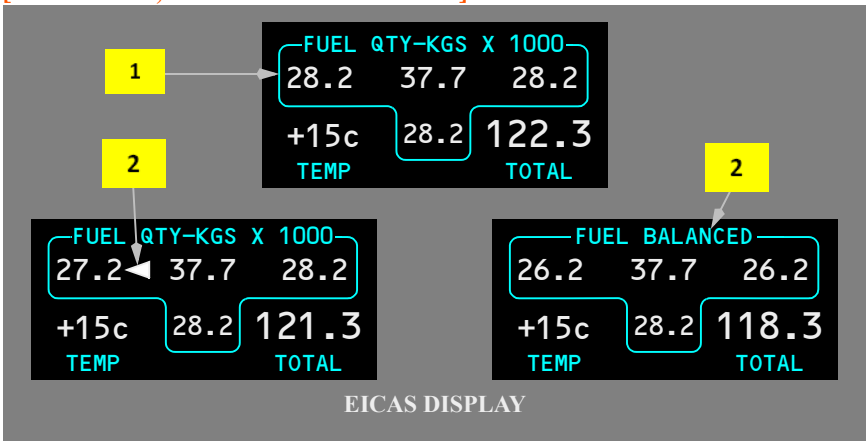
Expanded Fuel Indications

[English Units, 777-200, 777-200IGW, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[Metric Units, 777-200, 777-200IGW, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[English Units, 777-200LR with aux tank]**[Metric Units, 777-200LR with aux tank]****1 Expanded Fuel Indications**

The expanded FUEL QUANTITY display (left main, center, and right main tank quantities) appears for any of the following conditions:

- one or both crossfeed valves open
- one or more fuel tank quantity indications are inoperative
- the FUEL IN CENTER alert message is displayed (center tank quantity is amber)
- the FUEL QTY LOW alert message is displayed (low main tank quantity is amber)
- the FUEL IMBALANCE alert message is displayed

[AIMS05 installed]

- the airplane is on the ground and one or both engine(s) off

[AUX tank installed]

- the FUEL IN AUX alert message is displayed
- the FUEL AUX XFR alert message is displayed

2 Fuel Imbalance Indications

A fuel imbalance pointer is displayed on the expanded fuel quantity display next to the low tank quantity for the following imbalance conditions.

A solid white pointer is displayed if:

[Option – English Units]

- main tank fuel differs more than 1000 pounds
- main tank fuel differs more than 200 pounds and a crossfeed valve is open.

[Option – Metric Units]

- main tank fuel differs more than 500 kilograms
- main tank fuel differs more than 100 kilograms and a crossfeed valve is open.

A solid amber fuel imbalance pointer replaces the white pointer if the FUEL IMBALANCE message is displayed. The difference in fuel quantity which causes the FUEL IMBALANCE message to be displayed varies with total main tank fuel quantity.

The fuel imbalance pointer flashes if fuel balancing is going in the wrong direction.

[Option – English Units]

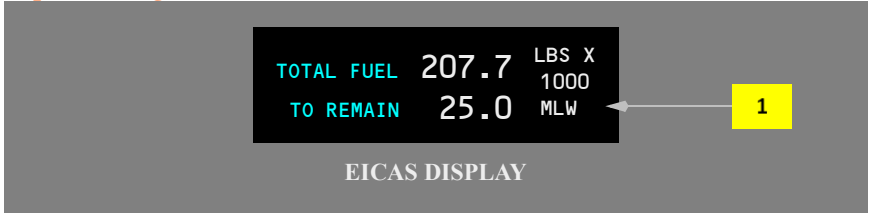
When fuel is back in balance within 200 pounds between the main tanks – FUEL BALANCED replaces FUEL QTY on the expanded fuel quantity display and flashes for 5 seconds.

[Option – Metric Units]

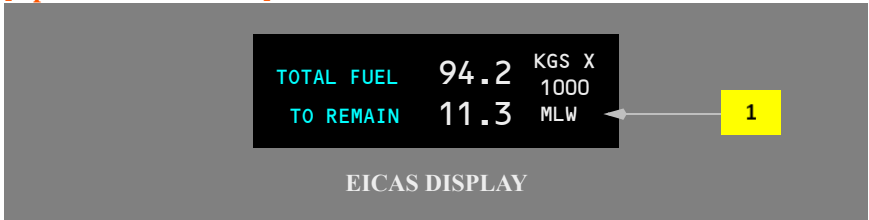
When fuel is back in balance within 100 kilograms between the main tanks – FUEL BALANCED replaces FUEL QTY on the expanded fuel quantity display and flashes for 5 seconds.

Fuel Jettison Indications

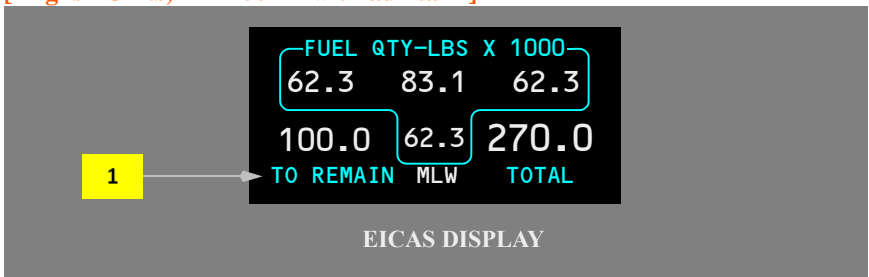
[Option – English Units]



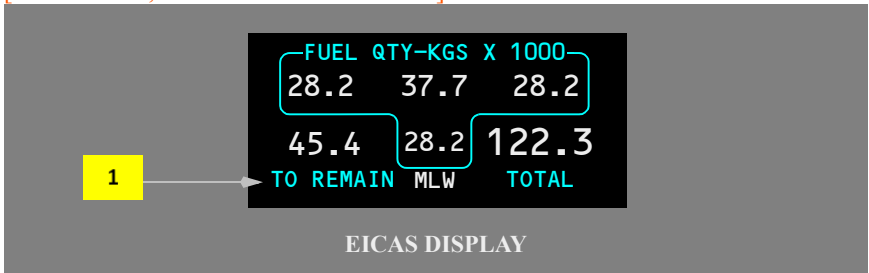
[Option – Metric Units]



[English Units, 777-200LR with aux tank]



[Metric Units, 777-200LR with aux tank]



1 Fuel Jettison Indications

Fuel to remain (fuel jettison ARMED):

- the fuel to remain defaults to a fuel quantity that will leave the airplane at maximum landing weight (MLW) when jettison is complete
- the fuel to remain display replaces the fuel temperature display.

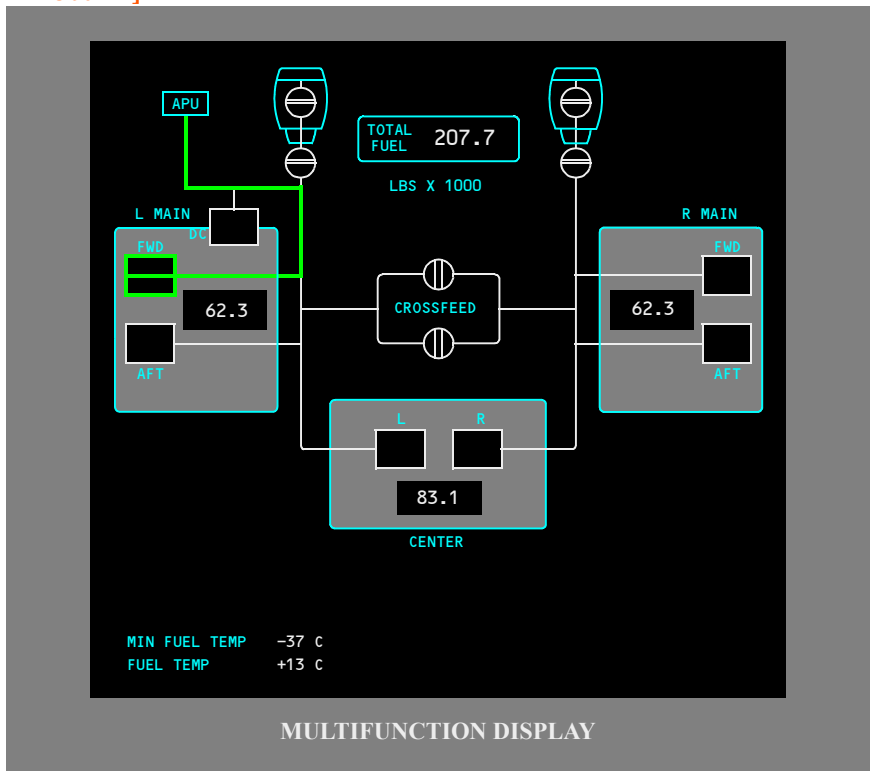
Fuel to remain MAN (manual) selection is displayed:

- fuel jettison system is ARMED
- the FUEL TO REMAIN selector is pulled on
- the quantity to remain can be changed by rotating the FUEL TO REMAIN selector to the slow or fast rate position.

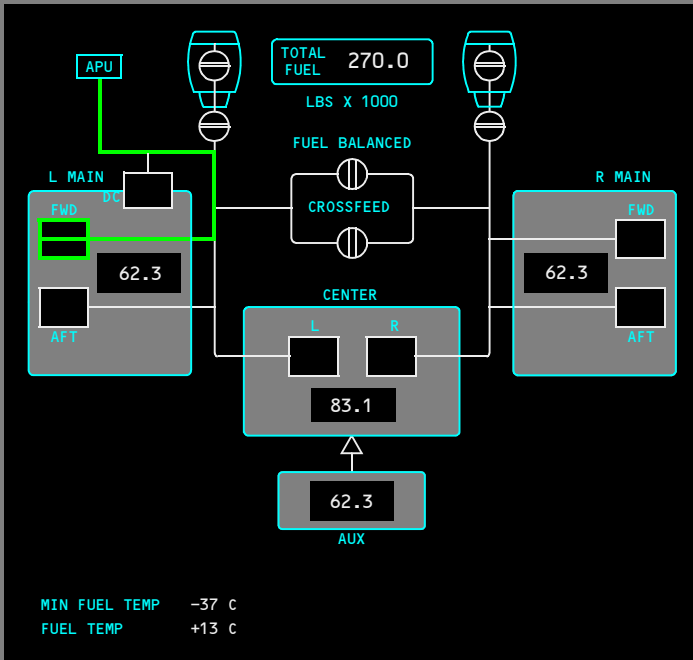
Fuel Synoptic Display

The fuel synoptic is displayed by pushing the FUEL synoptic display switch on the display select panel. Display select panel operation is described in Chapter 10, Flight Instruments, Displays.

[English Units, 777-200, 777-200IGW, 777-200LR w/o aux tank, 777-300, and 777-300ER]



[English Units, 777-200LR with aux tank]



MULTIFUNCTION DISPLAY