



**OPERATIONS MANUAL**  
**SECTION 6-5**  
**FUEL SYSTEM**

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## OPERATIONS MANUAL

### GENERAL DESCRIPTION

The fuel system supplies fuel at flow and pressure rates as required for the engine and APU operation. The fuel is contained in wing tanks.

Each wing has two independent integral tanks, namely the outboard tank and the inboard tank, which are separated by the main landing gear wheelwell and interconnected by tubes for gravity fuel transfer. The inboard tank has a subdivision named collector tank, which is located in the lowest region of the inboard tank and houses the fuel pumps.

### CAPACITY

The following figures represent the amount of usable and unusable fuel:

Usable Fuel (each wing)

Gallons/Pounds*	Liters/Kilograms**
441/2955	1670/1340

Unusable Fuel (each wing)

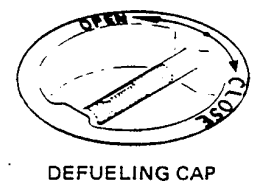
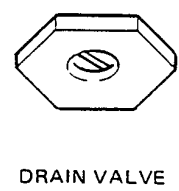
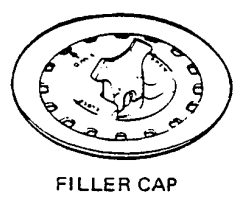
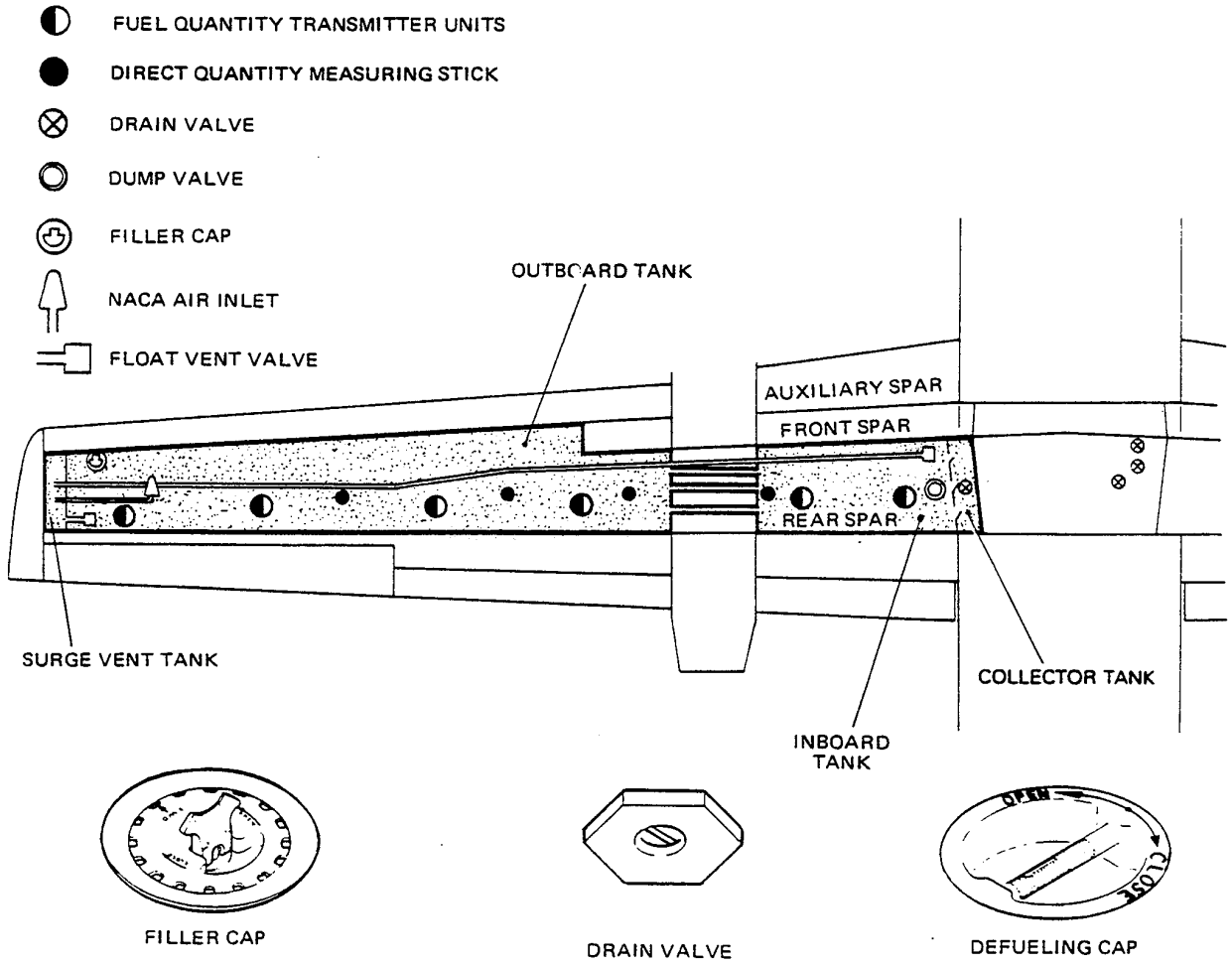
Gallons/Pounds*	Liters/Kilograms**
3.7/24.8	14/11.2

\* Fuel density = 6.7 pound per gallon.

\*\* Fuel density = 0.8029 kilograms per liter.



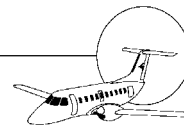
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**OPERATIONS MANUAL**



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**FUEL TANK**



## **FUEL FEED SYSTEM**

### **FUEL PUMPS**

Each fuel tank has a main jet fuel pump and two electric fuel booster pumps installed in the collector tank. They are responsible for feeding fuel to the engine and APU. In addition, each tank has two scavenger pumps located in the inboard tank which are responsible for supplying fuel to the collector tank.

The main jet pump is capable of supplying the required fuel to the engine and APU, except during start, crossfeed operation, or when the APU is on and the right engine is inoperative.

The electric booster pumps are identified as FRONT and REAR on the fuel panel.

### **FIREWALL SHUTOFF VALVE**

The firewall shutoff valve is commanded through the corresponding fire-extinguishing handle. When actuated, it cuts fuel supply to the associated engine.

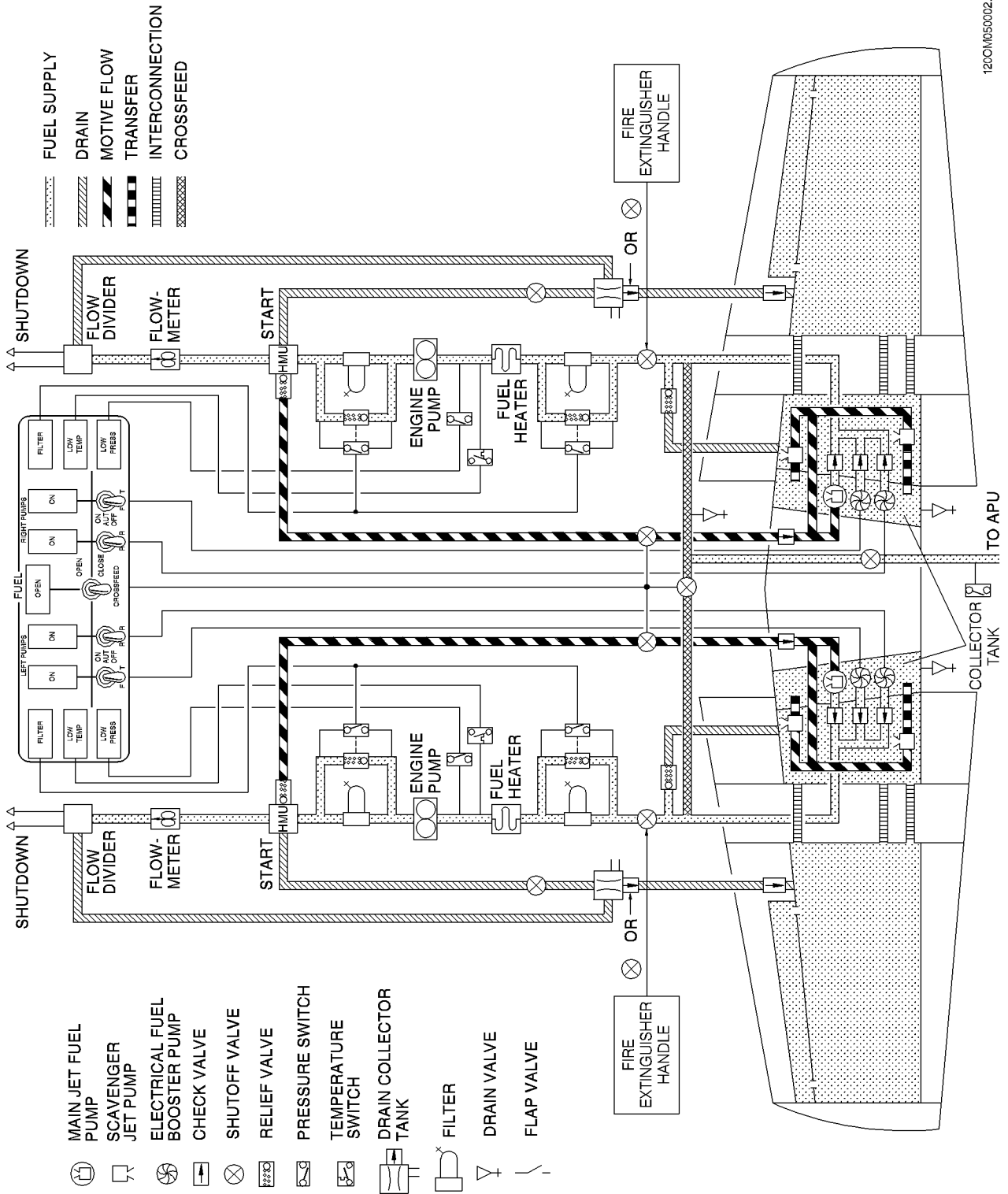
### **FUEL CROSSFEED SHUTOFF VALVE**

The engine fuel manifolds are interconnected with the use of the crossfeed valve. The valve provides a means of directing fuel to both engines from any tank.



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**FUEL FEED SCHEMATIC**





# OPERATIONS MANUAL

**ENGINE No. 2 PUMPS ON LIGHTS (WHITE)**

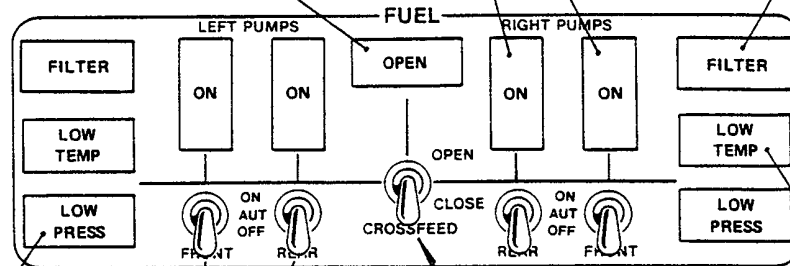
ILLUMINATED - If the relevant pump is on.

**CROSSFEED OPEN LIGHT (WHITE)**

ILLUMINATED - When crossfeed valve reaches a fully open position. Redundant with white CROSSFEED OPEN light on the fuel management panel.

**ENGINE No. 2 FILTER LIGHT (AMBER)**

ILLUMINATED - Before the fuel contamination reaches a degree sufficient to open the filter bypass. Redundant with amber FUEL light on the multiple alarm panel.



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**ENGINE No. 1 LOW PRESSURE LIGHT (AMBER)**

ILLUMINATED - Indicates low fuel pressure. Redundant with amber FUEL light on the multiple alarm panel.

**ENGINE No. 2 LOW TEMP LIGHT (AMBER)**

ILLUMINATED - Indicates a low fuel temperature. Redundant with amber FUEL light on the multiple alarm panel.

**ENGINE No. 1 FRONT AND REAR ELECTRIC FUEL BOOSTER PUMP SWITCHES**

On - Turns on the relevant electric pump.  
AUT - In case of fuel low pressure the electric pump and the relevant light will cycle. Then, the switch must be positioned to ON.  
OFF - Turns off the relevant electric pump.

**CROSSFEED SWITCH**

OPEN - The crossfeed valve opens, performing crossfeed operation.

**NOTE**

Cross-feed operation will be performed by using the electric booster pump of the tank intended to be used.

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**FUEL FEED PANEL (OVERHEAD PANEL)**



## OPERATIONS MANUAL

### PRESSURE REFUELING/DEFUELING

Pressure refueling and defueling are accomplished at the fueling panel, located on the right wing underside.

Refueling operation may be accomplished with the airplane either energized or not. When the airplane is energized, the system operation will be enabled:

- By selecting the MAN position of the REFUELING MASTER switch and the OPEN position of the SHUTOFF VALVE switch or;
- By selecting the AUTO position of the REFUELING MASTER switch and by setting the bug of the quantity indicators.

**CAUTION:** PRESSURE REFUELING WITH THE AIRPLANE BUSES DEENERGIZED IS NOT RECOMMENDED, SINCE NO INDICATION WILL BE AVAILABLE ON THE FUELING PANEL. IN THE EVENT OF ANY VENT VALVE FAILURE IN THE CLOSED POSITION, STRUCTURAL DAMAGE TO THE WING MAY OCCUR.

The defueling is performed by using the same adapter as used in the refueling system. Fuel tanks are defueled by means of the electric booster pumps via electrically-operated defuel valves which are controlled from the fueling panel. Suction pressure, from a ground equipment, up to 0.5 psig, may be applied to the adapter to increase the defueling flow rate. For detailed defueling instructions, see Maintenance Manual.

### GRAVITY REFUELING/DEFUELING

Gravity refueling is accomplished through a filler cap at the wing upper surface.

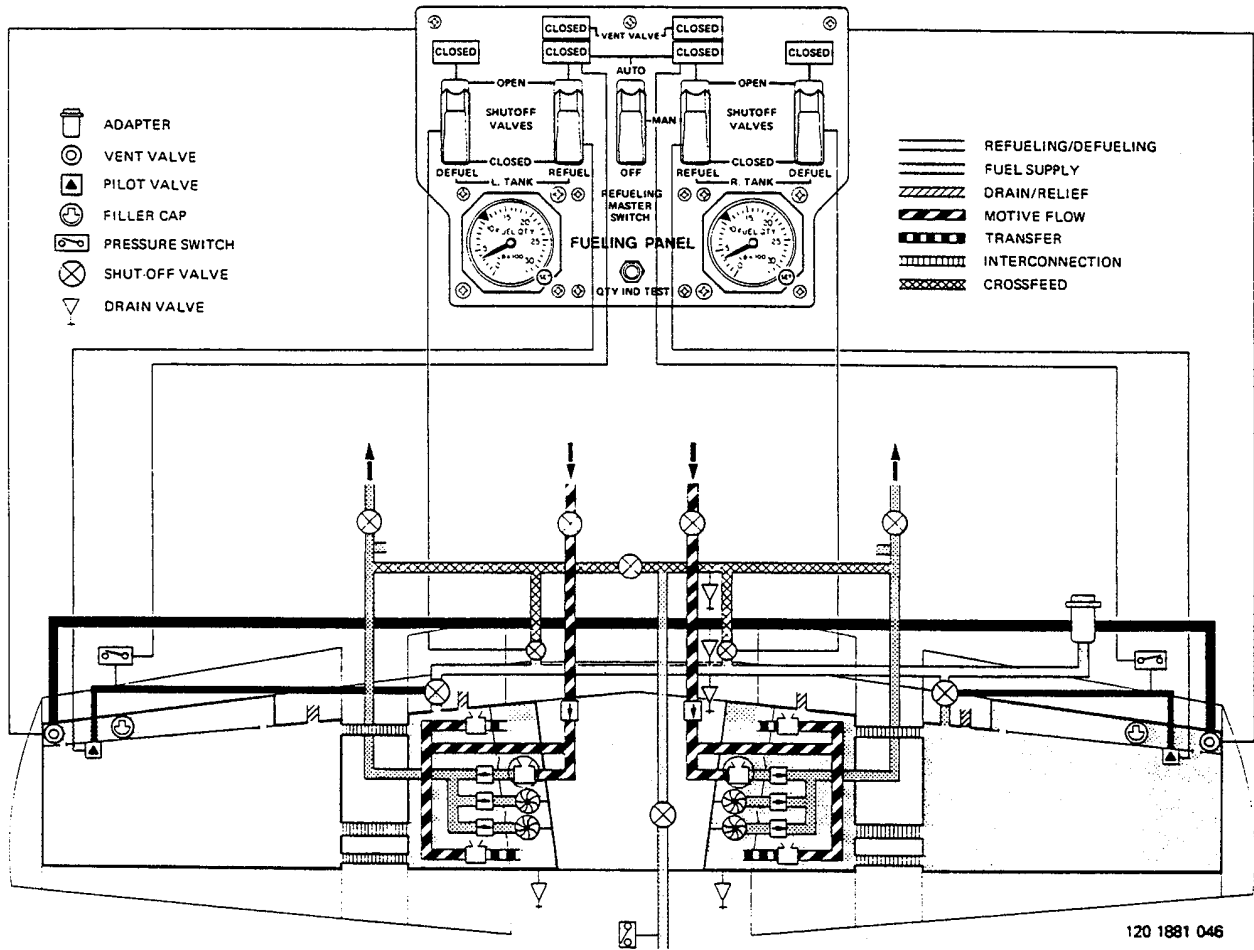
Manual defueling is accomplished through a dump valve installed on the lower surface of each inboard tank.





OPERATIONS MANUAL

(FUELING PANEL)



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REFUELING/DEFUELING SYSTEM SCHEMATIC





**OPERATIONS MANUAL**

**LEFT TANK REFUELING  
 CLOSED LIGHT (GREEN)**

**ILLUMINATED** - Indicates refueling shutoff valve is closed (relevant switch in closed position).

**RIGHT TANK REFUELING  
 SWITCH**

**OPEN** - Opens refueling shutoff valve, allowing refueling operation.

**CLOSED** - Closes refueling valves.

**LEFT TANK DEFUELING  
 CLOSED LIGHT (GREEN)**

**ILLUMINATED** - Indicates defueling shutoff valve is closed (relevant switch in closed position).

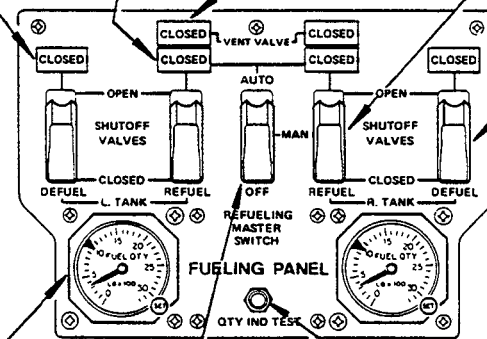
**LEFT TANK VENT VALVE  
 CLOSED LIGHT (AMBER)**

**ILLUMINATED** - Indicates the respective vent valve is closed, inhibiting refueling.

**RIGHT TANK DEFUELING  
 SWITCH**

**OPEN** - Opens defueling shutoff valve, allowing defueling operation.

**CLOSED** - Closes defueling valve.



**LEFT TANK FUEL QUANTITY  
 INDICATOR**

Indicates fuel quantity in the tank. The desired fuel quantity for automatic refueling is selected through a bug moved by a set knob.

**QUANTITY INDICATOR TEST BUTTON  
 PRESSED** - Right and left quantity indicators (and cockpit quantity indicators) pointers are driven to the end of the scale.

**REFUELING MASTER SWITCH**

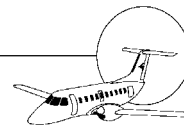
**AUTO** - Automatic operation is accomplished. It is necessary to set the bug on the fuel quantity indicator to the desired quantity. Reaching it, refueling operation is automatically shutoff.

**MAN** - Selects manual operation. Setting refueling shutoff switches to OPEN, shutoff valves allow refueling. Supplied fuel is monitored by quantity indicators and refueling is stopped by returning the switch to the CLOSED position.

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**FUELING PANEL  
 (RIGHT UNDERWING)**



## OPERATIONS MANUAL

### FUEL MANAGEMENT PANEL

#### FUEL TOTALIZER

Provides either total fuel used or fuel remaining indications. The desired function is obtained by pressing the FCTN button. The alphanumeric display will alternate between FU (fuel used) or FR (fuel remaining) each time the button is pressed. The corresponding quantity is shown on the numeric display (the last digit is fixed at zero).

To reset the total fuel used, FU function must be selected and, while the alpha display shows FU, the fuel used register can be reset to zero by pulling the PULL TO SET knob. This knob must be held pulled out for at least three seconds.

When the alpha display is in FR, the fuel remaining register can be initialized by pulling the PULL TO SET knob. The initial value is set equal to the total fuel quantity instrument indication. The knob must be held at least three seconds.

Manual fuel remaining reading adjustment can be accomplished by rotating the PULL TO SET knob from its mid position. Clockwise rotation will increase the value and counterclockwise rotation will decrease the value. The display change rate is determined by how far the knob is rotated.

To prevent improper readings due to power transients or memory error, a check-sum test is constantly made. If an error is detected, the display will show ER. In order to reset the error condition, the FCTN button must be pressed. Alpha display will show then FR, and the numeric display will show "0000". After an error is reset, the system must be initialized again to show proper reading. Alpha and numeric indication is blank for power or signal loss.

#### ENGINE No. 1 AND No. 2 FUEL FLOW INDICATORS

Analogically and digitally indicate the fuel flow mass, in pounds (or kilograms) per hour. The left fuel flow indicator is connected to DC bus 1 and the right fuel flow to DC bus 2. If a DC bus fails, the respective fuel flow indicator will be inoperative.

#### LEFT AND RIGHT TANK FUEL QUANTITY INDICATORS

Indicate the remaining usable fuel quantity in the tank. Pressing the test button in the refueling/defueling panel will cause the cockpit fuel quantity indicators to rotate clockwise to full scale.

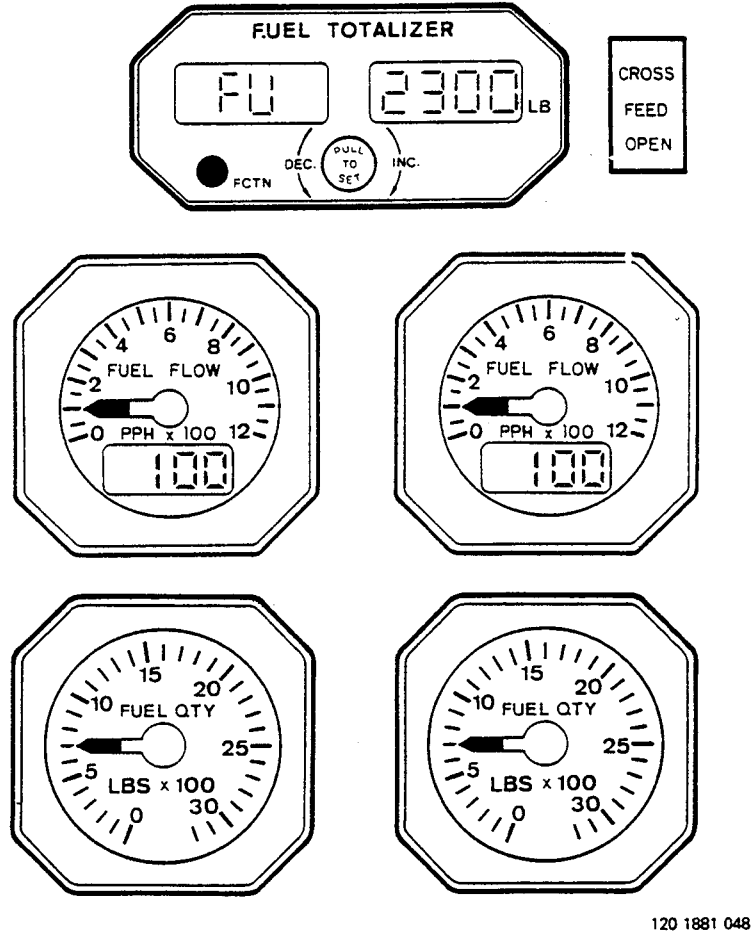
The left fuel quantity indicator is connected to DC bus 1 and the right fuel quantity is connected to DC bus 2. In the case of a DC bus failure, the fuel quantity indicator will be inoperative.

#### CROSS FEED OPEN INDICATOR LIGHT

The CROSS FEED OPEN white light on the fuel management panel, and the white OPEN light, on the fuel feed panel, indicate when the crossfeed valve is fully open.



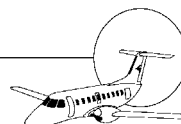
# OPERATIONS MANUAL



**NOTE: SOME AIRPLANES ARE EQUIPPED WITH FUEL INSTRUMENTS IN KILOGRAMS.**

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**FUEL MANAGEMENT PANEL  
(FORWARD PANEL)**



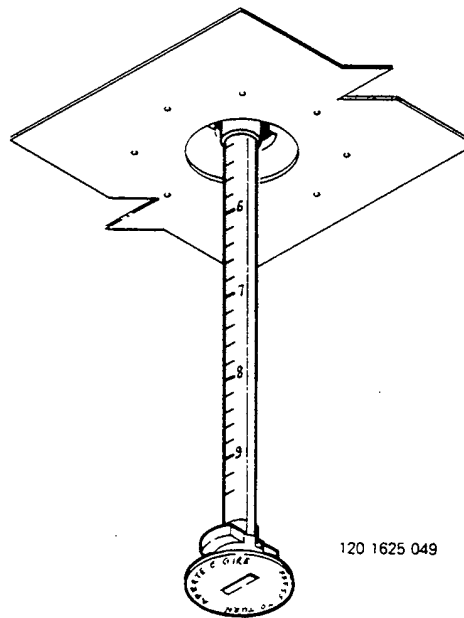
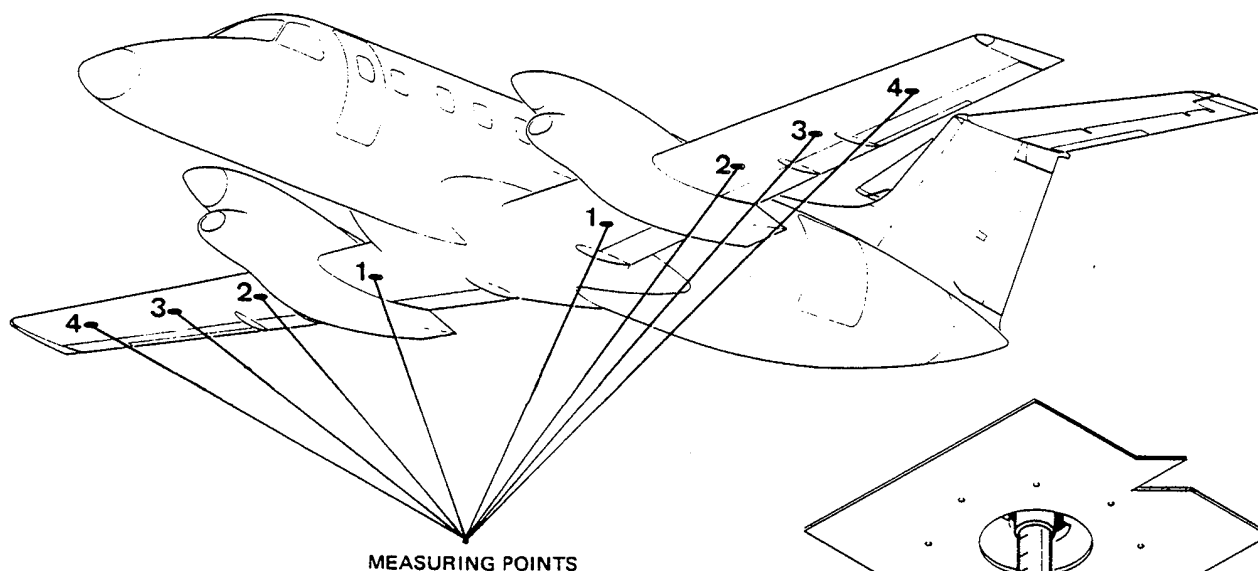
## OPERATIONS MANUAL

### DIRECT QUANTITY MEASURING SYSTEM (DRIPLESS STICK)

The aircraft is equipped with a direct quantity measuring system, comprising four measuring points located under the wing. Each measuring point is provided with a magnetic float, which holds a calibrated stick. When it reaches the fuel level, the stick provides a visual check of the fuel quantity in each wing.

To determine the usable fuel quantity in one of the wings, it is advisable to start at point No. 4 (wing tip) and proceed in the direction of the wing root until reaching the most outboard point which is not at the lower stop (zero reading). For a correct reading, press and turn the stick, allowing it to lower smoothly until the stick is held by the magnetic float. Next, enter the value indicated on the scale in the Direct Measuring System Table. Two sets of tables are presented: one in US Gallon and pound, and the other in liter and kilogram.

Fuel quantity readings should be performed with the aircraft laterally leveled, as checked through the ADI inclinometer.



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DETAIL

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**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
 – 2°)**

**NOTE:** The accuracy for U.S. readings is ± 2.6 U.S. Gal.

The values in pounds are valid for fuel densities between 6.68 and 6.84 lb/U.S. Gal. In this case the reading accuracy is ± 44 lb. For fuel densities out of this range, multiply the volume in U.S. Gal by the actual fuel density to find the mass in pounds.

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	US Gal	pound	US Gal	pound	US Gal	pound	US Gal	pound
0.1	62.	418.	133.	904.	191.	1296.	257.	1738.
0.2	63.	425.	135.	911.	193.	1305.	258.	1747.
0.3	64.	433.	136.	918.	194.	1314.	259.	1757.
0.4	65.	440.	137.	925.	195.	1323.	261.	1766.
0.5	66.	448.	138.	932.	197.	1332.	262.	1775.
0.6	67.	455.	139.	940.	198.	1340.	263.	1784.
0.7	68.	462.	140.	947.	199.	1349.	265.	1794.
0.8	69.	470.	141.	954.	200.	1358.	266.	1803.
0.9	70.	477.	142.	961.	202.	1367.	267.	1812.
1.0	72.	485.	143.	968.	203.	1376.	269.	1821.
1.1	73.	492.	144.	975.	204.	1384.	270.	1831.
1.2	74.	500.	145.	982.	206.	1393.	272.	1840.
1.3	75.	507.	146.	989.	207.	1402.	273.	1849.
1.4	76.	515.	147.	996.	208.	1411.	274.	1858.
1.5	77.	522.	148.	1003.	210.	1420.	276.	1868.
1.6	78.	530.	149.	1010.	211.	1428.	277.	1877.
1.7	79.	537.	150.	1017.	212.	1437.	278.	1886.
1.8	80.	544.	151.	1024.	213.	1446.	280.	1895.
1.9	81.	552.	152.	1031.	215.	1455.	281.	1905.
2.0	83.	559.	153.	1038.	216.	1464.	282.	1914.
2.1	84.	567.	154.	1045.	217.	1472.	284.	1923.
2.2	85.	574.	155.	1052.	219.	1481.	285.	1932.
2.3	86.	582.	156.	1059.	220.	1490.	287.	1942.
2.4	87.	589.	157.	1066.	221.	1499.	288.	1951.
2.5	88.	597.	158.	1073.	222.	1508.	289.	1960.
2.6	89.	604.	159.	1080.	224.	1516.	291.	1969.
2.7	90.	612.	160.	1087.	225.	1525.	292.	1979.
2.8	91.	619.	161.	1094.	226.	1534.	293.	1988.

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**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
– 2°)**

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	US Gal	pound	US Gal	pound	US Gal	pound	US Gal	pound
2.9	92.	627.	162.	1101.	228.	1543.	295.	1997.
3.0	94.	634.	164.	1108.	229.	1552.	296.	2006.
3.1	95.	641.	165.	1115.	230.	1560.	297.	2016.
3.2	96.	649.	166.	1122.	232.	1569.	299.	2025.
3.3	97.	656.	167.	1129.	233.	1578.	300.	2034.
3.4	98.	664.	168.	1136.	234.	1587.	302.	2043.
3.5	99.	671.	169.	1143.	235.	1595.	303.	2053.
3.6	100.	679.	170.	1150.	237.	1604.	304.	2062.
3.7	101.	686.	171.	1157.	238.	1613.	306.	2071.
3.8	102.	694.	172.	1164.	239.	1622.	307.	2080.
3.9	103.	701.	173.	1171.	241.	1631.	308.	2090.
4.0	105.	709.	174.	1178.	242.	1639.	310.	2099.
4.1	106.	716.	175.	1185.	243.	1648.	311.	2108.
4.2	107.	723.	176.	1192.	245.	1657.	312.	2117.
4.3	108.	731.	177.	1199.	246.	1666.	314.	2127.
4.4	109.	738.	178.	1206.	247.	1675.	315.	2136.
4.5	110.	746.	179.	1213.	248.	1683.	317.	2145.
4.6	111.	753.	180.	1220.	250.	1692.	318.	2154.
4.7	112.	761.	181.	1227.	251.	1701.	319.	2164.
4.8	113.	768.	182.	1234.	252.	1710.	321.	2173.
4.9	114.	776.	183.	1241.	254.	1719.	322.	2182.
5.0	116.	783.	184.	1248.	255.	1727.	323.	2191.
5.1	117.	791.	185.	1255.	256.	1736.	325.	2201.
5.2	118.	798.	186.	1262.	258.	1745.	326.	2210.
5.3	119.	806.	187.	1269.	259.	1754.	327.	2219.
5.4	120.	813.	188.	1276.	260.	1763.	329.	2228.
5.5	121.	820.	189.	1283.	261.	1771.	330.	2238.
5.6	122.	828.	190.	1290.	263.	1780.		
5.7	123.	835.	191.	1297.	264.	1789.		
5.8	124.	843.	193.	1304.	265.	1798.		
5.9	125.	850.	194.	1312.	267.	1807.		
6.0	127.	858.	195.	1319.	268.	1815.		
6.1	128.	865.	196.	1326.	269.	1824.		
6.2	129.	873.	197.	1333.	271.	1833.		

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**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
– 2°)**

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	US Gal	pound	US Gal	pound	US Gal	pound	US Gal	pound
6.3	130.	880.	198.	1340.	272.	1842.		
6.4	131.	888.	199.	1347.	273.	1851.		
6.5	132.	895.	200.	1354.	274.	1859.		
6.6	133.	902.	201.	1361.				
6.7	134.	910.	202.	1368.				
6.8	135.	917.	203.	1375.				
6.9	136.	925.	204.	1382.				
7.0	138.	932.	205.	1389.				
7.1	139.	940.	206.	1396.				
7.2	140.	947.	207.	1403.				
7.3	141.	955.	208.	1410.				
7.4	142.	962.	209.	1417.				
7.5	143.	970.	210.	1424.				
7.6	144.	977.						
7.7	145.	985.						
7.8	146.	992.						
7.9	147.	999.						
8.0	149.	1007.						
8.1	150.	1014.						
8.2	151.	1022.						
8.3	152.	1029.						
8.4	153.	1037.						
8.5	154.	1044.						
8.6	155.	1052.						
8.7	156.	1059.						
8.8	157.	1067.						
8.9	159.	1074.						
9.0	160.	1081.						
9.1	161.	1089.						
9.2	162.	1096.						
9.3	163.	1104.						
9.4	164.	1111.						
9.5	165.	1119.						

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**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
– 2°)**

**NOTE:** Assumed fuel density: 0.785 kg/l.

For other fuel densities, multiply the volume in liters by the actual fuel density, to find the mass in kilograms.

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	LITER	KG	LITER	KG	LITER	KG	LITER	KG
0.1	233	183	505	396	724	568	971	762
0.2	238	187	509	399	729	572	976	766
0.3	242	190	513	403	734	576	981	770
0.4	246	193	517	406	739	580	986	774
0.5	250	196	521	409	744	584	992	779
0.6	254	199	525	412	749	588	997	783
0.7	258	203	529	415	754	592	1002	787
0.8	263	206	533	418	759	596	1007	790
0.9	267	209	537	421	764	600	1012	794
1.0	271	212	541	425	768	603	1017	798
1.1	275	215	544	427	773	607	1023	803
1.2	279	219	548	430	778	611	1028	807
1.3	283	222	552	433	783	615	1033	811
1.4	288	226	556	436	788	619	1038	815
1.5	292	229	560	440	793	623	1043	819
1.6	296	232	564	443	798	626	1048	823
1.7	300	236	568	446	803	630	1054	827
1.8	304	239	572	449	808	634	1059	831
1.9	308	242	576	452	813	638	1064	835
2.0	312	245	580	455	818	642	1069	839
2.1	317	249	584	458	823	646	1074	843
2.2	321	252	588	462	827	649	1080	848
2.3	325	255	592	465	832	653	1085	852
2.4	329	258	595	467	837	657	1090	856
2.5	333	261	599	470	842	661	1095	860
2.6	337	265	603	473	847	665	1100	864
2.7	342	268	607	476	852	669	1105	867
2.8	346	272	611	480	857	673	1111	872
2.9	350	275	615	483	862	677	1116	876

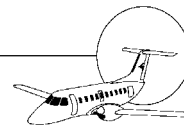


**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
 - 2°)**

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	LITER	KG	LITER	KG	LITER	KG	LITER	KG
3.0	354	278	619	486	867	681	1121	880
3.1	358	281	623	489	872	685	1126	884
3.2	362	284	627	492	877	688	1131	888
3.3	367	288	631	495	881	692	1136	892
3.4	371	291	635	498	886	696	1142	896
3.5	375	294	639	502	891	699	1147	900
3.6	379	298	642	504	896	703	1152	904
3.7	383	301	646	507	901	707	1157	908
3.8	387	304	650	510	906	711	1162	912
3.9	392	308	654	513	911	715	1167	916
4.0	396	311	658	517	916	719	1173	921
4.1	400	314	662	520	921	723	1178	925
4.2	404	317	666	523	926	727	1183	929
4.3	408	320	670	526	931	731	1188	933
4.4	413	324	674	529	936	735	1193	937
4.5	417	327	678	532	940	738	1198	940
4.6	421	330	682	535	945	742	1204	945
4.7	425	334	686	539	950	746	1208	948
4.8	429	337	690	542	955	750	1214	953
4.9	433	340	693	544	960	754	1219	957
5.0	438	344	697	547	965	758	1224	961
5.1	442	347	701	550	970	761	1229	965
5.2	446	350	705	553	975	765	1235	969
5.3	450	353	709	557	980	769	1240	973
5.4	454	356	713	560	985	773	1245	977
5.5	458	360	717	563	990	777	1250	981
5.6	463	363	721	566	995	781		
5.7	467	367	725	569	999	784		
5.8	471	370	729	572	1004	788		
5.9	475	373	733	575	1009	792		
6.0	479	376	737	579	1014	796		
6.1	483	379	741	582	1019	800		
6.2	488	383	744	584	1024	804		
6.3	492	386	748	587	1029	808		

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**OPERATIONS MANUAL**

**DIRECT MEASURING SYSTEM TABLE – (Roll: 0°; Pitch: 0° + 2°  
– 2°)**

STICK INDICATION	STICK FUEL QUANTITY (USABLE)							
	STICK 1		STICK 2		STICK 3		STICK 4	
	LITER	KG	LITER	KG	LITER	KG	LITER	KG
6.4	496	389	752	590	1034	812		
6.5	500	393	756	593	1039	816		
6.6	504	396	760	597				
6.7	508	399	764	600				
6.8	513	403	768	603				
6.9	517	406	772	606				
7.0	521	409	776	609				
7.1	525	412	780	612				
7.2	529	415	784	615				
7.3	533	418	788	619				
7.4	538	422	791	621				
7.5	542	425	795	624				
7.6	546	429						
7.7	550	432						
7.8	554	435						
7.9	558	438						
8.0	563	442						
8.1	567	445						
8.2	571	448						
8.3	575	451						
8.4	579	455						
8.5	583	458						
8.6	588	462						
8.7	592	465						
8.8	596	468						
8.9	600	471						
9.0	604	474						
9.1	608	477						
9.2	613	481						
9.3	617	484						
9.4	621	487						
9.5	625	491						

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