

Gulfstream IV

OPERATING MANUAL

ENGINE FUEL AND CONTROL

2A-73-10: Engine Fuel System

1. General Description:

The engine fuel system is a mechanical, all-speed governing system which controls fuel flow automatically to maintain a selected High Pressure (HP) speed and provide rapid, surge-free acceleration and deceleration control. A solenoid-operated, high idle setting ensures acceptable acceleration is available during final approach.

Fuel is supplied from the aircraft fuel system to an engine driven Low Pressure (LP) fuel pump which delivers it through the engine fuel cooled oil cooler, filter and flowmeter and to an engine driven variable output HP fuel pump. From the HP pump, fuel is delivered to a fuel regulator, which meters it into two separate flows to the spray nozzles. The main flow passes through the N1 shaft governor to the HP fuel cock, while the primary flow passes directly to the HP fuel cock. Both flows are then distributed respectively to the primary and main spray nozzles.

The HP fuel shutoff valve fuel cock has three positions: SHUT, START and OPEN. Only two of these positions, SHUT and OPEN, are utilized while operating the engine. The START position, although not selected, permits a supplementary fuel flow to the main spray nozzles to facilitate easier starting under certain conditions.

The N1 shaft governor prevents the LP compressor shaft from exceeding its limitation by trimming the fuel flow from the HP fuel pump.

2. Subsystems, Units and Components:

(See Figure 1.)

The engine fuel system consists of the following subsystems, units and components:

- Low pressure fuel pump
- Oil cooler
- Fuel filter
- High pressure fuel pump
- Low pressure shaft governor
- High pressure fuel shutoff valve
- Fuel tubes and manifolds
- Fuel nozzles

3. Description of Subsystems, Units and Components:

(See Figure 1.)

A. Low Pressure Fuel Pump:

The LP fuel pump attaches to the front face of the high-speed (HS) gearbox. It is sometimes known as the LP backing pump. The pump keeps the fuel pressure at the inlet to the HP fuel pump at a value high enough to prevent cavitation. The LP fuel pump has a splined shaft at its front end that engages a driving shaft in the HS gearbox. The basic design of the LP fuel pump is a housing with a fuel inlet and outlet port. A drains connector allows for fuel to go to the engine drains tank.

Gulfstream IV

OPERATING MANUAL

B. Oil Cooler:

The LP fuel pump delivers the fuel from the aircraft supply to the oil cooler. The LP fuel decreases the temperature of the oil in the cooler before the fuel goes to the fuel filter.

C. Fuel Filter:

The 10 micron LP fuel filter attaches to the left-hand side of the intermediate case. The basic design of the fuel filter is a housing which has a paper element in the inner chamber. The element removes unwanted matter from the fuel that comes from the fuel-cooled oil cooler and prevents foreign material from passing on to the HP pump.

D. High Pressure Fuel Pump:

The HP fuel pump attaches to the rear face of the high-speed gearbox. A shaft gear in the gearbox turns the drive shaft in the front of the fuel pump. The fuel pump receives LP fuel from the fuel filter and flowmeter. The pump then supplies the fuel, at a high pressure, to the Fuel Flow Regulator (FFR).

The HP fuel pump has a rotating assembly which has seven inclined hollow cylinders. The cylinders attach to an adjustable cam plate. The cam plate angle can therefore change to adjust the stroke of the pistons. A servo system controls the output of fuel to the FFR.

E. Low Pressure Shaft Governor:

The LP shaft governor limits the fuel flow to the fuel spray nozzle in some operating conditions. This ensures that the LP compressor shaft does not exceed its maximum speed limit.

F. High Pressure Fuel Shutoff Valve:

The HP fuel shutoff valve is a plunger-type valve operated by a rack and pinion. It attaches to the left-hand side of the HS gearbox with four bolts. In the full-flow position, the pilot flow and main flow of fuel go to the fuel manifolds. In the closed position the plunger closes off the flow of fuel to the manifolds, in this position the fuel, together with the servo-fuel for the HP fuel pump, goes to the LP outlet. The valve connects, through its operating lever and a control linkage, to a manual control in the crew compartment (see Figure 2).

G. Fuel Tubes and Manifolds:

Fuel tubes allow fuel to go from the inlet connector at the LP fuel pump through the subsequent units to the fuel spray nozzles. The tubes are made of stainless steel with ferrules welded on to their ends. The grooves in these ferrules are for rubber seal rings which prevent leakage of fuel when the tubes are installed. There are two fuel manifolds on the engine: the main and pilot fuel manifold. Short tubes, which have union nuts at each end, connect the manifolds to the fuel spray nozzles.

H. Fuel Nozzles:

Ten fuel spray nozzles supply a continuous spray of atomized fuel particles to the combustion chambers. Each fuel spray nozzle has two systems that supply fuel: a pilot system and a main system. The systems operate independently and give the correct combustion conditions for the full range of engine operation.

Gulfstream IV

OPERATING MANUAL

4. Controls and Indications:

(See Figure 3.)

NOTE:

A detailed description of the Engine Instruments and Crew Alerting System (EICAS) messages can be found in Section 5 of Honeywell's SPZ-8000 (or SPZ-8400) Digital Automatic Flight Control System Pilot's Manual for the Gulfstream IV.

Mounted on the fuel filter housing assembly are the following two pressure switches:

A. Fuel Pressure Low Warning Switch:

When a low pressure condition occurs, this 15 psi switch will illuminate the red L-R FUEL PRESS warning indication on the EICAS and/or the Standby Warning panel.

B. Fuel Filter Differential Pressure Switch:

When the fuel filter becomes obstructed, this 7 psid switch senses the difference in the fuel pressures upstream and downstream of the filter element and will illuminate the L-R FUEL FILTER warning indication on the EICAS and/or the Standby Warning panel.

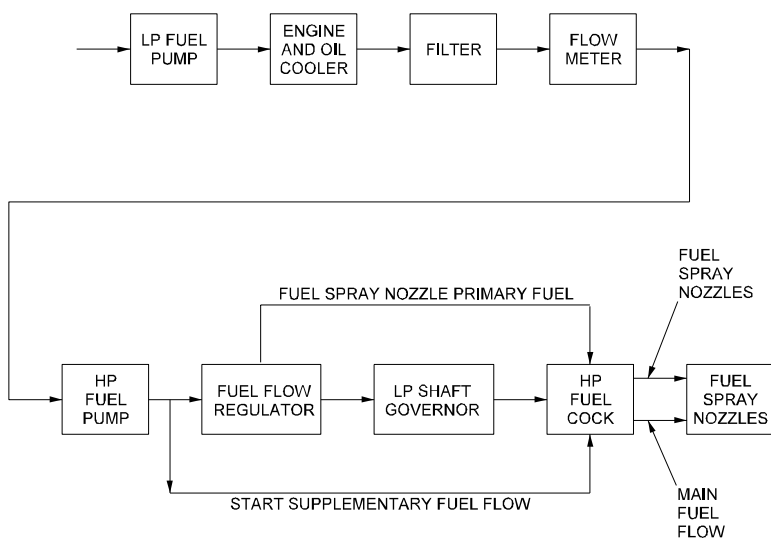
5. Limitations:

The maximum and minimum engine fuel temperatures are as follows:

- Maximum: 90°C (Fuel temperature up to 120°C for maximum of fifteen (15) minutes is permissible)
- Minimum: -40°C

Gulfstream IV

OPERATING MANUAL



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Engine Fuel System Simplified Block Diagram
Figure 1

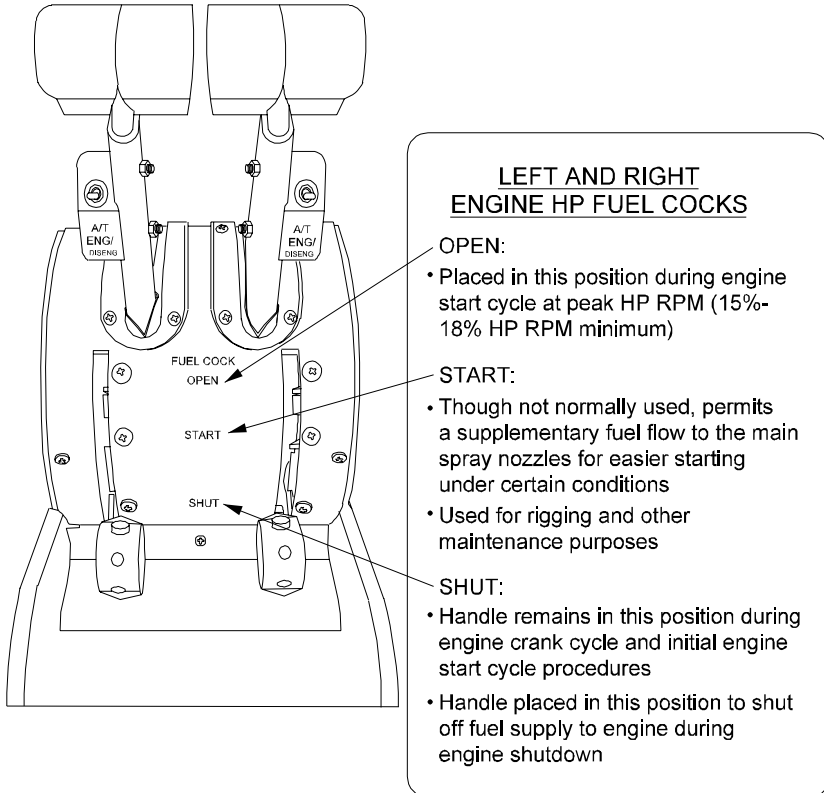
2A-73-00

Page 4
May 31/01

PRODUCTION AIRCRAFT SYSTEMS

Gulfstream IV

OPERATING MANUAL



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HP Fuel Cock Positions
Figure 2

PRODUCTION AIRCRAFT SYSTEMS

2A-73-00

Page 5
May 31/01

Gulfstream IV

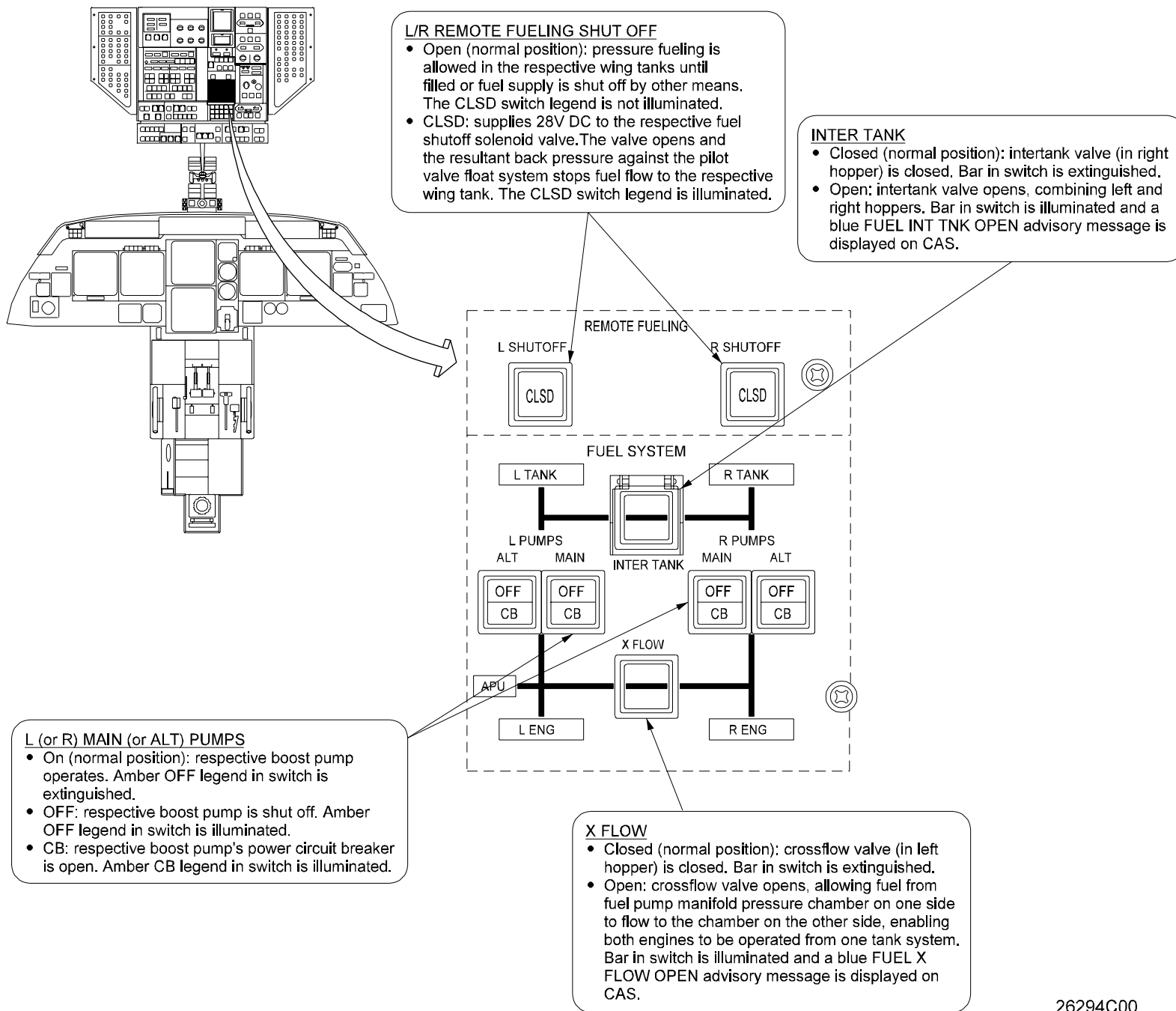
OPERATING MANUAL

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2A-73-00

Page 6
May 31/01

PRODUCTION AIRCRAFT SYSTEMS



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Engine Fuel System
Controls and Indications
Figure 3