

AUTOFEATHER light for that engine extinguishes.

The system is intended for use only during take-off and landing and should be turned off when establishing cruise climb.

LOW PITCH STOPS

Low pitch propeller position is determined by the Low Pitch Stop which is a mechanical/hydraulic stop. This mechanism, allows the blades to rotate beyond the low pitch position into reverse when selected. Beta and reverse blade angles are provided by adjusting the low pitch stop, controlled by the Power Levers in the reverse range.

PROPELLER SYNCHROPHASER

The propeller synchrophaser matches the rpm of the right propeller (slave propeller) to that of the left propeller (master propeller) and maintains the blades of one propeller at a predetermined relative position with the blades of the other propeller. Normal governor operation is unchanged and the synchrophaser will continuously monitor propeller rpm and reset the governor as required.

A magnetic pickup mounted in each propeller overspeed governor transmits electric pulses to a transistorized control box installed forward of the pedestal. The control box converts any pulse rate differences into correction commands, which are transmitted to a stepping type actuator motor mounted on the right engine cowl forward support ring. The motor trims the right propeller governor through a flexible shaft and trimmer assembly to exactly match the left propeller. The trimmer, installed between the governor control arm and the control cable, screws in or out to adjust the governor while leaving the control lever setting constant. A toggle switch installed adjacent to the synchroscope turns the system ON. With the switch OFF, the actuator automatically runs to the center of its range of travel before stopping to assure normal function when used again. To operate the system, synchronize the propellers in the normal manner and turn the synchrophaser ON. The system is intended for in-flight operations and is placarded to be OFF for take-off and landing. With the system ON and the landing gear extended, the caution flashers and a yellow light on the annunciator panel, PROP SYNC ON, will illuminate.

The right propeller rpm and phase will be adjusted to correspond to the left. To change rpm, adjust both propeller controls at the same time. This will keep the right governor setting within the limiting range of the left propeller. If the synchrophaser is ON but is unable to adjust the right propeller to match the left, the actuator has reached the end of its travel. To re-center, turn the switch OFF, synchronize the propellers manually, and turn the switch back ON.

To prevent the right propeller from losing excessive rpm if the left propeller is feathered while the synchrophaser is ON, the synchrophaser has a limited range of approximately ± 30 rpm from the manual governor setting.

FUEL SYSTEM

The fuel system consists of two separate systems connected by a crossfeed system.

Fuel for each engine is supplied from a nacelle tank and four interconnected wing tanks for a total of 192 gallons of usable fuel for each side with all tanks full. The outboard wing tanks supply the center section wing tank by gravity flow. The nacelle tank draws its fuel supply from the center section tank. Since the center section tank is lower than the other wing tanks and the nacelle tank, the fuel is transferred to the nacelle tank by the fuel transfer pump in the low spot of the center section tank.

Each system has two filler openings, one in the nacelle tank and one in the leading edge tank. To assure that the system is properly filled, service the nacelle tank first, then the wing tanks.

A crossfeed valve in the left hand fuel system makes it possible to connect the two systems. With the crossfeed valve OPEN one system can supply fuel to the other. Each system has a submerged boost pump in the nacelle tank and this pump supplies the motive force to transfer fuel as well as fuel boost to one or both engines. With one engine inoperative, the crossfeed system allows fuel from the inoperative side to be supplied to the operating engine.

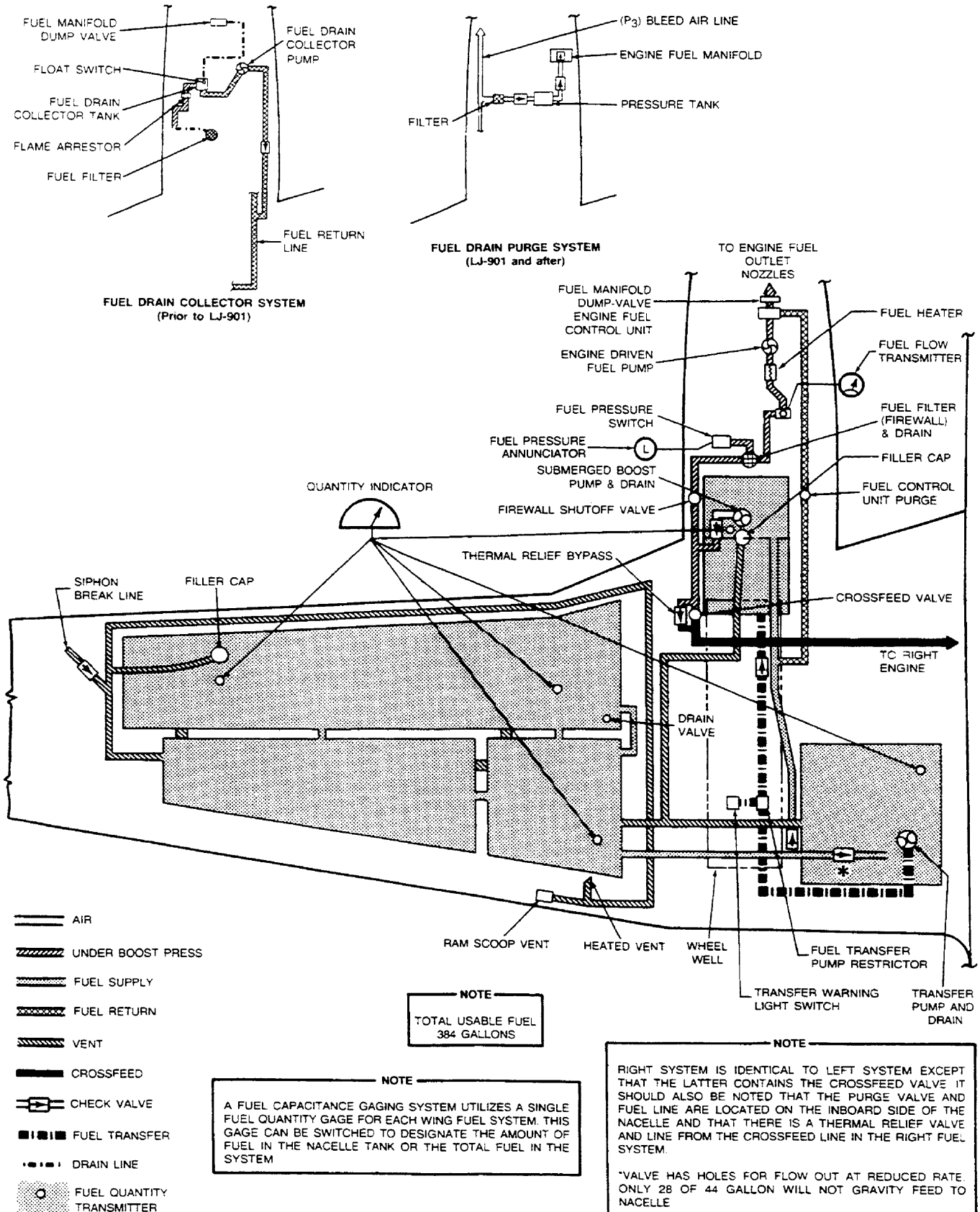
The fuel system is vented through a recessed ram scoop vent, coupled to a heated external vent, located on the underside of the wing, adjacent to the nacelle. The external vent is heated to prevent icing. One vent acts as a back-up for the other should one or the other become blocked.

BOOST PUMPS

The boost pumps are submerged, rotary, vane-type impeller pumps, electrically driven. One pump is located in each nacelle tank.

FUEL TRANSFER PUMPS

Submerged, electrically driven, impeller pumps located at the low spots in the wing center section tanks provide the motive force for fuel transfer from wing tanks to nacelle tanks. Fuel transfer is accomplished when the TRANSFER PUMP switches are turned ON, unless the nacelle tanks are full. A TRANSFER TEST switch (placarded L and R) is provided to verify the operation of each pump when its nacelle tank is full.



FUEL SYSTEM SCHEMATIC

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The nacelle tanks will continue to fill until the fuel reaches the upper transfer limit and a float switch turns the pump off. As the engines burn fuel from the nacelle tanks (60 gallon capacity each tank), fuel from the wing tanks transfers into the nacelle tanks each time their level drops approximately ten gallons.

When 131 gallons of fuel (each side) are used from the wing tanks (132 gallons usable each side), a pressure sensing switch reacts to a pressure drop in the fuel transfer line. After 30 seconds, the transfer pump shuts off and the annunciator panel illuminates, showing a NO FUEL TRANSFER light. The NO FUEL TRANSFER light also functions as an operation indicator for the transfer pump. Extinguishing the NO FUEL TRANSFER light is accomplished by turning the transfer switch OFF.

If the transfer pump fails to operate during flight, gravity feed will perform the transfer. When the nacelle tank level drops to approximately 150 lbs, the gravity feed port in the nacelle tank opens and gravity flow from the wing tank starts. All wing fuel except 28 gallons from each wing will transfer during gravity feed.

CROSSFEED

Crossfeeding fuel is authorized only in the event of engine failure or electric boost pump failure.

The crossfeed system is controlled by a three-position switch placarded OPEN, CLOSED, and AUTO. The valve can be manually opened or closed, but under normal flight conditions it is left in the AUTO position. In the AUTO position, the fuel pressure switches are connected into the crossfeed control circuit. In the event of a boost pump failure, causing a drop in fuel pressure, these switches open the crossfeed valve allowing the remaining boost pump to supply fuel to both engines.

In the event of a boost pump failure during takeoff, the system will begin to crossfeed automatically allowing the pilot to complete the takeoff without an increase in work load at a crucial time. After the takeoff is completed, or if the boost pump fails after takeoff, the crossfeed switch may be closed and the flight continued relying on the engine-driven high pressure pump. In some instances the pilot may elect to continue the flight with the remaining boost pump and the crossfeed system in operation.

CAUTION

Operation with the FUEL PRESSURE light on is limited to 10 hours, after which the engine-driven high pressure pump must be overhauled or replaced. When operating with Aviation Gasoline base fuels, operation on the engine driven high pressure pump alone is permitted up to 8000 feet for a period not to exceed 10 hours. Operation above 8000 feet requires boost or crossfeed.

The crossfeed system may be used in the case of an engine failure to allow the operating engine to draw fuel from the tanks on the opposite side of the airplane if necessary.

Refer to the EMERGENCY PROCEDURES section, "CROSSFEED", for detailed steps in carrying out these procedures.

FIREWALL SHUT-OFF

The system incorporates two firewall shutoff valves controlled by two switches, one on each side of the fuel system circuit breaker panel on the fuel control panel. These switches, respectively LEFT and RIGHT are identified as FUEL FIREWALL VALVE - OPEN - CLOSED. A red guard over each switch is an aid in preventing accidental operation. Like the boost pumps, the firewall shutoff valves receive electrical power from the main buses and also the essential buses which are connected directly to the battery.

FUEL DRAINS

During each preflight, the fuel sumps on the tanks, pumps and filters should be drained to check for fuel contamination. There are four sump drains and one filter drain in each wing and are located as follows:

NUMBER	DRAINS	LOCATION
1	Leading Edge Tank Sump	On underside of outboard wing just forward of main spar
1	Firewall Fuel Filter Drain	Pull ring located on firewall under cowl cover, right side of engine
1	Boost Pump Sump	Bottom center of nacelle forward of wheel well
1	Transfer Pump Sump Drain	Just outboard of wing root, forward of flap
1	Wheel Well Sump	Inside wheel well on gravity feed line

FUEL FILTER

Fuel supply lines forward of the firewall shutoff valves have the following items in sequence, on line:

Fuel Filter
Fuel Pressure Switch
Fuel Flow Indicator Transmitter
Fuel Heater
Engine Driven Fuel Pump
Engine Fuel Control Unit

The functions of the last three items are described under POWER PLANT in this section. Functions of the Fuel Filter, etc. are as their names imply.

A valve attached to the base of the Fuel Filter and opened or closed with a pull ring on the firewall (right side under cowl) makes it possible to drain fuel from the Fuel Filter for preflight check.

FUEL GAGING SYSTEM

The airplane is equipped with a capacitance fuel gaging system. The fuel panel utilizes a fuel quantity indicator for each side. A toggle switch, located between the two fuel quantity indicators, can be placed in the TOTAL position to provide an indication of all fuel in the system, or in the NACELLE position to indicate the quantity of fuel in the nacelle tanks only. Nacelle position is provided in order to verify nacelle fuel quantity during operations with NO FUEL TRANSFER illuminated where it is desirable to monitor gravity feed from wing tanks.

Fuel quantity gages indicate pounds of fuel.

FUEL DRAIN COLLECTOR SYSTEM

Prior to LJ-901:

After engine shutdown, the small amount of fuel present in the fuel nozzle manifolds, drains into a small collector tank. The tank is mounted to one of the lower fire shields in the aft engine compartment. An electric float switch senses the collector tank fuel level and activates an electric pump which then transfers the fuel back to the wing tank. When the collector tank is emptied, the float switch turns off the pump. The entire operation is automatic and requires no input from the crew.

FUEL PURGE SYSTEM

LJ-901 and after:

Engine compressor discharge air (P₃ air) pressurizes a small (purge) tank. On engine shutdown when fuel manifold pressure subsides, allowing the engine fuel manifold poppet valve to open, the purge tank pressure forces fuel out of the engine fuel manifold lines through the nozzles and into the combustion chamber. As the fuel is burned, a momentary surge in (N₁) gas generator rpm should be observed. The entire operation is automatic and requires no input from the crew.

On engine start-up fuel manifold pressure closes the fuel manifold poppet-valve allowing P₃ air to pressurize the purge tank.

USE OF AVIATION GASOLINE

If aviation gasoline is used as an alternate or emergency fuel, the hours of operation on gasoline must be calculated

to avoid exceeding the maximum of 150 hours of operation on gasoline between overhauls. Since the gasoline is being mixed with regular fuel, record the number of gallons of gasoline taken aboard for each engine. Determine the average fuel consumption for each hour of operation. If one engine has an average fuel consumption of 40 gallons per hour, for example, it is allowed 6000 gallons of aviation gasoline between overhauls (or 12,000 gallons between overhauls for both engines).

ELECTRICAL SYSTEM

BATTERY AND GENERATOR

The airplane electrical system is a 28-VDC (nominal) system with the negative lead of each power source grounded to the main airplane structure. DC electrical power is provided by one 34-ampere-hour, air-cooled, 20-cell, nickel-cadmium battery, and two 250-ampere starter/generators connected in parallel. The system is capable of supplying power to all subsystems that are necessary for normal operation of the airplane. The battery is directly connected to the battery emergency bus which supplies power for essential loads such as boost pumps, firewall shutoff valves, and the cabin threshold light circuit. The battery, left generator, and right generator each provide power to the buses.

A battery relay, controlled by the BAT switch, connects the battery to the battery bus. Isolation diodes permit the battery relay to be energized by external power or generator power in the event the battery charge is insufficient to activate the relay. A normal system potential of $28.25 \pm .25$ volts maintains the battery at full charge. An overvoltage relay opens the field circuit at 32 to 34 volts to provide overvoltage protection.

During engine starts, the battery is connected directly to the starter/generator by the starter relay. The starter/generator drives the compressor section of the engine through accessory gearing. The starter/generator initially draws 700 to 1000 amperes and then drops rapidly to about 300 amperes as the engine reaches 20% gas generator speed.

Each subpanel feeder supplies two dual buses through 50 ampere circuit breakers and isolation diodes. Thus, both dual subpanel feeder buses can be powered by either generator. The subpanel feeder also provides power, through a 50 ampere circuit breaker, to essential components. The essential components, therefore, are supplied by two sources, the battery emergency bus and the subpanel feeder. This provides a secondary source of power to the essential components in the event of an open fuse from the essential bus. The essential bus fuses may be checked before starting the engines by turning on the boost pumps with the battery switch off and listening for operation of the pump. In addition to supplying the subpanel buses, each main bus directly feeds a number of loads such as the