

**canadair
challenger**

OPERATING MANUAL
PSP 601A-6

SECTION 9

FIRE PROTECTION

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SECTION 9

FIRE PROTECTION

1. GENERAL

Fire protection, consisting of fire detection, warning and extinguishing, is provided by two independent systems: one for the auxiliary power unit (APU) and one for the two power plants. Each system includes fire detection and extinguishing electrical circuits. The fire extinguishing agent (Firex) bottles, two for the power plants and one for the APU, are located in the rear fuselage equipment bay.

Both systems are capable of detecting false fire warning signals generated by electrical shorts in the sensing cable circuits. The malfunctioning circuit is automatically isolated and a warning light in the flight compartment comes on to indicate a fire detection failure.

Titanium firewalls on the engine pylon serve to isolate the power plant fire zones from the adjacent aircraft structure. The fuel, hydraulic and engine bleed air lines are all isolated from the power plant fire zones by shutoff valves located on the inboard side of the firewall. The APU is surrounded by a banadized aluminum enclosure designed to contain an APU fire.

A separate system for overheat detection in the engine jet pipe and pylon area aft of the engine firewall is provided.

2. FIRE AND OVERHEAT DETECTION (Figure 1)

Fire and overheat detection is provided for five detection zones, two for each power plant and one for the APU. The power plant fire zones are: the area within the core cowling and around the engine combustor section, designated zone A; and the area around the engine jet pipe and a part of the pylon assembly behind the firewall, designated zone B. The APU fire zone is the area within the APU fireproof enclosure.

Heat sensing cables are routed through the fire zones and are connected to fire or overheat detection units in the flight compartment. The detection units discriminate between valid fire warnings and system faults and cause either warning or fault warning lights to come on in the flight compartment.

A. Fire Sensing Cables

Each fire sensing cable is a co-axial electrical cable consisting of two conductors, a stainless steel outer conductor grounded to the airframe and an inner conductor connected in a closed loop to a detection unit. The two conductors are separated by a semi-conductor medium which decreases in electrical resistance as temperature increases. When the resistance of the semi-conductor decreases to a preset limit, a warning is sent to the flight compartment via one of the detection units.

A single break in a cable does not impair its warning capabilities but if a cable is broken in more than one place, any section between breaks will not function.

The left and right power plants each have four fire sensing cables: two connected in series and routed through fire zone A, one routed around the jetpipe in fire zone B and one routed through the pylon in fire zone B. The APU fire zone contains one cable attached to the APU enclosure walls.

B. Fire and Overheat Detection Units

Three fire and overheat detection units are installed below the copilot's side console. Two of the units serve the left and right power plant zone A detection zones respectively and the remaining unit serves the APU. Two separate alarm circuits discriminate between valid fire or overheat warnings and false warnings. The system compares the speed and extent of sensing cable resistance change and initiates fire and overheat or fault warnings.

Two fire and overheat detection units, identical to those described above, serve the left and right power plant zone B detection zones.

C. Operation (Figures 1 and 2)

When a fire or overheat condition occurs in one of the fire zones, it is detected by the associated fire or overheat detection unit and interpreted as either a valid fire warning or as a fault.

If a valid fire warning is received, the detection unit causes the appropriate fire warning light to come on and activates the fire warning bell. In addition, if a valid APU fire warning is received, the APU fire or overheat detection unit initiates a shutdown of the APU. The fire warning light and the fire warning bell continue to operate as long as a fire/overheat condition exists. The fire warning bell is silenced via the TONE MUTED switch/light on the copilot's side panel.

If a fire detection unit detects a false warning signal caused by a short circuit in a sensing cable, it powers the appropriate amber FIRE WARN FAIL light and automatically isolates the defective fire warning circuit.

D. Fire Warning Circuit Testing

A fire warning test circuit is used to check the serviceability of the fire detection warning and fault circuits.

This test circuit simulates fire conditions in both power plants and in the APU. If the fire detection system is functioning correctly, the usual fire warnings take place.

NOTE: The APU fire shutoff relay is isolated from the fire warning circuits when a test is initiated. This permits operation of the APU during testing of the fire warning system.

The fire warning test circuit can also check the operation of the fault detection circuits in the detection units by simulating a short in each of the sensing cable circuits. If the fault detection circuits are functioning correctly, the usual fault warnings take place.

E. Engine Jet Pipe/Pylon Overheat Detection System (Figure 3)

This system consists of an ENGINE JET PIPE/PYLON panel, two overheat detection units and fire sensing cables in the zone B detection zones.

(1) Operation

When one of the overheat detection units receives a valid overheat signal from its associated zone B fire sensing cable, it causes the appropriate OVHT light on the ENGINE JET PIPE/PYLON panel to come on flashing. The light continues to flash until the overheat condition is corrected by reducing power or shutting down the engine.

If an overheat detection unit detects a short circuit in one of the fire sensing cables, the appropriate OVHT WARN FAIL light comes on. The detection unit also isolates the defective overheat warning circuit.

(2) System Testing

A test circuit is used to check the serviceability of the system. The test is successful if the usual overheat warnings take place.

The ability of the system to detect false overheat signals can also be tested by pressing the OVHT WARN FAIL switch/lights.

3. APU AND POWER PLANT FIRE EXTINGUISHING (Figure 4)

The power plant bottles are interconnected, which allows both bottles to be used on one power plant if necessary. The APU bottle is completely independent and discharges into the APU enclosure only. Firex bottle low-pressure warning lights and test switches for the bottle discharge cartridges (squibs) are provided (refer to Figure 5).

A. APU Fire Extinguishing (Figure 4)

The APU Firex bottle is clamped to the rear fuselage structure above the left side of the APU enclosure and charged with Halon 1301, a non-toxic and non-corrosive fire extinguishing agent, pressurized by dry nitrogen at 600 to 625 psig (at 15°C). The bottle is equipped with a fill valve and is protected against thermal overpressure by a pressure relief valve. Discharge is made through a pipe into the rear fuselage bay. A pressure gauge, mounted on the bottle, allows ground service personnel to monitor the charge pressure. A bottle low-pressure warning is also provided in the flight compartment.

B. Power Plant Fire Extinguishing (Figure 4)

Two Firex bottles for the power plant fire extinguishing system are bolted to the APU support structure in the rear fuselage equipment bay. The bottles are filled with Halon 1301 extinguishing agent pressurized by dry nitrogen at 600 to 625 psig (at 15°C). Each bottle is equipped with a pressure relief and fill valve and a pressure gauge, similar to the units on the APU Firex bottle. Two discharge valves are installed on each bottle to permit interconnection of the discharge lines, making it possible to discharge both the bottles into one power plant if necessary.

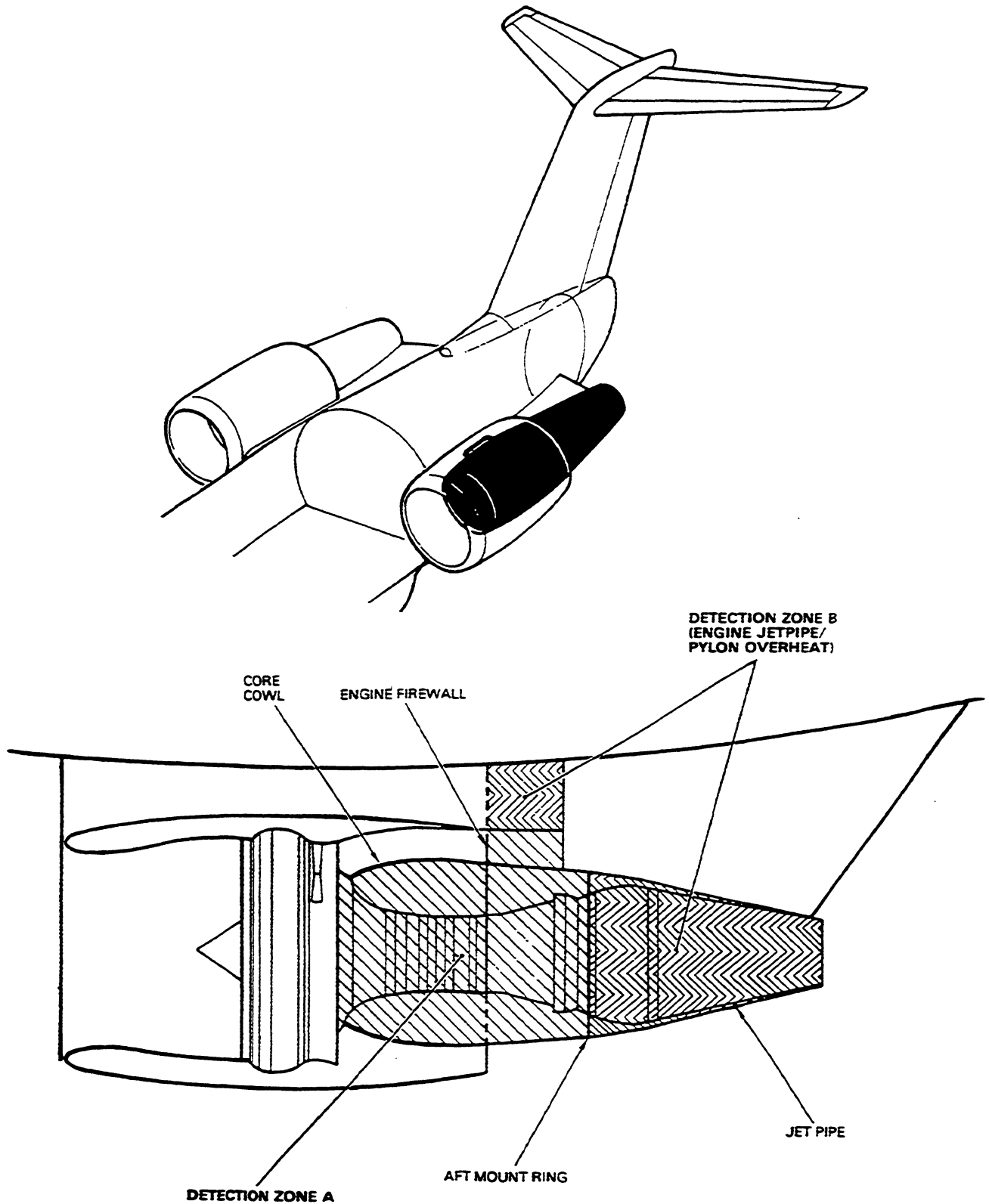
The discharge cartridges (squibs) for the power plant Firex bottles are identical to the APU bottle and operate in a similar manner.

C. System Operation (Figures 4, 5, 6 and 7)

For system operation, refer to the fire detection and extinguishing sequence, Figures 6 and 7.

D. System Reset

After a fire warning occurs and the appropriate fire warning switch/light (LH or RH ENG FIRE PUSH or APU FIRE PUSH) is pressed, the fire warning and extinguishing system can be reset, if circumstances warrant, by pressing the fire warning switch/light a second time which returns the system to the pre-warning condition. The fire warning light goes out, the fire warning bell stops and the APU or engine previously shut down can be restarted. Attempting to reset the system with a fire or overheat condition still present in the affected fire zone(s) results in the immediate reactivation of the fire warning.



Power Plant Fire and Overheat Detection Zones
Figure 1

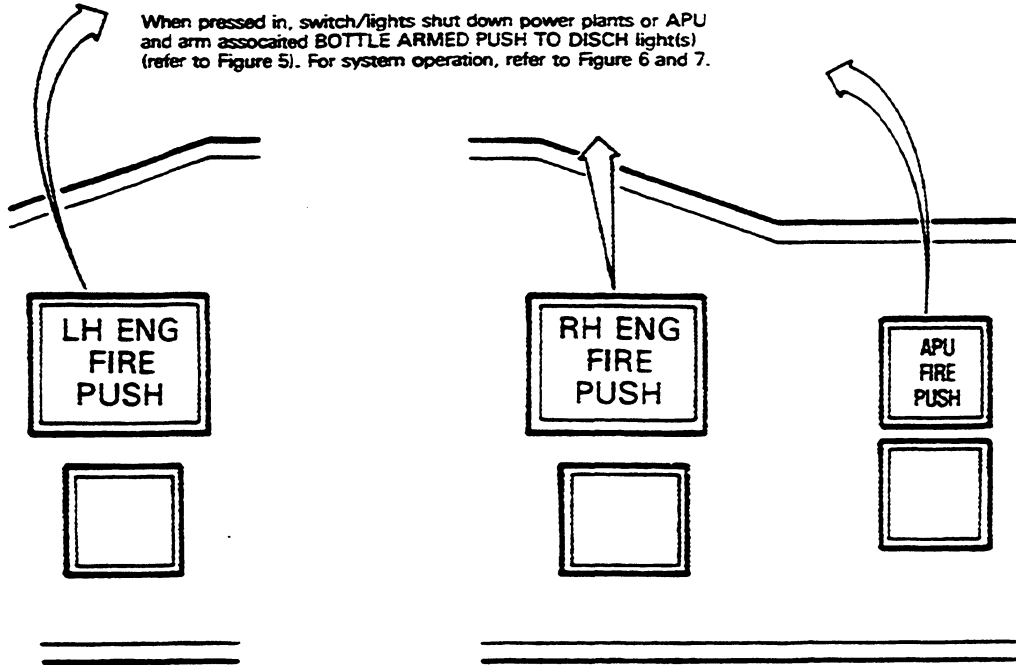
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LH ENG, RH ENG AND APU FIRE PUSH SWITCH/LIGHTS

Each switch/light is electrically connected to a fire and overheat detection unit.

Red LH ENG, RH ENG or APU FIRE PUSH lights come on if a valid fire warning is received by the associated fire and overheat detection unit.

When pressed in, switch/lights shut down power plants or APU and arm associated BOTTLE ARMED PUSH TO DISCH light(s) (refer to Figure 5). For system operation, refer to Figure 6 and 7.



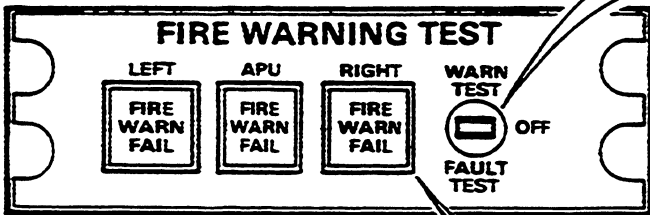
GLARESHIELD

FIRE WARNING TEST SWITCH

Three-position, spring-loaded toggle switch with the following functions:

WARN TEST - Simulates fire condition by grounding the fire sensing cables. Fire warning bell sounds and all the FIRE PUSH and the BOTTLE ARMED PUSH TO DISCH lights come on.

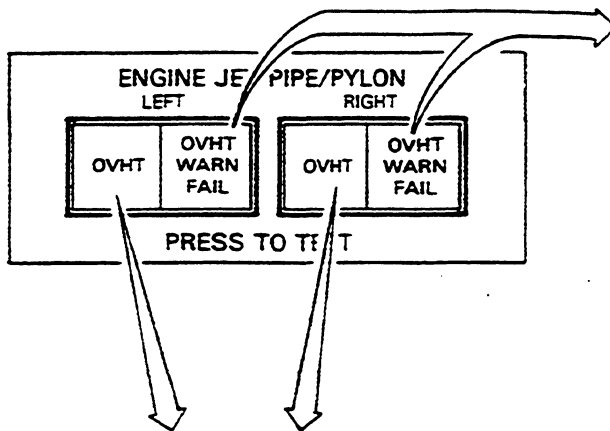
FAULT TEST - Simulates an electrical short in the fire sensing cables. All three FIRE WARN FAIL lights come on.



FIRE WARN FAIL LIGHTS

Amber FIRE WARN FAIL lights come on if a false warning, generated by an electrical short in a sensing cable circuit, is received by the associated fire and overheat detection unit. Light remains on and faulty detection circuit remains isolated from system until fault is corrected.

COPILOT'S CONSOLE



OVHT WARN FAIL SWITCH/LIGHTS

Amber lights come on if an overheat warning, generated by an electrical short, in a zone B sensing cable circuit, is received by associated overheat detection unit. Lights remain on and faulty detection circuit remains isolated from system until fault is corrected.

Pressing lights test overheat detection circuits. Correct operation of system is indicated by OVHT WARN FAIL lights coming on.

OVHT SWITCH/LIGHTS

Each switch/light is electrically connected to a zone B overheat detection unit.

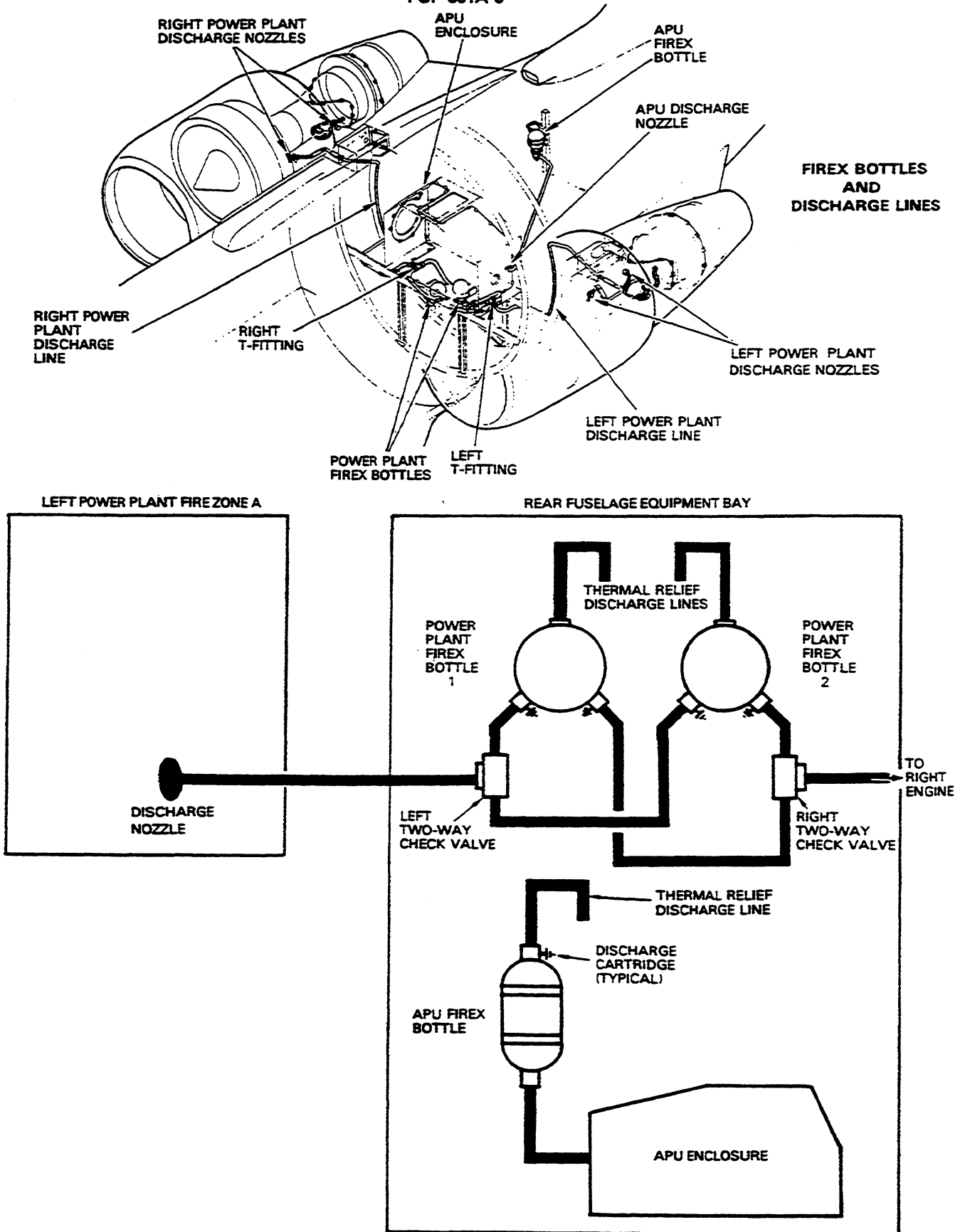
Red left and right OVHT lights come on flashing if a valid zone B overheat warning is received by the associated overheat detection unit.

Pressing lights test functioning of warning circuit and sensing cable continuity. Correct operation of system is indicated by OVHT lights coming on.

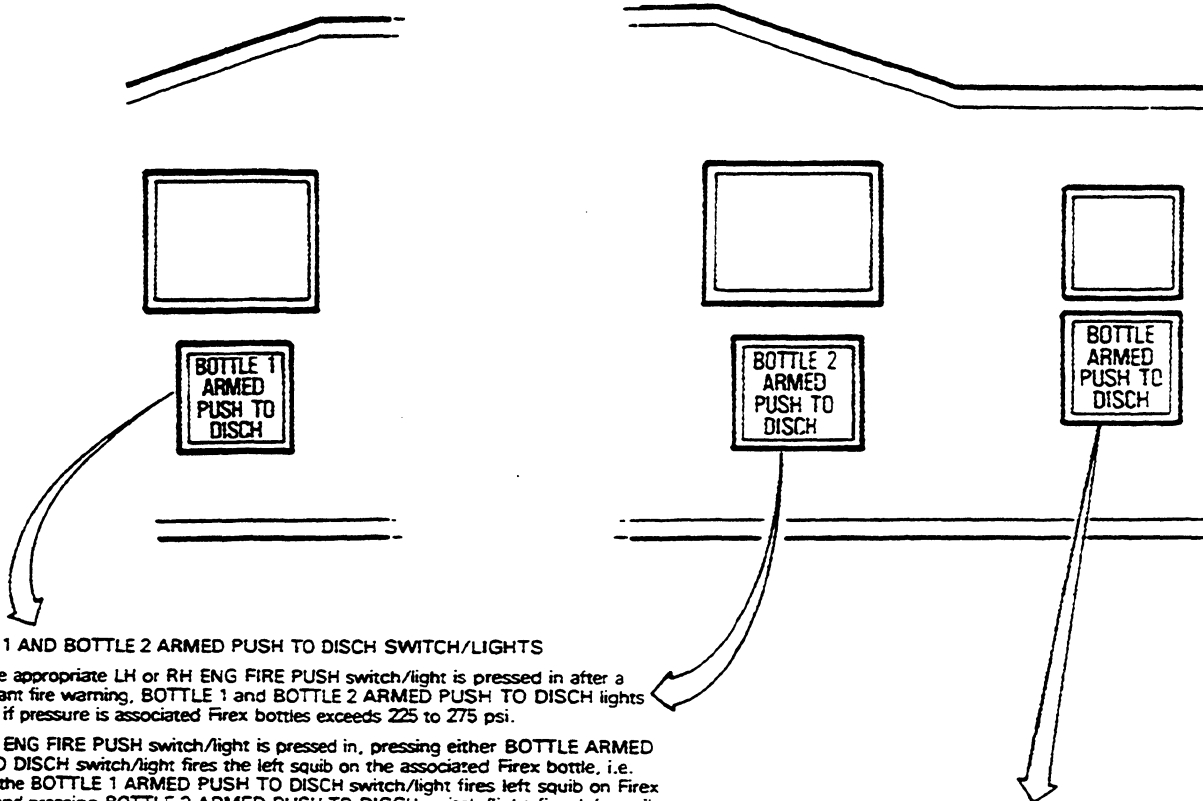
CENTRE INSTRUMENT PANEL

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**Fire Extinguishing System Discharge Lines - Schematic
Figure 4**



BOTTLE 1 AND BOTTLE 2 ARMED PUSH TO DISCH SWITCH/LIGHTS

When the appropriate LH or RH ENG FIRE PUSH switch/light is pressed in after a power plant fire warning, BOTTLE 1 and BOTTLE 2 ARMED PUSH TO DISCH lights come on if pressure in associated Firex bottles exceeds 225 to 275 psi.

After LH ENG FIRE PUSH switch/light is pressed in, pressing either BOTTLE ARMED PUSH TO DISCH switch/light fires the left squib on the associated Firex bottle, i.e. pressing the BOTTLE 1 ARMED PUSH TO DISCH switch/light fires left squib on Firex bottle 1 and pressing BOTTLE 2 ARMED PUSH TO DISCH switch/light fires left squib on Firex bottle 2. Right squibs are fired in a similar manner if RH ENG FIRE PUSH switch/light is pressed in response to a fire condition in the right power plant.

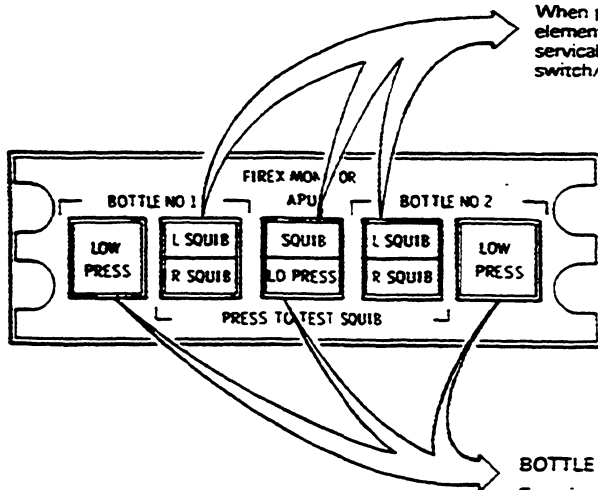
APU BOTTLE ARMED PUSH TO DISCH SWITCH/LIGHT

Following an APU fire warning, and after the APU FIRE PUSH switch/light has been pressed in, the green BOTTLE ARMED PUSH TO DISCH light comes on if pressure in APU Firex bottle exceeds 225 to 275 psi. Pressing switch/light in fires squib on APU Firex bottle.

GLARESHIELD

PRESS TO TEST SQUIB SWITCH/LIGHTS

When pressed in, test electrical continuity of ignition circuits to both the ignition elements inside the associated squib. Green light comes on if ignition circuit is servicable. Test current across ignition element is maintained at safe level by switch/light circuit.



BOTTLE LOW PRESS LIGHTS

Energized by circuits across electrical pressure switches integral with bottle-mounted pressure gauges. Amber LOW PRESS light comes on when associated bottle pressure drops below 275 to 225 psi and remains on until pressure increases to above 450 psi.

COPLOT'S CONSOLE

		FLIGHT COMPARTMENT INDICATIONS		
		APU FIRE PUSH	BOTTLE ARMED PUSH TO DISCH	APU LO PRESS
	RESULT			
1	Fire or overheat condition occurs in the APU fire zone.	ON	OUT	OUT
2	APU FIRE PUSH switch/light is pressed in.	ON	ON	OUT
3	BOTTLE ARMED PUSH TO DISCH switch/light is pressed in.	ON	ON	OUT
4	APU bottle fully discharges.	OUT	OUT	ON until APU bottle is recharged

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	EVENT	RESULT	FLIGHT COMPARTMENT INDICATIONS				
			LH ENG FIRE PUSH	BOTTLE 1 ARMED PUSH TO DISCH	BOTTLE 2 ARMED PUSH TO DISCH	BOTTLE NO 1 LOW PRESS	BOTTLE NO 2 LOW PRESS
1	Fire or overheat condition occurs in left power plant fire zones.	- LH ENG FIRE PUSH light comes on.	ON	OUT	OUT	OUT	OUT
2	Left throttle lever is set to IDLE position.	- LH ENG FIRE PUSH light remains on.	ON	OUT	OUT	OUT	OUT
3	LH ENG FIRE PUSH switch/light is pressed in.	- BOTTLE 1 ARMED PUSH TO DISCHARGE light comes on. - BOTTLE 2 ARMED PUSH TO DISCHARGE light comes on. - Left squibs of bottles 1 and 2 are armed. - Left firewall fuel shutoff valve closes. - Left bleed air shutoff valve closes. - Left hydraulic shutoff valve closes. - Left engine - driven generator shuts down.	ON	ON	ON	OUT	OUT
4	BOTTLE 1 ARMED PUSH TO DISCH switch/light is pressed in.	- Left squib on bottle 1 fires. - Firex agent from bottle 1 discharges into left power plant fire zone A.	ON	ON	ON	OUT	OUT
5	Bottle 1 fully discharges.	- Pressure switch on bottle 1 opens as pressure drops below 225 to 275 psi and BOTTLE NO 1 LOW PRESS light on Firex monitor panel comes on.	ON	OUT	ON	ON	OUT
6	Fire or overheat condition in left power plant persists.	- LH ENG FIRE PUSH light remains on.	ON	OUT	ON	ON	OUT
7	BOTTLE 2 ARMED PUSH TO DISCH switch/light is pressed in.	- Left squib on bottle 2 fires. - Firex agent from bottle 2 discharges into left power plant fire zone A.	ON	OUT	ON	ON	OUT
8	Bottle 2 fully discharges.	- Pressure switch on bottle 2 opens as pressure drops below 225 to 275 psi and BOTTLE NO 1 LOW PRESS light on Firex monitor panel comes on. - Left power plant fire goes out.	OUT	OUT	OUT	ON	ON until bottle 2 is recharged.

Power Plant Zone A Fire Detection and Extinguishing Sequence
Figure 7