

FIRE PROTECTION SYSTEM

Fire protection system, installed on each engine, is designed to provide pilots with a simple, quick and reliable means of detecting and responding to hazardous overheating conditions and fires. System incorporates detection, warning, fire extinguishing and testing devices for each engine. Major system components are two overheat/fire sensor (detector) tubes, two responder switches, fire warning and system indicating lights, two fire extinguishing cylinders, electrical actuating pushbuttons and test systems to check condition of lamps, system integrity and two audio alarm units.

The engine nacelle has two designated fire zones: Zone 1 includes the accessories and compressors section. Zone 2 includes the combustor section.

Zone 1 is protected by the fire extinguishing system. If either fire or an overheat condition is sensed in this zone, **FIRE** annunciator and audio alarm in the cockpit comes on.

Zone 2 is not protected by fire extinguishing system, since fire in this section is self controlled due to limited amount of flammable fluids in this section. If either fire or an overheat condition is sensed in this section, **OVERHT** annunciator and audio alarm in the cockpit comes on.

Detection system consists of gas-filled sensor tube, pressure-operated diaphragm alarm responder switch and detector integrity responder switch. Sensor tube coils around and encircles engine at all critical points to provide large area overheating detection and concentrated, small area, spot detection of fire. Each sensor tube consists of stainless steel, hermetically sealed housing with permanently attached sensor element forming single unit.

Electrical connector and two pressure (responder) switches are enclosed in housing. Sensor tube also contains a core (discrete

element) which releases halogen gas when heated above a preset operating point. Sensor tube is also precharged with helium gas which surrounds the core and provides arithmetic average gas response feature, enabling detection of general overheating condition within the nacelle when heated to a preset operating point. Therefore-, increased pressure caused by general overheating or fire causes the **FIRE** or **OVERHT** light come on, by closing the normally open contacts of alarm (responder) switch.

Both average and discrete functions are reversible, therefore, when sensor cools, averaging gas pressure lowers, halogen is re-absorbed into discrete core and resulting pressure drop, causes alarm switch contacts to open and extinguish warning lights. Integrity responder switch is connected to **PRESS TO TEST** switch and is installed in sensor tube to check integrity of sensor tube. It is similar to alarm responder switch but operates at lower pressure and contacts are normally closed. If sensor is ruptured and gas pressure is lost, contacts open, thus, when **PRESS TO TEST** pushbutton is pressed, **FIRE/OVERHT** warning lights, for affected side, will not illuminate, indicating sensor failure.

Warning for overheat or fire condition in Zone 1 or Zone 2 in engine nacelle, is indicated by illumination of **FIRE** or **OVERHT** warning lights in fire control panel located at top of center instrument panel. (Refer to FIRE EMERGENCIAS procedures in EMERGENCY PROCEDURES, SECTION II for action to be taken if **FIRE** or **OVERHT** warning lights illuminated). Either fire or an overheat condition in Zone 1 sufficient to cause illumination of **FIRE** warning light will usually be accompanied by excessive ITT indication. If retarding thrust lever to idle, or cutting off engine, does not extinguish the light, press the illuminated pushbutton. When the pushbutton is activated it electrically closes fuel and hydraulic shutoff valves of affected engine and simultaneously arms both fire extinguishing cylinders to be directed for discharge at that engine. Armed cylinders are indicated by illumination of green **ARM** lights in upper half of both cylinder discharge (**ARM/EMPTY**) pushbutton.

Two fire extinguishing cylinders are located in aft fuselage behind baggage compartment. Left cylinder has two discharge cartridges and right cylinder has three cartridges. Left discharge port of each cylinder goes through common tube to left engine nacelle. When **FIRE** pushbutton is pressed, both, respective (left or right) discharge cartridges of extinguisher cylinders are armed for discharge at affected engine only.

Fire extinguishing is accomplished by pressing either **ARM** pushbutton. When pressed, **ARM** pushbutton electrically ignites respective armed cartridge causing rupture of discharge port and discharge of extinguishing agent to affected engine nacelle. **ARM** light then extinguishes and yellow **EMPTY** (bottom half of pushbutton) light illuminates. If necessary, remaining **ARM** light may be pressed to discharge remaining cylinder to same engine, as stated above. When fire is extinguished, reversible actions of sensor tube, as previously described, cause red **FIRE** warning light to go out.

Each fire extinguisher cylinder is equipped with combined filler and thermal relief valve which are connected, by common tube, to red thermal discharge (blow-out disk) indicator on right side of fuselage, below pylon. Thermal discharge of cylinder causes disk to blow out, requiring replacement of cylinder. Disk must be checked during preflight inspection.

Each cylinder pressure may be read directly from gage mounted directly on the cylinder, through external access panel.

When **OVERHT** annunciator and audio alarm come on, either fire or an overheat condition exists in Zone 2. The procedure is similar to **FIRE** warning, except for the need to activate fire extinguishers, since fire in this zone is self controlled and there is no fire extinguishing system in this zone.

Fire containment is provided by firewalls which isolate engines from pylons. In addition, inside cowl surfaces, above and below pylons, are

covered by stainless steel foil to prevent fire breakthrough.

Electrical power for fire detection and extinguishing systems is 28 VDC supplied by No. 1 and No. 2 distribution buses through respective L and R FIRE DET circuit breakers and L and R FIRE EXT circuit breakers, on overhead panel.

PRESS TO TEST pushbutton, in center of fire control panel, tests electrical circuits, integrity of sensor (detector) tube and extinguishing cylinders discharge cartridges. When PRESS TO TEST pushbutton is pressed, with electrical power on, both **FIRE/OVERHT** warning lights and audio alarm come on, indicating integrity of the four sensor tubes; illumination of **ARM/EMPTY** lights indicate continuity of electrical circuits; illumination of four white lights in PRESS TO TEST pushbutton indicates continuity to respective extinguisher cylinder discharge cartridges. **ENG FIRE TEST OK** message comes on when test is successful.

The fire protection system is continuously monitored for failures. Whenever a system failure exists, the appropriate **FIRE** or **OVERHT** light comes on and the **ENG FIRE DETECT (L/R)** message is displayed on the EICAS.

A system failure message is signaled whenever:

1. Any detector wire has a short circuit
2. Any detector wire breaks
3. Any detector sensor tube losses gas pressure
4. Any detector electrical connector is loose or contaminated

Electrical failure can be isolated to its corresponding engine by pressing the **PRESS TO TEST** pushbutton. **FIRE** or **OVERHT** light does not come on and **ENG FIRE TEST OK** message is not displayed on the EICAS whenever there is a faulty detector or system wiring failure in the corresponding zone 1 or zone 2.

The **ENG FIRE BTLE** message is displayed on the EICAS whenever loss of halon gas pressure is sensed in the fire extinguishing container.

When the IND TEST switch on the overhead panel is pressed, the four green lights in the PRESS TO TEST pushbutton come on to indicate that all lights are operating.

Two portable, hand-operated fire extinguishers are also provided: One, in cockpit and one, in passenger cabin. Since location of these extinguishers may vary with each customized interior aircraft configuration, pilots should determine specific locations for each aircraft.

To use portable extinguisher, remove from quick-release bracket, hold upright by gripping handgrip with spray nozzle pointing forward. Slide red safety-catch down, with thumb and point nozzle to direct spray at base of fire. Squeeze lever in handgrip with palm of hand to discharge spray. Ruptured, red indicator disk indicates partial or total discharge of extinguisher, which should be replaced immediately after use.

FIRE PROTECTION SYSTEM CONTROLS AND INDICATORS

FIRE/OVERHT Pushbutton Indicator Left and Right (red lights) - Located at top of Center Instrument Panel - **FIRE** illuminates if either overheating or fire occur in Zone 1. **OVERHT** illuminates if overheating or fire occurs in Zone 2. Pushbuttons are covered with clear guards. When pressed, they close fuel and hydraulic shutoff valves and arm both extinguisher discharge cartridges for affected engine; **ARM/EMPTY** pushbuttons illuminate. Both **FIRE/OVERHT** lights have a dim glow, to indicate continuous self monitoring for fire detection systems failures.

ARM Pushbutton Indicator Left and Right (Green Light) - Located at top of Center Instrument Panel. Upper half of **ARM/EMPTY** (Discharge) Pushbuttons, **ARM** lights illuminate to indicate discharge cartridges for affected engine are armed. Each **ARM** light extinguishes and **EMPTY** light illuminates when **ARM** pushbutton is pressed and respective cylinder is discharged to affected engine.

EMPTY Indicator Left and Right (Yellow Light) - Located at top of Center Instrument Panel. Lower Half of **ARM/EMPTY** (Discharge) Pushbuttons. **EMPTY** light illuminates to indicate respective extinguisher cylinder has been discharged. When electrical power is on, lights stay on until cylinder is replaced.

(Continued)

PRESS TO TEST Pushbutton (Four Integral Lights) - Located at top of center instrument panel. It tests fire protection system; when pressing the pushbutton:

- a. Both **FIRE** lights come on to indicate integrity of sensor (detection) tubes in Zone 1.
- b. Both **OVERHT** lights come on to indicate integrity of sensor tubes in Zone 2.
- c. Both **ARM** and **EMPTY** lights come on to indicate continuity of electrical circuits.
- d. Four indicator lights in **PRESS TO TEST** pushbutton come on to indicate integrity of respective extinguisher cylinder discharge cartridges.

Red Thermal Discharge Indicator - Located at left side of fuselage, below the pylon. If blown out, thermal discharge of extinguished cylinder is indicated. Must be checked during preflight inspection.

NOTE

Only the four green lights in **PRESS TO TEST** pushbutton come on when **IND TEST** switch is used.

Warning Messages

ENG FIRE (L/R) - Engine fire (zone 1)

ENG OVER HEAT (L/R) - Engine overheat (zone 2)

Caution Messages

L ENG FIRE BTLE - Aircraft on ground and left fire extinguisher bottle pressure below 400 psi

R ENG/APU FIRE BTLE - Aircraft on ground and right fire extinguisher bottle pressure below 400 psi

ENG FIRE DETECT (L/R) - Engine fire or overheat detector malfunction

Advisory Messages

ENG FIRE TEST OK - Successful fire protection test

Gulfstream G200 - Fire Protection

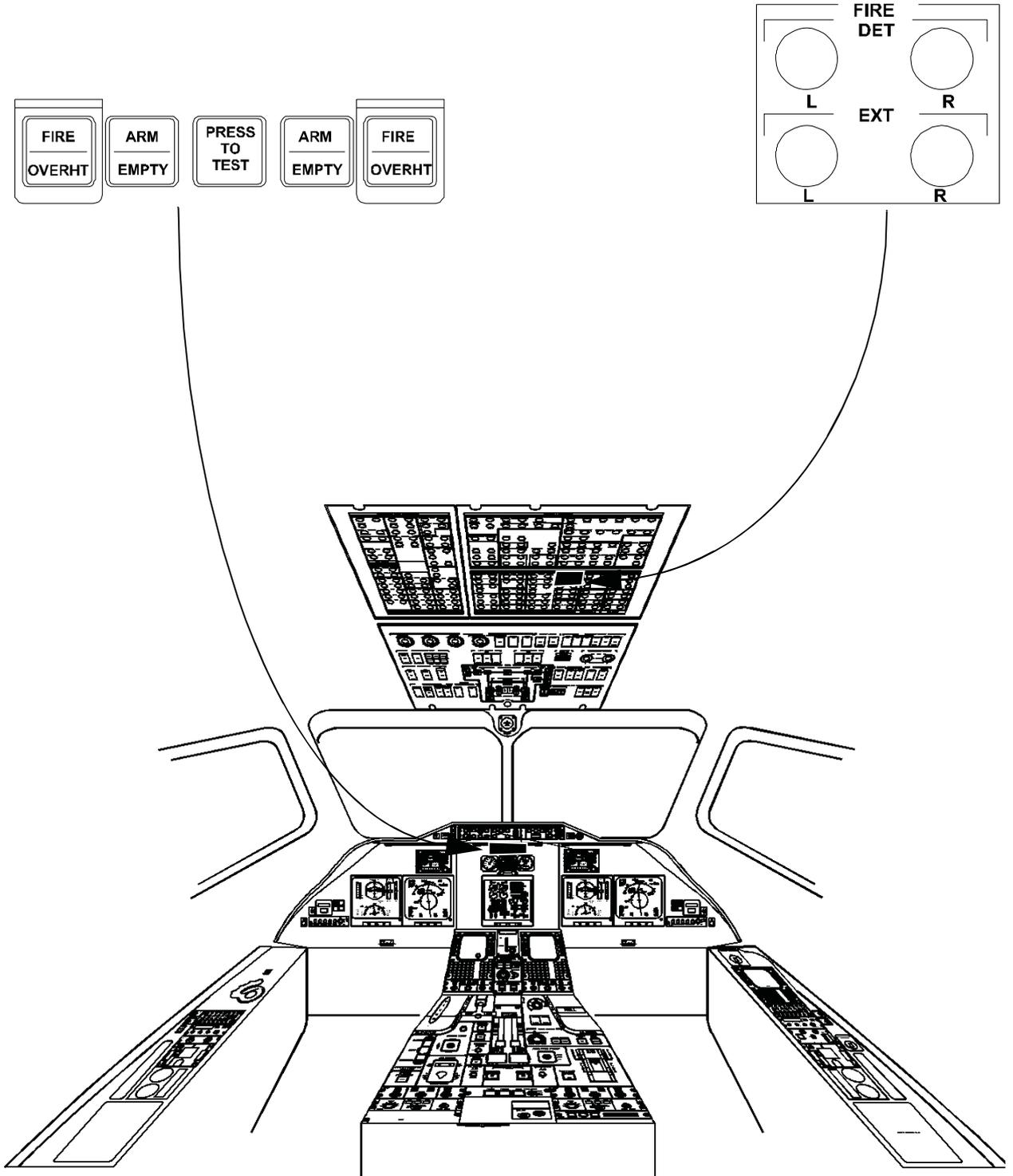


Figure 5-42. Fire Protection System Controls, Indicators and Warnings