

<b>FALCON 7X</b>	<b>ATA 26 – FIRE PROTECTION GENERAL</b>	<b>02-26-05</b>
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<b>ACRONYMS</b>
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<b>APU</b>	Auxiliary Power Unit
<b>ATSV</b>	Air Turbine Starter Valve
<b>CAS</b>	Crew Alerting System
<b>CB</b>	Circuit Breaker
<b>ECU</b>	Engine Control Unit
<b>FCP</b>	Fire Control Panel
<b>FPS</b>	Fire Protection System
<b>LH</b>	Left Hand
<b>MAU</b>	Modular Avionics Unit
<b>RH</b>	Right Hand
<b>SIL</b>	Silence
<b>SOV</b>	Shut Off Valve
<b>SSPC</b>	Solid State Power Controller

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**INTRODUCTION**

The fire protection system is designed to warn the crew in case of fire, overheat or smoke in certain aircraft zones.

The system allows the discharge of fire extinguisher in some of these zones.

The following table lists the concerned zones as well as related protection and extinguishing capabilities.

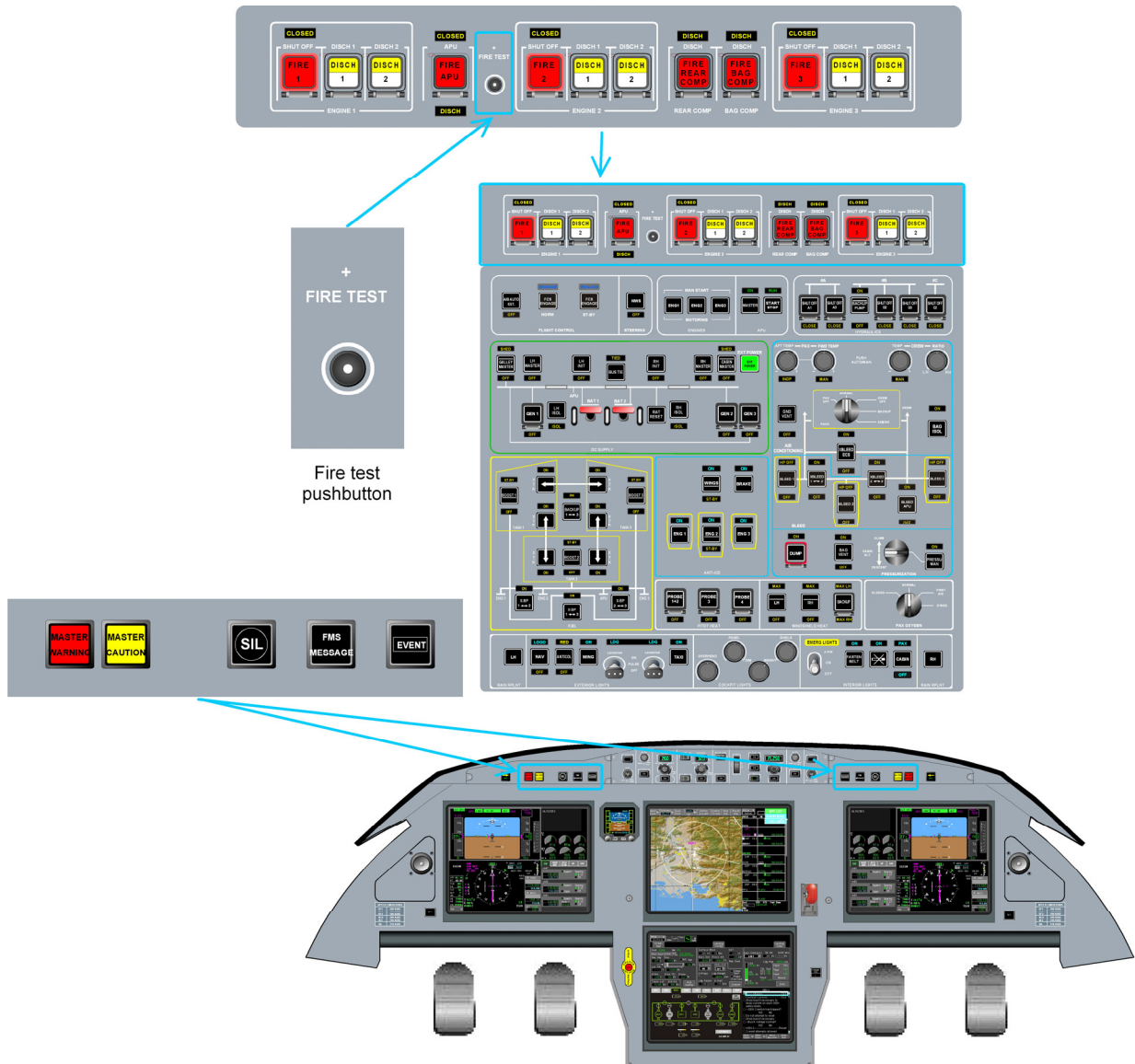
ZONE	FIRE DETECTION / OVERHEAT DETECTION	SMOKE DETECTION	FIRE EXTINGUISHING CAPABILITY
Engine	Yes Yes		Yes
APU	Yes Yes		Yes
Rear compartment	Yes Yes		Yes
Baggage compartment		Yes	Yes
Main Landing Gear wheel wells	Yes		

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**FLIGHT DECK OVERVIEW**

**CONTROLS**

Crew control of fire protection system is performed via the Fire Control Panel (FCP) on the Overhead Panel. Aural alerts can be interrupted with the Master warning or SIL pushbuttons.



**FIGURE 02-26-05-00 – FIRE PROTECTION CONTROLS**

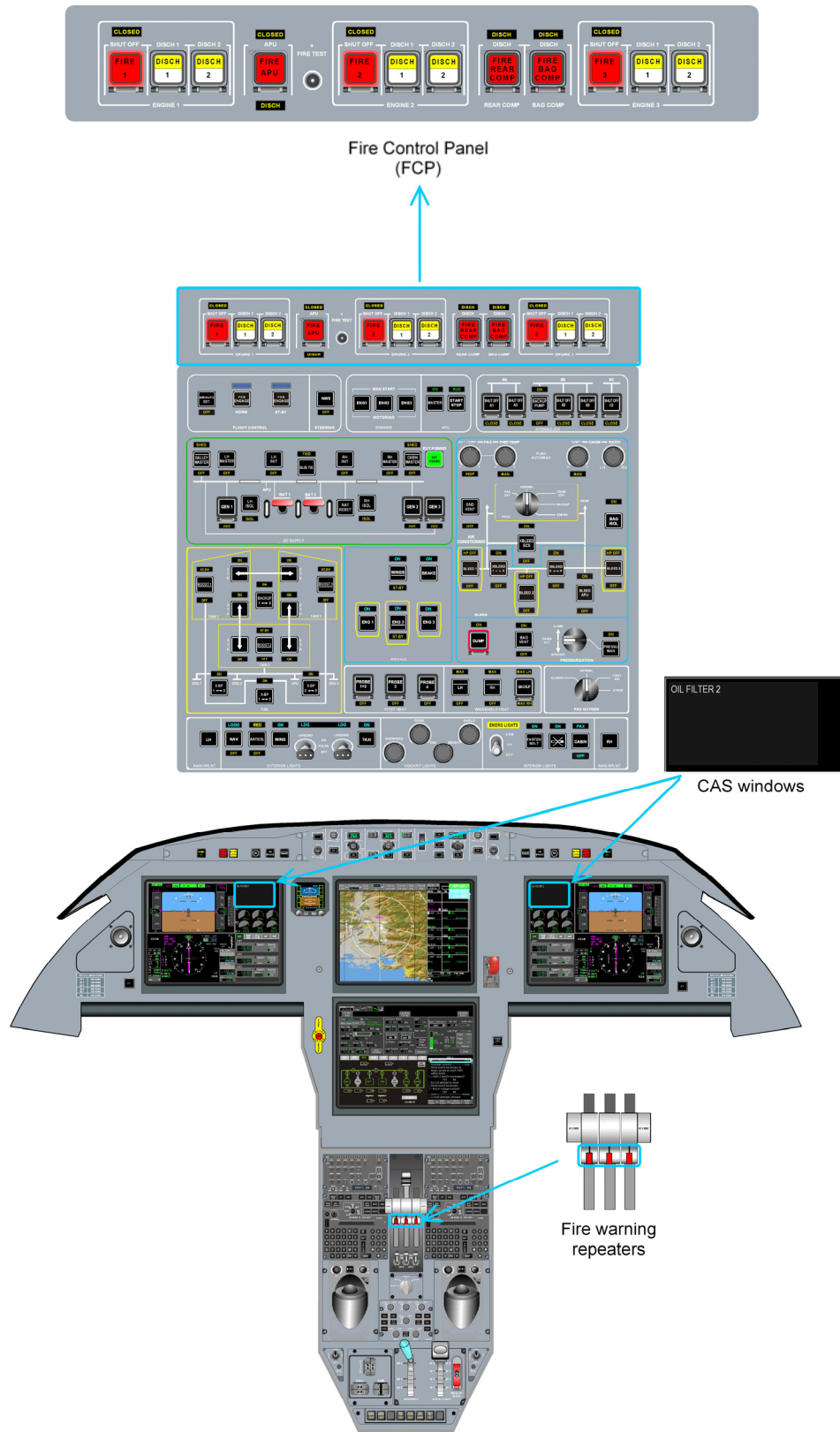
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### **INDICATIONS**

Cockpit indications are displayed:

- On the Fire Control Panel,
- On the throttle repeaters for engines on fire,
- On the ENG-CAS window for CAS messages,
- On the STATus synoptic / FAULT tab synoptic for failure messages.

There is no dedicated synoptic for the Fire Protection System (FPS).



**FIGURE 02-26-05-01 - FLIGHT DECK OVERVIEW**

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## **GENERAL**

The fire protection system can be separated into three functions:

- 1: Detection,
- 2: Extinction of Fire,
- 3. Auxiliary functions in case of engine or APU fire.

### **1. DETECTION**

Detection of fire or overheat is performed:

- For each engine: by two pneumatic detectors,
- For the APU: by one pneumatic detector,
- For the rear compartment: by one pneumatic detector.

Detection of fire or smoke in the baggage compartment is performed by a smoke detector.

Detection of overheat in the main wheel wells is performed by one pneumatic detector in each main wheel well.

### **2. EXTINCTION OF FIRE**

Fire extinction is performed:

- For the engines, APU and rear compartment: by the closure of the Shut Off Valves (SOV) and four built-in extinguishers,
- For the cockpit or cabin: by three portable extinguishers,
- For the baggage compartment, by
  - o Three portable extinguishers, or
  - o One of the four built-in extinguishers.

### **3. AUXILIARY FUNCTIONS IN CASE OF ENGINE OR APU FIRE**

For each engine: when the crew pushes the corresponding “FIRE” button of the Fire Control Panel:

- The corresponding Hydraulic and Fuel Shut Off Valves are closed,
- The corresponding generator is disconnected, (used for emergency landing procedure as, in other conditions, the engine will have been shut off first),

In addition, for engine 2:

- The Air Turbine Starter Valve (ATSV) is automatically closed,
- The Thrust Reverser is inhibited.

For the APU: when the fire is detected:

- The Fuel Shut Off Valve is automatically closed,
- The generator is automatically disconnected,
- An emergency shut down is commanded by the ECU.

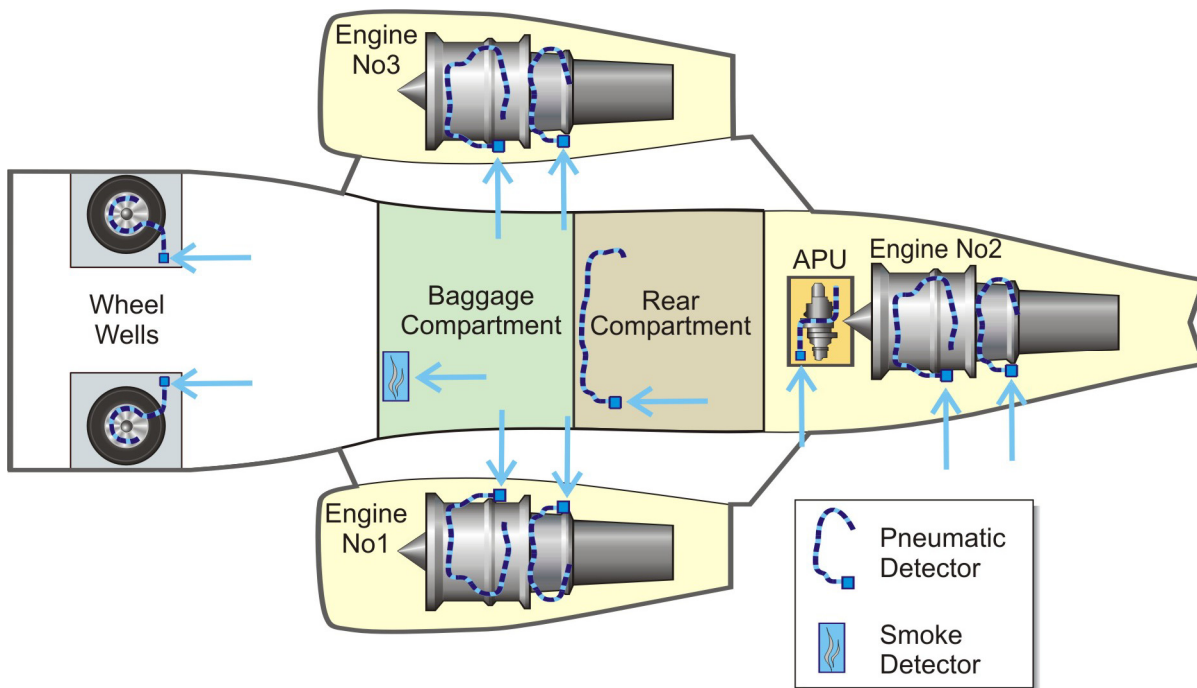
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**FIRE AND SMOKE DETECTION**

**SUMMARY OF FIRE AND SMOKE DETECTORS**

The Fire protection system features:

- 2 pneumatic detectors for each engine (total of 6),
- 1 pneumatic detector for the APU,
- 1 pneumatic detector for the rear compartment,
- 1 pneumatic detector for each wheel well (total of 2),
- 1 smoke detector in the baggage compartment.



**FIGURE 02-26-10-00 – FIRE AND SMOKE DETECTORS**



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## **PNEUMATIC DETECTORS**

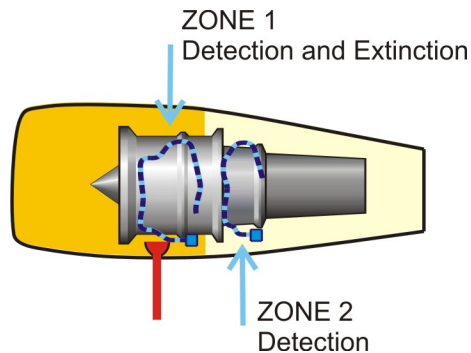
### **General**

A pneumatic fire detector is a tube containing an inert gas and a hydrogen saturated wire. The pressure within the tube will vary in case of overheat, which will trigger an alert for the crew.

### **Engines Fire Zones**

The engines have two designated fire zones:

- Zone 1 (the outer zone including accessories): this zone is equipped with
  - o A fire detector,
  - o A fire extinguishing system,
- Zone 2 (the inner zone): this zone is equipped with a fire detector only.



**FIGURE 02-26-10-01 - ENGINE FIRE ZONES**

## **SMOKE DETECTOR**

The smoke detector is of a "photoelectric" type which allows differentiating dust from smoke to avoid false alarms.

A smoke detector is installed in the baggage compartment.

➤ *Refer to ATA 26 - DESCRIPTION-SUPPLEMENTARY INFORMATION for additional information.*

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<b>FIRE EXTINCTION</b>
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**BUILT-IN FIRE EXINGUISHERS**

Four built-in fire extinguishers are located in the aft fuselage and provide fire protection for each engine, the APU, the rear and baggage compartments:

- Each engine is protected by two of the extinguishers,
- The APU, rear and baggage compartments are only protected by one extinguisher.

The built-in fire extinguishers should be used for the baggage compartment only if the fire is detected during a depressurization, Take Off or Landing. Otherwise, the crew should attempt extinguishing the fire with portable extinguishers.

The built-in extinguishers have two (or three) discharge head, which allows the protection of two (or three) zones by each extinguisher. However, each extinguisher is fully discharged after any discharge.

There is no extinction device available in the wheel well. The crew will only extend the gears to allow cooling of the area.

**PORTABLE FIRE EXTINGUISHERS**

Three portable Halon extinguishers are available in the aircraft in the event the crew has to extinguish a fire in the cabin or in the baggage compartment:

- One of the three portable extinguishers is installed in the cockpit,
- Two other extinguishers are located in the forward and aft cabin.

Exact location of the portable extinguishers will vary from one aircraft to the other depending on the interior layout.

Two of the portable extinguishers contain 2.5 lbs of Halon 1211 while the third portable extinguisher contains 9 lbs of Halon 1211.

➤ *Refer to ATA 25 – EQUIPMENT for additional information.*

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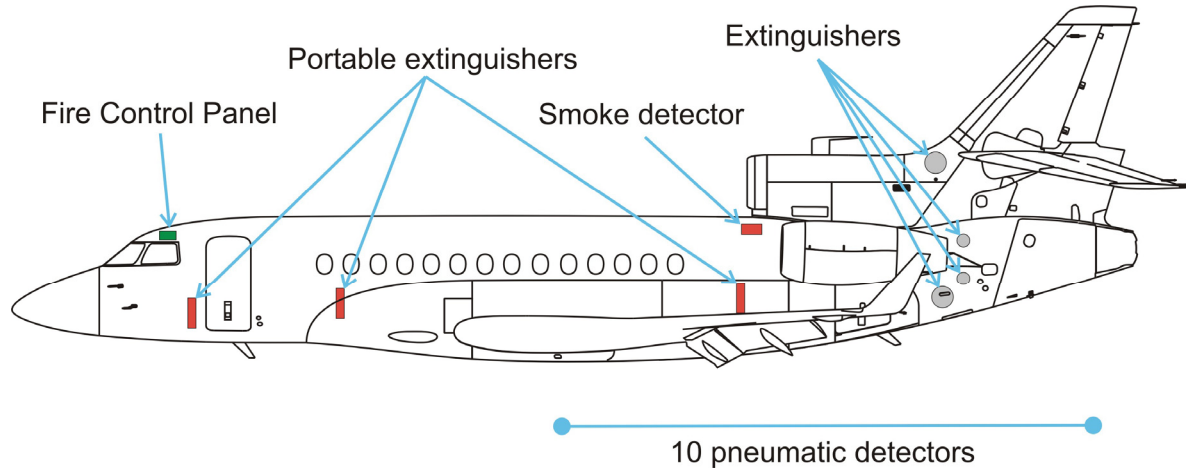
<b>DESIGN PRINCIPLES</b>
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The fire and overheat protection system was designed considering the following design principles:

- With regard to the technology:
  - o Pneumatic detectors of well proven technology were selected,
  - o A photoelectric type smoke detection system was selected, in order to avoid untimely alerts,
  - o Built in extinguishers of "all welded" type were selected for their robustness to leaks.
- With regard to the architecture:
  - o Two extinguishers are provided per engine,
  - o The bottle sharing is define such that at least one shoot for each engine remains available after a first fire.

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**LOCATION OF EQUIPMENT**



**FIGURE 02-26-15-00 - FIRE PROTECTION EQUIPMENTS LOCATION**

**NOTE**

The forward and aft lavatory, as well as the aft lounge can also be equipped with a smoke detector.

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**ELECTRICAL POWER SOURCE**

The following paragraph describes the power supply and the electrical protections of the different equipment of the fire protection system.

The electrical protection is provided:

- Either by Solid State Power Controllers (SSPC),
  - Or by Circuit Breakers (CB).
- Refer to ATA 24 – ELECTRICAL POWER for additional information.

**FIRE CONTROL PANEL (FCP)**

EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
Section 1	LH Essential	CB
Section 2	RH Essential	CB

**“ENGINES AND APU” FIRE PROTECTION**

	EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
<b>ENGINE 1</b>	Pneumatic detector	Powered by FCP Section 1	CB
	Fuel SOV	RH Essential Battery 1	CB
	Hydraulic SOV	RH Essential Battery 1	CB
	Throttle lamp	Powered by FCP	CB
	Ext. 1	RH Essential	CB
	Ext. 4	Battery 1	CB
<b>ENGINE 2</b>	Pneumatic detector	Powered by FCP Section 2	CB
	Fuel SOV	LH Essential Battery 2	CB
	Hydraulic SOV	LH Essential Battery 2	CB
	Throttle lamp	Powered by FCP	CB
	Ext. 3	Battery 2	CB
	Ext. 4	LH Essential	CB

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	EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
<b>ENGINE 3</b>	Pneumatic detector	Powered by FCP Section 1	CB
	Fuel SOV	RH Essential Battery 1	CB
	Hydraulic SOV	RH Essential Battery 1	CB
	Throttle lamp	Powered by FCP	CB
	Ext. 1	Battery 1	CB
	Ext. 2	RH Essential	CB
<b>APU</b>	Pneumatic detector	Powered by FCP Section 2	CB
	Fuel SOV	LH Essential	CB
	Ext. 2	LH Essential Battery 2	CB

**MAIN LANDING GEAR**

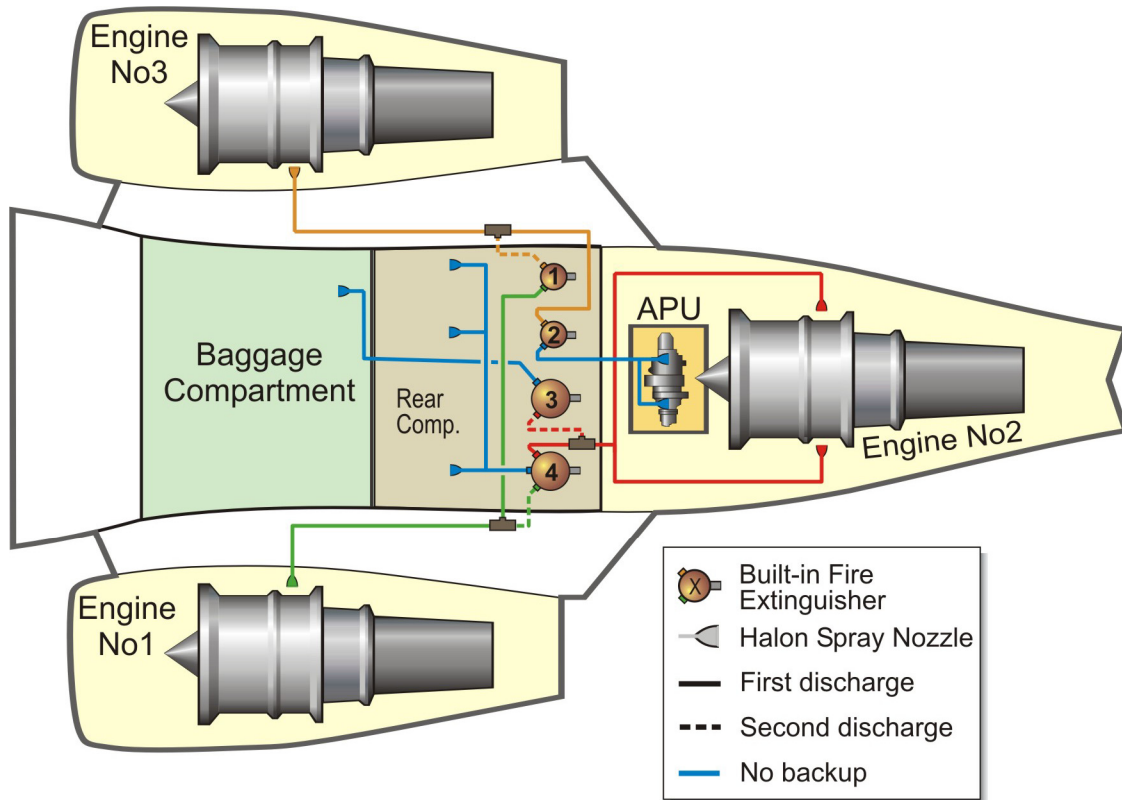
EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
Pneumatic detector (Left main Wheel well)	Powered by FCP Section 2	CB
Pneumatic detector (Right main wheel well)	Powered by FCP Section 2	CB

**COMPARTMENT**

	EQUIPMENT	POWER SUPPLY	TYPE OF PROTECTION
<b>BAGGAGE</b>	Smoke detector	RH Essential	SSPC
	Ext.3	RH Essential Battery 1	CB
<b>REAR</b>	Pneumatic detector	Powered by FCP Section 1	CB
	Ext. 4	RH Essential Battery 1	CB

**EXTINGUISHERS DISCHARGES**

ZONE	FIRST DISCHARGE	SECOND DISCHARGE
Engine 1	Extinguisher 1	Extinguisher 4
Engine 2	Extinguisher 4	Extinguisher 3
Engine 3	Extinguisher 2	Extinguisher 1
Rear compartment	Extinguisher 4	Not applicable
Baggage compartment in case alarm is triggered during depressurization, Take Off or Landing	Extinguisher 3	Not applicable
APU	Extinguisher 2	Not applicable



**FIGURE 02-26-15-01 - EXTINGUISHERS DISCHARGES**

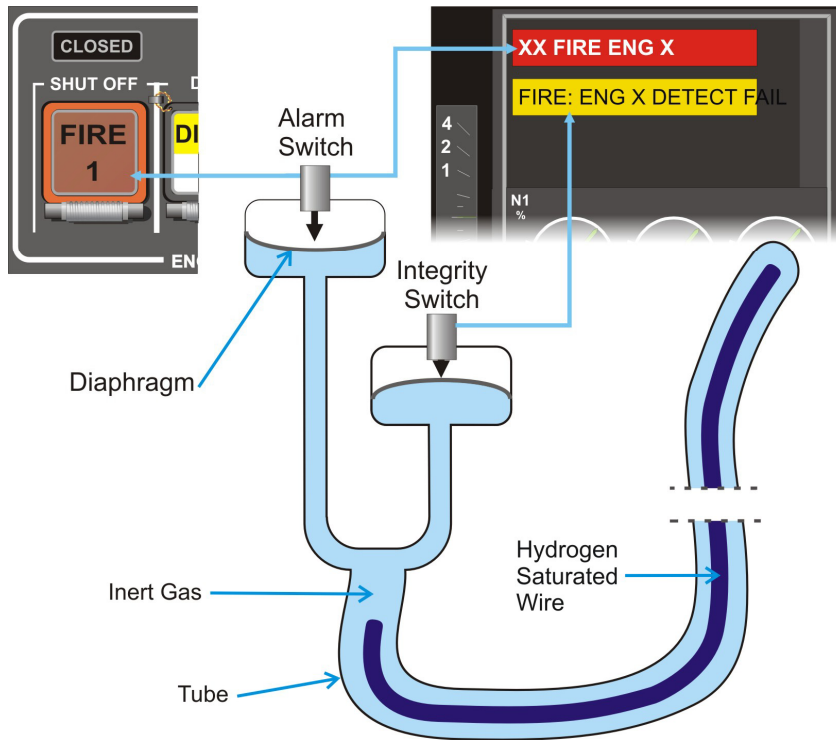
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**COMPONENT DETAILED DESCRIPTION**

**FIRE DETECTOR**

Each pneumatic fire detector is composed of:

- A tube containing an inert gas and an hydrogen saturated wire,
- Two pressure switches,
- Connector and wiring to the warning system.



**FIGURE 02-26-15-02 - PNEUMATIC DETECTOR**

The pneumatic detector pressure is monitored by two pressure switches:

- The alarm switch,
- The integrity switch.

**The alarm switch**

The alarm switch is normally open.

In case of a fire or overheat, the internal detector pressure rises and closes the switch, which rises the fire alarm. This process is reversible so that when the fire is extinguished, the alarm switch resumes to the normal position (open) and the warning stops. The temperature threshold is lower for a zone overheat than for a local flame.



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ZONE	ZONE OVERHEAT THRESHOLD	LOCAL FLAME THRESHOLD
Engine Zone 1	260°C	540°C
Engine Zone 2	430°C	680°C
Rear compartment	150°C	510°C
Main wheel wells	130°C	380°C
APU	275°C	565°C

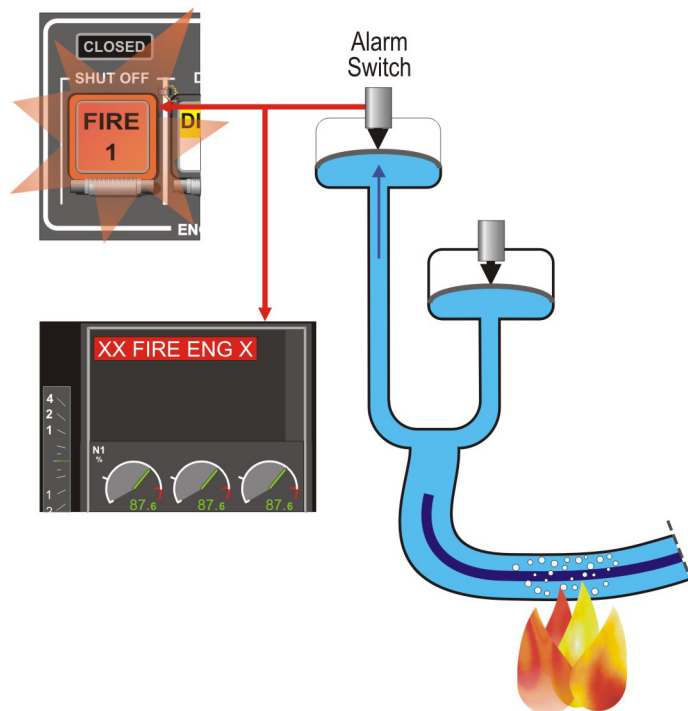


FIGURE 02-26-15-03 - DETECTION OF A FIRE (LOCAL FLAME)

### The integrity switch

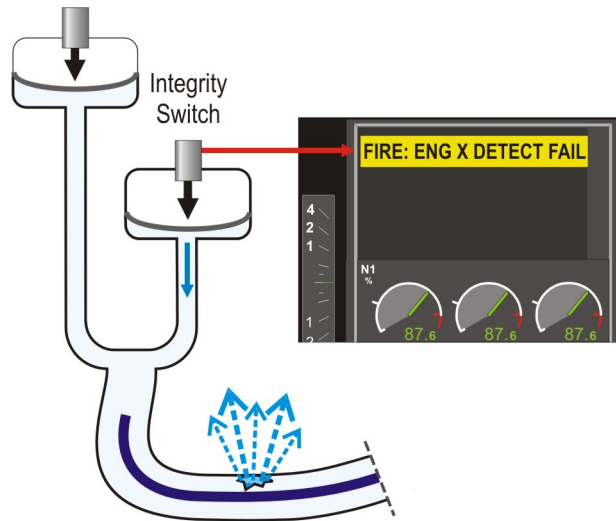
The integrity switch is used to monitor the validity of the sensor. It is normally closed.

In the closed position, the integrity switch shows that inert gas pressure does not drop below the integrity check pressure.

In case of a gas leak:

- The tube pressure decreases and opens the integrity switch,
- A CAS message is displayed indicating that the detector is failed.

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**FIGURE 02-26-15-04 - LEAK OF THE PNEUMATIC DETECTOR**

### **SMOKE DETECTOR**

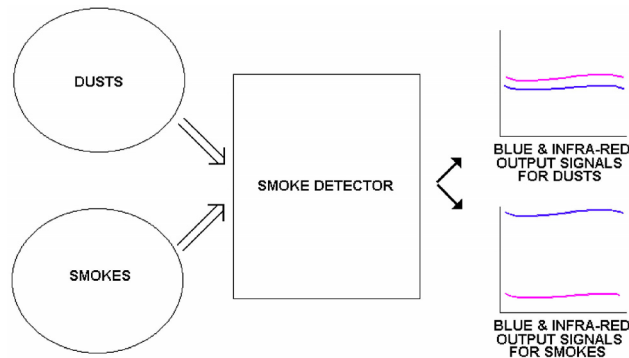
Each smoke detector is of a photoelectric type that operates on the dual light scattering principle.

The smoke chamber contains two light sources, which transmit a beam of light. Oriented away from the path of this light beam is a photosensitive device that reacts when light impinges upon it.

The open area detector relies on the free convection of airflow within the protected zone to obtain its own air samples for smoke monitoring.

When smoke particles enter in the chamber and cross the light beam, they cause a random reflection and scattering of the light, which is sensed by the photosensitive device.

This changes the electrical characteristics of the device in proportion to the amount of smoke in the chamber. When the characteristics of the device reach a preset level, an alarm signal is generated.



**FIGURE 02-26-15-05 - SMOKE DETECTION PRINCIPLE**

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In order to avoid the false alarm due to dust, the smoke detector light is pulsed on two different wave lengths (blue light and infrared light). The blue /IR light allows detecting if the particle in the detection chamber are smoke particles (0.1 microns) or dust particles (10 microns).

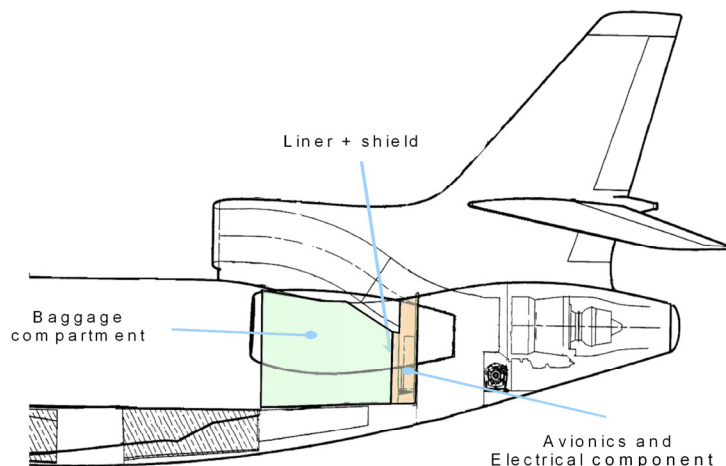
### **BUILT-IN EXTINGUISHERS**

Built-in extinguishers are filled with Halon 1301.

BUILT-IN EXTINGUISHER	WEIGHT	NUMBER OF DISCHARGE HEADS
Extinguisher 1	1.36 kg	2
Extinguisher 2	1.36 kg	2
Extinguisher 3	3.5 kg	2
Extinguisher 4	3.8 kg	3

### **LINER IN BAGGAGE COMPARTMENT**

The baggage compartment is fitted with a smoke detector. A liner will avoid fire spreading from the baggage compartment toward the avionics and electrical components of the baggage compartment.



**FIGURE 02-26-15-06 - BAGGAGE COMPARTMENT LINER**

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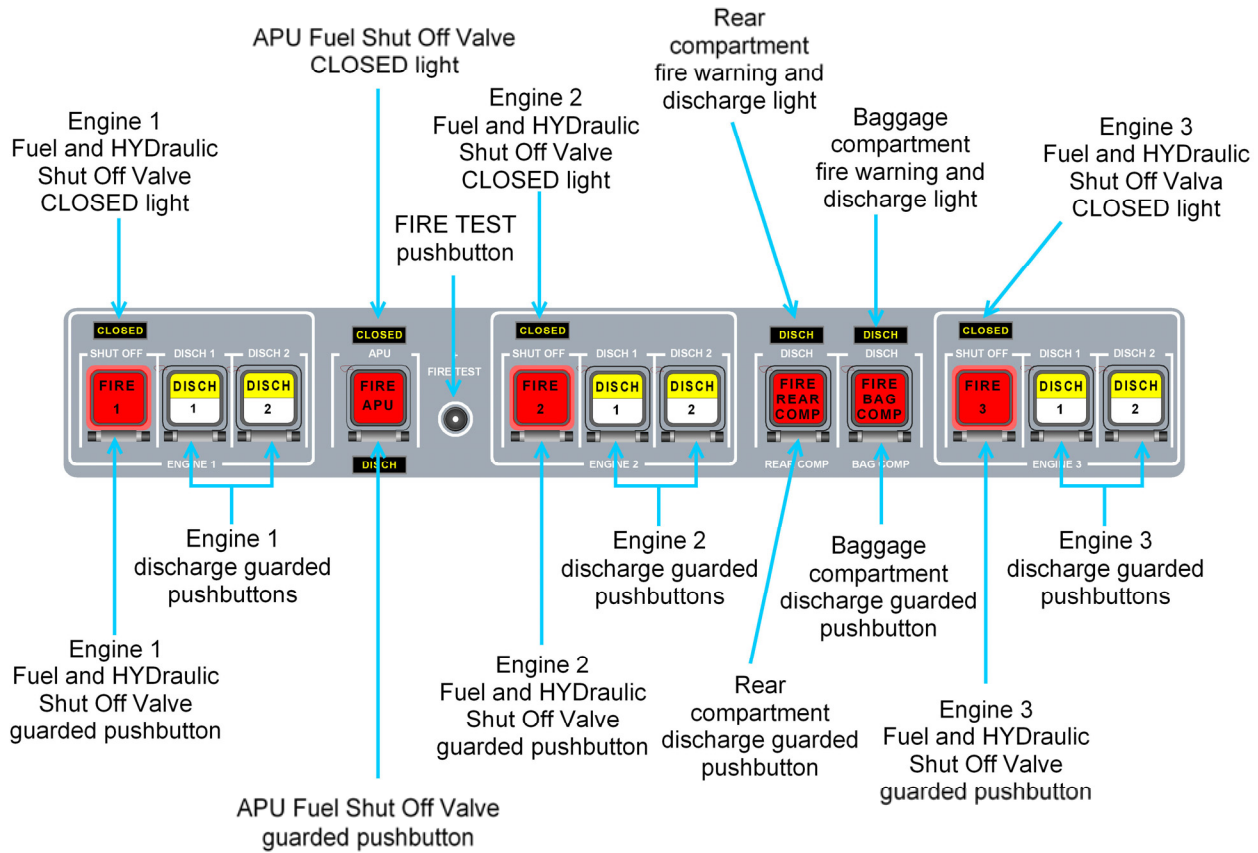
## FIRE CONTROL PANEL

### GENERAL DESCRIPTION

The Fire Control Panel located in the upper portion of the overhead panel provides indication as well as controls for Fire, Smoke and overheat protection.

The Fire Control Panel includes:








- "FIRE 1, 2 and 3" guarded pushbuttons which:
  - o Indicate the engine for which a fire is detected,
  - o Allow controlling the closure of engine Fuel and Hydraulic Shut-Off Valves so that fuel and hydraulic flow is cut off, and the disconnection of generator.
- Amber indicators "closed" above the "FIRE 1, 2, 3" pushbuttons which indicate that the Fuel shut off valve and hydraulic shut off valves of the relevant engine are closed.
- "DISCH 1, 2" guarded pushbuttons which:
  - o Provide decision help in case one extinguisher is not available,
  - o Allow discharging the relevant engine extinguishers, one at a time,
  - o Indicate when and extinguisher is discharged,
- "FIRE APU" guarded pushbutton which:
  - o Indicates that a fire is detected in the APU zone,
  - o Allows discharging the APU extinguisher,
- Amber indicator "closed" above the "FIRE APU" pushbutton which indicates that the Fuel shut off valve of the APU is closed in case of fire
- "FIRE REAR COMP" guarded pushbutton which:
  - o Indicates that a fire is detected in the rear compartment zone,
  - o Allows discharging the rear compartment extinguisher,
- "FIRE BAG COMP" guarded pushbutton which:
  - o Indicates that smoke is detected in the baggage compartment zone,
  - o Allows discharging the baggage compartment extinguisher (to be used if the alarm is triggered during a depressurization, Take Off or Landing -otherwise, the portable extinguisher would be used).
- **DISCH** indicators below the "FIRE APU", and above the "FIRE REAR COMP" and "FIRE BAG COMP" pushbuttons which indicate that the corresponding extinguisher is discharged,
- A FIRE TEST button to trigger the Fire Protection system test.

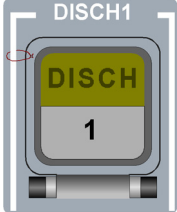
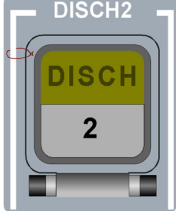
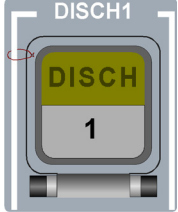
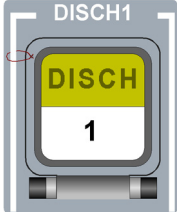
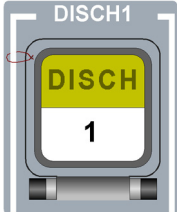
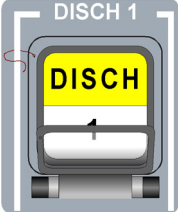



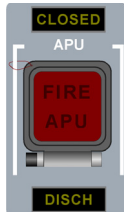
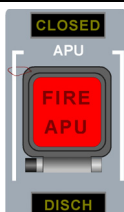


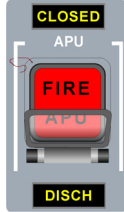
**FIGURE 02-26-20-00 - FIRE CONTROL PANEL**

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**SYNTHETIC TABLE**






CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION
		TO DEACTIVATE	
	Indicates fire on one Engine	Guarded 	
	Activates closure of the corresponding engine Fuel and Hydraulic Shut-Off Valves	Engine 1 fire occurs 	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>NOTE</b>            Light goes out when fire is extinguished         </div>
	Disconnects contactor of corresponding generator	Guard raised and FIRE 1 pushed to command closure of FSOV and HYD SOV (and disconnection of generator) 	
	Additionally, for engine 2:  Closes the ATSV and inhibits Thrust Reverser after landing	FSOV and HYD SOV are closed 	Fuel Shut-Off and Hydraulic Valves are closed when <b>CLOSED</b> indication is steadily illuminated.
			If a discrepancy between pushbutton control and Fuel Shut-Off Valves is detected, the <b>CLOSED</b> status light flashes

CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION
		TO DEACTIVATE	
 	<p>Indicates extinguisher available</p> <p>Discharges extinguishing agent from built-in extinguisher(s) to the detected engine fire</p> <p>Indicates extinguisher discharged</p>	<p>Safety guarded, <b>FIRE</b> pushbutton not pushed yet</p> 	
		<p>Fire detected and <b>FIRE</b> pushbutton pushed on</p>  	<p><b>1</b> and <b>2</b> illuminate steady white if both extinguishers are available. Otherwise, the light illuminates only for the available extinguisher.</p>
		<p>Guard raised and "DISCH" pushed to discharge Extinguisher</p> 	<p>When discharged, <b>DISCH</b> illuminates steady amber</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>NOTE</b></p> <p><b>DISCH</b> is steady when the discharge is not available even if the button has not been depressed</p> </div>


CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION
		TO DEACTIVATE	
	<p>Indicates fire in the APU fire zone</p> <p>Discharges extinguishing agent from built-in extinguisher in the APU fire zone.</p>	<p>Safety guarded</p> 	
		<p>Fire APU occurs</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>NOTE</b> light goes out when APU fire is extinguished</p> </div> 	
		<p>FCP automatically closes the FSOV and disconnection of APU generator</p> 	<p>The <b>CLOSED</b> light flashes during Shut-Off Valve operation, then remains steady when valve is fully closed.</p>
		<p>Guard raised and "FIRE APU" pushed to discharge the extinguisher</p> 	
			<p>When extinguisher is discharged, light is on</p>



CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION	
		TO DEACTIVATE		
	<p>Indicates fire in the rear compartment</p> <p>Discharges extinguishing agent from built-in extinguisher in the rear compartment</p>	<p>Safety guarded</p> 		
		<p>A Rear compartment fire occurs</p> <p><b>NOTE</b> light goes out when fire is extinguished</p>		
		<p>Guard raised and "FIRE REAR COMP" pushed to discharge the extinguisher</p>		
				<p>When extinguisher is discharged, light is on.</p>

CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION	
		TO DEACTIVATE		
	<p>Indicates fire in the rear compartment</p> <p>Discharges extinguishing agent from built-in extinguisher in the baggage compartment.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b></p> <p>Used without attempting to extinguish fire with manual extinguisher only in case of depressurization of the baggage compartment or during take-off or landing phase.</p> </div>	<p>Safety guarded</p> 		
		<p>Fire in baggage compartment occurs</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b></p> <p>Light goes out when fire is extinguished and / or smoke is no longer detected.</p> </div>		
		<p>Guard raised and "FIRE BAG COMP" pushed to discharge the extinguisher</p>		
				<p>When extinguisher is discharged, light is on.</p>

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CONTROL & INDICATION	FUNCTION	TO ACTIVATE	LOCAL INDICATION
		TO DEACTIVATE	
	Allows checking the protection system integrity both on ground or in flight.	Push during 1 s to launch the test.	<p>All lights should light on.</p> <p>During the test the CAS message: <b>FIRE TEST IN PROGRESS</b> is displayed.</p> <p>The message will disappear when the pushbutton is released.</p> <p>If the test failed, the <b>FIRE: TEST FAIL</b> CAS message is displayed and the light of the corresponding function does not light on the FCP.</p>

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## INDICATIONS

### GENERAL

In addition to indications on the Fire Control Panel, following indications are provided:

- Audio alerts system for all fire detections, and Smoke detection,
- CAS messages,
- Indications on the Fire Control Panel,
- Fire repeaters warning lights on the throttle levers.

### NOTE

Aural alerts can be stopped by pressing on the Master Warning, or on the SIL pushbutton.

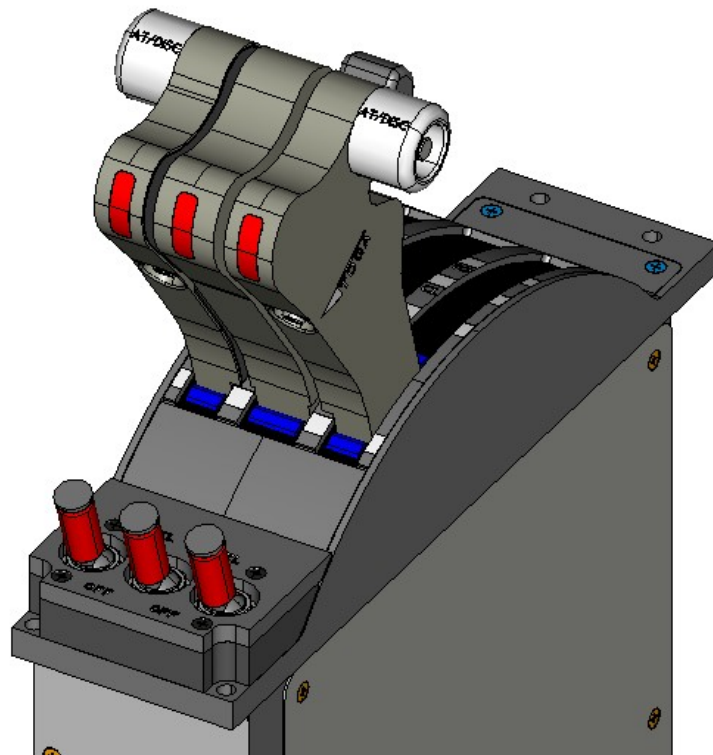





FIGURE 02-26-20-01 - THROTTLE LEVERS

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## SYNTHESIS OF INDICATIONS

As a summary, indications provided are:



- In case of engine fire:

**74 FIRE: ENGINE 1** CAS message + Fire aural alert +  +  lighted +  throttle fire warning repeater lighted

- In case of APU fire:

**72 FIRE: APU** CAS message + Fire aural alert+  +  light on



- In case of rear compartment fire:

**78 FIRE: REAR COMP** CAS message+ Fire aural alert +  +  light on .

- In case of baggage compartment fire or smoke:

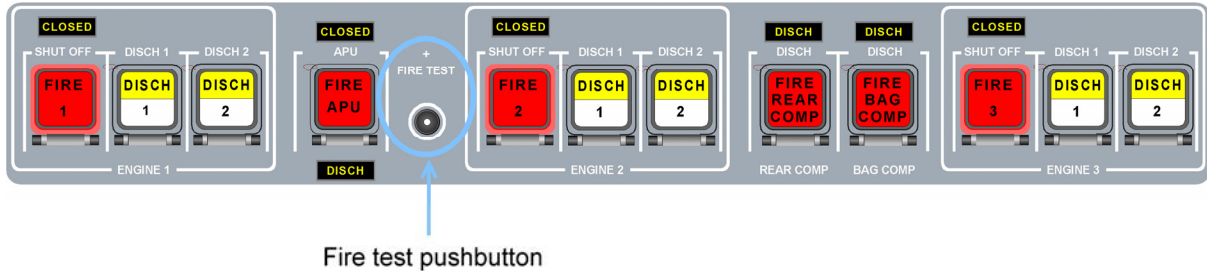
**96 FIRE: BAG COMP** CAS message+ Fire aural alert +  +  light on

- In case of wheel well overheat:

**80 FIRE: .. WHEEL OVHT** CAS message + Master Warning chime  +  .

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**FIRE CONTROL PANEL TEST**



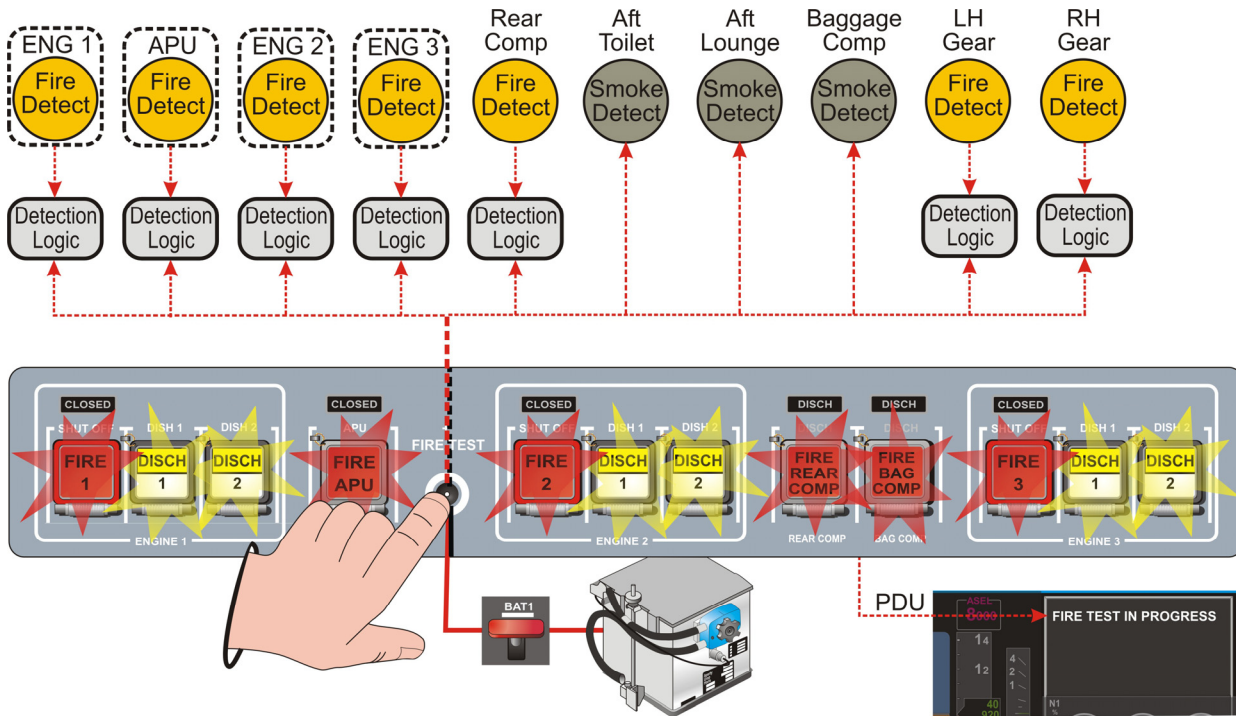
**FIGURE 02-26-25-00 - FIRE TEST PUSHBUTTON**

During the Fire Protection system test the following functions are verified:

- Integrity of electronic circuits of the Fire Control Panel,
- Integrity of pneumatics detectors,
- All the lights of the Fire Control Panel front panel are illuminated,
- Illumination of the throttle repeater,
- Communication between the FCP and the MAU.

If a failure appears on one function, the related light is not illuminated (i.e.: if the No 1 engine fire detector monitoring is detected failed during the test, the light "FIRE" of the No 1 engine is not illuminated), and the **FIRE TEST FAIL** CAS message is displayed.

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**FIGURE 02-26-25-00 - FIRE TEST**

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<b>SYSTEM MONITORING</b>
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Condition of the fire protection system is continuously monitored for the following items:

- Fire and smoke detection system integrity,
- Built-in extinguishers pressure,
- Cartridge line continuity.

➤ *Refer to CODDE 2 for exhaustive list of CAS messages.*



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<b>ACTIVE PROTECTIONS</b>
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**EXTINGUISHER OVERPRESSURE PROTECTION**

Each built in fire extinguisher is protected against rupture by a pressure relief valve.

In case of an overpressure:

- The relief valve frangible disk bursts,
- Pressure is relieved by discharging the extinguishing agent.

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No supplementary information to be provided on System Protections at present time.

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➤ *Refer to Ground Servicing manual.*