

12.7 (ATA 26) FIRE PROTECTION

12.7.1 Introduction

The fire protection system includes components throughout the aeroplane to provide detection, indication and extinguishing of fire conditions.

The fire protection system provides fire and smoke detection and fire extinguishing. Fire detection and extinguishing systems are provided for the engines, Auxiliary Power Unit (APU), baggage compartments, and the lavatory. Portable fire bottles are provided for the passenger compartment.

Indication and test functions are provided for the fire protection system on the fire protection panel in the flight deck for:

- Engines
- APU
- Baggage compartment.

Lavatory smoke detection is only indicated in the passenger compartment (cabin).

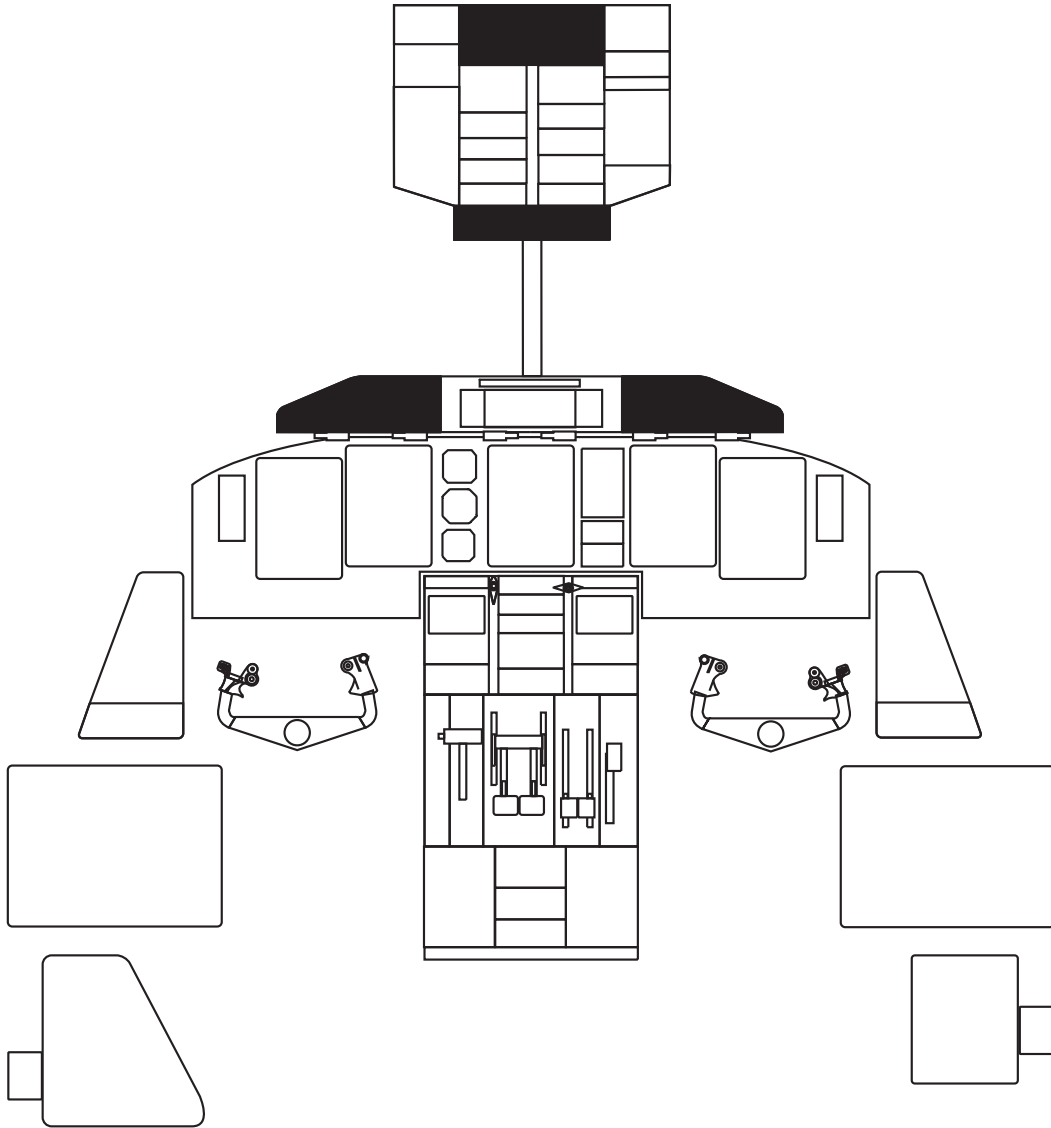
12.7.2 General

Fire or overheat detection is done by six Advanced Pneumatic Detectors (APD) in the engine nacelles and one (APD) in the APU. Smoke detection is done by two smoke detectors located in the aft baggage compartment, one in the forward baggage compartment and one in the lavatory. Fire or smoke detection is shown on the Fire Protection Panel and Caution and Warning Panel, located on the flight deck.

The detection system consists of:

- The nacelle fire detection system
- Smoke Detection System
- Lavatory Smoke Detection System
- APU fire detection

12.7.3 Controls and Indications - Fire Protection



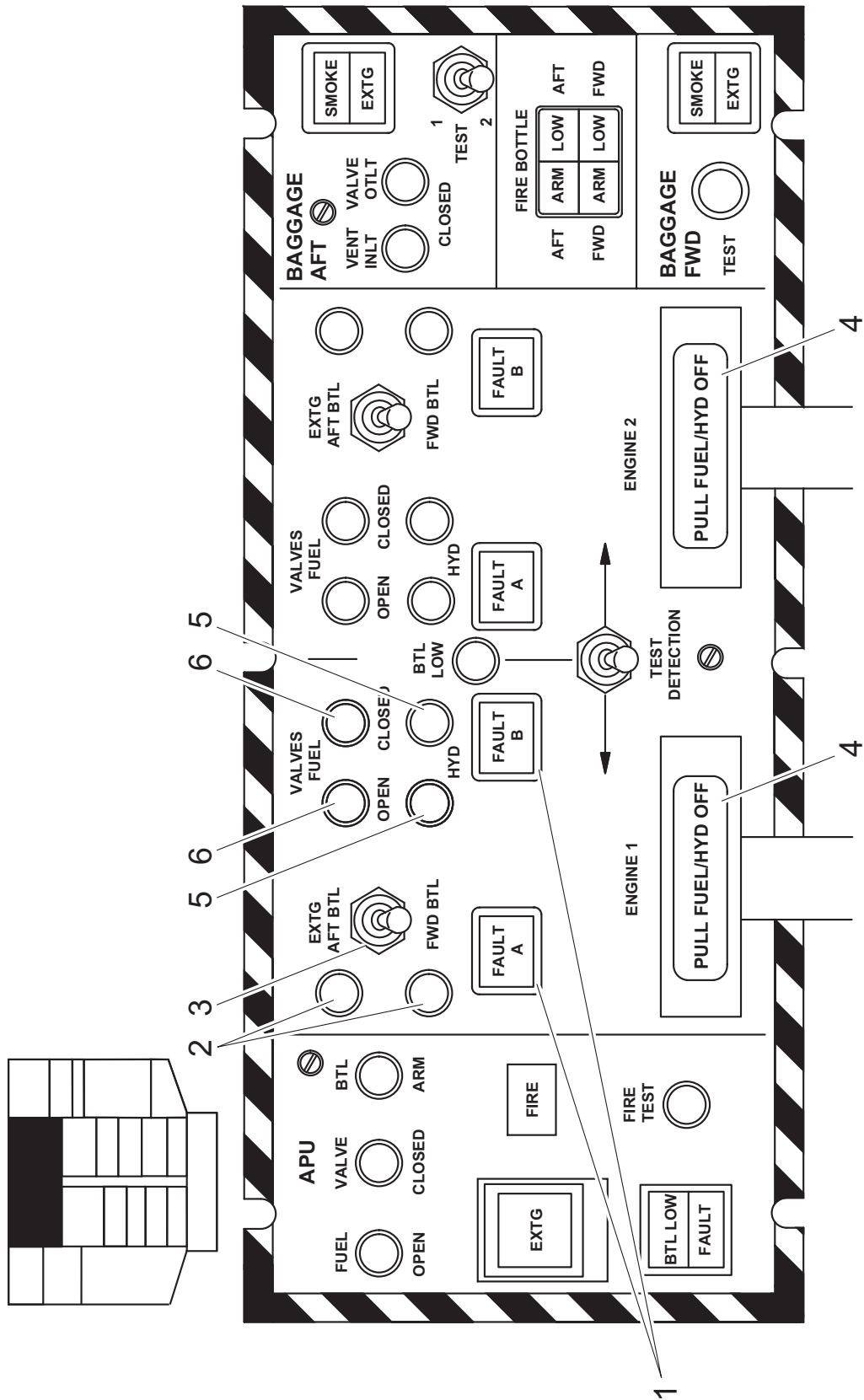


Figure 12.7-1 Fire Protection Panel (1 of 5)

ENGINE FIRE PROTECTION PANEL CALLOUTS

1. FAULT A and B LIGHTS (amber)

- malfunction detected within loop detector circuit on affected engine

2. BOTTLE ARMING LIGHTS (amber)

- PULL FUEL OFF handle has been pulled
- AFT or FWD fire extinguisher charged
- EXTINGUISHER DISCHARGE switch armed
- lights go out if associated bottle is discharged or system is disarmed

3. EXG SWITCH

AFT BTL - discharges aft bottle extinguishant into nacelle

FWD BTL - discharges forward bottle extinguishant into nacelle

4. PULL FUEL/HYD OFF HANDLE (red) (two position - In or Out)

PUSHED IN - normal operations

- overheat condition, or fire detected in associated nacelle will illuminate the appropriate engine handle
- fuel and hydraulic shut-off valves open

PULL OUT - fuel and hydraulic shut-off valves close

- arms extinguisher system
- turns on bottle arm lights (yellow)

5. HYD SHUT-OFF VALVE LIGHTS (green, white)

OPEN (green) - hydraulic shut-off valve open

CLOSED (white) - hydraulic shut-off valve closed

6. FUEL SHUT-OFF VALVE LIGHTS (green, white)

OPEN (green) - fuel shut-off valve open

CLOSED (white) - fuel shut-off valve closed

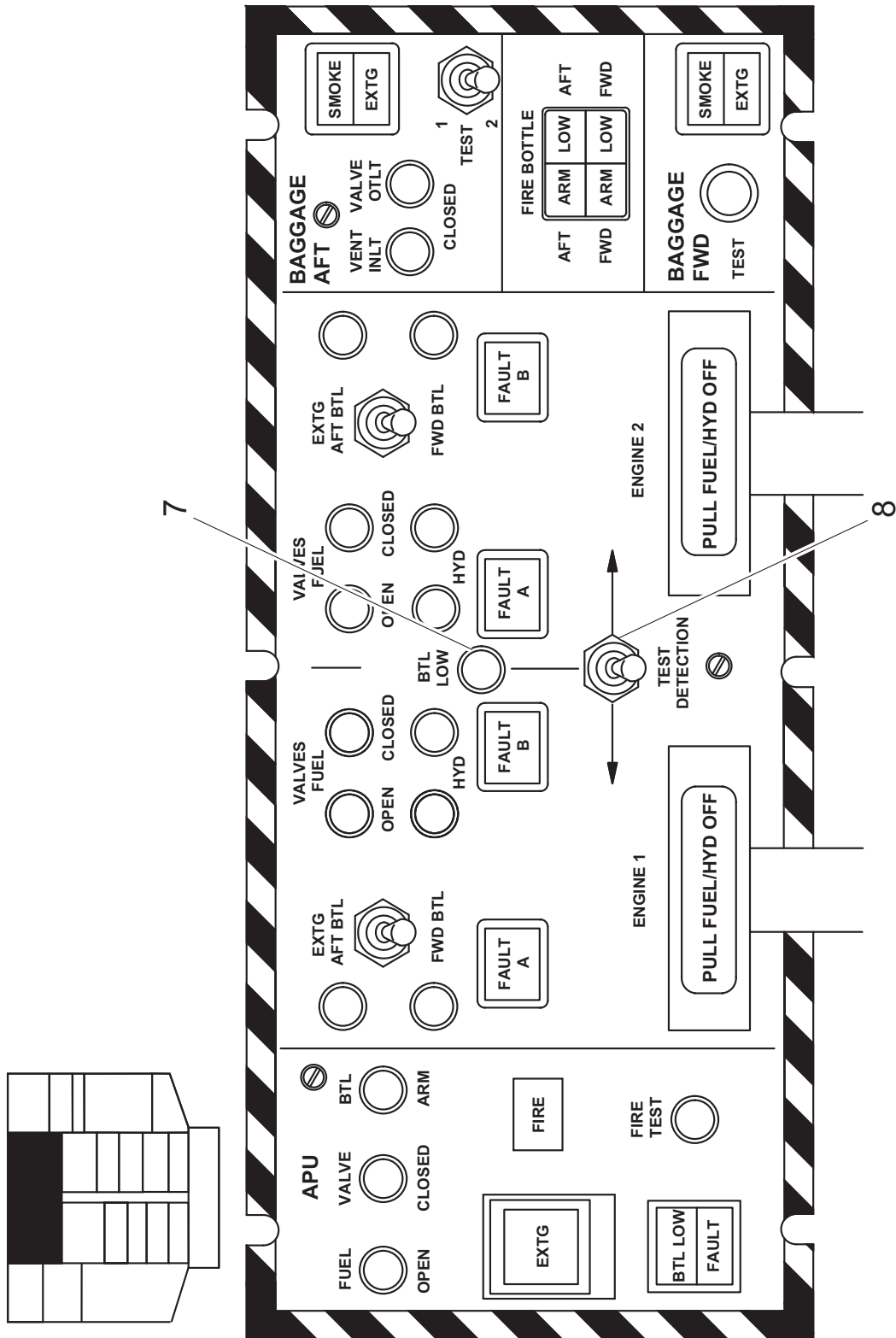


Figure 12.7-2 Fire Protection Panel (2 of 5)

ENGINE FIRE PROTECTION PANEL CALLOUTS (cont'd)

7. BTL LOW LIGHT (amber)

- one or both fire bottles are empty or the pressure is low

8. TEST DETECTION SWITCH (two position, spring loaded to center)

ENGINE 1 - observe for No. 1 engine

- MASTER WARNING LIGHT flashes (red) (3 chimes)
- CHECK FIRE DETECT warning light illuminates (red)
- PULL FUEL/HYD OFF lights (red)
- FAULT A and B lights (amber)
- Both ENGINE FIRE lights flash (red)
- Fire tone (optional)
- Push pilot's ENGINE FIRE light and see that both ENGINE FIRE lights stop flashing and fire tone stops

ENGINE 2 - same ENGINE 1 except for No. 2 engine

- Push copilot's ENGINE FIRE light and see that both ENGINE FIRE lights stop flashing and fire tone stops

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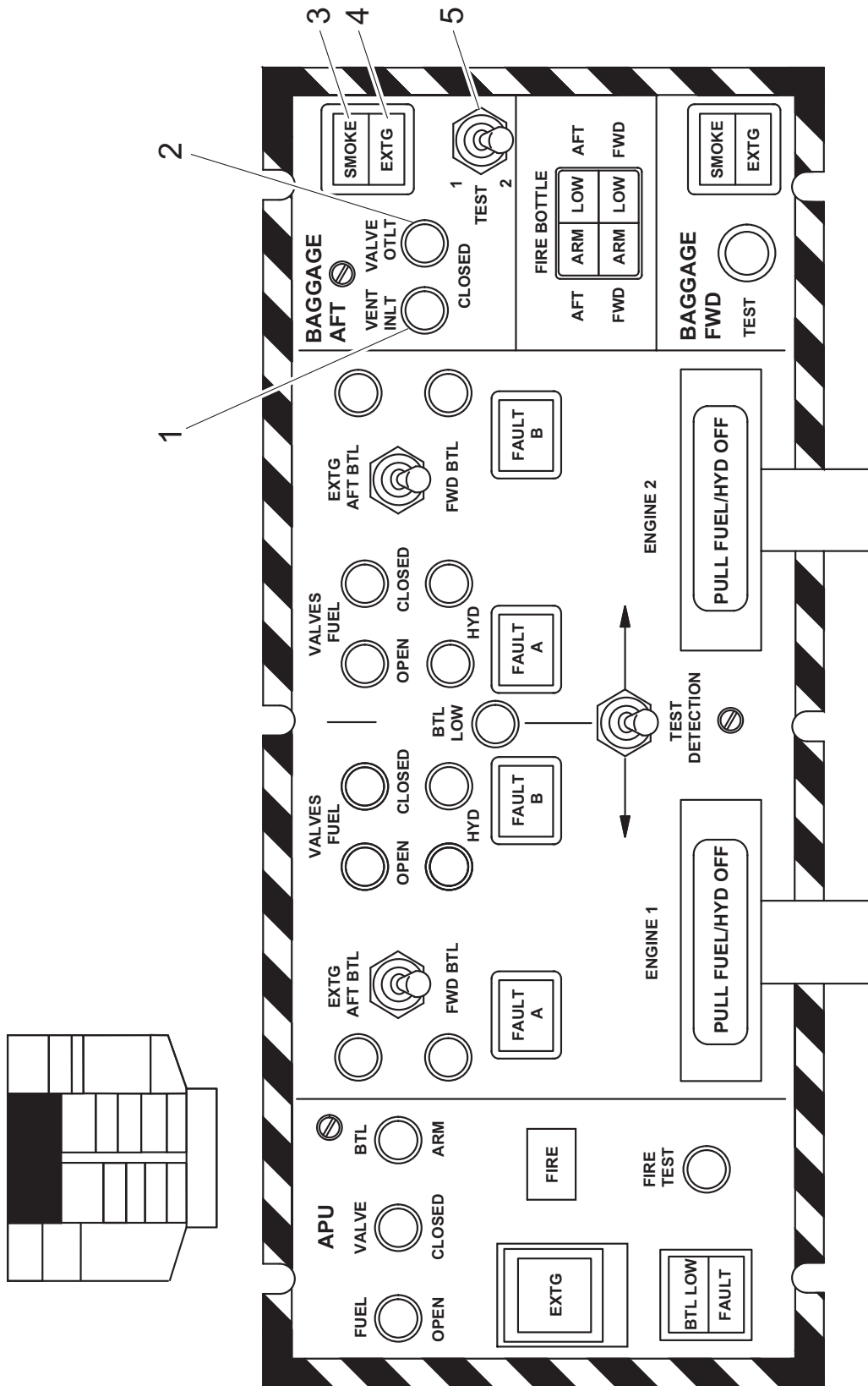


Figure 12.7-3 Fire Protection Panel Aft Baggage (3 of 5)

BAGGAGE COMP FIRE PROTECTION PANEL CALLOUT (cont'd)

1. AFT BAGGAGE VENT INLT DOOR LIGHT

(out) - vent inlet door is open

(white) - vent inlet door is closed

2. AFT BAGGAGE VALVE OTLT DOOR LIGHT

(out) - valve outlet door is open

(white) - valve outlet door is closed

3. AFT BAGGAGE SMOKE DETECTION LIGHT (red)

- smoke detected in the AFT baggage compartment

4. AFT BAGGAGE EXTG SWITCHLIGHT (guarded, momentary action)

PUSH - discharges aft HRD bottle extinguishant into aft baggage compartment followed by LRD bottle 7 minutes later

- AFT ARM segment (out)
- AFT LOW segment (amber) - HRD bottle depressurized
- FWD LOW segment (amber) - when LRD bottle depleted

5. AFT BAGGAGE SMOKE DETECTOR TEST SWITCH

(three position, spring loaded to centre off)

TEST 1:

- master warning light (red) - flashes
- SMOKE warning light (red) - illuminates
- SMOKE segment (red)
- EXTG segment (white)
- VENT INLT (white)
- VALVE OTLT (white)
- AFT BTL ARM segment (amber)

TEST 2:

Same as TEST 1

If LRD bottle has low pressure, then both LOW (FWD and AFT) lights illuminate.

NOTE: LRD bottle is shared between the forward and aft baggage compartment. Separate discharge cartridges are provided for each baggage compartment.

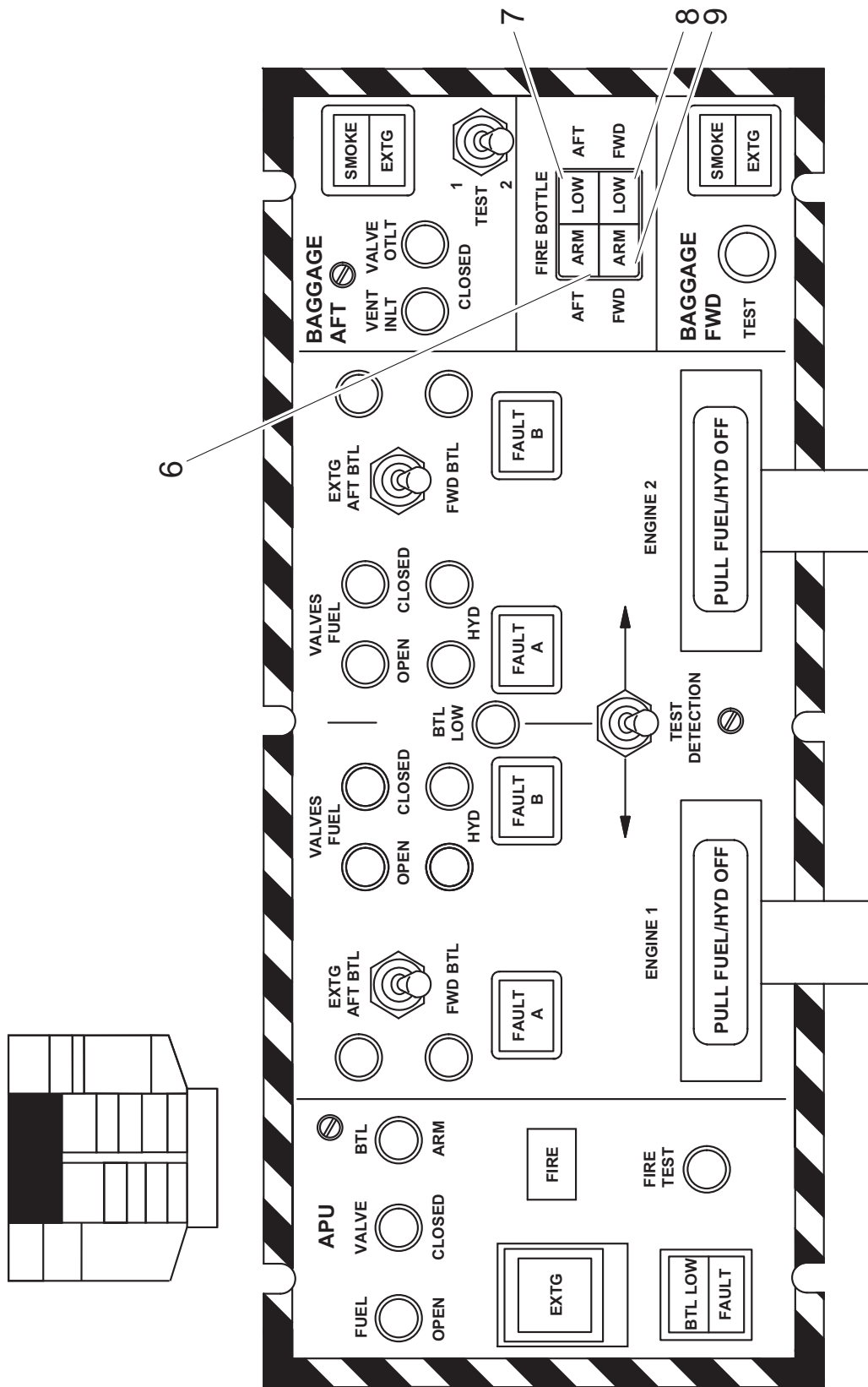


Figure 12.7-4 Fire Protection Panel Fwd Baggage (4 of 5)

BAGGAGE COMP FIRE PROTECTION PANEL CALLOUT (cont'd)

6. AFT BAGGAGE HRD BOTTLE ARM LIGHT (amber)

- aft baggage High Rate Discharge (HRD) bottle armed

7. HRD BOTTLE LOW PRESSURE LIGHT

AFT BAGGAGE FIRE:

AFT LOW segment (out) - HRD fire bottle is full (pressurized)

AFT LOW segment (amber) - HRD fire bottle is empty (low pressure)

FWD LOW segment (amber) - turns on after pushing EXTG switchlight, and when LRD bottle has depleted

FWD BAGGAGE FIRE:

FWD LOW segment (out) - HRD fire bottle is full (pressurized)

FWD LOW segment (amber) - HRD fire bottle is empty (low pressure)

AFT LOW segment (amber) - turns on after pushing EXTG switchlight and when LRD bottle has depleted

8. LRD BOTTLE LOW PRESSURE LIGHT

AFT BAGGAGE FIRE:

FWD LOW segment (out) - Low Rate Discharge (LRD) fire bottle is full (pressurized)

FWD LOW segment (amber) - LRD fire bottle is empty (low pressure)

FWD BAGGAGE FIRE:

AFT LOW segment (out) - LRD fire bottle is full (pressurized)

AFT LOW segment (amber) - LRD fire bottle is empty (low pressure)

NOTE: LRD bottle low pressure light is shared between the forward and aft baggage compartment depending on which baggage compartment is indicating smoke warning.

9. FWD HRD BOTTLE ARM LIGHT (amber)

Fwd baggage compartment High Rate Discharge (HRD) bottle armed

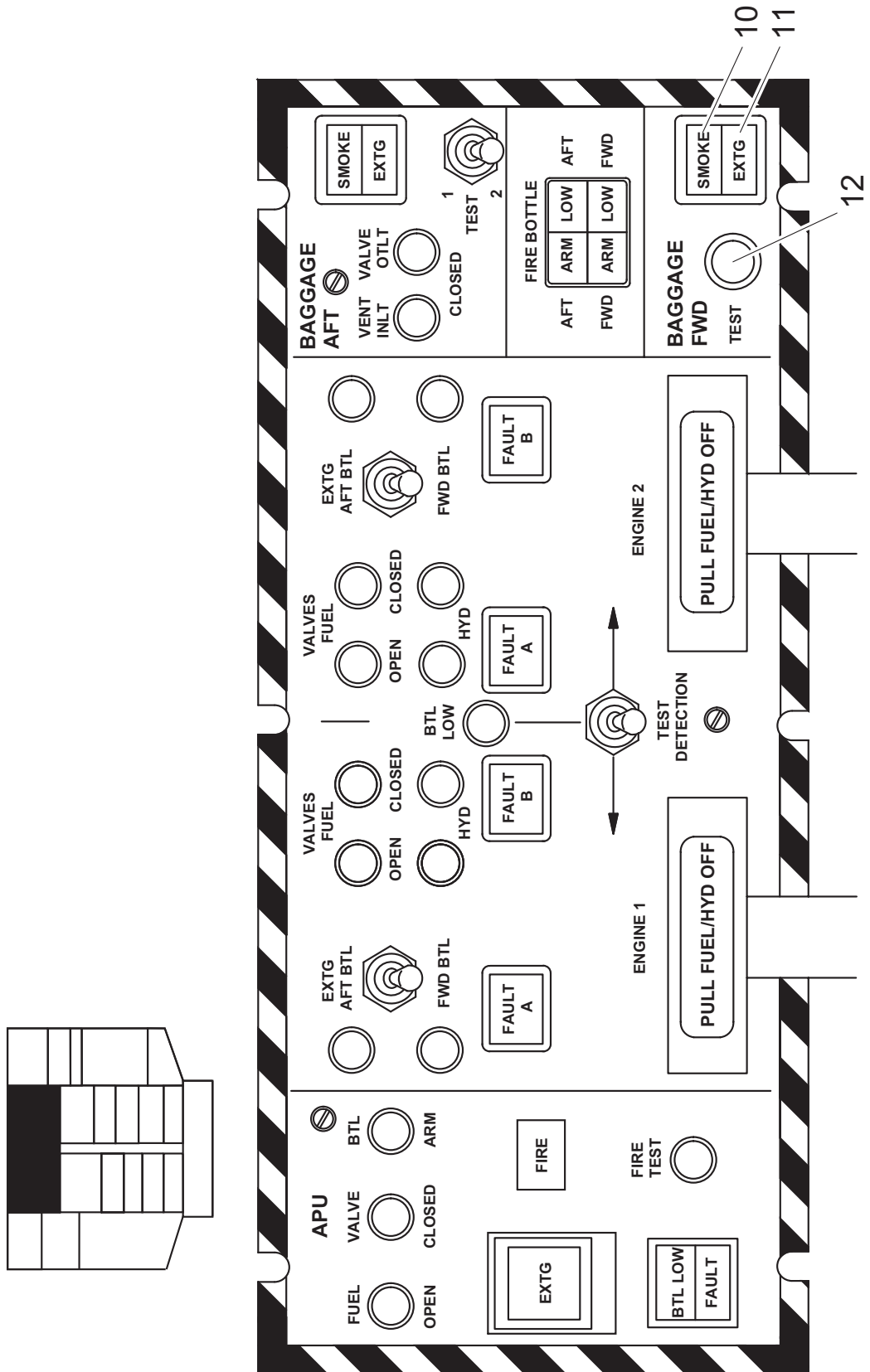


Figure 12.7-5 Fire Protection Panel Fwd Baggage (5 of 5)

BAGGAGE COMP FIRE PROTECTION PANEL CALLOUT (cont'd)

10. FWD BAGGAGE SMOKE DETECTION LIGHT (red)

- smoke detected in the FWD baggage compartment

11. FWD BAGGAGE EXTINGUISHER SWITCHLIGHT (white)

PUSH - discharges HRD and LRD bottle extinguishant into fwd baggage compartment

- FWD ARM segment (out)
- FWD LOW segment (amber) - HRD bottle depressurized
- AFT LOW segment (amber) - when LRD bottle has depleted

12. FWD BAGGAGE SMOKE DETECTOR TEST PUSHBUTTON (momentary action)

PUSH AND HOLD:

- master warning light (red) - flashes
- SMOKE warning light (red)
- SMOKE segment (red)
- EXTG segment (white)
- FWD ARM segment (amber)
- FWD LOW segment remains out

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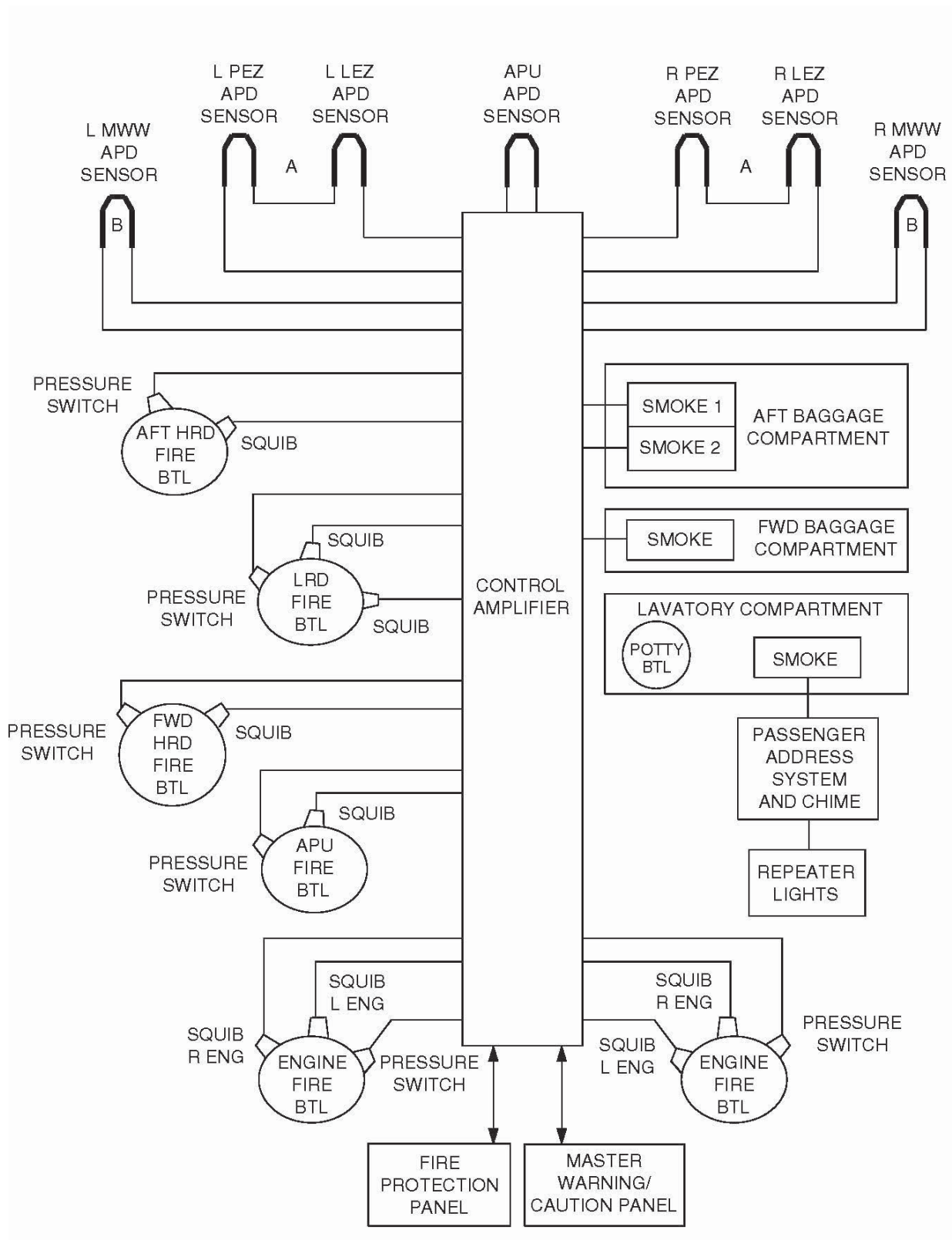


Figure 12.7-6 Fire Protection and Extinguishing Block Diagram

12.7.4 Fire Protection - Description

The aeroplane fire detection system (Figure 12.7-6) is designed to sense fire, smoke, and over-heat conditions for engine fire zones. When any one of these conditions is sensed, the system will supply a visual and aural warning to the flight deck.

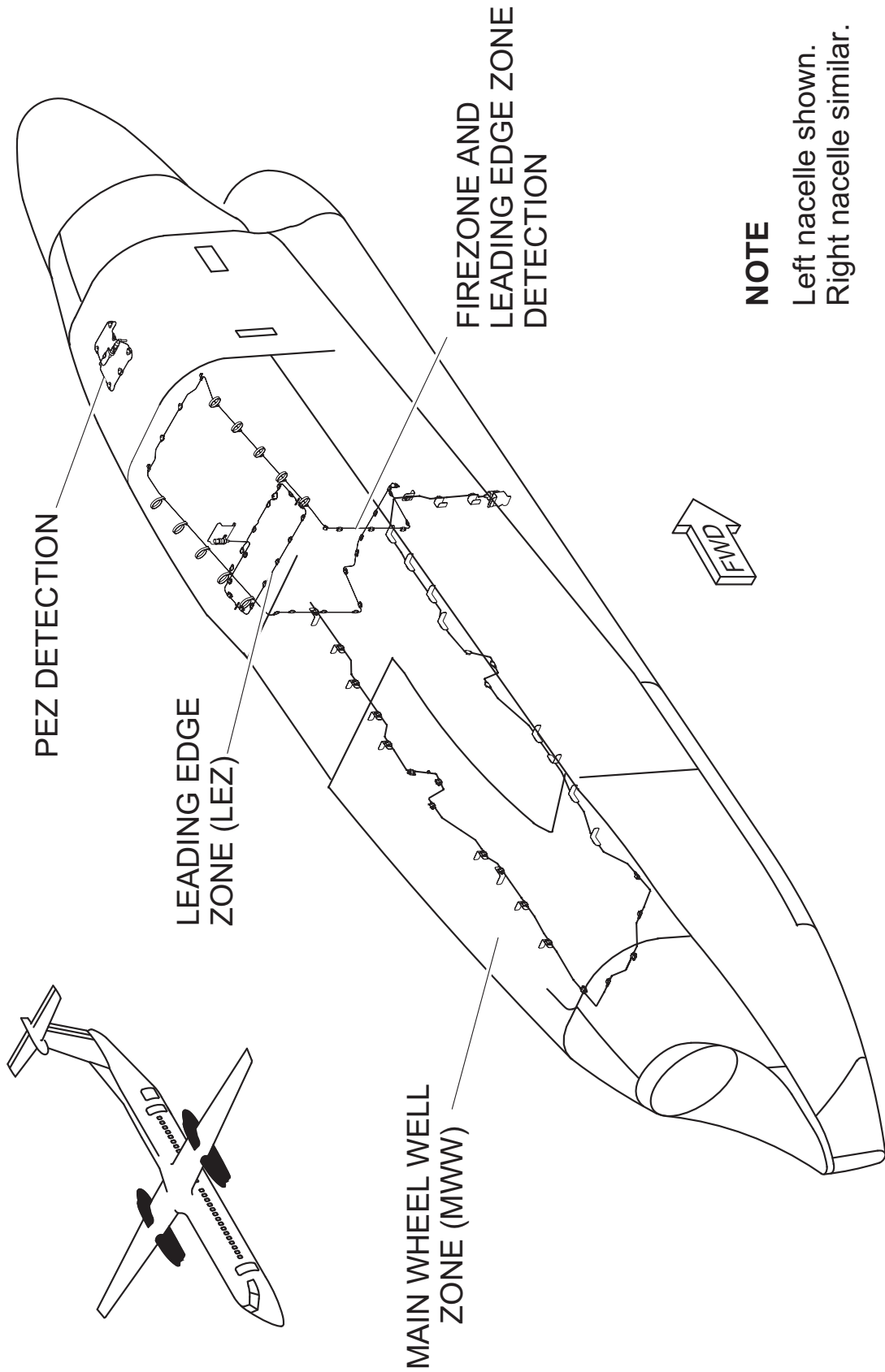


Figure 12.7-7 Advanced Pneumatic Detectors

12.7.5 Advanced Pneumatic Detectors (APD)

Advanced Pneumatic Detectors (APDs) or fire detection loops (Figure 12.7-6), give fire and over-heat detection in the Main Wheel Well (MWW) zone, Leading Edge Zone (LEZ) and Primary Engine Zone (PEZ). The ADPs supply fault indications to the Fire Protection Panel.

Three APDs are located in each nacelle (Figure 12.7-7). The nacelle fire detection system has one APD located in the engine primary zone (LEZ), one located around the PEZ and one extends around the MWW zone. A fire or overheat condition in the nacelles is shown on the fire protection panel.

The APDs in the engine nacelles, use sensor tubes filled with helium gas to monitor for fires. The helium gas is sensitive to changes in temperature. The fault and alarms signals are given by two switches, the integrity switch and the alarm switch. The alarm signals are processed by the control amplifier then sent to the fire protection panel.

The integrity switch monitors the pressure of the sensor element. If an APD breaks, the loss of pressure in the sensor will turn on the FAULT A or FAULT B light on the fire protection panel. The alarm switch is normally open, and closes when an overheat or fire condition occurs, caused by the pressure increase in the APD.

The Advance Pneumatic Detectors (APD) in the Primary Engine Zone (PEZ) and Leading Edge Zone (LEZ) are connected in series with the control amplifier in such a manner that:

- 1) if the APD in the PEZ fails OR the LEZ fails, a fault indication will result,
- 2) if the APD in the PEZ detects fire OR the APD in the LEZ detects fire, a fire indication will result,
- 3) if the APD in the PEZ fails (fault indication given) AND if the APD in the LEZ detects fire, a fire indication will also result. The panel will indicate a fault and a fire for this zone,
- 4) if the APD in the LEZ fails (fault indication given) AND if the APD in the PEZ detects fire, no fire indication will result. The panel will indicate a fault only.

NOTE: The engine 1 and 2 fire detector "A" #1 is the LEZ and detector "A" #2 is the PEZ..

12.7.6 Control Amplifier

The fire protection system control amplifier performs the following:

- Detection and extinguishing monitoring
- Built In Tests (BIT) functions
- Turns on advisory lights on the Fire Protection Panel
- Turns on CHECK FIRE DET warning light on the Caution and Warning panel
- Sounds the fire tone (optional).

During the fire detection test, the control amplifier is also tested. Loss of the control amplifier, will not cause complete loss of engine detection or extinguishing capability.

12.7.7 Fire Bottles

Two dual port FIRE bottles are installed FWD and AFT in the left wing root, for engine fire extinguishing. Each bottle is connected in a configuration that allows for two shots of suppressant into an engine nacelle, in the event the first shot is not effective.

A BTL LOW amber advisory light on the fire protection panel, turns on when a fire bottle is empty or the pressure is low. The Control Amplifier constantly monitors bottle pressure.

Fire suppressant is discharged into the right or left PEZ, LEZ and MWW zone. Electrical connections are installed for both explosive squibs and the bottle monitor pressure switch. The PULL FUEL/HYD OFF handle test will show which bottle needs service, the arming light for that bottle will not come on if it needs to be replenished.

12.7.8 Engine Fire Detection

When a fire overheat condition occurs, the alarm signals are processed by the Control Amplifier then sent to the Fire Protection Panel in the flight deck. If a fire or overheat condition occurs in either engine, this will cause the gas within the APD to expand and turn on the following lights in the flight deck:

- Applicable PULL FUEL/HYD OFF T-handle light (red) comes on
- Both ENGINE FIRE Warning Press to Reset lights (red) flash
- CHECK FIRE DET warning light (red) flashes
- Fire tone (optional)

Either ENGINE FIRE PRESS TO RESET indicator is pushed to turn the audible tone (optional) warning off and/or cancel the flashing engine fire lights. The ENGINE FIRE PRESS TO RESET stay on steady for the duration of the alarm condition.

12.7.9 ENGINE FIRE Extinguishing Operation

The fwd and aft bottle squibs are armed by pulling the PULL FUEL/HYD OFF handle. After arming, the extinguisher bottle is discharged by selecting the EXTG switch on the fire protection panel to FWD or AFT position. An electrical signal is sent which ignites the Electro-Explosive Device (EED). When the EED explodes it ruptures a burst disc, and the pressurized bottle then discharges the suppressant into the engine zones.

12.7.10 Smoke Detect and Fire Exting - Bag Compartment

Fire extinguishing for the baggage compartments is performed by two High Rate (HR) fire extinguisher bottles and one Low Rate (LR) fire extinguisher bottle. Each baggage compartment has one high rate fire extinguisher bottle. The Low Rate fire extinguisher bottle is shared between the FWD and AFT baggage compartments but is located in the AFT equipment bay (rear fuselage).

12.7.10.1 Aft Baggage Compartment

12.7.10.1.1 Smoke Detection

The aft baggage compartment has two smoke detectors. One smoke detector is located in the rear and one in the front of the baggage compartment. If smoke is sensed by one or both of the smoke detectors it produces an alarm signal.

This causes the following lights on the fire protection panel to turn on:

- FIRE BOTTLE – AFT ARM light (amber) turns on
- BAGGAGE AFT – SMOKE/EXTG switchlight turns on

The alarm will signal the control amplifier to operate relay contacts to remove power from the inlet and outlet vent valves causing them to close. This closes the airflow in the aft baggage compartment. The INLET and OTLT valve CLOSED lights will come on and the AFT bottle ARM light will turn on.

12.7.10.1.2 Fire Extinguishing Operation

Pushing the SMOKE/EXTG switchlight activates the High Rate fire extinguisher bottle into the aft baggage area. The AFT ARM light will go out and the AFT LOW light turn on. After a seven minute delay, the Low Rate fire extinguisher bottle will automatically discharge into the aft baggage area and the FWD LOW light will turn on when the LRD bottle has depleted.

12.7.10.2 Forward Baggage Compartment

12.7.10.2.1 Smoke Detection

The forward baggage compartment has one smoke detector. When smoke is sensed, the smoke detector produces an alarm signal.

This causes the following lights on the FIRE PROTECTION panel to turn on:

- FIRE BOTTLE - FWD ARM light (amber) turns on
- BAGGAGE FWD – SMOKE/EXTG switchlight turns on

12.7.10.2.2 Fire Extinguishing Operation

A High Rate fire extinguisher is installed in the forward baggage compartment. Pushing the SMOKE/EXTG switchlight activates the High Rate fire extinguisher bottle into the forward baggage area. The Low Rate fire extinguisher bottle will discharge at the same time.

The FIRE BOTTLE FWD ARM light will go out immediately and the FWD LOW light will turn on immediately (loss of bottle pressure). The AFT LOW light will turn on when the LRD bottle has depleted.

12.7.11 Flight Deck and Cabin Areas

12.7.11.1 Portable Fire Extinguishers

Four hand-operated fire extinguishers containing Halon 1211 are provided. One is located in the flight compartment, and three are in the passenger compartment. A gauge on each extinguisher indicates the serviceable range (green), overcharge range (yellow), and recharge range (red). Halon 1211 is effective on electrical, oil and fuel fires. The extinguishant is not corrosive or toxic, and will not freeze or cause cold burns. A red safety catch prevents accidental trigger movement and discharge.

WARNING

If a fire extinguisher is to be discharged in the flight compartment, all crew members must wear their oxygen masks, with the EMERGENCY position selected (100% oxygen at a positive pressure).

12.7.12 Lavatory Fire Protection

12.7.12.1 Smoke Detection

The lavatory compartment is protected by a single smoke detector located in the lavatory (Figure 12.7-8). A lavatory smoke alarm produces an indication on all cabin repeater lights, the smoke detector Light Emitting Diode (LED) and its audio alert. An audible chime is also produced through the P/A system. There is no indication of the lavatory smoke in the flight deck.

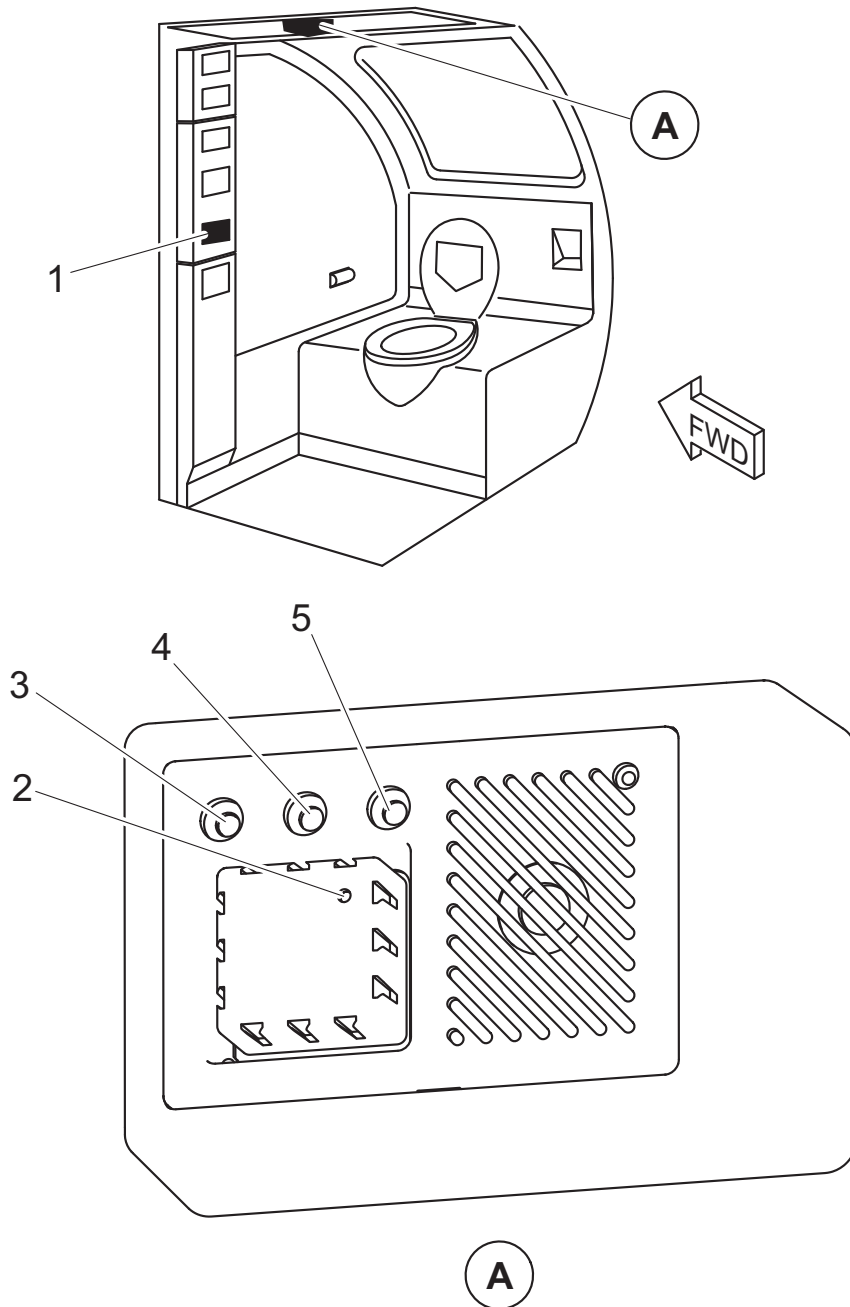
12.7.12.1.1 Smoke Detector Test

The lavatory smoke detector is tested by operating a self-test switch on the unit. During self-test activation, all cabin repeater lights will turn on and an audible single chime will be heard through the P/A system. A red LED on the smoke detector will turn on. Failure of the smoke detector unit, will cause no response during the self-test command.

12.7.12.1.2 FIRE Extinguishing

The lavatory compartment waste bin is protected by a single thermally activated fire extinguisher with no electrical interface (Figure 12.7-8). The Potty Bottle has dual discharge outlets. When a fire occurs in the lavatory compartment waste bin, the temperature of the end caps on the container increases to a set point. This causes the fusible seals to melt and release the end caps from the discharge tubes. The extinguishing agent is then released and discharged into the bin.

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LEGEND

1. Fire Bottle (Inside Cabinet).
2. Alarm Indicator Light.
3. Power Indicator Light.
4. Interrupt Pushbutton.
5. Self-Test Pushbutton.

Figure 12.7-8 Lavatory Fire Detection and Extinguishing