CHAPTER

26

Fire Protection

CHAPTER 26
FIRE PROTECTION

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

26-EFFECTIVE PAGES

CHAPTER 26
FIRE PROTECTION

Subject/Page	Date	COC
26-13-00		
1	May 05/2015	
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3	May 05/2015	
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FIRE PROTECTION

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FIRE PROTECTION

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2	Jul 25/2018	

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26-EFFECTIVE PAGES

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FIRE PROTECTION

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A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

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CHAPTER 26
FIRE PROTECTION

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FIRE PROTECTION - INTRODUCTION

Purpose

The fire protection systems monitor the airplane for these conditions:

- Fire
- Smoke
- Engine overheat
- Pneumatic duct leak.

The fire protection systems also include fire extinguishers.

Fire/Overheat Detection

The airplane has these fire/overheat detection systems:

- Engine fire detection
- Lavatory smoke detection
- Miscellaneous modules (flight crew rest) smoke detection
- APU fire detection
- Lower cargo compartment smoke detection
- Wheel well fire detection
- Duct leak and overheat detection
- Electrical and electronic (E/E) cooling smoke detection.

Extinguishing

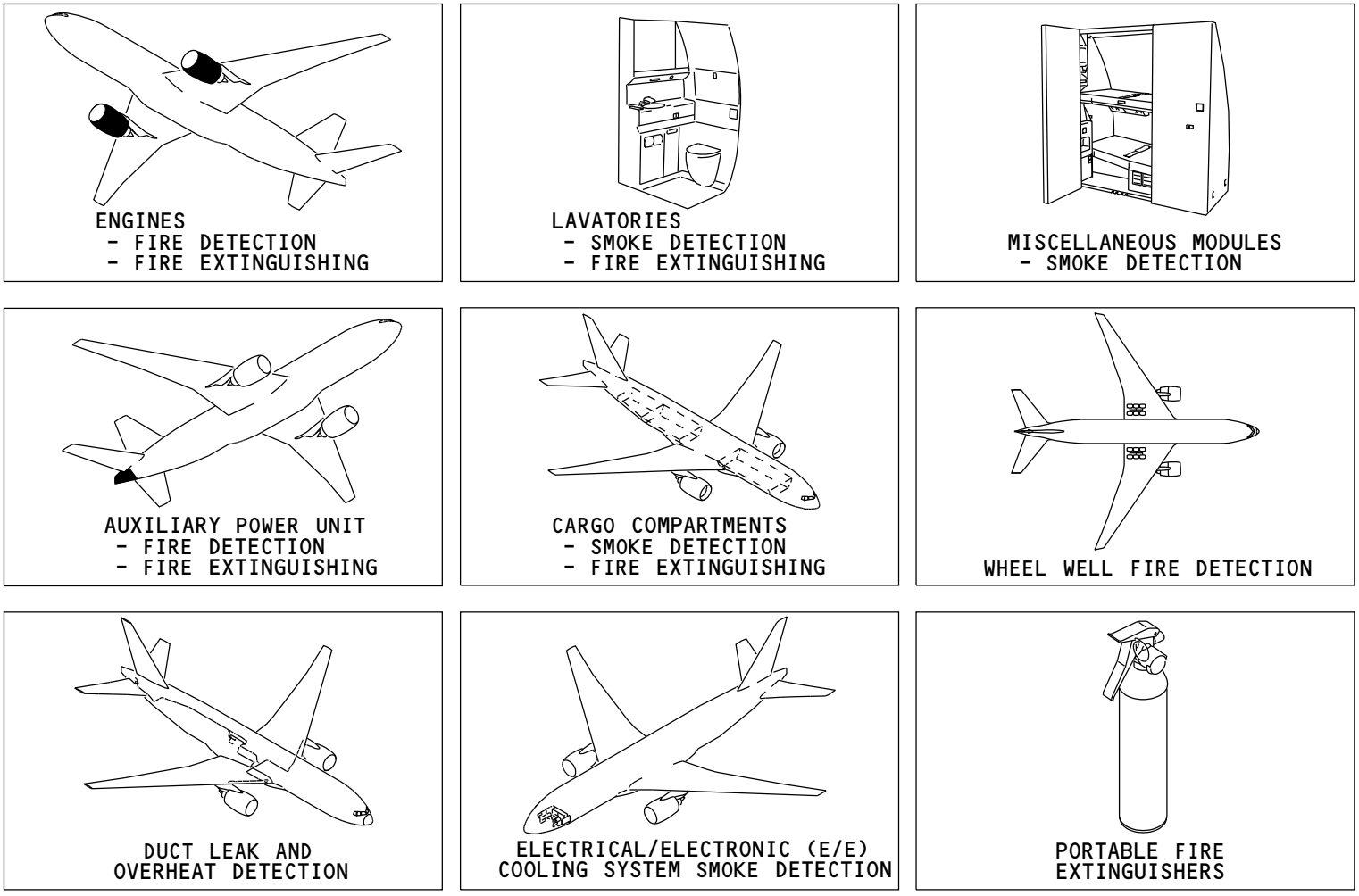
The airplane has these fire extinguishing systems:

- Engine fire extinguishing
- Lavatory waste compartment fire extinguishing
- APU fire extinguishing
- Lower cargo fire extinguishing
- Portable fire extinguishers.

Abbreviations and Acronyms

- ACIPS - airfoil and cowl ice protection system
- ACMF - airplane conditioning monitoring function
- ACMS - airplane conditioning monitoring system
- AGS - air ground system
- AIMS - airplane information management system
- APU - auxiliary power unit
- APUC - auxiliary power unit controller
- ARINC - Aeronautical Radio, Inc.
- ASCPC - air supply and cabin pressure controller
- ASG - ARINC signal gateway
- auto - automatic
- BIT - built-in-test
- BITE - built-in-test-equipment
- btl - bottle
- btls - bottles
- CACP - cabin area control panel
- cgo - cargo
- ch - channel
- CMCS - central maintenance computing system
- CSS - cabin services system
- CSCP - cabin system control panel
- disch - discharge
- DLODS - duct leak and overheat detection system
- ECS - environmental control system
- EDP - engine-driven pump
- EICAS - engine indicating and crew alerting system
- ELMS - electrical load monitoring system
- ENG - engine
- equip - equipment
- ext - external
- ext - extinguishing

- FCAC - forward cargo air conditioning
- FCR - flight crew rest
- fwd - forward
- ind - indicator
- kg - kilogram
- LED - light emitting diode
- LRU - line replaceable unit
- MAT - maintenance access terminal
- MD&T - master dim and test
- MEC - main equipment center
- MFD - multi-function display
- MGMT - management
- OEU - overhead electronics unit
- OPAS - overhead panel ARINC 629 system
- ovht - overheat
- ovrd - override
- press - pressure
- PSEU - proximity switch electronics unit
- pwr - power
- rmt - remote
- stby - standby
- vlv - valve
- WEU - warning electronic unit
- WES - warning electronic system
- WOW - weight-on-wheels



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FIRE PROTECTION - INTRODUCTION

FIRE PROTECTION - SYSTEM TESTS

General

These are the system tests for the fire extinguishing system:

- Cargo squibs
- Engine and APU squibs.

Cargo Squibs

WARNING KEEP PERSONS AWAY FROM THE CARGO COMPARTMENT DURING THIS TEST. IF A SQUIB FIRES ACCIDENTALLY, THE FIRE BOTTLE CAN RELEASE ITS CONTENTS AND CAUSE INJURIES.

This test supplies a small current to these squibs:

- Cargo compartment fire extinguishing bottles
- Cargo compartment fire extinguishing flow valves
- Engine fire extinguishing bottles
- APU fire extinguishing bottle.

The test makes sure that there are no open circuits in the cargo compartment fire extinguishing squibs and their related wiring.

Engine and APU Squibs

WARNING KEEP PERSONS AWAY FROM THE ENGINE AND APU DURING THIS TEST. IF A SQUIB FIRES ACCIDENTALLY, THE FIRE BOTTLE CAN RELEASE ITS CONTENTS AND CAUSE INJURIES.

This test supplies a small current to these squibs:

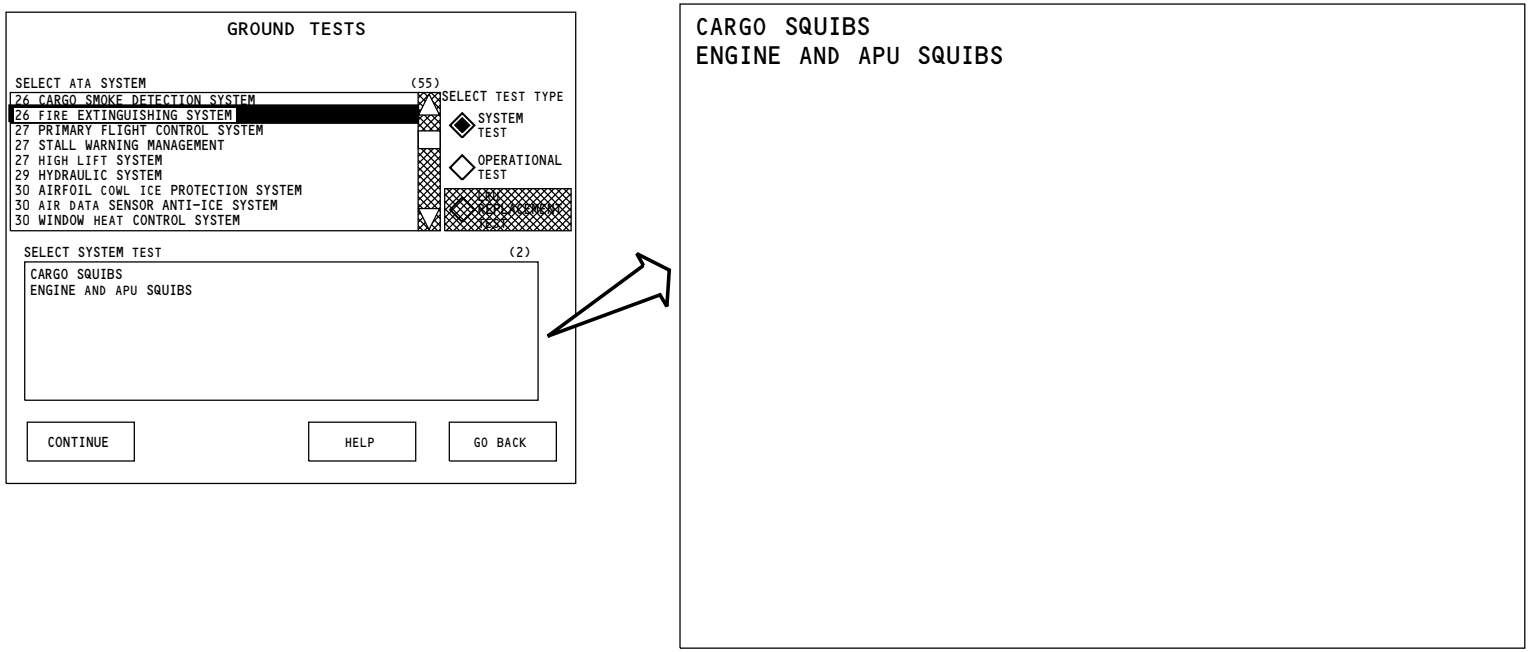
- Engine fire extinguishing bottles
- APU fire extinguishing bottle
- Cargo compartment fire extinguishing bottles
- Cargo compartment fire extinguishing flow valves.

The test makes sure that there are no open circuits in the engine and APU fire extinguishing squibs and their related wiring.

Training Information Point

NOTE: When you do either test, keep persons away from the cargo compartments, engines, and APU. Each test supplies power to all the squibs in the airplane.

When you do either test, the ELMS supplies a small current to all the squibs in the airplane. The MAT shows the test results only for the selected test. See Fire Protection - Squib Test - Functional Description in this section for more information.



M40916 S000617070_V1

FIRE PROTECTION - SYSTEM TESTS

FIRE PROTECTION - TRAINING INFORMATION POINT - FIRE/OVERHEAT TEST

General

The fire and overheat test switch (FIRE/OVHT TEST) does a test of these systems:

- Engine fire detection
- APU fire detection
- Lower cargo compartment smoke detection
- Wheel well fire detection.

Fire/Overheat Test

Push and hold the fire/overheat test switch. Make sure these indications come on:

- APU fire warning light
- Forward cargo fire warning light
- Aft cargo fire warning light
- Master warning lights
- Fire aural warning
- Engine fuel control switch fire warning lights
- Left and right engine fire warning lights
- FIRE TEST IN PROGRESS warning message.

Release the fire/overheat test switch when the test is complete. The test is complete when the warning message FIRE TEST PASS or FIRE TEST FAIL shows. All the test indications go away when you release the switch.

Fire Test Pass

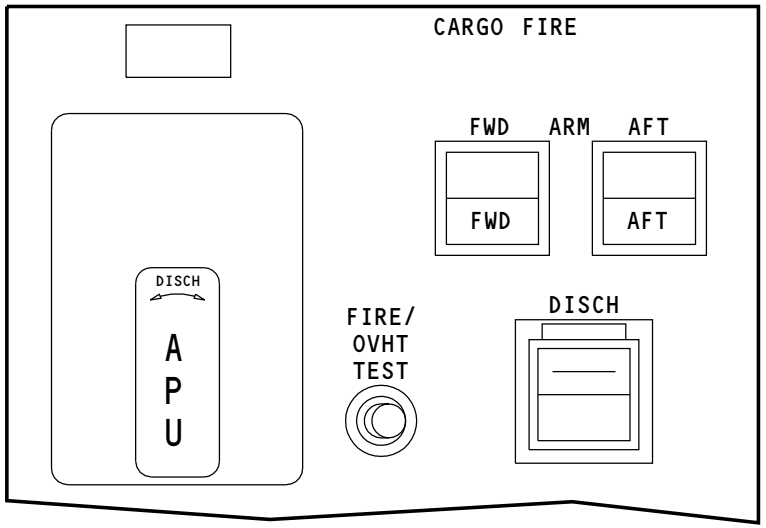
This message shows that the systems are serviceable. The systems may have faults which do not prevent flight. An example is a single loop fault in the engine fire detection system. Status messages show these faults. Look in the Dispatch Deviation Guide book to see if these faults limit flight operations.

Fire Test Fail

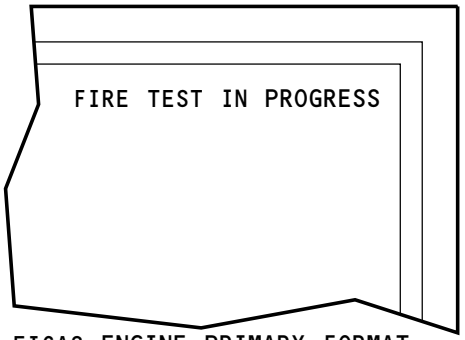
This message shows that one or more systems are not serviceable. These advisory messages show which system has a failure:

- DET FIRE ENG L
- DET FIRE ENG R
- DET FIRE APU
- DET FIRE CARGO FWD
- DET FIRE CARGO AFT
- DET FIRE WHEEL WELL.

Status messages show the failed LRUs.

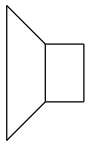


APU AND CARGO FIRE WARNING LIGHTS (P5)

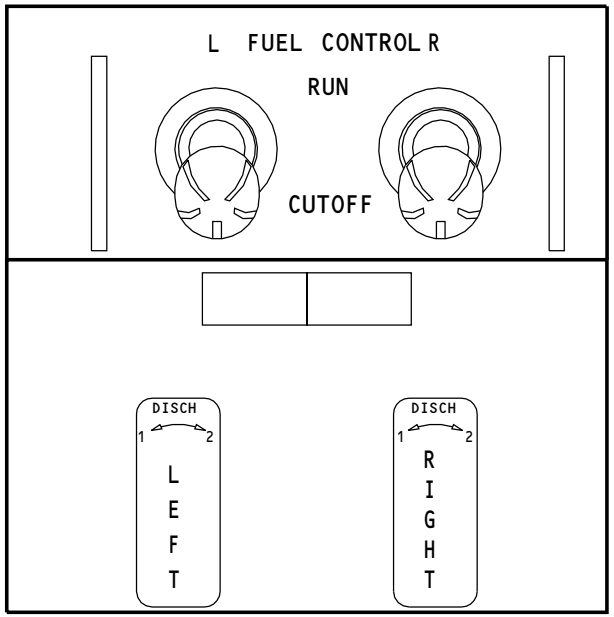


EICAS ENGINE PRIMARY FORMAT

MASTER WARNING LIGHTS



FIRE AURAL WARNING



ENGINE FIRE WARNING LIGHTS (P10/P8)

M40712 S000617071_V1

FIRE PROTECTION - TRAINING INFORMATION POINT - FIRE/OVERHEAT TEST

FIRE PROTECTION - SQUIB TEST - FUNCTIONAL DESCRIPTION - INTRODUCTION

General

The ELMS does an automatic test of all the fire extinguishing squibs. You can also use the MAT to do squib tests when the airplane is on the ground.

Squib Test Power

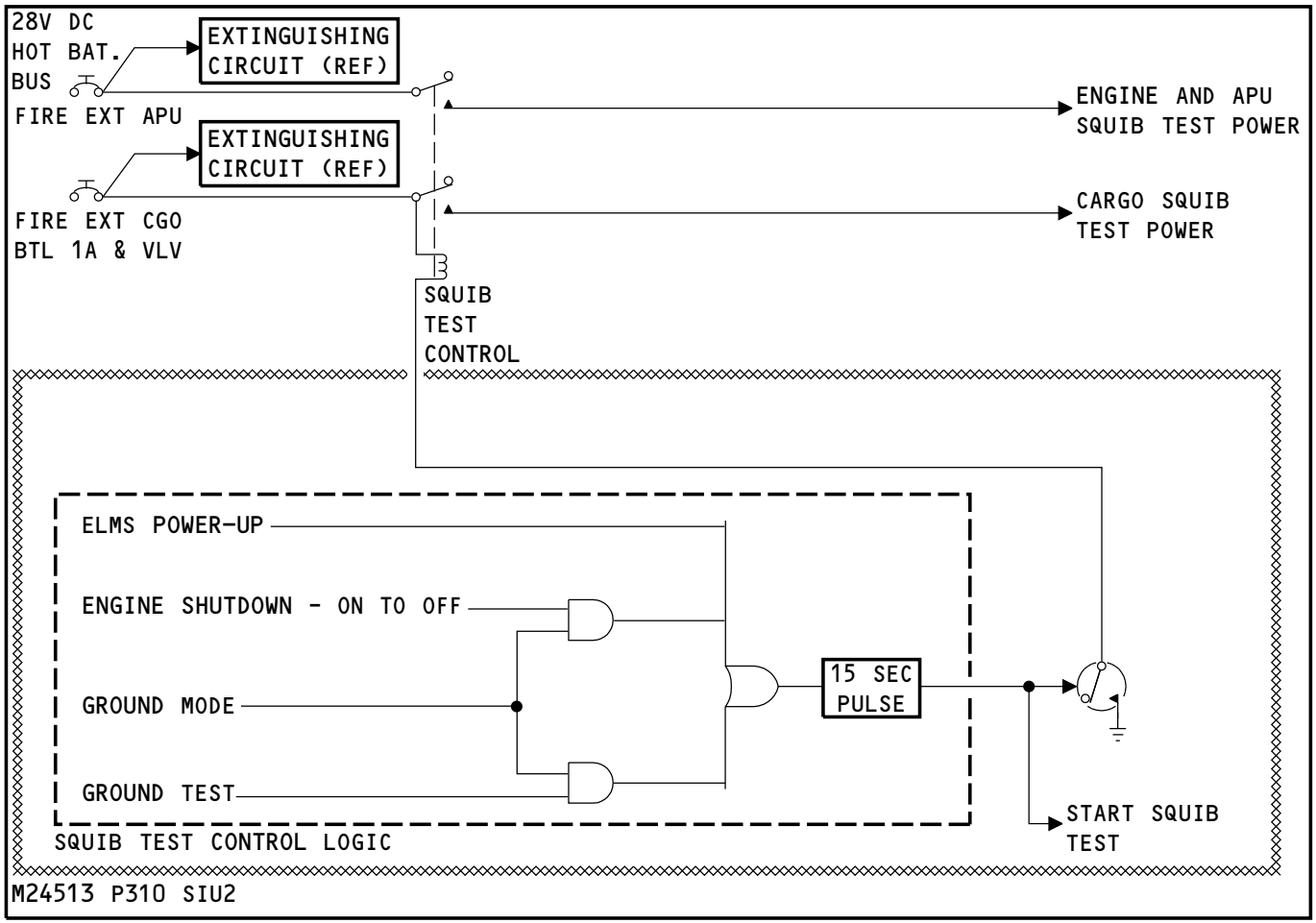
The hot battery bus supplies power through two circuit breakers for the fire extinguishing squib tests.

Squib Test Control

The squib test starts when the squib test control relay energizes. The ELMS energizes the relay for these conditions:

- At ELMS power-up
- At engine shutdown with the airplane on the ground
- When you do a squib test from the MAT.

The ELMS test logic energizes the squib test control relay for 15 seconds and also makes a START SQUIB TEST signal.



P310 STANDBY POWER MANAGEMENT PANEL

D49482 S0000157896_V1

FIRE PROTECTION - SQUIB TEST - FUNCTIONAL DESCRIPTION

FIRE PROTECTION - SQUIB TEST - FUNCTIONAL DESCRIPTION - TEST

General

The squib test does a check to make sure all the squibs have electrical continuity. The test also makes sure the circuit breakers that give power to the squibs are not open. Either condition causes a status message.

Squib Test Logic

When the START SQUIB TEST signal is active, the ELMS monitors the squib test voltage. High or low voltage shows a defect in the squib circuit. If the squib test voltage is not in limits, the ELMS latches a squib test failure signal and sends it to the AIMS. If you repair the squib circuit and do another test, the squib test failure signal resets.

The circuit breaker monitor does a check to make sure the circuit breaker that gives power to the squib is closed. If the circuit breaker is open, the ELMS sends the squib test failure signal to the AIMS.

A status message shows when the AIMS receives a squib test failure signal from the ELMS.

Squib Test Circuits

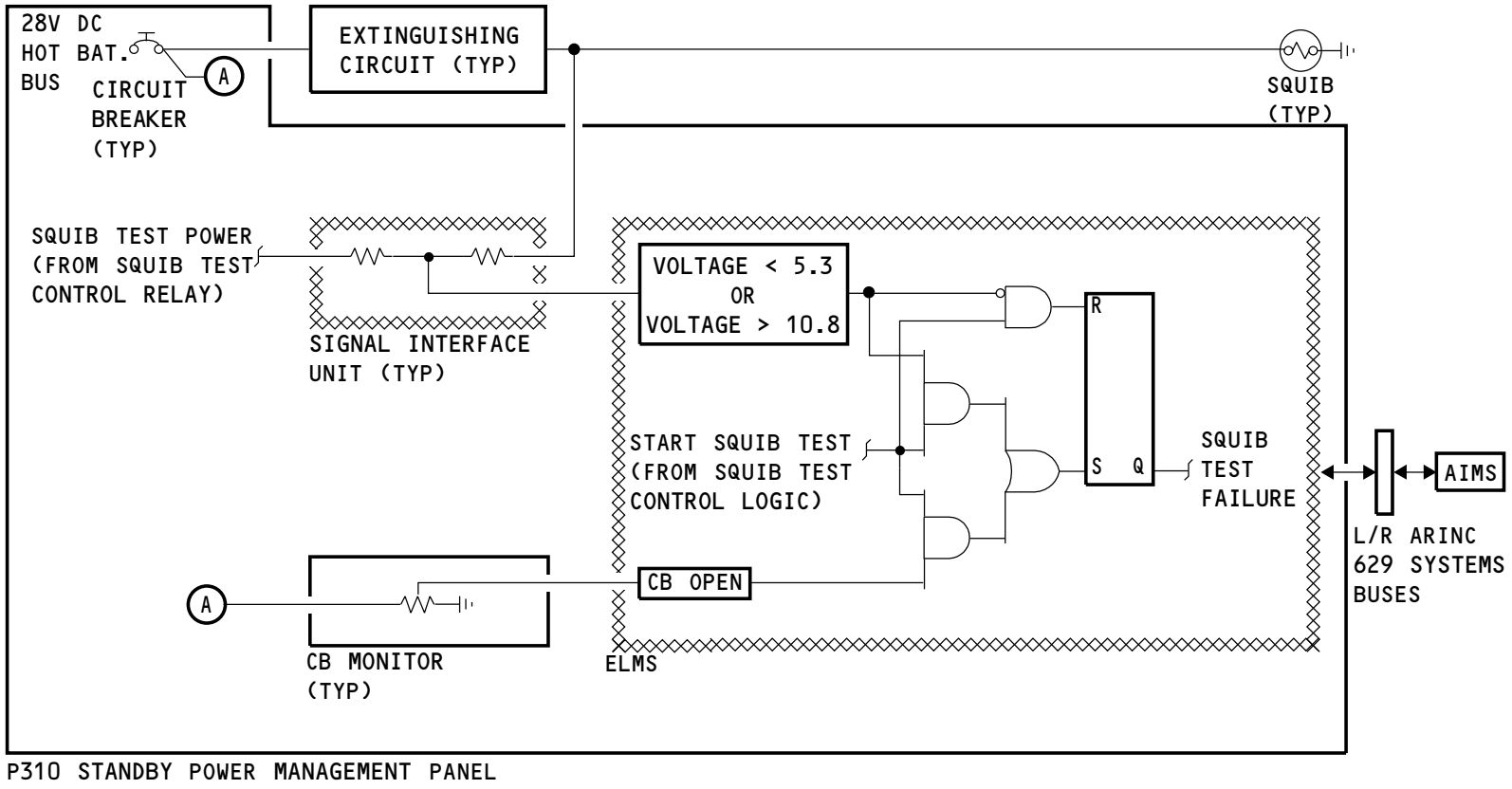
Each fire extinguishing squib has a similar test circuit.

Defects in the squib, circuit breaker, CB monitor, ELMS components, or their related wiring can cause a squib test to fail.

Training Information Point

A squib test failure causes a status message. After you correct the problem, do the related MAT ground test to clear the status message.

The same status message shows for a failed squib test and for low pressure in the related fire extinguishing bottle. Also, one message shows if the test fails for either squib (or the two squibs) in a cargo flow valve. Related maintenance messages help you find the problem.



D52079 S0000158596_V1

FIRE PROTECTION - SQUIB TEST - FUNCTIONAL DESCRIPTION - TEST

FIRE PROTECTION - OPERATIONAL TESTS

General

These are the operational tests for the fire extinguishing system:

- Cargo squibs
- Engine and APU squibs.

Cargo Squibs

WARNING KEEP PERSONS AWAY FROM THE CARGO COMPARTMENT DURING THIS TEST. IF A SQUIB FIRES ACCIDENTALLY, THE FIRE BOTTLE CAN RELEASE ITS CONTENTS AND CAUSE INJURIES.

This test supplies a small current to these squibs:

- Cargo compartment fire extinguishing bottles
- Cargo compartment fire extinguishing flow valves
- Engine fire extinguishing bottles
- APU fire extinguishing bottle.

The test makes sure that there are no open circuits in the cargo compartment fire extinguishing squibs and their related wiring.

LLAR Bottle Squib

WARNING KEEP PERSONS AWAY FROM THE LOWER LOBE ATTENDANTS REST COMPARTMENT DURING THIS TEST. IF A SQUIB FIRES ACCIDENTALLY, THE FIRE BOTTLE CAN RELEASE ITS CONTENTS AND CAUSE INJURIES.

This test supplies a small current to these squibs:

- Engine fire extinguishing bottles
- APU fire extinguishing bottle
- Cargo compartment fire extinguishing bottles
- Cargo compartment fire extinguishing flow valves.

The test makes sure that there is no open circuit in the LLAR bottle squib and its related wiring.

Engine and APU Squibs

WARNING KEEP PERSONS AWAY FROM THE ENGINE AND APU DURING THIS TEST. IF A SQUIB FIRES ACCIDENTALLY, THE FIRE BOTTLE CAN RELEASE ITS CONTENTS AND CAUSE INJURIES.

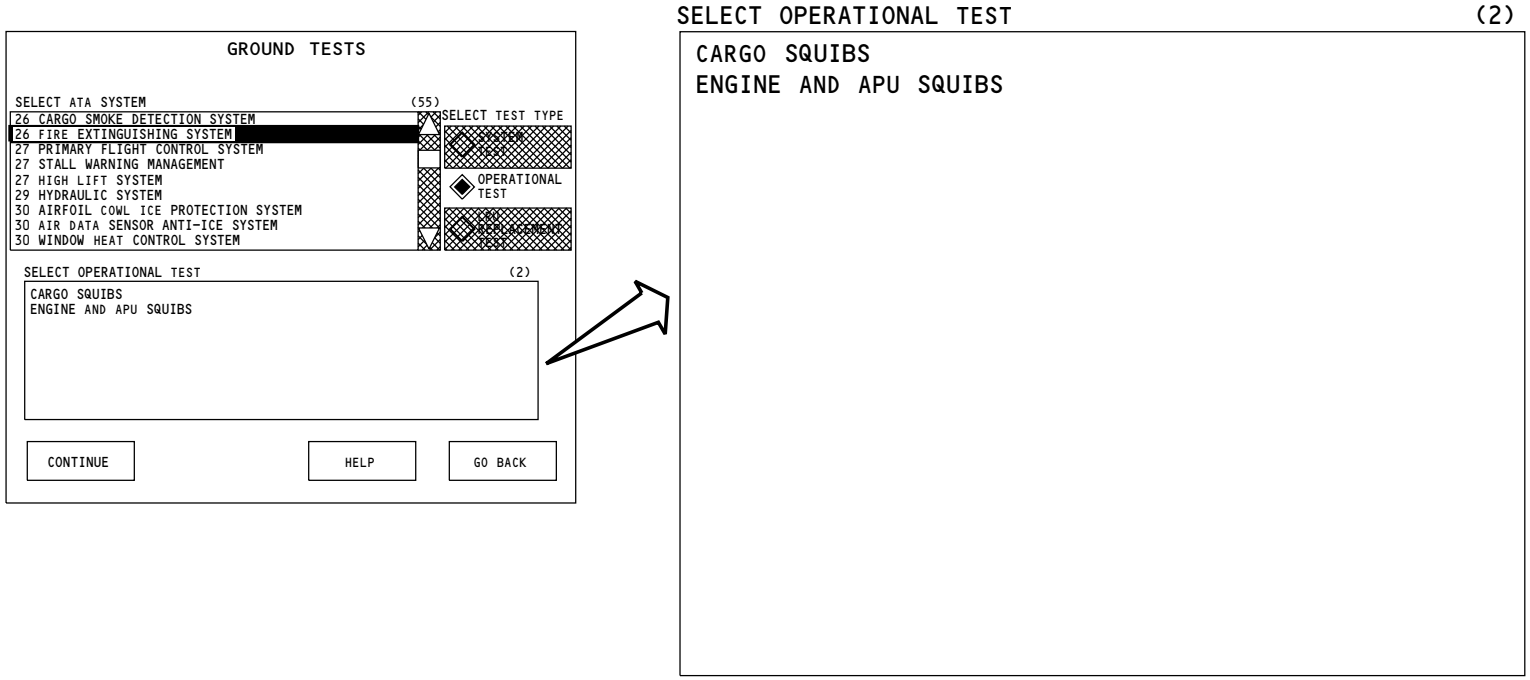
This test supplies a small current to these squibs:

- Engine fire extinguishing bottles
- APU fire extinguishing bottle
- Cargo compartment fire extinguishing bottles
- Cargo compartment fire extinguishing flow valves.

The test makes sure that there are no open circuits in the engine and APU fire extinguishing squibs and their related wiring.

Training Information Point

When you do any test that does a check of fire bottle squibs, the ELMS supplies a small current to fire bottle squibs for the bottles selected and to all other fire bottle squibs. The MAT shows the test results only for the selected test. See Fire Protection - Squib Test - Functional Description in this section for more information.



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FIRE PROTECTION - OPERATIONAL TESTS

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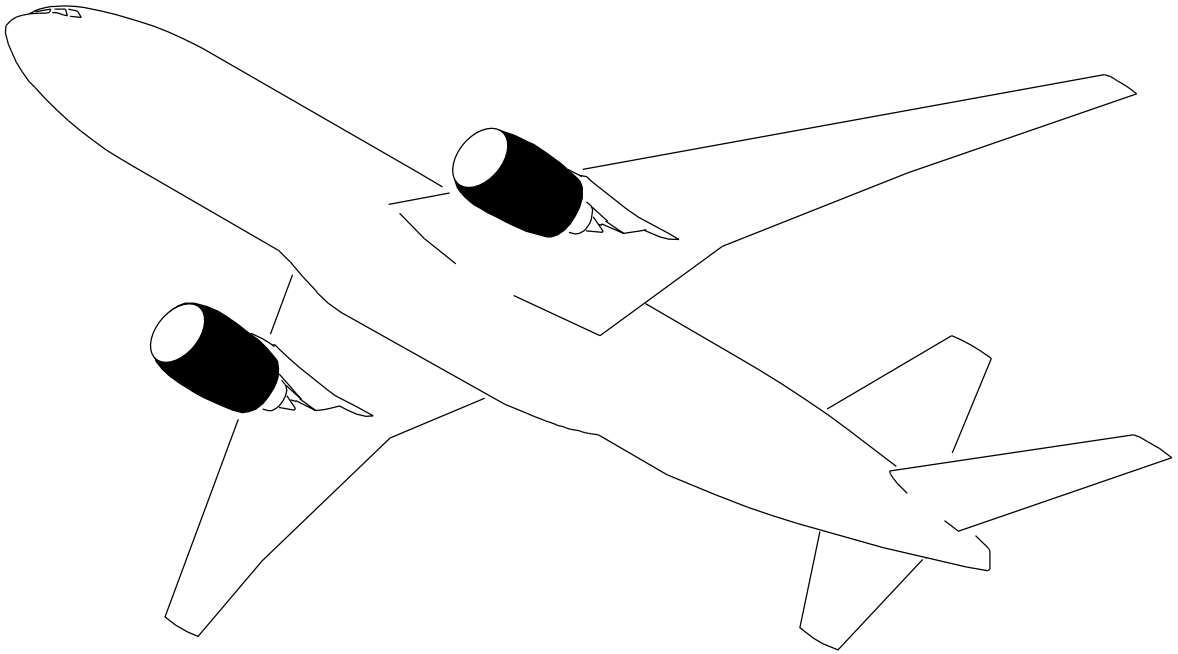
ENGINE FIRE DETECTION - INTRODUCTION

Purpose

The engine fire detection system does these functions:

- Gives warnings in the flight deck if there is a fire in an engine nacelle
- Gives caution indications in the flight deck if an engine has an overheat condition
- Measures nacelle temperature for the airplane condition monitoring system (ACMS).

The system has built-in test equipment. Failures cause EICAS messages, status messages, or maintenance messages.



M40715 S000617076_V1

ENGINE FIRE DETECTION - INTRODUCTION

ENGINE FIRE DETECTION - GENERAL DESCRIPTION

General

Each engine has two fire detection loops, loop 1 and loop 2. A fire detection card in the system card file monitors the loops for fires, overheat conditions, and faults. There is a fire detection card for each engine.

Overheat Detection

If the fire detection loops find an overheat condition, the fire detection card sends a signal to the AIMS and to the warning electronics unit. The AIMS shows a caution message and turns on the master caution light. The warning electronics unit turns on the caution aural.

When the overheat condition goes away, the indications go away.

Fire Detection

If an engine fire occurs, the fire detection card sends a signal to the AIMS and to the warning electronics unit. A warning message shows. The warning electronics unit turns on the master warning lights and the fire warning aural. Another fire alarm signal causes the fuel control switch fire warning light and the engine fire warning light to come on.

When the fire is extinguished, the indications go out of view.

Nacelle Temperature Recording

The fire detection card measures the average temperature of the loops. This data goes to the AIMS through the systems ARINC 629 buses. The airplane condition monitoring function records this data.

Continuous Fault Monitoring

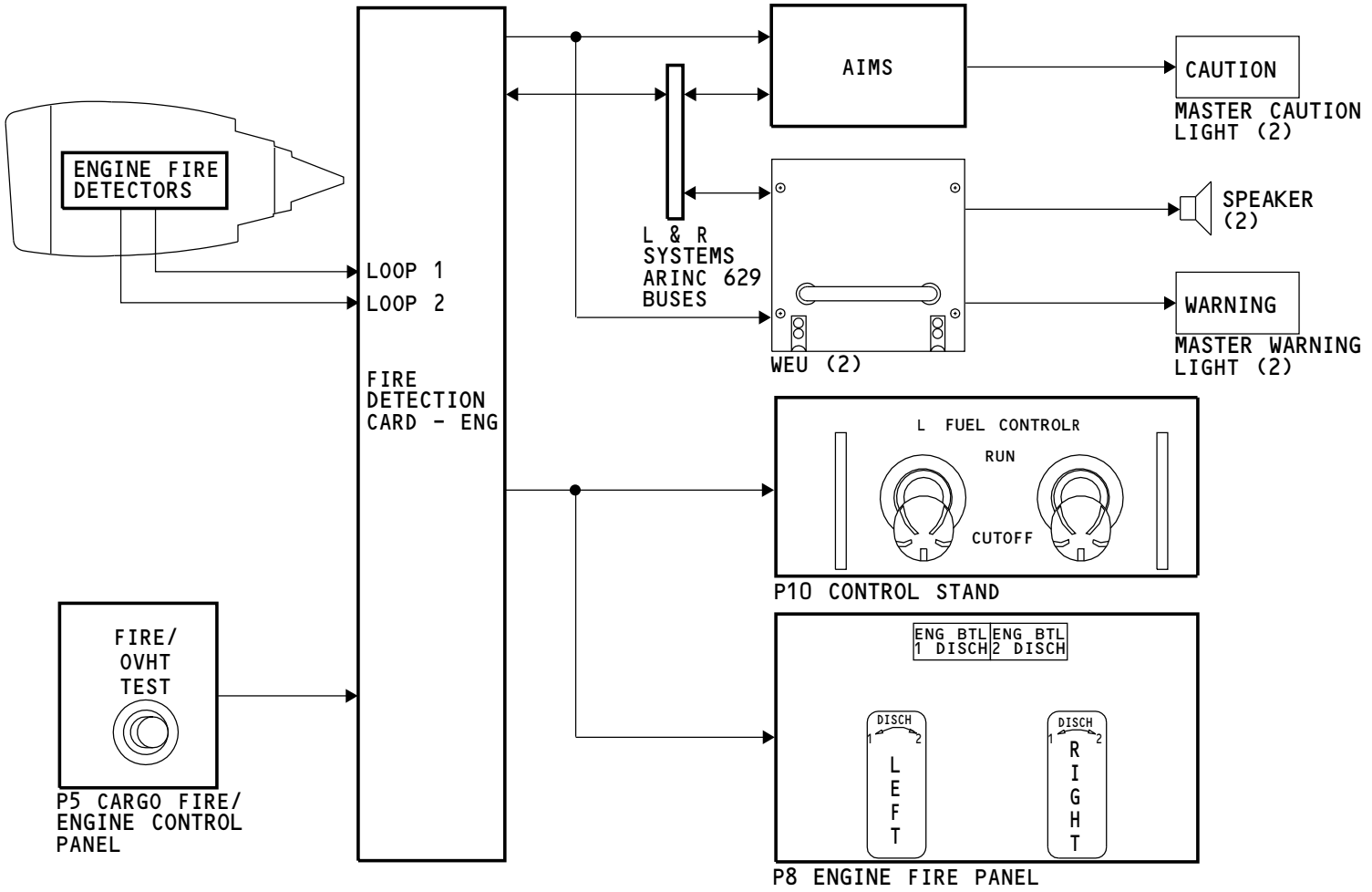
The fire detection card monitors the two loops and their wiring for defects. In normal (dual loop) operation, both loops must have a fire or overheat condition to cause the flight deck indications.

If a failure occurs in a loop, the fire detection card sends the data to the AIMS. A status message shows and the system changes to single loop operation. In this mode, fire/overheat indications occur when one loop is defective and the other has a fire or overheat condition.

System Tests

Use the FIRE/OVHT TEST switch on the P5 overhead panel to do a test of the system. Test results show on the primary display system.

The fire and overheat detection system has a built-in-test function which does tests of the loops, system logic, and interface electronics. System failures show on the primary display system and the MAT.



M40716 S000617077_V1

ENGINE FIRE DETECTION - GENERAL DESCRIPTION

ENGINE FIRE DETECTION - FLIGHT DECK AND MEC COMPONENT LOCATIONS

Flight Deck Component Locations

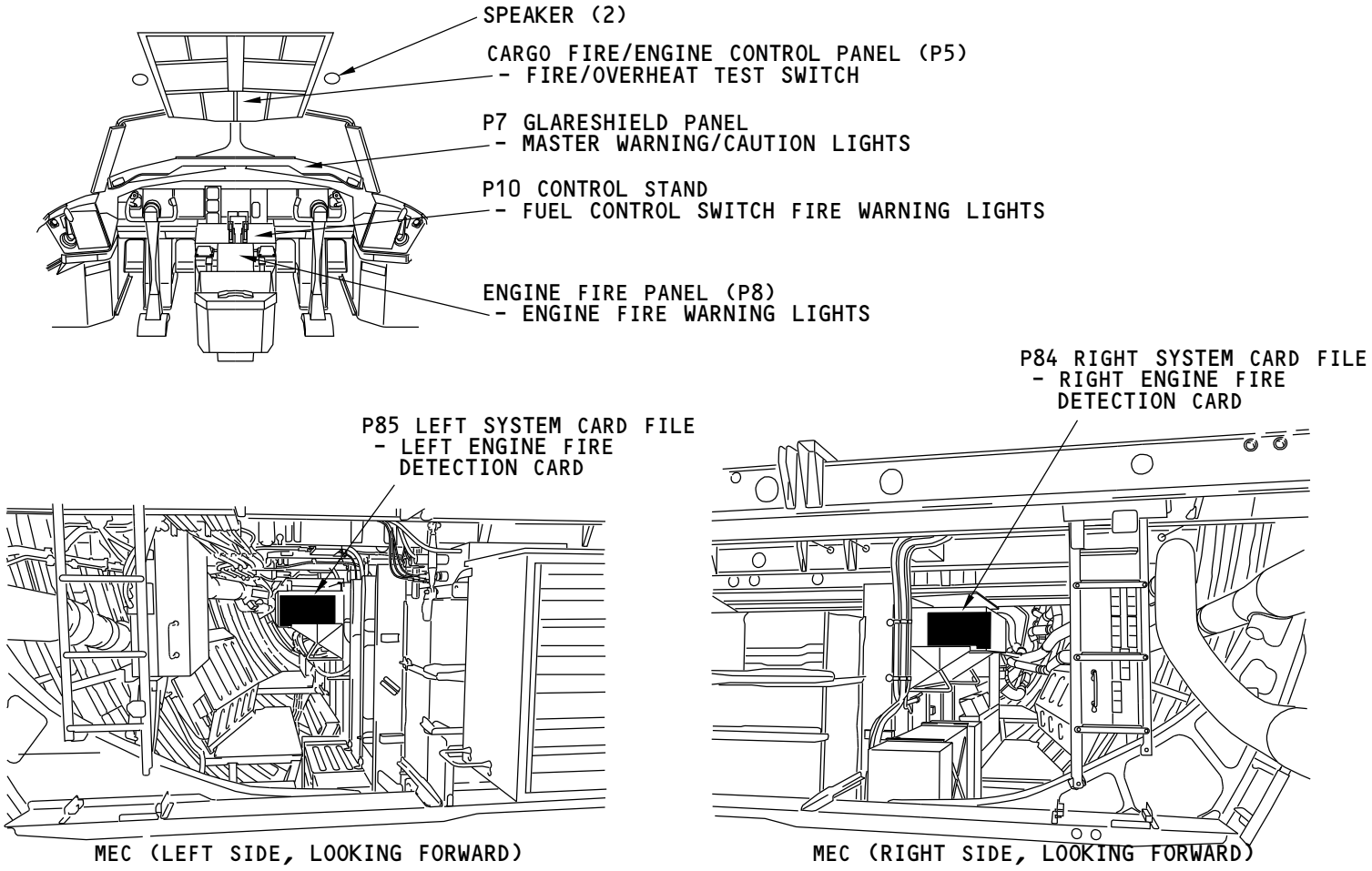
The components in the flight deck that have an interface with the engine fire detection system are:

- Speakers
- Fire/overheat test switch
- Master warning/caution lights
- Fuel control switch fire warning lights
- Engine fire warning lights.

MEC Component Locations

These are the engine fire detection system components in the main equipment center (MEC):

- Left engine fire detection card
- Right engine fire detection card.



M40718 S000617079_V1

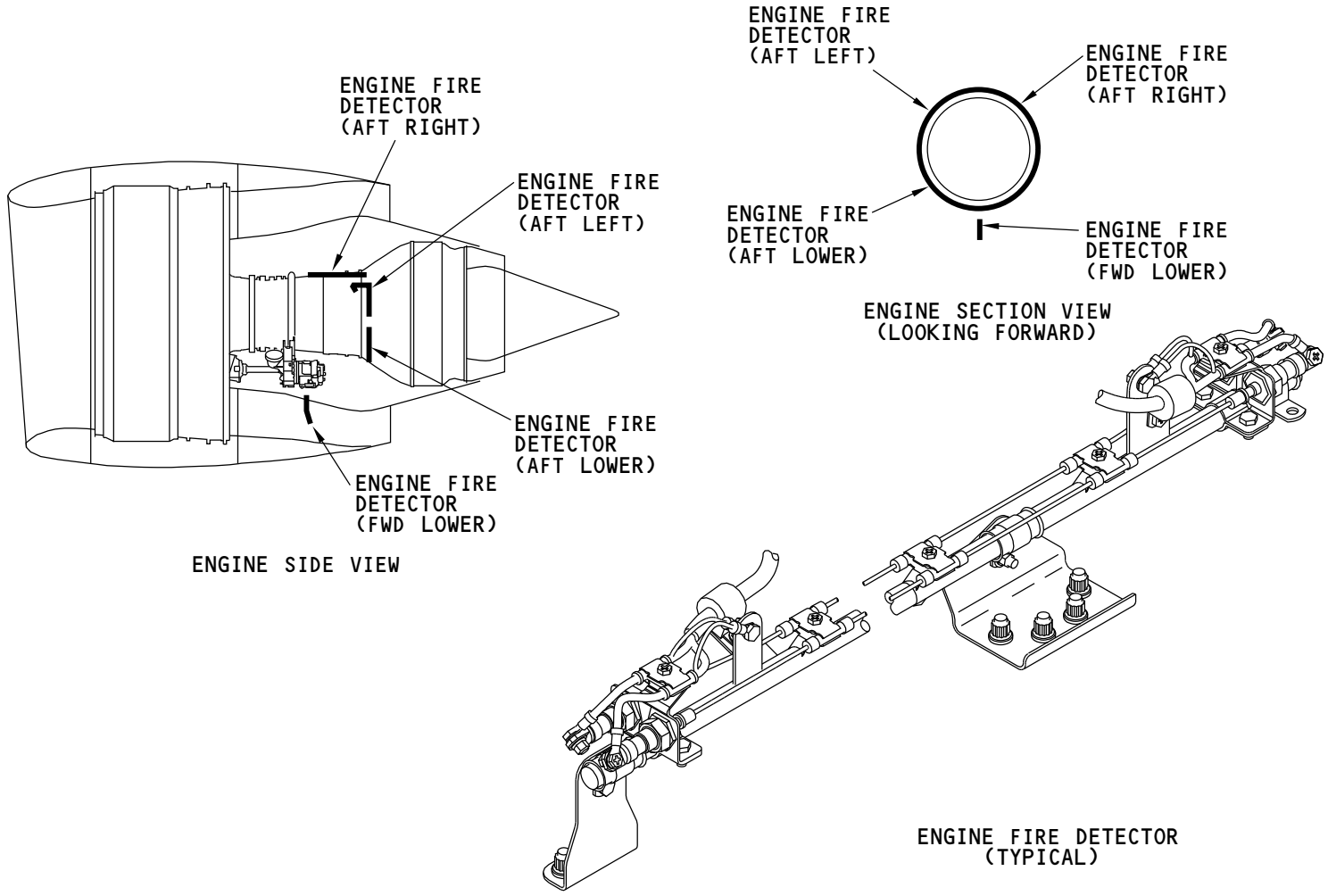
ENGINE FIRE DETECTION - FLIGHT DECK AND MEC COMPONENT LOCATIONS

ENGINE FIRE DETECTION - ENGINE COMPONENT LOCATIONS

Component Locations

These are the engine fire detection system components on the engines:

- Engine fire detector - aft right
- Engine fire detector - aft left
- Engine fire detector - aft lower
- Engine fire detector - forward lower.



M40720 S000617081_V1

ENGINE FIRE DETECTION - ENGINE COMPONENT LOCATIONS

ENGINE FIRE DETECTION - ENGINE FIRE DETECTORS

Purpose

The engine fire detectors monitor the temperature in the engine nacelles.

Physical Description

Each detector has two elements that attach to a support tube. The elements connect to make loop 1 and loop 2.

The element is an inconel tube filled with a thermistor core material. Two electrical conductors go through the length of the core. One conductor has a ground connection to the tube. The other conductor connects to the fire detection card.

Functional Description

As the temperature of the core increases, electrical resistance to ground decreases. The fire detection card monitors this resistance. If the resistance decreases to the overheat set point, an overheat indication occurs in the flight deck. There is a 7.2 second time delay for the overheat indication. If the resistance decreases more to the fire set point, a fire warning occurs. When the fire or overheat condition is gone, the resistance increases to the reset point and the flight deck indications go away.

The tables show temperatures in degrees F (and degrees C) which cause overheat and fire indications. Reset temperatures are also shown.

DETECTOR	OVERHEAT TEMP	RESET TEMP
FWD LOWER	501 (261)	486 (252)
AFT LOWER	706 (374)	689 (365)
AFT LEFT	706 (374)	689 (365)
AFT RIGHT	706 (374)	689 (365)

DETECTOR	FIRE TEMP	RESET TEMP
FWD LOWER	610 (321)	595 (313)
AFT LOWER	826 (441)	810 (432)
AFT LEFT	826 (441)	810 (432)
AFT RIGHT	826 (441)	810 (432)

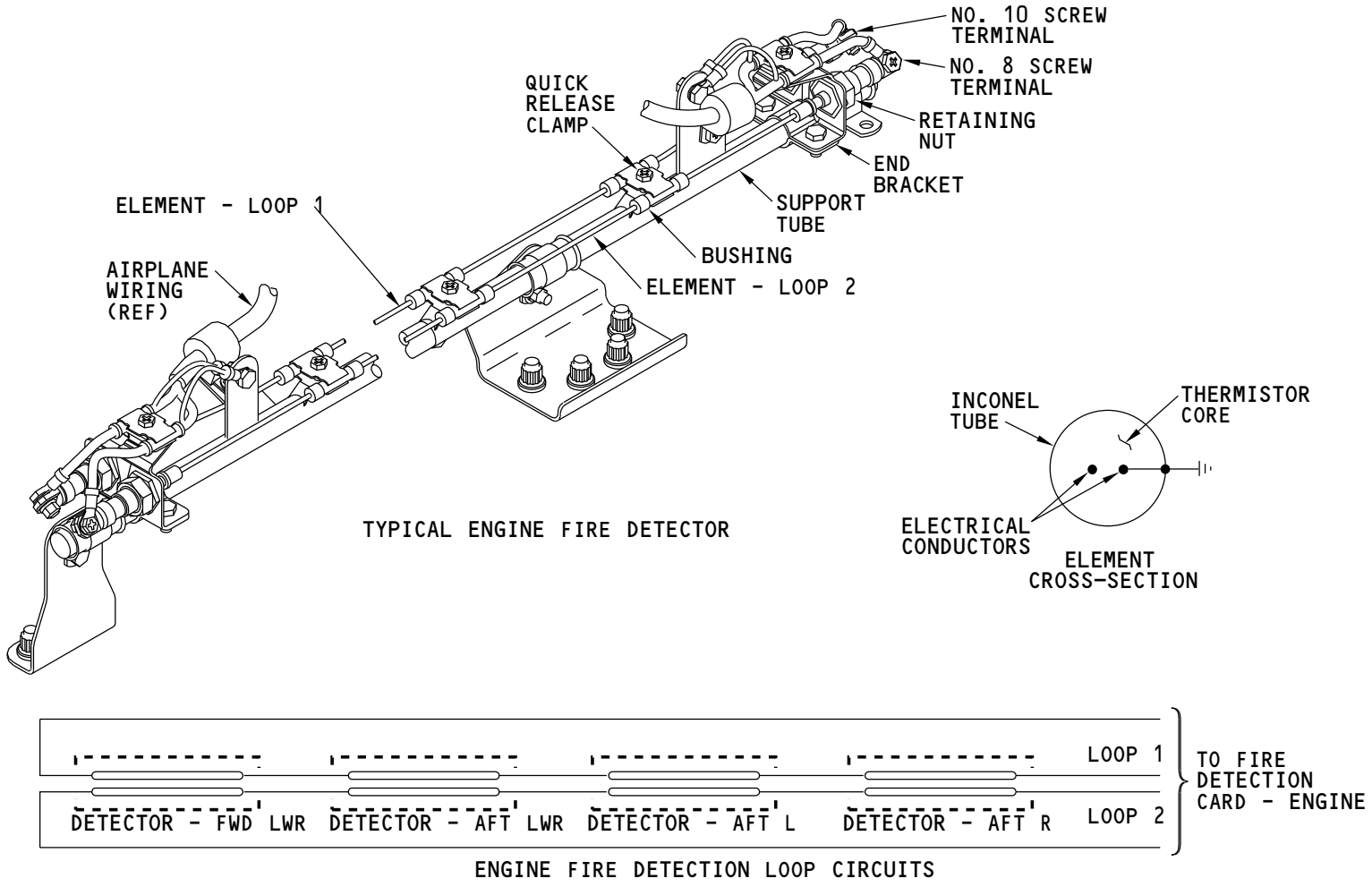
The rate of change of resistance identifies an electrical short or a fire. The resistance decreases more quickly with an electrical short than with a fire.

In addition to fire and overheat detection, the engine fire detectors continuously supply nacelle temperature data to the airplane condition monitoring function of the AIMS.

Training Information Point

Each element uses a #10 screw wire-termination on one end and a #8 screw wire-termination on the other end. The elements are installed so each end of the detector has a #8 terminal and a #10 terminal. This prevents crossed wiring. The #10 terminal and the mating wire terminal have a black stripe around the insulation.

The ends of the element attach to the support tube bracket with retaining nuts. Quick-release clamps and bushings support the element along its length.



M40723 S000617084_V1

ENGINE FIRE DETECTION - ENGINE FIRE DETECTORS

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ENGINE FIRE DETECTION - FIRE DETECTION CARDS

Purpose

The fire detection card has these purposes:

- Measures the nacelle temperature and sends it to the airplane condition monitoring system (ACMS)
- Monitors the fire detectors for a fire or overheat condition and supplies alarm signals
- Monitors the fire detectors for defects and sends fault data to AIMS
- Sets the logic (and/or logic) for the detector loops
- Does tests of the engine fire detection system.

Fire Detection Circuits

The fire detection circuits monitor the resistance of the fire detector element thermistor core. The resistance of the core is normally high. If the resistance goes low, the circuit supplies a FIRE output.

A short circuit in the loop also causes low resistance. The rate at which the resistance changes identifies an electrical short or a fire. A short circuit causes the resistance to decreases very quickly. A fire causes the resistance to decrease more slowly.

If the resistance decreases quickly, the circuit supplies a SHORT output for the life of the short circuit. If the short circuit stays for more than 0.2 seconds, the circuit supplies a DESELECT output. A deselect output also occurs if a power-up BIT finds an open circuit in the loop.

Program Logic Device

Output signals from the fire detection circuits go to the program logic device. The device normally causes dual-loop operation. Both Loop 1 and loop 2 must have a fire to cause fire alarms. If a detection circuit sends a FAULT signal, the logic device causes single-loop operation. A FAULT is a short, deselect, or power loss. The table shows alarm and fault conditions:

LOOP 1	LOOP 2	CARD OUTPUT
NORMAL	NORMAL	-
FIRE	NORMAL	FAULT (SEE TEXT)
FIRE	FIRE	ALARM
NORMAL	FIRE	FAULT (SEE TEXT)
FAULT	NORMAL	FAULT - LOOP 1
NORMAL	FAULT	FAULT - LOOP 2
FIRE	FAULT	ALARM
FAULT	FIRE	ALARM
FAULT	FAULT	FAULT - BOTH LOOPS

If one loop reports a fire and the other loop is normal, a 15 second timer starts. During this time, if the loop status changes from fire to normal, the timer stops. If the status of the normal loop changes to fire, the card sends a fire alarm.

If neither loop changes status in 15 seconds, the card does a test of the normal loop. If the test fails, the card removes the selection of that loop and sends a fire alarm. If the test passes, the card removes the selection of the other loop and reports a fault.

Temperature Monitor Circuit

This circuit measures the average temperature of the fire detection loops. The ARINC 429 transmitter sends temperature data to AIMS.

The circuit also compares average temperature to an overheat set point kept in memory. If the temperature is more than the set point for 7.2 seconds, the temperature monitor circuit sends an overheat alarm through the ARINC 429 transmitter to AIMS.

Software in the temperature monitor circuit selects single or dual loop logic as applicable.

Built-In-Test Circuit

BIT continuously monitors the fire detection circuits. The ARINC 429 transmitter sends failure data to the AIMS as soon as BIT finds the condition.

BIT also does a test of the complete engine fire detection system at these times:

- At power-up
- After power interrupt
- Every five minutes of operation.

BIT signals a fire on both loops at the same time and does a check of the system. The ARINC 429 transmitter sends a fire alarm signal to AIMS. The CMCS uses this signal to make sure the fire detection system transmits ARINC data. Fire warnings do not occur during the tests.

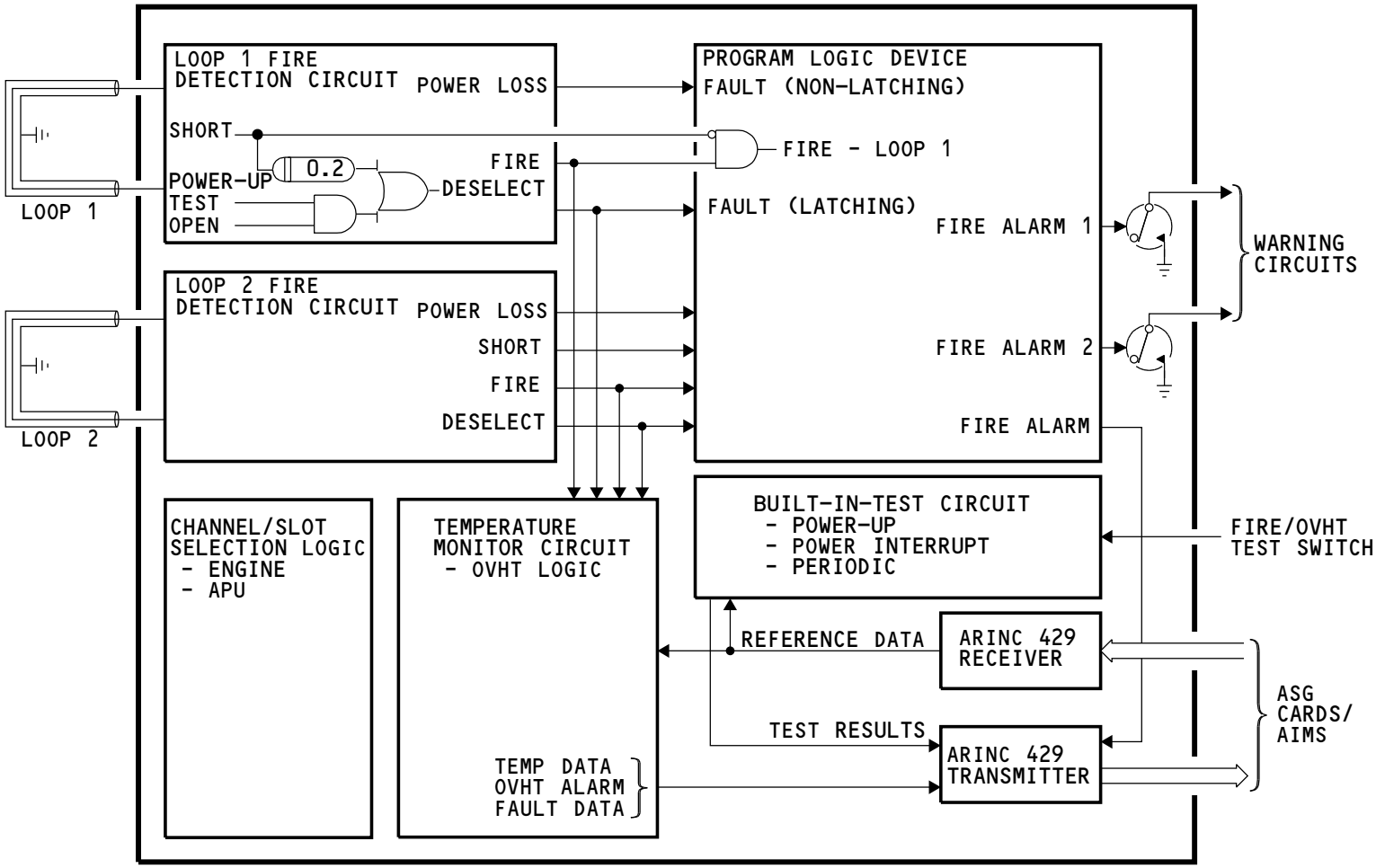
If there is a failure, the ARINC 429 transmitter sends fault data to the AIMS. The system changes to single loop operation if necessary.

The fire/ovht test switch in the flight deck starts a similar test. If there is a fault, the ARINC 429 transmitter sends fault data to the AIMS. Fire warnings occur during this test.

Training Information Point

The engine and APU fire detection cards function differently but are interchangeable. Program pins in the cardfile interface with the channel/slot selection logic circuit. That circuit tells the card whether to function as an APU fire detection card or as a left or right engine fire detection card.

The fire detection cards are electrostatic discharge sensitive (ESDS) devices. Be careful to obey the procedures in part II of the maintenance manual (Standard Practices - Airframe, Electrostatic Discharge Sensitive Devices - Maintenance Practices) before you touch the cards.



M40725 S000617086_V1

ENGINE FIRE DETECTION - FIRE DETECTION CARDS

ENGINE FIRE DETECTION - FUNCTIONAL DESCRIPTION

Fire Detection

If there is a fire in an engine nacelle, the fire detection card supplies three fire alarm outputs. Alarm 1 supplies a ground for these components:

- The fire switch unlocking solenoid
- The engine fire warning lights
- The fuel control switch fire warning light.

Alarm 2 supplies a signal to AIMS and to the warning electronics unit. An EICAS warning message shows. The master warning lights and fire warning aural come on.

A third fire alarm output goes to the AIMS through the ASG (ARINC signal gateway) cards. The CMCS uses this signal to make sure the engine fire detection system transmits ARINC data.

The indications go away when the fire is out.

Overheat Detection

If the fire detection loops find an overheat condition, the fire detection card sends a signal to AIMS through the ASG cards. An EICAS caution message shows. The master caution light and caution aural come on. When the overheat condition is gone, the indications go away.

Nacelle Temperature Recording

The fire detection card measures the average temperature of the engine fire detectors. This data is sent to AIMS through the ASG cards. The ACMF (airplane condition monitoring function) of the AIMS puts this data in memory.

Single/Dual Loop Operation

The fire detection card monitors the loops for faults. In normal (dual loop) operation, both loops must have a fire or overheat condition to cause the flight deck indications.

If one detection loop fails, the card sends data about the failure to the AIMS. A status message shows. The card changes to single loop operation if necessary.

If both detection loops fail, an advisory message and status messages show. The fire detection system does not operate.

BITE

BITE does a test of the engine fire detection system for these conditions:

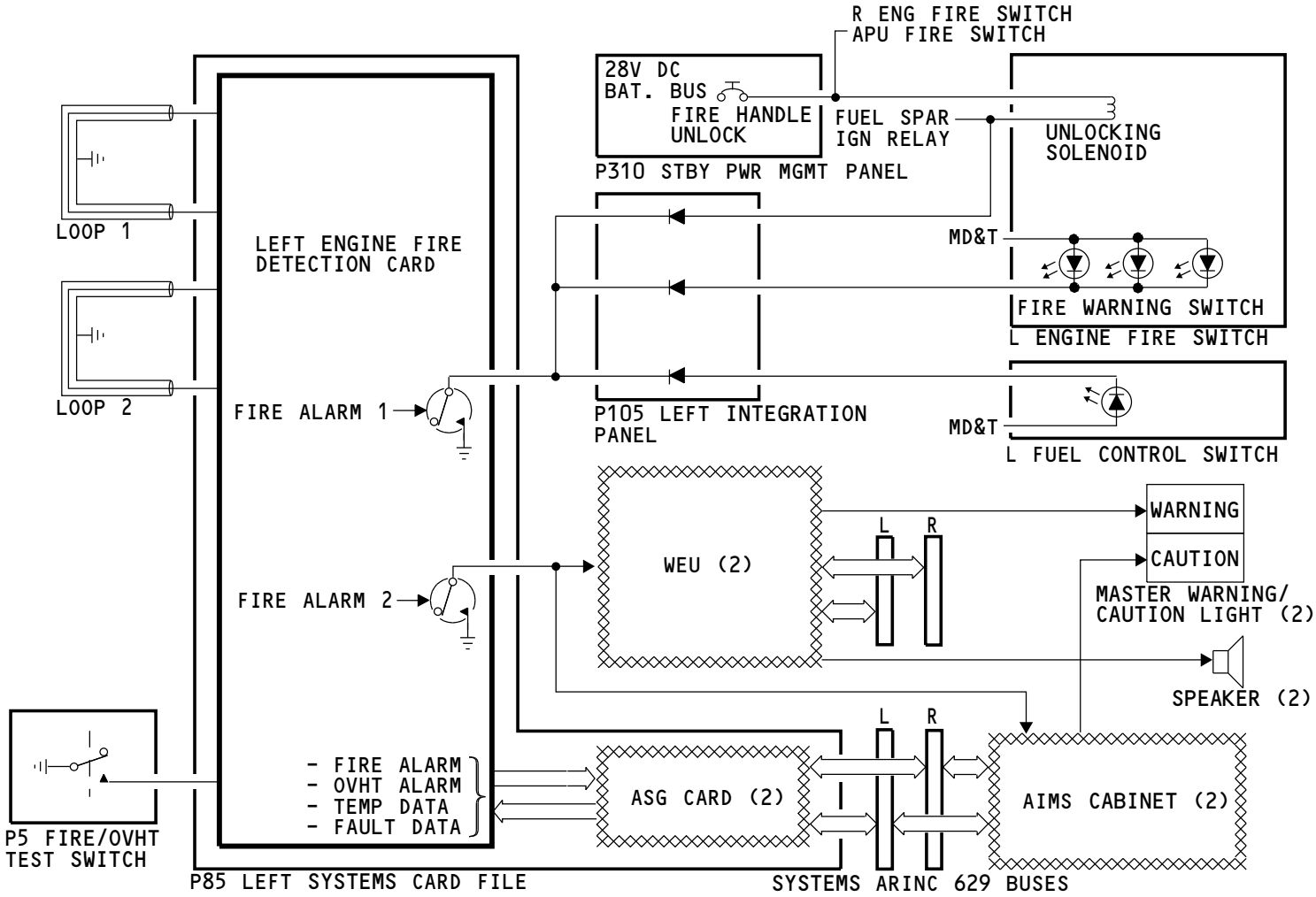
- When the system first gets power
- After a power interrupt
- Every 5 minutes of operation.

BIT data goes to the AIMS. If the system has a malfunction, the primary display system shows advisory or status messages. The MAT shows maintenance messages.

If a loop opens after the power-up BIT, the system stays in the dual-loop mode until you apply electrical power again. A loop which is open in only one place still operates. If the power-up BIT finds an open loop, the system changes to single-loop operation. Both ends of the loop are possibly disconnected.

After you do maintenance, use the FIRE/OVHT TEST switch to make sure the system operates correctly.

You can use the MAT to see the nacelle temperature data kept in memory by the ACMF.



M40726 S000617087_V1

ENGINE FIRE DETECTION - FUNCTIONAL DESCRIPTION

ENGINE FIRE DETECTION - INDICATIONS

Overheat Indication

If an engine has an overheat condition, these indications occur in the flight deck:

- The master caution lights come on
- The caution aural operates
- An engine overheat caution message shows.

Fire Indication

If an engine has a fire, these indications occur in the flight deck:

- The master warning lights come on
- The fire warning aural operates
- An engine fire warning message shows
- The engine fire warning light comes on
- The fuel control switch fire warning light comes on.

Failure Indications

If continuous fault monitoring or built-in-test finds a fault, indications show in the flight deck.

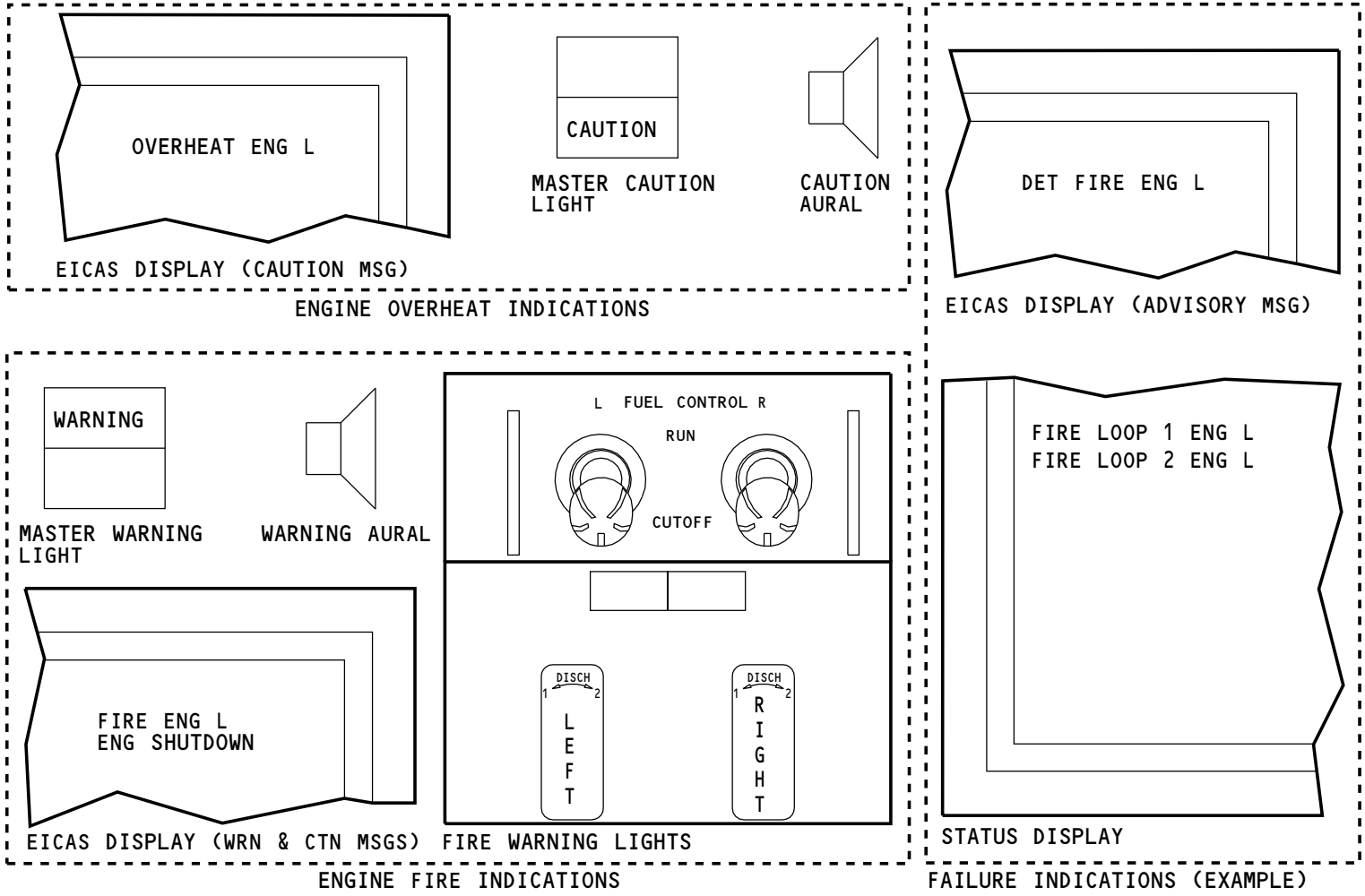
Dual loop failures in the engine fire detection system cause advisory messages and status messages. The engine fire detection system does not operate.

Single loop failures in the engine fire detection system cause status messages. The engine fire detection system still operates.

Failures in the temperature monitor function cause a status message.

Training Information Point

Maintenance messages, that you get from the maintenance access terminal, generally give more details about the failure condition. For example, if a loop fails, the maintenance message tells you that the loop is open or shorted or connected incorrectly. If the loop is shorted, the maintenance message tells which detector element or wiring segment has the short.



M40728 S000617089_V1

ENGINE FIRE DETECTION - INDICATIONS

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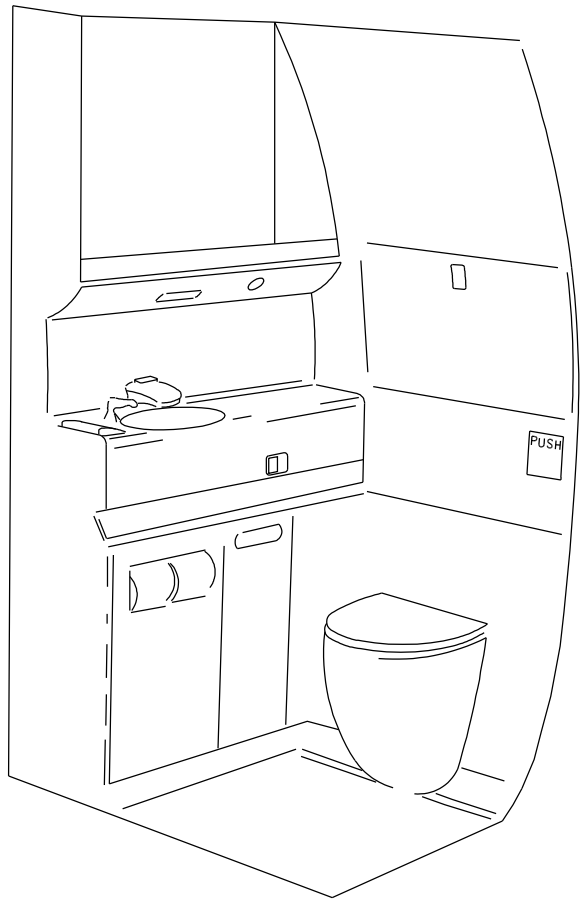
LAVATORY SMOKE DETECTION - INTRODUCTION

Purpose

The lavatory smoke detectors monitor the lavatories for smoke. Smoke indications show at the lavatory and at attendant stations.



M40732 S000617093_V1

LAVATORY SMOKE DETECTION - INTRODUCTION

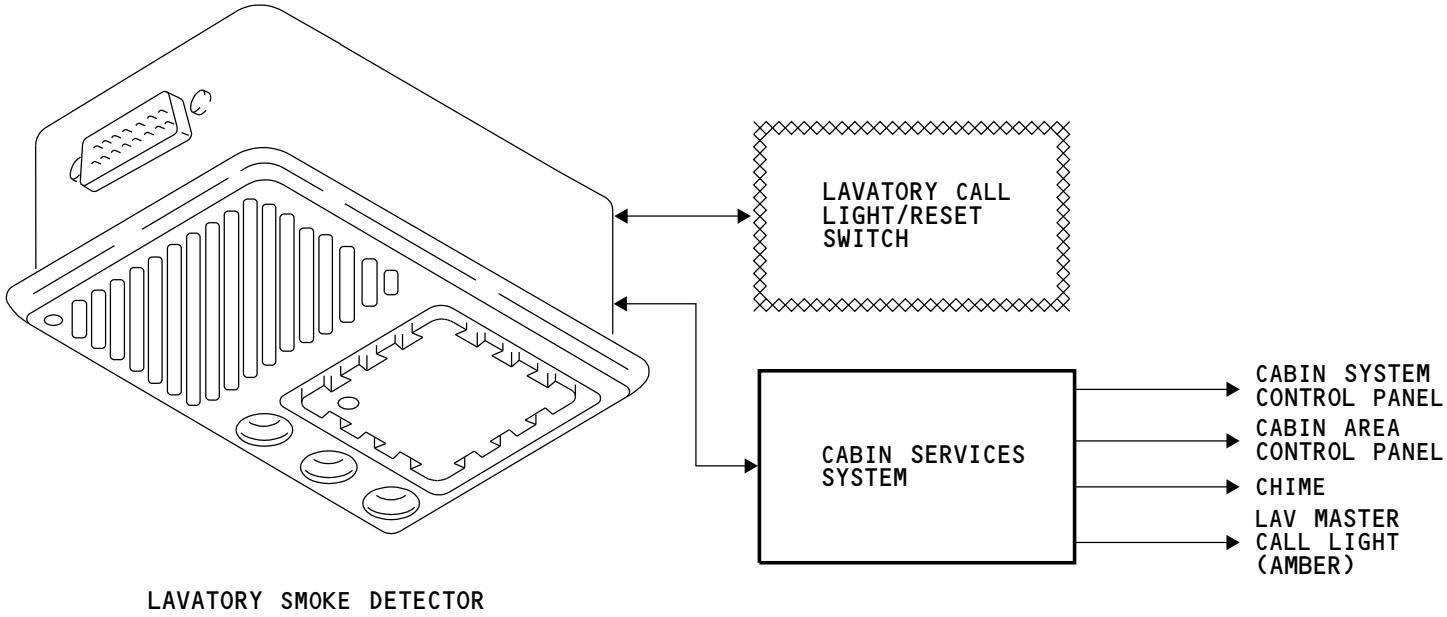
LAVATORY SMOKE DETECTION - GENERAL DESCRIPTION

Interfaces

The lavatory smoke detector has these interfaces:

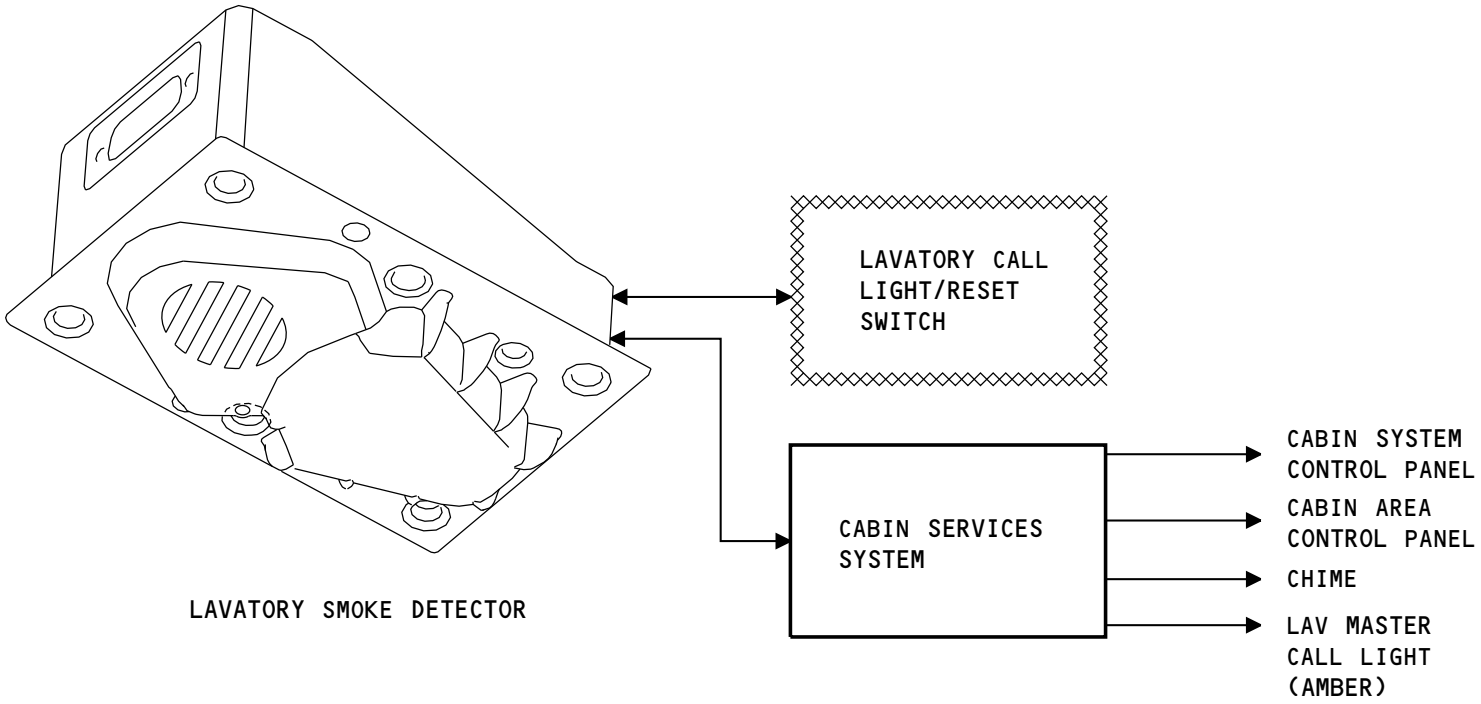
- Cabin services system (CSS)
- Lavatory call light/reset switch.

CSS gives smoke indications at the related attendant station. A lavatory smoke message shows on the cabin system control panel (CSCP) and the cabin area control panel (CACP). The amber master call light and chime related to the lavatory come on.



M40739 S000617100_V1

LAVATORY SMOKE DETECTION - GENERAL DESCRIPTION



2027400 S0000404206_V2

LAVATORY SMOKE DETECTION - GENERAL DESCRIPTION

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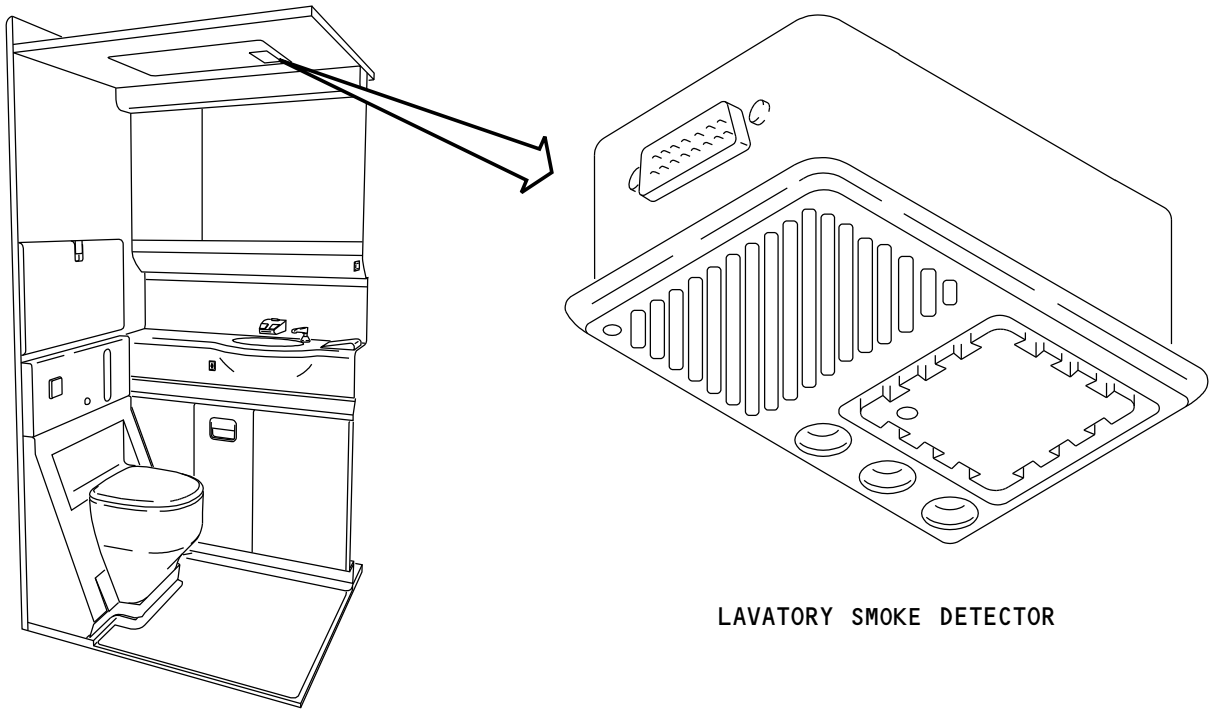
LAVATORY SMOKE DETECTION - COMPONENT LOCATIONS

Lavatory

A lavatory smoke detector is in the ceiling of each lavatory.



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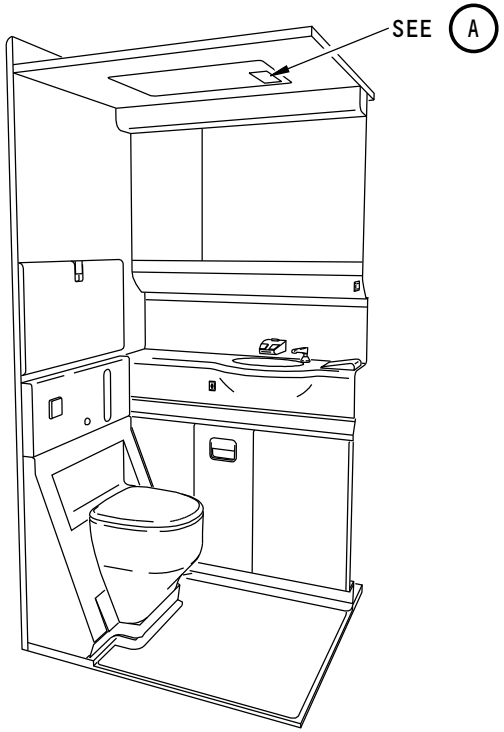
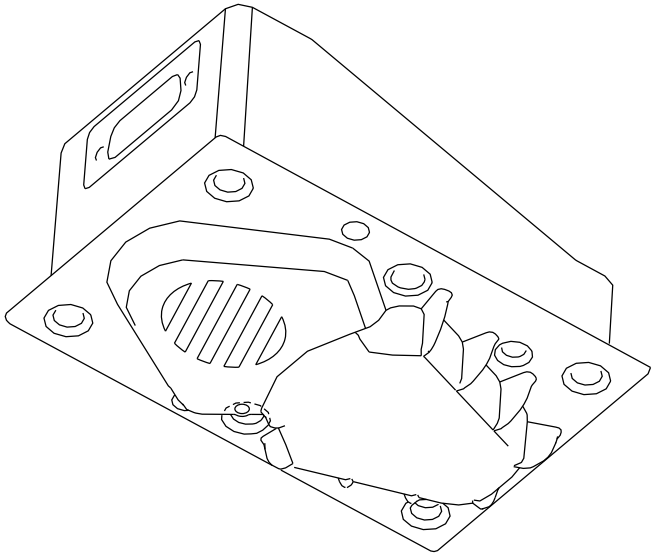
LAVATORY SMOKE DETECTION - COMPONENT LOCATIONS



LAVATORY (TYP)



LAVATORY SMOKE DETECTOR

A

2027391 S0000404208_V2

LAVATORY SMOKE DETECTION - COMPONENT LOCATIONS

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LAVATORY SMOKE DETECTION - LAVATORY SMOKE DETECTOR

Purpose

The lavatory smoke detector monitors the lavatories for smoke and gives warnings if there is smoke.

Physical Description

The smoke detector has these parts:

- Electrical connector
- Mounting bracket
- Smoke sensor

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

- Filter
- Alarm LED (red)
- Power-on LED (green)
- Interrupt switch

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

- Status LED (red or solid green)
- Cancel switch

ARO ALL

- Test switch
- Alarm horn.

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

Operation

The power-on LED comes on when the smoke detector gets power. The alarm LED and horn come on when the detector finds smoke. Push the interrupt switch to make the horn stop. The alarm LED stays on until the smoke is gone.

Use the test switch to do a test of the smoke detector. The horn and alarm LED (red) must come on.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

Operation

The Status LED (solid green) comes on when the smoke detector gets power. The Status LED (red) and horn come on when the detector finds smoke. Push the Cancel switch to make the horn stop. The Status LED (red) stays on until the smoke is gone.

Use the test switch to do a test of the smoke detector. The horn and Status LED (red) must come on.

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

Training Information Point

The smoke sensor is an LRU. There is a filter inside the smoke sensor. It is necessary to clean the filter periodically. You can remove the smoke sensor without removing the smoke detector. To remove the smoke sensor, use a pocket scale to move the lock release lever. This will permit the sensor to move out of the smoke detector assembly.

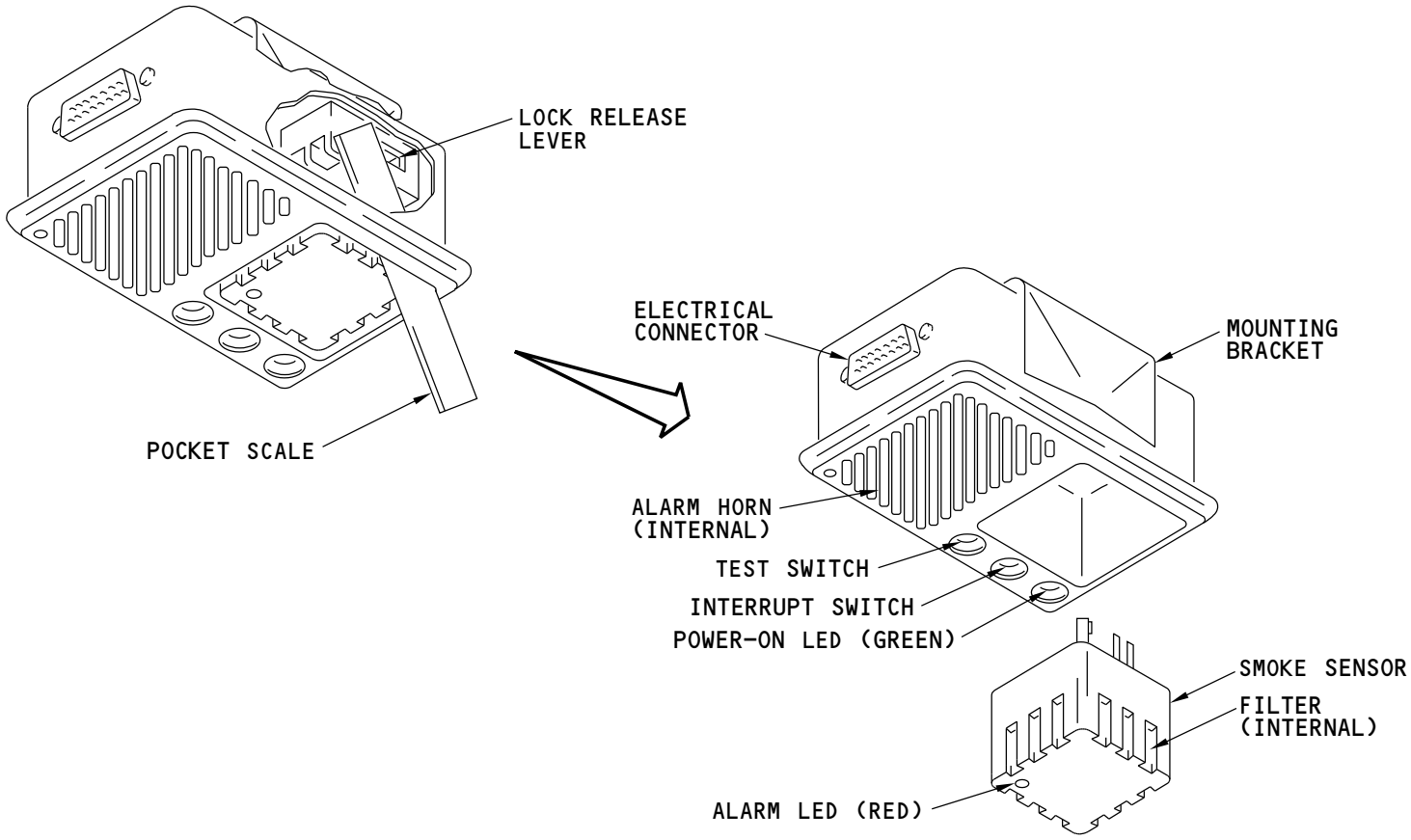
CAUTION DO NOT TOUCH THE ELECTRODE INSIDE OF THE SENSOR.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

Training Information Point

There is a labyrinth assembly inside the smoke sensor. It is necessary to clean the labyrinth assembly periodically.

ARO ALL



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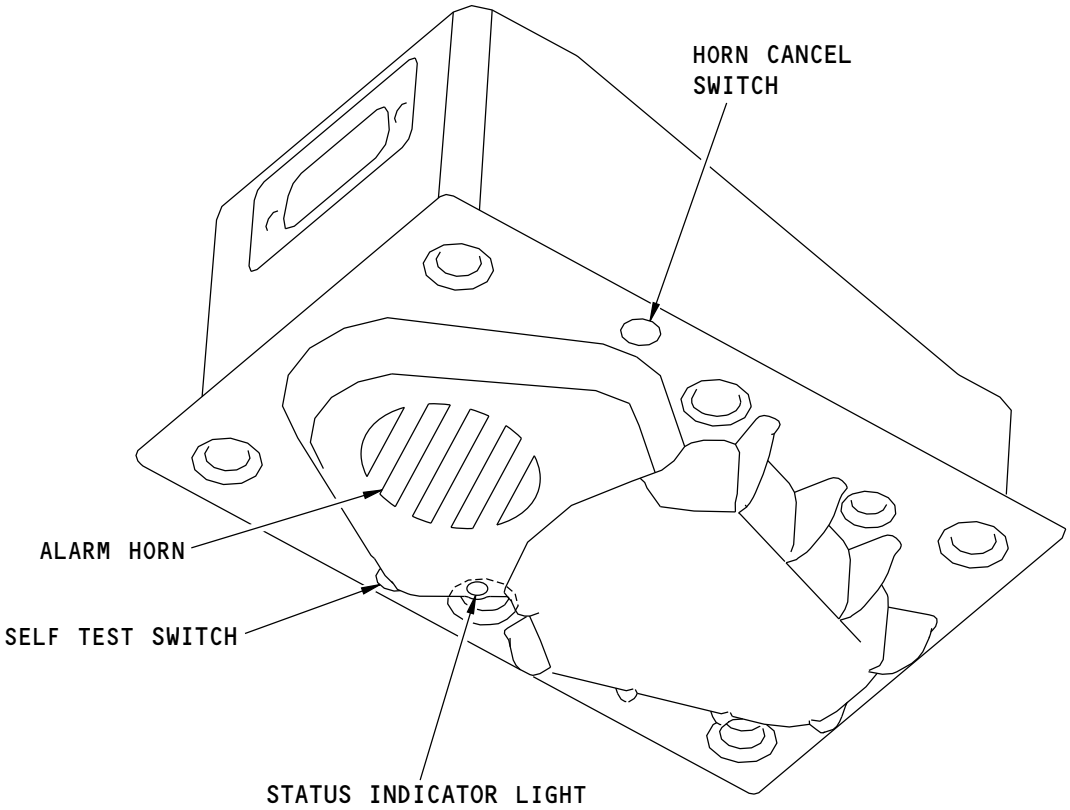
LAVATORY SMOKE DETECTION - LAVATORY SMOKE DETECTOR



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LAVATORY SMOKE DETECTION - LAVATORY SMOKE DETECTOR

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LAVATORY SMOKE DETECTION - FUNCTIONAL DESCRIPTION

General

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

The left or right main buses supply 28v dc electrical power for the lavatory smoke detectors. Power LED (green) shows that the smoke detector has power.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

The left or right main buses supply 28v dc electrical power for the lavatory smoke detectors. Status LED (solid green) shows that the smoke detector has power.

ARO ALL

Smoke Detection

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

If there is smoke in the sensing chamber, the Alarm LED (red) comes on. The timing circuit makes an intermittent ground. The warning horn and lavatory call light operate intermittently.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

If there is smoke in the sensing chamber, the Status LED (red) comes on. The timing circuit makes an intermittent ground. The warning horn and lavatory call light operate intermittently.

ARO ALL

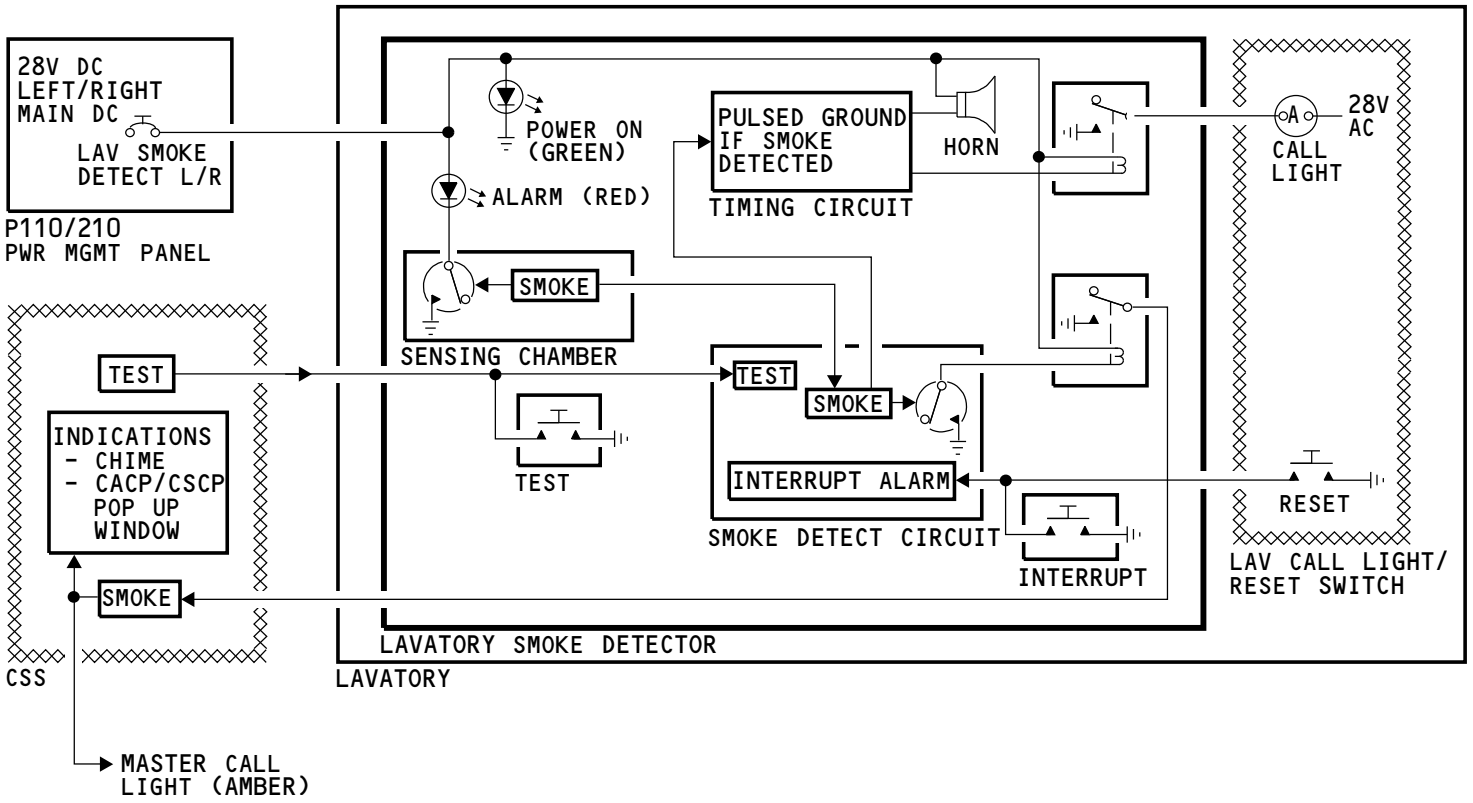
The smoke detection circuit makes a ground for the relay. The energized relay makes a ground signal for the overhead electronics unit (OEU) (not shown) in CSS. This interface gives these indications:

- Lavatory Master call light flashes
- CSCP/CACP pop-up window shows
- Lavatory call chime operates.

Push the lavatory call reset switch or the smoke detector interrupt switch to cancel the smoke indications. If there is still smoke in the lavatory, the alarm LED (red) stays on. All smoke indications go away automatically when the smoke is gone.

Training Information Point

You can do a test of all the lavatory smoke detectors from the cabin system control panel. Use the cabin tests menu ALL TEST. The OEU makes a ground for the test circuit in the smoke detectors.



M40747 S000617108_V1

LAVATORY SMOKE DETECTION - FUNCTIONAL DESCRIPTION

LAVATORY SMOKE DETECTION - OPERATION - INDICATIONS

Smoke Indications

If there is smoke in a lavatory, these are the indications:

- Lavatory call light flashes
- Master call light for the lavatory comes on
- Lavatory call chime sounds
- Lavatory smoke pop-up window shows at the CSCP and CACPs
- Smoke detector horn operates

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

- Smoke detector Alarm LED (red) comes on.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

- Smoke detector Status LED (red) comes on.

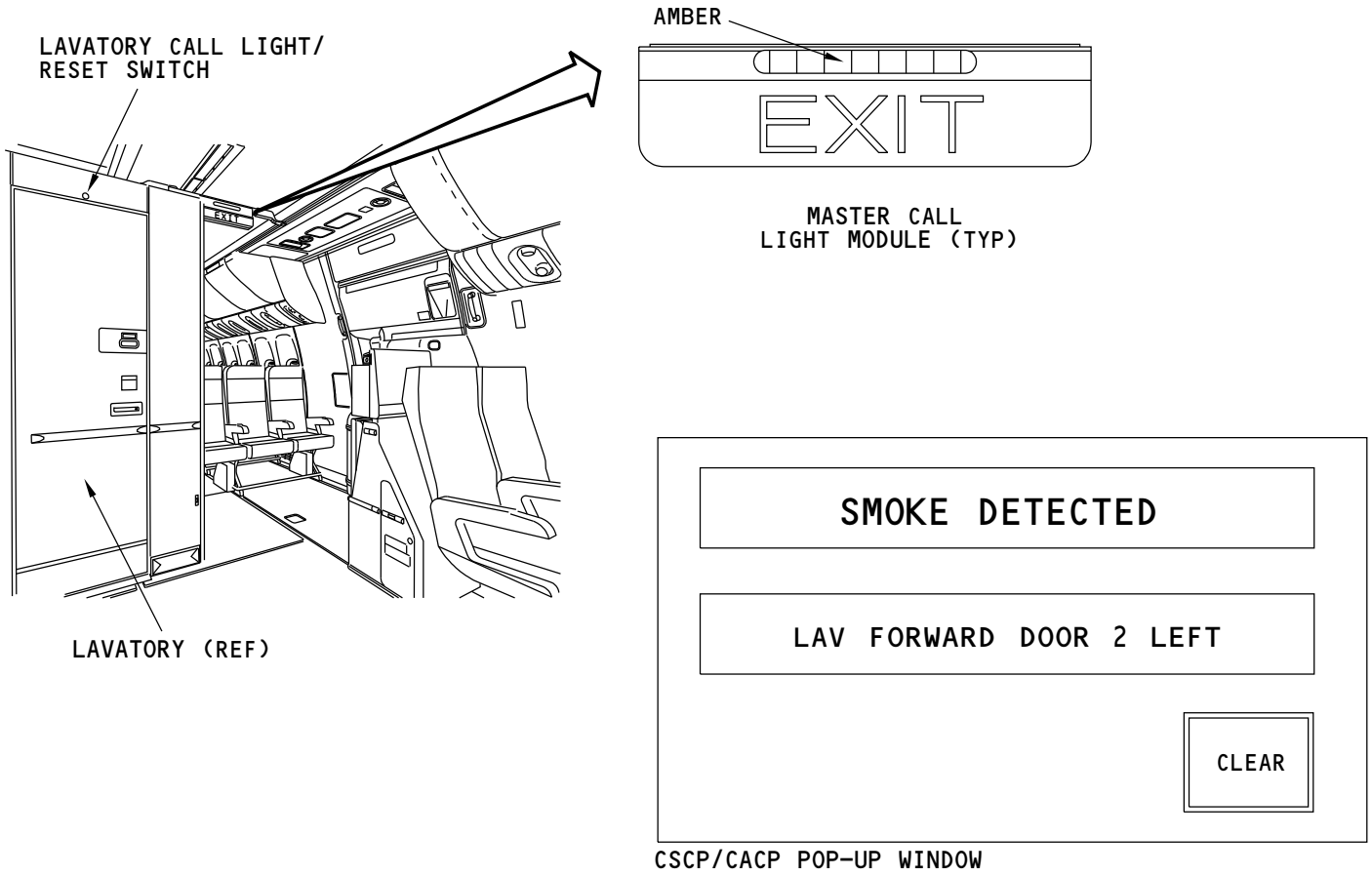
ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

Push the lavatory call light/reset switch or the smoke detector Alarm Interrupt switch to make the indications stop. All indications except the smoke detector Alarm LED should go away. The alarm LED goes out when the smoke is gone.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

Push the lavatory call light/reset switch or the smoke detector Horn Cancel switch to make the indications stop. All indications except the smoke detector Status LED (red) should go away. The Status LED (red) turns to solid green when the smoke is gone.

ARO ALL



M40749 S000617110_V1

LAVATORY SMOKE DETECTION - OPERATION - INDICATIONS

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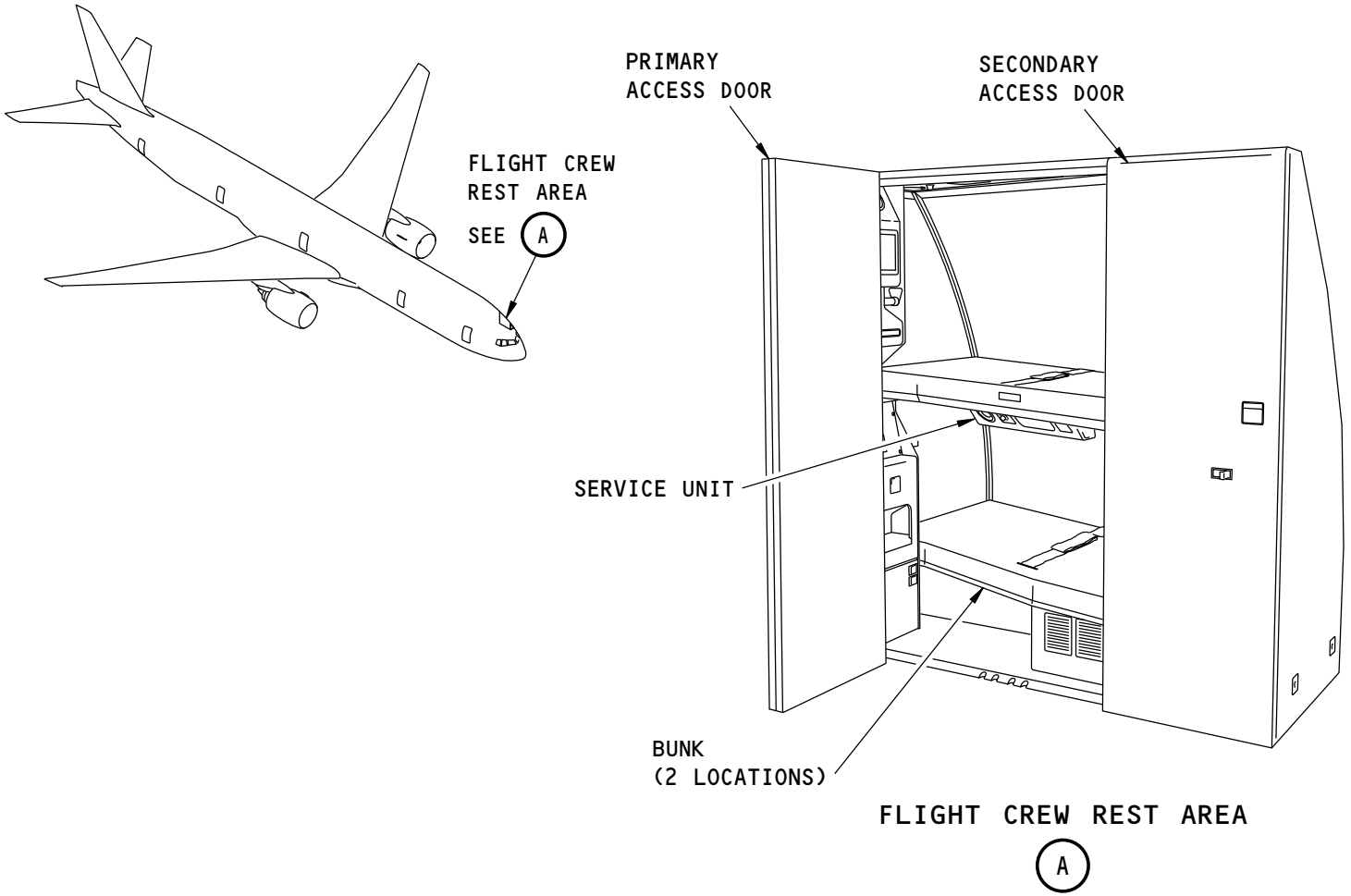
MISCELLANEOUS MODULE SMOKE DETECTION - INTRODUCTION

Purpose

The main deck flight crew rest (MDFCR) smoke detection system monitors the flight crew rest area for smoke.



2323157 S0000527155_V1

MISCELLANEOUS MODULE SMOKE DETECTION - INTRODUCTION

MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - GENERAL DESCRIPTION

General

The smoke detection system gives indications to the flight crew and cabin attendants if there is smoke in the crew rest area. There is one smoke detector for each bunk and one for the common area.

Indications

CSS gives these smoke indications to the cabin attendants:

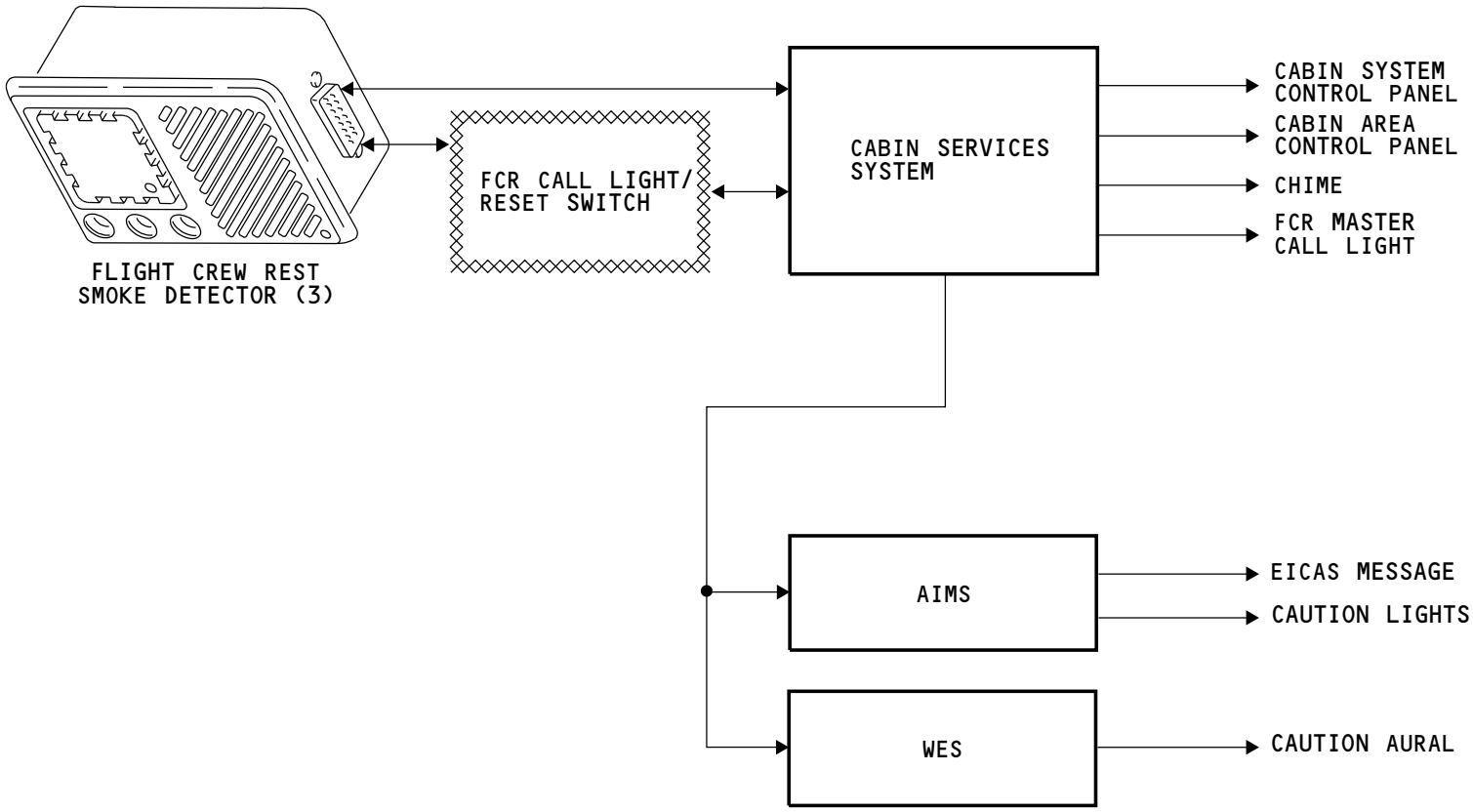
- CSCP/CACP crew rest smoke message shows
- Master call light
- Chime.

The AIMS causes an EICAS caution message and the caution lights to show in the flight deck. The warning electronic system (WES) causes the caution aural to sound.

The flight crew rest call light flashes and the warning horn in the smoke detector operates.

System Test

The cabin services system ALL TEST does a test of the flight crew rest smoke detection system. Each smoke detector also has a test switch you can use to do a test of the detector.



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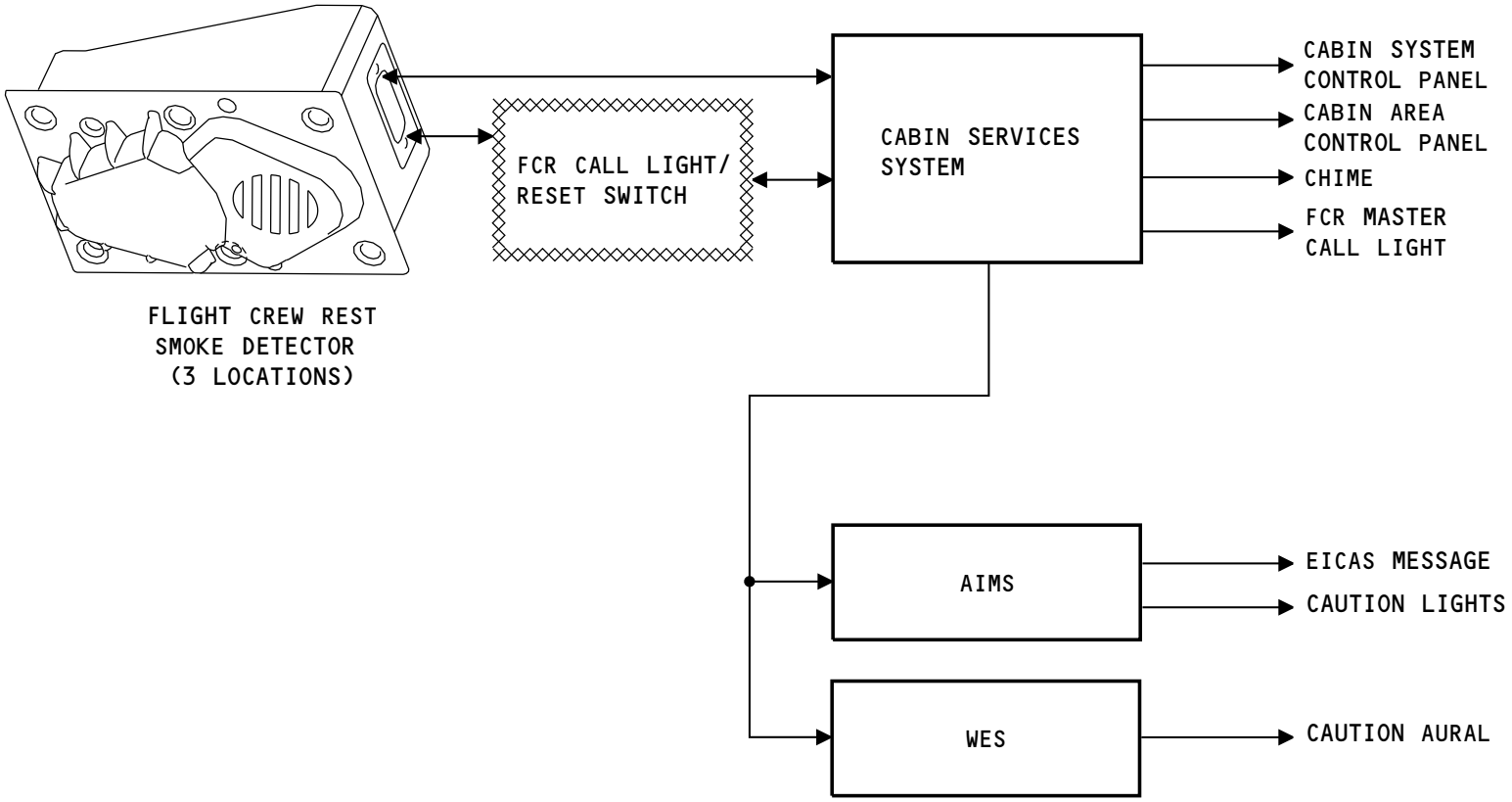
MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - GENERAL DESCRIPTION



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MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - GENERAL DESCRIPTION

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MISCELLANEOUS MODULE SMOKE DETECTION - CREW REST AREA SMOKE DETECTOR

Purpose

The smoke detector monitors the crew rest area for smoke and gives warnings if there is smoke.

Physical Description

The smoke detector has these parts:

- Electrical connector
- Mounting bracket

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

- Smoke sensor
- Filter
- Alarm LED (red)
- Power-on LED (green)
- Interrupt switch

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

- Status LED (red)
- Status-on LED (solid green)
- Horn Cancel switch

ARO ALL

- Test switch
- Alarm horn.

Operation

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

The power-on LED comes on when the smoke detector gets power. The alarm LED and horn come on when the detector senses smoke. Push the interrupt switch to make the horn stop. The alarm LED stays on until the smoke is gone.

Use the test switch to do a test of the smoke detector. The horn and alarm LED (red) come on during the test.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

The status-on LED (solid green) comes on when the smoke detector gets power. The status LED (red) and horn come on when the detector senses smoke. Push the horn cancel switch to make the horn stop. The status LED (red) stays on until the smoke is gone.

Use the test switch to do a test of the smoke detector. The horn and status LED (red) come on during the test.

ARO ALL

Training Information Point

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

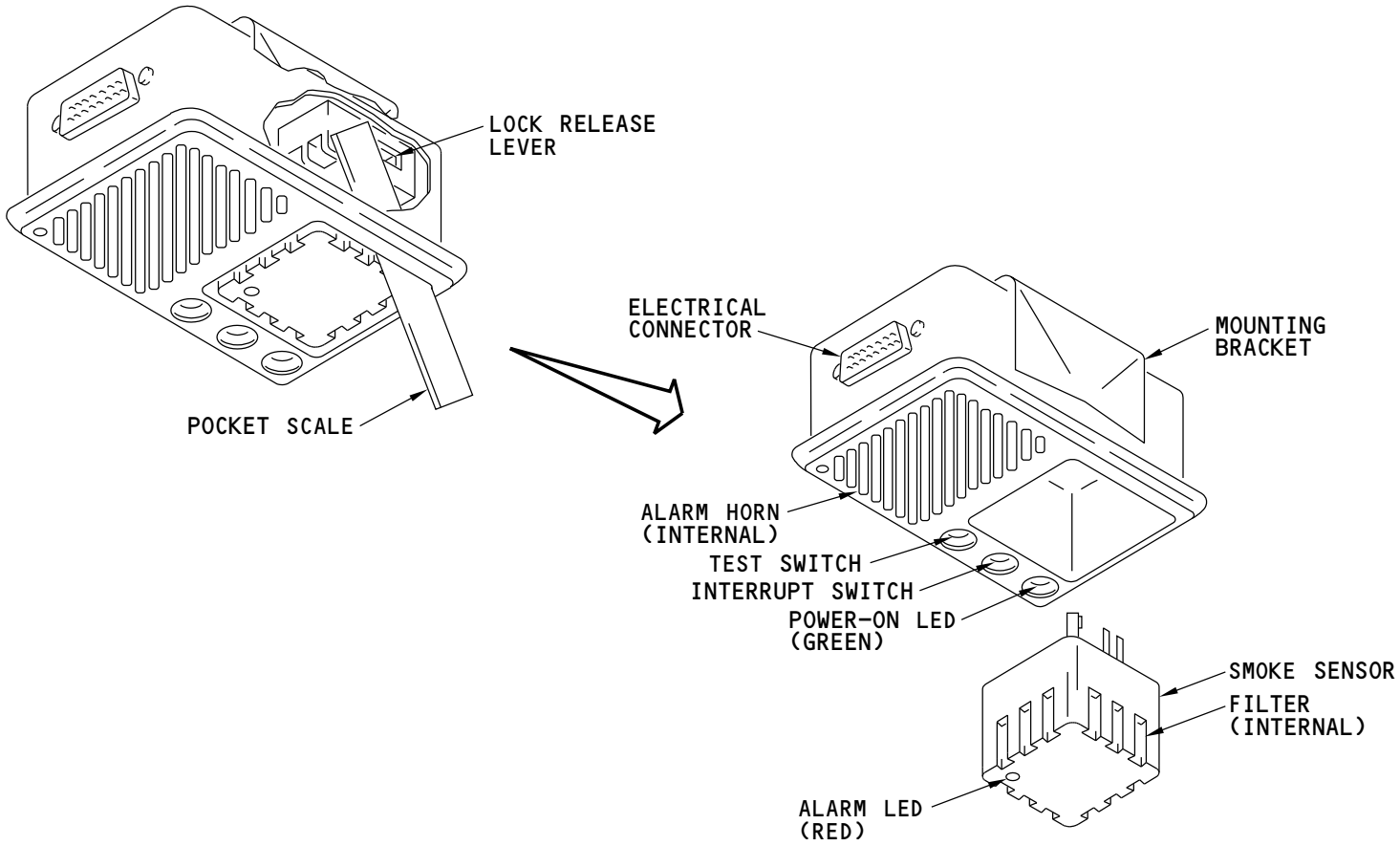
The smoke sensor is an LRU. There is a filter inside the smoke sensor. It is necessary to clean the filter. It is not necessary to remove the smoke detector to remove the smoke sensor. To remove the smoke sensor, use a pocket scale to move the lock release lever. This lets the sensor come out of the smoke detector assembly.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

There is a labyrinth assembly inside the smoke detector. It is necessary to clean the labyrinth assembly regularly.

ARO ALL

CAUTION DO NOT TOUCH THE ELECTRODE INSIDE OF THE SENSOR.



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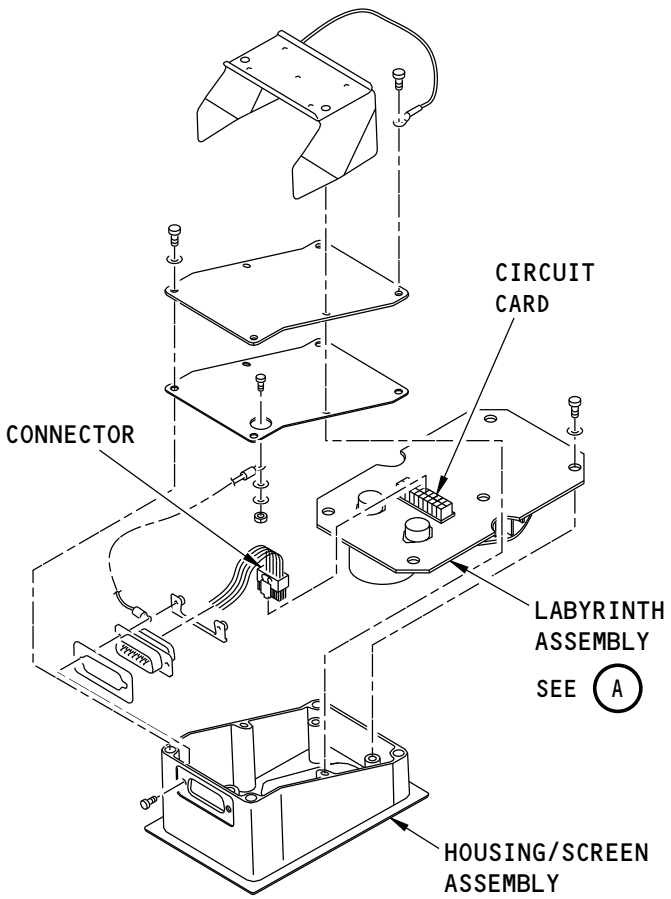
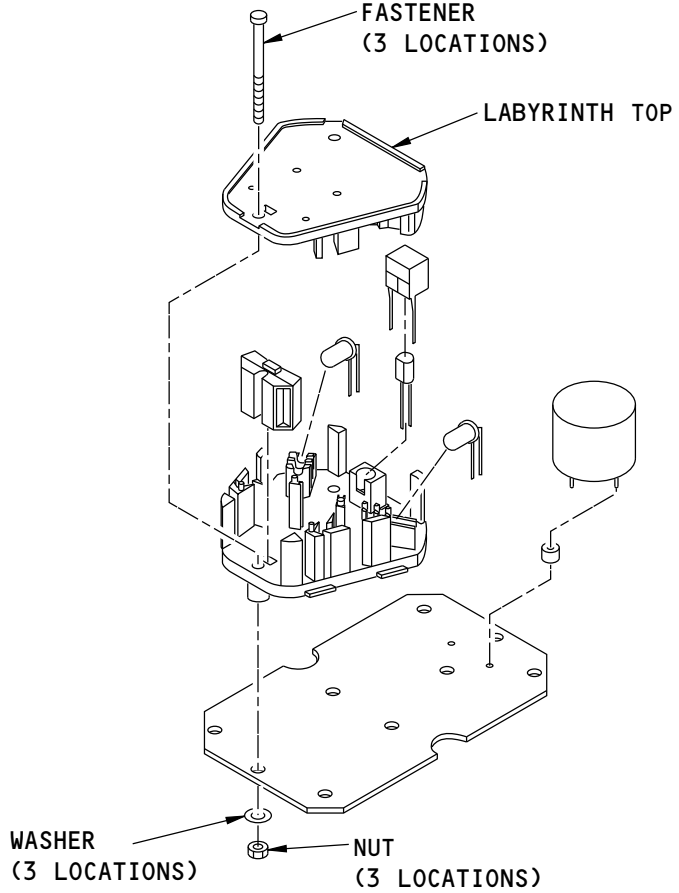
MISCELLANEOUS MODULE SMOKE DETECTION - CREW REST AREA SMOKE DETECTOR



SMOKE DETECTOR



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MISCELLANEOUS MODULE SMOKE DETECTION - CREW REST AREA SMOKE DETECTOR

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MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - FUNCTIONAL DESCRIPTION

General

The left main dc bus supplies 28 volt electrical power to the flight crew rest smoke detectors. The power-on LED (green) shows that the smoke detector has power.

Smoke Detection

If there is smoke in the sensing chamber, the alarm LED (red) comes on. The timing circuit makes an intermittent ground and causes the warning horn to operate. The smoke detection circuit makes a ground for the relay. The energized relay makes a ground signal for these items:

- The ELMS electronic unit (EEU)
- The call light select relay
- The call light flasher relay
- The overhead electronics unit (OEU).

The EEU sends data about the alarm condition to the AIMS to cause the SMOKE CREW REST F/D advisory message to show.

The call light select relay and the call light flasher relay cause the flight crew rest call light to flash.

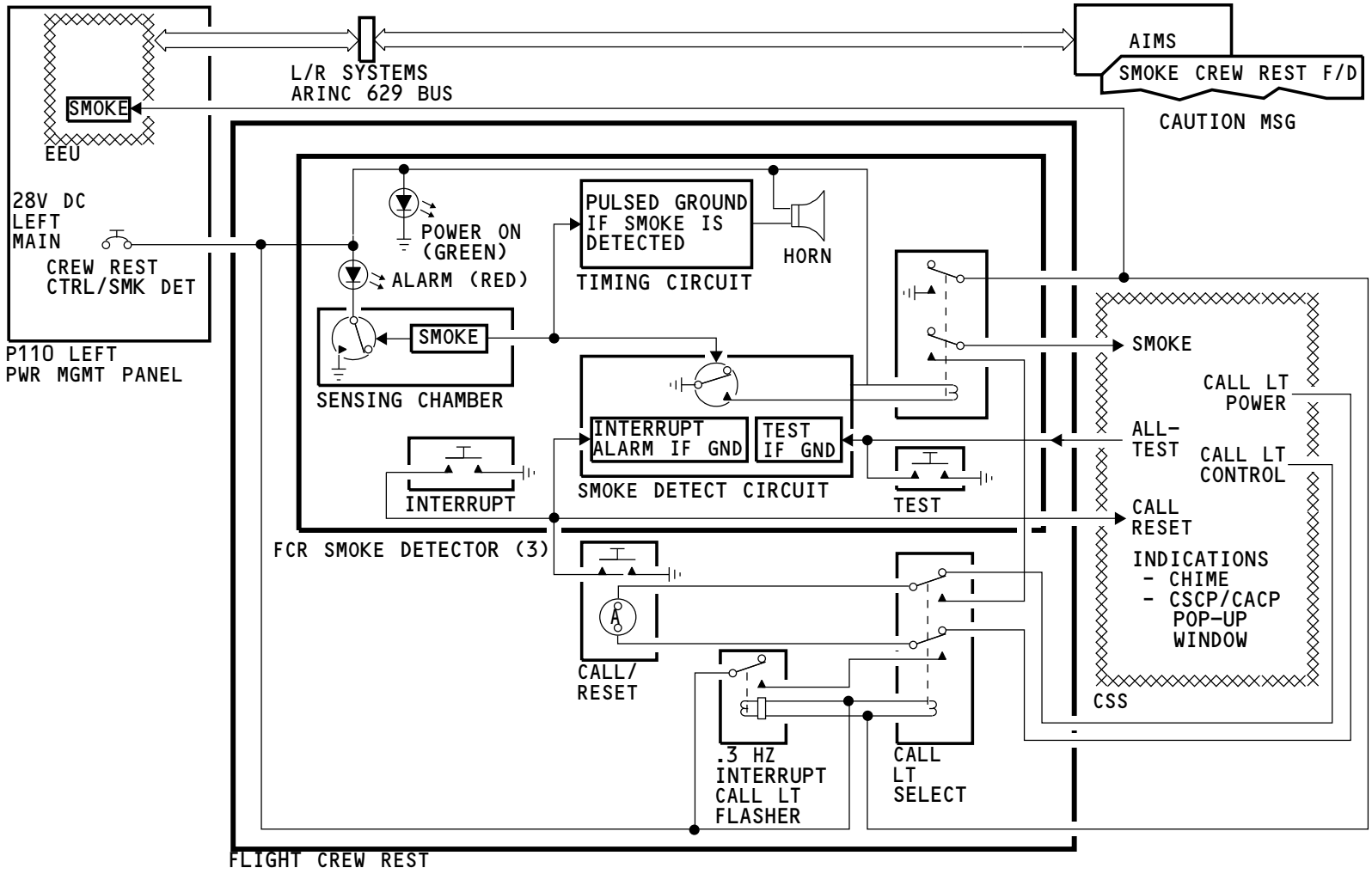
The OEU is the interface with the cabin services system. The CSS gives these indications:

- FCR master call light flashes
- CSCP/CACP pop-up windows show
- FCR call chime operates.

Push the call/reset switch or the smoke detector interrupt switch to cancel the smoke indications. If there is still smoke in the crew rest area, the alarm LED (red) stays on. All smoke indications go away automatically when the smoke is gone.

Training Information Point

You can do a test of the crew rest smoke detectors from the cabin system control panel. Use the cabin tests menu ALL TEST. During the ALL TEST, the OEUs make a ground for the test circuit in the smoke detectors. Test results show on the CSCP.



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MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - FUNCTIONAL DESCRIPTION

MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - INDICATIONS

Smoke Indications

If there is smoke in the flight crew rest area, these are the indications:

- Flight crew rest call light flashes
- Master call light for the crew rest comes on
- Flight crew rest call chime sounds
- Crew rest smoke pop-up window shows at the CSCP and CACPs
- Smoke detector horn operates

ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

- Smoke detector alarm LED comes on.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

- Smoke detector status LED (red) comes on.

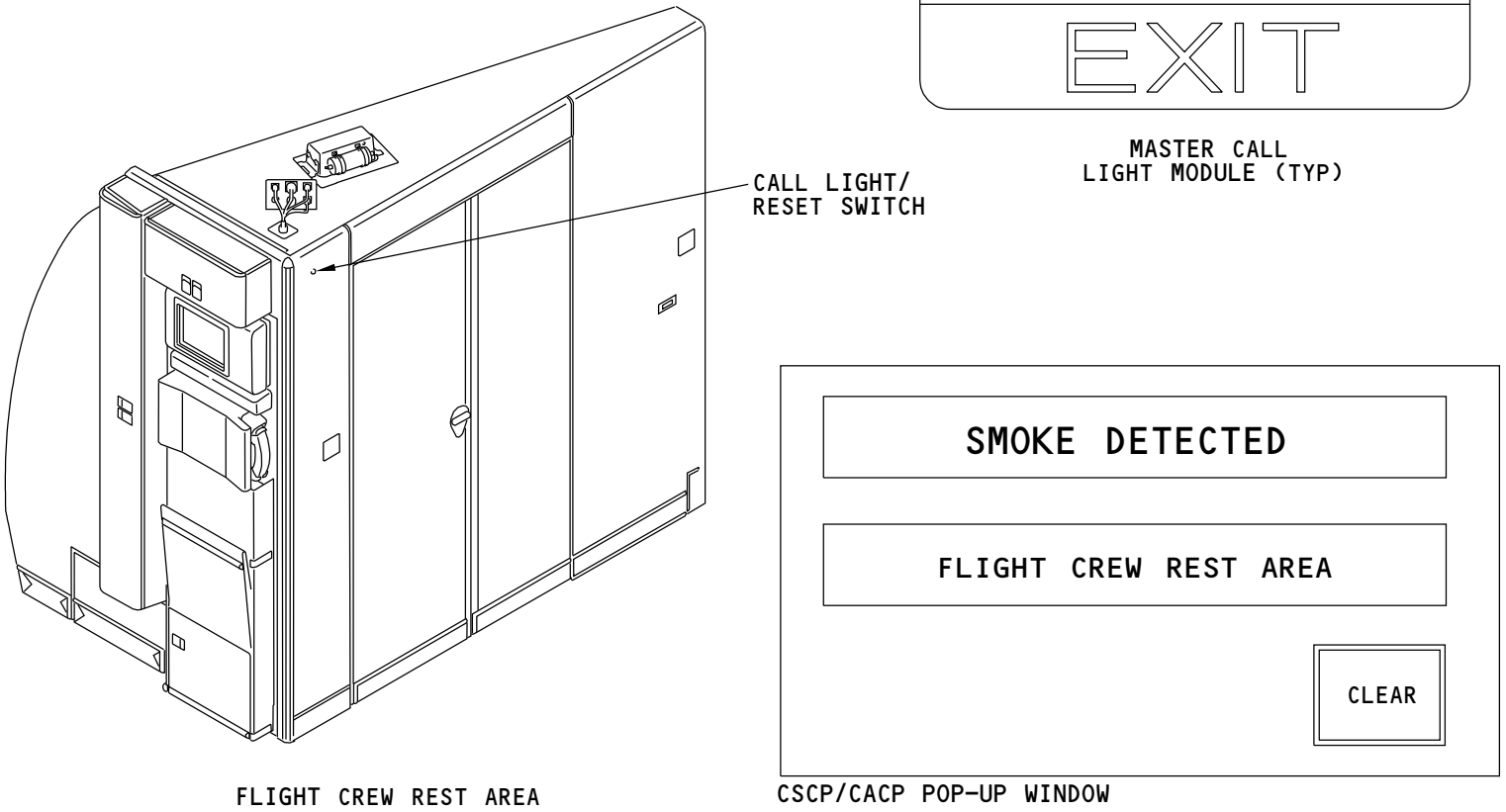
ARO ALL; AIRPLANES WITH JAMCO SMOKE DETECTORS

Push the flight crew rest call light/reset switch or the smoke detector interrupt switch to make the indications stop. All indications except the smoke detector alarm LED should go away. The alarm LED goes out when the smoke is gone.

ARO ALL; AIRPLANES WITH KIDDE SMOKE DETECTORS

Push the flight crew rest call light/reset switch or the smoke detector horn cancel switch to make the indications stop. All indications except the smoke detector status LED (red) should go away. The status LED (red) goes out when the smoke is gone.

ARO ALL



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MISCELLANEOUS MODULE SMOKE DETECTION - FLIGHT CREW REST - INDICATIONS

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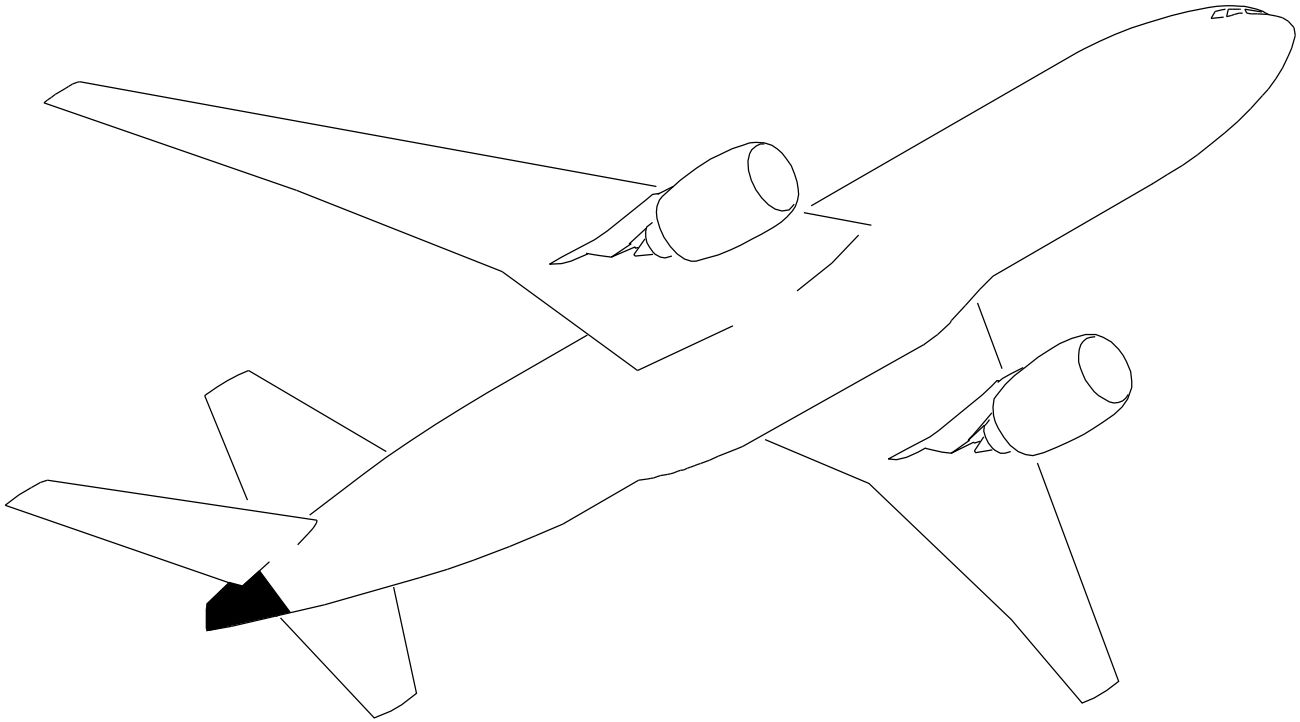
APU FIRE DETECTION - INTRODUCTION

Purpose

The APU fire detection system warns the flight or ground crew of an APU fire. The APU stops automatically if there is a fire.

If a fire occurs on the ground and the engines are not running, the APU fire extinguisher discharges automatically. This permits unattended operation of the APU.



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APU FIRE DETECTION - INTRODUCTION

APU FIRE DETECTION - GENERAL DESCRIPTION

General

The APU fire detection system has these components:

- APU fire detectors
- Fire detection card - APU.

There are two modes of operation: unattended mode and attended mode. A signal from the electrical load management system (ELMS) puts the card in the unattended mode when the airplane is on the ground with the engines not running. When the airplane is in the air, or an engine is running, the system operates in the attended mode.

Built-in-test equipment does tests of the system. Faults cause alert messages, status messages, and maintenance messages. Use the fire/overheat test switch to do a manual test of the system. See the fire protection section for more information about the fire/overheat test (SECTION 26-00).

Fire Detection Loops

The APU has two fire detection loops, loop 1 and loop 2. The APU fire detection card continually monitors the two loops for faults. If there are no faults, the card monitors both loops for fires. This is dual loop operation.

If a loop fails, the card sends the data to the AIMS. Status and maintenance messages show. The system changes to single loop operation and monitors only the loop that has not failed. Fire alarms occur if the loop that has not failed has a fire.

Operation

If there is an APU fire, the detection card sends an alarm signal to these components and systems:

- The electrical load management system (ELMS)
- The APU controller
- The AIMS
- The warning electronics system (WES).

The ELMS and the APU controller stop the APU. The AIMS causes a warning message. The WES turns on the master warning lights and the fire warning aural.

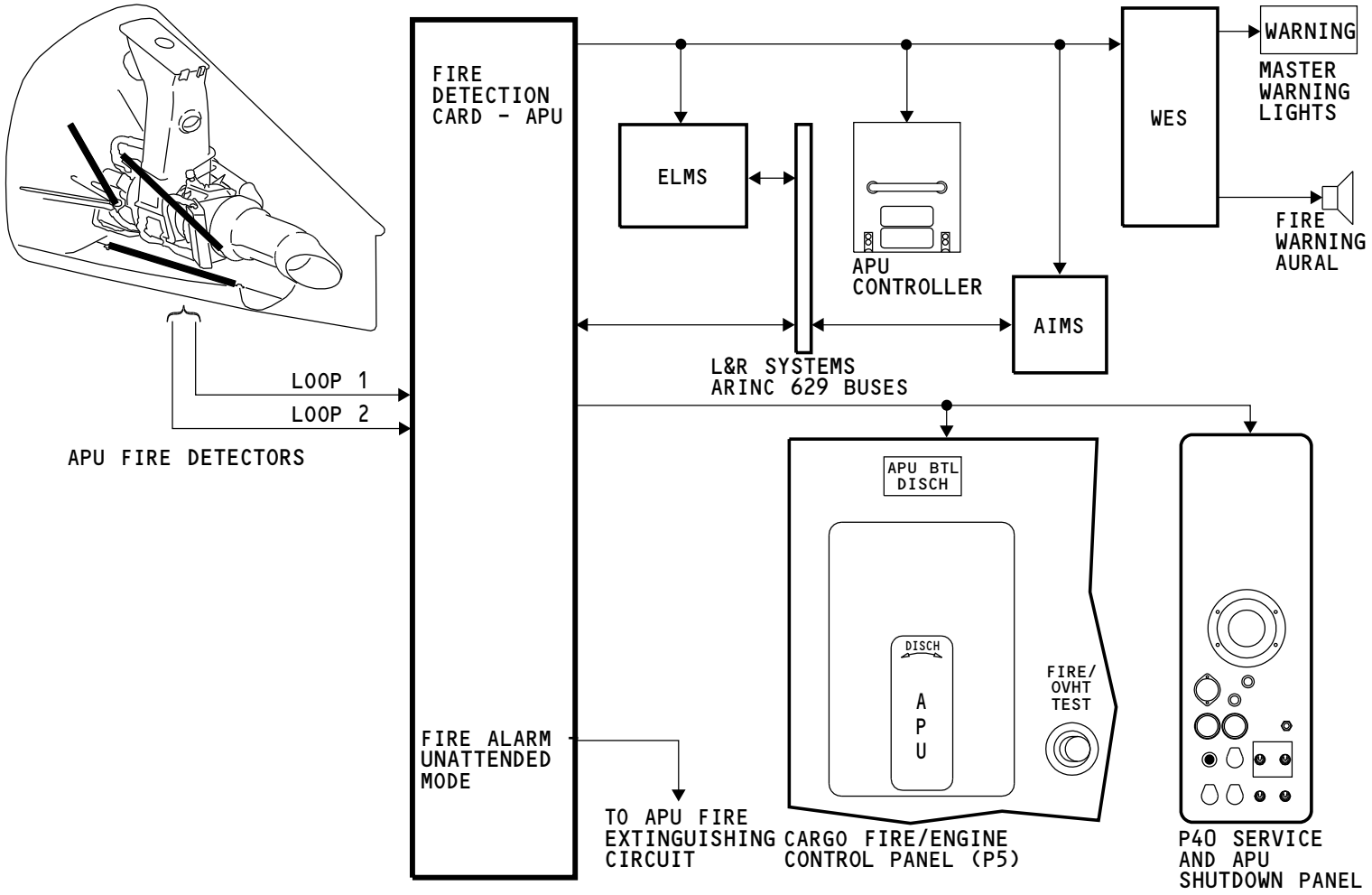
A second fire alarm signal turns on the APU fire warning light in the fire switch. If the airplane is on the ground, a warning horn and a light come on at the P40 service and APU shutdown panel.

Attended Mode

Normal operation in the attended mode is dual loop with AND logic. Loop 1 AND loop 2 both must have a fire to cause fire alarms. AND logic helps prevent false alarms. A crew member decides whether or not to use the fire extinguishing system.

Unattended Mode

Normal operation in the unattended mode is dual loop with OR logic. Loop 1 OR loop 2 must have a fire to cause fire alarms. OR logic gives maximum safety for unattended operation. The fire extinguishing system operates automatically.



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APU FIRE DETECTION - GENERAL DESCRIPTION

APU FIRE DETECTION - FLIGHT DECK AND MEC COMPONENT LOCATIONS

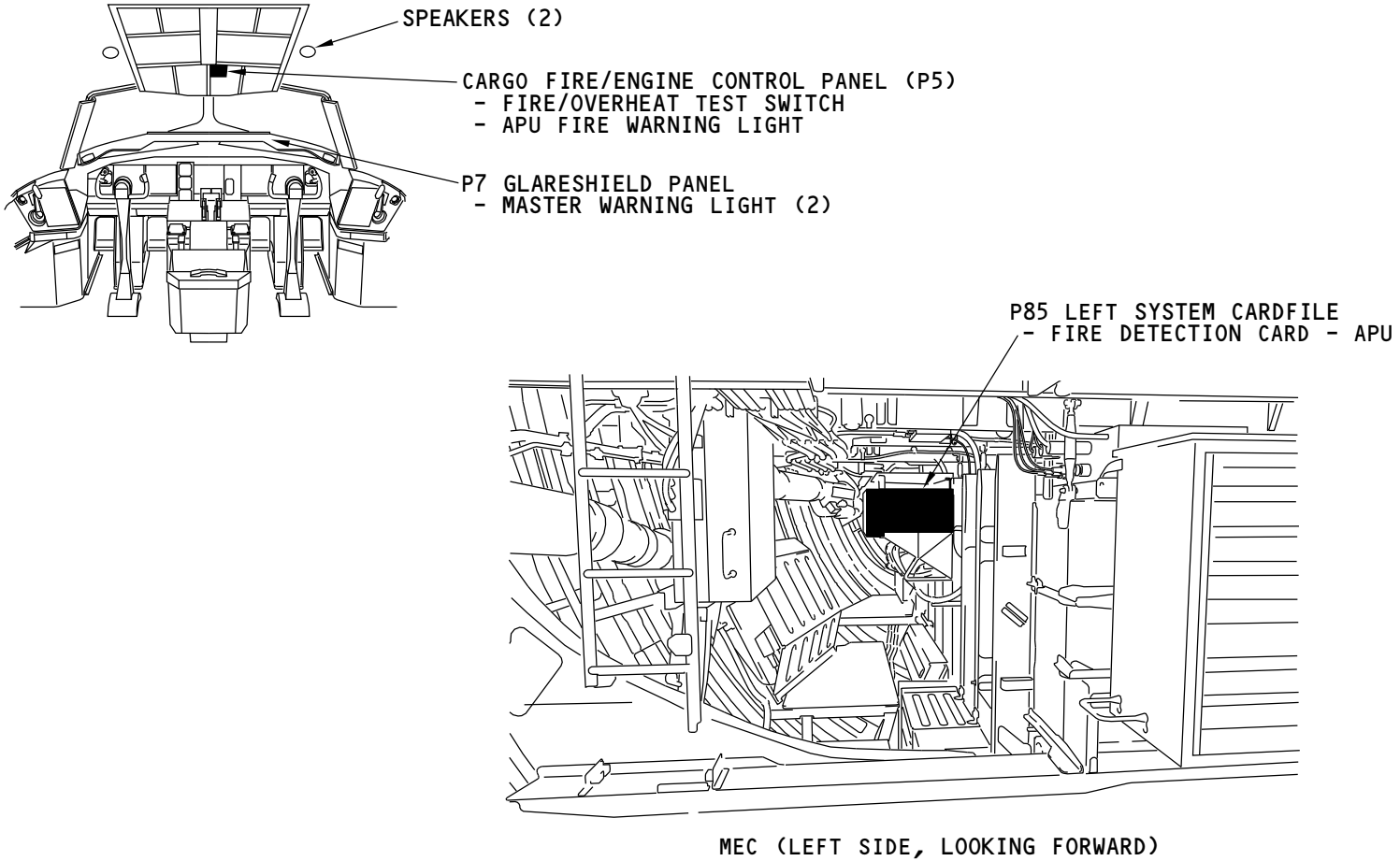
Flight Deck Component Locations

The components in the flight deck that have an interface with the APU fire detection system are:

- Speakers
- Fire/overheat test switch
- Master warning lights
- APU fire warning light.

MEC Component Locations

The APU fire detection card is in the MEC.



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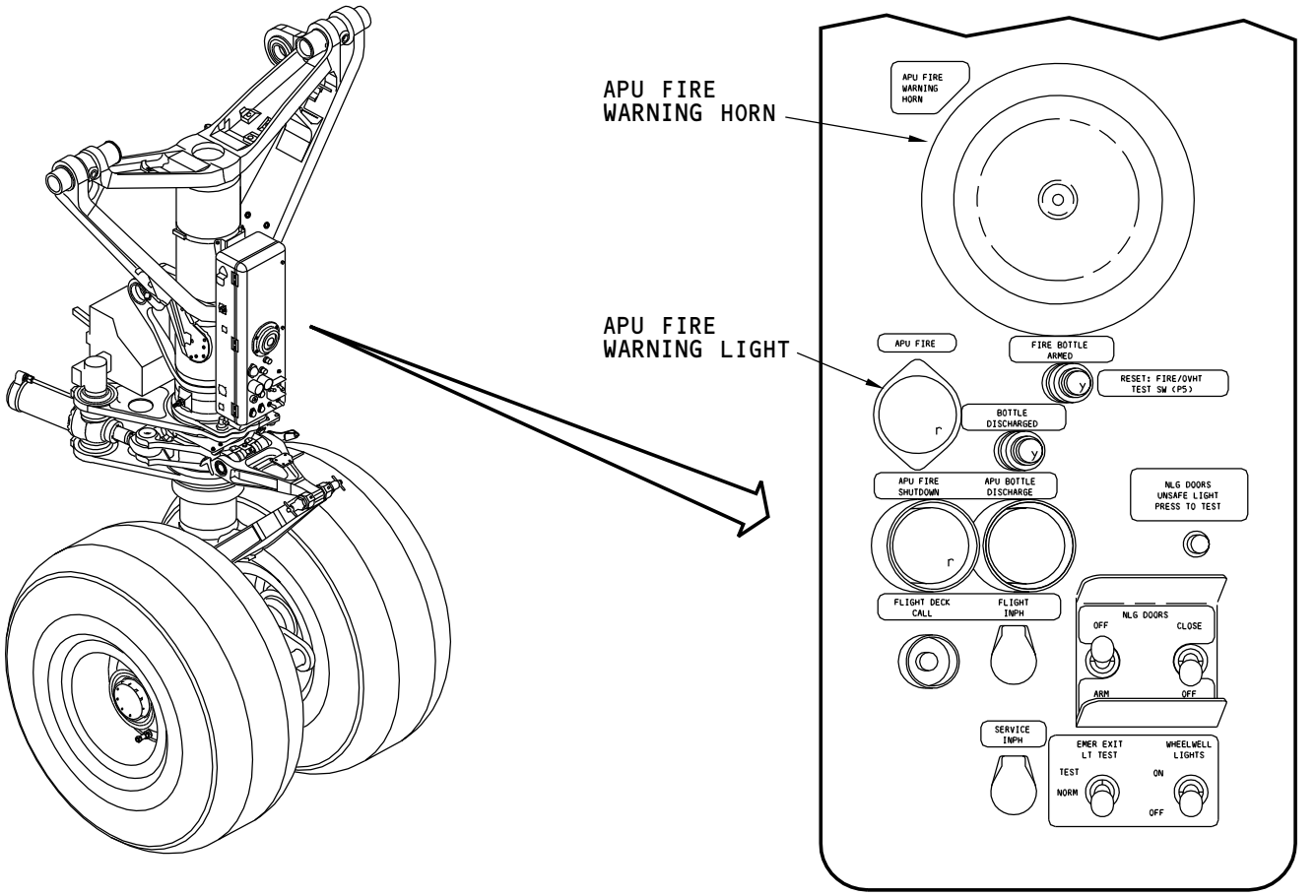
APU FIRE DETECTION - FLIGHT DECK AND MEC COMPONENT LOCATIONS

APU FIRE DETECTION - NOSE LANDING GEAR COMPONENT LOCATIONS

Nose Landing Gear Component Location

The P40 service and APU shutdown panel is on the nose landing gear. The panel has an APU fire warning horn and an APU fire warning light.



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APU FIRE DETECTION - NOSE LANDING GEAR COMPONENT LOCATIONS

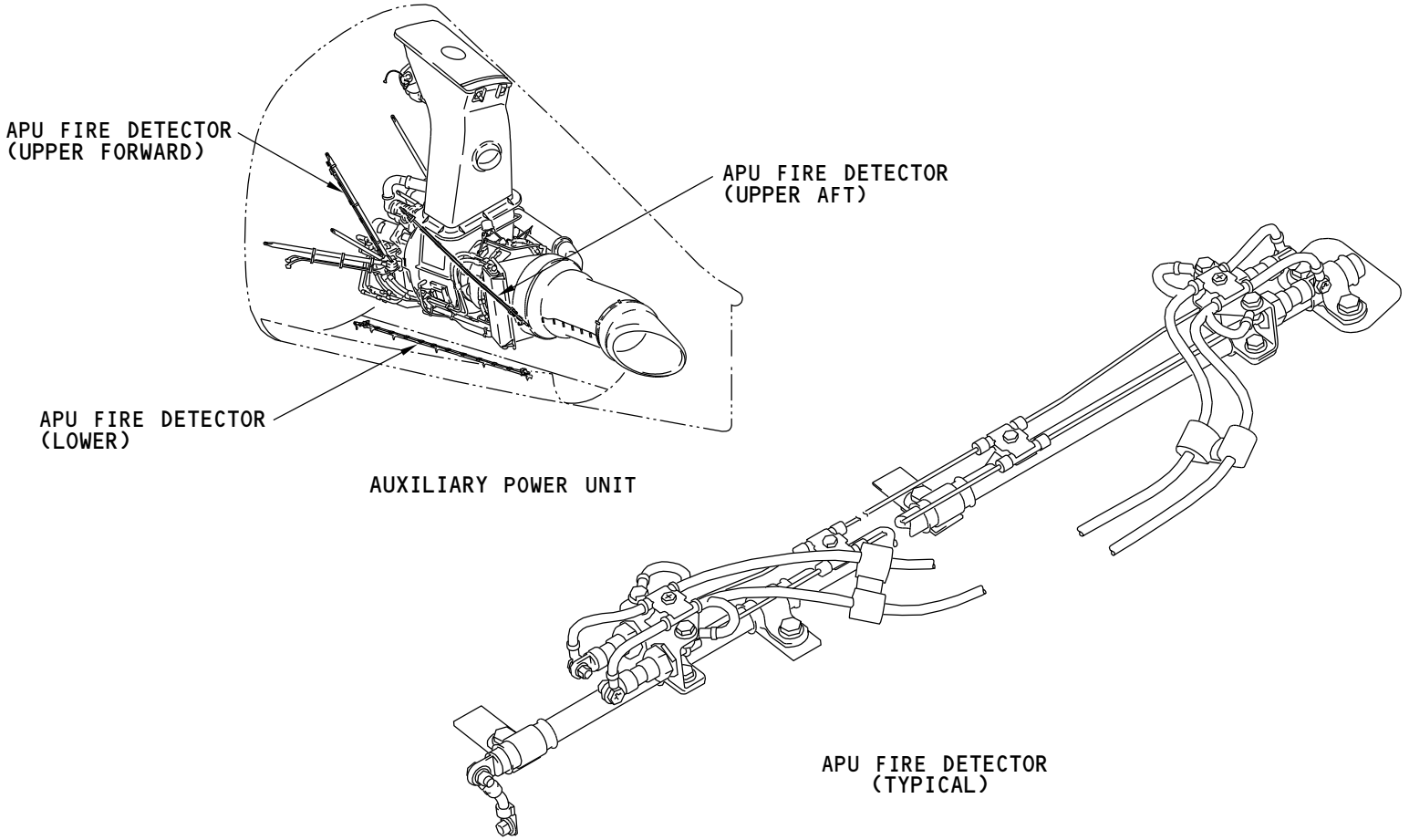
APU FIRE DETECTION - APU COMPONENT LOCATIONS

Component Locations

These are the APU fire detection system components in the APU compartment:

- APU fire detector - upper forward
- APU fire detector - upper aft
- APU fire detector - lower.

The upper forward detector is on the forward support and vibration isolation mount. The upper aft detector is on the left side of the APU compartment. The lower detector is on the left APU access door.



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APU FIRE DETECTION - APU COMPONENT LOCATIONS

APU FIRE DETECTION - APU FIRE DETECTORS

Purpose

The APU fire detectors monitor the temperature in the APU compartment.

Physical Description

Each detector has two elements attached to a support tube. The elements connect to make loop 1 and loop 2.

The element is an inconel tube filled with a thermistor core material. Two electrical conductors go through the length of the core. One conductor has a ground connection to the tube. The other conductor connects to the APU fire detection card.

Functional Description

As the temperature of the core increases, electrical resistance to ground decreases. If the resistance decreases to the set point, a fire alarm occurs. When the fire is gone, the resistance increases to the reset point and the alarm signal goes away.

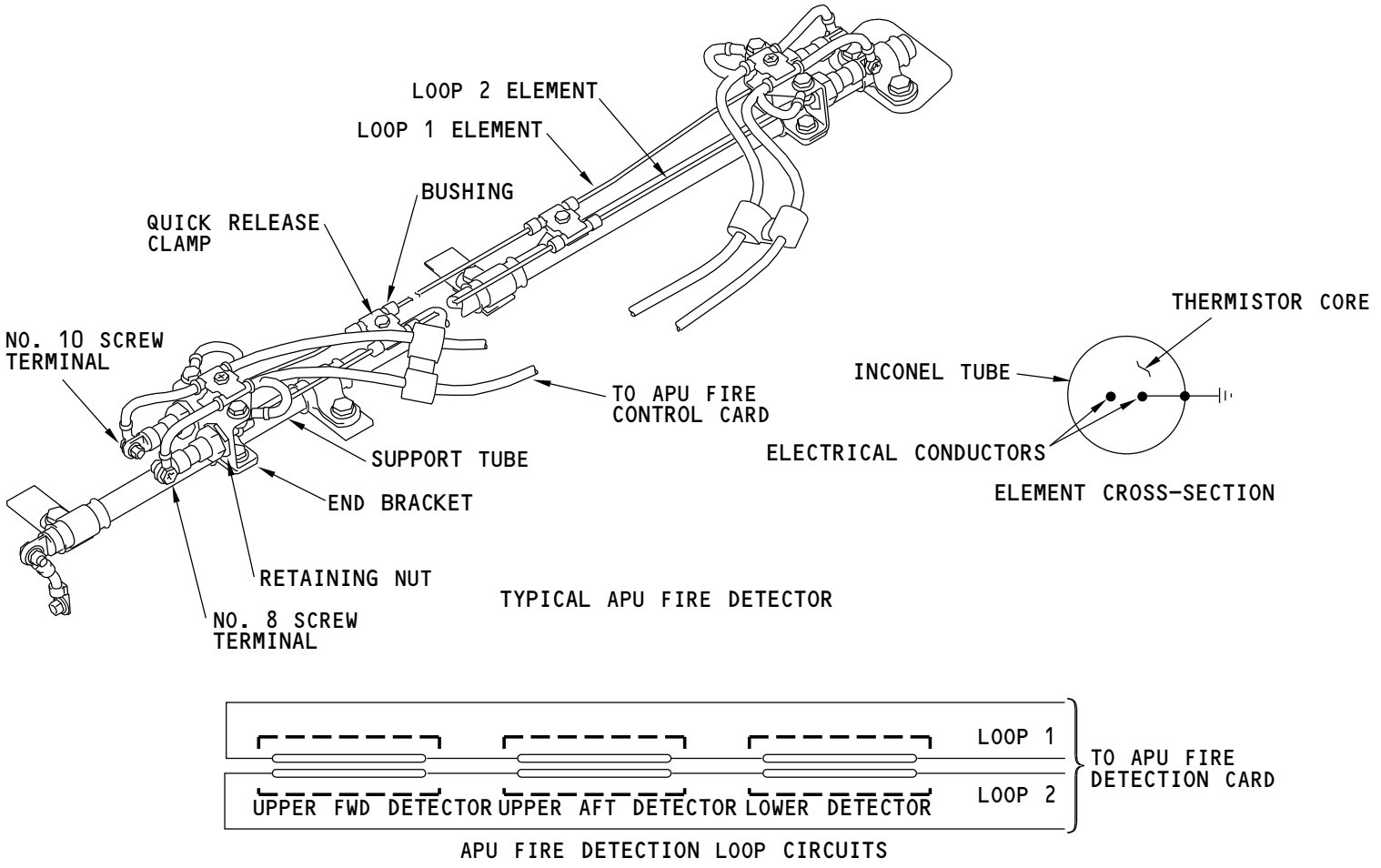
The tables show approximate temperatures in degrees F (and degrees C) which cause a fire alarm. Reset temperatures are also shown.

DETECTOR	FIRE TEMP	RESET TEMP
UPPER FWD	479 (248)	468 (242)
UPPER AFT	511 (266)	499 (259)
LOWER	488 (253)	478 (248)

Training Information Point

Each element uses a #10 screw wire-termination on one end and a # 8 screw wire-termination on the other end to prevent crossed wiring. The #10 terminal and the mating wire terminal have a black stripe around the insulation.

The ends of the element attach to the support tube bracket with retaining nuts. Quick-release clamps and bushings support the element along its length.



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APU FIRE DETECTION - APU FIRE DETECTORS

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APU FIRE DETECTION - FIRE DETECTION CARD - APU

Purpose

The APU fire detection card has these purposes:

- Operate in attended or unattended mode
- Monitor the detectors for a fire condition
- Monitor the detectors for failures and send the data to AIMS
- Set the correct logic for the loops (and/or logic)
- Do tests of the APU fire detection system.

Location

The APU fire detection card is in the P85 system card file in the A9 slot. The cardfile slots have labels.

Fire Detection Circuits

The fire detection circuit monitors the resistance of the detector element thermistor core. The resistance of the core is normally high. If the resistance goes low, the card supplies a FIRE output.

A short circuit in the loop also cause low resistance. The rate at which the resistance changes identifies an electrical short or a fire. A short circuit causes the resistance to decreases quickly. A fire causes the resistance to decrease more slowly.

If the resistance decreases quickly, the circuit supplies a SHORT output for the life of the short circuit. If the short circuit stays for more than 0.2 seconds, the circuit supplies a DESELECT output. A deselect output also occurs if a power-up BIT finds an open circuit in the loop.

Program Logic Device

The program logic device gives attended or unattended mode of operation. A signal from the ARINC 429 receiver puts the device in the correct mode.

The device sets the correct logic for the fire detection circuits. Dual-loop operation is normal. If a detection circuit sends a short, deselect, or power loss signal, the logic device changes to single-loop operation.

The program logic device supplies the fire alarm signals to the other circuits which have interfaces with the card.

Attended Mode Operation

The program logic device operates with AND logic. Loop 1 and loop 2 both must have a fire to cause the alarms. The table shows alarm and fault conditions:

ATTENDED MODE - AND LOGIC		
LOOP 1	**LOOP 2**	**CARD OUTPUT**
NORMAL	NORMAL	-
FIRE	NORMAL	FAULT (SEE TEXT)
FIRE	FIRE	ALARM
NORMAL	FIRE	FAULT (SEE TEXT)
FAULT	NORMAL	FAULT - LOOP 1
NORMAL	FAULT	FAULT - LOOP 2
FIRE	FAULT	ALARM
FAULT	FIRE	ALARM
FAULT	FAULT	FAULT - BOTH LOOPS

If one loop reports a fire and the other loop is normal, a 15 second timer starts. During this time, if the loop status changes from fire to normal, the timer stops. If the status of the normal loop changes to fire, the card sends a fire alarm.

If neither loop changes status in 15 seconds, the card does a test of the normal loop. If the test fails, the card removes the selection of that loop and sends a fire alarm. If the test passes, the card removes the selection of the other loop and reports a fault.

Unattended Mode Operation

The program logic device operates with OR logic. A fire at loop 1 OR loop 2 causes fire alarms. The table shows alarm and fault conditions:

APU FIRE DETECTION - FIRE DETECTION CARD - APU

UNATTENDED MODE - OR LOGIC		
LOOP 1	**LOOP 2**	**CARD OUTPUT**
NORMAL	NORMAL	-
FIRE	NORMAL	ALARM
FIRE	FIRE	ALARM
NORMAL	FIRE	ALARM
FAULT	NORMAL	FAULT - LOOP 1
NORMAL	FAULT	FAULT - LOOP 2
FIRE	FAULT	ALARM
FAULT	FIRE	ALARM
FAULT	FAULT	FAULT - BOTH LOOPS

The unattended fire alarm signal causes the fire extinguishing system to operate automatically.

Built-In-Test Circuit

BIT continuously monitors the fire detection circuits. The ARINC 429 transmitter sends failure data to the AIMS as soon as BIT finds the condition.

BIT also does a test of the full fire detection system:

- At power-up
- After power interrupt
- Every five minutes of operation.

BIT signals a fire on both loops at the same time and does a check of the system. The ARINC 429 transmitter sends a fire alarm signal to AIMS. The central maintenance computing system (CMCS) uses this signal to make sure the fire detection system transmits ARINC data. Fire warnings and APU shutdown do not occur during the tests.

If there is a failure, the ARINC 429 transmitter sends the data to the AIMS.

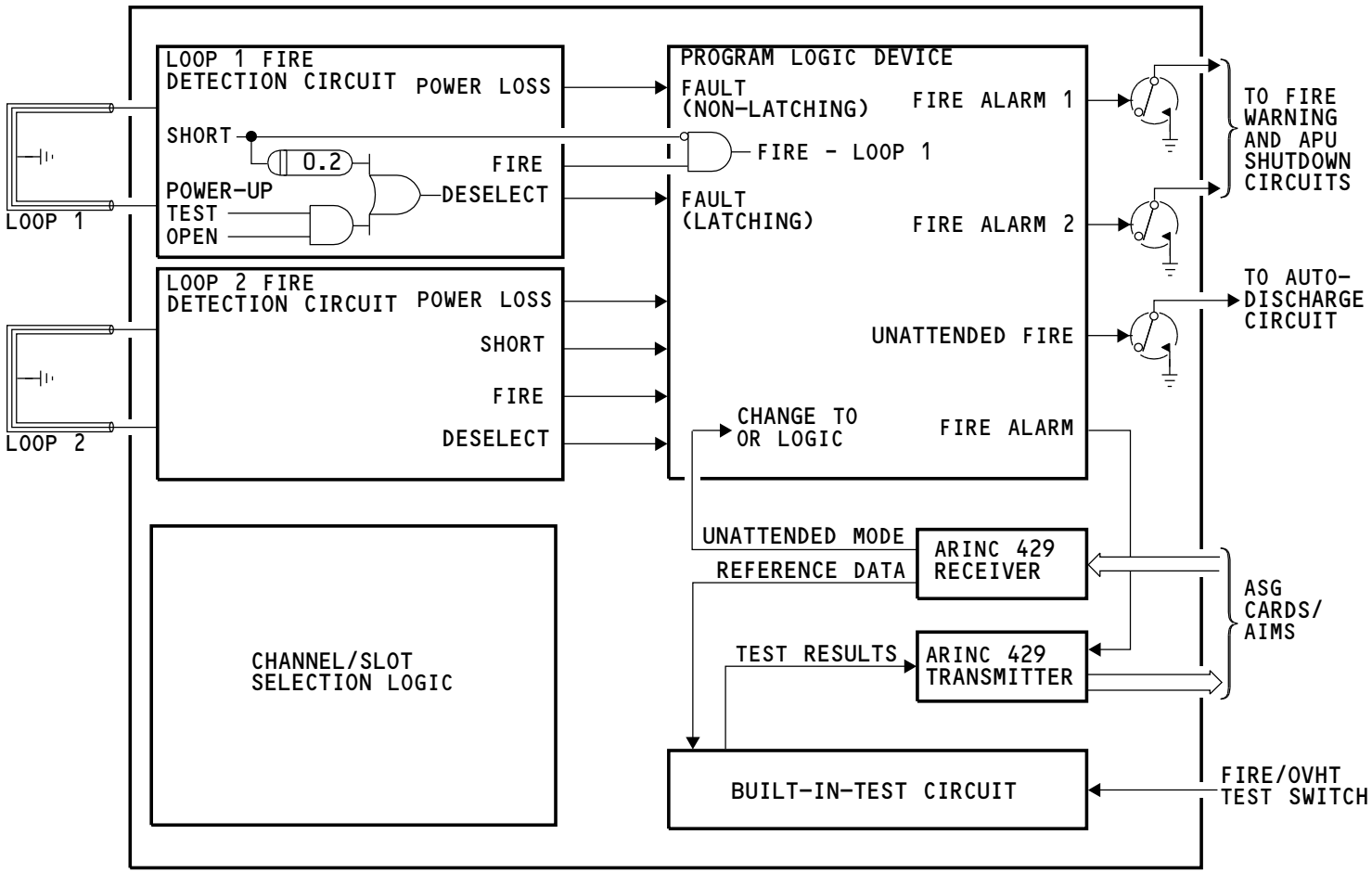
The system changes to single loop operation if necessary.

The fire/overheat test switch starts a similar test. If there is a failure, the ARINC 429 transmitter sends the data to the AIMS. Fire warnings occur during this test.

Training Information Point

The engine and APU fire detection cards function differently but are interchangeable. Program pins in the cardfile have an interface with the channel/slot selection logic circuit. This circuit tells the card whether to function as an APU or engine fire detection card.

The fire detection cards are electrostatic discharge sensitive (ESDS) devices. Be careful to obey the procedures in part II of the maintenance manual (Standard Practices - Airframe, Electrostatic Discharge Sensitive Devices - Maintenance Practices) before you touch the cards.



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APU FIRE DETECTION - FIRE DETECTION CARD - APU

APU FIRE DETECTION - FUNCTIONAL DESCRIPTION - FLIGHT DECK INDICATION CIRCUIT

Attended Mode

If there is an APU fire, the APU fire control card supplies fire alarm 1 and fire alarm 2 outputs. Alarm 1 makes a ground for these:

- The fire switch unlocking solenoid
- The APU fire warning light
- The nose gear electrical service panel circuit.

Alarm 2 supplies a ground signal to these:

- The APU controller
- The ELMS
- The warning electronics system (WES)
- The AIMS.

The APU controller and ELMS shut down the APU. The WES turns on the master warning light and the fire warning aural. The AIMS shows an EICAS warning message.

The indications go away when the fire is out.

Unattended Mode

A signal from the ELMS puts the APU fire control card in the unattended mode when the airplane is on the ground with both engines off. The systems ARINC 629 buses transmit the unattended mode signal from ELMS through AIMS to the APU fire detection card.

The fire detection card supplies fire alarm 1 and fire alarm 2 outputs, the same as in the attended mode.

The fire detection card also supplies an unattended fire signal. This signal causes the APU fire extinguisher to discharge automatically.

BITE

BITE monitors the fire detection card and loops for faults. BITE also does a full system test for these conditions:

- When the system first gets power
- After a power interrupt
- Every five minutes of operation.

BIT data goes to the AIMS through the systems ARINC 629 buses. The primary display system shows advisory or status messages. The MAT shows maintenance messages.

System faults include detector open circuits, detector short circuits, and defective cards. If a fault involves only one loop, a status message shows and the fire detection system still operates.

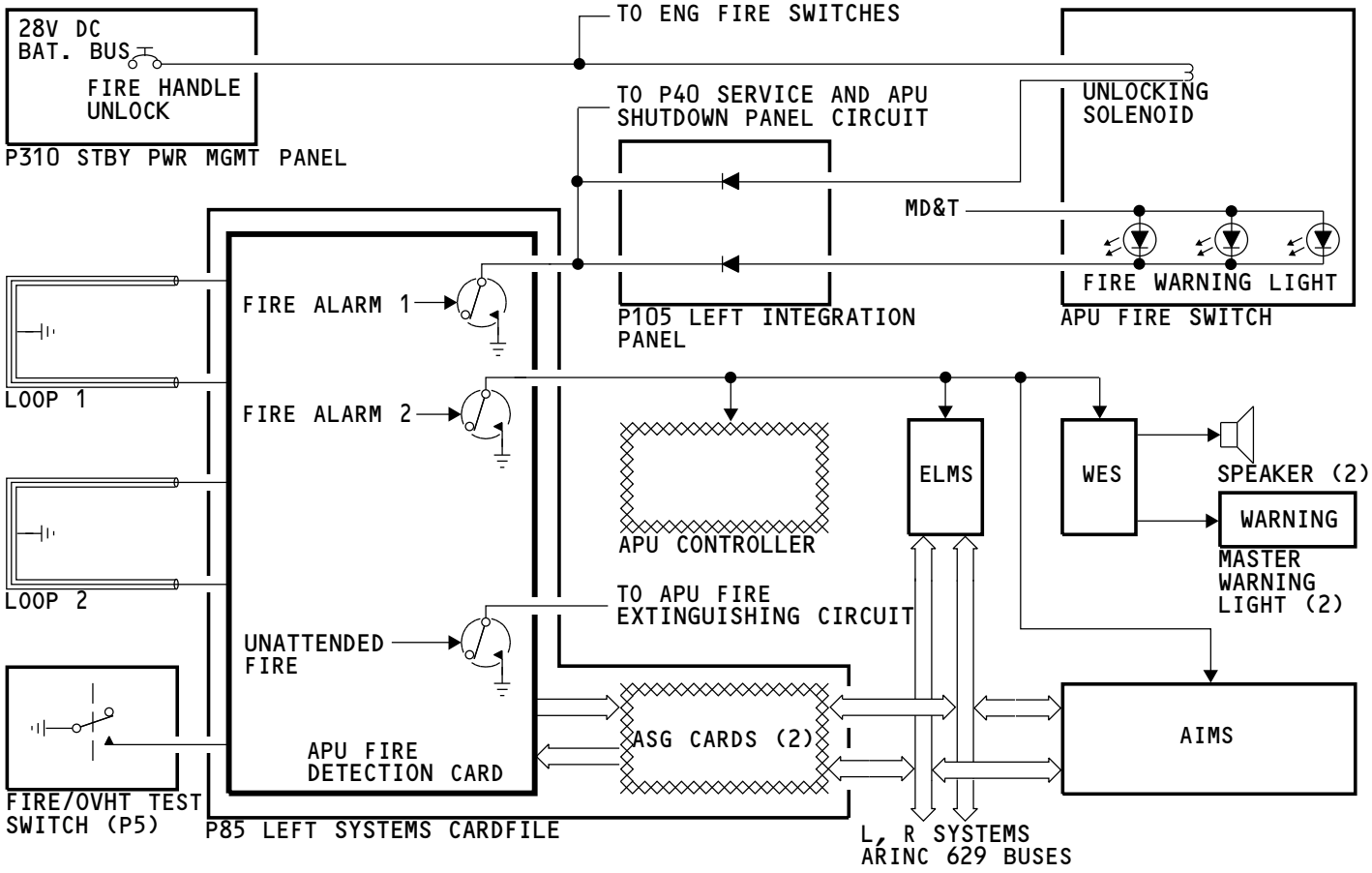
If the power-up BIT finds an open loop, the system changes to single-loop operation. Both ends of the loop are possibly disconnected. If the loop opens after the power-up BIT, the system stays in the dual-loop mode until the next electrical power-up. A loop which is open in only one place still operates. The related maintenance message specifies that loop 1 or loop 2 is open.

If a loop has a short circuit or if a card is defective, the system changes to single-loop operation. A status message shows.

If the fault involves both loops, the fire detection system does not operate. Advisory and status messages show.

Training Information Point

After you do maintenance, use the fire/overheat test switch to make sure the system operates correctly. Be careful not to pull the APU fire switch. The switch is unlocked during the test.



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APU FIRE DETECTION - FUNCTIONAL DESCRIPTION - FLIGHT DECK INDICATION CIRCUIT

APU FIRE DETECTION - FUNCTIONAL DESCRIPTION - P40 PANEL INDICATION CIRCUIT

General

Fire indications at the P40 service and APU shutdown panel are different on the ground and in the air. For both conditions, the battery bus supplies power to the circuit through the APU fire switch in the flight deck.

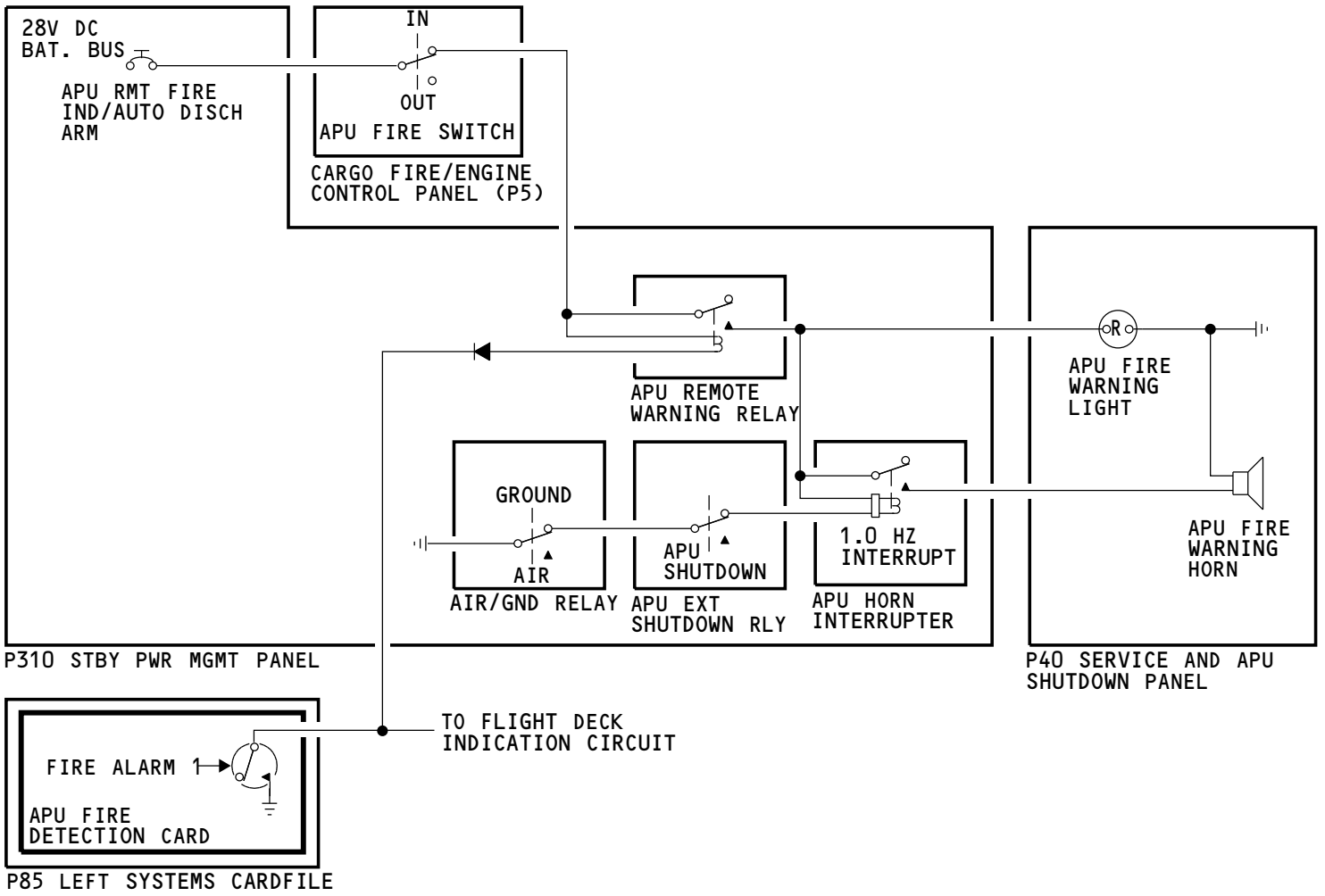
Ground Operation

If there is an APU fire, the APU fire detection card makes a ground for the APU remote warning relay. The relay energizes and supplies power to the APU fire warning light and the horn interrupter. If the airplane is on the ground and the APU external shutdown relay is not energized, the APU horn interrupter energizes. This supplies power to the APU fire warning horn. The horn interrupter causes the warning horn to sound intermittently.

If you pull the APU fire switch in the flight deck, the warnings at the P40 service and APU shutdown panel go away. If you push the APU fire shutdown switch on the P40 panel, the APU external shutdown relay energizes and stops the horn.

Air Operation

In flight, the air/ground relay is in the AIR position. The warning horn does not operate.



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APU FIRE DETECTION - FUNCTIONAL DESCRIPTION - P40 PANEL INDICATION CIRCUIT

APU FIRE DETECTION - INDICATIONS

Flight Deck Indications

If there is an APU fire, these indications occur in the flight deck:

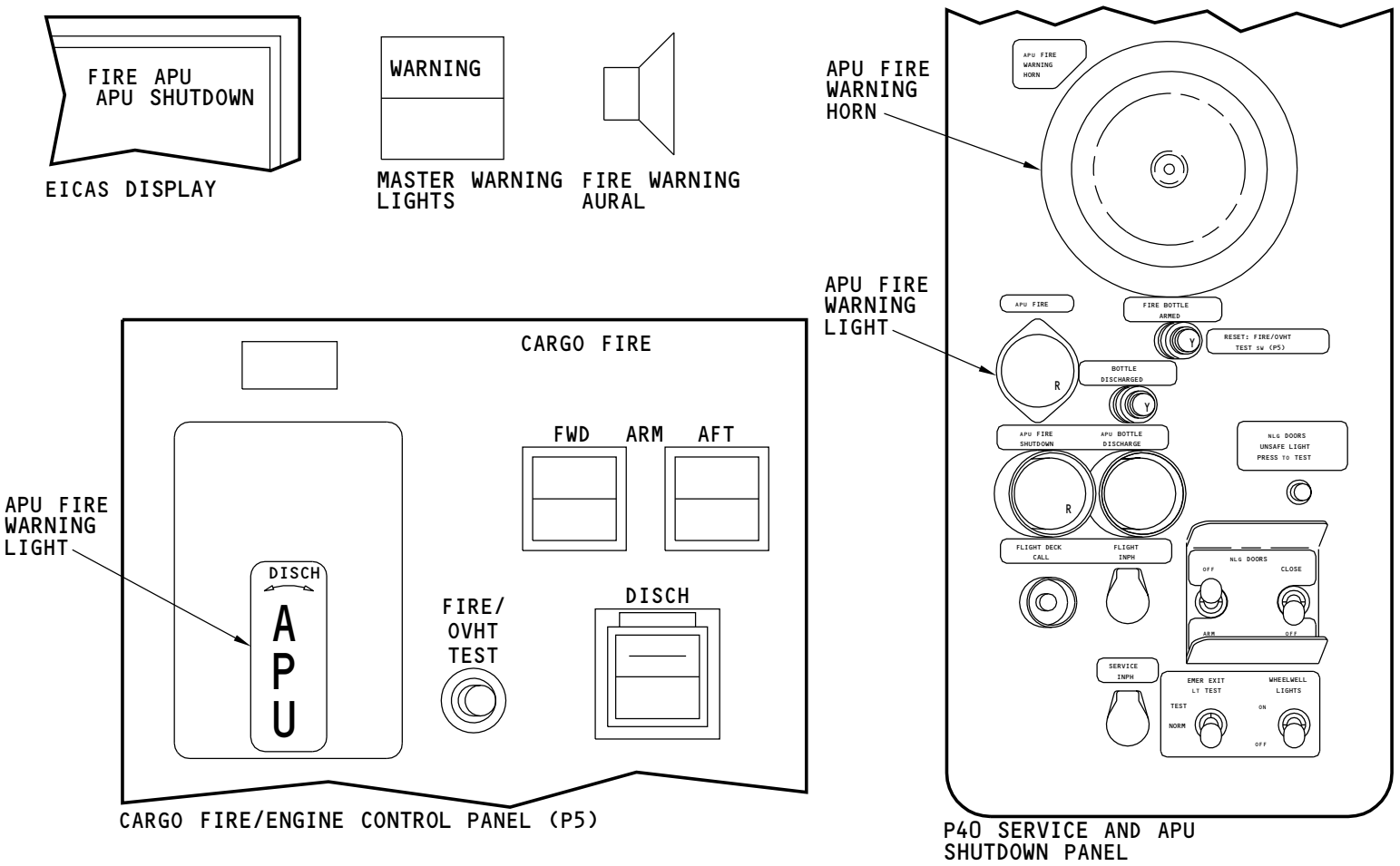
- The master warning lights come on
- The fire warning aural operates
- An APU fire EICAS warning message shows
- The APU fire warning light comes on.

Also, because the APU stops automatically, the APU fault light comes on and an EICAS advisory message shows APU shutdown.

Service and APU Shutdown Panel Indications

If the airplane is on the ground, these indications occur at the P40 service and APU shutdown panel:

- The APU fire warning horn operates intermittently
- The APU fire warning light comes on.



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APU FIRE DETECTION - INDICATIONS

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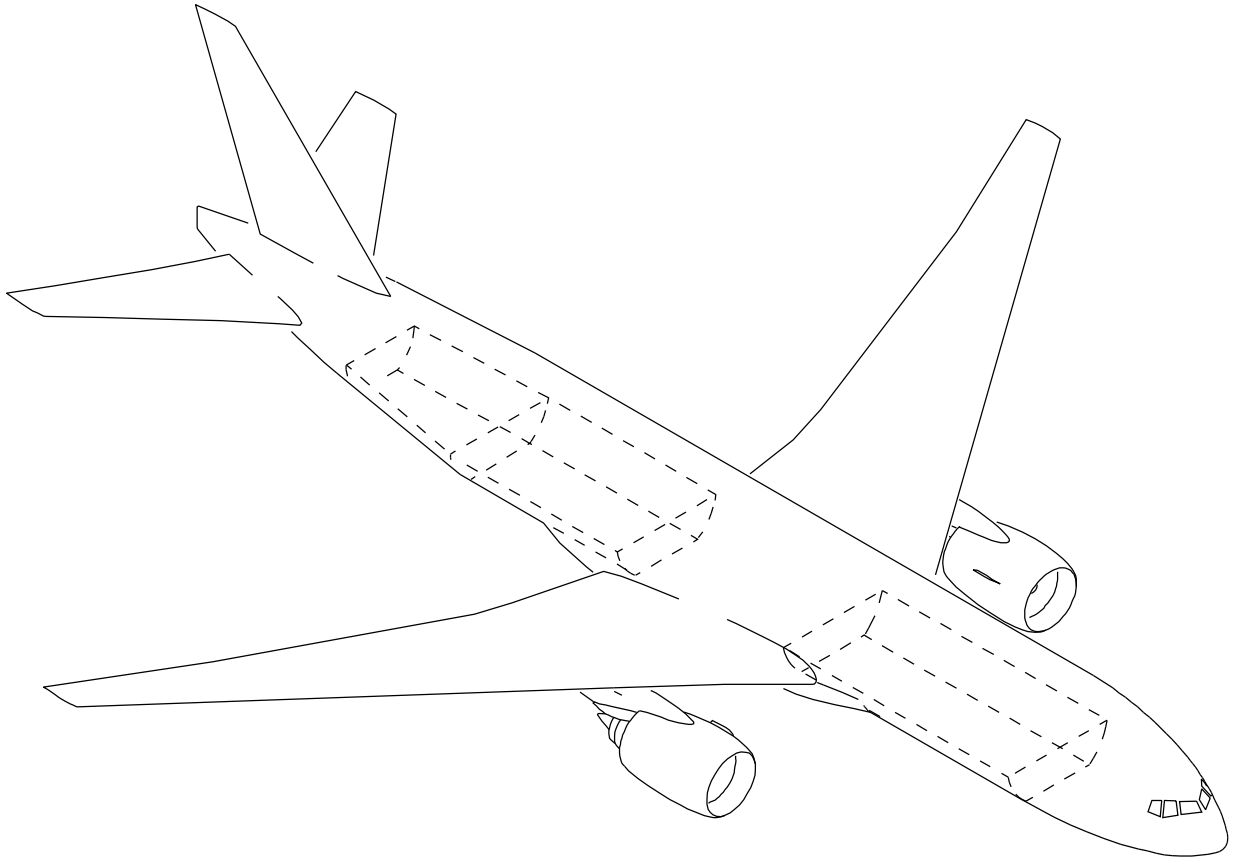
LOWER CARGO COMPARTMENT SMOKE DETECTION - INTRODUCTION

Purpose

The lower cargo compartment smoke detection system gives warnings in the flight deck if there is smoke in a lower cargo compartment.

The system also monitors and controls a remote smoke detector for the electronic equipment cooling system.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - INTRODUCTION

LOWER CARGO COMPARTMENT SMOKE DETECTION - GENERAL DESCRIPTION

General

The forward and aft lower cargo compartments each have one smoke detector. The smoke detector monitors the cargo compartment air for smoke.

The cargo smoke detector can be one of two types. One connects directly to the smoke tubes and the other has a water drain manifold attached to the outboard side. You can replace parts of the alternate smoke detector (with the water drain manifold) for installation in the position of the original smoke detector. When the replacement smoke detector is installed, water drains through the tube for the fourth zone (not used).

The forward and aft lower cargo compartments each have one smoke detector. The smoke detector monitors the cargo compartment air for smoke. The air goes through water separator/heater units before it goes into the smoke detector. The water separators remove condensed moisture from the air and the heaters increase the dew point. This keeps humid air from causing false smoke alarms.

The forward cargo smoke detector also controls an electrical/electronic cooling smoke detector and supplies electrical power to it.

See the electrical and electronic cooling smoke detection section for more information about the electrical/electronic cooling smoke detector (SECTION 26-19).

Interfaces

The lower cargo compartment smoke detection system has these interfaces:

- E/E cooling smoke detector
- Left and right systems card files
- AIMS
- Warning electronics system (WES)
- Overhead panel ARINC 629 system (OPAS)
- Proximity sensor electronics unit (PSEU)
- Equipment cooling system
- Cargo fire/engine control panel.

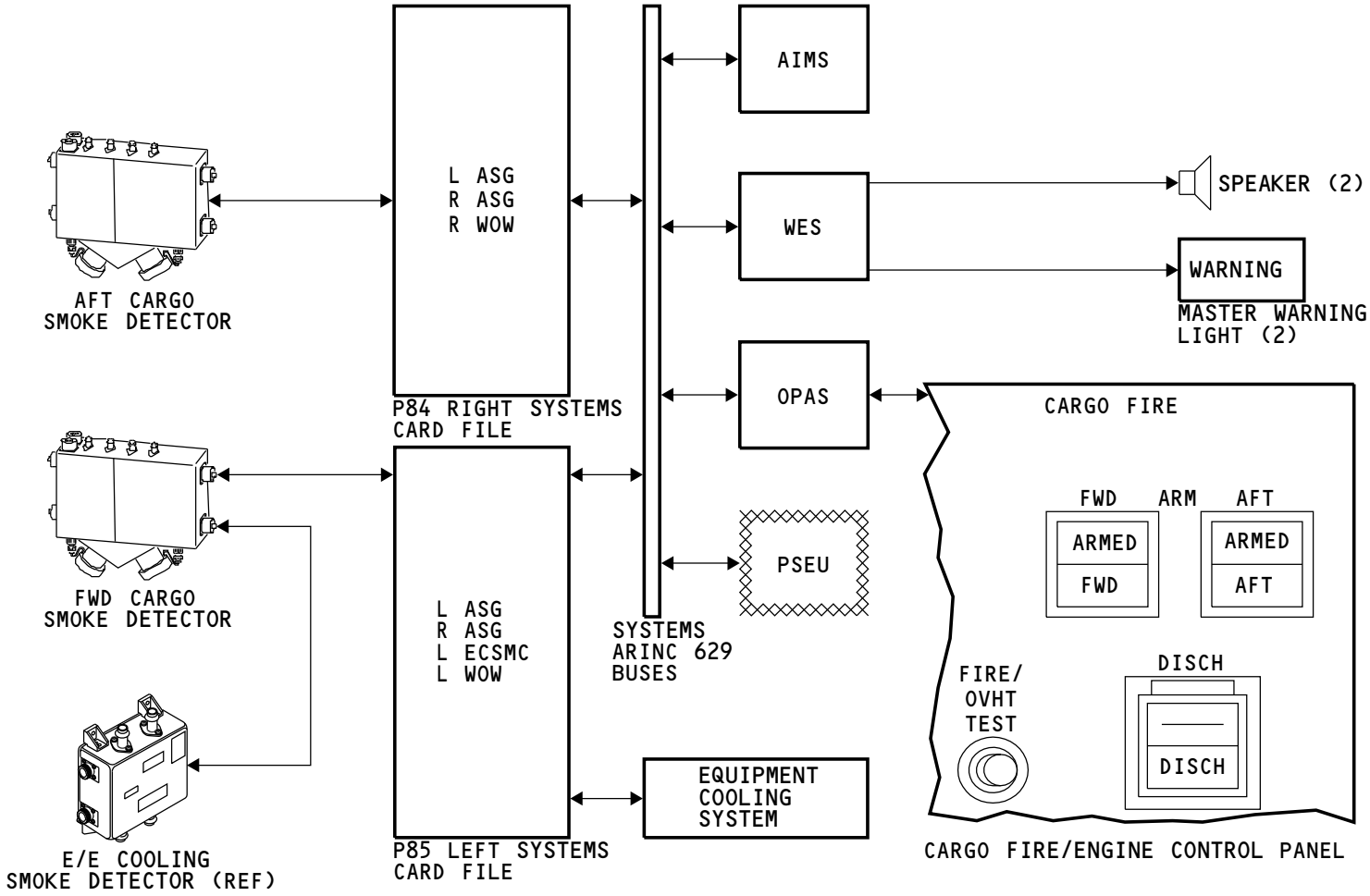
General Operation

If there is smoke in a cargo compartment, AIMS causes a cargo fire warning message. The WES turns on the fire warning aural and the master warning lights. The OPAS turns on the FWD or AFT cargo fire warning light on the cargo fire/engine control panel.

System Tests

The smoke detectors have built-in-test-equipment (BITE). The BITE does power-up and periodic tests of the system. Faults cause alert messages, status messages, or maintenance messages.

You can also use the fire/overheat test switch to do a test of the system. See the fire protection section for more information about the fire/overheat test (SECTION 26-00).



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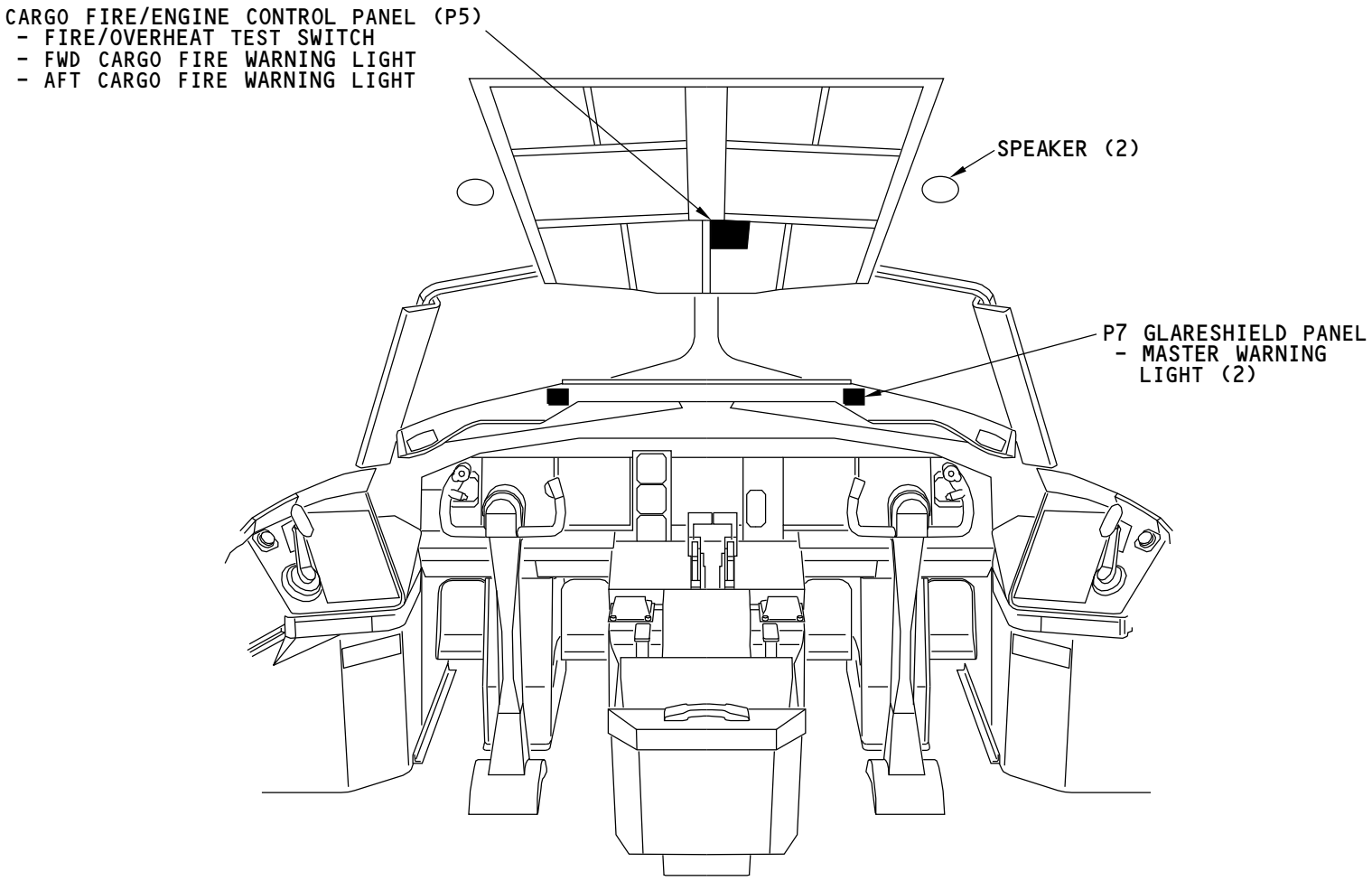
LOWER CARGO COMPARTMENT SMOKE DETECTION - GENERAL DESCRIPTION

LOWER CARGO COMPARTMENT SMOKE DETECTION - FLIGHT DECK COMPONENT LOCATIONS

Component Locations

These are the components in the flight deck that have an interface with the lower cargo compartment smoke detection system:

- Speakers
- Cargo fire/engine control panel
- Master warning lights.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - FLIGHT DECK COMPONENT LOCATIONS

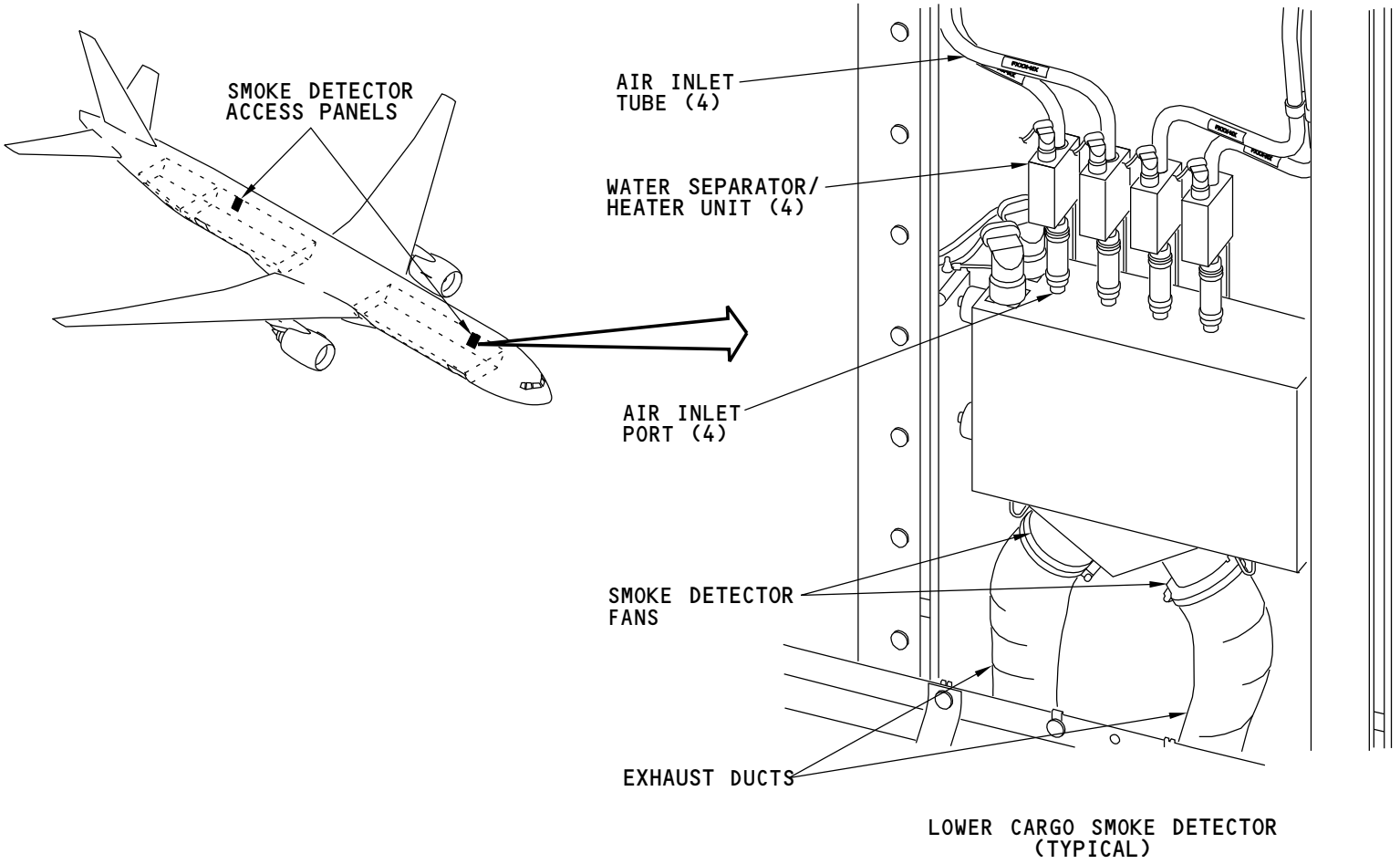
Lower Cargo Compartments

The forward and aft lower cargo compartments each have one smoke detector. Each smoke detector has two fans. Air sampling ports in the cargo compartment ceiling connect to air inlet tubes. The air inlet tubes are above the ceiling and behind the left side of the cargo compartments. The tubes connect to air inlet ports at the top of the smoke detectors. Exhaust ducts take air from the fans and release it behind the sidewall lining.

A water separator/heater unit is in line with each air inlet tube. The water separator/heater units attach to the inlet ports of the smoke detector.

Training Information Point

Open the cargo compartment sidewall lining that is opposite the cargo doors to get access to the smoke detectors.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - LOWER CARGO COMPARTMENT COMPONENT LOCATIONS

LOWER CARGO COMPARTMENT SMOKE DETECTION - LOWER CARGO SMOKE DETECTOR AND FANS - INTRODUCTION

Purpose

The smoke detectors monitor air in the cargo compartments for smoke. The fans bring air from the cargo compartment into the smoke detector. Only one fan on each detector operates at a time.

Physical Description

The forward and aft lower cargo smoke detectors are identical. The smoke detectors have these components:

- Two electrical connectors
- Four air inlet ports
- Four shock mounts
- Two fans
- Four airflow sensors (internal)
- Four smoke detection chambers (internal)
- Two electronic control channels (internal).

The smoke detectors use light emitting diode (LED) optical smoke detectors and acoustic air flow sensors.

Location

There is a smoke detector in the forward and aft lower cargo compartments. The detectors are behind the cargo compartment sidewall lining opposite the cargo doors.

Training Information Point

The smoke detector is an LRU and the fans are LRUs. The smoke detector has no internal LRUs. There is no scheduled maintenance of the cargo smoke detectors or fans. Alert messages or status messages show if there is a fault condition.

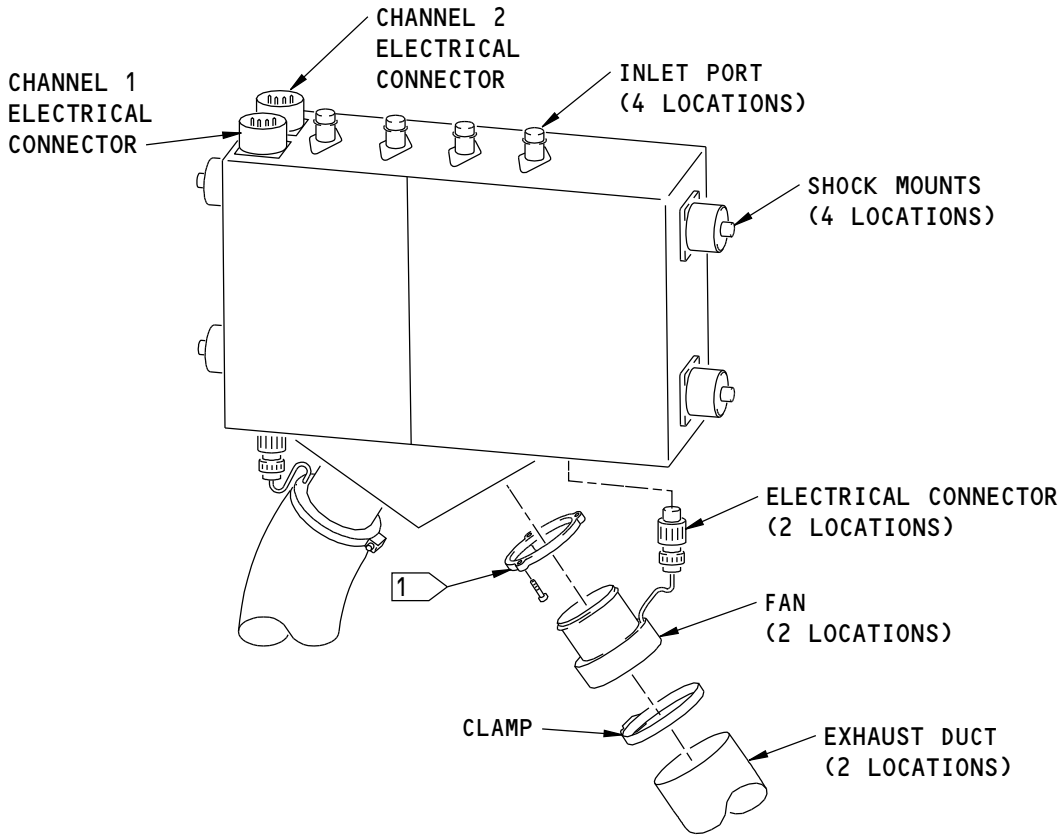
The forward lower cargo smoke detector and the aft lower cargo smoke detector are interchangeable. Four bolts attach the smoke detector to the structure.

Each smoke detector channel has its own electrical connector. The two connectors are different so you cannot cross-connect the wires. Program pins in the connectors give the detector this information:

- Location in the airplane, forward or aft
- If a remote smoke detector is connected
- The active air inlet ports.

Clamps attach the fans to the smoke detector. The length of the wire connected to the fan is such that you cannot connect the wire to the wrong connector on the smoke detector.

The lower cargo smoke detectors are onboard software loadable LRUs. You use the maintenance access terminal (MAT) to load software into the smoke detectors.



1 SOME FANS HAVE AN OPTIONAL CONFIGURATION WITH A RING.

M40799 S000617160_V2

LOWER CARGO COMPARTMENT SMOKE DETECTION - LOWER CARGO SMOKE DETECTOR AND FANS - INTRODUCTION

LOWER CARGO COMPARTMENT SMOKE DETECTION - LOWER CARGO SMOKE DETECTOR - FUNCTIONAL DESCRIPTION

General

The smoke detector has two channels that control and monitor these components:

- Airflow sensor
- Optical smoke detector
- Heaters (not shown)
- Fans.

Airflow Sensors

The airflow sensor has these parts:

- Transmitter
- Receiver.

The sensor monitors the amount of air that goes through each air inlet port. The smoke detector sends a fault message on an ARINC 429 bus for these conditions:

- Too much airflow
- Not enough airflow
- Failed airflow sensor.

Optical Smoke Detectors

The optical smoke detector has these parts:

- Two source light emitting diodes (LEDs)
- Two intensity monitor photodiodes
- Two scatter detector photodiodes.

One set of diodes connects to channel 1. The other set of diodes connects to channel 2. Only one set of diodes operates at a time.

Inside the smoke detection chamber, air flows between a source LED and a scatter detector photodiode. Usually, only a small amount of light from the IED gets to the scatter detector. If the air has smoke in it, the smoke particles reflect more light on the scatter detector. This causes an alarm signal.

The intensity monitor photodiode makes sure that the source LED is on and keeps the output of the source LED constant. This configuration also finds contamination of the LED and photodiodes. A defective diode or contamination causes the detector to change to the other set of diodes. The detector sends a fault message.

Channel 1 And 2 Circuits

The two channels operate independently. If one channel fails, the other channel can control all functions of the smoke detector.

One channel does continuous BITE while the other channel controls the smoke detector. Channel 1 controls during one electrical power cycle, channel 2 controls during the next power cycle. If the control channel or its diodes fail, the other channel takes over. The detector sends a fault message.

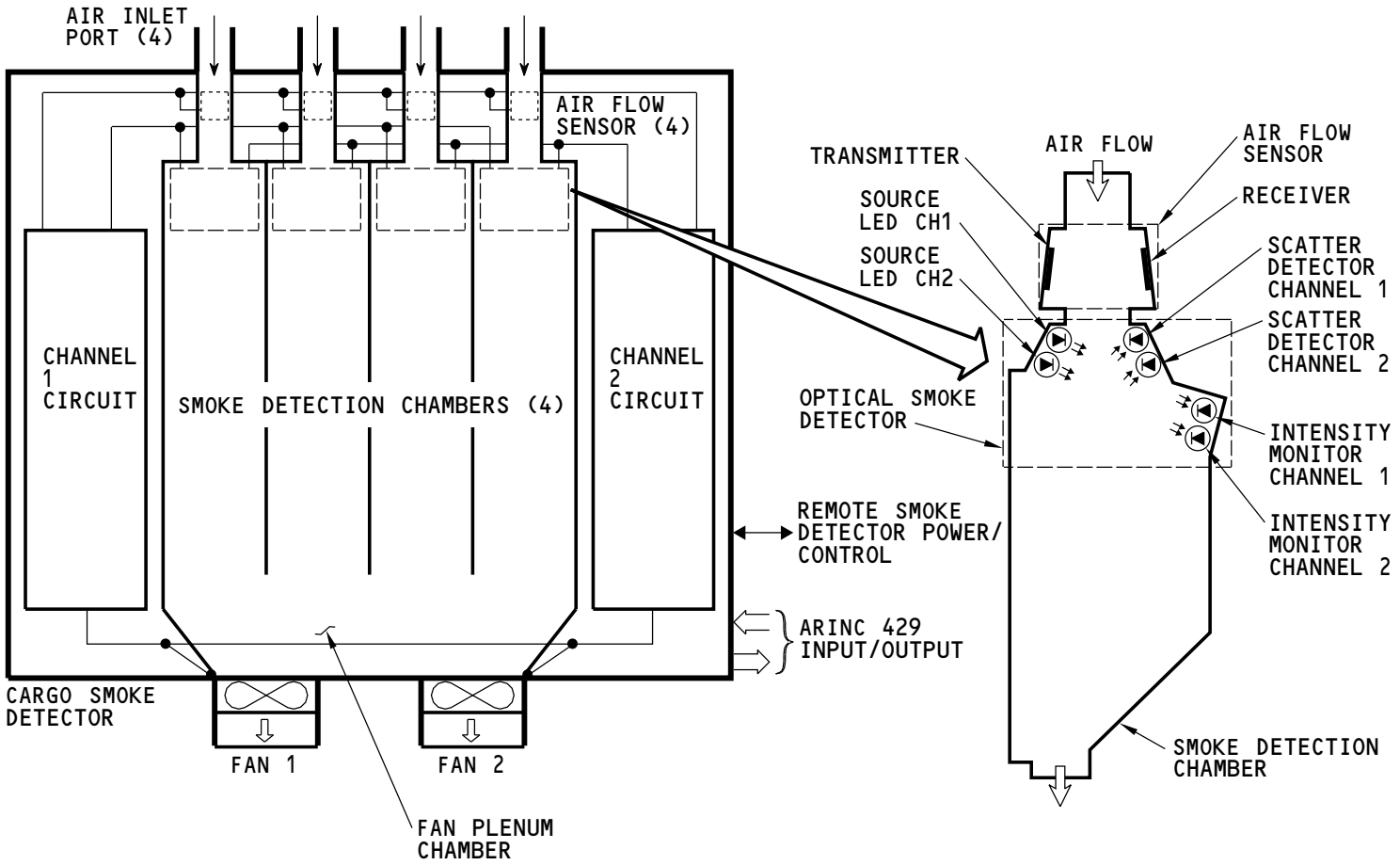
Fans

During usual operation, only one fan operates at a time. Channel 1 usually controls fan 1, and channel 2 usually controls fan 2. If a fan fails, the control channel turns on the other fan. The detector sends a fault message. The fans have a built in check valve which prevents reverse air flow through the fan that is off.

Condensation from the water separator/heater units goes into the fan plenum chamber then out through the fan. An internal splash shield (not shown) keeps water spray out of the smoke detection chambers.

Remote Smoke Detector Control

The smoke detector can supply electrical power to a remote smoke detector and control its operation.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - LOWER CARGO SMOKE DETECTOR - FUNCTIONAL DESCRIPTION

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LOWER CARGO COMPARTMENT SMOKE DETECTION - FUNCTIONAL DESCRIPTION - CIRCUIT

General

The circuit for the forward lower cargo compartment is shown. The circuit for the aft lower cargo compartment operates the same. The left and right main ac buses supply power to the smoke detectors. The smoke detector gets inputs from these:

- Left ECS miscellaneous card (ECSMC)
- Weight-on-wheels (WOW) card
- Overhead panel ARINC 629 system (OPAS)
- Proximity sensor electronics unit (PSEU) 2
- AIMS.

The smoke detector sends data to these:

- Overhead panel ARINC 629 system (OPAS)
- Warning electronics system (WES)
- AIMS.

Electrical Power

Each channel continuously monitors the electrical power input to the opposite channel. If power to one channel is not within limits, the smoke detector sends a fault message to AIMS. This condition shows on the fire protection maintenance page.

System Tests

The smoke detectors have built-in-test equipment (BITE). BITE does a power-on test automatically when it gets electrical power, and a periodic test regularly during operation.

You can do a test (initiated test) with the fire/overheat test switch or the maintenance access terminal. The test switch sends a signal through the overhead panel cardfile and ASG cards to the smoke detector. BITE does a test of the system. When you use the MAT, AIMS tells the smoke detector to do a power-up BIT sequence.

Smoke Detection

If there is smoke in the cargo compartment, the detector sends an alarm signal through the ARINC 429 bus to the ASG cards. The ASG cards send the alarm signal through the systems ARINC 629 buses to these systems and components:

- OPAS
- WES
- AIMS.

OPAS makes a ground to turn on the cargo fire warning light. The WES turns on the master warning lights and fire aural warning. The AIMS causes a warning message.

Ground Operation

The cargo smoke detector fans do not operate during cargo handling. This keeps contamination of the detectors to a minimum. The fan in the forward compartment does not operate when all these conditions occur:

- The right engine is off
- The weight-on-wheels (WOW) is set on ground
- The forward cargo door is open

The fan in the aft compartment does not operate when all these conditions occur:

- The right engine is off
- The weight-on-wheels (WOW) is set on ground
- The bulk cargo door and either large or small door are open.

The WOW card supplies the air/ground signal. The proximity sensor electronics unit (PSEU 2) supplies the cargo door open signal. AIMS supplies the engine operating/not operating signal.

If the smoke detector does not receive the expected inputs, it continues to operate with these default values:

- Air

- Cargo doors closed
- Right engine operating.

Airflow Sensing

The smoke detector airflow sensors make allowance for changes in air density. The detector uses air temperature and pressure data to do this. Cargo compartment temperature data comes from the left ECSMC. Cabin altitude comes from the AIMS.

If the smoke detector does not receive the expected inputs, it continues to operate with these default values:

- Cabin altitude 8000 feet
- Cargo compartment temperature 40 degrees F.

Water Separator/Heater Units

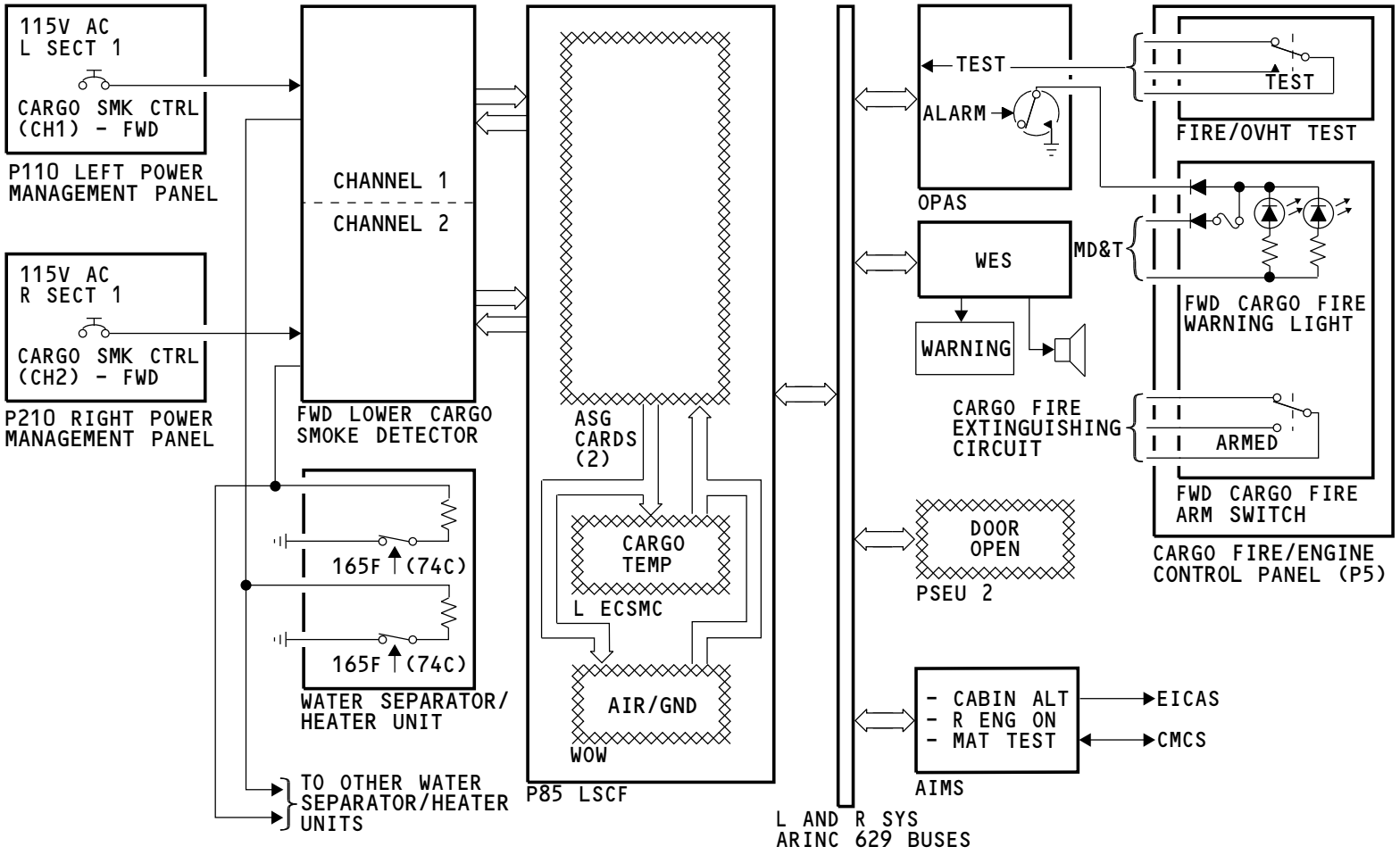
The two smoke detector channels gives power to the water separator/heater units as long as the input voltage is less than 122 volts AC. A thermal switch inside the water separator/heater unit controls the temperature. The smoke detector monitors operation of the heaters. If the heater fails, the smoke detector sends data about the failure to AIMS. The CMCS shows status and maintenance messages for the heaters.

Training Information Point

The CMCS shows status and maintenance messages for the smoke detectors. A fire protection maintenance page shows information about the system.

The cargo smoke detectors keep fault data in memory. You can use the MAT to access this fault data. You can also use the MAT to access smoke detector hardware and software part numbers.

Use the CMCS download function to load new software into the smoke detector.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - FUNCTIONAL DESCRIPTION - CIRCUIT

LOWER CARGO COMPARTMENT SMOKE DETECTION - INDICATIONS

General

Operation of the lower cargo compartment smoke detection system is automatic and does not need crew action. The system operates when the main ac buses have power.

Cargo Smoke Indication

If there is smoke in a lower cargo compartment, these indications occur in the flight deck:

- A cargo fire EICAS warning message shows
- The master warning lights come on
- The fire warning aural operates
- The cargo fire warning light comes on.

The master warning lights and fire warning aural do not operate during part of the takeoff if there is a fire.

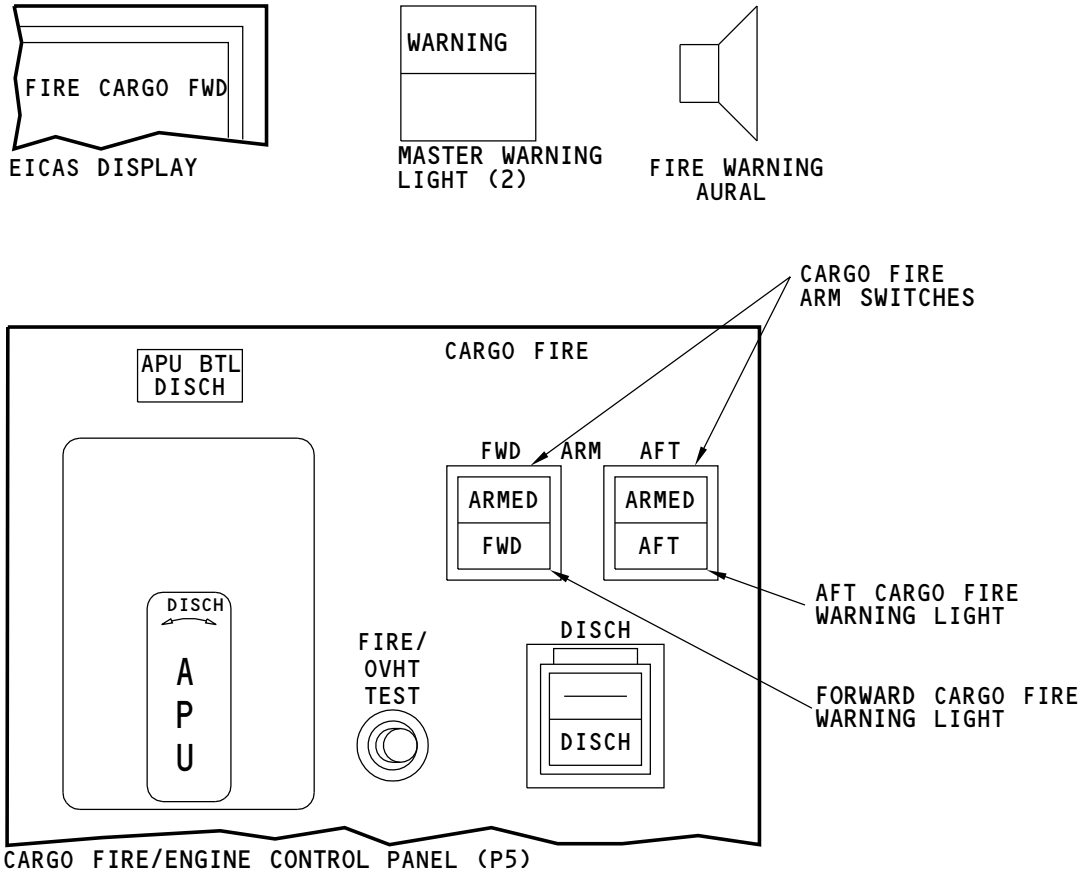
Training Information Point

If the smoke detector fails while it supplies a fire alarm signal, the alarm signal latches. This condition occurs if soot from a cargo fire causes contamination of the smoke detector optics.

All these conditions must be true to make the alarm signal stop:

- Airplane is on the ground
- Related cargo fire arm switch is off
- There is no cargo smoke
- There is no failure condition.

You can use the fire/overheat test switch or the MAT to do a test of the system at any time. Test results show on the primary display system.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - INDICATIONS

LOWER CARGO COMPARTMENT SMOKE DETECTION - TRAINING INFORMATION POINTS

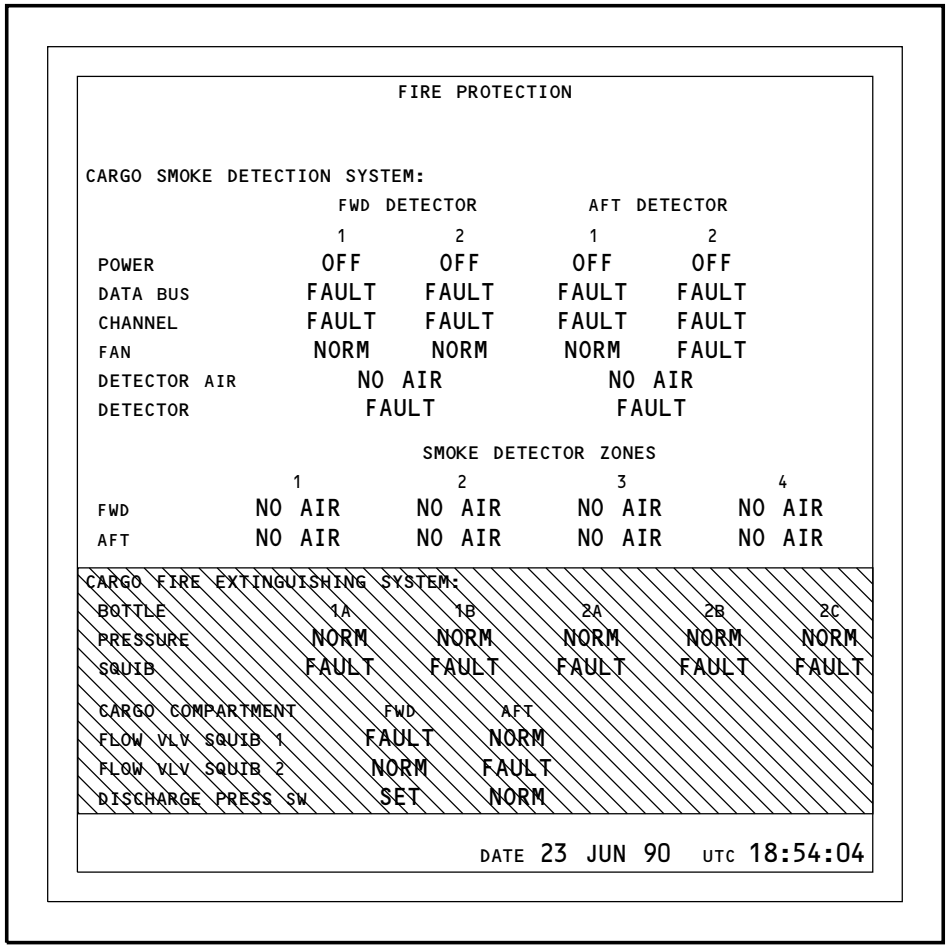
Maintenance Page

Operational status of the cargo smoke detection system shows on the fire protection maintenance page.

Advisory, Status, And Maintenance Messages

Advisory, status, or maintenance messages show for these fault conditions:

- Low airflow at the zone 1, 2, 3, or 4 air inlet port (blocked air sampling tube)
- Too much airflow at the zone 1, 2, 3, or 4 air inlet port (air sampling tube not connected)
- Faulty air flow sensor
- Smoke detector optic contamination
- Smoke detector internal failure
- Fan failure
- Water separator/heater unit failure
- Power source failure
- ARINC 429 bus failure
- Program pin parity error
- Software not compatible with hardware.



FIRE PROTECTION MAINTENANCE PAGE

M40809 S000617169_V1

LOWER CARGO COMPARTMENT SMOKE DETECTION - TRAINING INFORMATION POINTS

LOWER CARGO COMPARTMENT SMOKE DETECTION - SYSTEM TESTS

General

These are the system tests for the cargo smoke detection system:

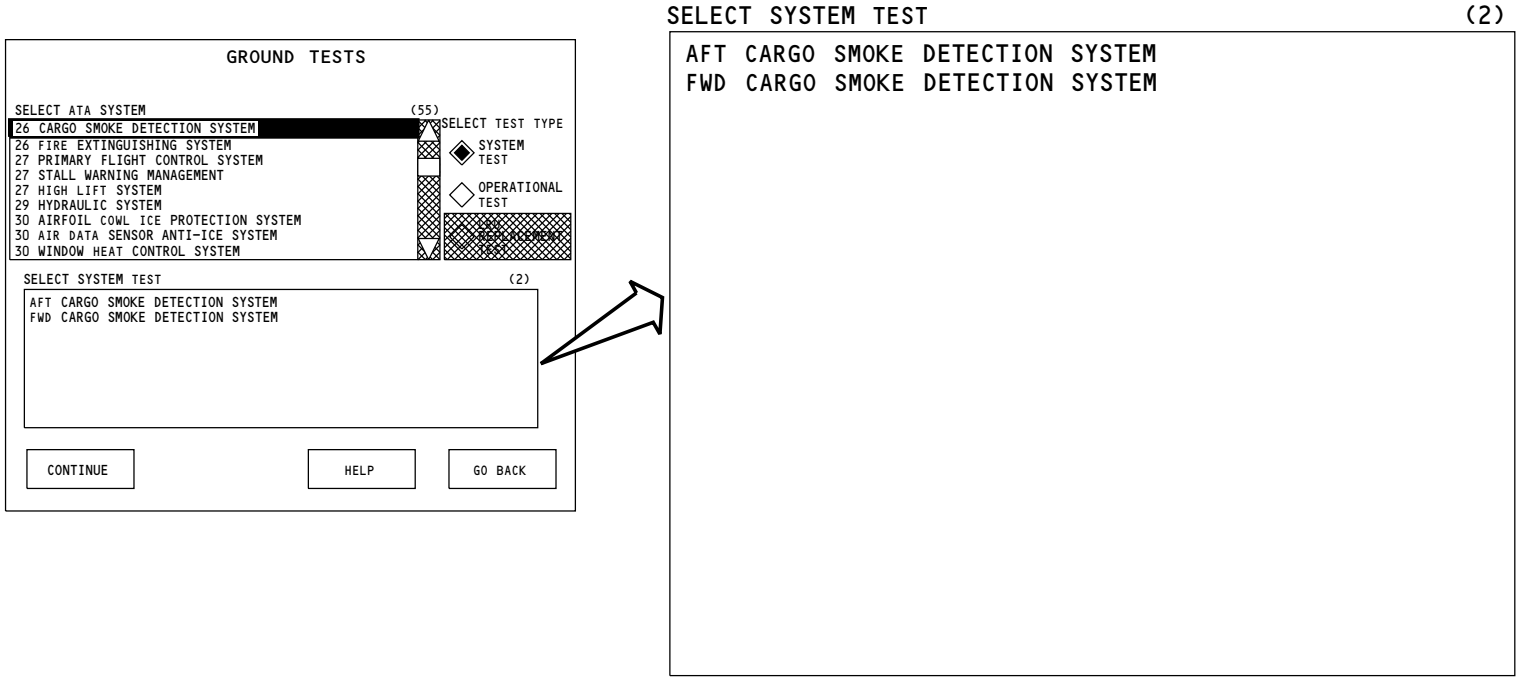
- Aft Cargo Smoke Detection System
- Fwd Cargo Smoke Detection System.

Aft Cargo Smoke Detection System

This test makes sure that the aft lower cargo compartment smoke detector operates correctly.

Fwd Cargo Smoke Detection System

This test makes sure that the forward lower cargo compartment smoke detector operates correctly.



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LOWER CARGO COMPARTMENT SMOKE DETECTION - SYSTEM TESTS

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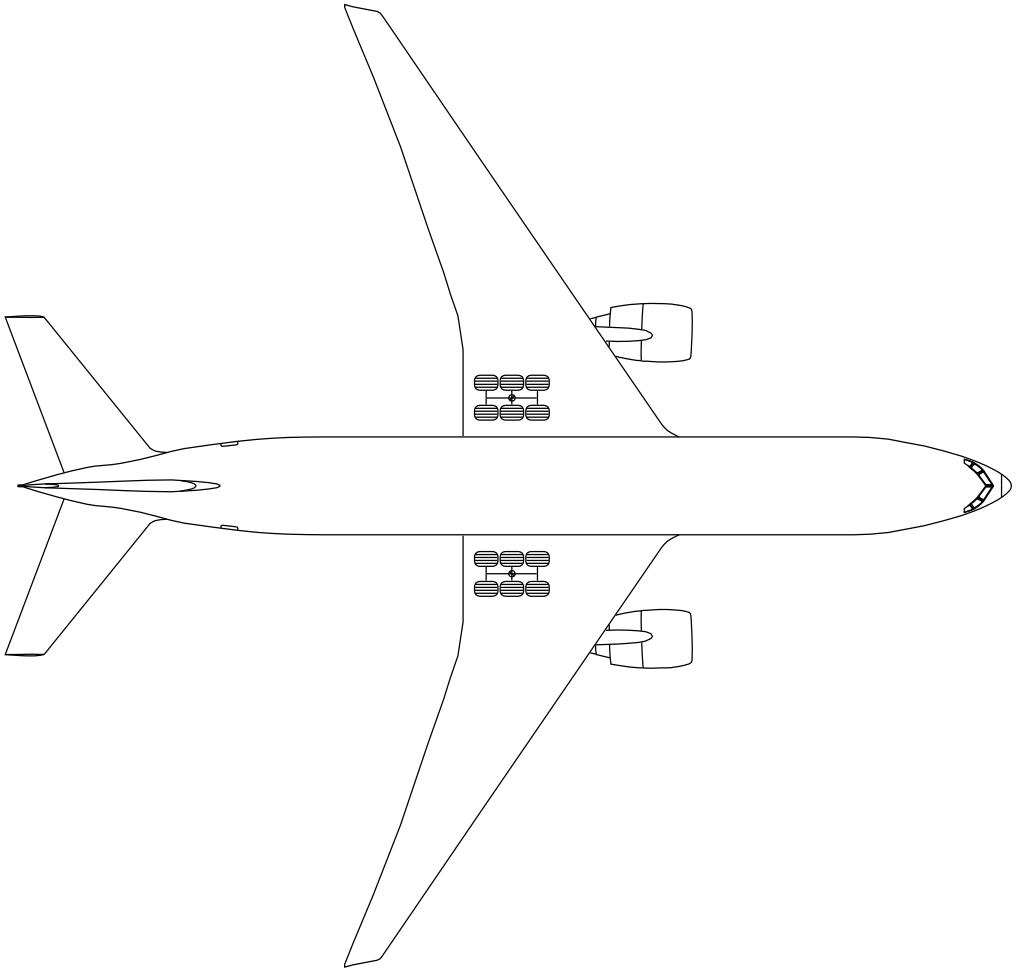
WHEEL WELL FIRE DETECTION - INTRODUCTION

Purpose

The wheel well fire detection system monitors the main wheel wells for a fire condition.

General

The wheel well fire detection system has an interface with the duct leak and overheat detection system. A fire in a wheel well causes an EICAS warning message in the flight deck.



M40812 S000617173_V1

WHEEL WELL FIRE DETECTION - INTRODUCTION

WHEEL WELL FIRE DETECTION - GENERAL DESCRIPTION

General

There are two adjacent fire detectors in each main wheel well. Each detector in the left wheel well connects to a detector in the right wheel. This makes two detector loops that operate independently.

Interfaces

The wheel well fire detection system has these interfaces:

- AIMS
- Warning electronics unit (WEU)
- Cargo fire/engine control panel
- Duct leak/overheat detection system (DLODS).

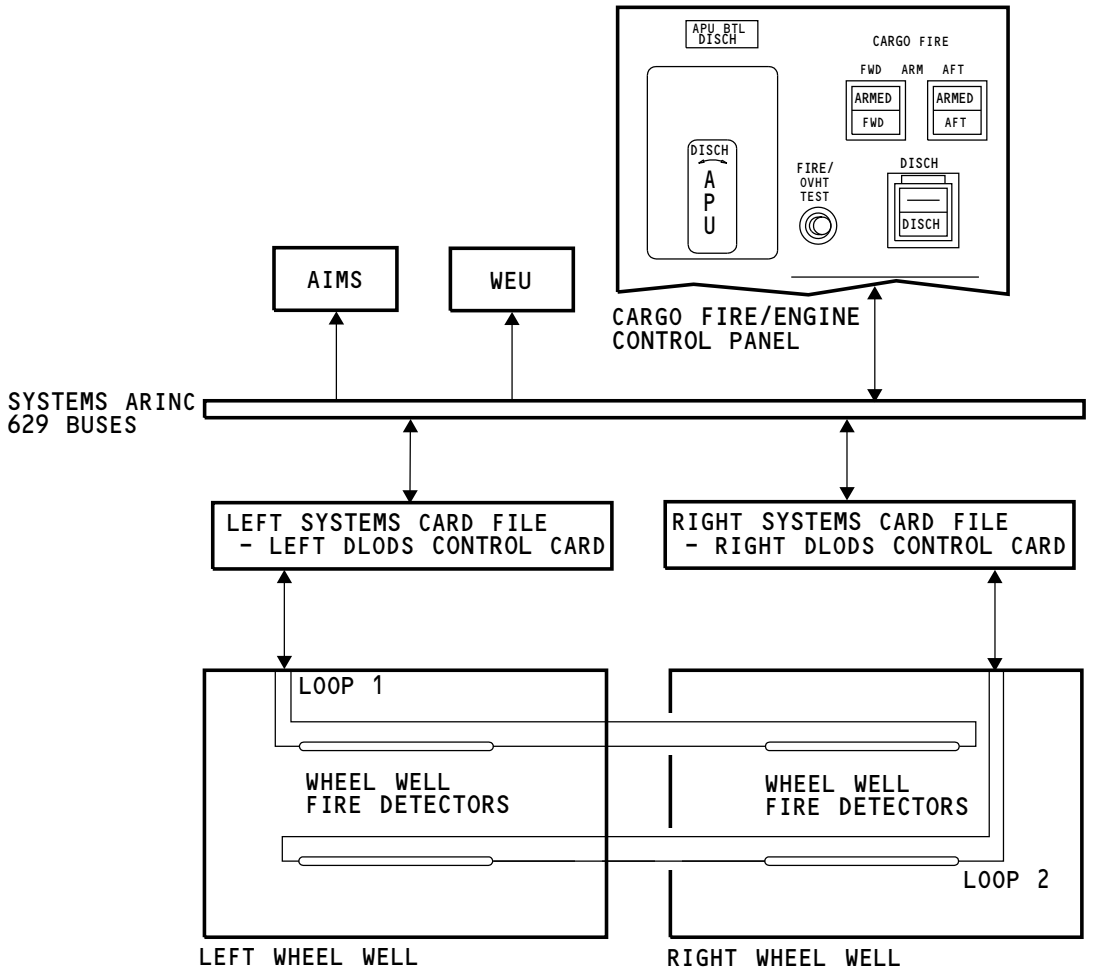
General Operation

Duct leak and overheat detection (DLODS) control cards in the left and right card files monitor the wheel well detectors. If both loops give an indication of a wheel well fire, the DLODS control cards send a signal to the AIMS. A fire warning message shows on EICAS.

Tests

The DLODS control cards continuously test the detector loops for open and short circuits. If the DLODS control cards find a failure, the cards send a signal to AIMS. A maintenance message shows if a single loop fails. A status message shows if both loops fail.

Use the fire/overheat test switch to manually test the wheel well fire detection system.



M40813 S000617174_V1

WHEEL WELL FIRE DETECTION - GENERAL DESCRIPTION

WHEEL WELL FIRE DETECTION - COMPONENT LOCATIONS

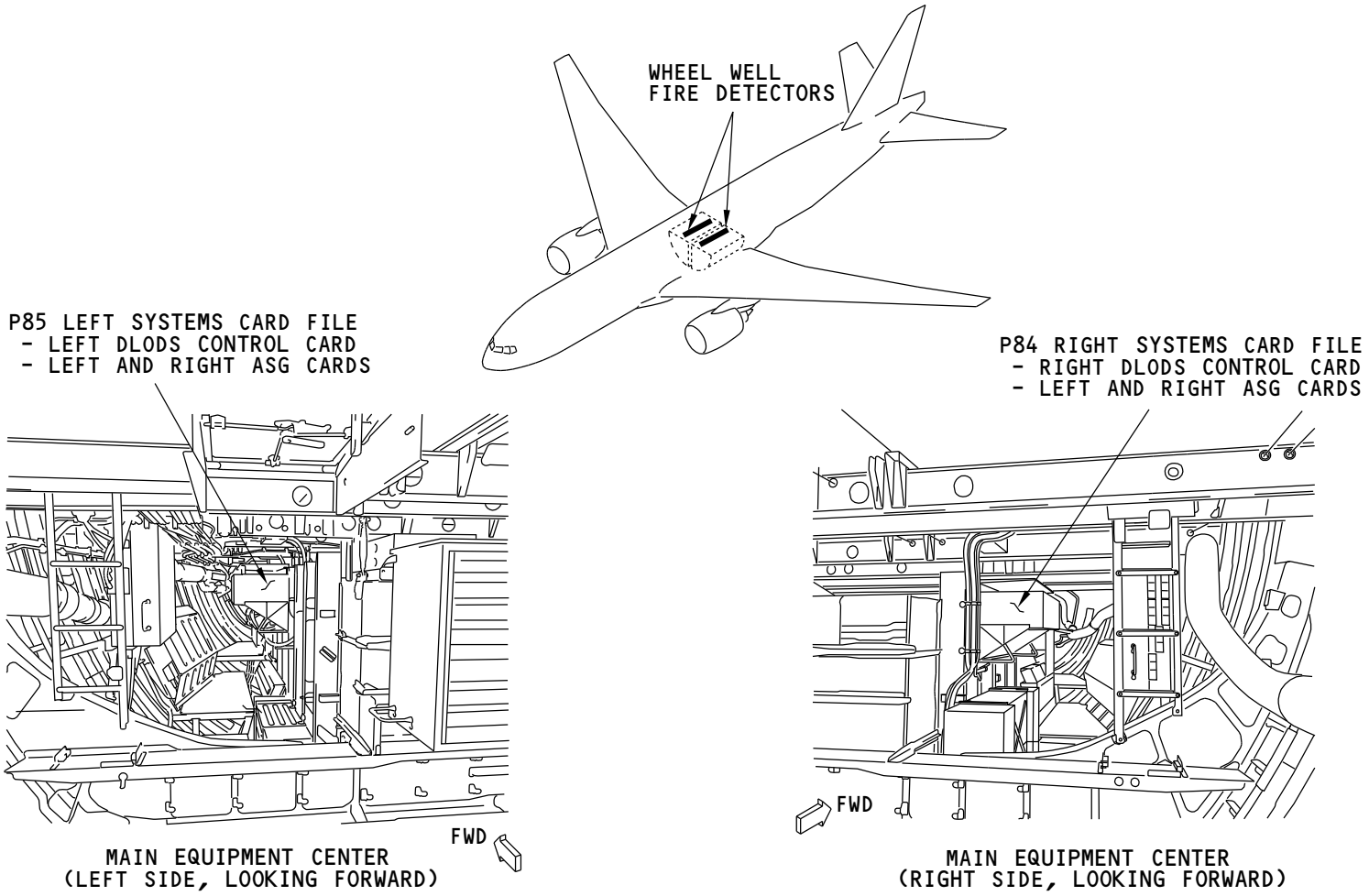
Wheel Wells

Each wheel well has two wheel well fire detectors.

Main Equipment Center

These are the components in the main equipment center that have an interface with the wheel well fire detection system:

- Left DLODS control card
- Left and Right ASG cards (two each)
- Right DLODS control card.



M40814 S000617175_V1

WHEEL WELL FIRE DETECTION - COMPONENT LOCATIONS

WHEEL WELL FIRE DETECTION - WHEEL WELL FIRE DETECTORS - INTRODUCTION

Purpose

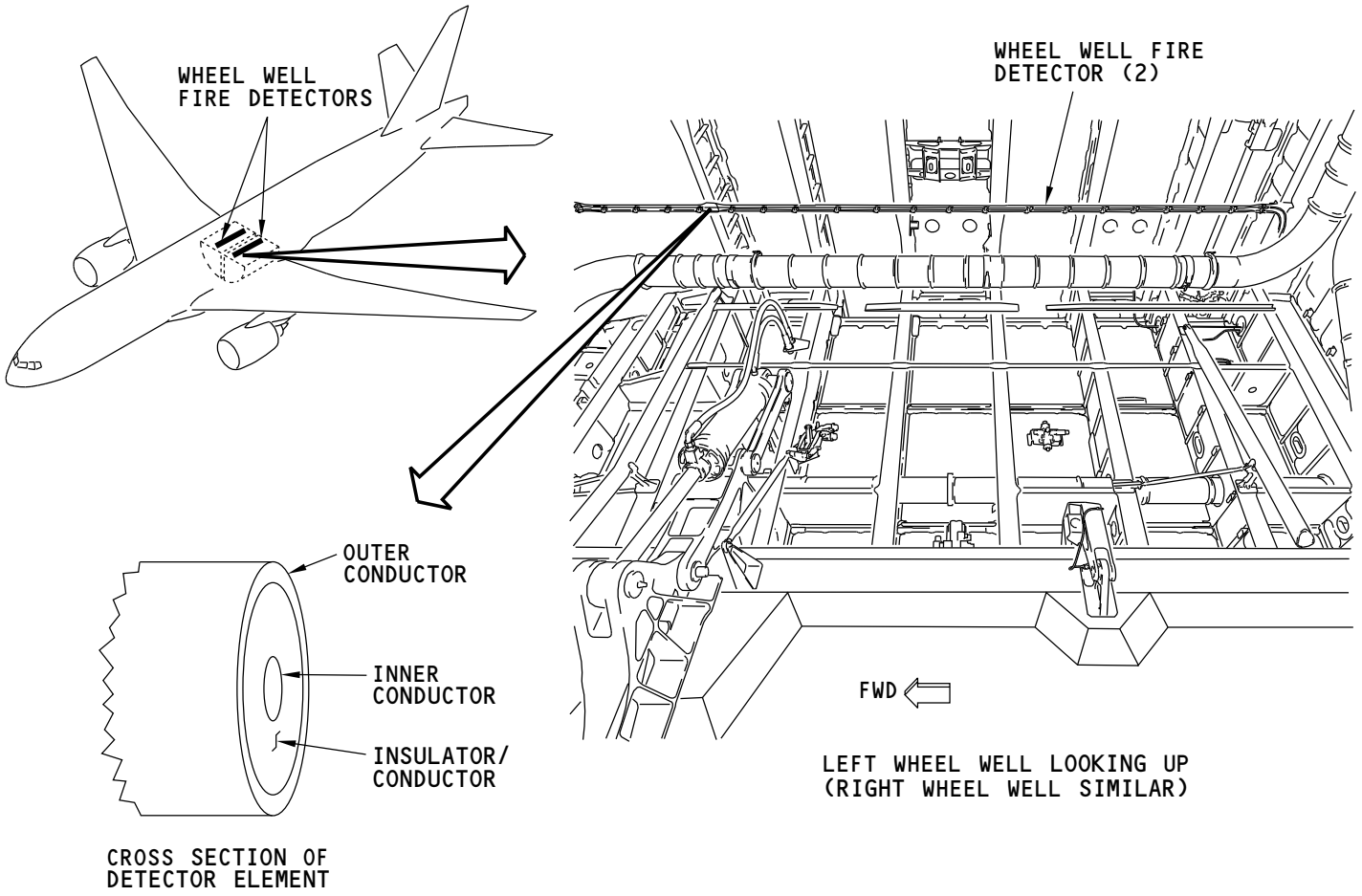
Wheel well fire detectors monitor the main gear wheel wells for tire fires.

Physical Description

The wheel well fire detector has two electrical elements with connectors at each end. Each detector element has an outer conductor around an inner conductor. The material between these conductors is an electrical insulator at temperatures less than 575 F (302 C).

Location

A pair of detectors are at the top of each main gear wheel well. These detectors are above the wheels when the landing gear retracts.



M40815 S000617176_V1

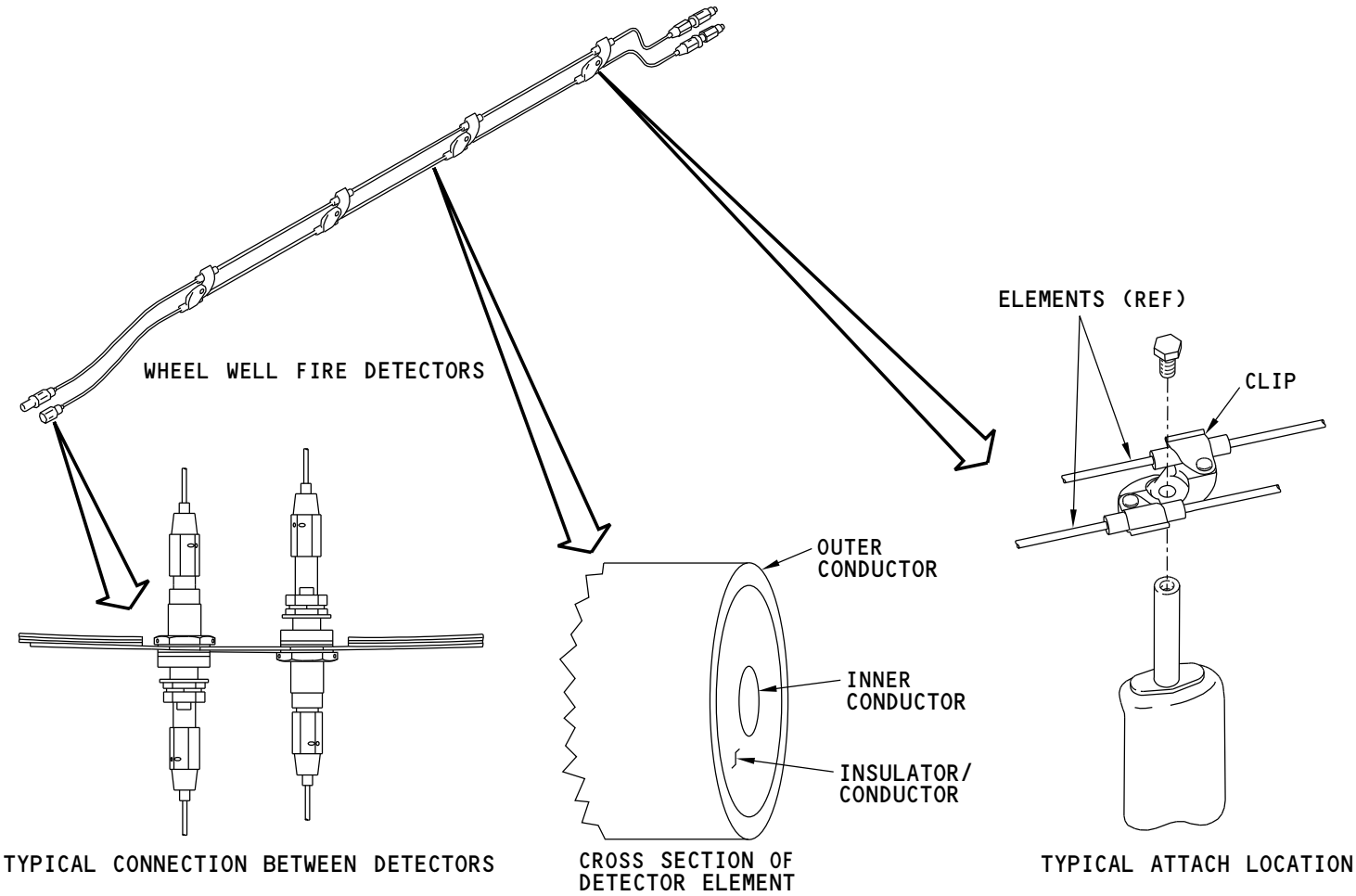
WHEEL WELL FIRE DETECTION - WHEEL WELL FIRE DETECTORS - INTRODUCTION

Functional Description

When a fire occurs, the material between the conductors melts. In the liquid condition this material conducts electricity.

Training Information Point

A clip attaches a pair of adjacent detector elements to structural points in each wheel well. Connectors on each end connect detectors together in series through airplane wiring.



M40816 S000617177_V1

WHEEL WELL FIRE DETECTION - WHEEL WELL FIRE DETECTORS - FUNCTIONAL DESCRIPTION

WHEEL WELL FIRE DETECTION - FUNCTIONAL DESCRIPTION

Fire Detection

The wheel well fire detection system has two detector loops that operate independently.

The left duct leak and overheat detection system (DLODS) control card monitors loop 1. The right (DLODS) control card monitors loop 2. Each card electrically excites its related loop at a specified voltage. The signal from the loop shows a high electrical resistance at temperatures less than the fire set point (575 F, 302 C). At the fire set point or higher, the signal from the loop shows a low electrical resistance.

If the DLODS control cards find low resistance in both loops of a wheel well, the cards send a signal to the AIMS to indicate a fire. A warning message shows on EICAS. The warning electronic unit (WEU) turns on the master warning lights and fire aural warning.

Loop Failure

The DLODS control cards continuously monitor the detector loops for open and short circuits. If a card finds a short circuit in only one loop of a wheel well, the cards send a signal to AIMS to show a short circuit failure of the detector.

If the signal from the loop shows an open circuit, The DLODS control cards send a signal to AIMS to show an open circuit failure of the detector.

A short or open circuit failure of one detector loop causes maintenance messages. A failure of the two loops causes a status message to show.

DLODS Control Card Failure

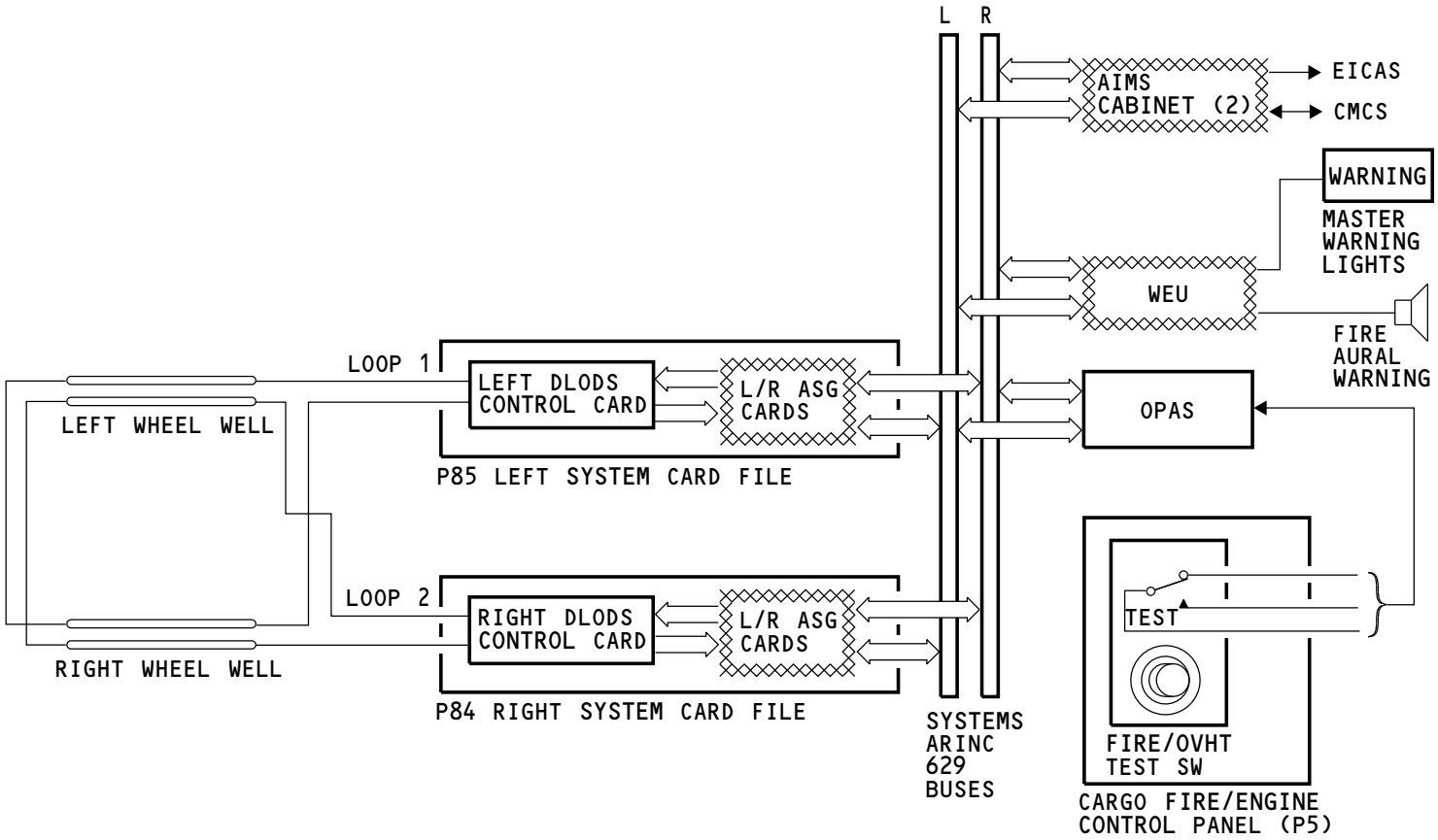
If a DLODS control card has a failure, a status message on EICAS show the loop monitored by that card as failed. The serviceable card then uses the other loop as the only source of fire detection.

Fire/Overheat Test

A fire/overheat test causes the DLODS control cards to do a test of the wheel well fire detectors. If the cards find an open or a short circuit in the loop, they send a signal to AIMS. EICAS messages report the results of the test. Failure of the two loops causes an advisory message to show.

Training Information Point

The advisory message that shows as a result of the fire/overheat test only shows for this manual test. If the DLODS control card finds a failure during continuous testing, there is no advisory message.



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WHEEL WELL FIRE DETECTION - FUNCTIONAL DESCRIPTION

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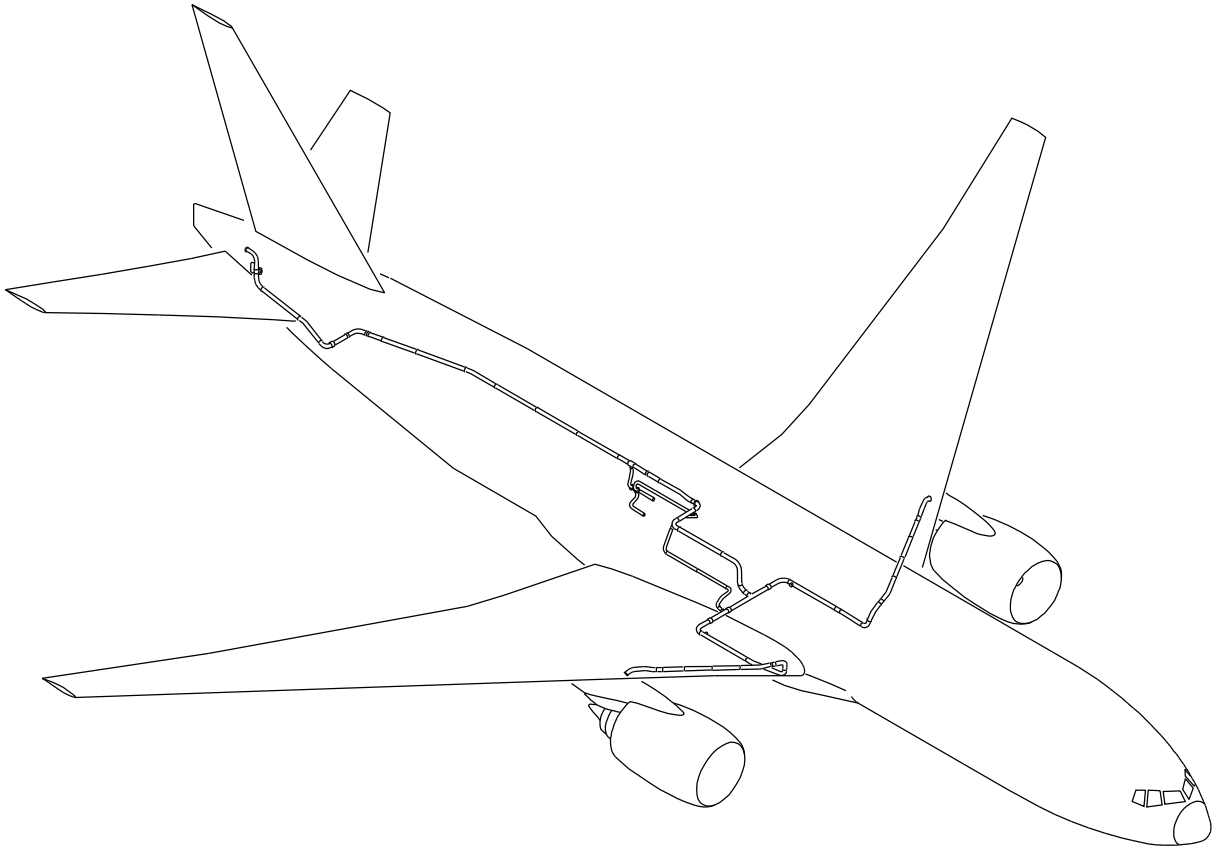
DUCT LEAK AND OVERHEAT DETECTION - INTRODUCTION

Purpose

The duct leak and overheat detection system (DLODS) monitors the pneumatic ducts and engine anti-ice ducts for leaks.

General

DLODS has an interface with the pneumatic and engine anti-ice systems. Valves in these systems close automatically to stop the leak. A duct leak that does not stop can cause structural damage to the airplane. EICAS messages tell the crew about the duct leak.



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DUCT LEAK AND OVERHEAT DETECTION - INTRODUCTION

DUCT LEAK AND OVERHEAT DETECTION - GENERAL DESCRIPTION

General

The duct leak and overheat detection system (DLODS) has these detectors:

- Wheel well fire detectors (ref)
- Fan case overheat detectors
- Strut overheat detectors
- Wing duct leak detectors
- Body duct leak detectors.

Three identical DLODS control cards monitor the detectors:

- Left DLODS control card
- Center DLODS control card
- Right DLODS control card.

Interfaces

The DLODS control cards have these interfaces:

- Pneumatic system (ASCPC)
- Engine anti-ice system (ACIPS cards - EAI)
- Overhead panel ARINC 629 system (OPAS)
- APU controller (APUC)
- Warning electronic system (WES)
- AIMS primary display system and central maintenance computing function.

Wheel Well Fire Detection

If a wheel well fire detector finds a fire, the DLODS control cards send a signal on the data bus. The warning electronic system turns on the fire bell and the master warning lights. The AIMS shows an EICAS warning message.

When you do a fire/overheat test, you test the wheel well fire detection part of DLODS, but not the duct leak and overheat detection part.

See the fire protection section for more information about the fire/overheat test (SECTION 26-00).

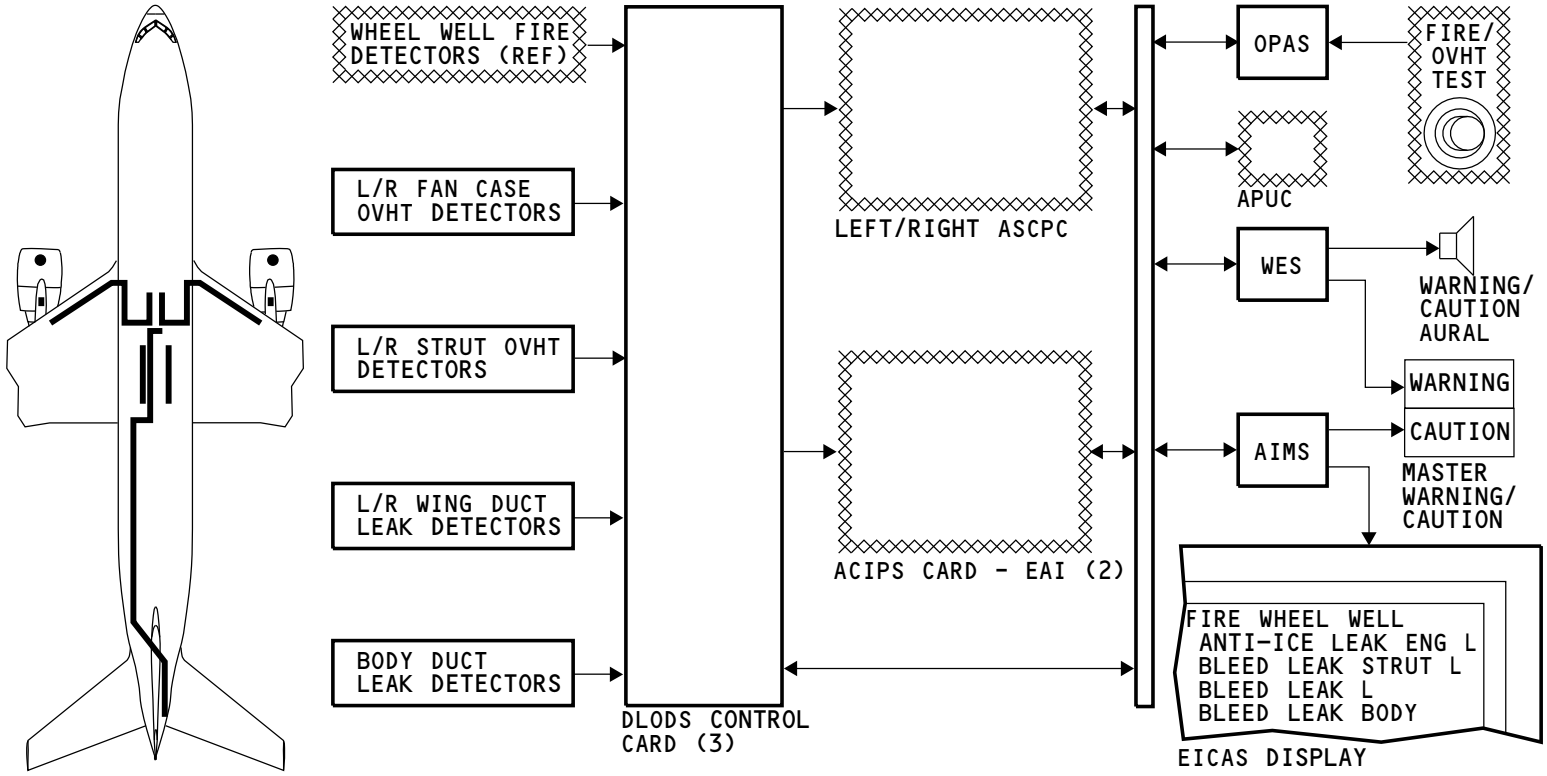
See the wheel well fire detection system section for more information about the wheel well fire detection system (SECTION 26-17).

Duct Leak and Overheat Detection

If a detector finds an overheat condition, the DLODS control cards send a signal on the data bus. The warning electronic unit turns on the master caution aural. The AIMS turns on the master caution lights and shows an EICAS caution message. For a fan case overheat condition, the DLODS control cards also send a signal to the EAI ACIPS cards to close the engine anti-ice valve. For a strut overheat condition, a wing duct leak, or a body duct leak, the DLODS control cards send a signal to the ASCPC. Pneumatic system valves close automatically to isolate the leak. A signal to the APUC causes the APU surge valve to open if necessary.

BITE

The DLODS cards continuously monitor the detectors for open and short circuits. For either condition, the DLODS control cards send a signal to the AIMS. A status message shows which detector has failed.



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DUCT LEAK AND OVERHEAT DETECTION - GENERAL DESCRIPTION

Engine Struts and Nacelles

These DLODS components are in the engine struts and nacelles:

- Right strut overheat detectors
- Right fan case overheat detector
- Left strut overheat detectors
- Left fan case overheat detector.

Wings and Fuselage

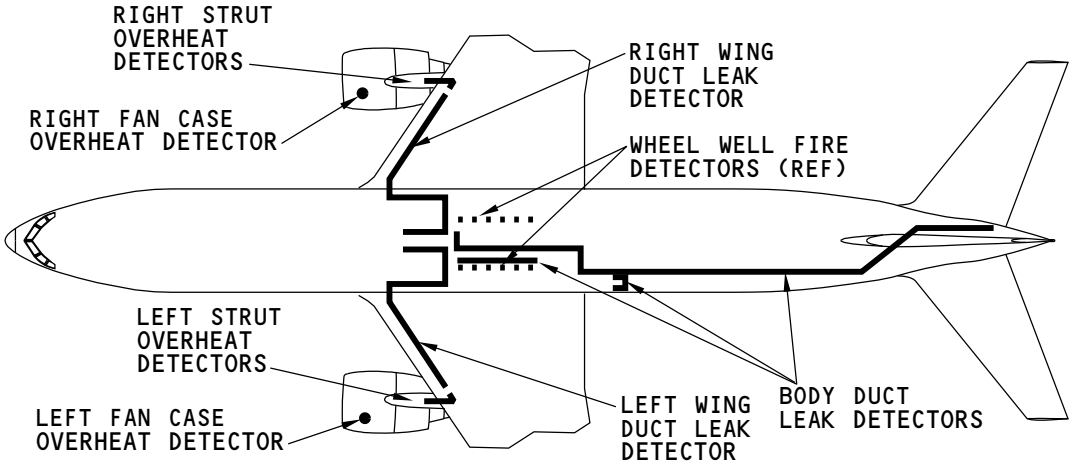
These DLODS components are in the wings and fuselage:

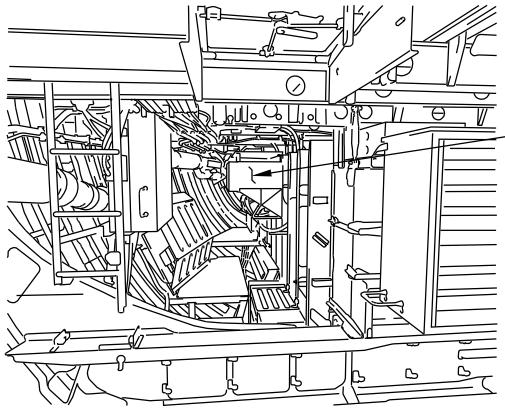
- Right wing duct leak detector
- Body duct leak detectors
- Left wing duct leak detector.

Main Equipment Center

These DLODS components are in the main equipment center:

- Left DLODS control card
- Right DLODS control card
- Center DLODS control card.

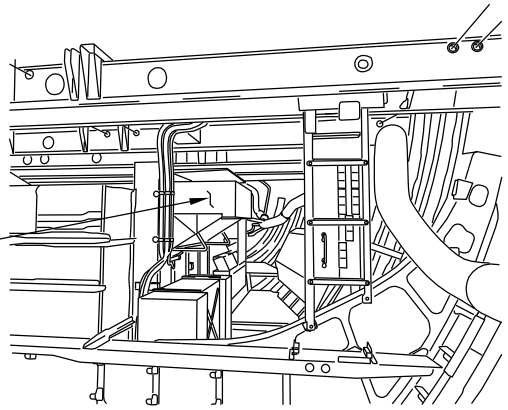




MAIN EQUIPMENT CENTER
(LEFT SIDE, LOOKING FORWARD)

P85 LEFT SYSTEMS CARD FILE
- LEFT DLODS CONTROL CARD

P84 RIGHT SYSTEMS CARD FILE
- RIGHT DLODS CONTROL CARD
- CENTER DLODS CONTROL CARD



MAIN EQUIPMENT CENTER
(RIGHT SIDE, LOOKING FORWARD)

M40820 S000617181_V1

DUCT LEAK AND OVERHEAT DETECTION - COMPONENT LOCATIONS

DUCT LEAK AND OVERHEAT DETECTION - FAN CASE OVERHEAT DETECTORS

Purpose

The fan case overheat detector monitors the temperature in the area around the engine fan case. A leak in the engine anti-ice duct causes an overheat condition.

Physical Description

The fan case overheat detector has two elements: loop 1 and loop 2, attached to a metal support. Bolts connect the elements to the airplane wiring.

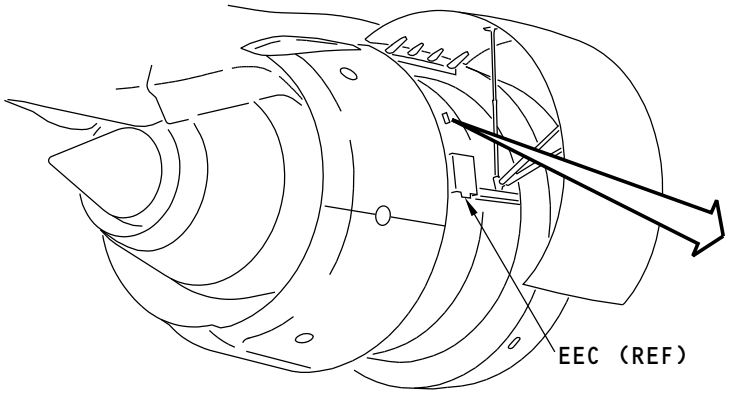
Each element has an outer conductor around an inner conductor. The separator between these conductors is an electrical insulator at temperatures less than the overheat set point (255F, 124C).

Functional Description

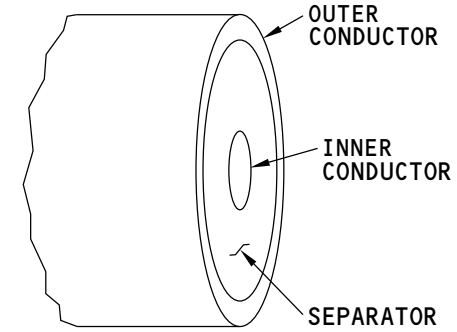
When the temperature is more than the set point, the separator conducts electricity. The electrical continuity between the inner and outer conductors gives an input to the DLODS control card.

Location

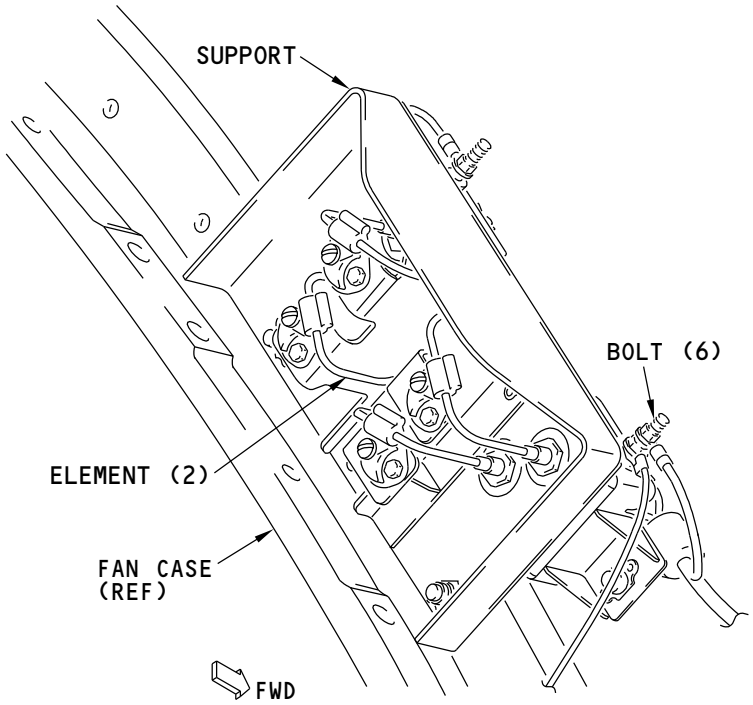
The fan case overheat detector attaches to the right side of the fan case above the electronic engine control.



ENGINE RIGHT SIDE



CROSS SECTION OF ELEMENT



FAN CASE OVERHEAT DETECTOR

M40822 S000617183_V1

DUCT LEAK AND OVERHEAT DETECTION - FAN CASE OVERHEAT DETECTORS

DUCT LEAK AND OVERHEAT DETECTION - STRUT OVERHEAT DETECTORS

Purpose

The strut overheat detectors monitor the temperature in the engine strut and the wing leading edge immediately inboard of the strut. A leak in the pneumatic duct causes an overheat condition.

Physical Description

Each side of the airplane has a dual loop strut overheat detector circuit. Each loop in the circuit has a set of elements that connect in series. Clips attach one long pair of elements to the front of the wing spar. A metal frame assembly contains another pair of elements. Electrical connectors and bolts connect the elements to the airplane wiring.

Each element has an outer conductor around an inner conductor. The separator between these conductors is an electrical insulator at temperatures less than the overheat set point (310F, 154C).

Functional Description

When the temperature is more than the set point, the separator conducts electricity. The electrical continuity between the inner and outer conductors gives an input to the DLODS control card.

Location

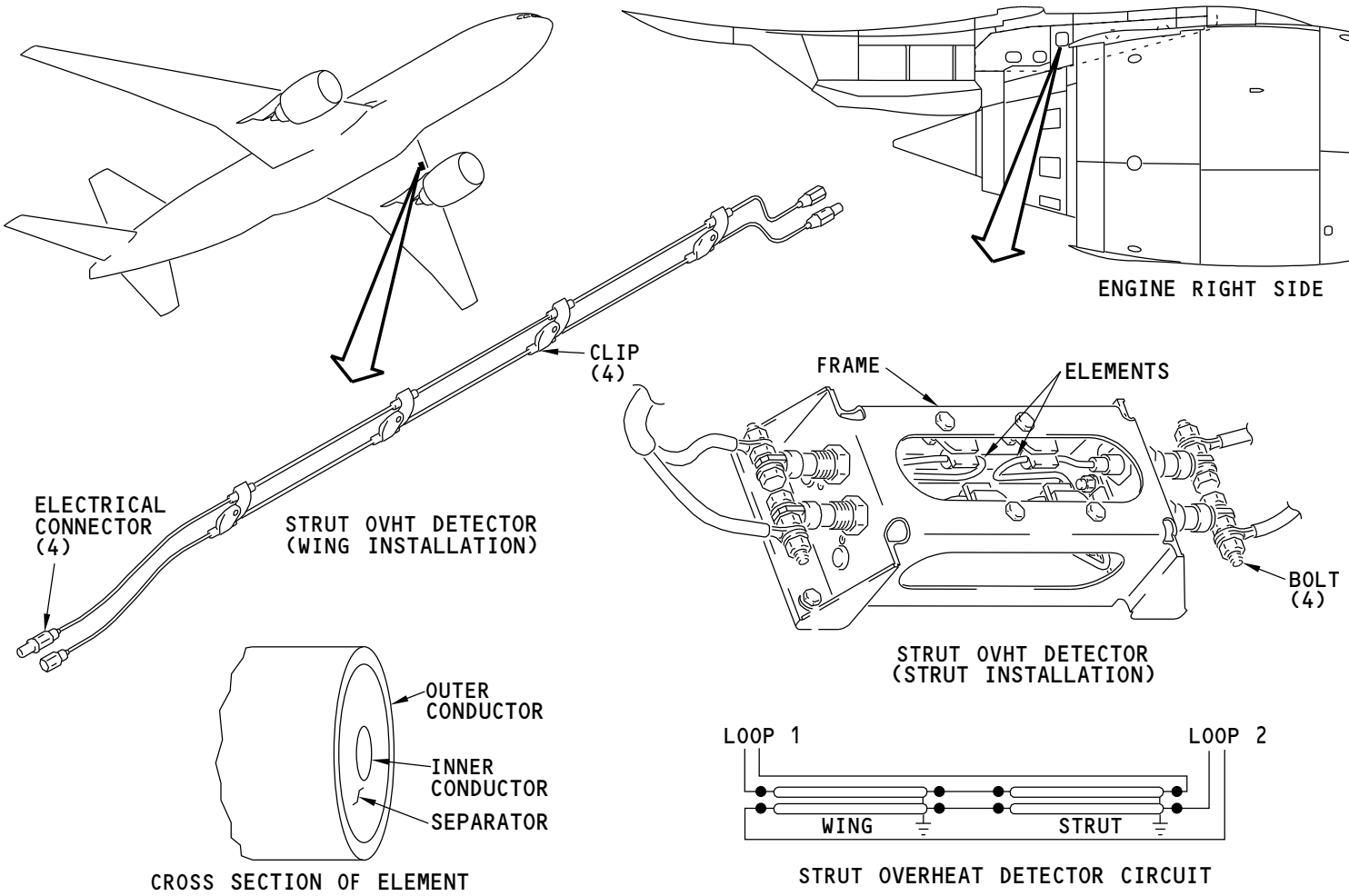
The strut overheat detectors are in two locations. One type is in the wing leading edge and another type is in the engine strut.

Access to the detector in the wing is through two panels on the bottom of the fixed leading edge. The panels are immediately inboard of the strut.

Access to the detector in the strut is through the pressure relief door in the right side of the strut.

Training Information Point

The strut overheat detection system has a fault locating feature for the detector loops. Maintenance messages include a zone number to help you find the location of a duct leak or a short circuit.



M40824 S000617185_V1

DUCT LEAK AND OVERHEAT DETECTION - STRUT OVERHEAT DETECTORS

DUCT LEAK AND OVERHEAT DETECTION - WING DUCT LEAK DETECTORS

Purpose

Wing duct leak detectors monitor the pneumatic distribution ducts in the wing leading edges and in the environmental control system (ECS) bays for leaks.

Physical Description

Each side of the airplane has a dual loop wing duct leak detector circuit. Each loop in the circuit has five elements that connect in series. Clips along the length of the detectors attach the elements to the structure.

Each element has an outer conductor around an inner conductor. The separator between these conductors is an electrical insulator at temperatures less than the overheat set point (255F, 124C).

Functional Description

When the temperature is more than the set point, the separator conducts electricity. The electrical continuity between the inner and outer conductors gives an input to the DLODS control card.

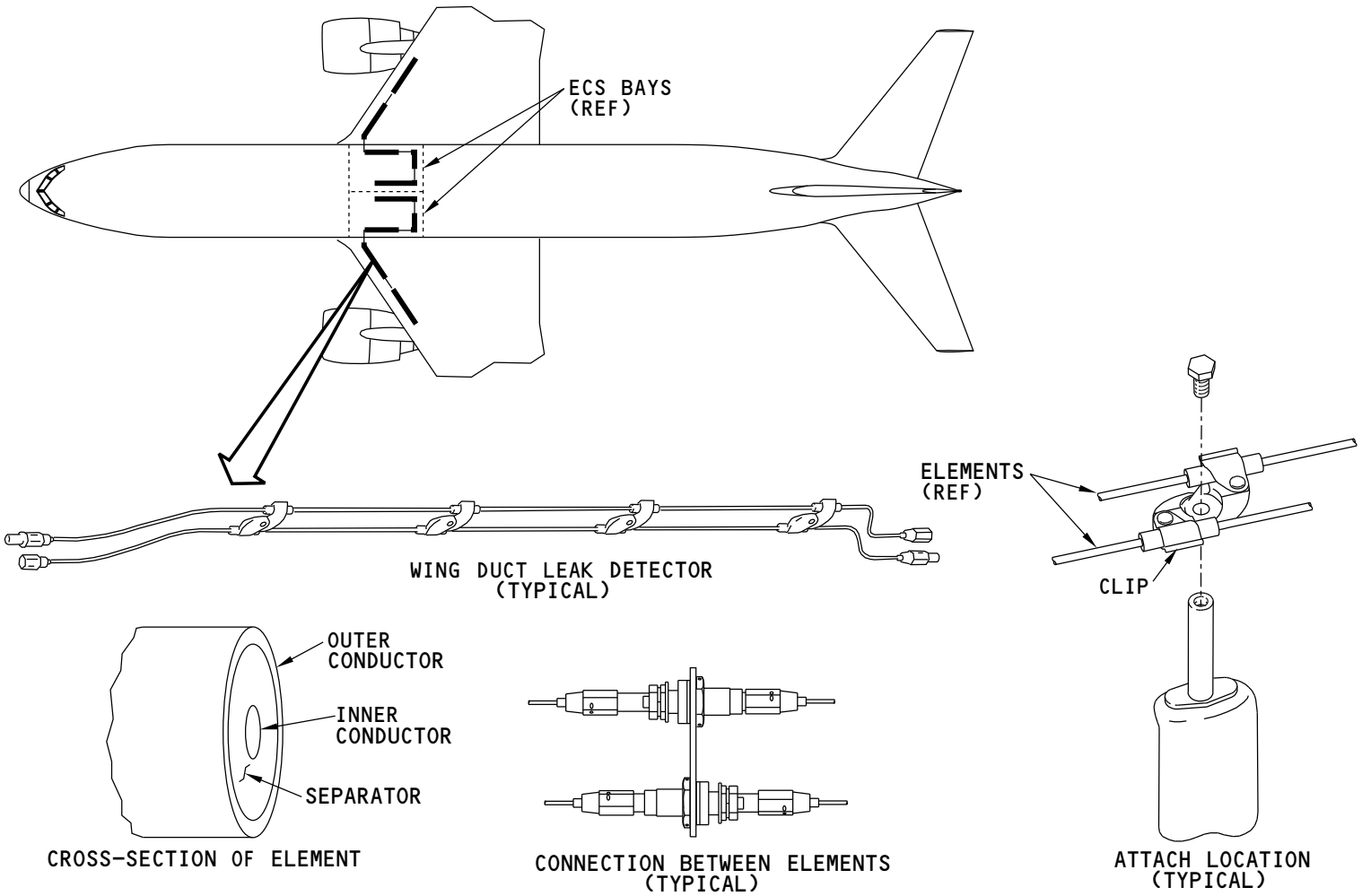
Location

The wing duct leak detectors are near the pneumatic distribution system ducts in the wing leading edges and in the ECS bays.

Training Information Point

Where loop 1 uses a male connector, loop 2 uses a female connector to prevent cross connection of the loops.

The wing duct leak detection system has a fault locating feature for the detection loops. Maintenance messages include a zone number to help you find the location of a duct leak, short circuit, or open circuit.



M40827 S000617188_V1

DUCT LEAK AND OVERHEAT DETECTION - WING DUCT LEAK DETECTORS

DUCT LEAK AND OVERHEAT DETECTION - BODY DUCT LEAK DETECTORS

Purpose

Body duct leak detectors monitor the pneumatic distribution ducts for leaks in these areas:

- Main wheel wells
- Outboard of the aft and bulk cargo compartments, left side
- Fuselage from the aft pressure bulkhead to the APU firewall
- Air driven pump area.

Physical Description

The airplane has a dual loop body duct leak detector circuit. Each loop in the circuit has fourteen elements that connect in series. Clips along the length of the assembly attach the elements to the structure.

Each element has an outer conductor around an inner conductor. The separator between these conductors is an electrical insulator at temperatures less than the overheat set point (255F, 124C).

Functional Description

When the temperature is more than the set point, the separator conducts electricity. The electrical continuity between the inner and outer conductors gives an input to the DLODS control card.

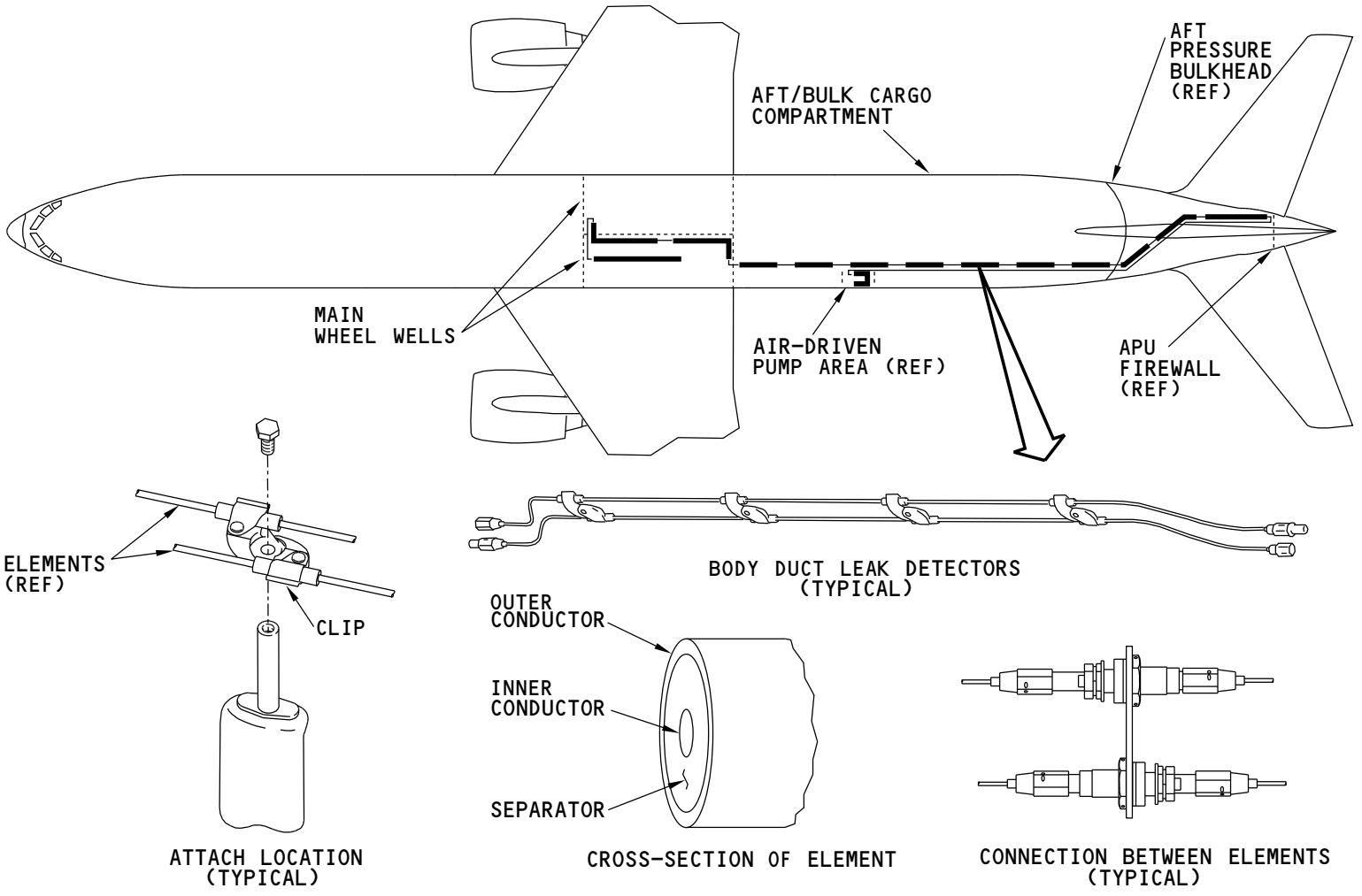
Location

The body duct leak detectors are near the pneumatic distribution ducts in the body areas. The detectors extend from the main wheel wells to the APU firewall.

Training Information Point

Where loop 1 uses a male connector, loop 2 uses a female connector to prevent cross connection of the loops.

The body duct leak detection system has a fault location feature for the detector loops. Maintenance messages include a zone number to help you find the location of a duct leak, short circuit, or open circuit.



M40829 S000617190_V1

DUCT LEAK AND OVERHEAT DETECTION - BODY DUCT LEAK DETECTORS

DUCT LEAK AND OVERHEAT DETECTION - FUNCTIONAL DESCRIPTION

General

The three DLODS control cards monitor the detector loops. Each DLODS control card uses ARINC 429 buses and two ARINC signal gateway (ASG) cards as an interface with the ARINC 629 systems buses. The DLODS control cards use this configuration to send data to each other and to other systems and LRUs.

Detector Status

Each detector loop has three possible conditions:

- Usual - low impedance in the inner conductor loop circuit and high impedance between the inner and outer conductors
- Open circuit - high impedance in the inner conductor loop circuit
- Short circuit - low impedance between the inner and outer conductors.

A loop in the usual condition has no electrical defects and no overheat condition. A loop with an open circuit is broken or disconnected from the card. A loop with a short circuit is damaged or has an overheat condition.

Control Card Logic

The cards compare the condition of both loops of a detector to find an overheat condition. The cards transmit an overheat signal if both loops have a short circuit. The cards also transmit an overheat signal if one loop has a short circuit while the other loop has an open circuit.

If a DLODS control card fails, the remaining cards do not get information about the loops connected to the failed card. The operating cards transmit an overheat signal if one loop has a short and the other loop connects to a failed card.

Interfaces

A wheel well fire causes an EICAS warning message and master warning indications. The fire/overheat test switch does a test of the wheel well fire detection part of DLODS.

Duct leak or overheat conditions cause EICAS caution messages and master caution indications. The duct leak or overheat input to the ASCPCs causes pneumatic system valves to close and isolate the leak. The input to the APUC causes the APU surge valve to open if it is necessary. A fan case overheat input to the ACIPS cards causes the engine anti-ice valve to close.

Training Information Point

The AIMS shows a loop failure status messages if a loop is not in the usual condition. The message specifies the detector circuit and the loop. The message shows for loops with open or short circuits. If there is an overheat condition, loop failure messages show for both detector loops. If a DLODS control card fails, loop failure messages show for all the loops that connect to that card.

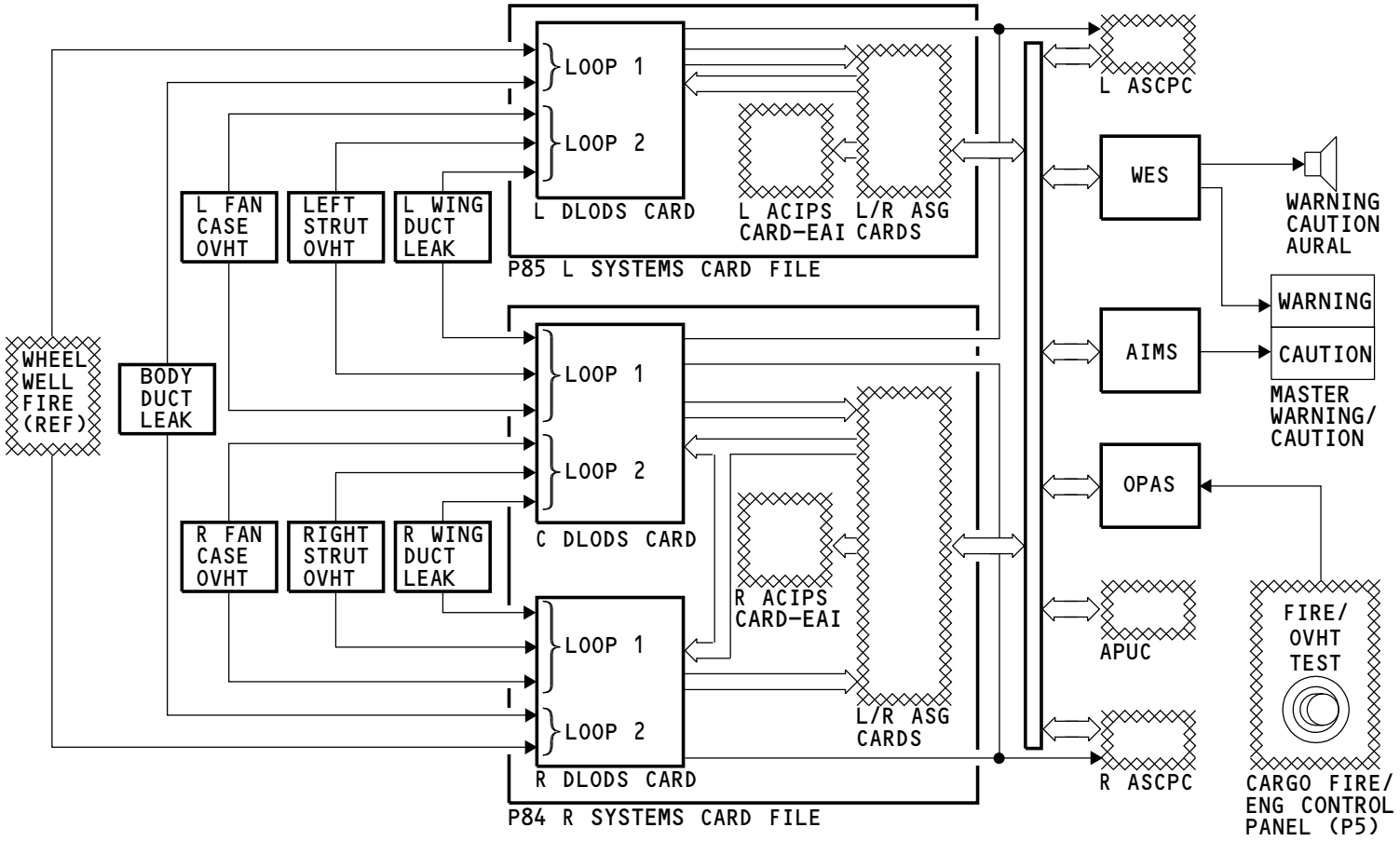
The central maintenance computing system also shows messages for loops not in the usual condition. The maintenance message specifies the detector circuit, loop, and if the problem is an open or short. The message also specifies the zone location for these failures:

- Strut overheat detectors - short circuit
- Wing duct leak detectors - short and open
- Body duct leak detectors - short and open.

The zone location for a short circuit helps you find electrical defects and duct leaks.

The CMCS also shows a maintenance message for a failed DLODS control card.

You use the MAT data load function to replace the software in the DLODS control cards.



M40830 S000617191_V1

DUCT LEAK AND OVERHEAT DETECTION - FUNCTIONAL DESCRIPTION

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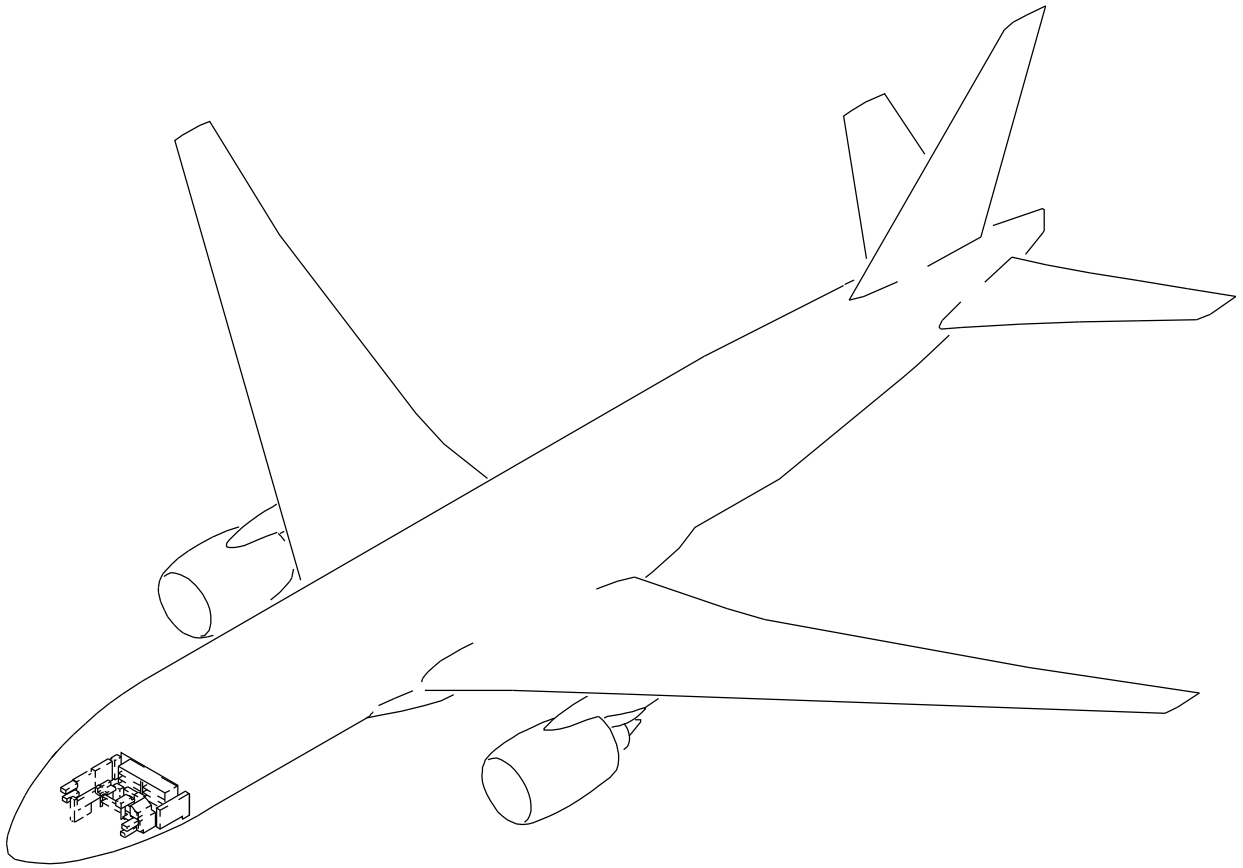
ELECTRICAL/ELECTRONIC (E/E) COOLING SMOKE DETECTION - INTRODUCTION

Purpose

The electrical/electronic cooling smoke detection system monitors the forward equipment cooling system airflow for smoke.

General

The smoke detection system has an interface with the equipment cooling system. If there is smoke in the equipment cooling system supply or exhaust, the system operates in the override mode. This removes the smoke from the airplane.



M40831 S000617193_V1

ELECTRICAL/ELECTRONIC (E/E) COOLING SMOKE DETECTION - INTRODUCTION

E/E COOLING SMOKE DETECTION - GENERAL DESCRIPTION

General

The electrical/electronic (E/E) cooling smoke detector monitors air from the supply and exhaust parts of the forward equipment cooling system. If the detector finds smoke in the air, the equipment cooling system goes into the override mode. When the airplane is pressurized, cabin differential pressure causes the smoke to go overboard.

Interfaces

The E/E cooling smoke detector has interfaces with the AIMS and the ECS miscellaneous cards (ECSMCs) through the forward cargo smoke detector and the ASG cards.

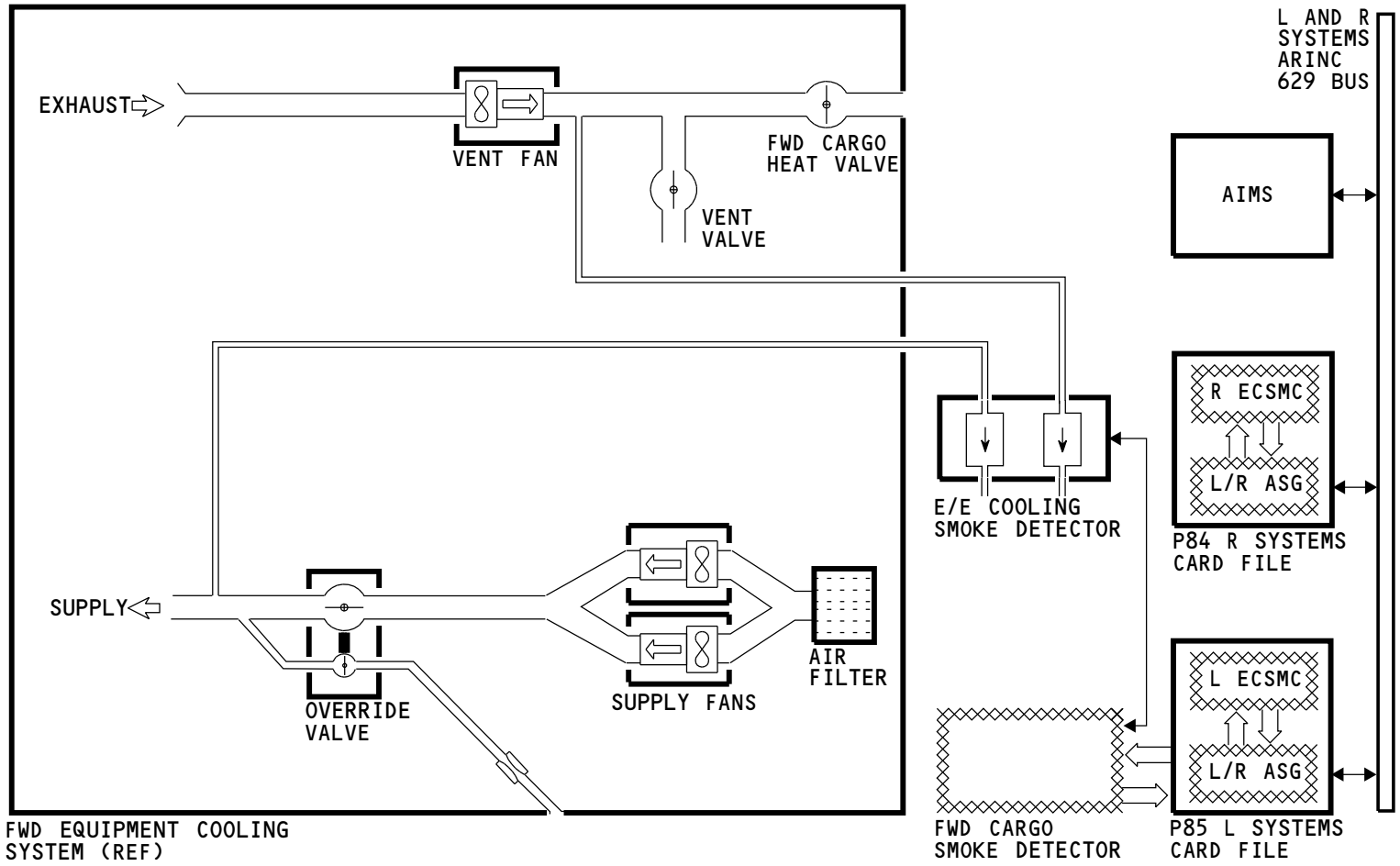
The forward cargo smoke detector controls the E/E cooling smoke detector, supplies electrical power to it, and gets smoke alarms from it.

General Operation

If there is smoke in the equipment cooling airflow, the E/E cooling smoke detector sends an alarm signal to the forward cargo smoke detector. The forward cargo smoke detector sends alarm data to the systems card files. In the card files, the alarm data goes to the ECSMCs. The ECSMC that is in control of the equipment cooling system puts the system into the override mode.

System Tests

The E/E cooling smoke detector has BITE. Fault data goes to the forward cargo smoke detector, to the left systems card file, then to the AIMS. Faults cause EICAS status messages.



M40832 S000617194_V1

E/E COOLING SMOKE DETECTION - GENERAL DESCRIPTION

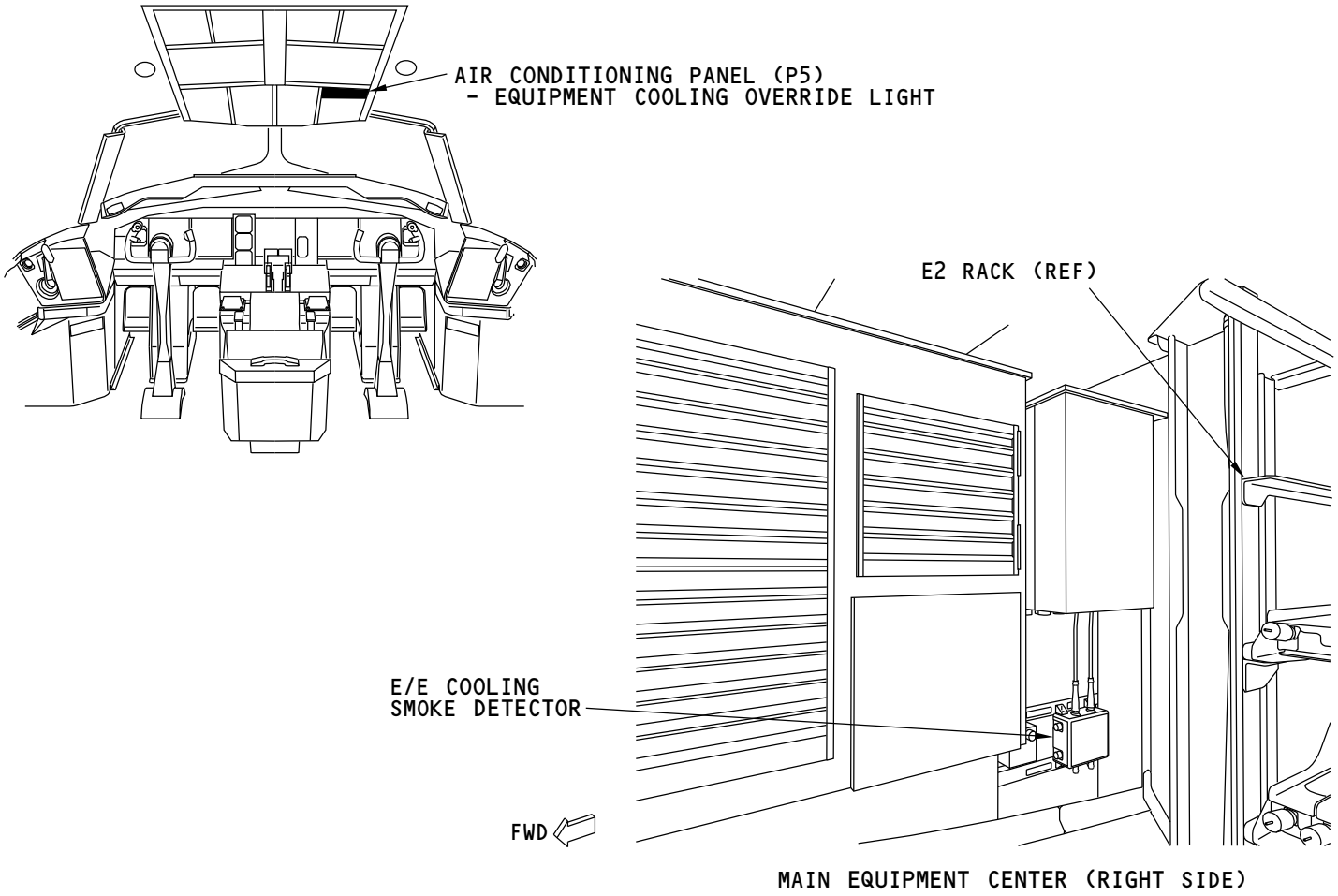
E/E COOLING SMOKE DETECTION - COMPONENT LOCATIONS

Flight Deck Component Locations

The air conditioning panel has an interface with the electrical/electronic cooling smoke detection system.

MEC Component Locations

The E/E cooling smoke detector is in the main equipment center. It is on the right side, just outboard of the E2 rack.



M40833 S000617195_V1

E/E COOLING SMOKE DETECTION - COMPONENT LOCATIONS

E/E COOLING SMOKE DETECTION - E/E COOLING SMOKE DETECTOR - INTRODUCTION

Purpose

The E/E cooling smoke detector monitors air in the forward equipment cooling system for smoke.

Physical Description

The E/E cooling smoke detector has these components:

- Two air inlet ports
- Four mounting brackets
- Two smoke detection chambers (internal)
- Two electronic control channels (internal)
- Two air outlet ports
- Two electrical connectors.

Location

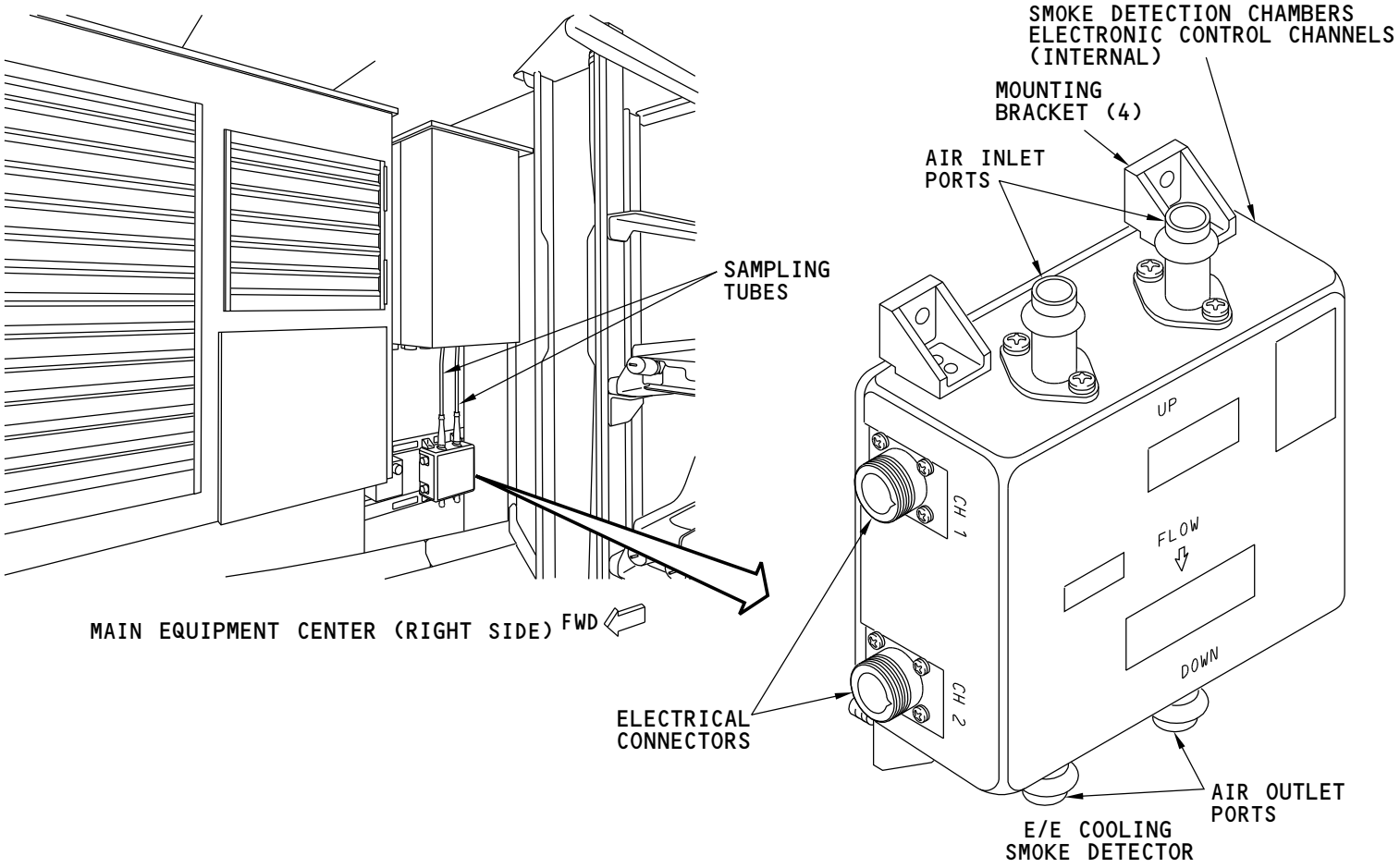
The E/E cooling smoke detector is on the right side of the main equipment center, outboard of the E2 rack.

Training Information Point

There is no scheduled maintenance of the E/E cooling smoke detector. Status and maintenance messages show if there is a fault condition.

The smoke detector is an LRU. Four bolts attach the smoke detector to the structure. Two sampling tubes connect to the air inlet ports. The sampling tubes are made of aluminum and attached to the structure with clamps. This makes it difficult to connect them to the wrong inlet ports on the detector. Each smoke detector channel has its own electrical connector. The two connectors are different so you cannot cross-connect the wires.

The smoke detector has no internal LRUs.



M40834 S000617196_V1

E/E COOLING SMOKE DETECTION - E/E COOLING SMOKE DETECTOR - INTRODUCTION

E/E COOLING SMOKE DETECTION - E/E COOLING SMOKE DETECTOR - FUNCTIONAL DESCRIPTION

General

The two channels contain identical circuits. The forward cargo smoke detector makes a decision about which channel operates. The operating channel monitors the optical smoke detectors.

Optical Smoke Detectors

The optical smoke detector has these parts:

- Two source light emitting diodes (LEDs)
- Two intensity monitor photodiodes
- Two scatter detector photodiodes.

One set of diodes connects to channel 1. The other set of diodes connects to channel 2.

Inside the smoke detection chamber, air flows between a source LED and a scatter detector photodiode. Normally, only a small amount of light from the lED reaches the scatter detector. If the air has smoke in it, the smoke particles reflect more light onto the scatter detector. This causes a smoke alarm signal.

The intensity monitor photodiode makes sure the source LED is on and keeps the output of the source LED constant. This configuration also finds contamination of the LED and photodiodes.

BITE

The detector does power-up and periodic BITE tests. The power-up BITE includes these tests:

- Supply voltage
- Source LED intensity
- Optical contamination
- Scatter detector operation.

The periodic BITE test monitors the source LED intensity and the scatter detector operation.

If the operating channel fails, BITE sends a signal to the forward cargo smoke detector. That smoke detector causes the other E/E cooling smoke detector channel to operate.

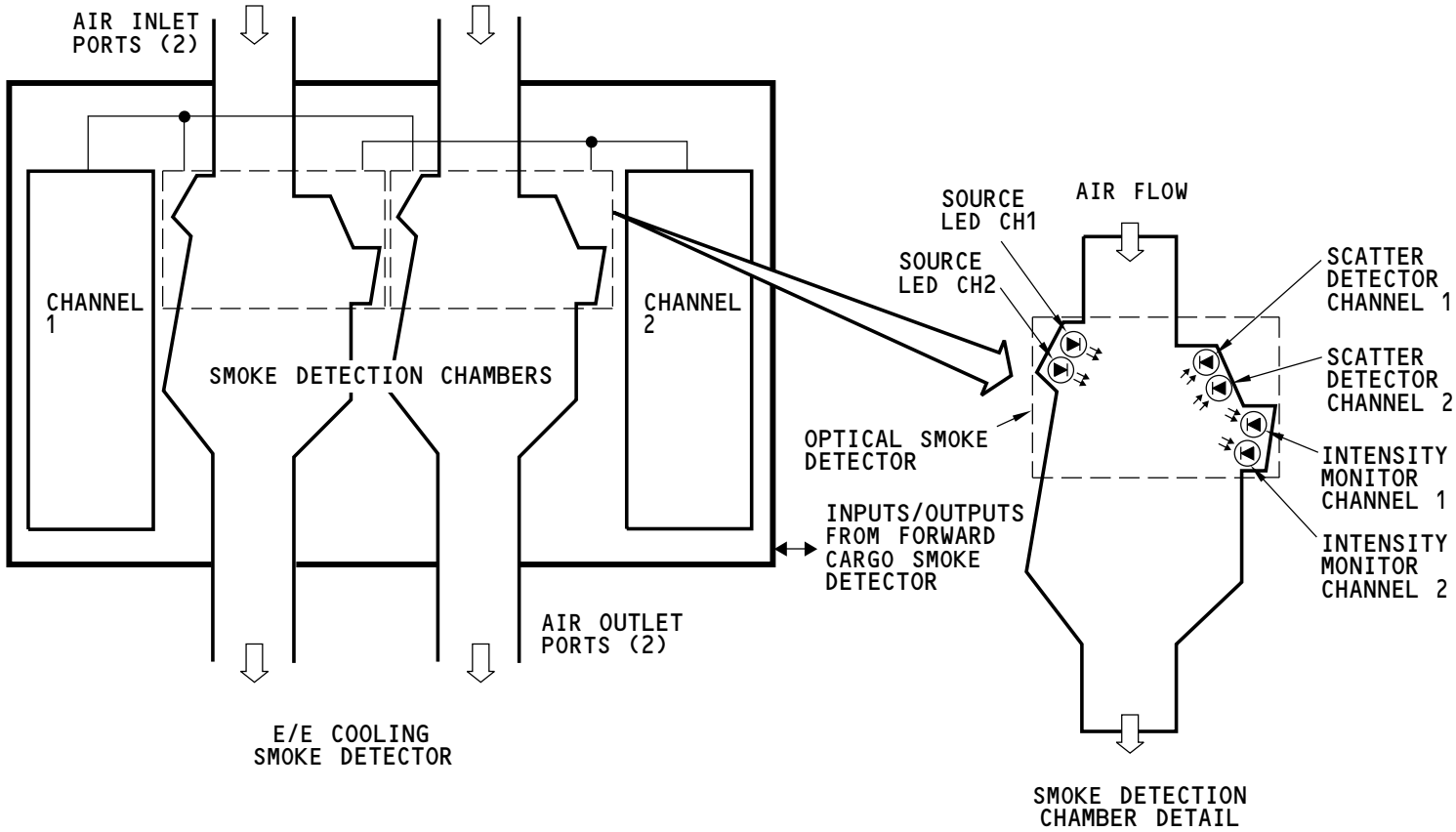
Inputs And Outputs

The smoke detector gets these inputs from the forward cargo smoke detector:

- 10.5v dc power
- LED 1 and 2 on/off

The smoke detector sends these outputs to the forward cargo smoke detector:

- Smoke alarm, chamber 1, channel 1
- Smoke alarm, chamber 2, channel 1
- Smoke alarm, chamber 1, channel 2
- Smoke alarm, chamber 2, channel 2
- Channel 1 BITE test pass/fail
- Channel 2 BITE test pass/fail.



M40835 S000617197_V1

E/E COOLING SMOKE DETECTION - E/E COOLING SMOKE DETECTOR - FUNCTIONAL DESCRIPTION

E/E COOLING SMOKE DETECTION - FUNCTIONAL DESCRIPTION

General

The E/E cooling smoke detector connects to the forward lower cargo smoke detector. The cargo smoke detector has two identical electronic channels. Channel 1 controls during one electrical power cycle, channel 2 controls during the next power cycle.

Each channel of the E/E cooling smoke detector connects to the related channel in the forward lower cargo smoke detector. The E/E cooling smoke detector gets these inputs from the cargo smoke detector control channel:

- DC power
- LED 1 and 2 on/off signals.

The E/E cooling smoke detector sends these outputs to the Lower cargo smoke detector control channel:

- Alarm 1 (smoke in detection chamber 1
- Alarm 2 (smoke in detection chamber 2)
- BITE pass/fail.

Smoke Detection

If there is smoke in one or two detection chambers, the E/E cooling smoke detector sends an alarm signal to the forward cargo smoke detector. The forward cargo smoke detector sends the alarm signal through the ARINC 429 bus to the ASG cards and left ECS miscellaneous card. The ASG cards transmit the alarm signal over the ARINC 629 buses to these systems and components:

- Overhead panel ARINC 629 system (OPAS)
- AIMS
- Right systems cardfile.

The OPAS makes a ground to turn on the E/E cooling override light. The AIMS causes a status message to show. The central maintenance computing function records the event as a flight deck effect for the in-bound flight. In the right systems cardfile, the ASG cards send the alarm signal to the right ECS miscellaneous card. The ECS miscellaneous cards put the equipment cooling system into the override mode. This sends the smoke overboard.

BITE

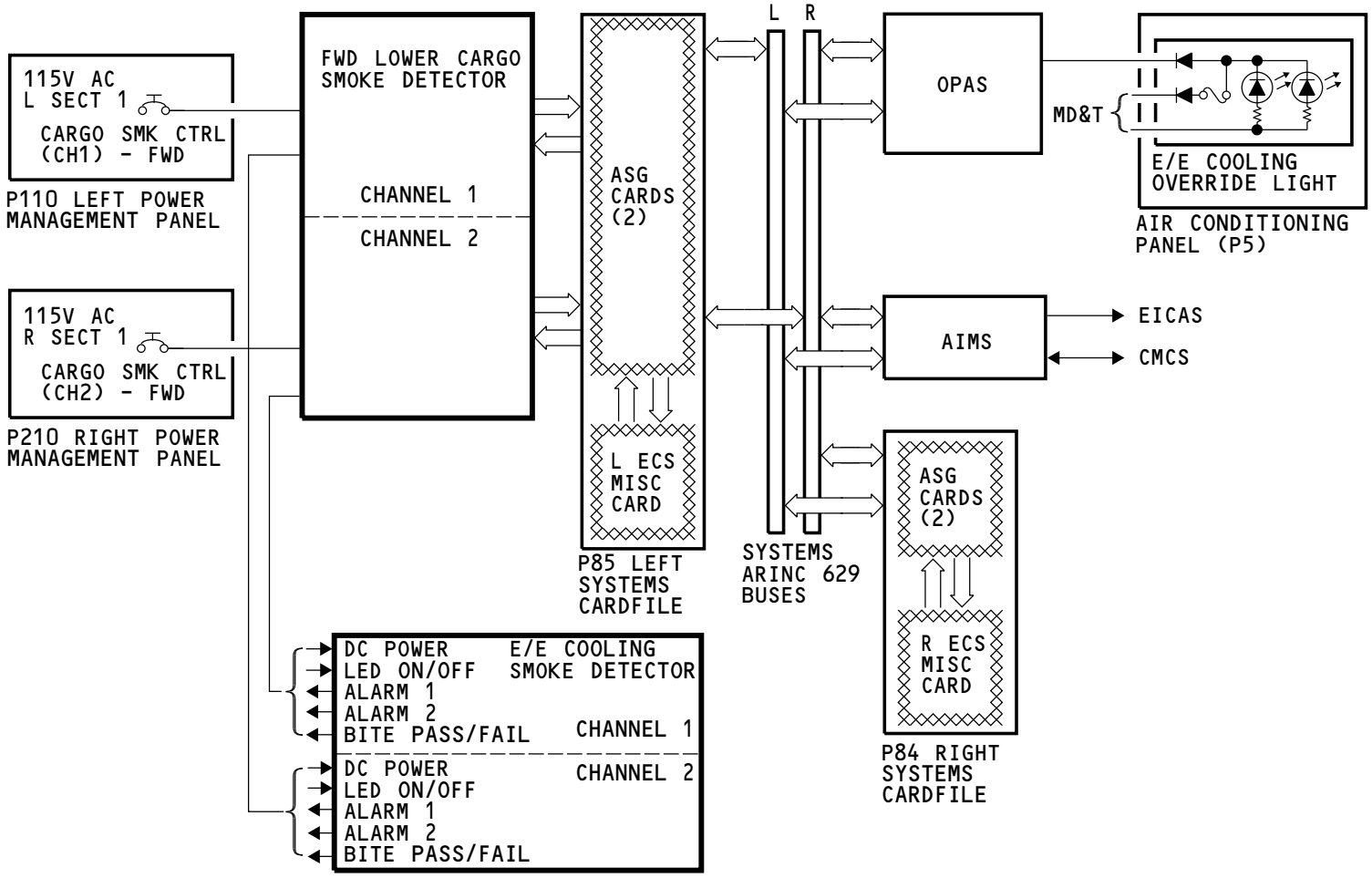
The forward cargo smoke detector controls the BITE circuits in the E/E cooling smoke detector. BITE tests occur when the system first gets power and regularly during operation. If the E/E cooling smoke detector fails a BITE test, it sends a BITE fail signal to the cargo smoke detector. The signal causes these things to occur:

- The cargo smoke detector operates the other channel in the E/E cooling smoke detector
- The cargo smoke detector puts the fault data in memory
- The cargo smoke detector sends the fault information to the AIMS. The CMCS shows status and maintenance messages.

You can do a test of the system from the MAT. AIMS tells the cargo smoke detector to do a power-up BIT sequence.

Training Information Point

Use the MAT to get E/E cooling smoke detector fault data from the cargo smoke detector memory.



M40836 S000617198_V1

E/E COOLING SMOKE DETECTION - FUNCTIONAL DESCRIPTION

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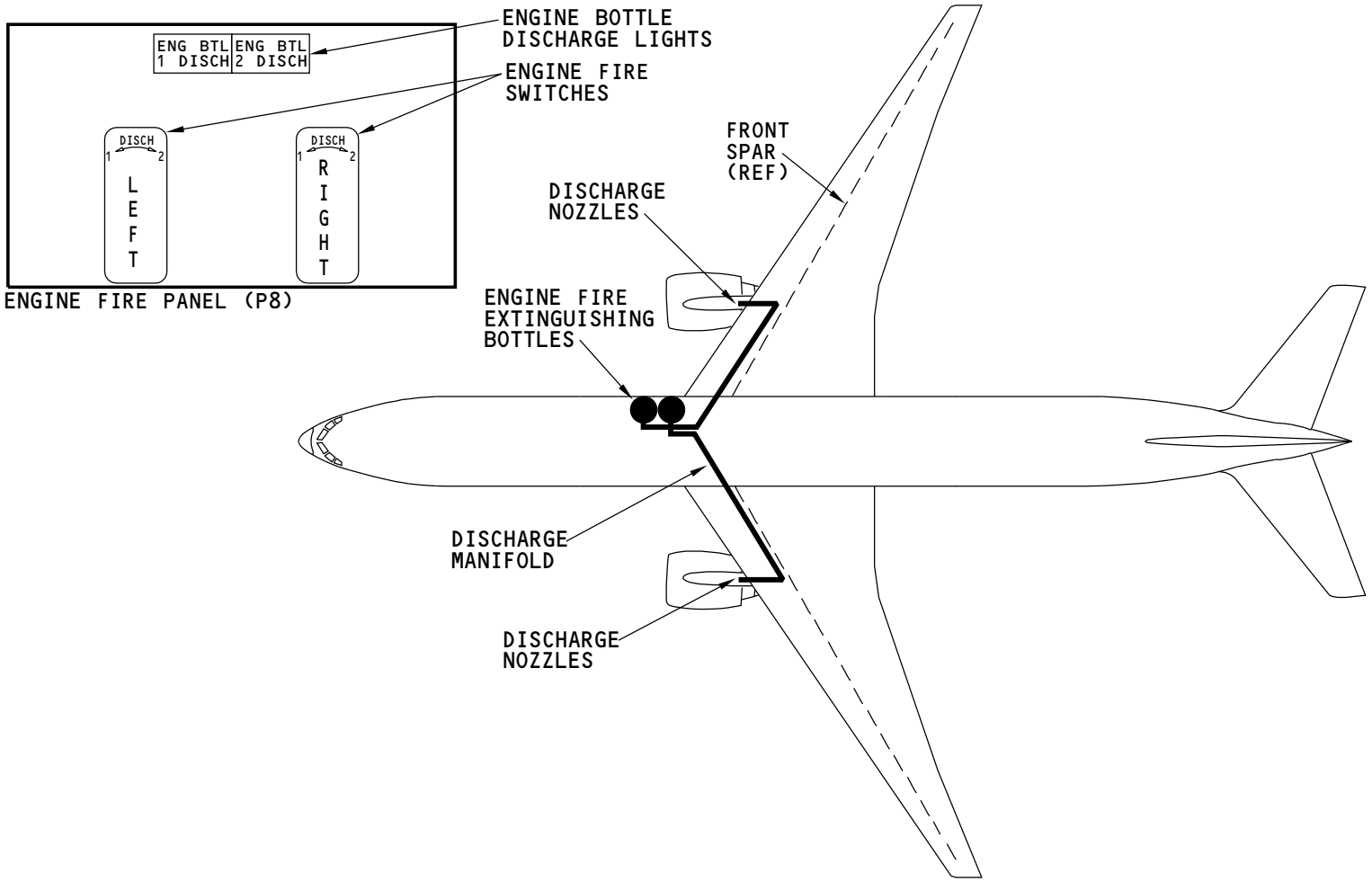
ENGINE FIRE EXTINGUISHING - INTRODUCTION

Purpose

The engine fire extinguishing system extinguishes fires in the engine nacelles.

General Description

The two fire extinguishing bottles contain halon fire extinguishing agent pressurized with nitrogen. You use the engine fire switches in the flight deck to release the halon. Halon from each bottle can go to the right or left engine. EICAS messages, status messages, and indicator lights show when the bottle pressure is low.



M40838 S000617200_V1

ENGINE FIRE EXTINGUISHING - INTRODUCTION

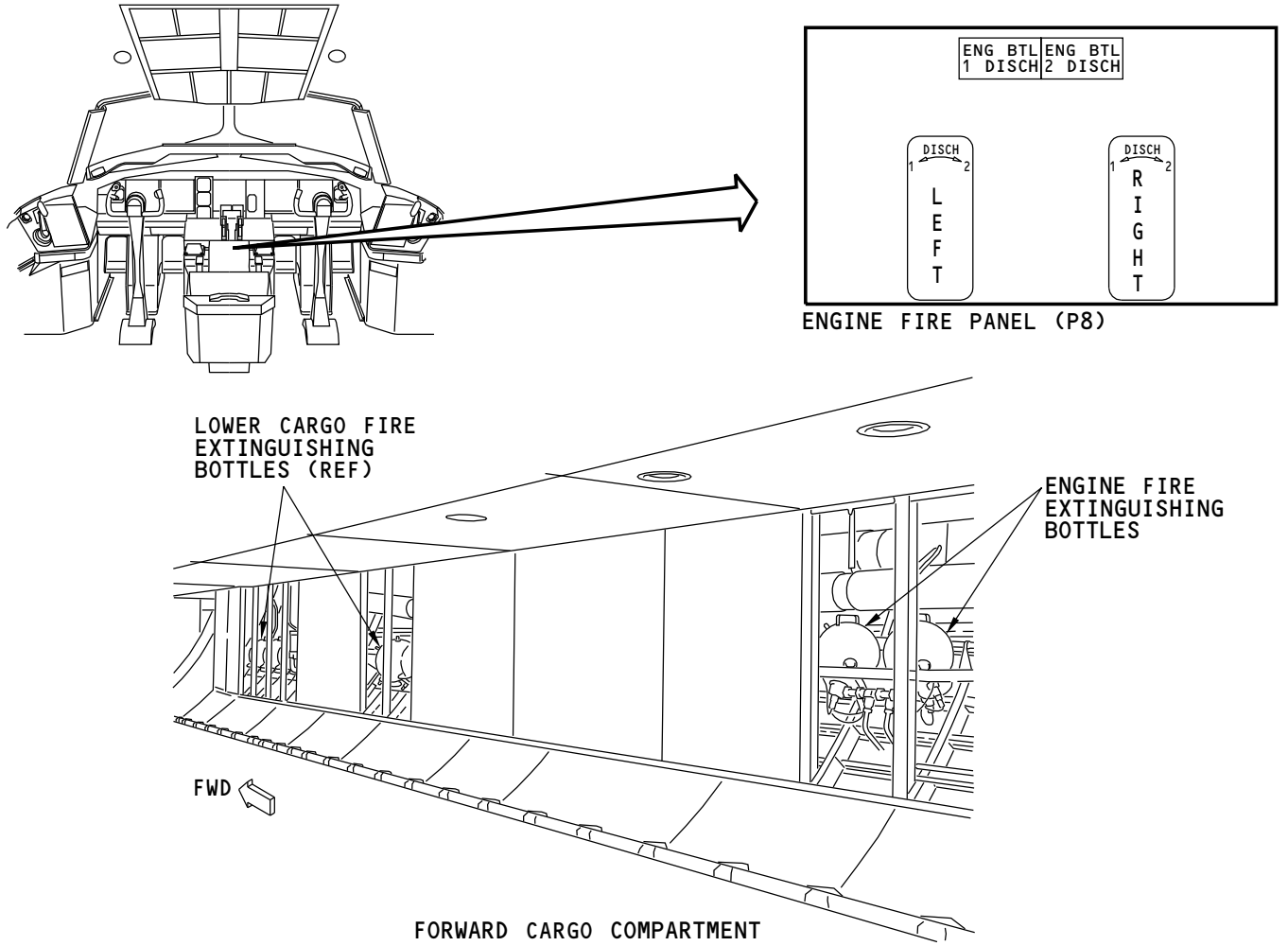
ENGINE FIRE EXTINGUISHING - COMPONENT LOCATIONS

Flight Deck Component Locations

The engine fire panel is in the flight deck on the P8 aisle stand.

Forward Cargo Compartment Component locations

The two engine fire extinguishing bottles are behind the right sidewall lining of the forward cargo compartment, aft of the cargo door. Open the cargo compartment lining to get access to the bottles.



M40840 S000617202_V1

ENGINE FIRE EXTINGUISHING - COMPONENT LOCATIONS

ENGINE FIRE EXTINGUISHING - ENGINE FIRE EXTINGUISHING BOTTLES

Purpose

The engine fire extinguishing bottles contain the fire extinguishing agent.

Location

The two fire extinguishing bottles are outboard of the right sidewall lining of the forward cargo compartment. The access panel is identified ENGINE FIRE EXTINGUISHER ACCESS PANEL.

Physical Description

The two engine fire extinguishing bottles are identical. Each bottle has these components:

- A safety relief and fill port
- A handle for removal and installation
- A pressure switch
- Two discharge assemblies
- An identification plate
- Four mounting lugs.

The engine fire extinguishing bottles are interchangeable with the APU fire extinguishing bottle.

Functional Description

The bottles contain halon fire extinguishing agent pressurized with nitrogen. If the pressure in the bottle becomes too high, the safety relief and fill port opens so the bottle does not explode. The discharge assembly has an explosive squib. An electric current from the fire extinguishing circuit fires the squib. This releases the halon through the discharge port.

The pressure switch gives flight deck indications when bottle pressure decreases. The switch monitors the pressure inside the bottle and is normally open. When the pressure decreases because of a leak or because of bottle discharge, the switch closes an indicating circuit.

Training Information Point

A special service platform is available which makes bottle replacement easier.

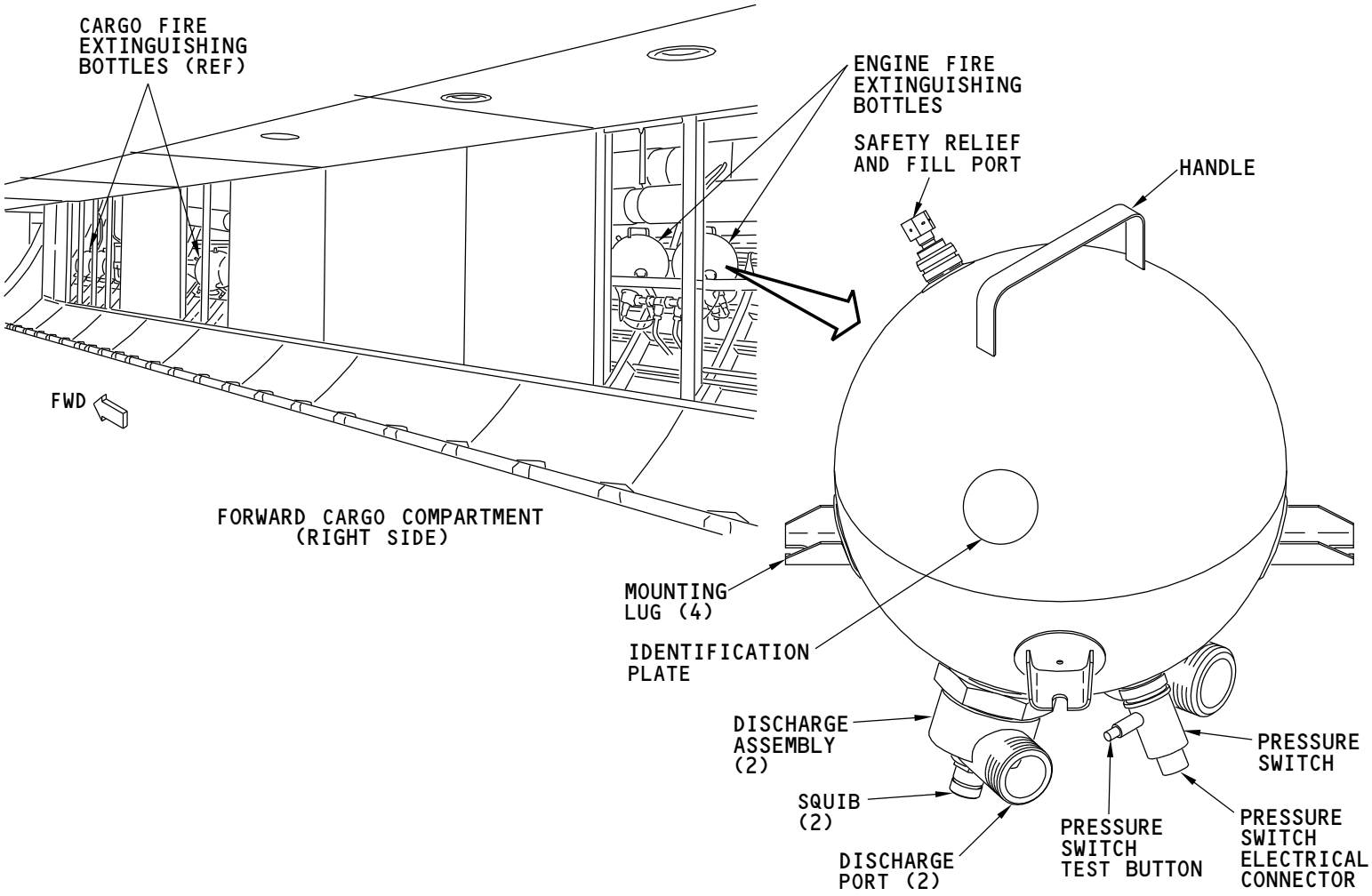
When you replace bottles, handle them carefully to prevent damage. Compare the weight of the new bottle with the weight on the identification plate. This prevents installation of a bottle which is not full.

The discharge ports for the left and right engines are different sizes. This prevents crossed connections. Install the bottle with the identification plate inboard.

WARNING BE CAREFUL WHEN YOU MOVE THE FIRE EXTINGUISHING BOTTLE. THE FIRE EXTINGUISHING BOTTLE IS HIGHLY PRESSURIZED AND HAS AN EXPLOSIVE CARTRIDGE AS A COMPONENT. ACCIDENTAL DISCHARGE OF THE FIRE EXTINGUISHING BOTTLE CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

WARNING DO NOT TOUCH THE SQUIB BEFORE YOU DO THE PROCEDURES FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE TO RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, THE FIRE EXTINGUISHING BOTTLE CAN RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.



M40842 S000617204_V1

ENGINE FIRE EXTINGUISHING - ENGINE FIRE EXTINGUISHING BOTTLES

ENGINE FIRE EXTINGUISHING - ENGINE FIRE BOTTLE SQUIB

Purpose

The squib releases the halon from the engine fire extinguishing bottle.

Location

The squib is in the discharge assembly at the bottom of the fire bottle. A fire bottle has two squibs, one for each engine.

Physical Description

The squib is an electrically operated explosive device. It is adjacent to a bottle diaphragm that can break. The diaphragm normally seals the pressurized bottle.

Functional Description

The squib fires when you put the fire switch to the DISCH 1 or DISCH 2 position. The explosion opens the diaphragm. Nitrogen pressure inside the bottle pushes the halon through the discharge port.

Training Information Point

The ELMS does an automatic squib test for these conditions:

- When ELMS first gets power
- At engine shutdown with the airplane on the ground.

You can also use the maintenance access terminal (MAT) to do a squib test. See the fire protection section for more information about the squib tests (SECTION 26-00).

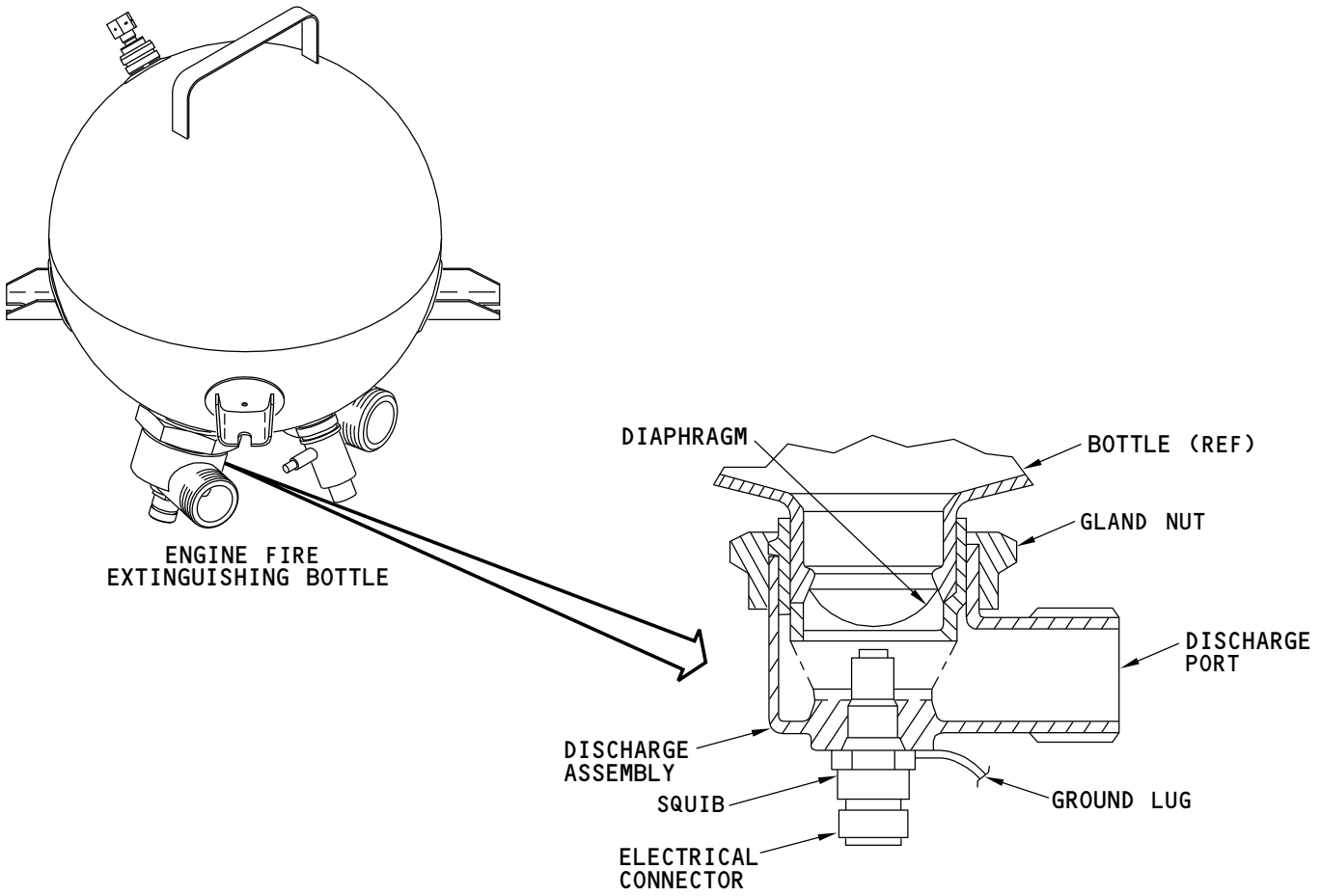
You must replace The squib every 10 years. The service date is on one of the squib wrench flats. You can replace the squib without removing the fire extinguishing bottle.

WARNING MAKE SURE THERE IS NO VOLTAGE AT THE ELECTRICAL CONNECTOR. IF THERE IS A VOLTAGE AT THE ELECTRICAL CONNECTOR, THE SQUIB CAN ACCIDENTALLY FIRE AND CAUSE THE FIRE EXTINGUISHING BOTTLE TO RELEASE ITS CONTENTS. ACCIDENTAL DISCHARGE OF THE FIRE EXTINGUISHING BOTTLE CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

WARNING PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, THE FIRE EXTINGUISHING BOTTLE CAN RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.

CAUTION DO NOT PUT A SHUNT PLUG ON THE SQUIB. THE SHUNT PLUG CAN CAUSE DAMAGE TO THE SQUIB PINS.

The electrical connectors and the discharge assembly interface threads are different sizes for the left and right engine squibs. This prevents incorrect connection.



M40843 S000617205_V1

ENGINE FIRE EXTINGUISHING - ENGINE FIRE BOTTLE SQUIB

ENGINE FIRE EXTINGUISHING - ENGINE FIRE PANEL

Purpose

The engine fire panel keeps the engine fire switches and engine fire bottle discharge lights together and in easy reach of the flight crew.

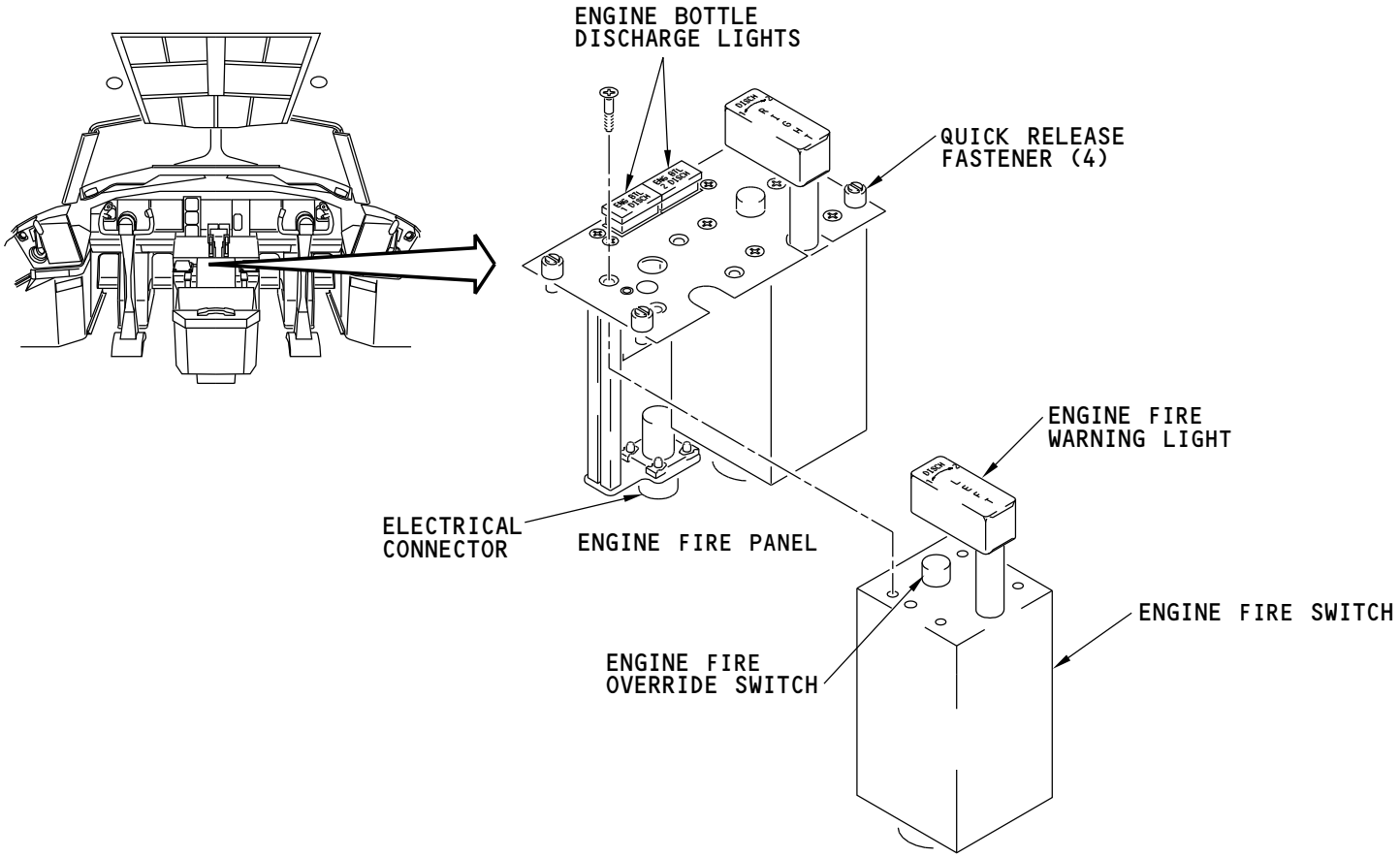
Location

The engine fire panel is in the flight deck on the P8 aisle stand.

Physical Description

The engine fire panel has a fire switch for each engine and a discharge light for each fire bottle.

Quick release fasteners attach the panel to the aisle stand structure. Electrical connectors connect the airplane wires to the panel.



M40844 S000617206_V1

ENGINE FIRE EXTINGUISHING - ENGINE FIRE PANEL

ENGINE FIRE EXTINGUISHING - ENGINE FIRE SWITCH

Purpose

The engine fire switch does four things:

- Gives an indication of an engine fire
- Stops the engine
- Isolates the engine from the airplane systems
- Controls the engine fire extinguishing system.

Physical Description

The engine fire switch includes these parts:

- Engine fire warning light
- Solenoid
- Engine fire override switch
- Push-pull switch contacts (internal)
- Rotary switch contacts (internal)
- Electrical connector.

Functional Description

The solenoid locks the fire switch so you cannot pull it accidently. If an engine has a fire, the fire warning light comes on and the solenoid energizes to release the switch.

The fire override switch lets you pull the fire switch when the solenoid is not energized.

When you pull the fire switch, the push-pull switch contacts operate electrical circuits which stop the engine and isolate it from the airplane systems.

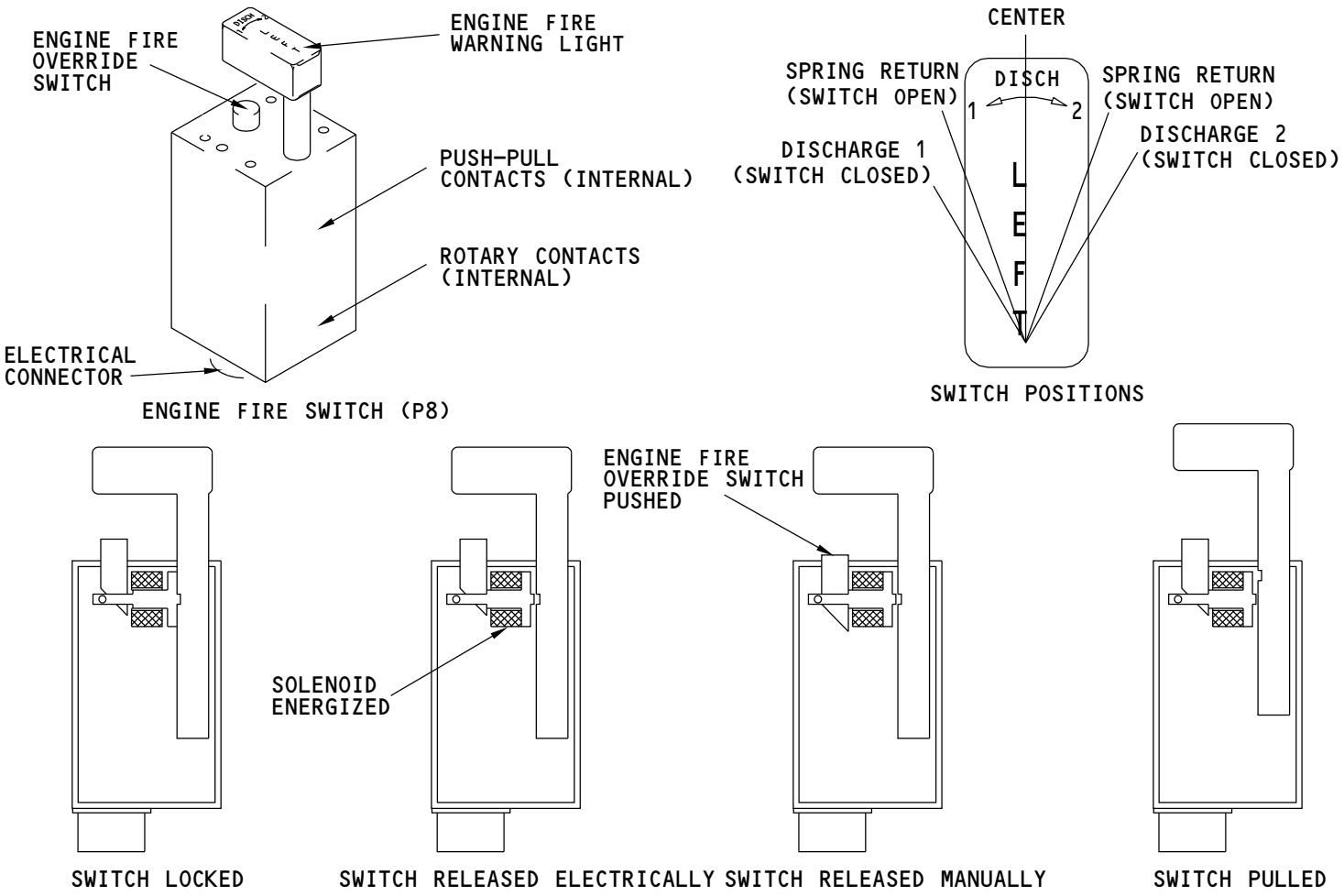
With the switch pulled, you can rotate it left or right to a mechanical stop at the discharge position. The rotary switch contacts close and operate the fire extinguishing system.

When you release the switch, a spring moves the switch a small distance from the discharge position to open the rotary switch contacts.

You must put the switch back to the center position before you can push the switch in.

Training Information Point

The left and right engine and APU fire switches are not interchangeable. The fire warning light labels and the electrical connectors are different. The engine fire switches have a hole that engages a peg in the control panel. The hole position is different in the left and right switches.



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ENGINE FIRE EXTINGUISHING - ENGINE FIRE SWITCH

ENGINE FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - BOTTLE DISCHARGE

General

Each bottle has two discharge assemblies. The discharge assemblies connect the bottles to the discharge manifolds. One manifold goes to discharge nozzles in the left engine nacelle. The other manifold goes to discharge nozzles in the right engine nacelle.

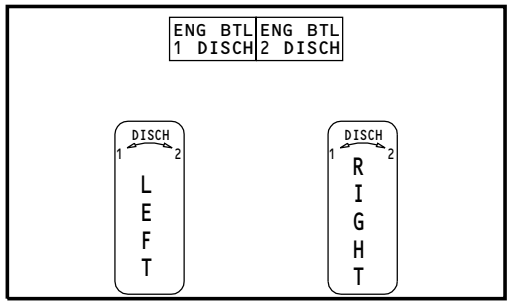
Functional Description

Explosive squibs inside the discharge assemblies connect to the fire switches in the flight deck. Squibs for the left engine connect to the left switch; squibs for the right engine connect to the right switch. A squib for bottle 1 fires when you put the related fire switch to DISCH 1. A squib for bottle 2 fires when you put the related switch to DISCH 2. When a squib fires, the bottle releases the halon into the engine nacelle.

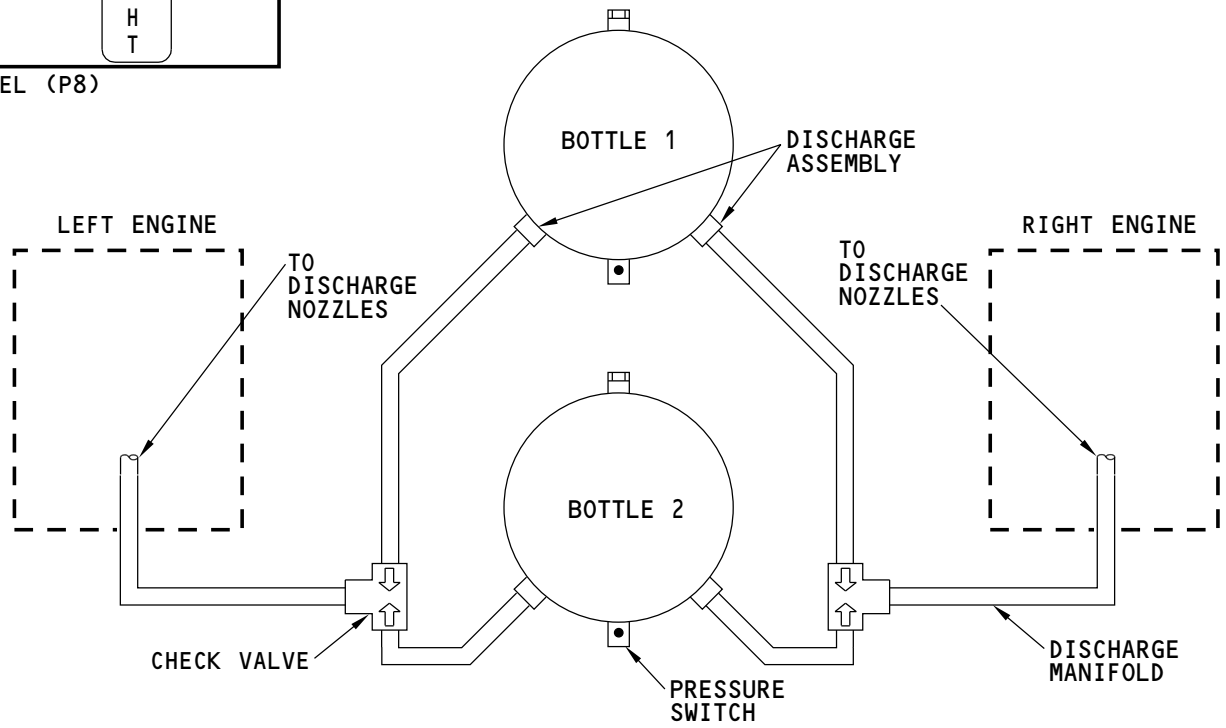
A pressure switch monitors the pressure in each bottle. The switch turns on the discharge indicator light when the bottle pressure decreases. The switch also causes advisory and status messages to show.

Training Information Point

Rigid tubing connects the bottles to the check valves. The diameter of the tubing is different for the left and right engines. This prevents incorrect connection.



ENGINE FIRE PANEL (P8)



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ENGINE FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - BOTTLE DISCHARGE

ENGINE FIRE EXTINGUISHING - ENGINE FIRE SWITCH CIRCUIT - FUNCTIONAL DESCRIPTION

General

The engine fire switch includes a solenoid, fire warning lights, and two sets of electrical contacts. One set of contacts controls engine functions. The other set of contacts controls the engine fire extinguishing system.

Solenoid and Warning Light Operation

The solenoid energizes if an engine has a fire. This releases the fire switch so you can pull it. The engine fire warning lights come on to help you identify the correct switch to use.

The same condition normally occurs in both engine fire switches while you do a fire/overheat test.

The solenoid also energizes when the battery switch is ON and the fuel control switch is in CUTOFF.

You can override the solenoid with the engine fire override switch.

Out Position

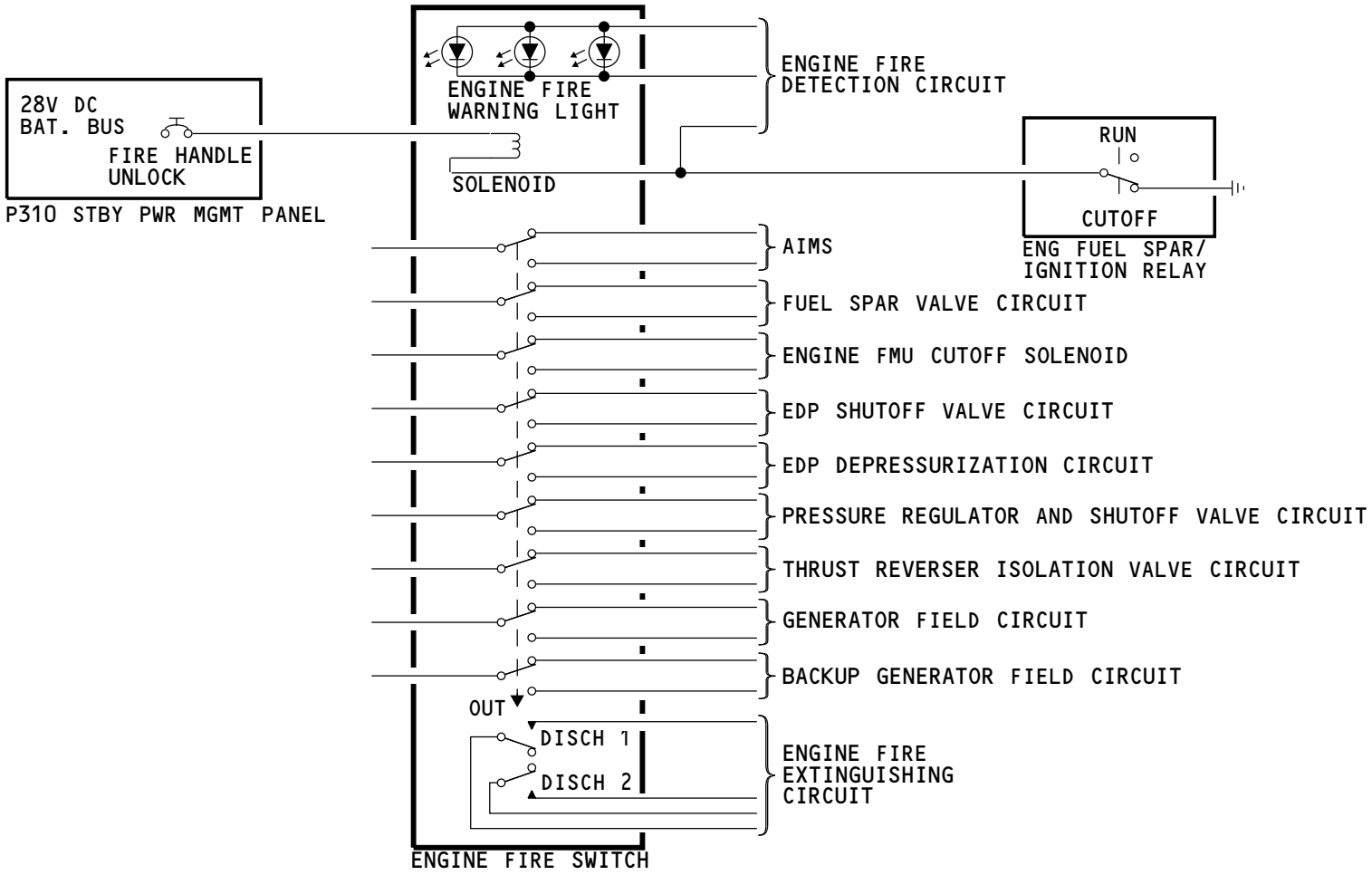
When you pull the fire switch, this is how the switch isolates the engine:

- Closes the fuel spar valve
- De-energizes the engine fuel metering unit (FMU) cutoff solenoid
- Closes the engine hydraulic pump shutoff valve
- Depressurizes the engine driven hydraulic pump valve
- Closes the pressure regulator and shutoff valve
- Removes power from thrust reverser isolation valve
- Trips the generator field
- Trips the backup generator field.

A signal to the AIMS cancels messages related to these isolation functions.

Discharge Positions

The DISCH 1 position fires the squib for bottle 1. The DISCH 2 position fires the squib for bottle 2.



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ENGINE FIRE EXTINGUISHING - ENGINE FIRE SWITCH CIRCUIT - FUNCTIONAL DESCRIPTION

Bottle Discharge

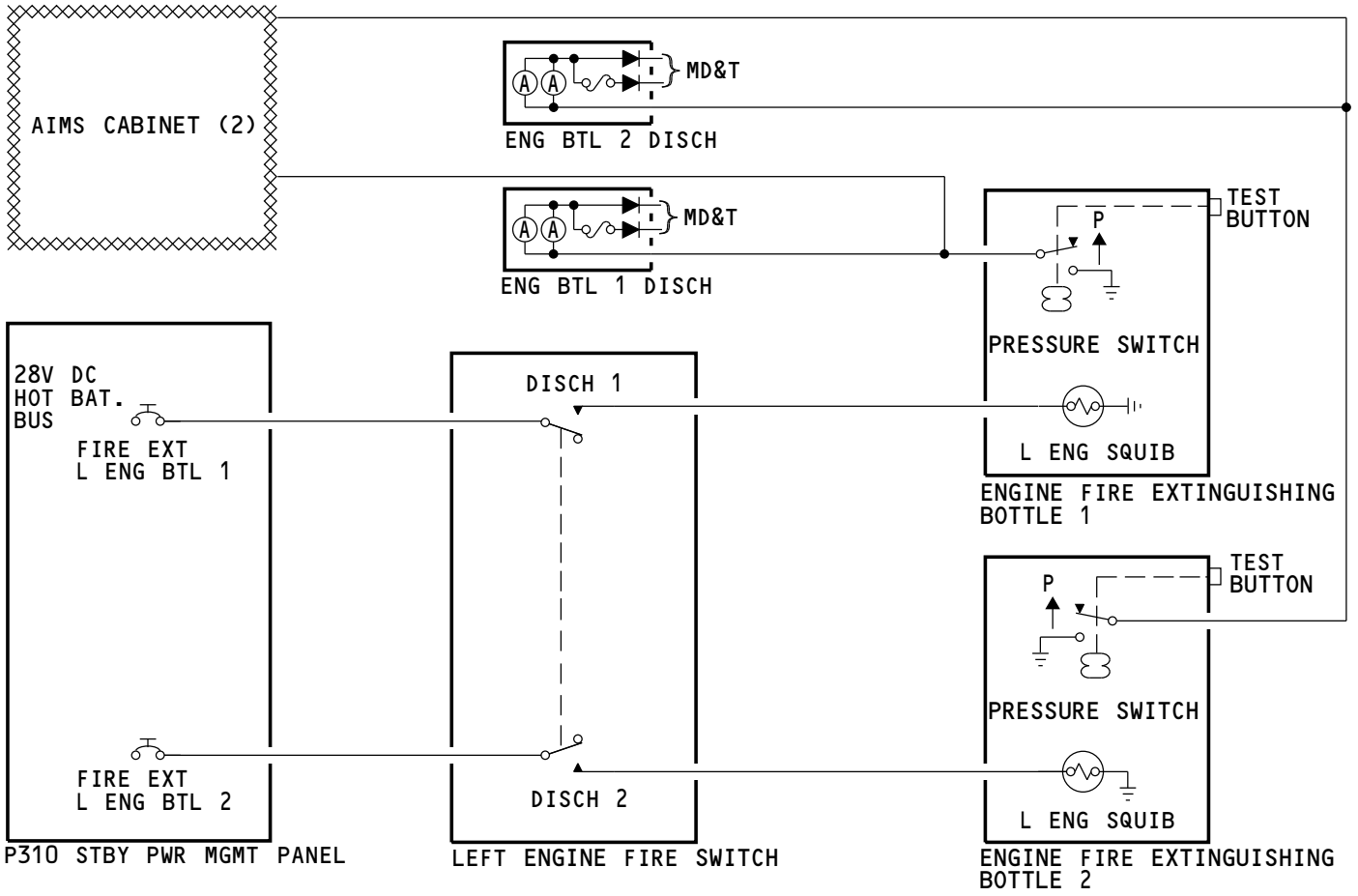
The engine fire switch supplies power from the hot battery bus to the engine fire extinguishing bottle squibs. The DISCH 1 position fires the squib for bottle 1. The DISCH 2 position fires the squib for bottle 2.

Discharge Indication

When pressure inside the bottle decreases, the pressure switch closes and makes a ground for the discharge indicator light. The ground also causes AIMS to show advisory and status messages.

Training Information Point

You can do a check of the pressure switch circuit on the ground. Push and hold the test button to close the switch. The bottle discharge light in the flight deck should come on. Bottle discharge advisory and status messages should show.



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ENGINE FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - ENGINE FIRE EXTINGUISHING CIRCUIT

ENGINE FIRE EXTINGUISHING - OPERATION

Engine Fire Warning

If an engine has a fire, the engine fire detection system gives a fire warning in the flight deck. The engine fire warning lights come on to identify the fire switch to use to extinguish the fire. The solenoid in the fire switch energizes and releases the switch so you can pull it. If the solenoid does not energize, push the fire override switch to release the fire switch manually.

Fire Switch Out

If the engine is running, it stops when you pull the fire switch. The fire switch isolates the engine from the airplane systems.

Fire Bottle Discharge

If the fire warnings do not go away with the switch pulled, put the switch to DISCH 1 or DISCH 2. Hold the switch against the stop for one second. This fires a bottle squib and release the fire extinguishing agent into the engine nacelle. Make sure the engine bottle discharge light comes on.

If the first bottle does not extinguish the fire, you can put the switch to the other DISCH position. This fires the squib for the other bottle.

Discharge Indications

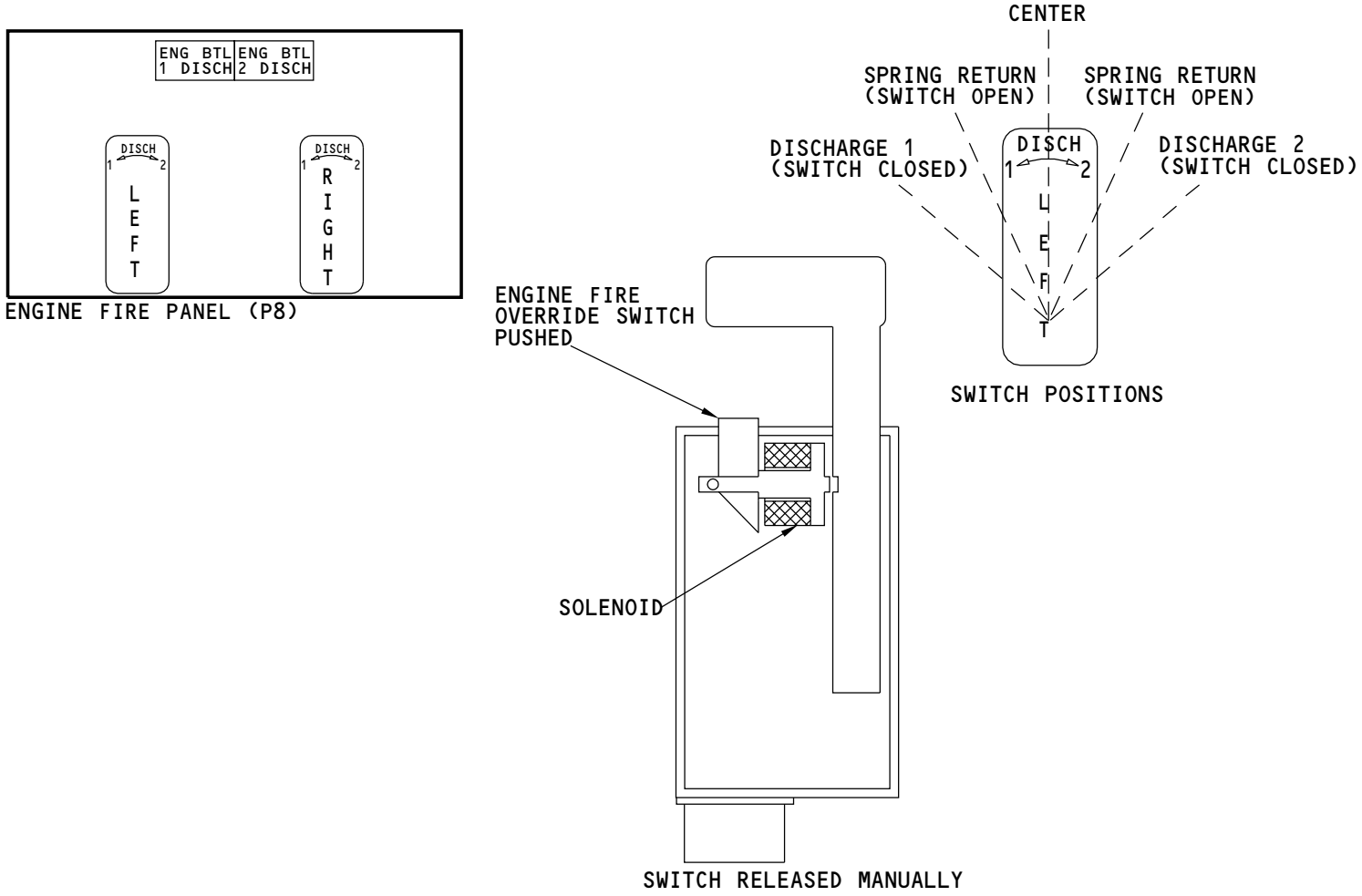
The engine bottle discharge light comes on when halon is released from the bottle. Advisory and status messages also show.

Training Information Point

Be careful not to discharge the engine fire bottles accidently. The fire switch is normally locked when the engine is running so you cannot pull it accidently. The switch releases if the engine has a fire. The switch also releases for these two conditions:

- When the battery switch is ON and the engine fuel control switch is in CUTOFF
- During a fire/overheat test.

The engine fire switches connect to the hot battery bus. If you pull and rotate the switch, the fire bottles will discharge. This happens with the battery switch ON or OFF, and with or without ground power on the airplane.



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ENGINE FIRE EXTINGUISHING - OPERATION

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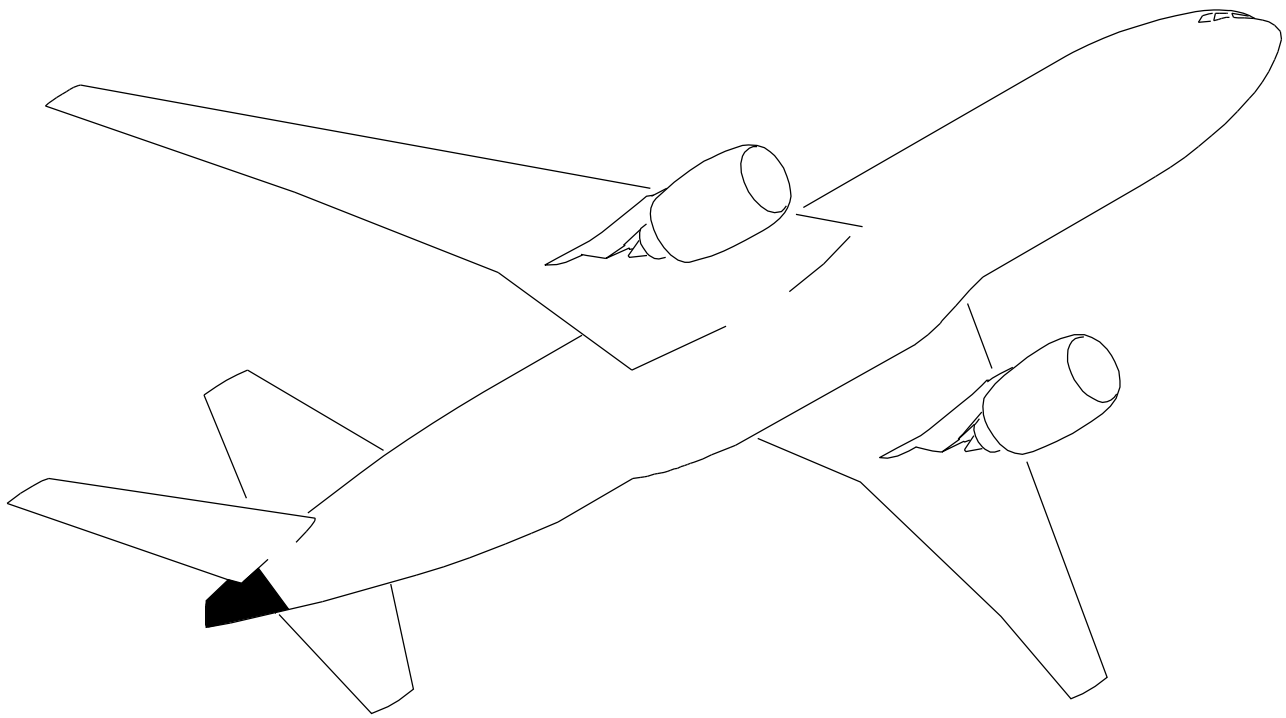
APU FIRE EXTINGUISHING - INTRODUCTION

Purpose

The APU fire extinguishing system extinguishes fires in the APU compartment.

General

If a fire occurs on the ground and the engines are not running, the APU fire extinguisher discharges automatically. This permits unattended operation of the APU. You can also operate the system manually from the flight deck or the nose gear service panel.



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APU FIRE EXTINGUISHING - INTRODUCTION

APU FIRE EXTINGUISHING - GENERAL DESCRIPTION

General

The APU fire extinguishing system has these components:

- APU fire extinguishing bottle
- APU fire extinguishing bottle squib
- Cargo fire/engine control module
- APU fire switches
- Service and APU shutdown panel.

The APU operates in the unattended mode when the airplane is on the ground and the engines are not running. In the this mode, a signal from the APU fire detection system discharges the fire bottle automatically.

The APU operates in the attended mode when at least one engine is running. If there is an APU fire in this mode, the crew discharges the bottle manually. Fire switches are on the cargo fire/engine control panel and the service and APU shutdown panel.

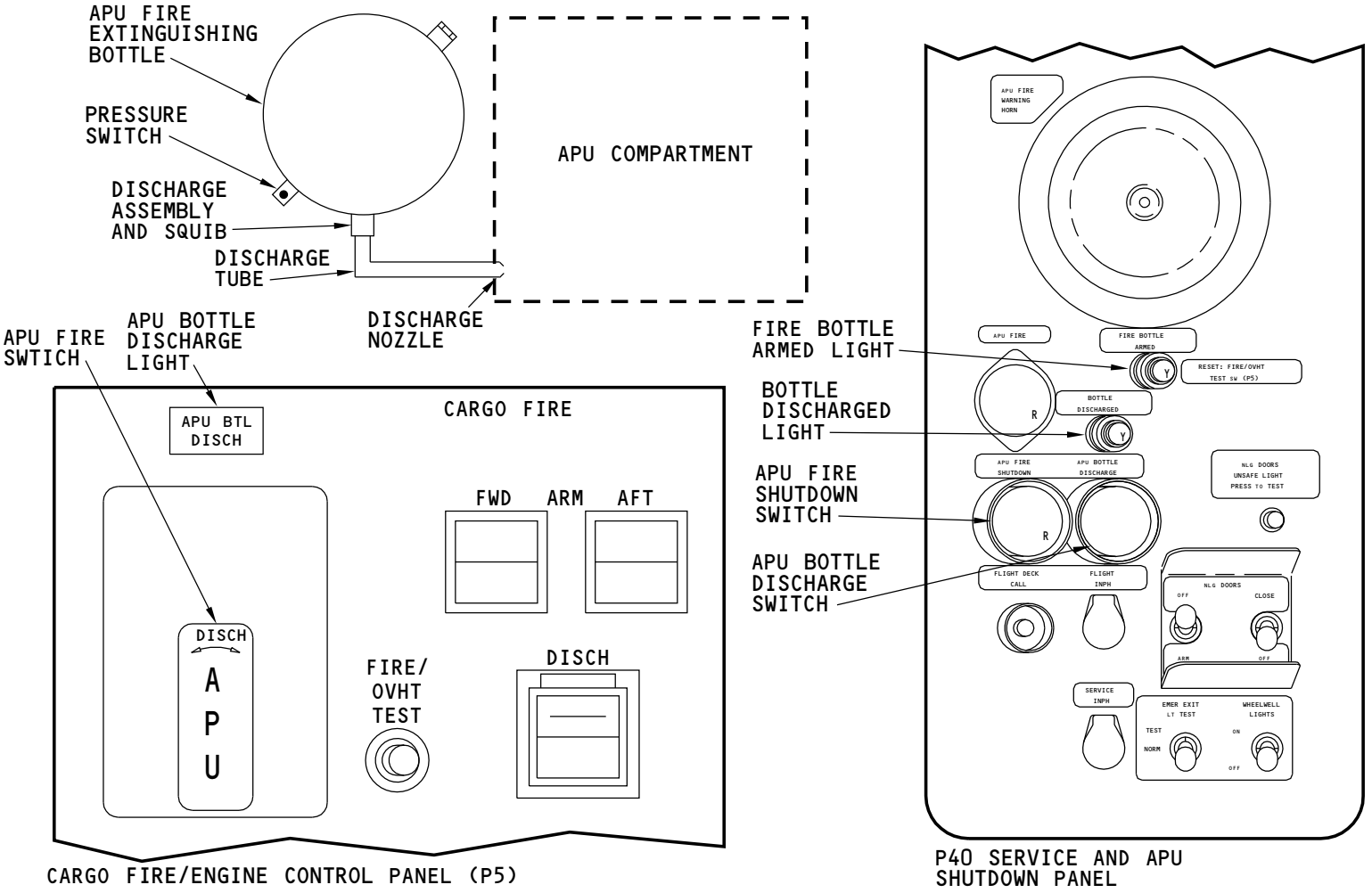
EICAS messages and indicator lights show when the bottle pressure is low.

Operation

The APU fire extinguishing bottle contains halon fire extinguishing agent pressurized with nitrogen. A discharge assembly connects the bottle to a discharge tube. The tube goes to a discharge nozzle in the APU compartment.

An explosive squib inside the discharge assembly releases the halon from the bottle. The squib connects to the fire switches and to the APU fire detection card.

A pressure switch monitors the pressure in the bottle. When the bottle discharges, the switch turns on the discharge indicator lights. The switch also causes EICAS advisory and status messages to show.



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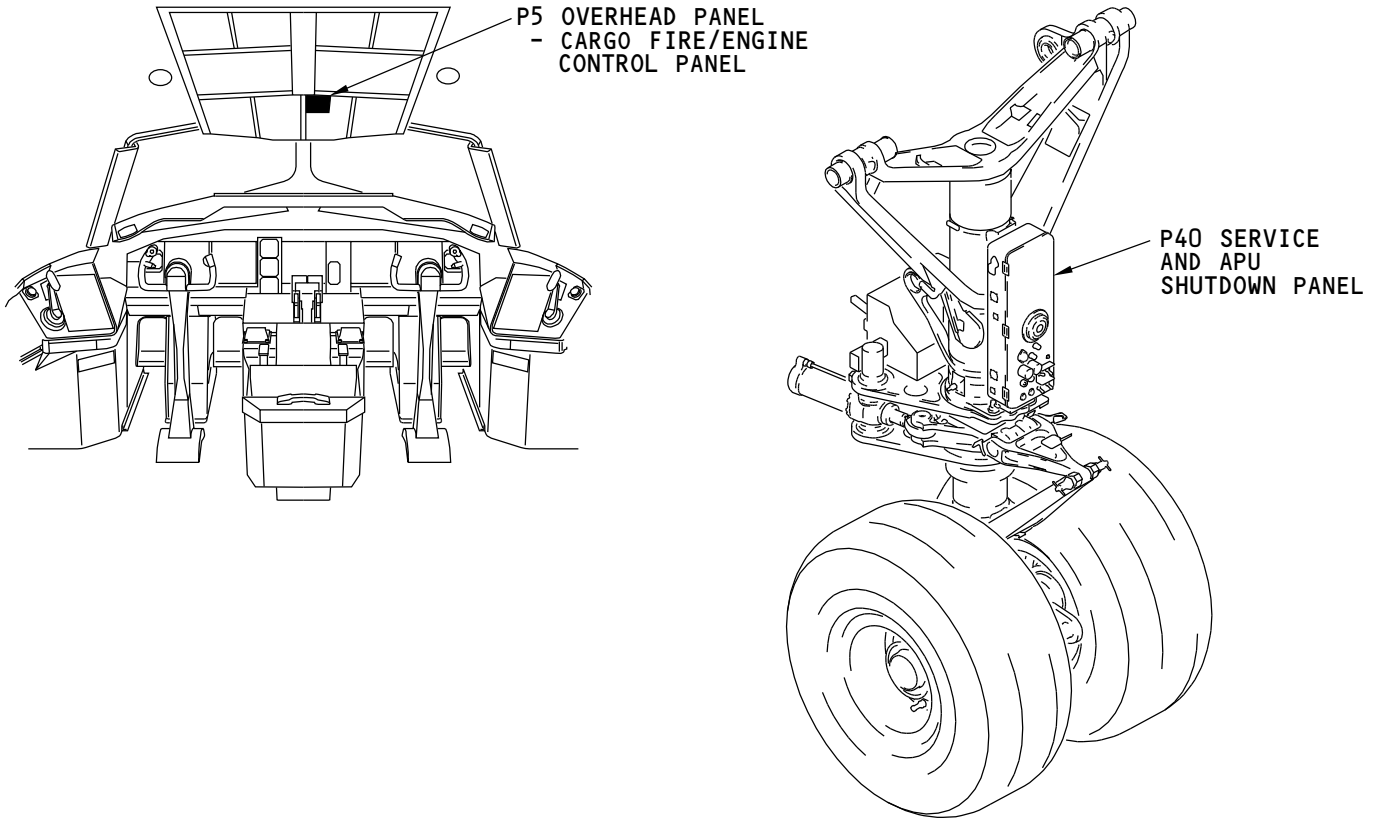
APU FIRE EXTINGUISHING - GENERAL DESCRIPTION

Cargo Fire/Engine Control Panel

The cargo fire/engine control panel is in the flight deck on the P5 overhead panel.

P40 Service and APU Shutdown Panel

APU fire controls are on the P40 service and APU shutdown panel. That panel is on the nose landing gear.



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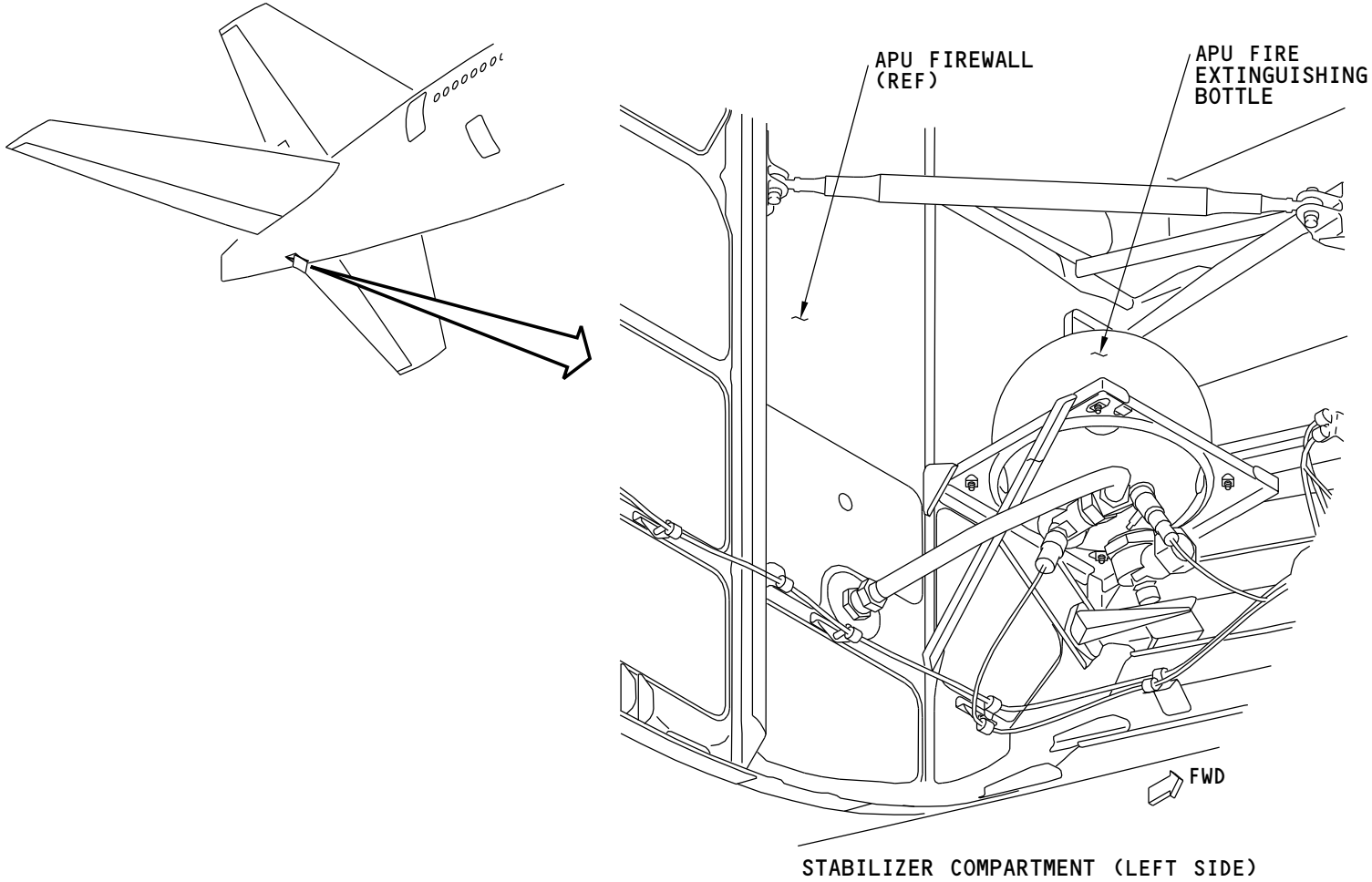
APU FIRE EXTINGUISHING - COMPONENT LOCATIONS - CONTROL PANELS

APU FIRE EXTINGUISHING - COMPONENT LOCATIONS - FUSELAGE

Fuselage Component Location

The APU fire extinguishing bottle is on the left side of the stabilizer compartment.



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APU FIRE EXTINGUISHING - COMPONENT LOCATIONS - FUSELAGE

APU FIRE EXTINGUISHING - APU FIRE EXTINGUISHING BOTTLE

Purpose

The APU fire extinguishing bottle contains the halon fire extinguishing agent.

Location

The fire extinguishing bottle is on the forward side of the APU firewall, inside the control bay access door.

Physical Description

The fire extinguishing bottle has these components:

- A safety relief and fill port
- An identification plate
- A pressure switch
- A handle
- Two squibs
- Two discharge assemblies
- Four mounting brackets.

The APU fire extinguishing bottle is interchangeable with the engine fire extinguishing bottles. Caps cover one squib and discharge port.

Functional Description

The bottle contains halon fire extinguishing agent pressurized with nitrogen. If the pressure in the bottle becomes too high, the safety relief and fill port opens so the bottle does not explode.

The discharge assembly has an explosive squib. An electric current from the fire extinguishing circuit fires the squib. This releases the halon through the discharge port.

The pressure switch gives control panel indications when bottle pressure decreases. The switch monitors the pressure inside the bottle and is normally open. When the bottle pressure decreases because of a leak or because of bottle discharge, the switch closes an indicating circuit.

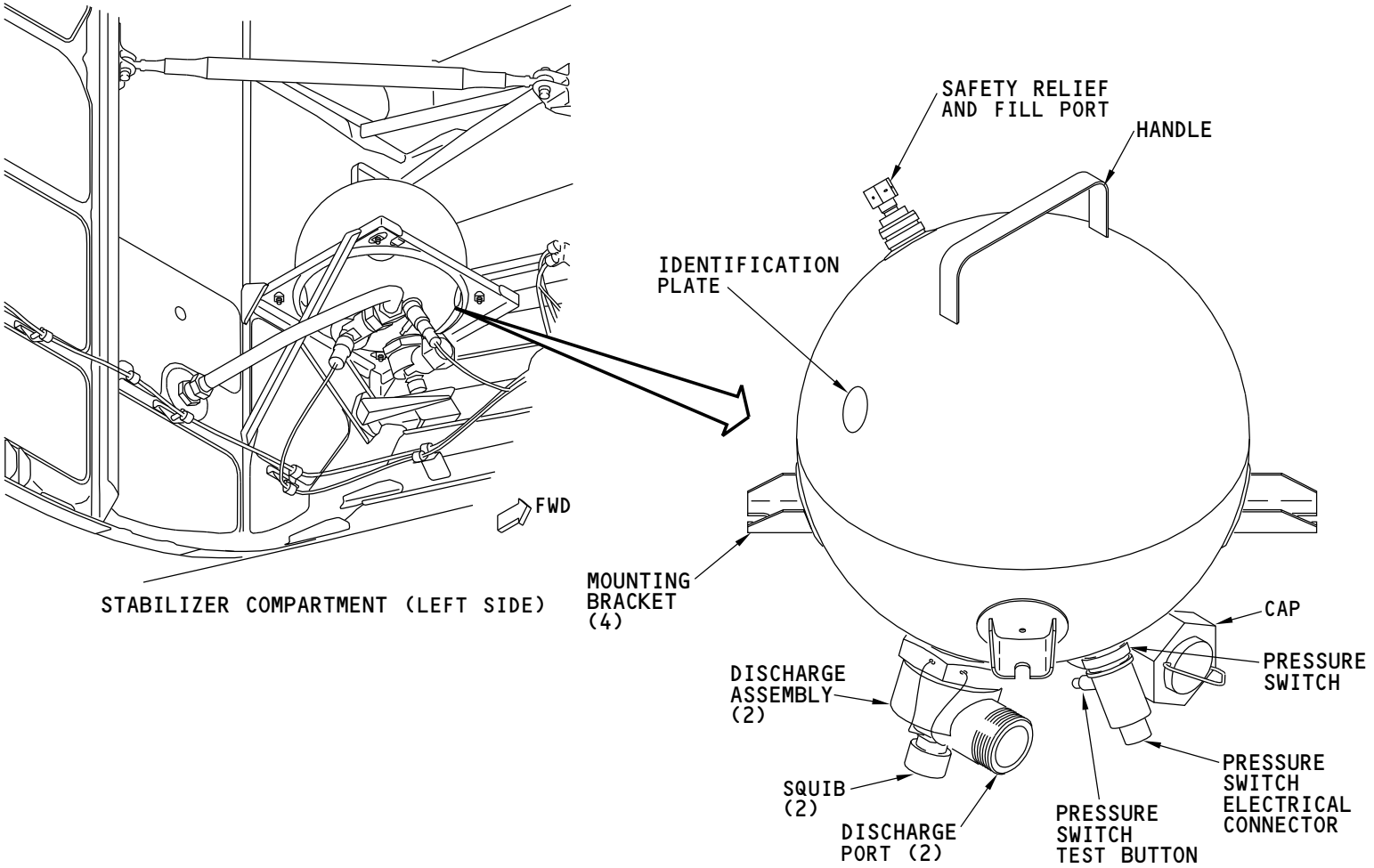
Training Information Point

A special service platform is available to use during bottle replacement.

When you replace the bottle, compare the weight of the new bottle with the weight on the bottle identification plate. This prevents installation of a bottle which is not full.

WARNING BE CAREFUL WHEN YOU MOVE THE FIRE EXTINGUISHING BOTTLE. THE FIRE EXTINGUISHING BOTTLE IS HIGHLY PRESSURIZED AND HAS AN EXPLOSIVE CARTRIDGE AS A COMPONENT. ACCIDENTAL DISCHARGE OF THE FIRE EXTINGUISHING BOTTLE CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

WARNING STAY OFF THE CONTROLS BAY ACCESS DOOR, 313AL. YOUR WEIGHT CAN RELEASE THE SPRING-LOADED LATCHES. IF YOU FALL THROUGH THE DOOR, INJURIES WILL OCCUR.



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APU FIRE EXTINGUISHING - APU FIRE EXTINGUISHING BOTTLE

APU FIRE EXTINGUISHING - APU FIRE BOTTLE SQUIB

Purpose

The squib releases the halon from the APU fire extinguishing bottle.

Location

The squib is in the discharge assembly at the bottom of the fire bottle.

Physical Description

The squib is an electrically operated explosive device. It is adjacent to a bottle diaphragm that can break. The diaphragm normally seals the pressurized bottle.

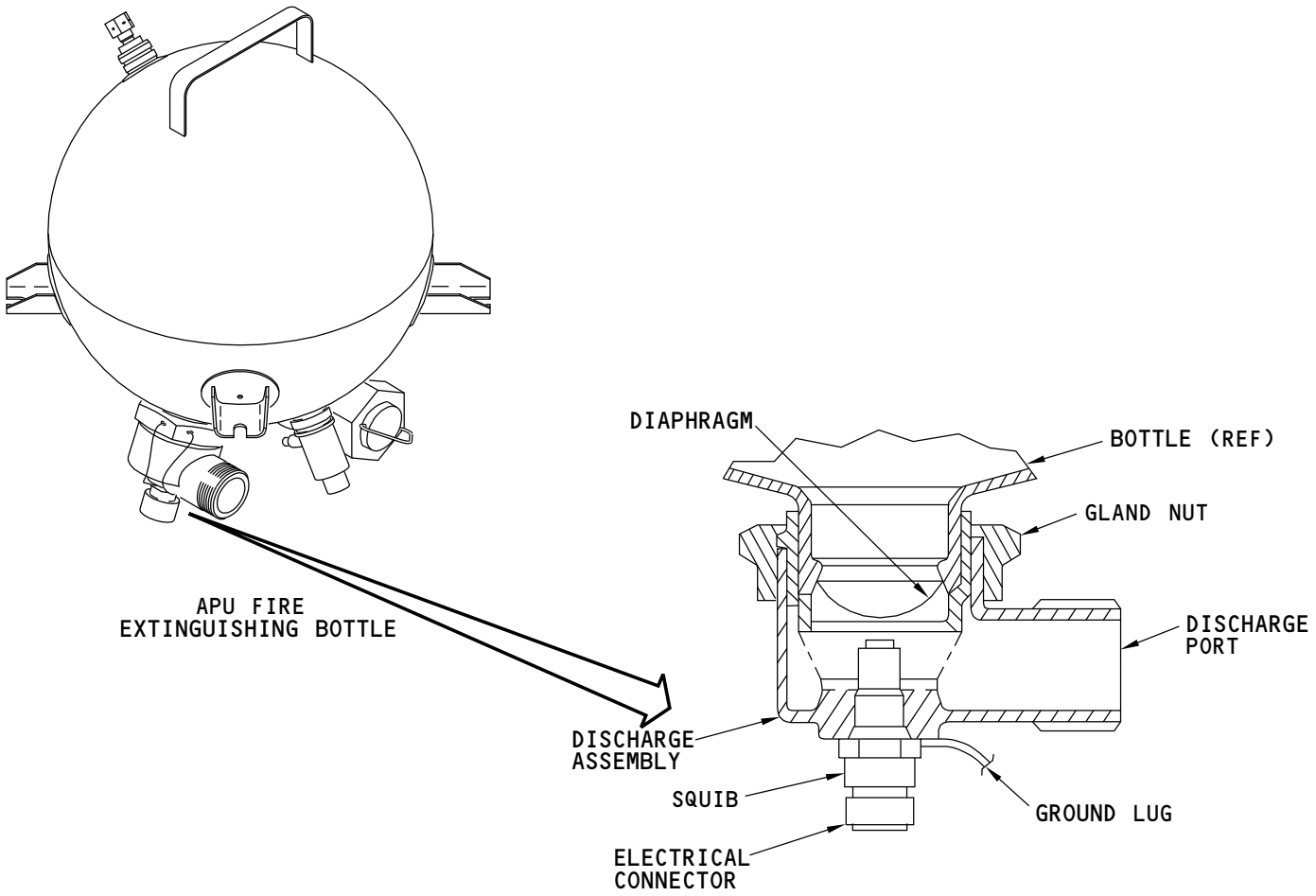
Functional Description

The squib fires when you operate the discharge controls. The explosion opens the diaphragm. Nitrogen pressure inside the bottle pushes the halon through the discharge port.

Training Information Point

You must replace the squib every 10 years. The service date is on one of the squib wrench flats. You can replace the squib without removing the fire extinguishing bottle.

WARNING INSTALL THE PROTECTIVE COVER ON THE SQUIB WHEN THE AIRPLANE WIRING IS DISCONNECTED FROM THE SQUIB. FOLLOW THE INSTRUCTIONS IN THE COMPONENT MAINTENANCE MANUAL IF YOU NEED TO MEASURE THE SQUIB RESISTANCE. INCORRECT PROCEDURES OR EQUIPMENT COULD FIRE THE SQUIB AND CAUSE INJURY.



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APU FIRE EXTINGUISHING - APU FIRE BOTTLE SQUIB

APU FIRE EXTINGUISHING - CARGO FIRE/ENGINE CONTROL PANEL

Purpose

The cargo fire/engine control panel permits flight deck control of the APU and cargo fire extinguishing systems. The panel also permits control of the electronic engine control mode, engine ignition, and autostart.

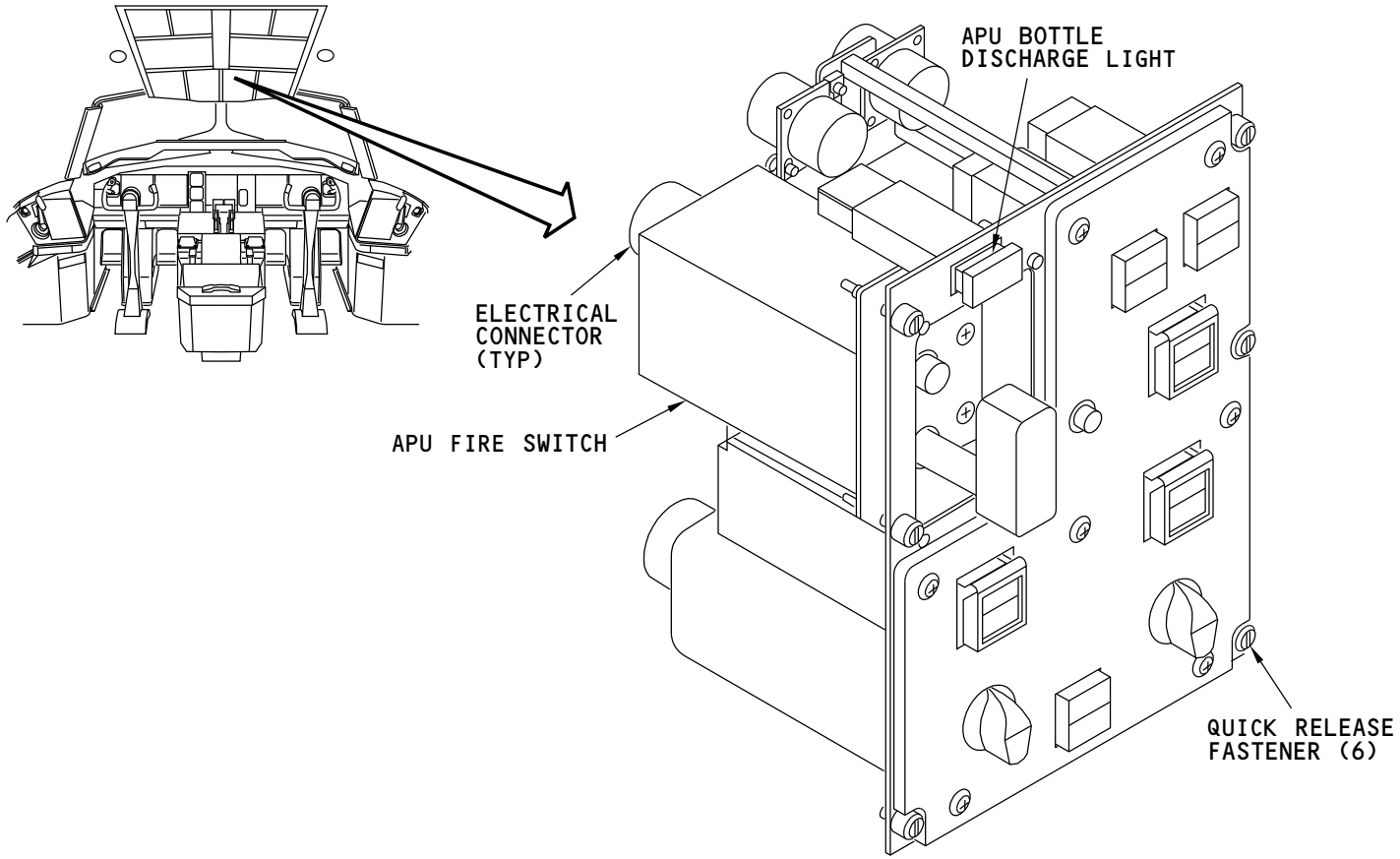
Location

The cargo fire/engine control panel is in the flight deck on the P5 overhead panel.

Physical Description

The cargo fire/engine control panel has a fire switch for the APU and a discharge light for the APU fire bottle.

Quick release fasteners attach the module to the overhead panel structure. Electrical connectors connect the airplane wires to the panel.



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APU FIRE EXTINGUISHING - CARGO FIRE/ENGINE CONTROL PANEL

APU FIRE EXTINGUISHING - APU FIRE SWITCH

Purpose

The APU fire switch gives an indication of an APU fire and controls the APU fire extinguishing system.

Physical Description

The APU fire switch includes these parts:

- APU fire warning light
- Solenoid
- APU fire override switch
- Push-pull switch contacts (internal)
- Rotary switch contacts (internal).

The fire warning light uses three light emitting diodes (LEDs).

Location

The APU fire switch is on the cargo fire/engine control panel. That panel is on the P5 overhead panel.

Functional Description

The solenoid locks the fire switch so you cannot pull it accidently. If the APU has a fire, the fire warning light comes on and the solenoid energizes to release the switch.

When you pull the fire switch, the push-pull switch contacts isolate the APU from the airplane systems.

When the switch is out, you can rotate it left or right to a mechanical stop at the discharge position. The rotary switch contacts close and operate the fire extinguishing system.

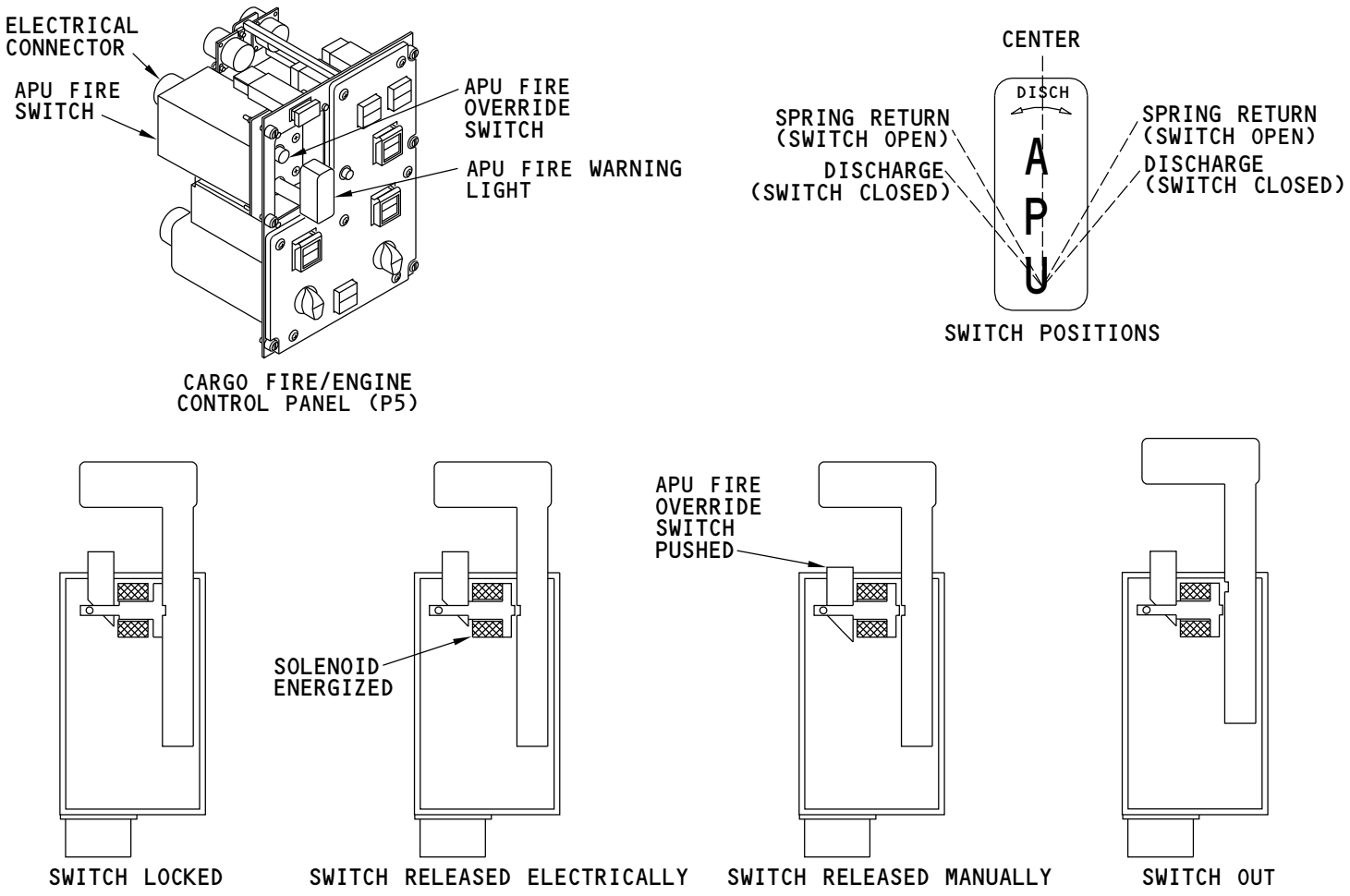
When you release the switch, a spring moves the switch a small distance from the discharge position to open the rotary switch contacts.

The fire override switch lets you pull the fire switch when the solenoid is not energized.

You must put the switch back to the center position before you can push the switch in.

Training Information Point

The engine and APU fire switches are not interchangeable. The fire warning light labels and the electrical connectors are different.



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APU FIRE EXTINGUISHING - APU FIRE SWITCH

APU FIRE EXTINGUISHING - P40 SERVICE AND APU SHUTDOWN PANEL

Purpose

The P40 service and APU shutdown panel gives warnings outside the airplane of an APU fire. The panel has APU fire extinguishing controls with easy access from outside the airplane. The panel also gives easy access to controls for other service equipment.

Physical Description

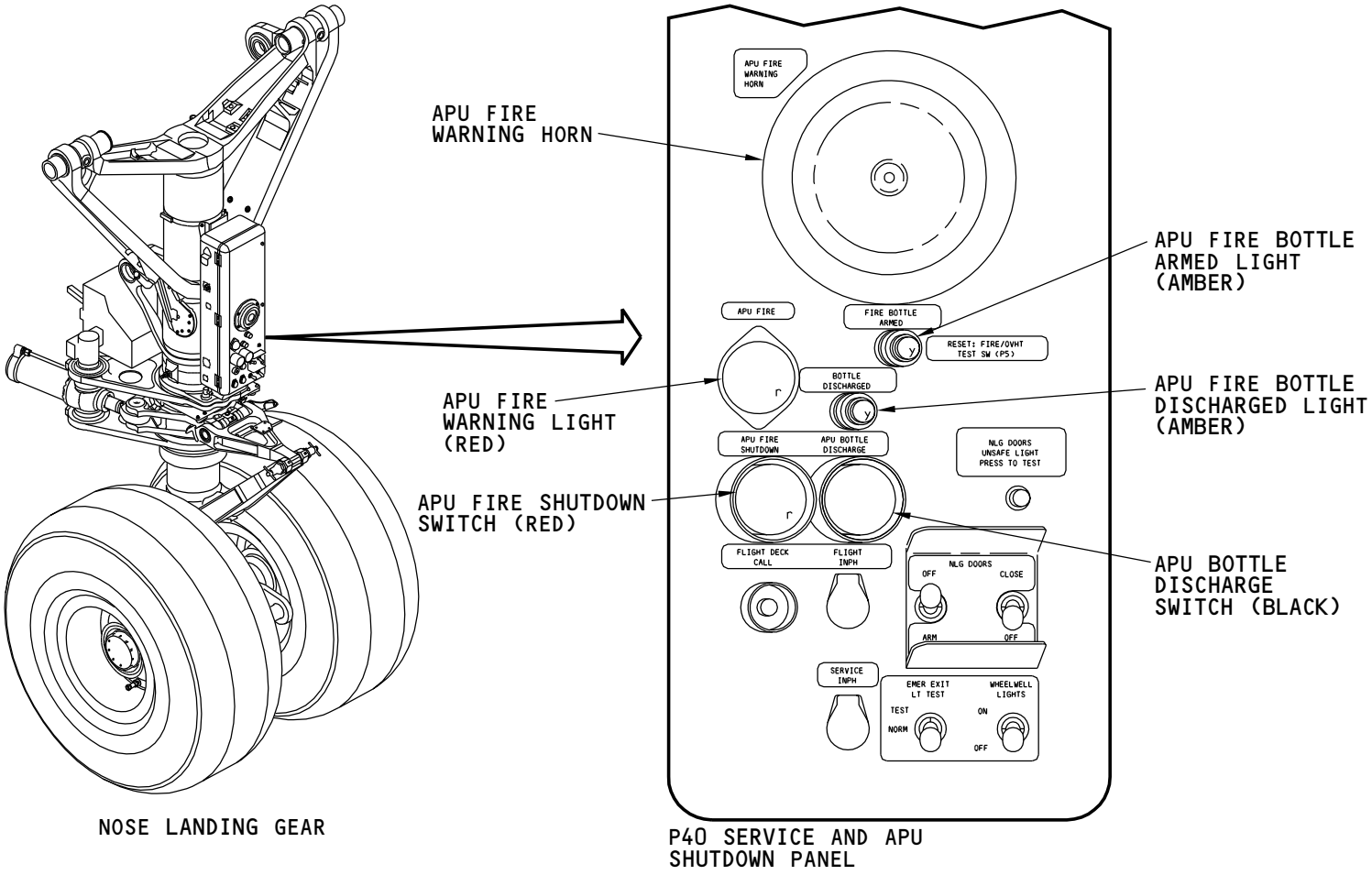
The panel has this fire protection equipment:

- APU fire warning horn
- APU fire bottle armed light
- APU fire bottle discharged light
- APU bottle discharge switch
- APU fire shutdown switch
- APU fire warning light.

Training Information Point

With the battery switch on, push these lights to make sure they operate:

- APU fire bottle armed light
- APU fire bottle discharged light.



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APU FIRE EXTINGUISHING - P40 SERVICE AND APU SHUTDOWN PANEL

APU FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - FIRE SWITCH CIRCUIT

Warning Light and Solenoid Operation

The APU fire warning light comes on if there is an APU fire. The solenoid energizes and releases the fire switch so you can pull it.

This also occurs while you do a fire/overheat test.

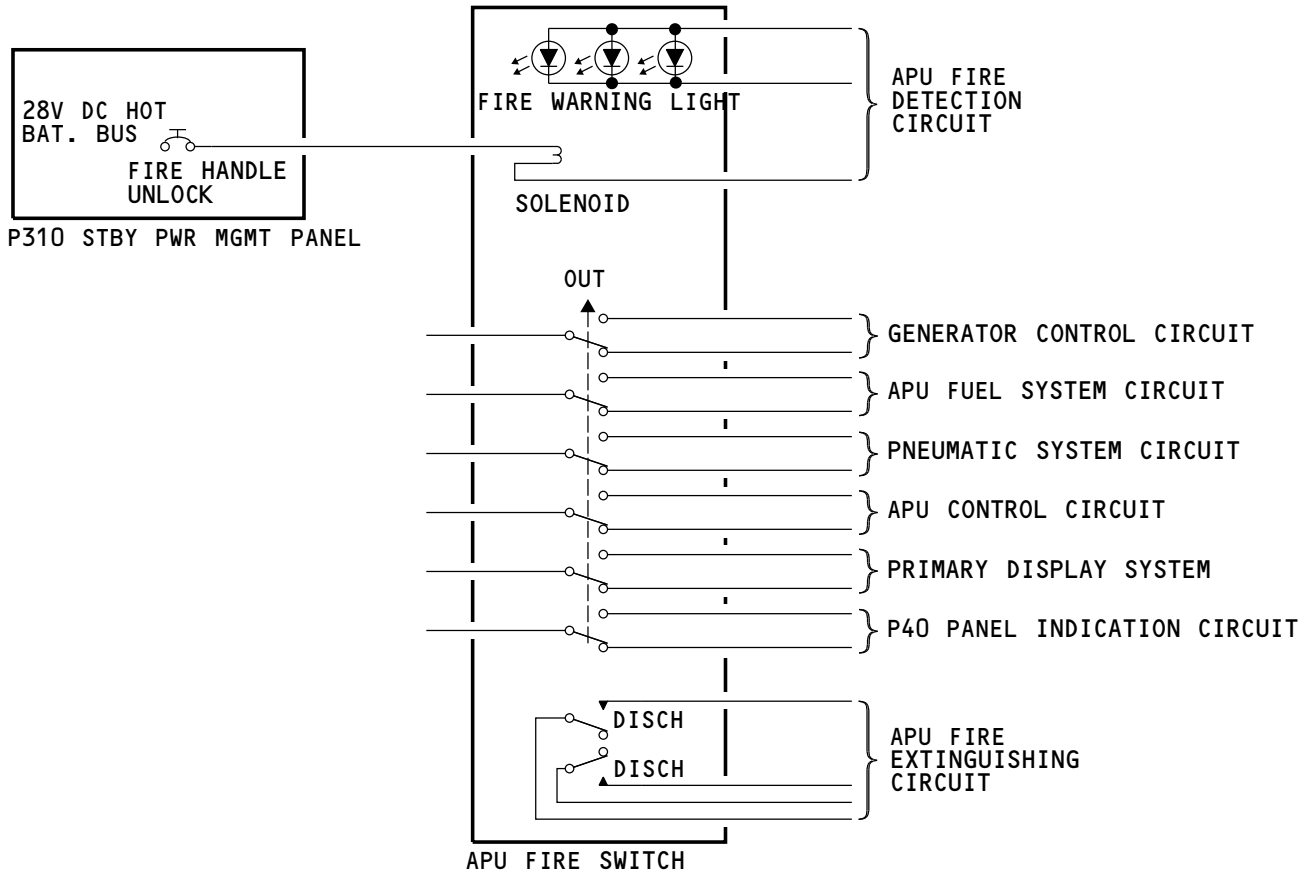
Out Position

When you pull the fire switch, these functions occur:

- The generator field trips
- The APU fuel shutoff valve closes
- The APU shutoff valve closes
- The APU stops
- EICAS messages which are not necessary do not show
- Fire warnings at the P40 panel are canceled.

Discharge Positions

The left or right DISCH position fires the APU fire extinguishing bottle squib.



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APU FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - FIRE SWITCH CIRCUIT

APU FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - APU FIRE EXTINGUISHING CIRCUIT

General

The APU fire extinguishing bottle squib fires for these three conditions:

- Unattended fire alarm
- Controls on the P40 service and APU shutdown panel are operated
- Flight deck fire switch is operated.

For each condition, power comes from the 28v dc hot battery bus.

Unattended Fire Alarm

Fire alarm 1 from the APU control card makes a ground for the APU remote warning relay. The relay energizes if the APU fire switch on P5 is not out. The unattended fire alarm makes a ground for the APU auto fire bottle discharge relay. The relay energizes after a 10-second delay. Power from the hot battery bus goes through the relay contacts to the squib.

Service and APU Shutdown Panel

The APU external shutdown relay energizes when you push the APU fire shutdown switch. The relay latches through its own contact and the fire/overheat test switch. With the relay energized, the fire bottle armed light comes on and power goes to the APU bottle discharge switch. When you push the APU bottle discharge switch, the squib fires.

Flight Deck Fire Switch

When the APU fire switch is in the left or right discharge position, power from the hot battery bus fires the squib.

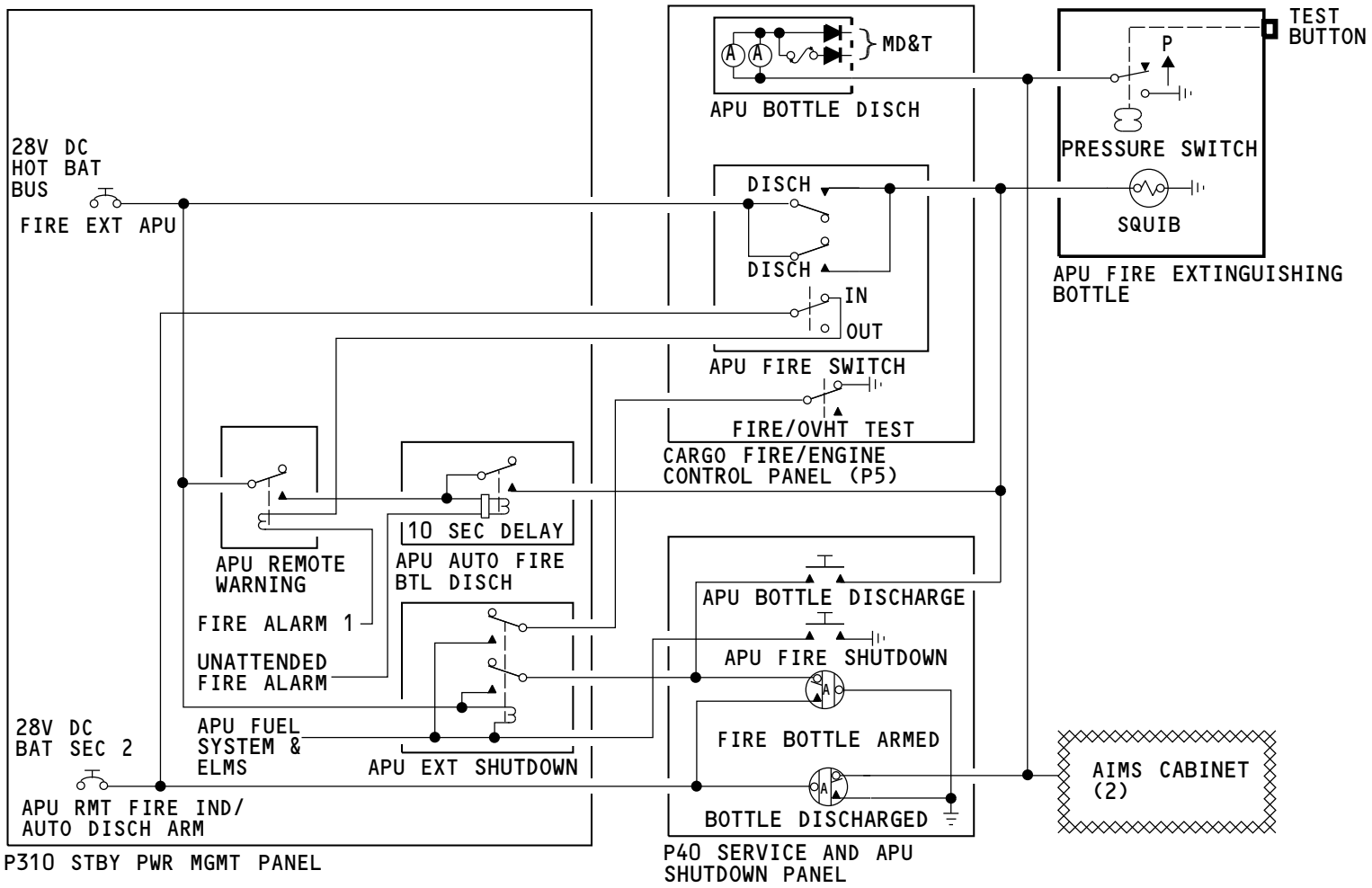
Indications

When pressure inside the bottle decreases, the pressure switch closes and makes a ground for the discharge indicator lights. The ground also causes advisory and status messages.

When you push the APU fire shutdown switch, the APU external shutdown relay latches through its own contact and the fire/overheat test switch. A ground for the APU fuel system closes the APU fuel shutoff valve. The ground signal to ELMS causes an EICAS status message. The message shows a remote APU shutdown and stays until you do a fire/overheat test to release the relay. You cannot start the APU with the relay latched.

Training Information Point

You can do a check of the pressure switch circuit on the ground. Push and hold the bottle pressure switch test button to close the switch. The bottle discharge lights on the P5 and P40 panels must come on. Bottle discharge advisory and status messages must show.



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APU FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - APU FIRE EXTINGUISHING CIRCUIT

APU FIRE EXTINGUISHING - OPERATION - FLIGHT DECK

General

The APU operates in the unattended mode when the airplane is on the ground with the engines not running. If there is an APU fire in the unattended mode, the fire extinguisher discharges automatically.

If there is a fire during attended mode operation, the fire extinguisher does not discharge automatically. Fire warnings are the same in attended and unattended modes.

APU Fire Warning

If there is an APU fire, the APU fire detection system gives fire warnings and automatically stops the APU. The APU fire warning light comes on to identify the correct fire switch to use to extinguish the fire. The fire switch solenoid releases the switch so you can pull it.

Fire Switch Out

If the APU is on, it stops when you pull the fire switch. The fire switch isolates the APU from the airplane systems.

Fire Bottle Discharge

If the fire warnings do not go away with the switch out, put the switch to the left or right DISCH position. Hold the switch against the discharge stop for one second. This fires the bottle squib and releases the fire extinguishing agent into the APU compartment. Make sure the APU bottle discharge light comes on.

Discharge Indications

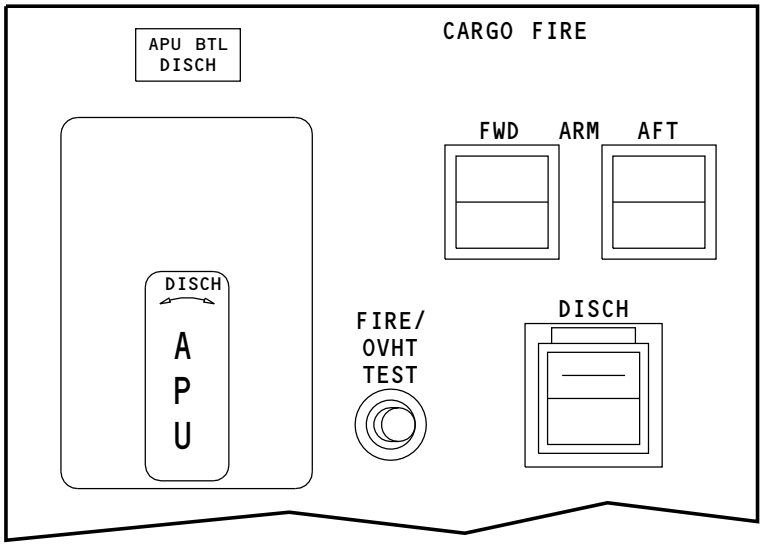
The APU bottle discharge light comes on when halon goes out of the bottle. Advisory and status messages also show.

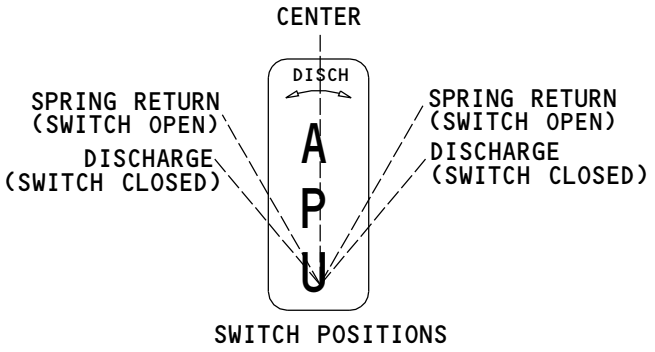
Training Information Point

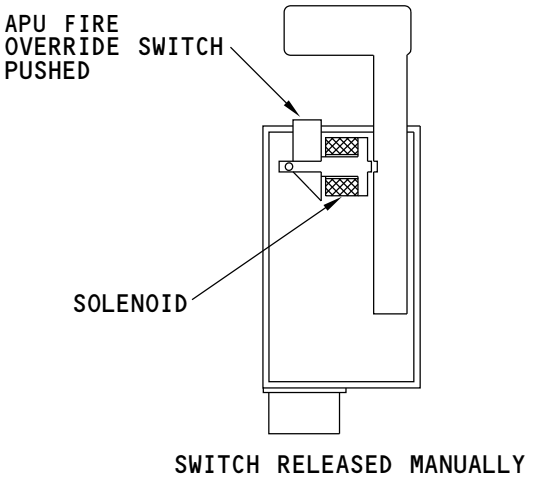
The fire override switch lets you pull the switch when the solenoid is not energized.

The switch releases during a fire and while you do a fire/overheat test.

The APU fire switch connects to the hot battery bus. You can discharge the APU fire bottle with the battery switch off and without ground power on the airplane.







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APU FIRE EXTINGUISHING - OPERATION - FLIGHT DECK

APU FIRE EXTINGUISHING - OPERATION - P40 SERVICE AND APU SHUTDOWN PANEL

General

If the APU has a fire during ground operation, the APU fire detection system gives a fire warning at the P40 service and APU shutdown panel. The APU fire warning light comes on and the APU fire warning horn operates intermittently.

APU Fire Extinguishing

When you push the APU fire shutdown switch, these things happen:

- The fire extinguishing system arms
- The fire warning horn stops
- If the APU is still running it stops
- The APU fuel shutoff valve closes.

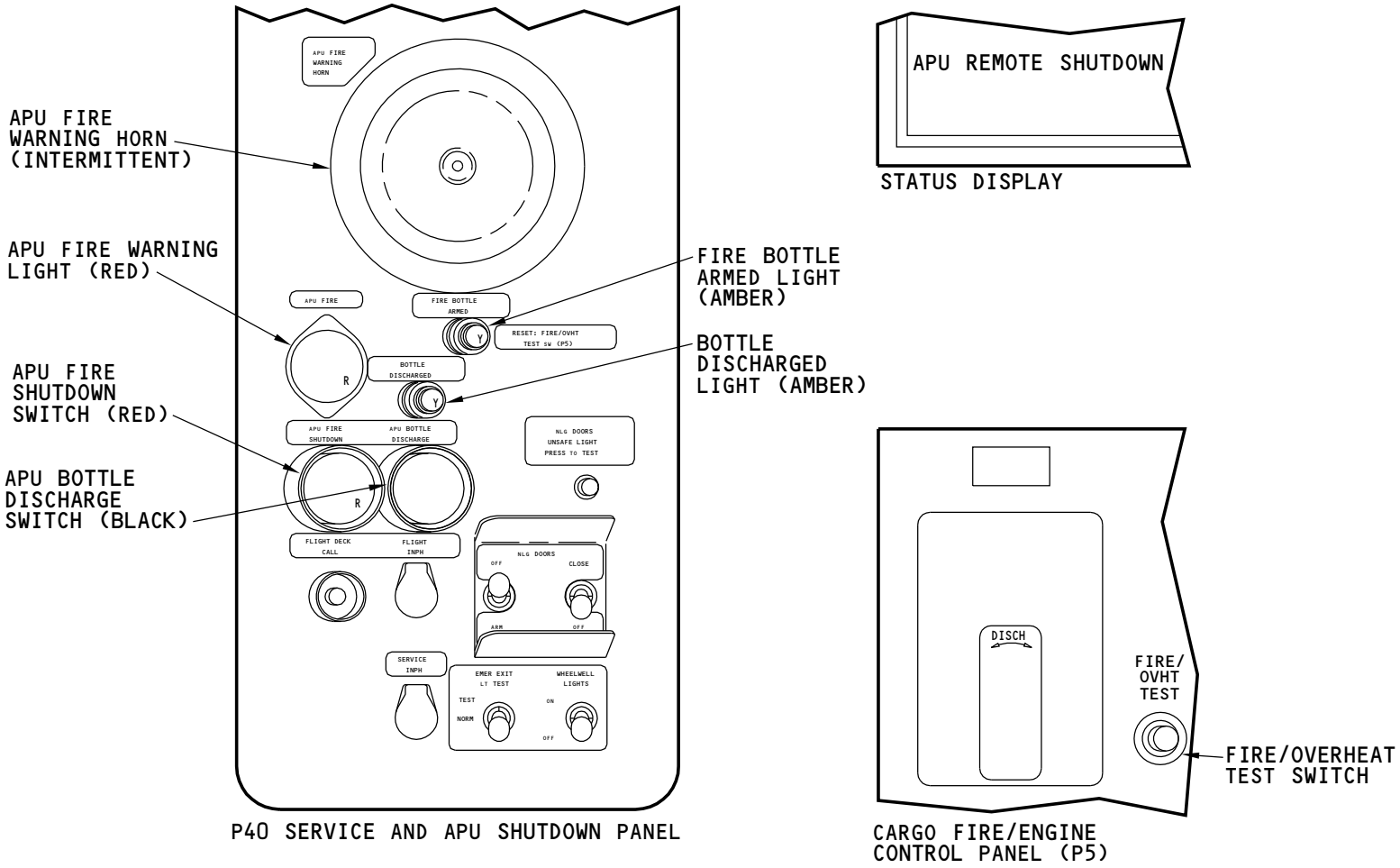
Make sure the fire bottle armed light comes on.

If the fire warning light stays on after you push the fire shutdown switch, push the bottle discharge switch to discharge the fire extinguisher bottle. Make sure the bottle discharged light comes on.

Training Information Point

When you push the APU fire shutdown switch, the circuit latches through the fire/overheat test switch in the flight deck. A status message shows a remote APU shutdown. You cannot start the APU with the circuit latched. Do a fire/overheat test to release the circuit and remove the status message. Also make sure the circuit is released before you replace the fire extinguishing bottle.

NOTE: The APU fire switches connect to the hot battery bus. If you push the APU fire shutdown switch and the bottle discharge switch, the APU fire bottle discharges. This happens with the battery switch ON or OFF, and with or without ground power on the airplane.



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APU FIRE EXTINGUISHING - OPERATION - P40 SERVICE AND APU SHUTDOWN PANEL

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LOWER CARGO FIRE EXTINGUISHING - INTRODUCTION

Purpose

The lower cargo fire extinguishing system extinguishes fires in the forward or aft lower cargo compartments.

General Description

The lower cargo fire extinguishing system has these components:

- Three fire extinguishing metered bottles
- A filter regulator
- Fwd and aft in-line pressure switches
- Two flow valves
- Two fire extinguishing dump bottles
- Ten discharge nozzles.

The fire extinguishing bottles contain halon 1301 fire extinguishing agent pressurized with nitrogen. Tubing connects the bottles to discharge nozzles in the cargo compartment ceilings. Flow valves send the halon to the forward or aft compartment.

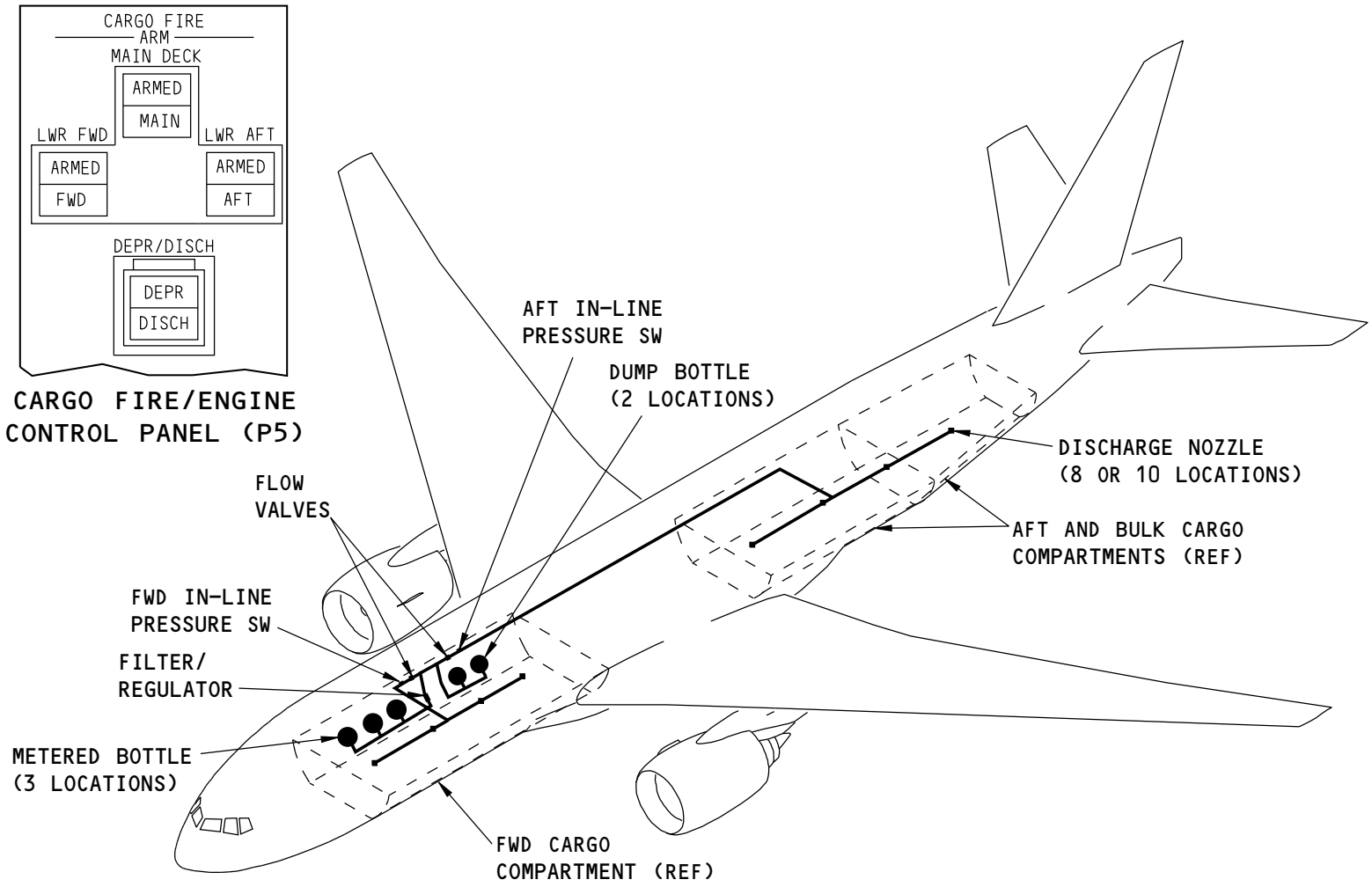
In the flight deck, cargo fire arming switches set the discharge to the forward or aft compartment. The discharge switch starts the fire bottle discharge sequence. A line pressure switch turns on the DISCH indication to show that the discharge sequence has started.

The two dump bottles discharge into the selected compartment as soon as you push the discharge switch. The bottles discharge quickly to extinguish the fire.

After a time delay, the metered bottles discharge slowly and at a controlled rate through the filter regulator. Halon from the metered bottles replaces the extinguishing agent leakage. This keeps the correct concentration of extinguishing agent in the cargo compartment to keep the fire extinguished for 195 minutes.

The metered bottles operate differently in flight and on the ground. If the airplane is on the ground when you push the discharge switch, one metered bottle starts to discharge after a twenty-minute delay. The discharge continues until the bottle is empty. The other metered bottles do not discharge.

If you push the discharge switch in flight, none of the metered bottles start to discharge immediately. If the airplane lands in less than twenty minutes, one metered bottle starts to discharge when the airplane lands. The other metered bottles do not discharge. If the airplane does not land in twenty minutes, all of the metered bottles start to discharge twenty minutes after you push the discharge switch. The discharge continues until the bottles are empty.



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LOWER CARGO FIRE EXTINGUISHING - INTRODUCTION

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LOWER CARGO FIRE EXTINGUISHING - INTERFACES

General

The lower cargo fire extinguishing system has these interfaces:

- Cargo fire/engine control panel (P5)
- Overhead panel ARINC 629 system (OPAS)
- AIMS
- ELMS
- Cabin temperature controllers
- Left and right ASCPCs
- Left and right ECS miscellaneous cards.

Cargo Fire Extinguishing System Interfaces

These are the results when you push the FWD or AFT arm switches on the P5 panel:

- The circuit for the forward or aft flow valve arms
- The circuit for the two dump bottles arms
- The switch gives OPAS a FWD or AFT ARMED signal
- OPAS transmits the ARMED signal on the 629 buses

These are the results when you push the DISCH switch on the P5 panel:

- The selected flow valve opens
- The dump bottles discharge
- The DISCH switch gives the OPAS a DISCH signal
- OPAS transmits the DISCH signal on the 629 buses
- The in-line pressure switch turns on the DISCH light on the P5 overhead panel
- ELMS discharges the metered bottles after a delay
- When the cargo fire extinguishing system is armed or senses smoke, position change of ECS components is commanded.

As the pressure in each bottle decreases, a pressure switch on the bottle sends a signal to the ELMS. The ELMS sends this data to the AIMS. The AIMS shows advisory and status messages to show that the bottle pressure is low.

Environmental Control System Interfaces

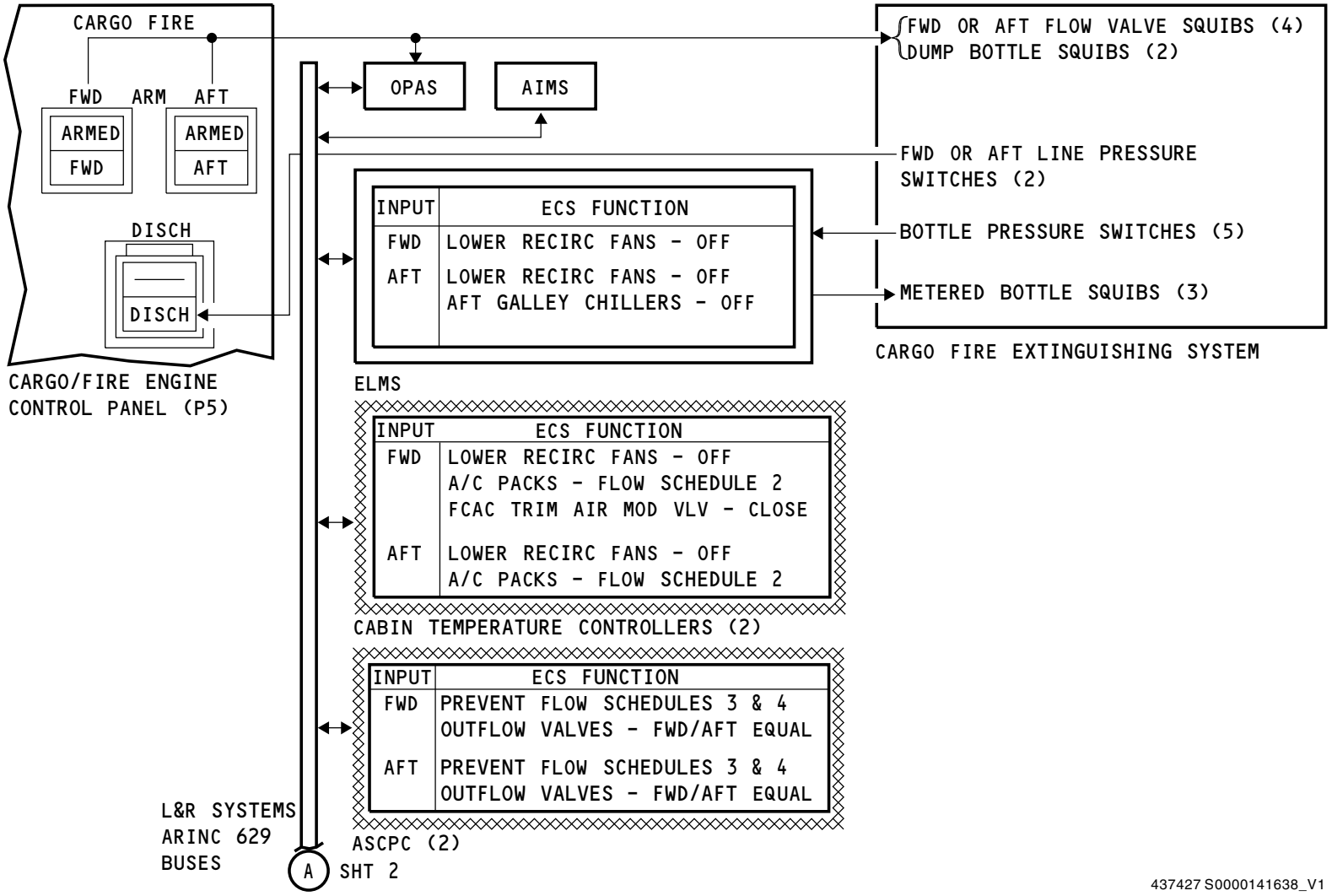
These are the results in the environmental control system when OPAS transmits the FWD ARMED signal:

- Lower recirculation fans - off
- Air conditioning packs - flow schedule 2
- Forward cargo air conditioning (FCAC) trim air modulating valve - closed
- Pressurization air outflow - 50 percent forward, 50 percent aft
- Equipment cooling system - override mode
- Galley chiller boost fan - off
- Forward cargo heating system turns off, all valves go to close
- Forward cargo ventilation system turns off, all valves go to close and exhaust fan turns off.
- IFE Cooling Fan - off

These are the results in the environmental system when OPAS transmits the AFT ARMED signal:

- Lower recirculation fans - off
- Air conditioning packs - flow schedule 2
- Pressurization air outflow - 50 percent forward, 50 percent aft
- Lav/galley vent fans - off
- Aft cargo heat valves - closed
- Bulk cargo vent fan - off
- Bulk cargo heat valves - closed.

These functions change the air flow around and through the cargo compartments. This keeps the fire extinguishing agent in the cargo compartment and keeps smoke out of the passenger compartment and flight deck.



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LOWER CARGO FIRE EXTINGUISHING - INTERFACES (SHEET 1)

LOWER CARGO FIRE EXTINGUISHING - COMPONENT LOCATIONS

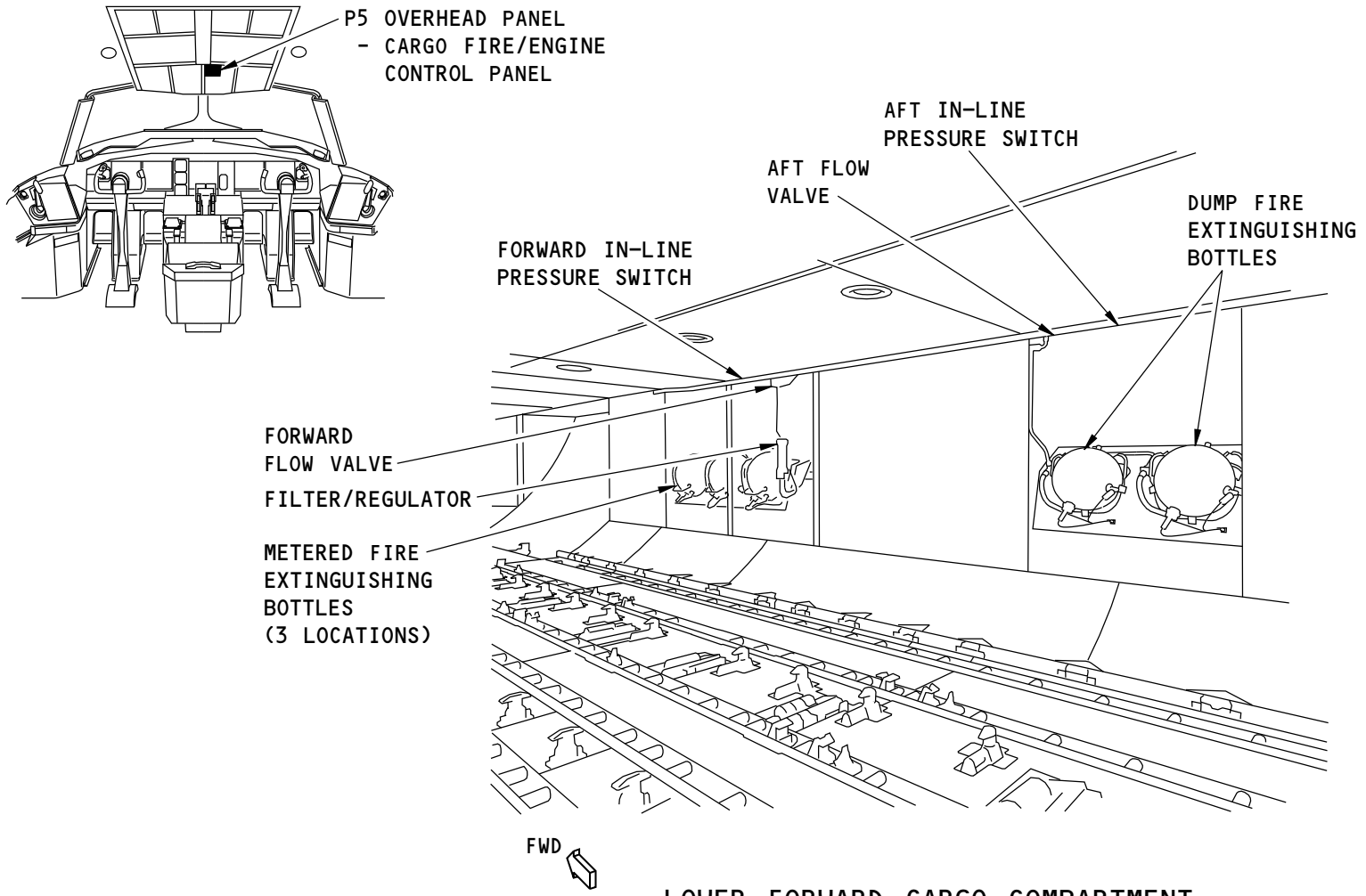
Flight Deck

The cargo fire/engine control panel is in the flight deck on the P5 overhead panel.

Lower Forward Cargo Compartment

These components of the lower cargo fire extinguishing system are in the lower forward cargo compartment:

- Filter/regulator
- Metered fire extinguishing bottles
- Forward flow valve
- Forward in-line pressure switch
- Aft flow valve
- Aft in-line pressure switch
- Dump fire extinguishing bottles.



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LOWER CARGO FIRE EXTINGUISHING - COMPONENT LOCATIONS

LOWER CARGO FIRE EXTINGUISHING - LOWER CARGO FIRE EXTINGUISHING BOTTLES - INTRODUCTION

Purpose

The lower cargo fire extinguishing bottles contain the fire extinguishing agent.

Location

The bottles are on the right side of the forward lower cargo compartment, behind the cargo compartment lining. Release the snaps then roll up the lining for access.

Physical Description

The bottles contain halon 1301 fire extinguishing agent pressurized with nitrogen. The metered bottles and dump bottles look the same but contain different amounts of halon. The metered bottles weigh approximately 80 lb (36 kg). The dump bottles weigh approximately 68 lb (31 kg). The mounting bracket arrangement on the metered bottles is different from the arrangement on the dump bottles.

The fire extinguishing bottles have these components:

- Identification plate
- Safety relief and fill port
- Handles
- Pressure switch
- Mounting brackets
- Discharge assembly
- Warning Label.

Indications

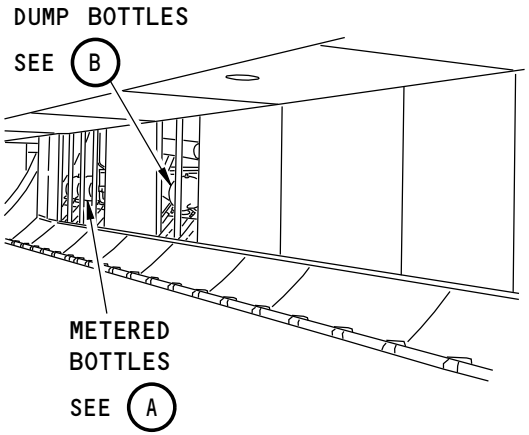
Status messages, maintenance messages, and a fire protection maintenance page show if the bottle pressure is low.

Functional Description

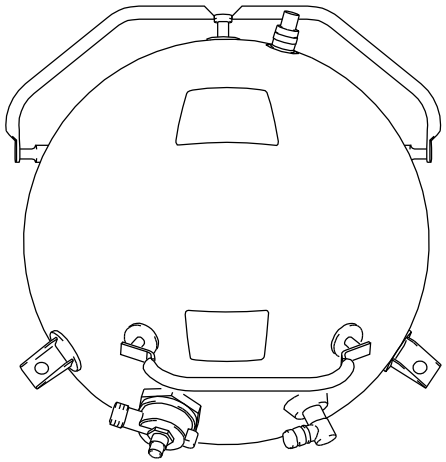
The discharge assembly has an explosive squib which releases the halon through the discharge port.

The pressure switch monitors the pressure inside the bottle and is normally open. When the bottle pressure decreases, the switch closes and sends a signal for indication.

The safety relief and fill port is a single fitting on the bottle. The safety relief opens to make sure the bottle does not break if internal pressure is too high.

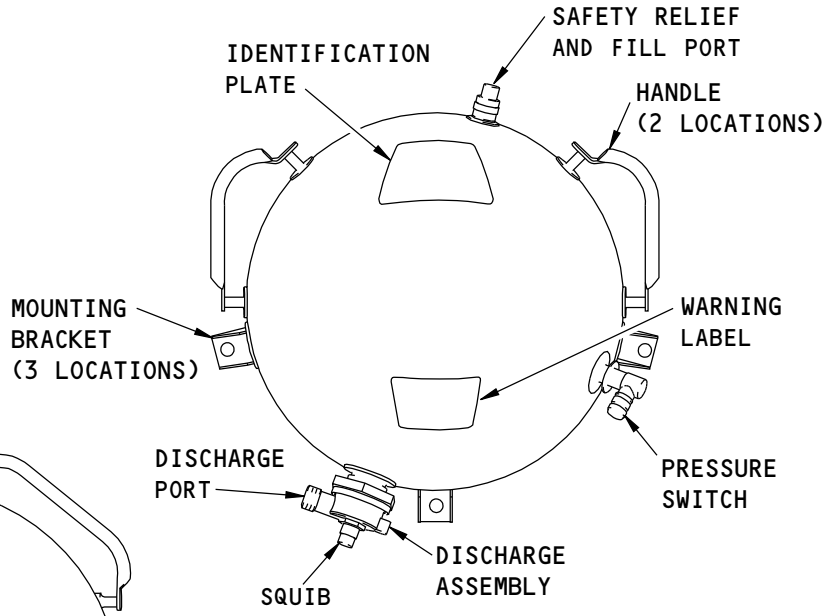


LOWER FORWARD
CARGO COMPARTMENT



METERED BOTTLE
(EXAMPLE)

A



DUMP BOTTLE
(EXAMPLE)

B

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LOWER CARGO FIRE EXTINGUISHING - FIRE EXTINGUISHING BOTTLES - TRAINING INFORMATION POINTS

Bottle Weight

You cannot fill an empty bottle on the airplane. You must replace the bottle. Compare the weight of the new bottle with the weight on the bottle identification plate. This prevents installation of a bottle which is not full.

Removal/Installation

WARNING BE CAREFUL WHEN YOU DISCONNECT THE HOSE ASSEMBLY FROM THE FIRE EXTINGUISHER BOTTLE. IF THE FIRE EXTINGUISHING BOTTLE DISCHARGED, THE TUBING MAY BE PRESSURIZED. WHEN YOU RELEASE THE PRESSURE IN THE TUBING YOU CAN CAUSE INJURY TO PERSONS.

WARNING DO NOT TOUCH THE SQUIB BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE TO RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, THE FIRE EXTINGUISHING BOTTLE CAN RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.

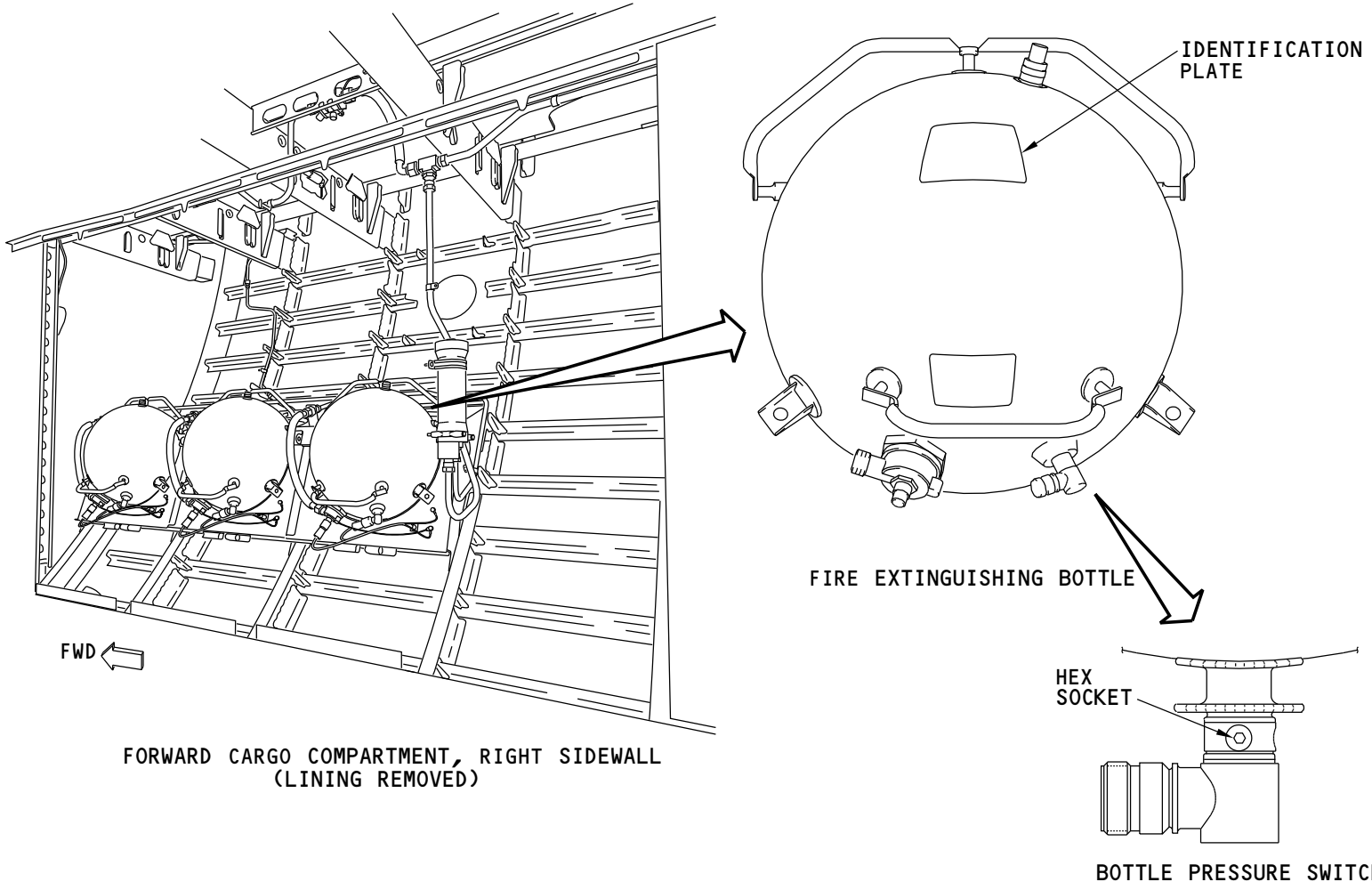
WARNING BE CAREFUL WHEN YOU MOVE THE FIRE EXTINGUISHING BOTTLE. THE FIRE EXTINGUISHING BOTTLE IS HIGHLY PRESSURIZED AND HAS AN EXPLOSIVE CARTRIDGE AS A COMPONENT. ACCIDENTAL DISCHARGE OF THE FIRE EXTINGUISHING BOTTLE CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

The discharge tubing and electrical wires are not long enough to connect to the wrong bottle. The electrical connectors for the squib and the pressure switch are different. You cannot connect the airplane wiring to the wrong device.

A platform is available to stand on while you remove and install the fire bottles.

Tests

Operate the pressure switch with a hex wrench to do a test of the pressure switch and indicating circuit. If the circuit operates properly, bottle discharge indications show in the flight deck when you operate the pressure switch.



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LOWER CARGO FIRE EXTINGUISHING - FIRE EXTINGUISHING BOTTLES - TRAINING INFORMATION POINTS

LOWER CARGO FIRE EXTINGUISHING - LOWER CARGO FIRE EXTINGUISHING BOTTLE SQUIBS

Purpose

The squib breaks a diaphragm to release the halon from the fire extinguishing bottle.

Location

The squibs are in the discharge assembly at the bottom of the fire bottles.

Physical Description

The squib is an electrically operated explosive device. It is adjacent to a bottle diaphragm that can break. The diaphragm normally seals the pressurized bottle.

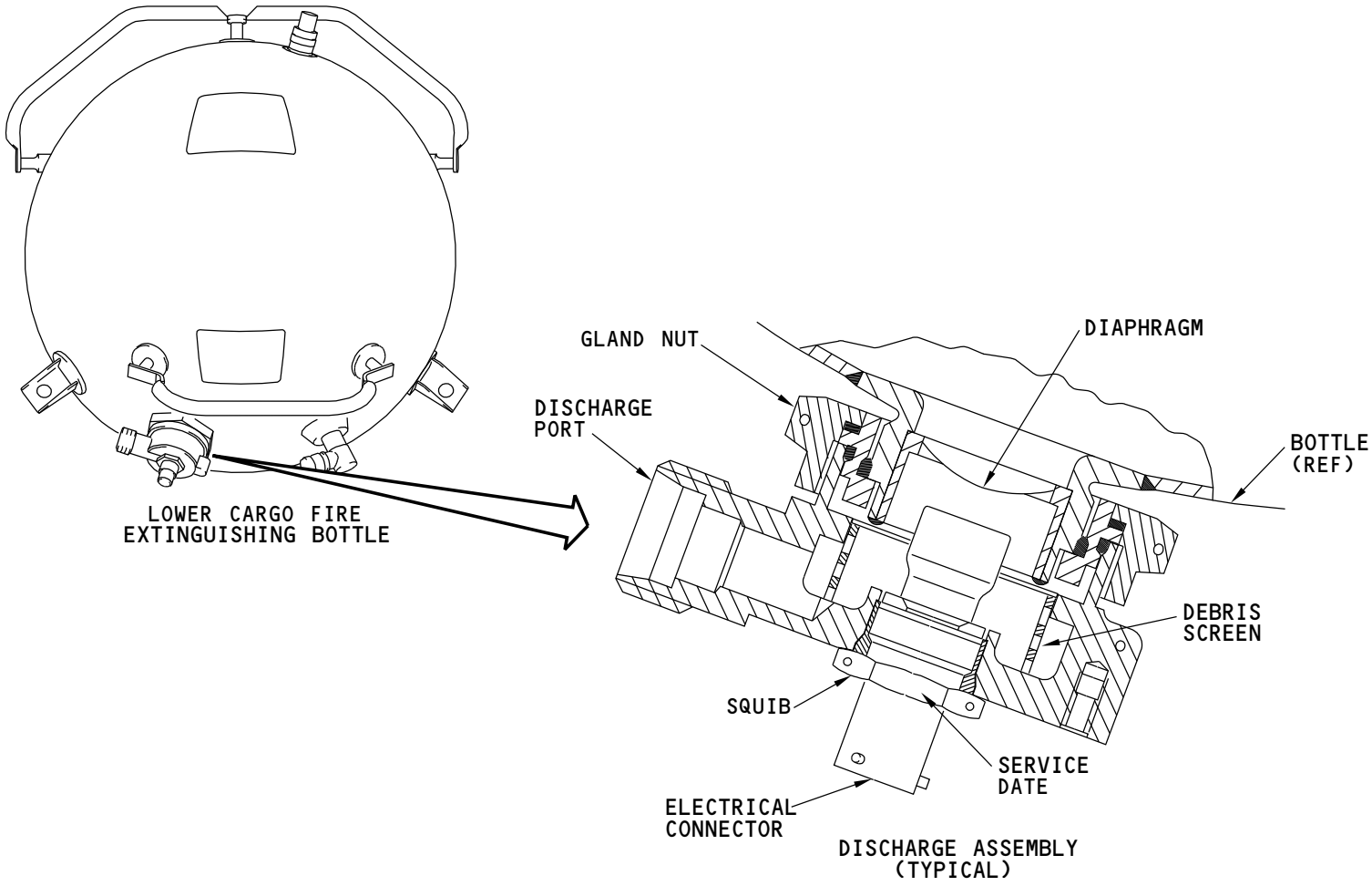
Functional Description

The squib fires when you operate the discharge controls. The explosion opens the diaphragm. Nitrogen pressure inside the bottle pushes the halon through the discharge port.

Training Information Point

The electrical load management system (ELMS) does a test of the squibs during each flight leg. Look at the status messages, maintenance messages or the fire protection maintenance page to see if the squibs are serviceable. You can also use the MAT to do a test of the squibs.

You must replace the squib every 10 years. The service date is on the squib. You can replace the squib without removing the fire extinguishing bottle.



M40885 S000617250_V1

LOWER CARGO FIRE EXTINGUISHING - LOWER CARGO FIRE EXTINGUISHING BOTTLE SQUIBS

LOWER CARGO FIRE EXTINGUISHING - IN-LINE PRESSURE SWITCH

Purpose

The in-line pressure switch gives a flight deck indication when there is pressure in the discharge line downstream of a flow valve. The cargo fire discharge light comes on to show that the fire extinguishing system operates. A maintenance message also shows.

Physical Description

The in-line pressure switch has these parts:

- Electrical connector
- Reset button
- Inlet fitting.

A bolt and clamp attaches the switch to the airplane structure.

Location

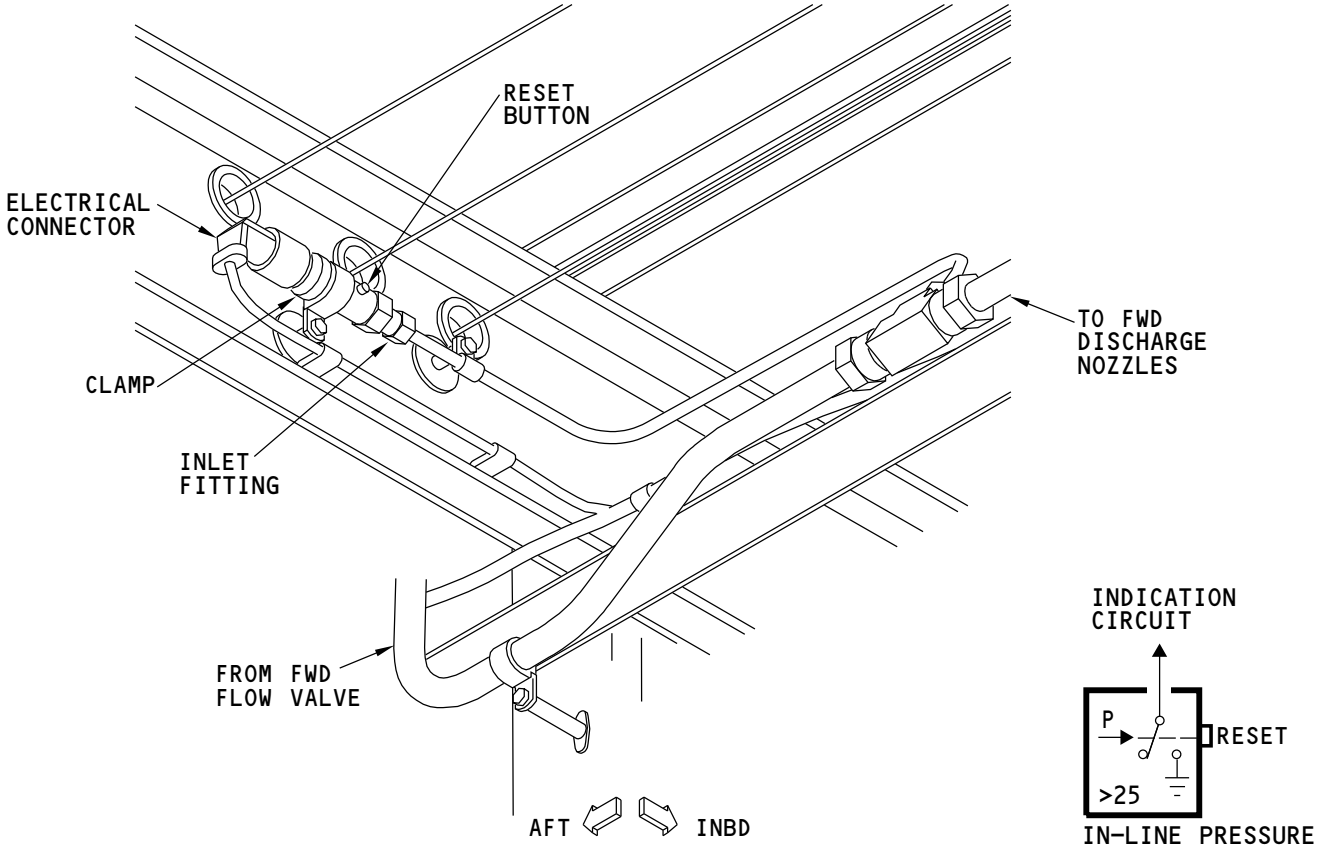
The forward in-line pressure switch is just forward of the forward flow valve. The aft in-line pressure switch is just aft of the aft flow valve. Access is through the lower cargo fire extinguishing bottle access panels.

Functional Description

The switch is normally open. When halon pressurizes the discharge line, the switch closes. Indicating circuits give the flight deck indications. The switch latches in the closed position.

Training Information Point

The in-line pressure switch latches closed when the fire extinguishing system operates. A maintenance message and the fire protection maintenance page show this condition. Use the reset button to set the switch contacts open.



FWD IN-LINE PRESSURE SWITCH
(AFT INSTALLATION SIMILAR)

M40886 S000617251_V1

LOWER CARGO FIRE EXTINGUISHING - IN-LINE PRESSURE SWITCH

LOWER CARGO FIRE EXTINGUISHING - FILTER/REGULATOR

Purpose

The filter/regulator causes a slow and continuous flow of halon from the metered bottles into the cargo compartment to keep the fire out.

Physical Description

The filter regulator has these parts:

- Inlet port
- Outlet port
- Filter/drier element (internal)
- Regulator (internal).

Location

The filter regulator is near the metered bottles, behind the lining of the lower forward cargo compartment. Access is through the metered bottle access panel.

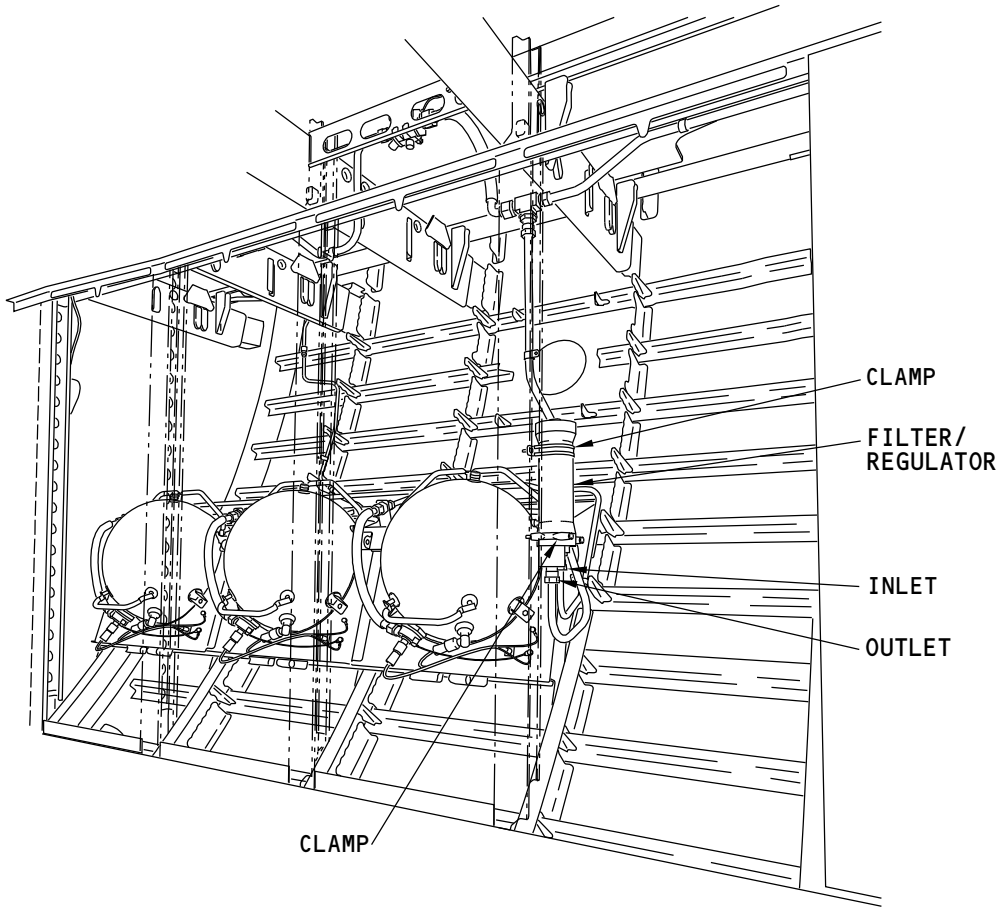
Functional Description

From the inlet port, halon goes through the filter/drier element, then through the regulator to the outlet port. The filter/drier makes sure no contamination goes to the regulator. The regulator controls the flow of halon to the discharge nozzles.

Training Information Point

The filter/regulator is internally sealed at the inlet and outlet. Pressurized halon opens the seals when the fire extinguishing system operates.

Replace the filter/regulator after the fire extinguishing system operates. The inlet and outlet are different sizes so you cannot install it incorrectly.



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LOWER CARGO FIRE EXTINGUISHING - FILTER/REGULATOR

LOWER CARGO FIRE EXTINGUISHING - FLOW VALVE

Purpose

The forward flow valve lets fire extinguishing agent from the bottles go to the forward cargo compartment. The aft flow valve lets fire extinguishing agent from the bottles go to the aft cargo compartment.

Physical Description

The flow valve has these parts:

- Two protective caps
- Two cap rests
- Inlet port
- Diaphragm
- Two squibs
- Outlet port
- Debris screen.

Location

The two flow valves are behind the right sidewall lining of the forward cargo compartment, near the ceiling. The forward flow valve is above the metered bottles. The aft flow valve is above the dump bottles. Access is through the fire bottle access panels.

Functional Description

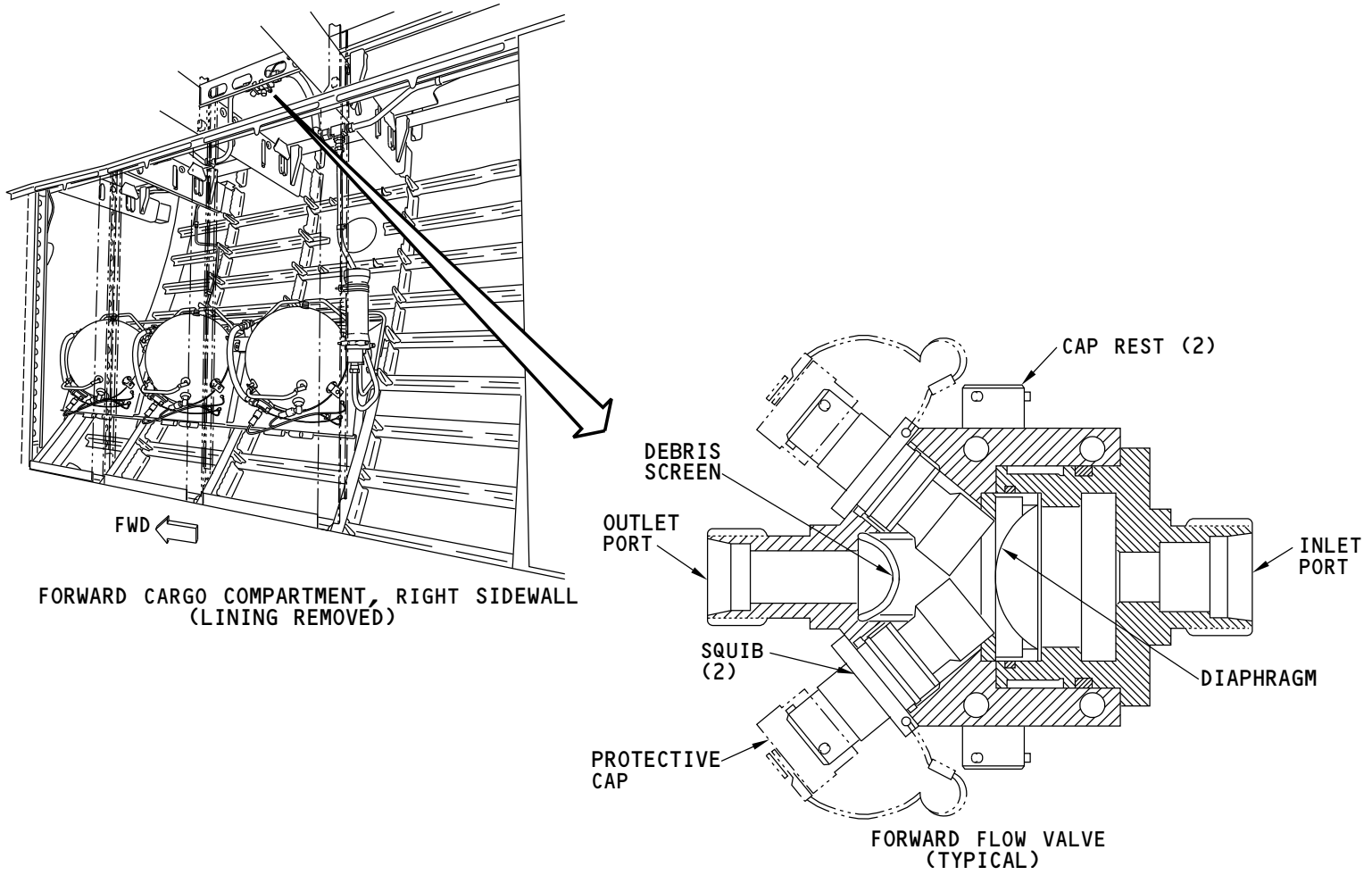
The inlet port connects to the fire extinguishing bottles. The outlet port connects to the discharge line. The valve is normally closed by the diaphragm between the inlet and outlet.

Two explosive squibs are adjacent to the diaphragm. The squibs fire when you operate the related fire extinguishing controls. The explosion tears the diaphragm and lets halon go through the valve. The debris screen catches pieces of the disc and squibs to prevent contamination of downstream components. Only one squib is necessary to tear the diaphragm. Two squibs are used to make sure the valve opens.

Training Information Point

Replace the correct flow valve after the fire extinguishing system operates. Different size inlet and outlet ports prevent incorrect installation. The two squibs have the same purpose. Connect the airplane wiring to the squibs in any sequence. The forward and aft flow valves are interchangeable.

WARNING INSTALL THE PROTECTIVE CAPS ON THE ELECTRICAL CONNECTORS ANY TIME THE AIRPLANE WIRING IS NOT CONNECTED. ACCIDENTAL DISCHARGE OF THE SQUIBS CAN CAUSE INJURY.



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LOWER CARGO FIRE EXTINGUISHING - FLOW VALVE

LOWER CARGO FIRE EXTINGUISHING - FLOW VALVE SQUIB

Purpose

The squibs open the flow valve to let halon go to the forward or aft cargo compartment.

Location

The squibs are in the flow valves.

Physical Description

The squib is an electrically operated explosive device. It is adjacent to a diaphragm that can break. The diaphragm normally isolates the valve inlet from the outlet.

Functional Description

The squibs fire at the same time the dump bottles discharge. The explosion opens the diaphragm. Halon flows through the flow valve to the discharge nozzles.

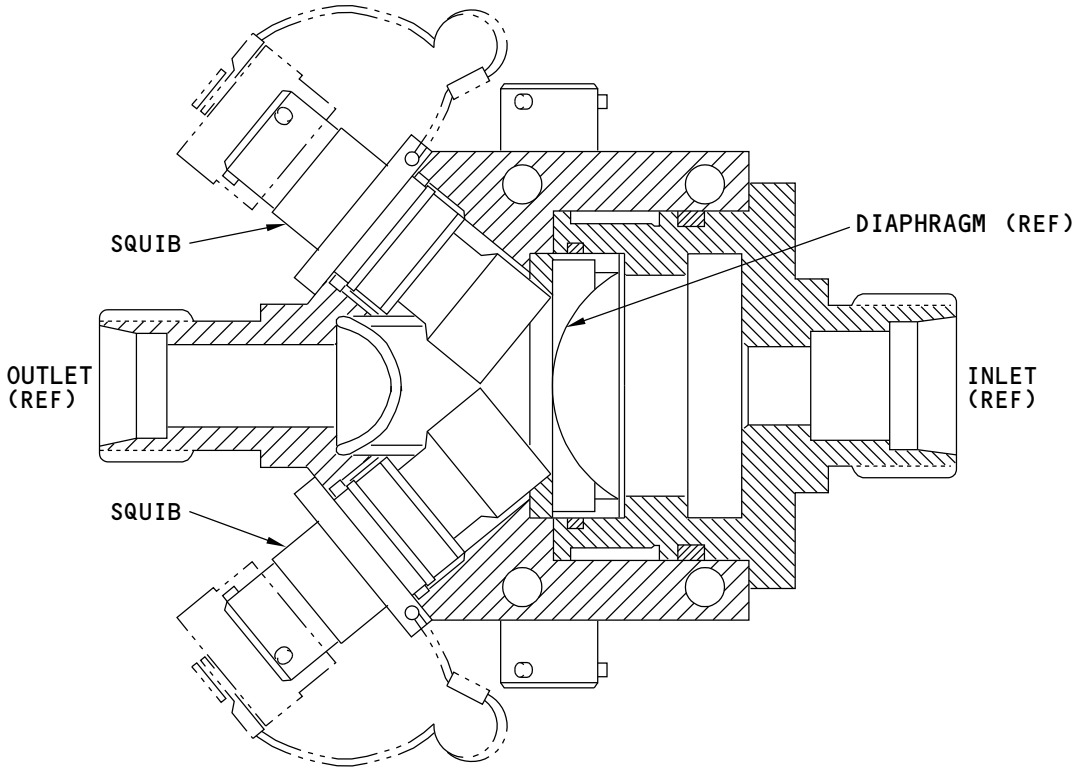
Training Information Point

WARNING DO NOT TOUCH THE SQUIB BEFORE YOU DO THE PROCEDURES FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE THE SQUIB TO FIRE AND CAUSE INJURY TO PERSONS.

WARNING PUT A PROTECTIVE COVER ON THE SQUIB. IF YOU DO NOT PUT A PROTECTIVE COVER ON THE SQUIB, THE SQUIB CAN ACCIDENTLY FIRE AND CAUSE INJURY TO PERSONS.

You must replace the squib every 10 years. The service date is on the squib. Both flow valve squibs are the same. Connect the airplane wiring to the squibs in any sequence.

The lower cargo extinguishing system does a test of the squibs during each flight leg. Look at the status messages, maintenance messages or the fire protection maintenance page to see if the squibs are serviceable. You can also use the MAT to do a test of the squibs.



M40889 S000617254_V1

LOWER CARGO FIRE EXTINGUISHING - FLOW VALVE SQUIB

LOWER CARGO FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - FLOW

General

An explosive squib inside the discharge assembly releases halon from the bottles. Flow valves, also operated by explosive squibs, let the halon go to the forward or aft cargo compartment. Flight and ground operation are different.

Operation - Flight

This is what happens when you operate the controls for a lower cargo fire:

- The squibs for bottles 1A and 1B fire
- The squibs in the selected flow valve fire
- A twenty-minute timer in the ELMS starts.

The squib explosion opens the diaphragms in the dump bottles and in the selected flow valve. Nitrogen pressure pushes the halon from the bottles, through the open flow valve, and into the selected cargo compartment. Pressure in the discharge line operates the in-line pressure switch. This switch gives a flight deck indication of bottle discharge.

Pressure switches monitor the pressure in the dump bottles. When the pressure decreases, the switches causes low pressure indications to show in the flight deck.

After twenty minutes, the ELMS fires the squibs for bottles 2A, 2B, 2C, and 2D and 2E (when installed). Halon from the bottles goes through the filter/regulator and into the selected cargo compartment. The filter/regulator causes a slow and continuous flow of halon into the cargo compartment to keep the fire out.

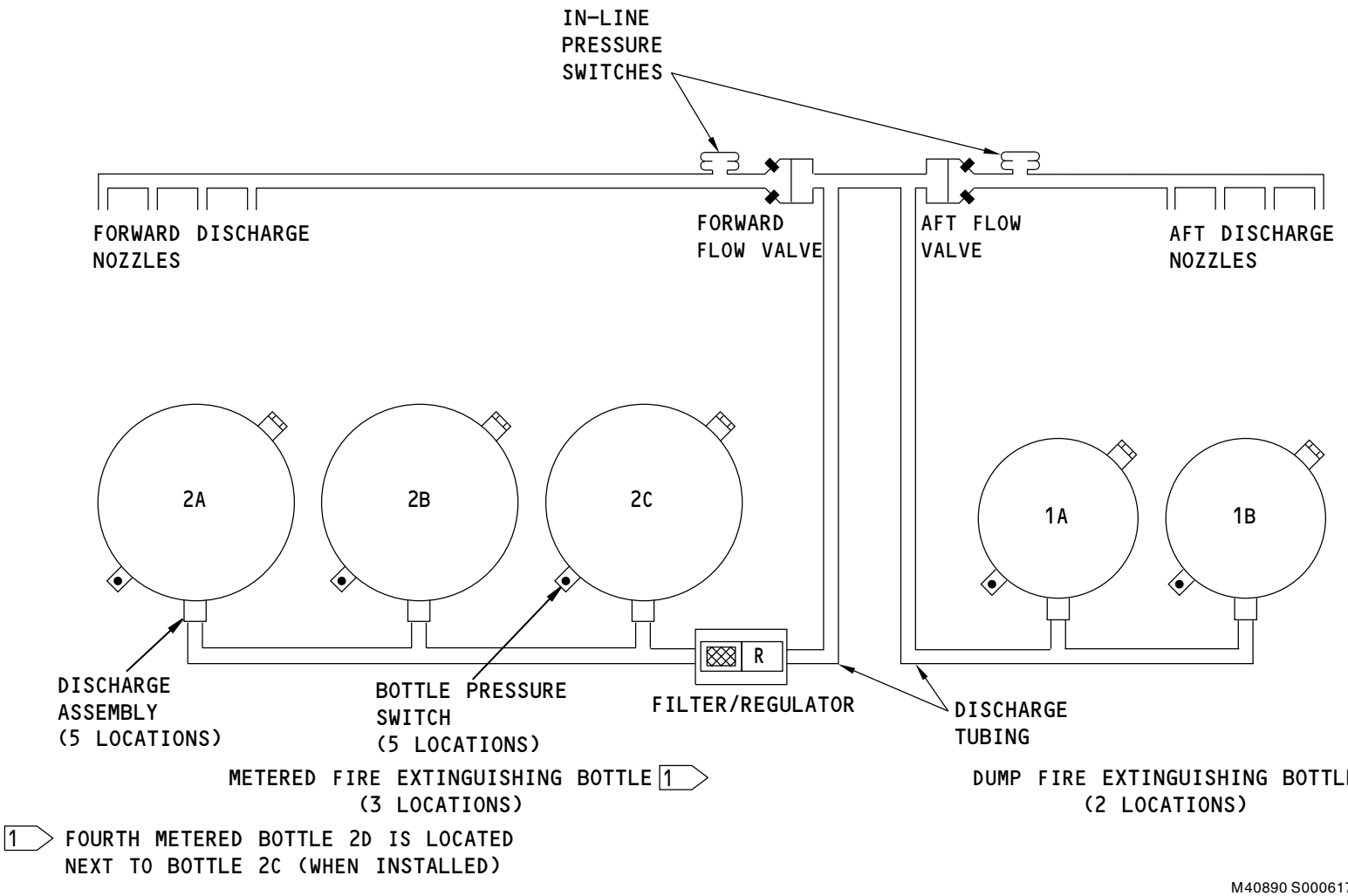
If the airplane lands before the twenty minute time delay ends, bottle 2A discharges at landing. Bottles 2B, 2C, and 2D and 2E (when installed) do not discharge.

When pressure in a metered bottle decreases, the bottle pressure switch causes advisory and status low pressure messages to show.

Operation for an aft cargo fire is almost the same. The aft flow valve opens instead of the forward flow valve. This causes the fire extinguishing agent to go to the aft lower cargo compartment.

Operation - Ground

If you operate the system when the airplane is on the ground, the metered bottle discharge is different. After the twenty minute time delay, the squib for bottle 2A fires. Bottles 2B, 2C, and 2D and 2E (when installed) do not discharge when the airplane is on the ground.



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LOWER CARGO FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - FLOW

Bottle Discharge

Push the forward or aft cargo fire arm switch to arm the cargo fire extinguishing system. The switch makes a ground for the squib bottles 1A, 1B control relay. Push the cargo fire discharge switch to fire the squibs. That switch lets power from the hot battery bus go to energize the relay. With the relay energized, power from the hot battery bus goes to the bottle 1A and 1B squibs. At the same time, power goes through the discharge switch and the arm switch to the forward or aft flow valve squibs.

Discharge Indication

Pressure in the discharge line closes the forward or aft in-line pressure switch. The ELMS makes a ground for the cargo fire discharge light and sends a signal to the AIMS. Advisory and maintenance messages show that the forward or aft in-line pressure switch is closed. The fire protection maintenance page also shows this condition.

When pressure inside a bottle decreases, the bottle pressure switch closes and makes a ground. The ELMS sends a signal to the AIMS. Status and maintenance messages show low bottle pressure. The fire protection maintenance page also shows this condition.

Squib Test

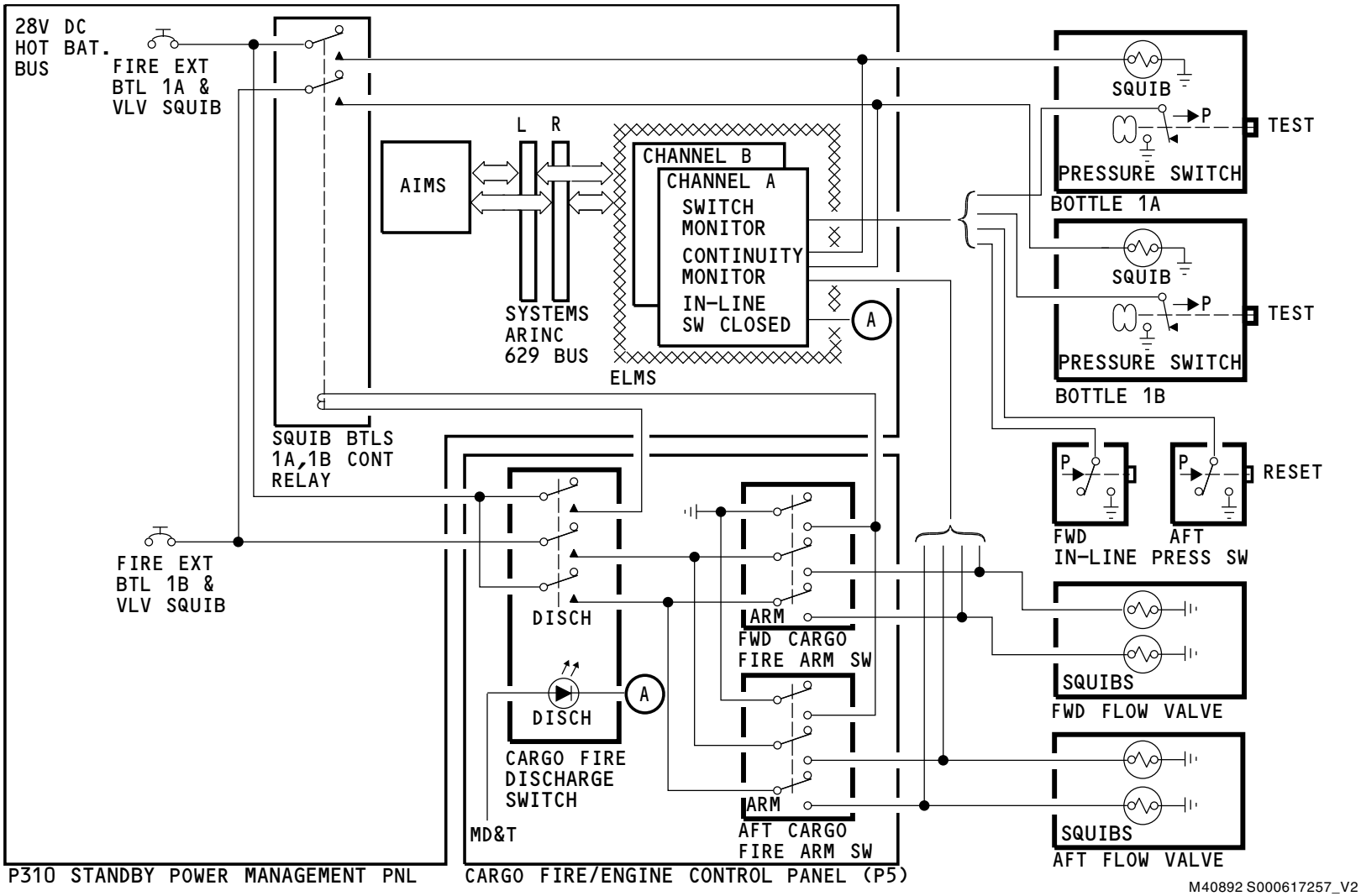
The ELMS monitors the electrical continuity of the squib circuits. The ELMS does this check one time during each flight leg. The ELMS transmits data about an open squib circuit to the AIMS. Status and maintenance messages show that a squib circuit is faulty. The fire protection maintenance page also shows this condition.

You can also do a test of the squib circuits with the MAT.

Training Information Point

You can do a check of the bottle pressure switch circuits on the ground. Use a hex key to rotate the bottle pressure switch test socket to close the switch. A bottle low pressure status messages must show

The in-line pressure switch latches closed when the fire extinguishing system operates. Use the reset button to set the switch contacts open.



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LOWER CARGO FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - DUMP BOTTLES CIRCUIT

Bottle Discharge

When you push a cargo fire arm switch, a signal goes to the overhead panel ARINC 629 system (OPAS). The OPAS sends this data to the ELMS. Pushing the discharge switch starts a twenty minute timer. After twenty minutes, the discharge control circuit makes a ground for the two squib control relays. The relays energize and send power from the hot battery bus to the metered fire bottle squibs.

Discharge Indication

When pressure inside a bottle decreases, the bottle pressure switch closes and makes a ground. The ELMS electronics unit sends a signal to the AIMS. Status and maintenance messages show low bottle pressure. The fire protection maintenance page also shows this condition.

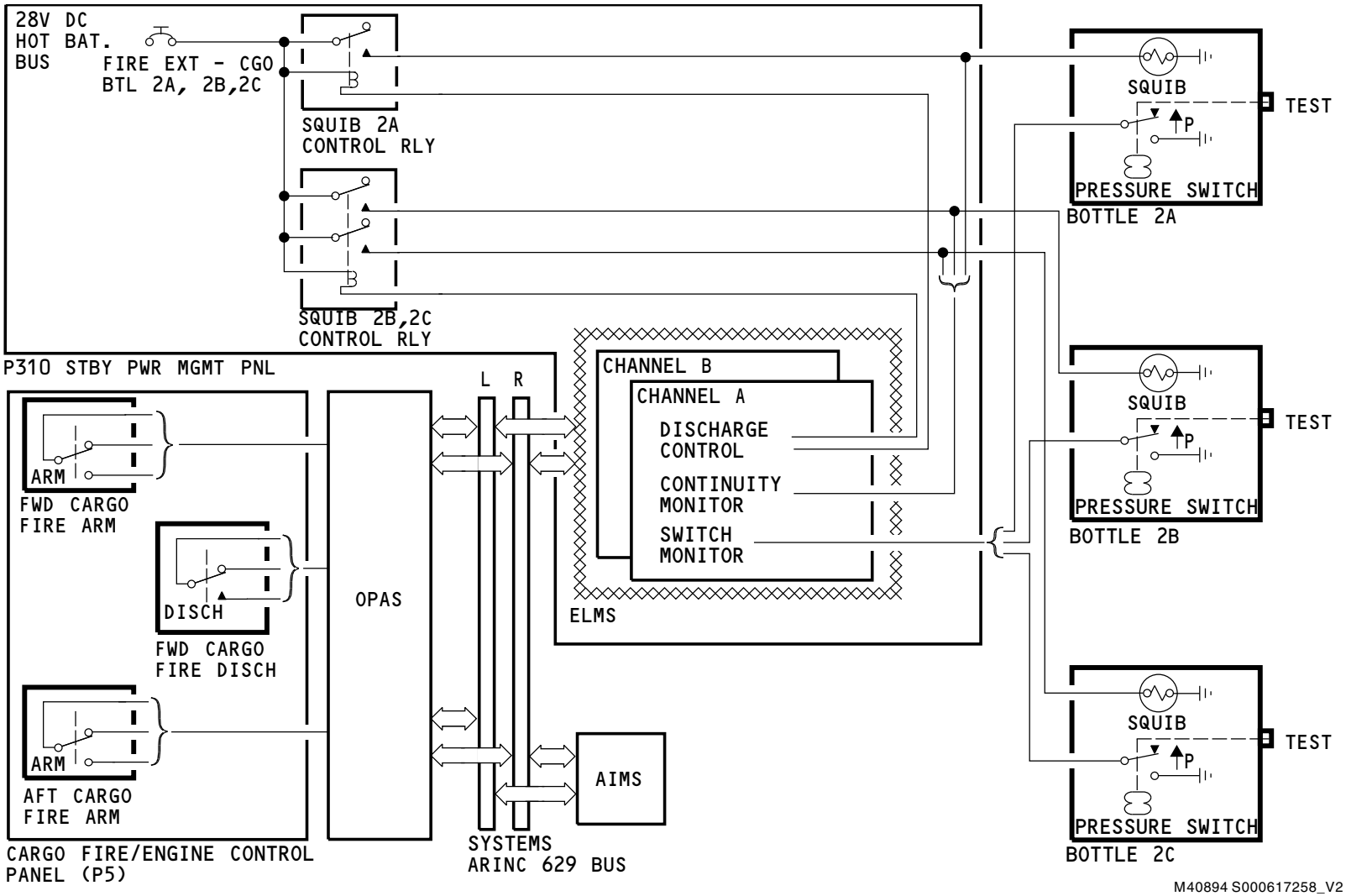
Squib Test

The ELMS monitors the electrical continuity of the squib circuits. The ELMS does this check one time during each flight leg. The ELMS transmits data about an open squib circuit to the AIMS. Status and maintenance messages show that a squib circuit is faulty. The fire protection maintenance page also shows this condition.

You can also do a test of the squib circuits with the MAT.

Training Information Point

You can do a check of the bottle pressure switch circuits on the ground. Use a hex key to rotate the bottle pressure switch test socket to close the switch. A bottle low pressure status messages must show.



M40894 S000617258_V2

LOWER CARGO FIRE EXTINGUISHING - FUNCTIONAL DESCRIPTION - METERED BOTTLES CIRCUIT

Cargo Smoke Indication

If there is smoke in a lower cargo compartment, these indications occur in the flight deck:

- The master warning lights come on
- The fire warning aural operates
- A cargo fire warning message shows
- The cargo fire warning light comes on.

The master warning lights and fire warning aural are prevented from operating during part of the takeoff.

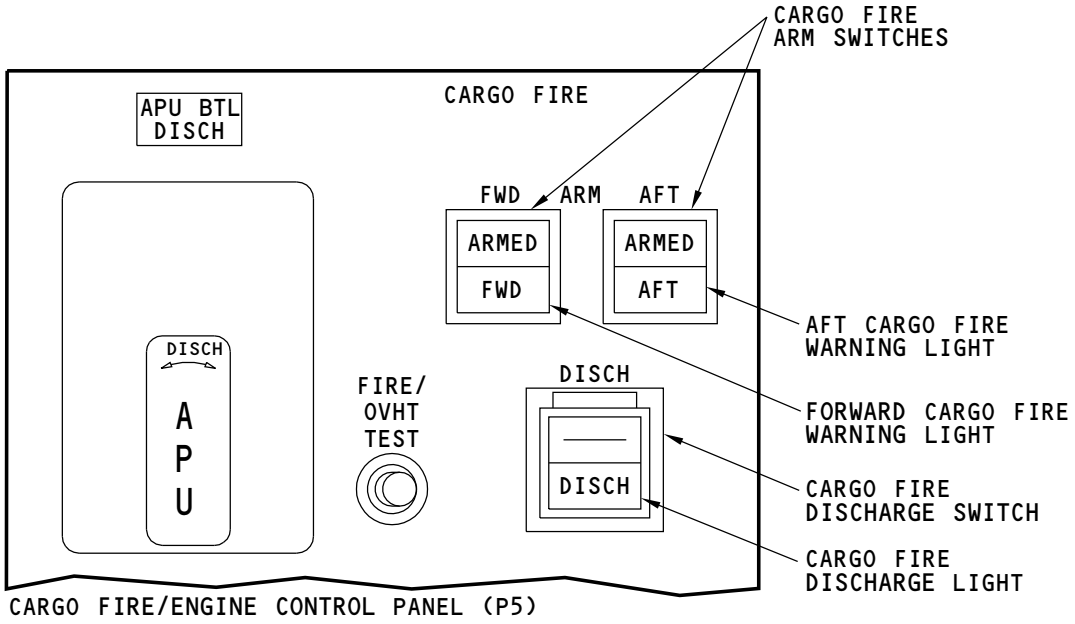
Operation

Push the lighted cargo fire arm switch to arm the system. Push the cargo fire discharge switch and hold it for one second. Make sure the cargo fire discharge light comes on.

Training Information Point

The two dump bottles fire as soon as you push the cargo fire discharge switch. With the airplane on the ground, twenty minutes later bottle 2A fires and starts a metered discharge.

The lower cargo fire extinguishing system uses the hot battery bus. You can discharge the lower cargo fire bottle with the battery switch off and without ground power on the airplane.



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LOWER CARGO FIRE EXTINGUISHING - OPERATION - CONTROLS

LOWER CARGO FIRE EXTINGUISHING - OPERATION - INDICATIONS

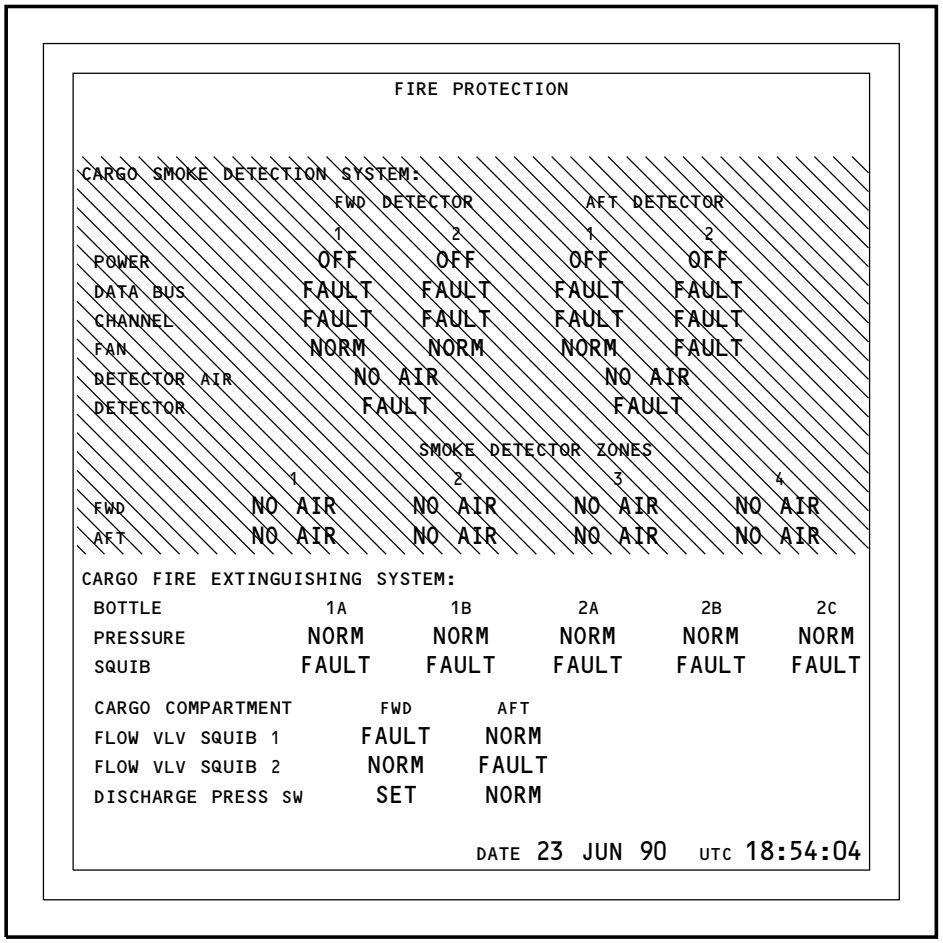
Fire Protection Maintenance Page

Operational status of the lower cargo fire extinguishing system is shown on the fire protection maintenance page format.

EICAS And Maintenance Messages

EICAS or maintenance messages show these conditions:

- A fire bottle has Low pressure
- A bottle squib circuit is open
- A flow valve squib circuit is open
- An in-line pressure switch is set
- The initiated squib test is complete.



FIRE PROTECTION MAINTENANCE PAGE

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LOWER CARGO FIRE EXTINGUISHING - OPERATION - INDICATIONS

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LAVATORY WASTE COMPARTMENT FIRE EXTINGUISHING - FIRE EXTINGUISHER BOTTLE

Purpose

The lavatory waste compartment fire extinguisher extinguishes fires in the waste compartment.

Physical Description

The fire extinguisher is a bottle with two nozzles. The bottle contains a pressurized fire extinguishing agent. The nozzles are sealed with a solder which melts at approximately 170 F (77 C).

Location

The fire extinguisher is above the waste container in the cabinet under the sink. The fire extinguisher nozzles point into the waste container. Open the cabinet for access.

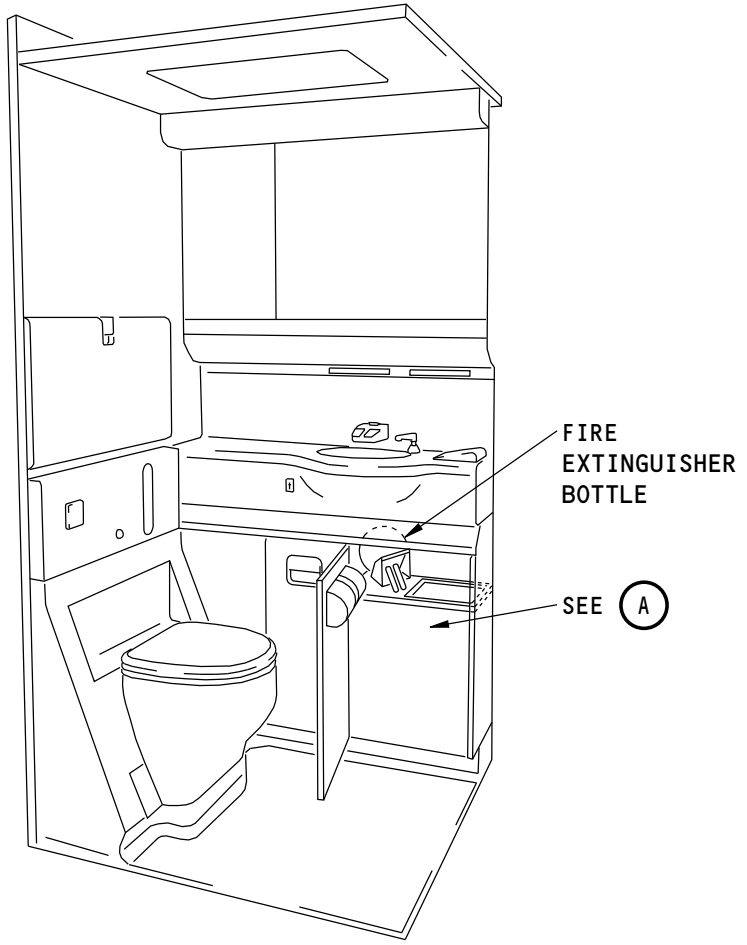
Functional Description

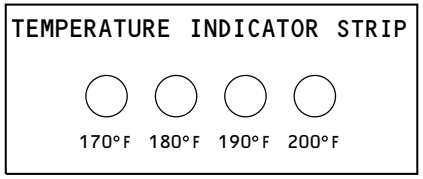
A fire in the waste container melts the solder on the nozzles. This releases the fire extinguishing agent from the bottle to put out the fire.

Training Information Point

A temperature indicator on the side of the waste container shows if there has been a fire. You can see the indicator without removing the container to look inside. The indicator circles are normally white. Black circles show a fire.

You can weigh the fire extinguisher to find out if it is empty. Replace an empty bottle; you cannot fill it again.





TEMPERATURE INDICATOR

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LAVATORY WASTE COMPARTMENT FIRE EXTINGUISHING - FIRE EXTINGUISHER BOTTLE

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PORTABLE FIRE EXTINGUISHERS

General

Portable fire extinguishers are located throughout the airplane (Flight Compartment and Passenger Compartment). These consist of nine (9) Bromochlorodifluoromethane (BCF) or 2-bromotrifluoropropene (2-BTP), and two (2) water fire extinguishers. The number of portable fire extinguishers fitted is the same on both the A-market and the IGW airplanes. All are attached by quick-release mounting straps.

The BCF/2-BTP fire extinguishers are located in the stow boxes at the crew seats at Doors 1, 2, and 3, and in the cupboards adjacent to the crew seats at Door 4. There is also a BCF/2-BTP fire extinguisher located in the flight deck.

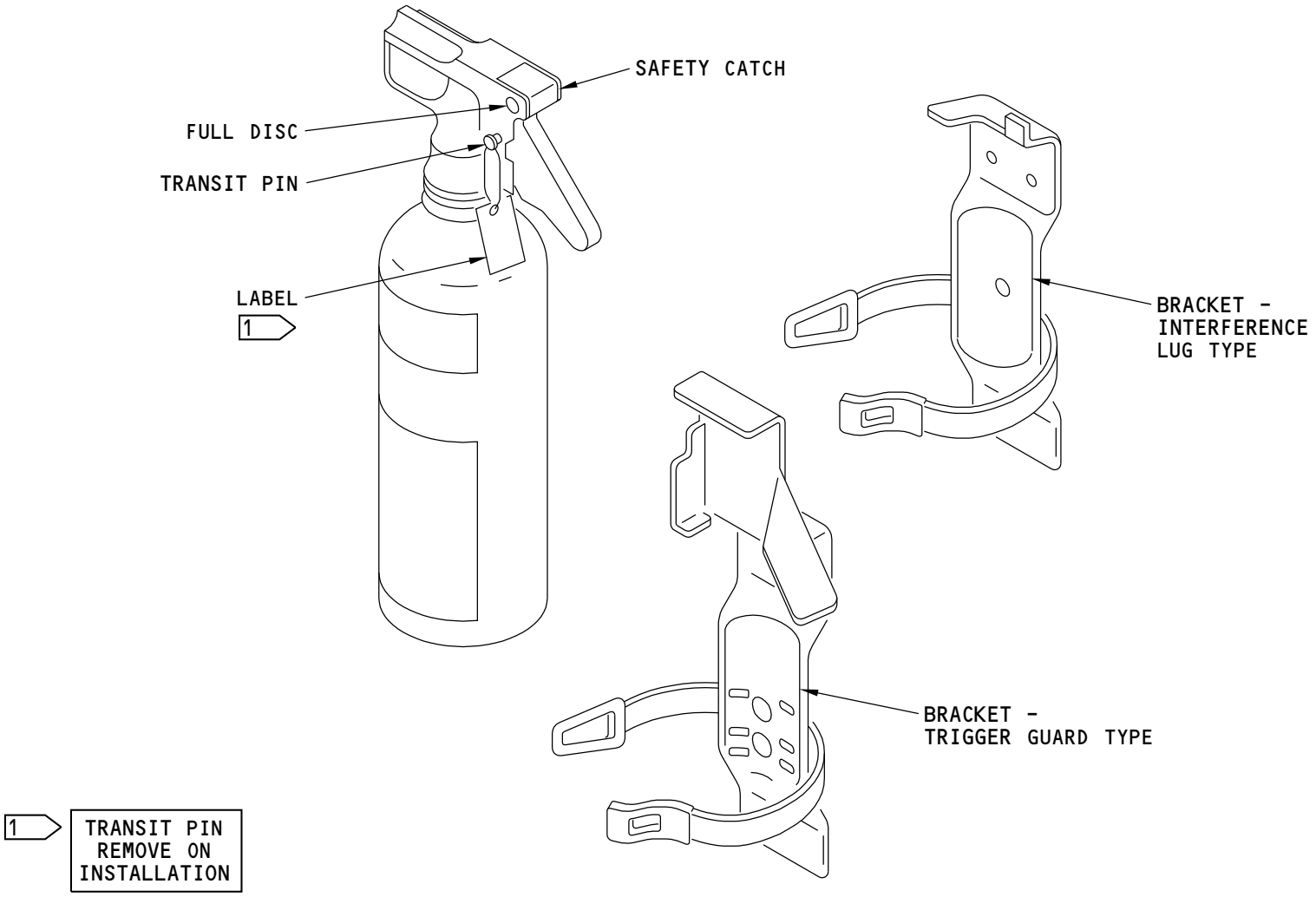
The pressurized water extinguishers are located in the stowage box at the crew seat at Door 1 Left, and in the cupboard adjacent to the crew seat at Door 4 Right.

The extinguisher can have a one/two quick-release strap bracket, and is easily removed from its bracket with one hand. To operate, hold the extinguisher in either hand, slide the (red) safety catch up with the thumb, direct the nozzle toward the base of the fire source, and squeeze the trigger with the palm of the hand. This will cause a piston valve in the operating handle to fracture a frangible plug seal on the top of the container, releasing the extinguishant through the discharge nozzle, which is designed to give a wide, flat pattern. Releasing the trigger closes a secondary seal and interrupts the flow of extinguishant, thus retaining part of the charge without waste, for dealing with flash-backs or re-ignition, should they occur. On first pressing the trigger, a red indicator disc is ejected from the rear of the operating head. This provides a visual indication of partial or complete discharge.

BCF/2-BTP Fire Extinguishers

The BCF/2-BTP fire extinguishers are effective in combating Class A, B, or C, type fires. To operate, first release the safety catch, and then press the trigger. This fractures the frangible seal, discharging the contents through the nozzle. Operation of the trigger also fractures the restraining disk, providing a visual indication that the extinguisher has been used. Once used, a new, recharged container must be installed.

The 2-bromotrifluoropropene (2-BTP) is a non-ozone depleting substance (non-ODS), chemically-acting fire suppressant with a similar toxicological profile as Halon 1211. The 2-BTP is the selected replacement for Halon 1211 in portable fire extinguishers.



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PORTABLE FIRE EXTINGUISHERS (EXAMPLE)