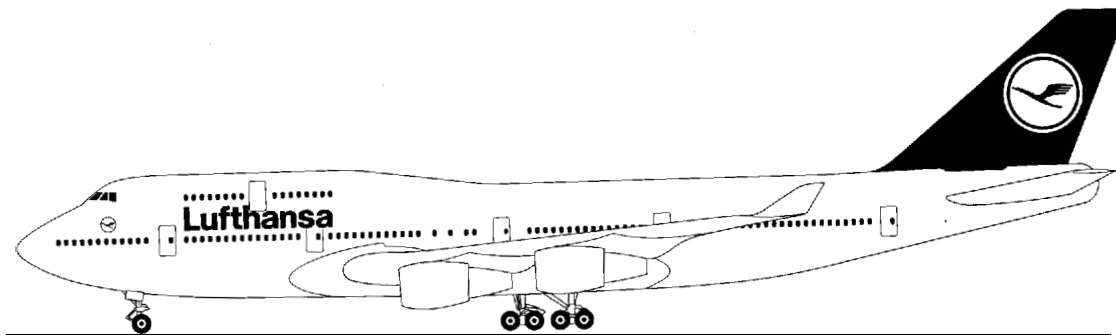




Lufthansa Technical Training

Training Manual B 747-400

ATA 26 FIRE PROTECTION ATA Spec 104 Level 3



Book No:

Lufthansa
Technical Training GmbH
Lufthansa Base

Issue: JAN 2002
For Training Purposes Only
© Lufthansa 1995



Lufthansa Technical Training

For training purpose and internal use only.

Copyright by Lufthansa Technical Training GmbH.

All rights reserved. No parts of this training manual may be sold or reproduced in any form without permission of:

Lufthansa Technical Training GmbH

Lufthansa Base Frankfurt

D-60546 Frankfurt/Main

Tel. +49 69 / 696 41 78

Fax +49 69 / 696 63 84

Lufthansa Base Hamburg

Weg beim Jäger 193

D-22335 Hamburg

Tel. +49 40 / 5070 24 13

Fax +49 40 / 5070 47 46

FIRE PROTECTION



FIRE PROTECTION

FIRE PROTECTION GENERAL

The fire protection systems consist of overheat, fire and smoke detection and extinguishing in various parts of the airplane.

Protection is provided for:

- Engines (overheat, fire, extinguishing)
- Auxiliary power unit (fire, extinguishing)
- Main wheel well (fire)
- Pneumatic system (overheat)
- Cargo compartments (smoke, extinguishing)
- Crew rest (smoke)

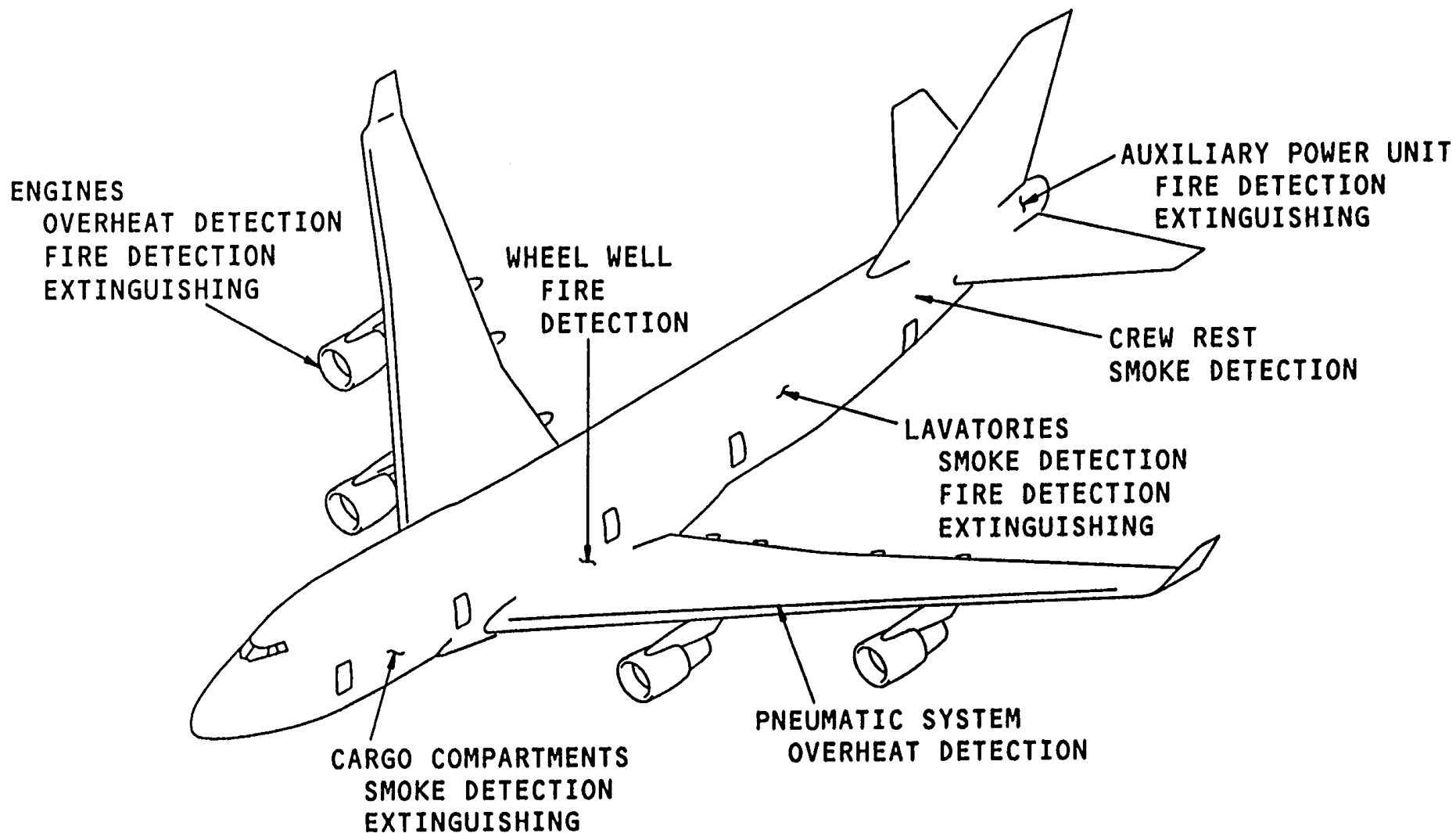


Figure 1 FIRE PROTECTION

FIRE PROTECTION



OVERHEAT, FIRE & SMOKE DETECTION SYSTEM

Engine Overheat

The engine overheat condition is sensed by the dual loop overheat detector and monitored by the detector and automatic fire/overheat logic test system (AFOLTS) cards.

Indications of engine overheat are by aural caution, master caution lights and EICAS.

Engine Fire

The engine fire condition is sensed by dual loop fire detectors and monitored by the detector and AFOLTS cards.

Indications of engine fire are by fire bell, master warning lights, fire handle on P5, fuel control switch on P8 and EICAS.

APU Fire

The APU fire condition is sensed by dual loop fire detectors and monitored by the detector and AFOLTS cards.

Indications of APU fire are by fire bell, master warning lights, fire handle on P5, EICAS and fire light and horn on M869.

Cargo Smoke

The forward and aft cargo compartment smoke is sensed by smoke detectors and monitored by the AFOLTS cards.

Indications of lower lobe cargo smoke are by fire bell, master warning lights, fire light on P5 and EICAS.

Wheel Well Fire

The wheel well fire condition is sensed by the detector card.

Indications of wheel well fire are by fire bell, master warning lights and EICAS.

Wing Leading Edge Overheat

The wing leading edge overheat condition is sensed by overheat switches and monitored by the AFOLTS card.

Indications of wing leading edge overheat are by aural caution, master caution lights and EICAS.

Lavatory Smoke

The lavatory smoke is sensed by smoke detectors.

Indications of lavatory smoke are by horn and light on the smoke detector, flashing of attendant master call lights, chime, external lavatory call light and attendant panel lights.

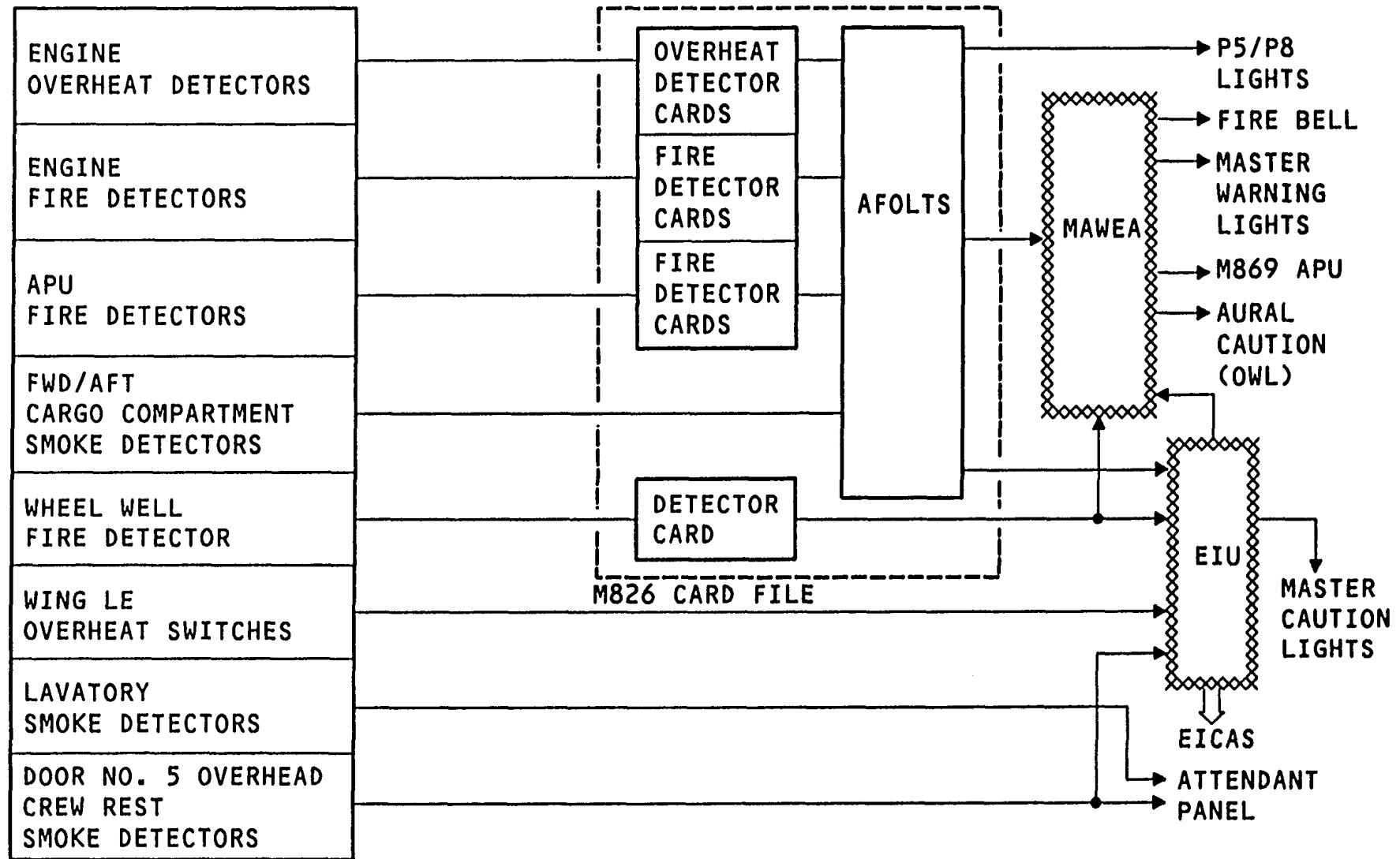
Door No. 5 Overhead Crew Rest Smoke

The door No. 5 overhead crew rest smoke is sensed by the smoke detectors.

Indications of crew rest area smoke are by horn and light on the smoke detector, flashing of attendant master call lights, chime, attendant panel lights, aural caution, master caution lights and EICAS.

Takeoff Inhibit

The fire warning indications are inhibited during takeoff. The inhibit functions starts when the computed airspeed is greater than decision speed. If airspeed information is not available from the ADC or FMC, the inhibit function starts when the airplane pitch angle exceeds 50. The inhibit function ends when radio altitude is equal to or more than 400 feet or after 25 seconds, whichever occurs first.

**Figure 2 OVERHEAT, FIRE AND SMOKE DETECTION SYSTEM**

FIRE PROTECTION



M826 CARD FILE

The M826 card file contains 35 printed circuit cards for the engine, auxiliary power unit, wheel well and cargo smoke detection. It is located in the E/E compartment on the left side of the nose gear wheel well.

The cards are:

A1	Engine 1 fire detector A
A2	Engine 1 fire detector B
A3	AFOLTS engine 1 fire/overheat
A4	Engine 1 overheat detector A
A5	Engine 1 overheat detector B
A6	Engine 2 fire detector A
A7	Engine 2 fire detector B
AB	AFOLTS engine 2 fire/overheat
A9	Engine 2 overheat detector A
A10	Engine 2 overheat detector B
All	Engine 3 fire detector A
A12	Engine 3 fire detector B
A13	AFOLTS engine 3 fire/overheat
A14	Engine 3 overheat detector A
A15	Engine 3 overheat detector B
A16	Engine 4 fire detector A
A17	Engine 4 fire detector B
A18	AFOLTS engine 4 fire/overheat
A19	Engine 4 overheat detector A
A20	Engine 4 overheat detector B
A21	APU fire detector loop A

A22	AFOLTS APU fire
A23	APU fire detector loop B
A24	Wheel well fire detector
A25-A29	Unused card slot
A30	Diodes
A31	AFOLTS forward cargo smoke
A32	AFOLTS aft cargo smoke
A33-A35	Unused card slot

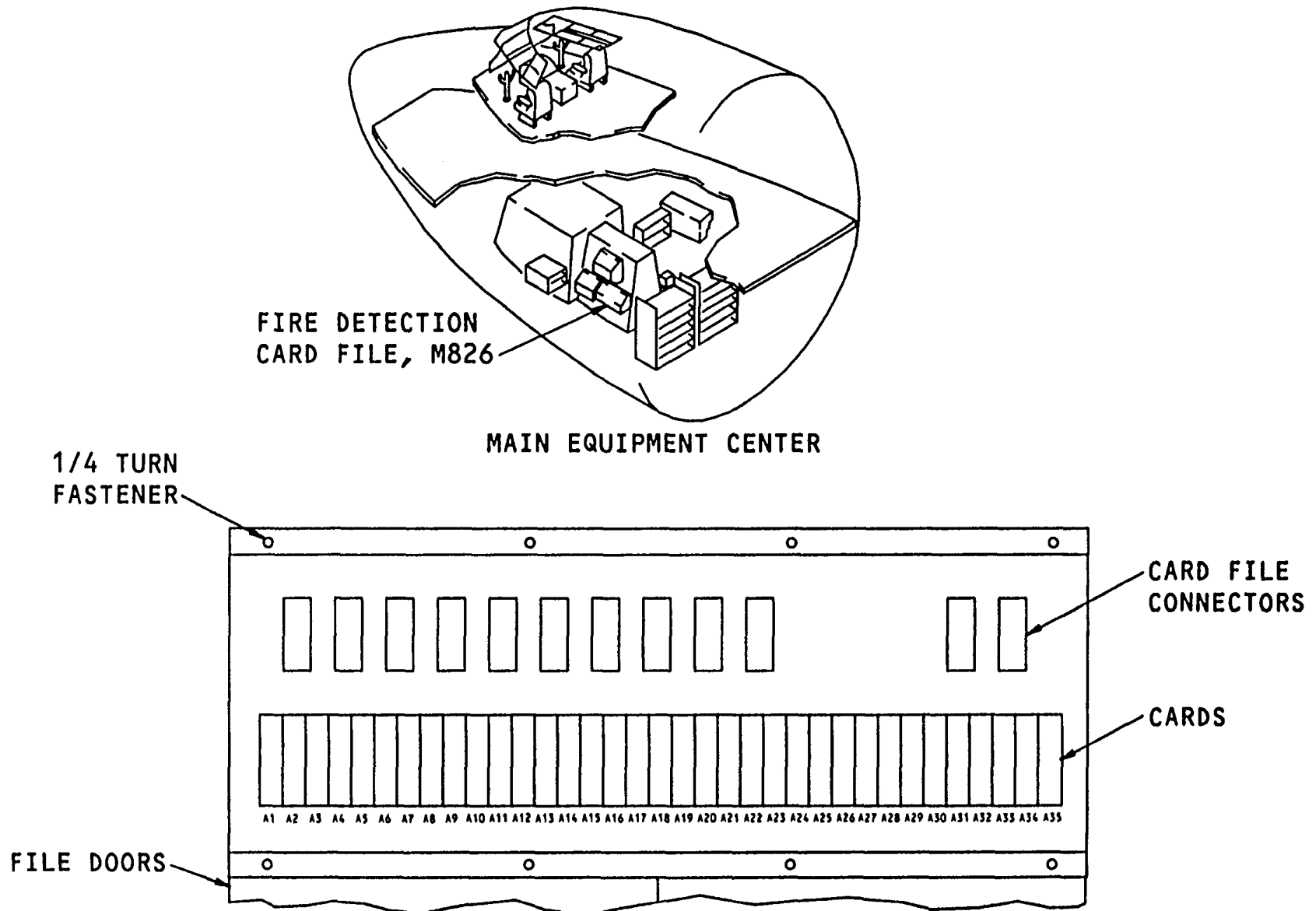


Figure 3 M826 CARD FILE

FIRE PRTECTION



FIRE DETECTION TESTS - CMC MESSAGES

Display

The engine overheat, engine fire, APU fire, cargo smoke, wheel well fire and wing leading edge overheat messages are displayed on the control display unit (CDU).

Messages

GROUND TEST SYSTEMS

26 FIRE PROTECTION

GROUND TESTS MENU

FIRE/OVERHEAT TEST

TEST CONDITIONS

Conducting the test, results in a display of TEST CONDITIONS and PASS or FAIL indication. The FAIL indication will enable display of faults for the overheat, fire and smoke detection systems.

The test is inhibited by the GRD TESTS switch in the NORM position.

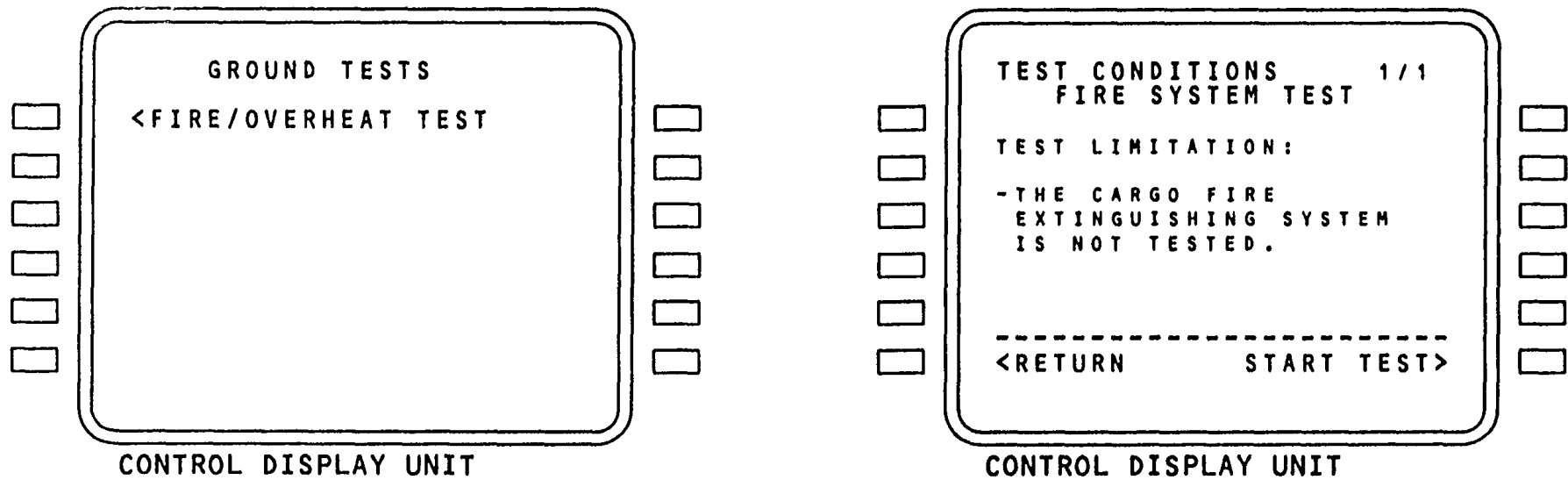


Figure 4 FIRE DETECTION TESTS - CMC MESSAGES

FIRE PROTECTION



ENGINE OVERHEAT AND FIRE PROTECTION

Detection

The overheat and fire detection system in the nacelle provides overheat and fire protection for the engine.

The system consists of one dual overheat detector and three dual fire detectors located on the engine. The indications are located in the flight deck.

Extinguishing

The engine fire extinguishing system provides means for smothering a fire in the engine nacelles.

The system consists of four identical fire extinguisher bottles. Two bottles are located in each wing leading edge inboard of the engines. A discharge manifold connects two bottles to the two engine nacelles. The controls and indications are located in the flight deck.

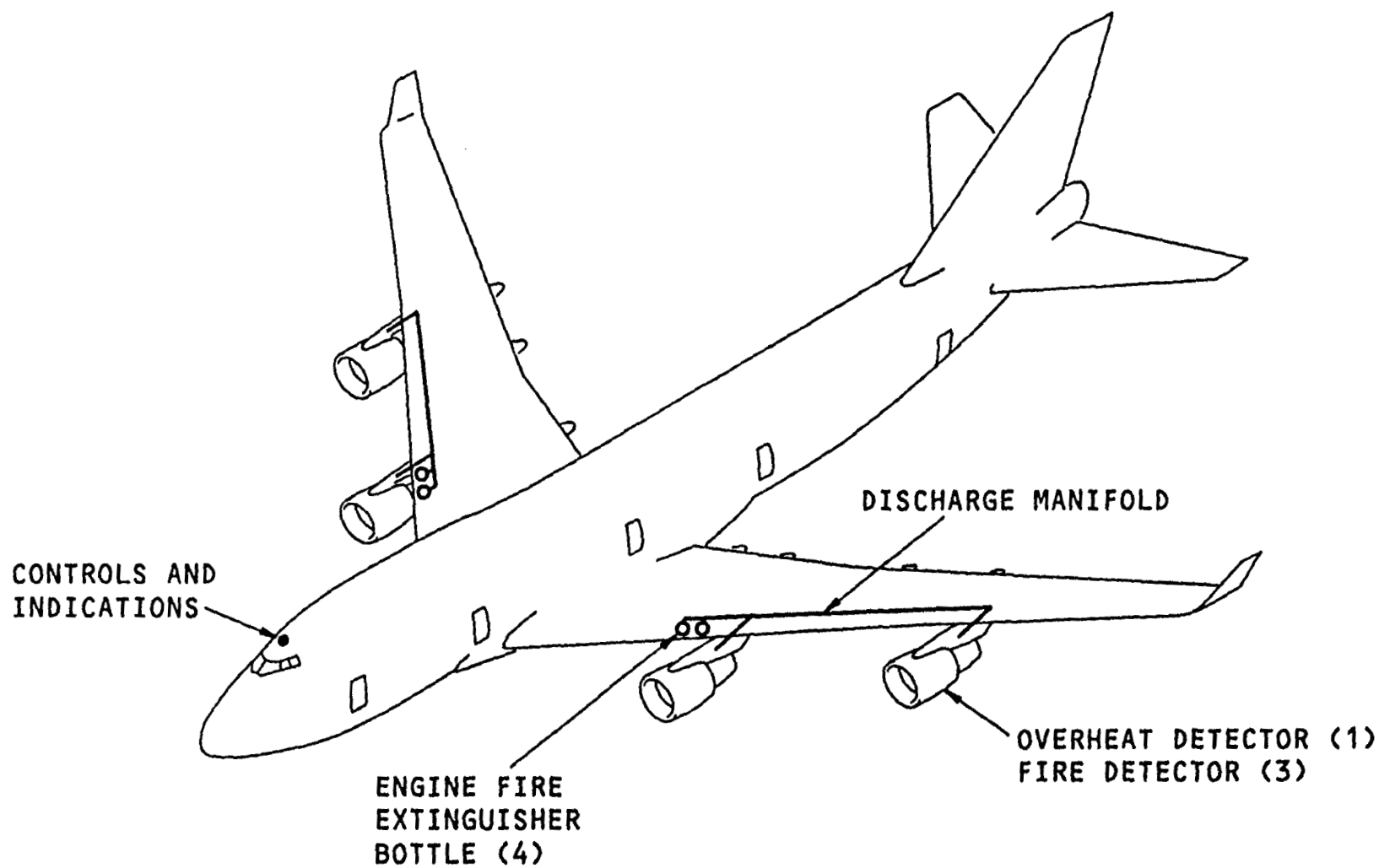


Figure 5 ENGINE OVERHEAT AND FIRE PROTECTION



ENGINE OVHT & FIRE DETECTION

ENGINE OVERHEAT AND FIRE DETECTORS

General

The dual overheat and fire detector assemblies are mounted on the engine. The overheat detector and one fire detector are located above the engine and two fire detectors are located at the sides and below the engine.

Each detector assembly consists of two detectors attached by brackets at each end of the tube and clamps along the tube.

Operation

The detector has two sensing elements, each element has two pressure switches and two resistors on one end of an inert gas filled tube. The tube has a gas emitting core insert for localized discrete sensing.

For overheat, a pressure switch (normally open) on the overheat detector senses overheat condition and the second (normally closed) senses a loss of gas pressure. When the temperature increases to 550° F (288° C) along the length of the overheat detector or 900° F (483° C) along a 1

foot (30 cm) section of the detector, the gas pressure increases closing the pressure switch and actuates the engine overheat indication.

For fire, a pressure switch (normally open) on the fire detector senses fire and the second (normally closed) senses a loss of gas pressure. When the temperature increases to 750° F (399° C) along the length of the fire detector or 1100° F (593° C) along a 1 foot (30 cm) section of the detector, the gas pressure increases closing the pressure switch and actuates the engine fire indication.

If the gas pressure decreases, the pressure switch opens and detector failure is indicated in the flight deck.

Maintenance Practices

The detector is removed by disconnecting the two electrical connectors and releasing the clamps along the length of the detector.

CAUTION: SUPPORT DETECTOR WHEN RELEASING MOUNTING CLIPS.

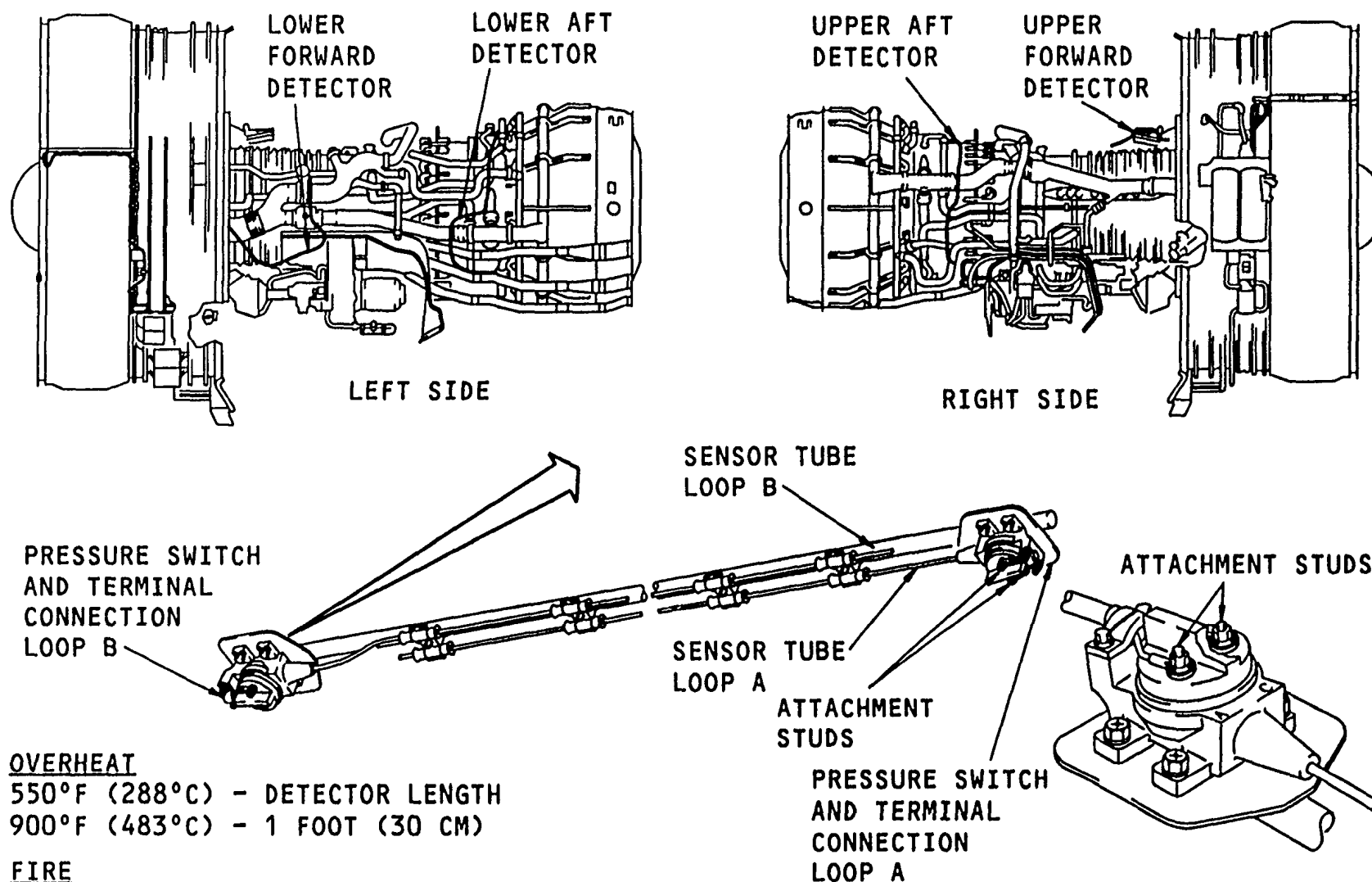


Figure 6 ENGINE OVERHEAT AND FIRE DETECTORS

ENGINE OVHT & FIRE DETECTION



DETECTION & EXTINGUISHING INDICATION

General

The engine overheat and fire detection indications and fire extinguisher bottle discharge controls and indications are located in the module M7326, ENGINE/APU/CARGO FIRE CONTROL on P5.

Overheat/Fire Detection Indication

The overheat indications consist of master caution lights and EICAS displays. The aural caution operates through the speakers.

The fire indications consist of four red engine fire handle lights, two red master warning lights, EICAS displays and four red fuel control switches. The fire warning bell operates through the speakers.

The engine overheat and fire detection system is tested by the test switch.

Extinguishing Controls

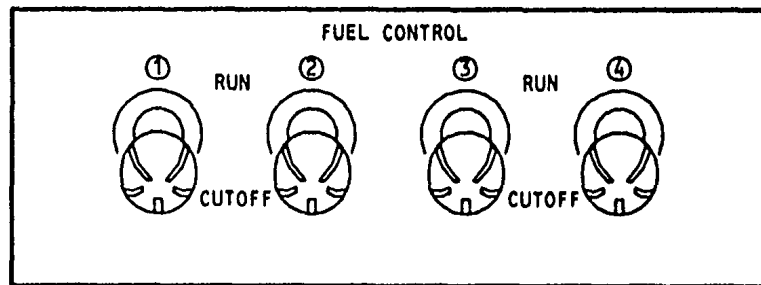
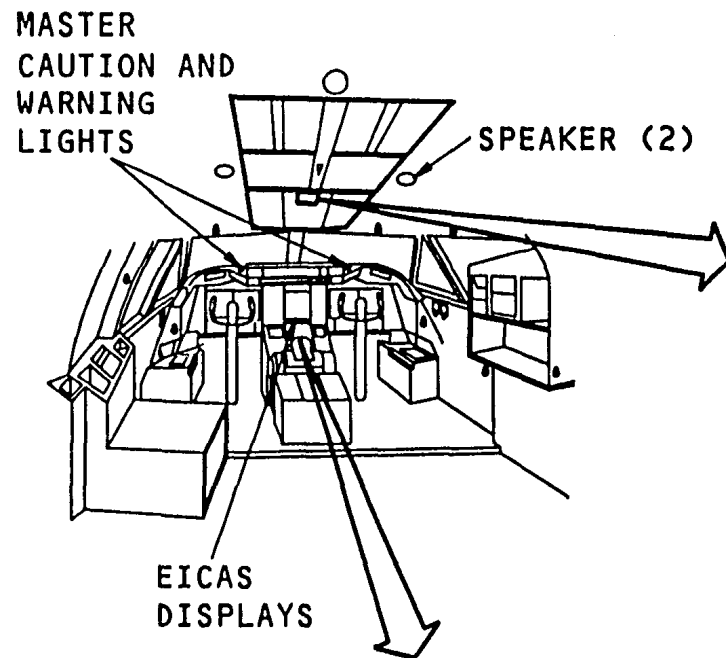
The controls consist of four red engine fire switch handles which can be rotated clockwise or counterclockwise to discharge a fire extinguisher bottle.

For odd numbered engines, bottle A is discharged by counterclockwise handle rotation and bottle B is discharged by clockwise handle rotation. For even numbered engines, bottle A is discharged by clockwise handle rotation and bottle B is discharged by counterclockwise handle rotation.

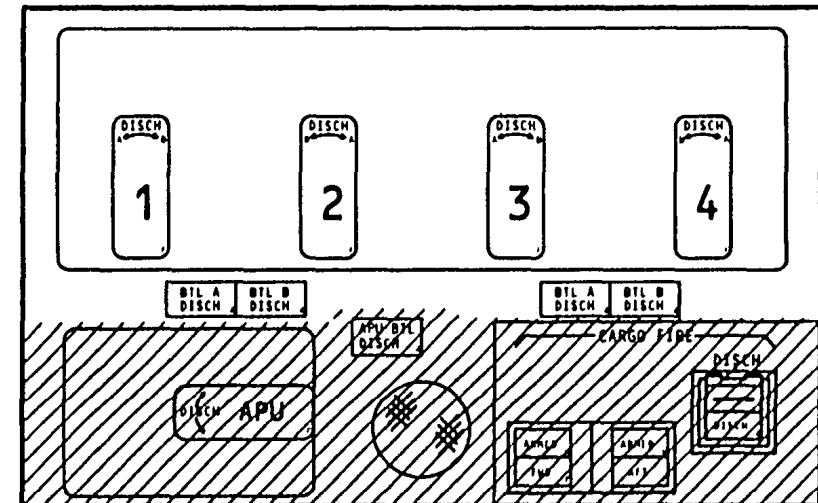
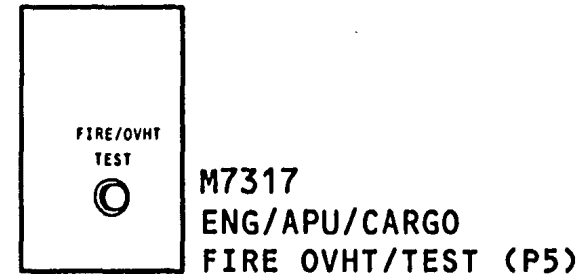
Extinguishing indication

The indication consists of two amber BTL A DISCH and two amber BTL B DISCH lights. The lights illuminate when the engine fire bottles are discharged.

ENGINE OVHT & FIRE DETECTION



P8



M7326 ENG/APU/CARGO FIRE CONTROL (P5)

Figure 7 DETECTION & EXTINGUISHING INDICATION

ENGINE OVHT & FIRE DETECTION



OVERHEAT DETECTION CIRCUIT

General

The engine overheat detector loop is connected to two detector cards. The card circuit distinguishes between an overheat detection and a fault based on the closing or opening of the respective pressure switch.

Normal Operation

The overheat and fault, and test indication is processed by the automatic fire/overheat logic test systems (AFOLTS) card.

Normally, the card is configured in a two loop AND logic. An overheat signal from two detector loops activates the alarm outputs to the modular avionics warning electronic assembly (MAWEA) and EICAS. The MAWEA provides caution indication.

If two detector loops do not operate, the fault outputs from the card enable the EICAS display.

One Detector Operation

If one detector loop has a fault, the AFOLTS card reconfigures to single detector operation. If overheat is detected, the card outputs an alarm signal to the MAWEA and EICAS. The MAWEA provides caution indication and the EICAS displays the operating and failed detectors.

Power-up Test

When electrical power is provided to the detection system during the initial airplane power-up operation, the AFOLTS card initiates a test sequence of the detectors. If one detector loop is not operating (failed), the card will reconfigure to the second detector allowing the corresponding indication of failure to be displayed on EICAS.

Manual Test

The test in M7317 ENGINE/APU/CARGO FIRE/OVHT TEST on P5 initiates a test sequence of the AFOLTS card and detectors. The normal response is the same as during the overheat detection. Failure of a detector is indicated on the EICAS display.

ENGINE OVHT & FIRE DETECTION



Lufthansa
Technical Training

B747 - 400

008.01

26-1 1

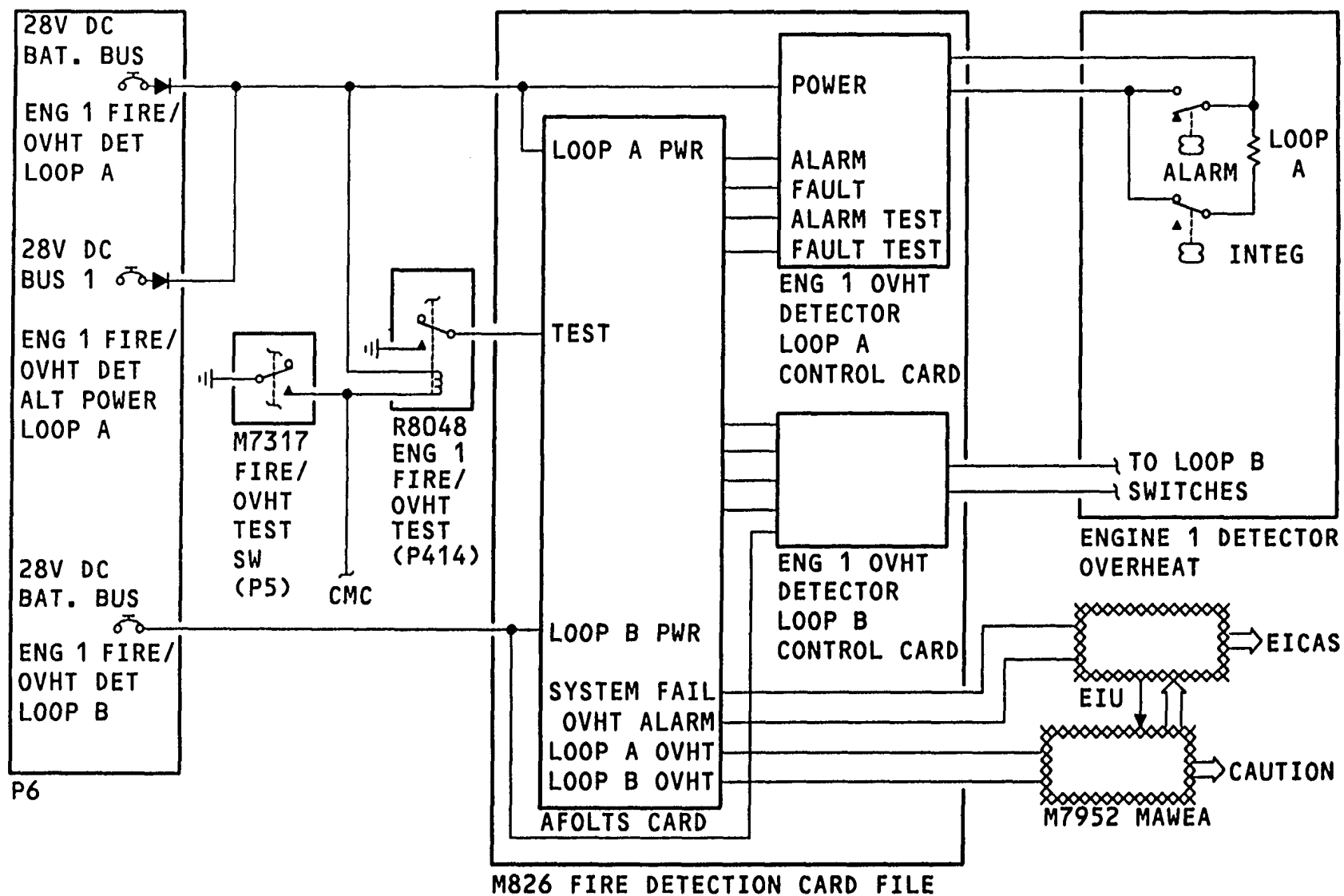


Figure 8 ENGINE OVERHEAT DETECTION CIRCUIT

ENGINE OVHT & FIRE DETECTION



**Lufthansa
Technical Training**

B7474 - 400

009.01

26-1 1

POWER-UP OPERATION & INDICATION

During the initial airplane power-up, the engine overheat detection system is automatically tested.

If a detector loop fails the test, the AFOLTS card automatically re-configures to one detector loop operation. The indication of failure is on the EICAS display.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	(NONE)	DUAL DETECTOR
PASSED	FAILED	EICAS - ENG 1 OVHT LP B (S)	DETECTOR LOOP A
FAILED	PASSED	EICAS - ENG 1 OVHT LP A (S)	DETECTOR LOOP B
FAILED	FAILED	EICAS - >DET FIRE/OVHT 1 (C) - ENG 1 OVHT LP A/B (S)	SYSTEM FAIL

Figure 9 POWER-UP OPERATION & INDICATION

ENGINE OVHT & FIRE DETECTION



OVHT DETECTION MANUAL TEST INDICATION

The engine overheat detection system is tested by the test switch on P5.

The initial indication on EICAS is TEST IN PROGRESS. After five seconds the indication is TEST PASSED or FIRE TEST FAIL.

Failure of a detector loop is indicated on the EICAS display. The AFOLTS card reconfigures to an operating detector loop.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	EICAS - TEST IN PROGRESS (A) EICAS - TEST PASSED (A)	DUAL DETECTOR
PASSED	FAILED	EICAS - TEST PASSED (A) - ENG 1 OVHT LP B (S)	DETECTOR LOOP A
FAILED	PASSED	EICAS - TEST PASSED (A) - ENG 1 OVHT LP A (S)	DETECTOR LOOP B
FAILED	FAILED	EICAS - FIRE TEST FAIL (A) - OVHT ENG 1 NAC (B) - >DET FIRE/OVHT 1 (C) - ENG 1 OVHT LP A/B (S)	SYSTEM FAIL

Figure 10 OVHT DETECTION MANUAL TEST INDICATION

ENGINE OVHT & FIRE DETECTION



OVHT DETECTION NORMAL OPS & INDICATION

The overheat detectors mounted on the engine normally operate with AND logic. During failure of one loop, the system reverts to OR logic using the non-failed loop.

The indications of overheat detection or failure are displayed in the flight deck.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION
OVERHEAT	OVERHEAT	EICAS - OVHT ENG 1 NAC (B) - ENG 1 OVHT LP A/B (S)
OVERHEAT	FAULT	EICAS - OVHT ENG 1 NAC (B) - ENG 1 OVHT LP A/B (S)
FAULT	OVERHEAT	EICAS - OVHT ENG 1 NAC (B) - ENG 1 OVHT LP A/B (S)
FAULT	FAULT	EICAS - >DET FIRE/OVHT 1 (C) - ENG 1 OVHT LP A/B (S)
OVERHEAT	NO OVERHEAT	EICAS - ENG 1 OVHT LP A (S)
NO OVERHEAT	OVERHEAT	EICAS - ENG 1 OVHT LP B (S)

Figure 11 OVHT DETECTION NORMAL OPS & INDICATION

**OVERHEAT DETECTION EICAS MESSAGES**

The engine overheat detection EICAS messages are shown on the main and auxiliary displays.

- TEST IN PROGRESS: warning message on main EICAS display. Fire/overheat system test in progress.
- TEST PASSED: warning message on main EICAS display. All fire/overheat test discretes true during test.
- FIRE TEST FAIL: warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- OVHT ENG 1 (TYP) NAC: caution message on main EICAS display Engine 1 (TYP) overheat detected.
- >DET FIRE/OVHT 1 (TYP): advisory message on main EICAS display Engine 1 (TYP) overheat or fire detection loop A and B failure.
- ENG 1 (TYP) OVHT LP A: status message on auxiliary EICAS display. Engine 1 (TYP) overheat detection loop A overheat or fault. (60 Sec TD)
- ENG 1 (TYP) OVHT LP B: status message on auxiliary EICAS display. Engine 1 (TYP) overheat detection loop B overheat or fault. (60 Sec TD)
- FIRE/OVHT SYS: status message on auxiliary EICAS display. Loss of fire/overheat system power input. (60 sec TD)

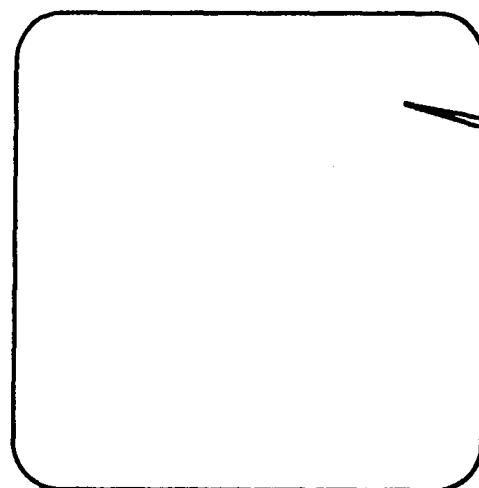
ENGINE OVHT & FIRE DETECTION

Lufthansa
Technical Training

B747 - 400

012.01

26-1 1



MAIN DISPLAY

WARNING MESSAGES

TEST IN PROGRESS

FIRE TEST FAIL

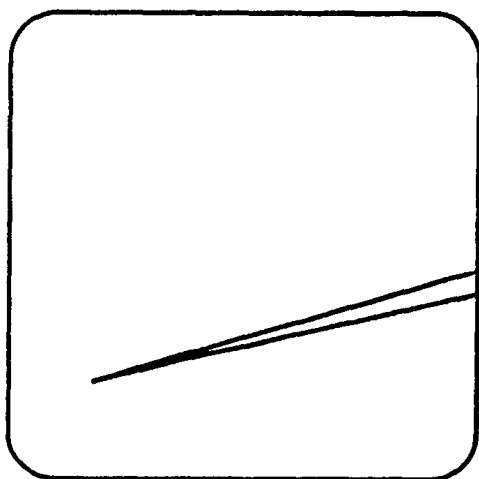
TEST PASSED

CAUTION MESSAGE

OVHT ENG 1 (TYP) NAC

ADVISORY MESSAGE

>DET FIRE/OVHT 1 (TYP)



AUXILIARY DISPLAY

STATUS MESSAGES

ENG 1 (TYP) OVHT LP A

ENG 1 (TYP) OVHT LP B

FIRE/OVHT SYS

Figure 12 OVERHEAT DETECTION EICAS MESSAGES

ENGINE OVHT & FIRE DETECTION



ENGINE FIRE DETECTION CIRCUIT

General

The engine fire detector loop is connected to two detector cards. The card circuit distinguishes between a fire and a fault based on closing or opening the respective pressure switch.

Normal Operation

The fire, fault, and test indication is processed by the automatic fire/overheat logic test systems (AFOLTS) card.

Normally, the card is configured in a two detector AND logic. A fire signal from two detector loops activates the two alarm outputs to the modular avionics warning electronic assembly (MAWEA), EICAS, the red fire handle light and a solenoid in the M7326 ENGINE/APU/CARGO FIRE CONTROL in PS energizes and red fuel control switch light on P8 illuminates. The MAWEA enables operation of the fire warning bell and two master warning lights. If two detector loops do not operate, the fault outputs from the card enable the EICAS display.

One Detector Operation

If one detector loop does not operate, the AFOLTS card reconfigures to single detector operation at the time of power up/manual test. If fire is detected, the card outputs one alarm signal to the MAWEA, EICAS and red lights. The MAWEA enables operation of the fire warning bell and two master warning lights. The EICAS displays the operating and failed detectors.

Power-up Test

When electrical power is provided to the detection system during the initial airplane power-up operation, the AFOLTS card initiates a test sequence of the detectors. If one detector loop is not operating (failed), the card will reconfigure to the second detector allowing the corresponding indication of failure to be displayed on EICAS.

Manual Test

The test switch in M7317 ENGINE/APU/CARGO FIRE/OVHT TEST on P5 initiates a test sequence of the AFOLTS card and detectors. The normal response is the same as during the fire detection. Failure of a detector is indicated on the EICAS display. If one detector loop is not operating (failed), the card will reconfigure to the second detector allowing the corresponding indication of failure to be displayed on EICAS.

ENGINE OVHT & FIRE DETECTION



Lufthansa
Technical Training

B747 - 400

013.01

26-1 1

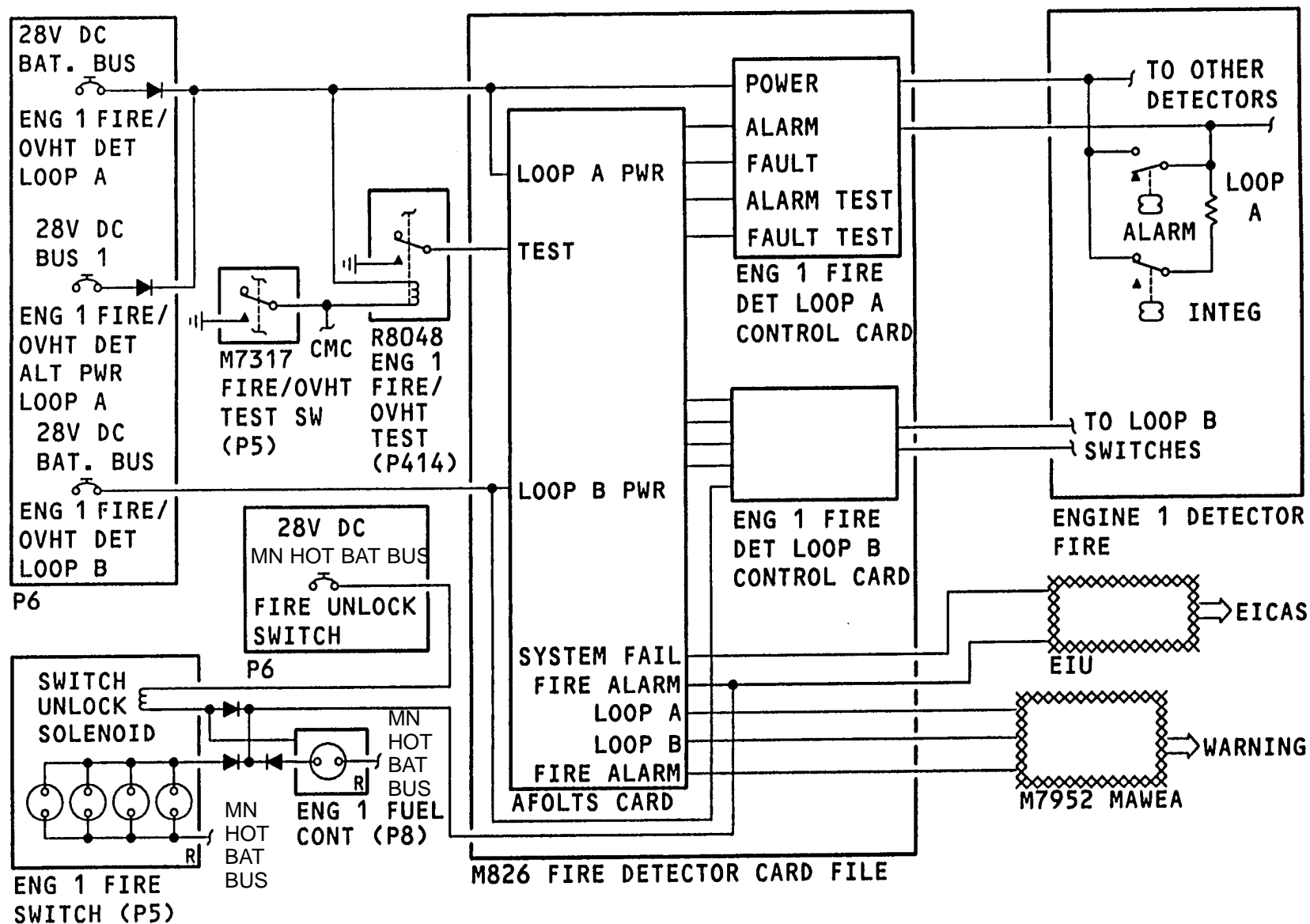


Figure 13 FIRE DETECTION CIRCUIT

ENGINE OVHT & FIRE DETECTION



POWER-UP OPERATION & INDICATION

During the initial airplane power-up, the engine fire detection system is automatically tested.

If a detector loop fails the test, the AFOLTS card automatically re-configures to one detector loop operation. The indication of failure is on the EICAS display.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	(NONE)	DUAL DETECTOR
PASSED	FAILED	EICAS - ENG 1 FIRE LP B (S)	DETECTOR LOOP A
FAILED	PASSED	EICAS - ENG 1 FIRE LP A (S)	DETECTOR LOOP B
FAILED	FAILED	EICAS - >DET FIRE/OVHT 1 (C) - ENG 1 FIRE LP A/B (S)	SYSTEM FAIL

Figure 14 POWER-UP OPERATION & INDICATION

ENGINE OVHT & FIRE DETECTION



MANUAL TEST INDICATION

The engine fire detection system is tested by the test switch on P5.

The initial indication on EICAS is TEST IN PROGRESS. After five seconds the indication is TEST PASSED or FIRE TEST FAIL.

Failure of a detector loop is indicated on the EICAS display. The AFOLTS card reconfigures to an operating detector loop.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	EICAS - TEST IN PROGRESS (A) MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - TEST PASSED (A)	DUAL DETECTOR
PASSED	FAILED	MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - TEST PASSED (A) - ENG 1 FIRE LP B (S)	DETECTOR LOOP A
FAILED	PASSED	MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - TEST PASSED (A) - ENG 1 FIRE LP A (S)	DETECTOR LOOP B
FAILED	FAILED	EICAS - FIRE TEST FAIL (A) - FIRE ENG 1 (A) - >DET FIRE/OVHT 1 (C) - ENG 1 FIRE LP A/B (S)	SYSTEM FAIL

Figure 15 MANUAL TEST INDICATION

ENGINE OVHT & FIRE DETECTION



NORMAL OPERATION INDICATION

The fire detectors mounted on the engine normally operate with AND logic. During failure of one loop, the system reverts to OR logic using the non-failed loop.

The indications of fire detection or failure are displayed in the flight deck.



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION
FIRE	FIRE	MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - FIRE ENG 1 (A) - ENG 1 FIRE LP A/B (S)
FIRE	FAULT	MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - FIRE ENG 1 (A) - ENG 1 FIRE LP A/B (S)
FAULT	FIRE	MASTER WARNING AND ENGINE FIRE HANDLE, FUEL CONTROL SWITCH, BELL, EICAS - FIRE ENG 1 (A) - ENG 1 FIRE LP A/B (S)
FAULT	FAULT	EICAS - >DET FIRE/OVHT 1 (C) - ENG 1 FIRE LP A/B (S)
FIRE	NO FIRE	EICAS - ENG 1 FIRE LP A (S)
NO FIRE	FIRE	EICAS - ENG 1 FIRE LP B (S)

Figure 16 NORMAL OPERATION INDICATION

ENGINE OVHT & FIRE DETECTION



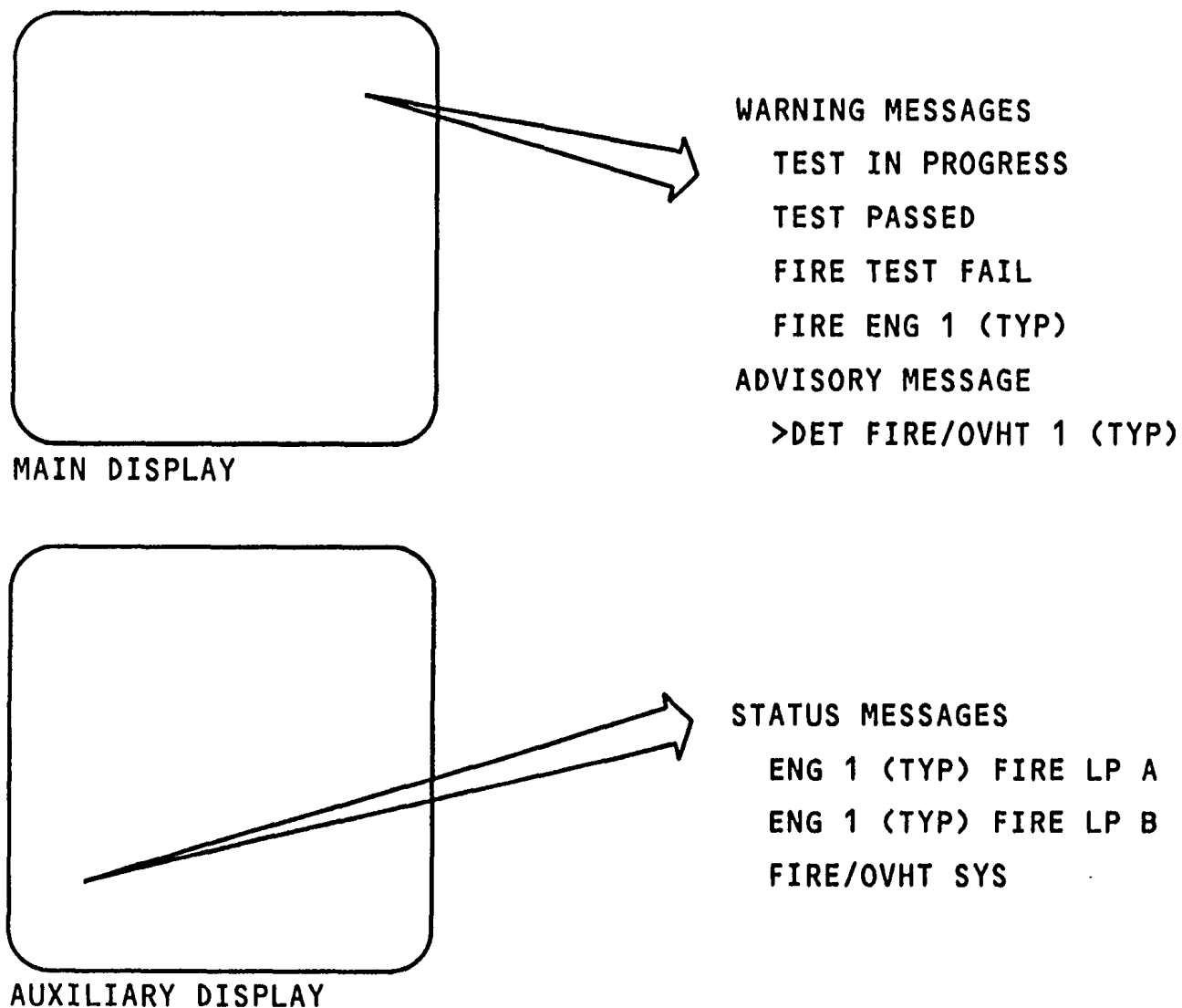
ENGINE FIRE DETECTION EICAS MESSAGES

The engine fire detection EICAS messages are shown on the main and auxiliary displays.

- TEST IN PROGRESS: warning message on main EICAS display Fire/overheat system test in progress.
- TEST PASSED: warning message on main EICAS display. All fire/overheat test discretes true during test.
- FIRE TEST FAIL: warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- FIRE ENG 1 (TYP): warning message on main EICAS display. Engine 1 (TYP) fire detected.
- >DET FIRE/OVHT 1 (TYP): advisory message on main EICAS display Engine 1 (TYP) overheat or fire detection loop A and loop B failure.
- ENG 1 (TYP) FIRE LP A: status message on auxiliary EICAS display. Engine 1 (TYP) fire detection loop A fire or fault. (60 sec TD)
- ENG 1 (TYP) FIRE LP B: status message on auxiliary EICAS display. Engine 1 (TYP) fire detection loop B fire or fault. (60 sec TD)
- FIRE/OVHT SYS: status message on auxiliary EICAS display. Loss of fire/overheat system power input. (60 sec TD)

ENGINE OVHT & FIRE DETECTION**Lufthansa
Technical Training****B747 - 400**

017.01

26-1 1**Figure 17 ENGINE FIRE DETECTION EICAS MESSAGES**

ENGINE OVHT & FIRE DETECTION



ENGINE FIRE HANDLE SWITCH

The engine fire handle switch provides indication of fire and is used for fire extinguishing control. It is located in module M7326, ENG/APU/CARGO FIRE CONTROL on P5. The handle is normally held locked by a deenergized solenoid.

When fire is detected, or during test of the engine overheat/fire system, the solenoid energizes and unlocks the handle. Pulling the handle operates controls for stopping and isolating the engine. Rotating the handle discharges the extinguisher bottle.

Placing the engine fuel control switch to the cut off position energizes the switch solenoid to unlock the fire handle.

The handle can be unlocked manually by pushing on the plunger under the handle.

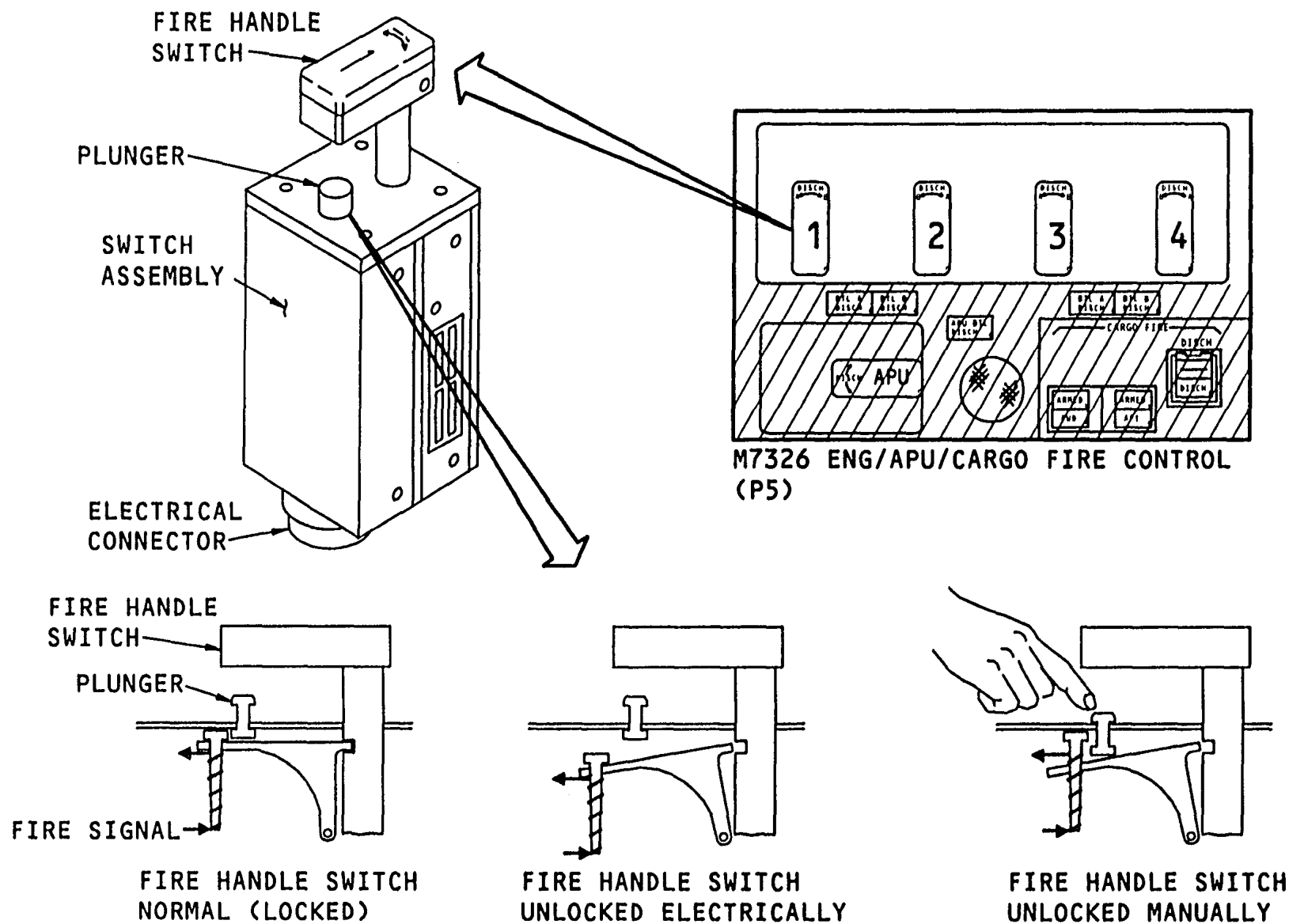


Figure 18 ENGINE FIRE HANDLE SWITCH

ENGINE OVHT & FIRE DETECTION



FIRE HANDLE SWITCH CIRCUIT

When the engine fire condition is detected or during test, the handle illuminates red and the switch solenoid energizes to unlock the handle.

Pulling the fire handle:

- Shuts off engine fuel condition (cutoff solenoid) (76-11)
- Closes the hydraulic pump shutoff valve (29-11)
- Closes the pressure regulator and shutoff valve, pressure regulating valve and high pressure shutoff valve (36-11)
- Closes the fuel spar valve (28-22)
- Trips engine generator (24-22)

Rotation of the fire handle discharges the extinguisher bottle.

The switch solenoid energizes to unlock the fire handle when the engine is not operating. Placing the engine fuel control switch to the cut off position energizes relay R8371 which allows switch solenoid to energize to unlock the handle.

ENGINE OVHT & FIRE DETECTION

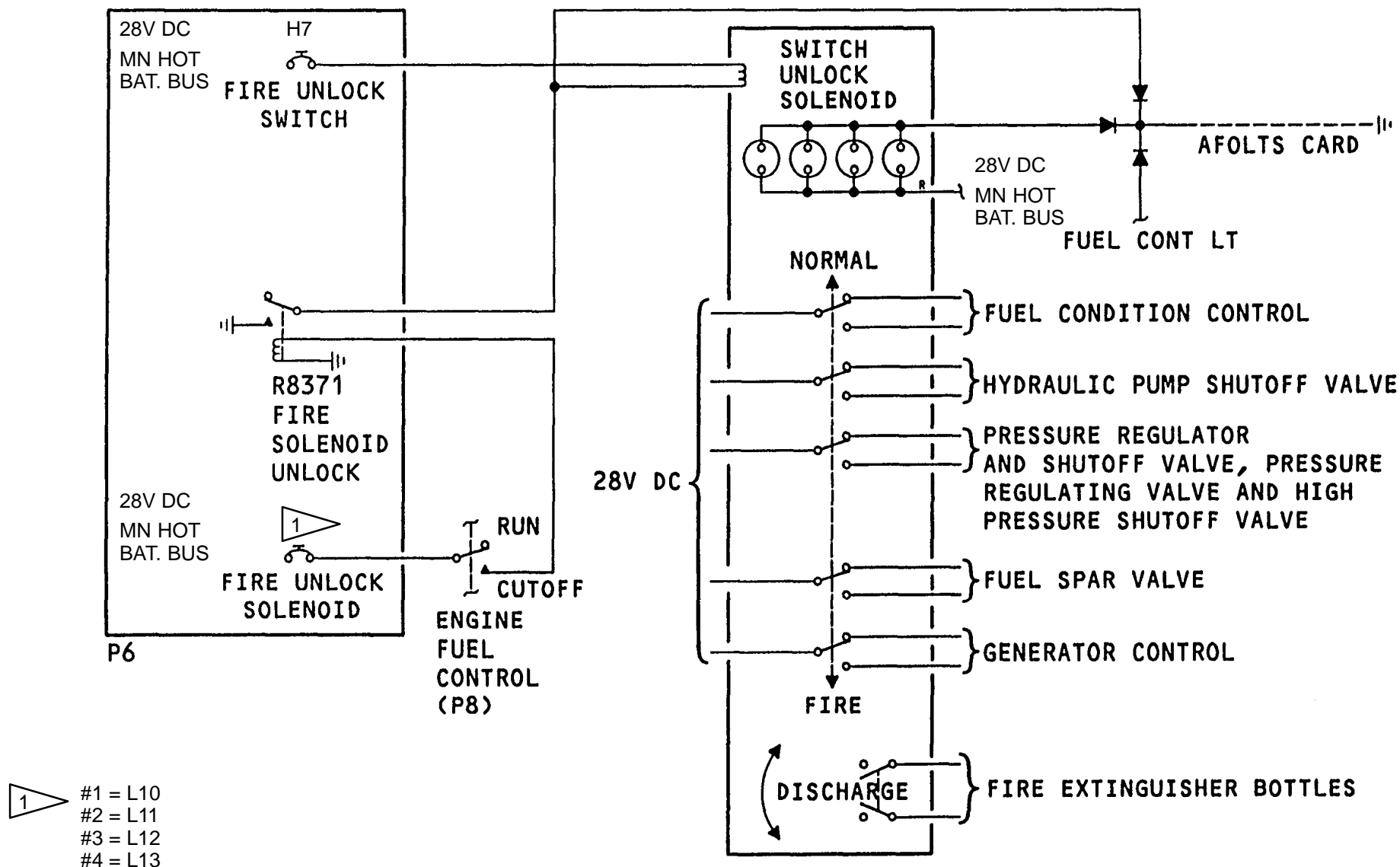


Figure 19 FIRE HANDLE SWITCH CIRCUIT

ENGINE FIRE EXTINGUISHING



ENGINE FIRE EXTINGUISHING

ENGINE FIRE EXTINGUISHING SYSTEM

The engine fire extinguishing system is of a gaseous smothering type. Two engine fire extinguisher bottles, A and B, are located in each wing leading edge. Each bottle is equipped with two squibs, pressure switch and a discharge plug port. The bottles are manifolded together to provide two discharges to the same engine.

Discharge lines are connected from the bottles to the discharge nozzles in each engine nacelle. The extinguisher agent is discharged through the four nozzles to the fan and core sections of the engine.

An overpressure discharge plug port is located on each bottle.

ENGINE FIRE EXTINGUISHING

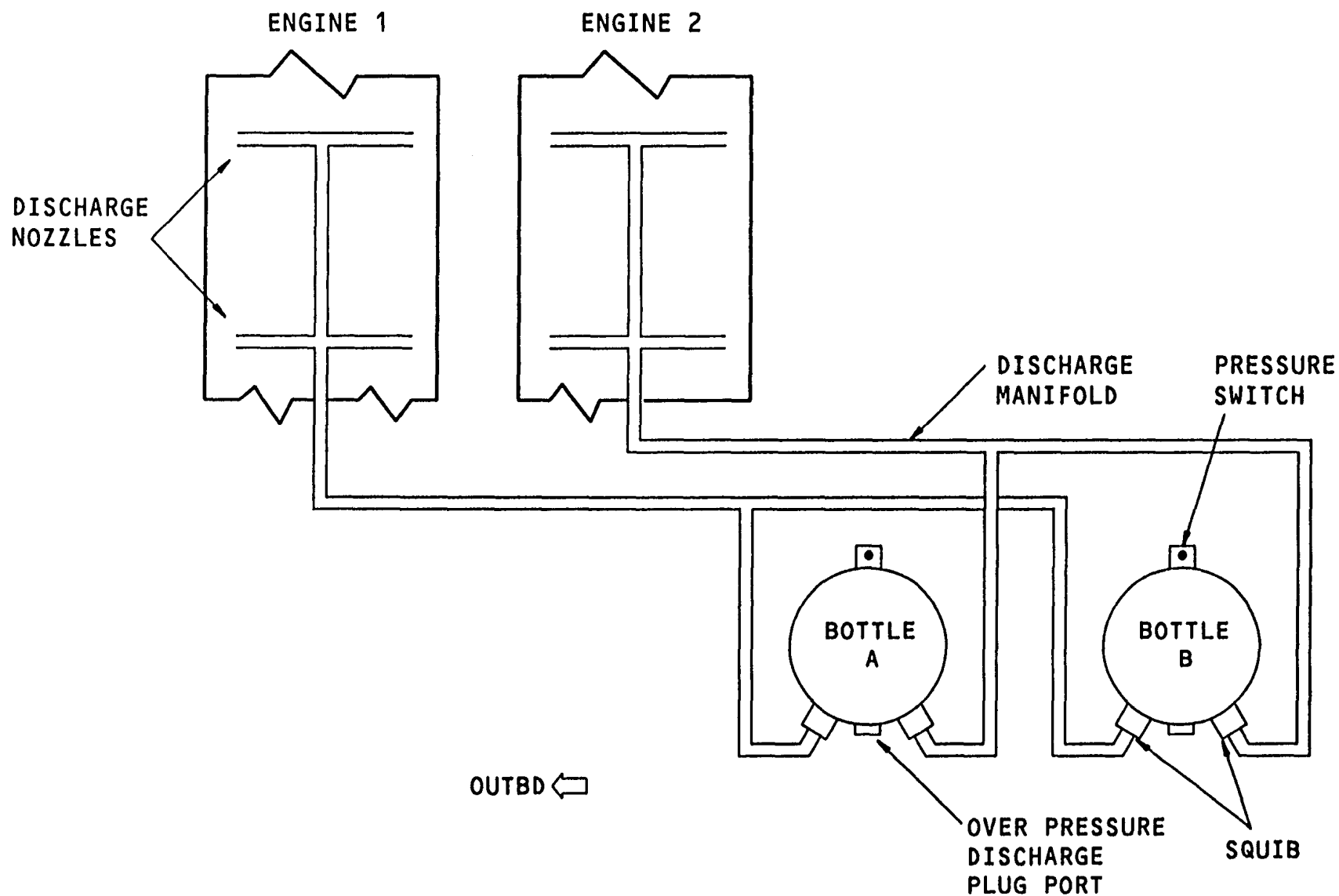


Figure 20 ENGINE FIRE EXTINGUISHING SYSTEM

ENGINE FIRE EXTINGUISHING



FIRE EXTINGUISHER BOTTLE

General

Two engine fire extinguisher bottles are located in each wing leading edge and are manifolded together to provide two discharges to each engine. Each bottle is attached at four points to the support structure. The bottle has a volume of 630 cubic inches and contains 18 pounds of halon pressurized by nitrogen to 600 psig at 70°F (21°C). Access to the bottles is by extending the wing leading edge flaps.

Located on the bottle are two squibs for discharging the bottle into either of the two engine nacelles, a pressure switch for the bottle discharge indication and a discharge plug port with two orifices for overpressure discharge. When the pressure in the bottle reaches 1200 to 1400 psig, the discharge plug diaphragm ruptures and the bottle contents is discharged into the wing leading edge.

Maintenance Practices

A discharged fire extinguisher bottle must be replaced, it can not be serviced on the airplane.

Prior to a new bottle installation, the gross weight of the bottle has to be checked against the weight marked on the bottle. A weight deviation of more than 0.25 pound is cause for bottle rejection.

This prevents installation of an improperly serviced bottle.

WARNING: DO NOT HANDLE BOTTLE WITH DISCHARGE PORTS EXPOSED KEEP PROTECTIVE CAPS OVER THE PORTS TO PREVENT DAMAGE TO THE DIAPHRAGMS. DO NOT PROBE DIAPHRAGMS. REMOVE PROTECTIVE CAPS ONLY DURING BOTTLE INSTALLATION. DAMAGE TO THE DIAPHRAGMS MAY CAUSE ACCIDENTAL BOTTLE DISCHARGE AND CAUSE INJURY TO PERSONNEL.

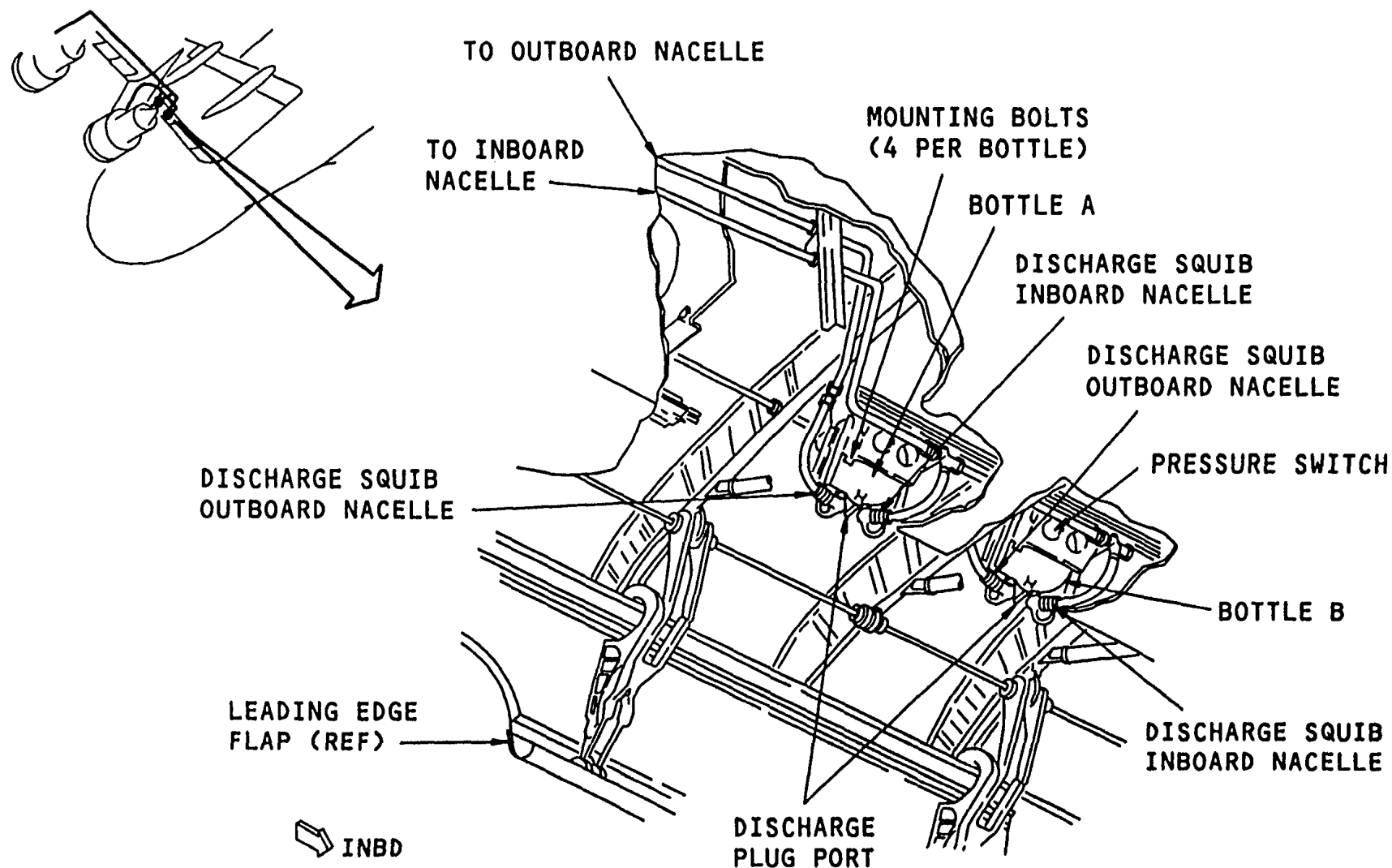


Figure 21 ENGINE FIRE EXTINGUISHER BOTTLE

ENGINE FIRE EXTINGUISHING



EXTINGUISHER BOTTLE COMPONENTS

Extinguisher Bottle Squib

The engine fire extinguisher bottle squibs are located at the base of the bottle below the discharge swivel assemblies. The squibs are for discharging the fire bottle into the engine nacelle.

The squibs are connected to the airplane's electrical connectors by squib pigtails preventing cross connection of squibs.

The squib consists of an electrically operated explosive device. When power is supplied to the squib, the explosive device detonates and ruptures a diaphragm in the swivel assembly allowing bottle contents to discharge.

The squib can be removed and replaced without removal of the fire extinguisher bottle.

Extinguisher Bottle Pressure Switch

The engine fire extinguisher bottle pressure switch is located at the base of the bottle. The switch is for indication of the bottle condition. When the bottle pressure decreases to 225 psig, the switch operates and provides circuit continuity for the indicating system.

The pressure switch operation and the indicating system can be checked on the ground. Pushing the test button on the pressure switch checks the indicating circuit continuity, which can be observed in the flight deck on M7326, ENGINE/APU/CARGO FIRE CONTROL on P5 and on the EICAS display.

WARNING: DO NOT APPLY POWER IN ANY FORM (TEST LIGHT OR THE LIKE) TO THE BOTTLE DISCHARGE SQUIB RECEPTACLE. FOR TESTING OF SQUIB CONTINUITY, DO NOT USE OHM-METER CAPABLE OF SUPPLYING MORE THAN 80 MILLIAMPS OR THE SQUIB MAY BE DETONATED. INSTALL SHUNT ACROSS FACE OF BOTTLE SQUIB ELECTRICAL CONNECTOR PRIOR TO REMOVAL OR INSTALLATION OF THE BOTTLE. AN ACCIDENTALLY FIRED BOTTLE MAY CAUSE INJURY TO PERSONNEL.

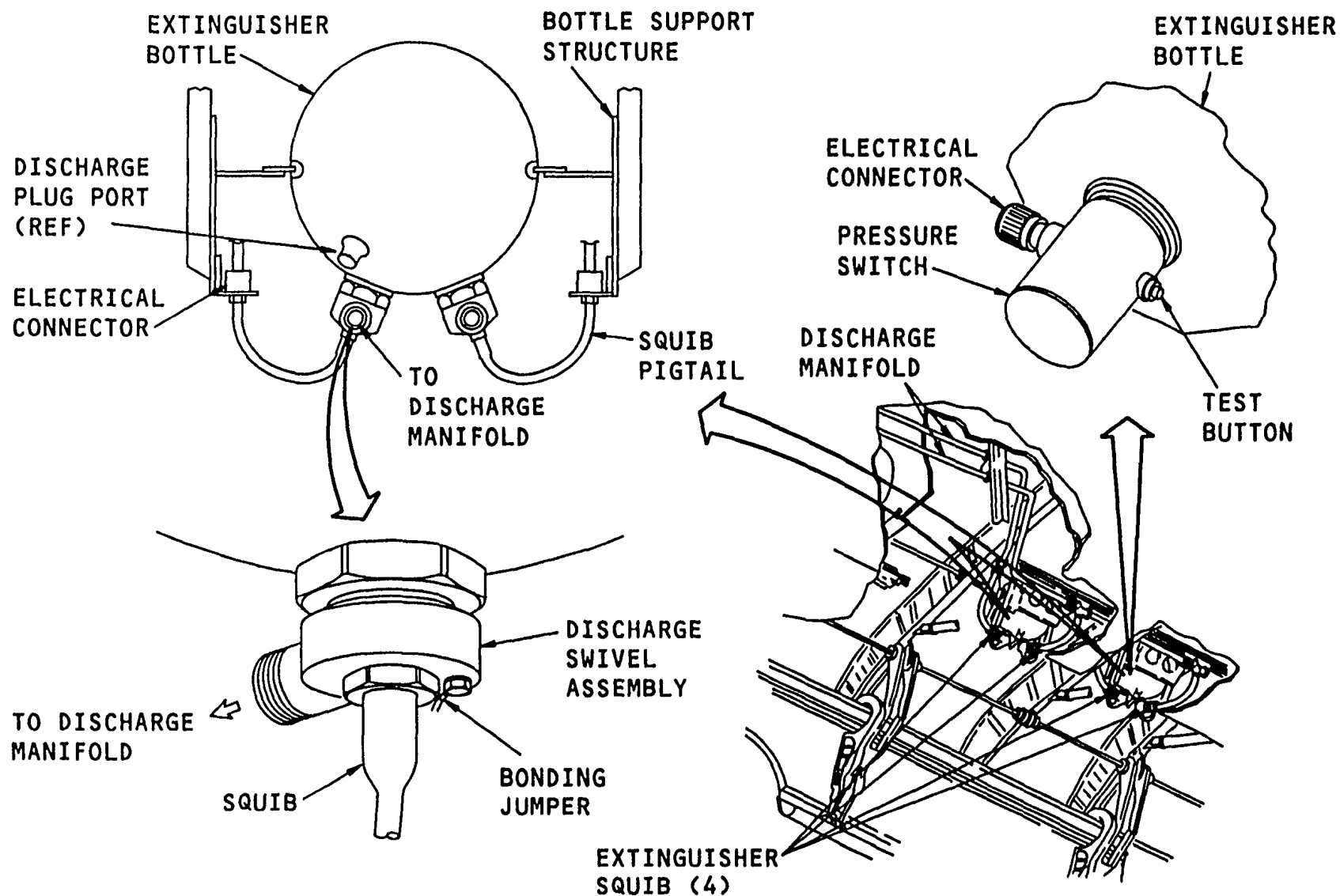


Figure 22 EXTINGUISHER BOTTLE COMPONENTS

ENGINE FIRE EXTINGUISHING



BOTTLE DISCHARGE CIRCUIT

The engine fire extinguisher bottle is discharged by the squib located on the bottle. The power to the squib is provided by discharge switches in the flight deck.

A bottle is discharged by the clockwise (CW) or counterclockwise (CCW) rotation of the engine fire switch handle. For engines 1 and 3, when the handle is rotated clockwise, power is supplied to extinguisher bottle B corresponding engine squib. When the handle is rotated counterclockwise, power is supplied to extinguisher bottle A corresponding engine squib.

For engines 2 and 4, clockwise handle rotation discharges bottle A and counterclockwise rotation discharges bottle B.

CAUTION: THE ENGINE FIRE EXTINGUISHER DISCHARGE CIRCUIT IS POWERED FROM THE HOT BATTERY BUS.

ENGINE FIRE EXTINGUISHING

Lufthansa
Technical Training

B747 - 400

023.01

26-21

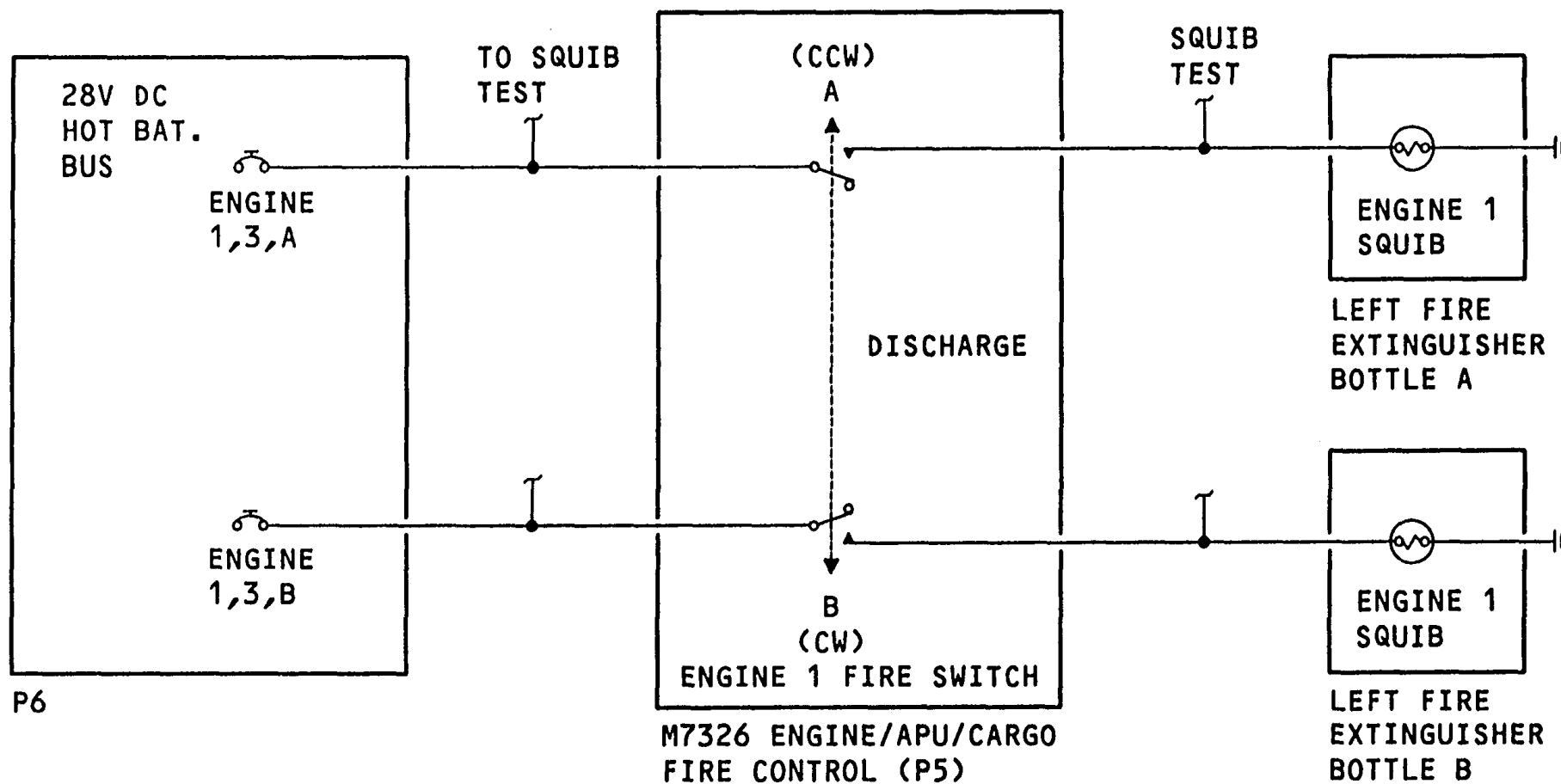


Figure 23 BOTTLE DISCHARGE CIRCUIT

ENGINE FIRE EXTINGUISHING



BOTTLE DISCH INDICATION CIRCUIT

When the engine fire extinguisher bottle is discharged, the pressure switch closes at approximately 225 psig. The amber BTL A DISCH (or BTL B DISCH) light illuminates on the M7326 ENGINE/APU/CARGO FIRE CONTROL module.

This information is also sent to the EICAS display unit through the EFIS/EICAS interface units.

The discharge indication can be tested by manual operation of the test button on the pressure switch.

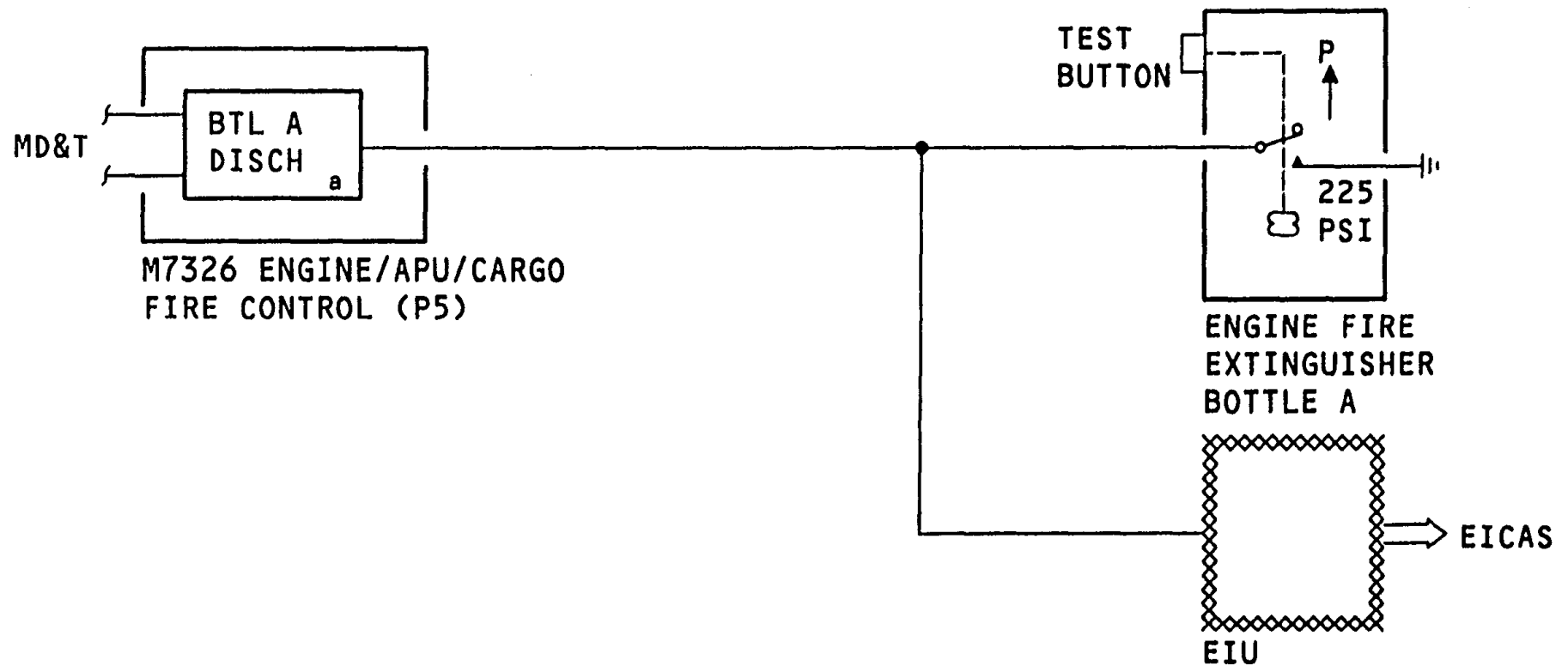


Figure 24 BOTTLE DISCH INDICATION CIRCUIT

ENGINE FIRE EXTINGUISHING



BOTTLES EICAS MESSAGES

The engine fire extinguisher bottles EICAS messages are shown on the main and auxiliary displays.

- >BTL LO L ENG A: advisory message on main EICAS display. Left engine fire extinguisher bottle A low pressure
- >BTL LO L ENG B: advisory message on main EICAS display. Left engine fire extinguisher bottle B low pressure
- >BTL LO R ENG A: advisor message on main EICAS display. Right engine fire extinguisher bottle A low pressure
- >BTL LO R ENG B: advisor message on main EICAS display. Right engine fire extinguisher bottle B low pressure
- BTL LOW L ENG A: status message on auxiliary EICAS display. Left engine fire extinguisher bottle A low pressure
- BTL LOW L ENG B: status message on auxiliary EICAS display. Left engine fire extinguisher bottle B low pressure
- BTL LOW R ENG A: status message on auxiliary EICAS display. Right engine fire extinguisher bottle A low pressure
- BTL LOW R ENG B: status message on auxiliary EICAS display. Right engine fire extinguisher bottle B low pressure

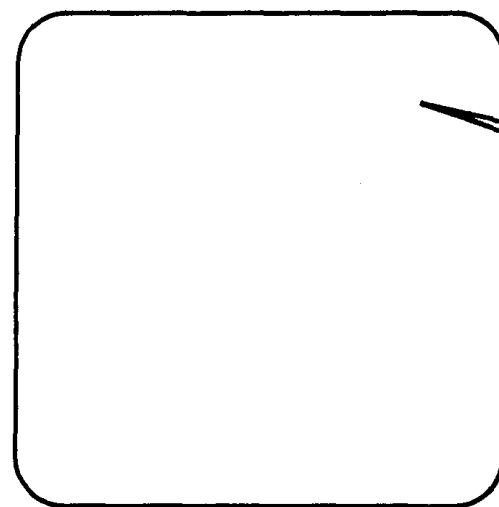
ENGINE FIRE EXTINGUISHING

Lufthansa
Technical Training

B747 - 400

025.01

26-21



MAIN DISPLAY

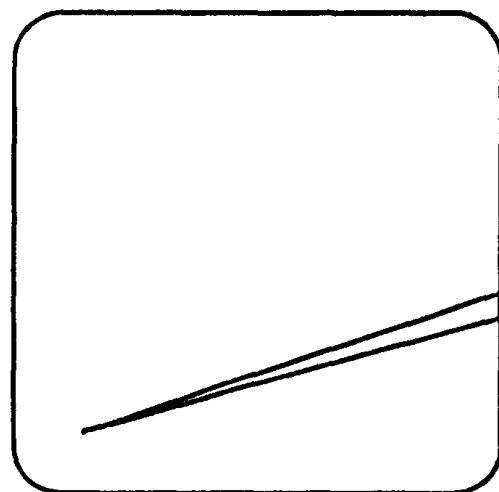
ADVISORY MESSAGES

>BTL LO L ENG A

>BTL LO L ENG B

>BTL LO R ENG A

>BTL LO R ENG B



AUXILIARY DISPLAY

STATUS MESSAGES

BTL LOW L ENG A

BTL LOW L ENG B

BTL LOW R ENG A

BTL LOW R ENG B

Figure 25 BOTTLES EICAS MESSAGES

ENGINE FIRE EXTINGUISHING



SQUIB TEST CONTROLS

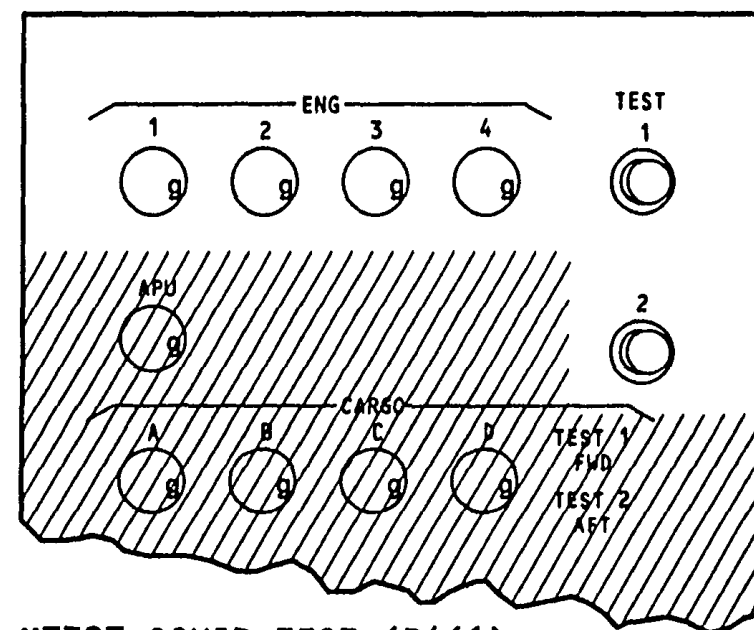
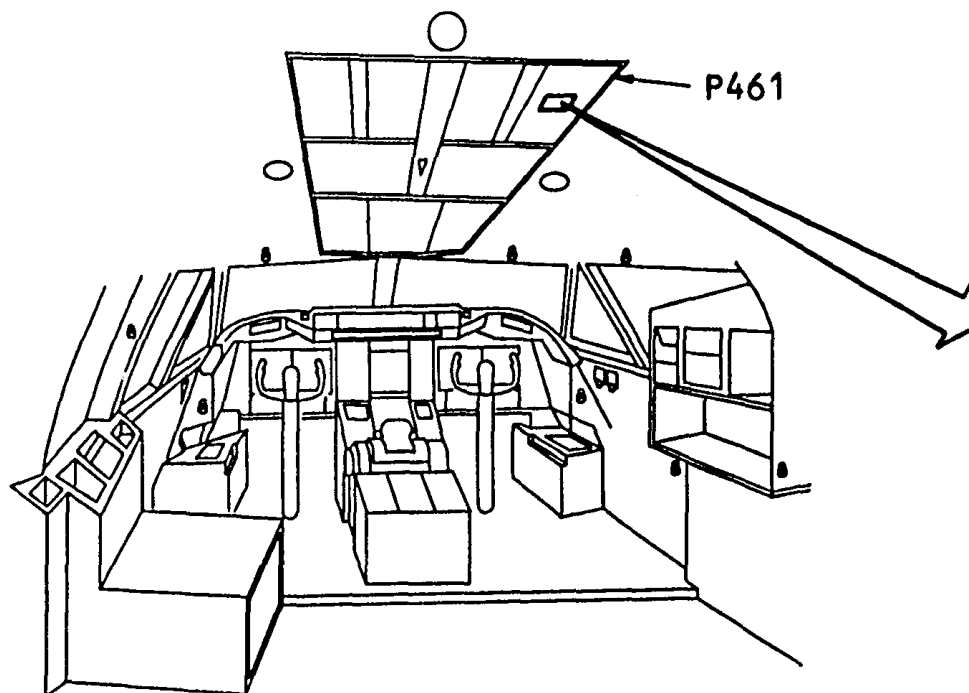
The engine fire extinguisher bottles squib test controls are located in M7327, SQUIB TEST on P461.

The controls consist of two push-button switches, 1 and 2, and four green indicating lights.

The test is performed by pushing and holding switch 1 followed by switch 2. If the green lights illuminate, the circuit through the eight squibs is verified.

NOTE: WHEN REPLACING BULBS IN THE GREEN INDICATING LIGHTS, ENSURE THAT A CORRECT BULB IS USED WHICH PROVIDES THE NECESSARY CIRCUIT RESISTANCE. IF AN INCORRECT BULB IS USED, THE SQUIB WILL BE DISCHARGED DURING TEST.

ENGINE FIRE EXTINGUISHING



M7327 SQUIB TEST (P461)

Figure 26 SQUIB TEST CONTROLS

ENGINE FIRE EXTINGUISHING



SQUIB TEST CIRCUIT

The engine fire extinguisher bottle squibs are tested by test switch 1 and 2.

Pushing and holding test switch 1 connects the green indicating light to ground through the squib of extinguisher bottle A. Test switch 2 connects the light to ground through the squib of extinguisher bottle B. When the light illuminates, the circuit through the squib is verified.

ENGINE FIRE EXTINGUISHING

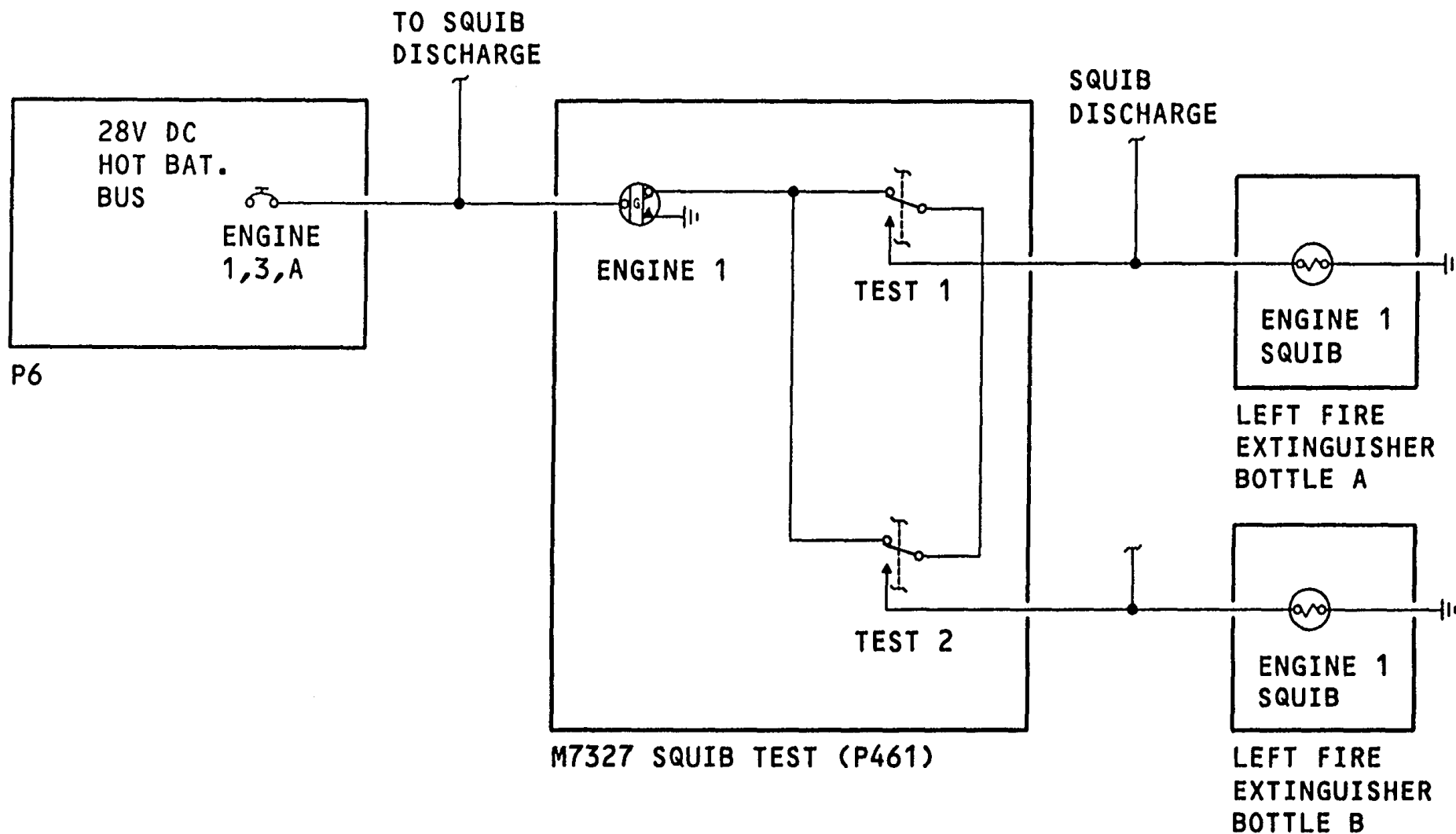


Figure 27 BOTTLES SQUIB TEST CIRCUIT

APU FIRE DETECTION



APU FIRE DETECTION

APU FIRE PROTECTION

Detection

The APU fire detection system provides fire protection for the APU compartment.

The system consists of dual fire detectors located above and below the APU. The indications are located in the flight deck and in the right main wheel well.

Extinguishing

The APU fire extinguishing system provides means for smothering a fire in the APU compartment.

The system consists of a fire extinguisher bottle located forward of the APU compartment, a fire shutdown module located in the right body wheel well, and controls and indications located in the flight deck.

APU FIRE DETECTION

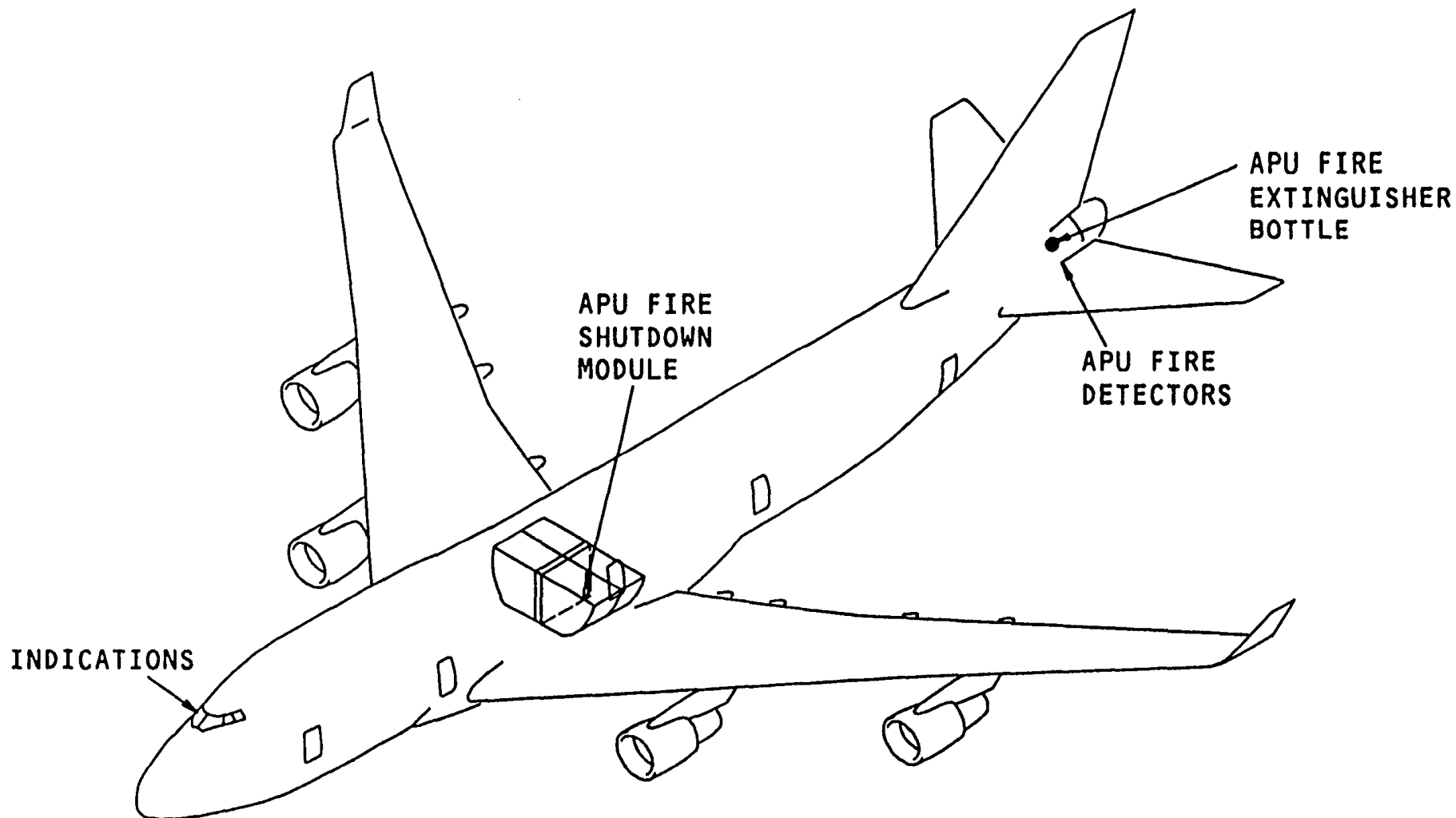


Figure 28 APU FIRE PROTECTION

APU FIRE DETECTION



APU FIRE DETECTOR

General

Two dual fire detector assemblies are located in the APU compartment. The upper assembly is installed in a vertical position and is approximately parallel to the aft APU support. The lower assembly is installed on the interior surface of the left APU access door.

Each detector assembly consists of two detectors mounted in parallel to a rigid support tube. The detectors are attached by brackets at each end of the tube and clamps along the tube.

The detector has two sensing elements, each element has two pressure switches and two resistors on one end of an inert gas filled tube. The tube has a gas emitting core insert for localized discrete sensing. One pressure switch (normally open) senses fire condition and the second (normally closed) senses a loss of gas pressure. When the temperature increases to 410°F (210°C) along the length of either detector or 585°F (308°C) along a 1-foot (30 cm) of either detector, the gas pressure increases closing a pressure switch and actuates the APU fire indication.

If the gas pressure decreases, the pressure switch opens and detector failure is indicated in the flight deck.

Maintenance Practices

The detector is removed by disconnecting the two electrical connectors and releasing the clamps along the length of the detector.

CAUTION: SUPPORT DETECTOR WHEN RELEASING MOUNTING CLIPS. KEEP DETECTOR BENDING TO A MINIMUM TO PREVENT DAMAGE TO DETECTOR.

APU FIRE DETECTION

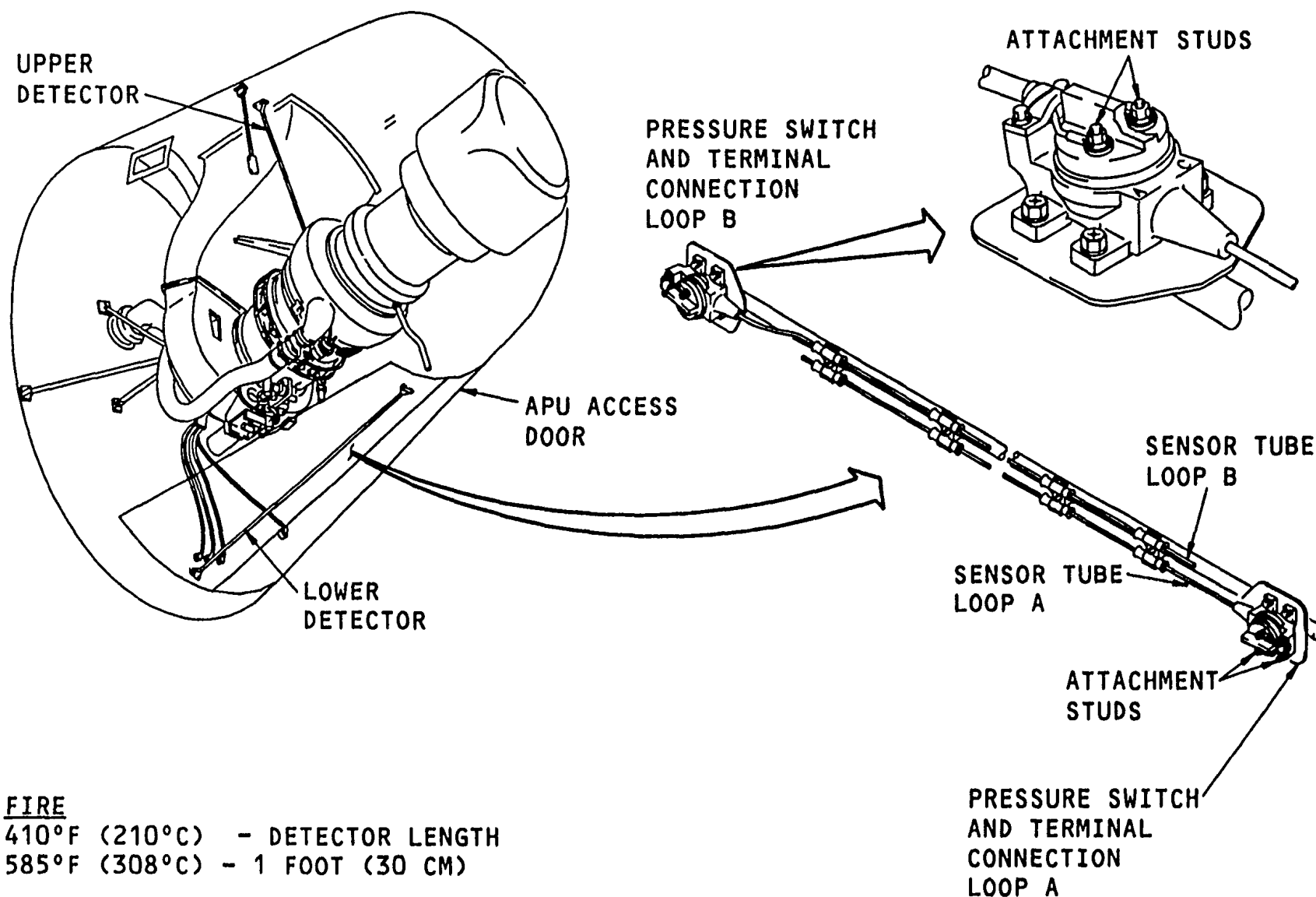


Figure 29 APU FIRE DETECTOR

APU FIRE DETECTION



DETECTION & EXTINGUISHING INDICATION

General

The APU fire detection and fire extinguisher bottle discharge indication is located in the module M7326, ENGINE/APU/CARGO FIRE CONTROL on P5. The fire extinguisher bottle discharge controls are on P5 and on M869, APU FIRE SHUTDOWN in the right body wheel well on the keel beam.

Fire Detection Indication

In the flight deck, the indications consist of a red APU fire handle light, two red master warning lights and EICAS displays. The fire warning bell operates through the speakers.

The APU fire detection system is tested by the test switch.

on the module are located a red fire light, horn, stop switch, extinguisher switch and fire handle.

Extinguishing Controls

The red APU fire switch handle can be rotated clockwise or counterclockwise to discharge the fire extinguisher bottle. The APU fire control handle is pulled down to arm the extinguisher discharge switch. The extinguisher is then discharged by pushing the discharge switch

Extinguishing Indication

The indication consists of an amber APU BTL DISCH light. The light illuminates when the APU extinguisher bottle is discharged.

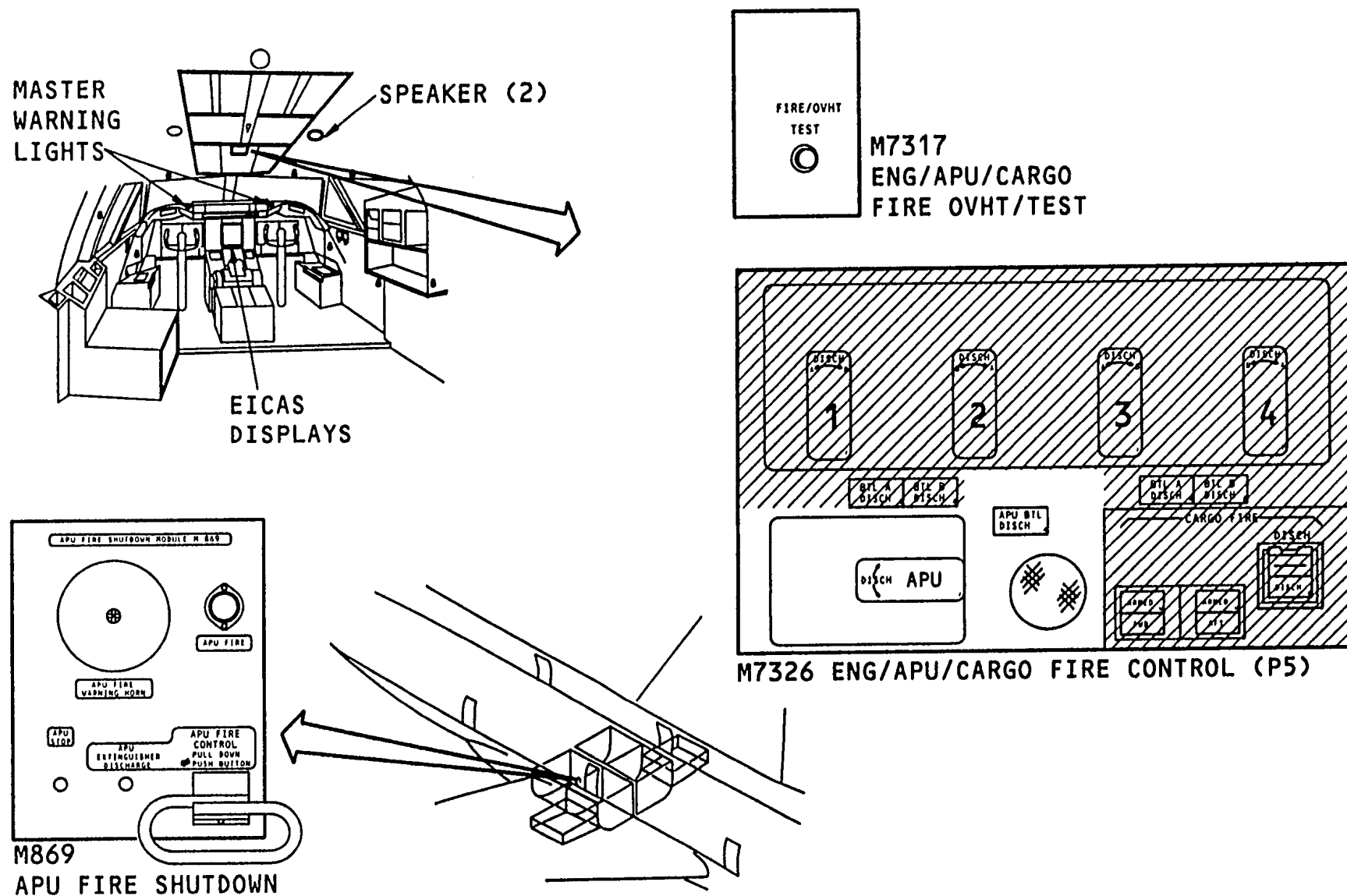


Figure 30 DETECTION AND EXTINGUISHING INDICATION

APU FIRE DETECTION



APU FIRE DETECTION CIRCUIT

General

The two APU fire detector loops are connected to two detector cards. The card circuit distinguishes between a fire detection and a fault based on the closing or opening of the respective pressure switch.

Normal Operation

The fire and fault, and test indication is processed by the automatic fire/overheat logic test systems (AFOLTS) card.

The card input is configured in a two detector OR logic. A fire signal from the detector loops activates the alarm outputs to the modular avionics warning electronic assembly (MAWEA), EICAS, the red APU fire handle light and solenoid in the M7326 ENGINE/APU/CARGO FIRE CONTROL on P5 and the red light and horn on M869 APU FIRE SHUTDOWN. The MAWEA enables operation of the fire warning bell and two master warning lights.

The APU automatically shutdown.

If two detector loops do not operate, fault outputs from the card enable the EICAS display.

One Detector Operation

If one detector loop has a fault, the AFOLTS card reconfigures to single detector operation at the time of powerup/manual test. If fire is detected, the card outputs an alarm signal to the MAWEA, EICAS, red lights and horn. The MAWEA enables operation of the fire warning bell and two master warning lights the EICAS displays the operating and failed detectors.

The APU automatically shutdown.

NOTE: THE HORN OPERATES ONLY ON THE GROUND.

Power-Up Test

When electrical power is provided to the detection system during the initial airplane power-up operation, the AFOLTS card initiates a test sequence of the detectors. If one detector loop is not operating (failed), the card will reconfigure to the second detector allowing the corresponding indication of failure to be displayed on EICAS.

Manual Test

The test switch in M7317 ENGINE/APU/CARGO FIRE/OVHT TEST on P5 checks the detector continuity and prevents APU shutdown during test. Failure of a detector is indicated on the EICAS display.

If one detector loop is not operating (failed), the card will reconfigure to the second detector allowing the corresponding indication of failure to be displayed on EICAS.

APU FIRE DETECTION

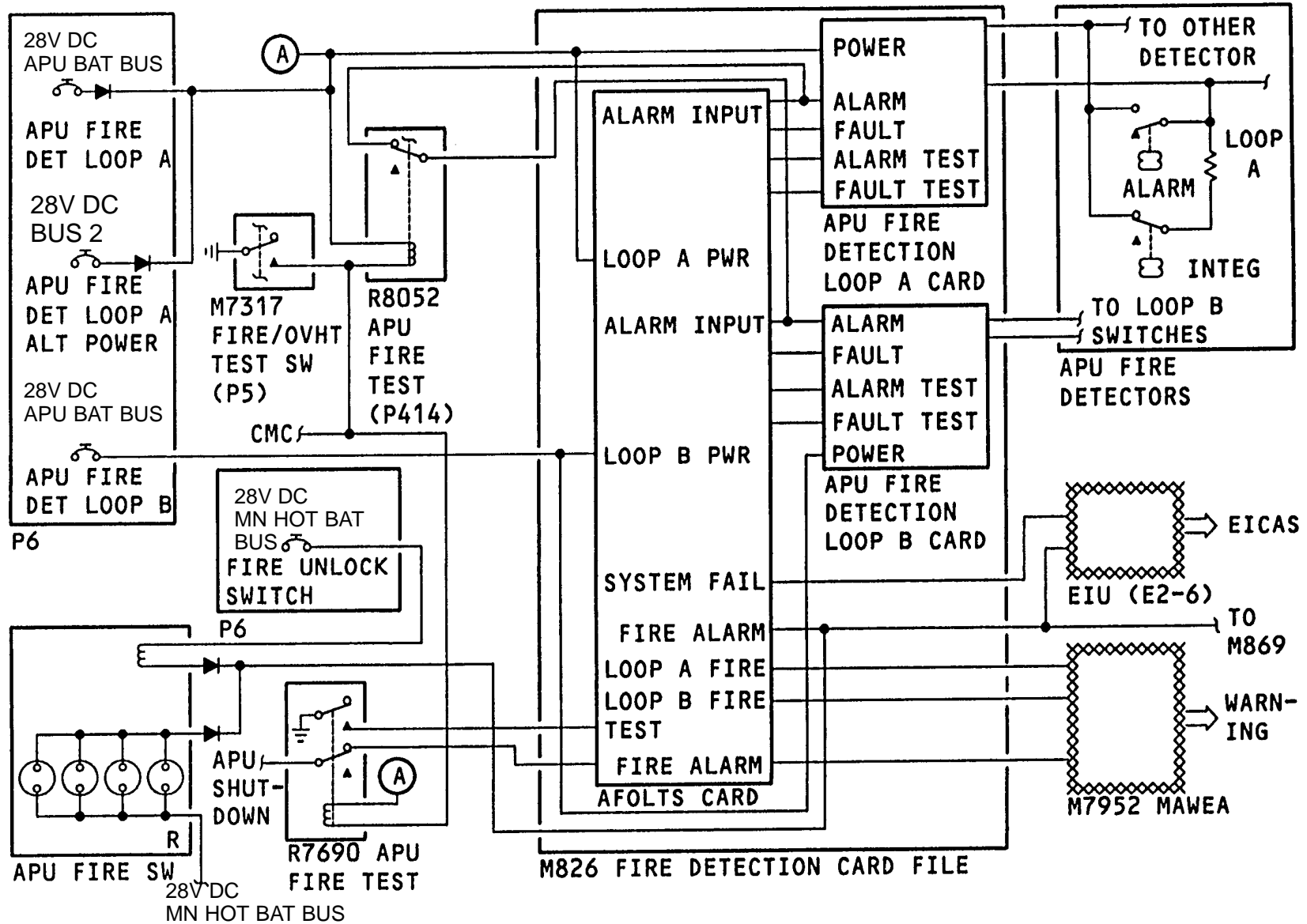


Figure 31 APU FIRE DETECTION CIRCUIT

APU FIRE DETECTION



POWER-UP OPERATION INDICATION

During the initial airplane power-up, the APU fire detection system is automatically tested.

If a detector loop fails the test, the AFOLTS card automatically re-configures to one detector loop operation. The indication of failure is on the EICAS display.

APU FIRE DETECTION



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED PASSED	PASSED FAILED	(NONE) EICAS - APU FIRE LOOP B (S)	DUAL DETECTOR DETECTOR LOOP A
FAILED FAILED	PASSED FAILED	EICAS - APU FIRE LOOP A (S) EICAS - >DET FIRE APU (C) - APU FIRE LOOP A/B (S)	DETECTOR LOOP B SYSTEM FAIL

Figure 32 POWER-UP OPERATION INDICATION

APU FIRE DETECTION



MANUAL TEST INDICATION

The APU fire detection system is tested by the test switch on P5.

Initial indication on EICAS is TEST IN PROGRESS. After five seconds the indication is TEST PASSED or FIRE TEST FAIL.

Failure of a detector loop is indicated on the EICAS display. The AFOLTS card reconfigures to an operating detector loop.

APU FIRE DETECTION



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	EICAS - TEST IN PROGRESS (A) MASTER WARNING AND APU FIRE HANDLE LIGHTS, BELL, HORN EICAS - TEST PASSED (A)	DUAL DETECTOR
PASSED	FAILED	MASTER WARNING AND APU FIRE HANDLE LIGHTS, BELL, HORN EICAS - TEST PASSED (A) - APU FIRE LOOP B (S)	DETECTOR LOOP A
FAILED	PASSED	MASTER WARNING AND APU FIRE HANDLE LIGHTS, BELL, HORN EICAS - TEST PASSED (A) - APU FIRE LOOP A (S)	DETECTOR LOOP B
FAILED	FAILED	EICAS - FIRE TEST FAIL (A) - FIRE APU (A) - >DET FIRE APU (C) - APU FIRE LOOP A/B (S)	SYSTEM FAIL

Figure 33 MANUAL TEST INDICATION

APU FIRE DETECTION



NORMAL OPS INDICATION

The two detectors located in the APU compartment normally operate with OR logic. During failure of one loop, the system uses the non-failed loop.

The indications of fire detection or failure are displayed in the flight deck.

APU FIRE DETECTION



DETECTOR LOOP A	DETECTOR LOOP B	INDICATION
FIRE	FIRE	MASTER WARNING AND APU FIRE HANDLE, BELL, HORN EICAS - FIRE APU (A) - APU FIRE LOOP A/B (S)
FIRE	FAULT	MASTER WARNING AND APU FIRE HANDLE, BELL, HORN EICAS - FIRE APU (A) - APU FIRE LOOP A/B (S)
FAULT	FIRE	MASTER WARNING AND APU FIRE HANDLE, BELL, HORN EICAS - FIRE APU (A) - APU FIRE LOOP A/B (S)
FAULT	FAULT	EICAS - >DET FIRE APU (C) - APU FIRE LOOP A/B (S)
FIRE	NO FIRE	MASTER WARNING AND APU FIRE HANDLE, BELL, HORN EICAS - FIRE APU (A) - APU FIRE LOOP A (S)
NO FIRE	FIRE	MASTER WARNING AND APU FIRE HANDLE, BELL, HORN EICAS - FIRE APU (A) - APU FIRE LOOP B (S)

Figure 34 NORMAL OPS INDICATION

APU FIRE DETECTION



EICAS MESSAGES

The APU fire detection EICAS messages are shown on the main and auxiliary displays.

- TEST IN PROGRESS: warning message on main EICAS display. Fire/overheat system test in progress.
- TEST PASSED: warning message on main EICAS display. All fire/overheat test discretes true during test.
- FIRE TEST FAIL: warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- FIRE APU: warning message on main EICAS display. APU fire detected.
- >DET FIRE APU: advisory message on main EICAS display. APU fire loop A and B failure.
- APU FIRE LOOP A: status message on auxiliary EICAS display. APU fire detection loop A fire or fault. (60 sec TD)
- APU FIRE LOOP B: status message on auxiliary EICAS display. APU fire detection loop B fire or fault. (60 sec TD)

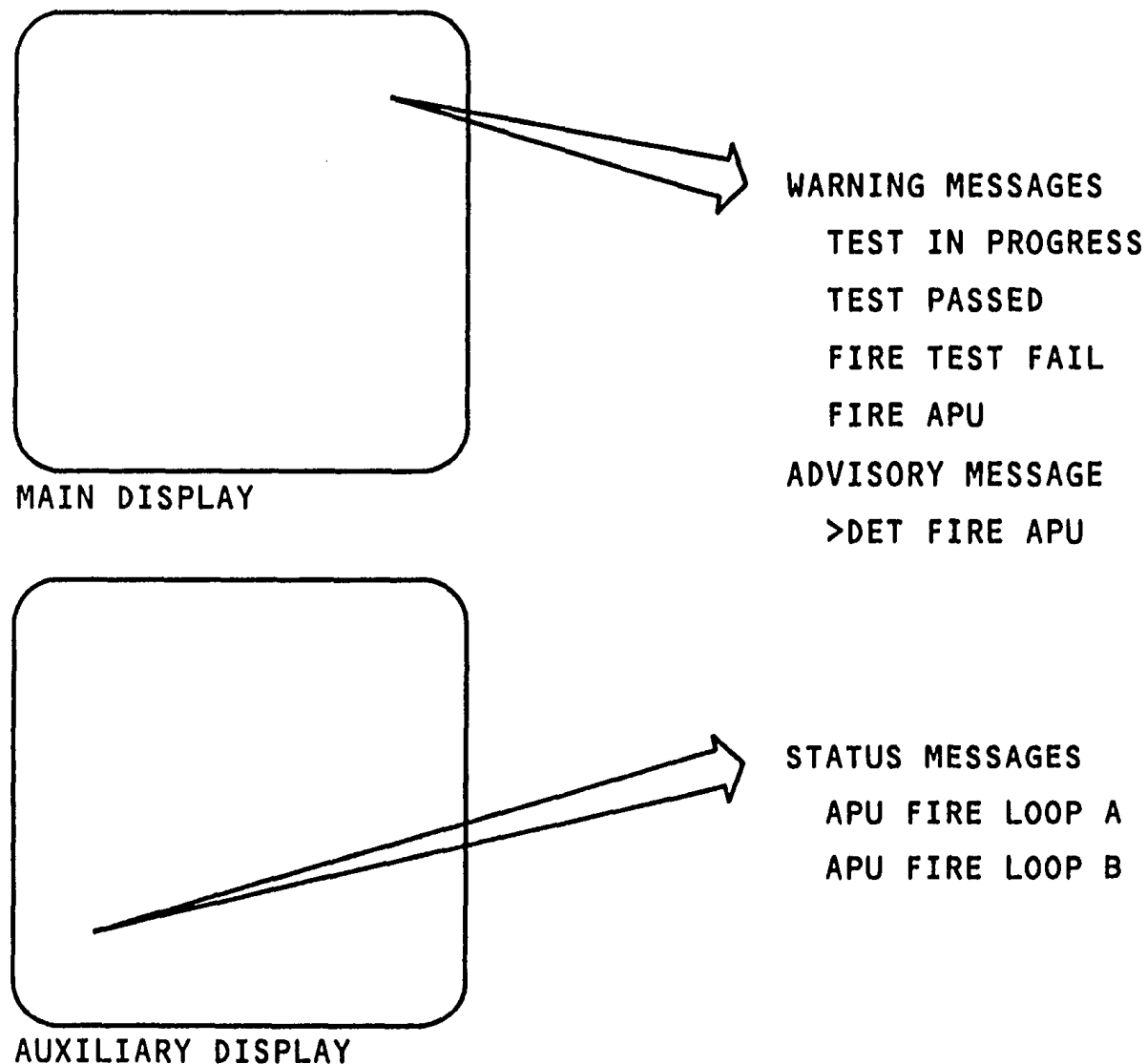


Figure 35 EICAS MESSAGES

APU FIRE DETECTION



APU FIRE HANDLE SWITCH

The APU fire handle switch provides indication of fire and is used for fire extinguishing control. It is located in module M7326, ENG/APU/CARGO FIRE CONTROL on P5. The handle is normally held locked by a deenergized solenoid.

When fire is detected or during test of the APU fire system, the solenoid energizes and unlocks the handle. Pulling the handle, stops operation of the horn and operates controls for stopping and isolating the APU. Rotating the handle discharges the extinguisher bottle.

The handle can be unlocked manually by pushing on the plunger under the handle.

APU FIRE DETECTION

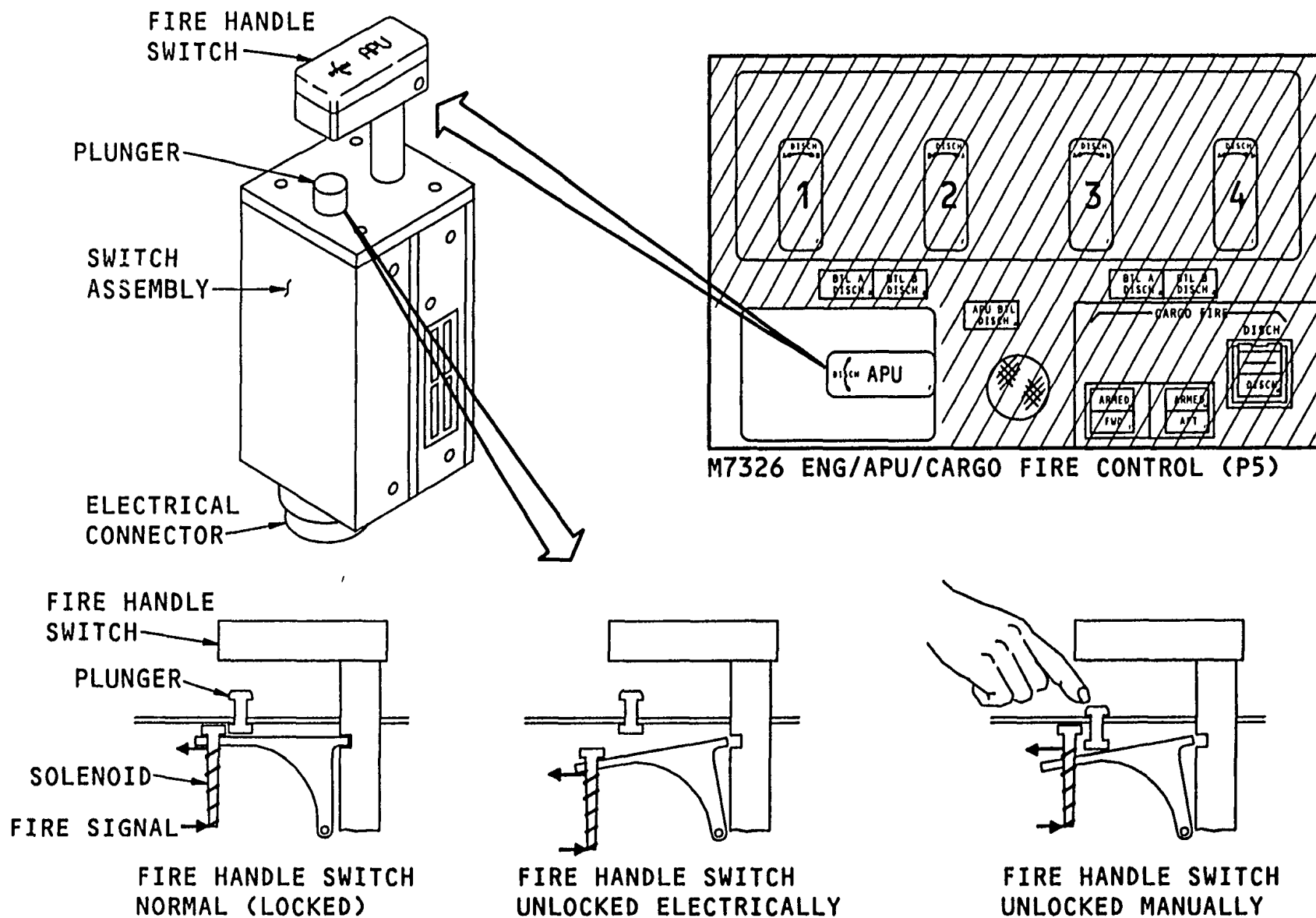


Figure 36 APU FIRE HANDLE SWITCH



APU FIRE DETECTION

APU FIRE HANDLE SWITCH CIRCUIT

When the APU fire condition is detected or during test, the handle illuminates red and the switch solenoid energizes to unlock the handle.

During the fire condition, pulling the fire handle:

- Trips APU generator
- Shuts down APU
- Closes APU isolation valve
- Closes the fuel shutoff valve
- Resets the fire horn

Rotation of the fire handle discharges the extinguisher bottle.

APU FIRE DETECTION

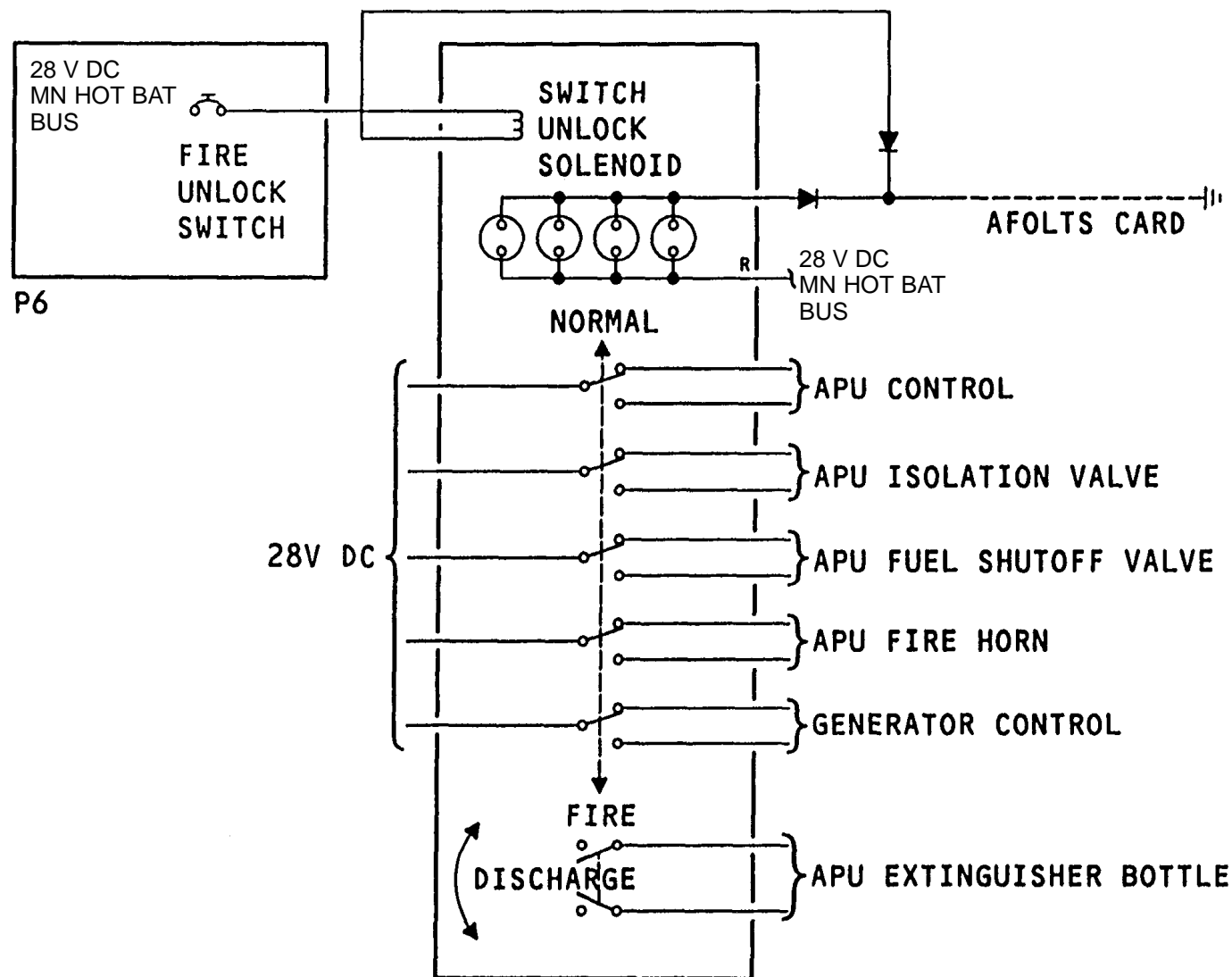


Figure 37 APU FIRE HANDLE SWITCH CIRCUIT

APU FIRE EXTINGUISHING



APU FIRE EXTINGUISHING

APU FIRE SHUTDOWN MODULE

General

The APU fire shutdown module allows ground personnel to be alerted to a fire condition in the APU. It is located on the keel beam at the aft end of the right main wheel well.

Operation

When fire is detected in the APU compartment, the red fire light illuminates and the horn operates (only on the ground). Pulling the APU FIRE CONTROL handle, stops the horn operation, arms the extinguisher discharge switch and stops the APU, (this is a back-up, fire detection stops the APU).

The extinguisher bottle is discharged by pushing and holding the APU EXTINGUISHER DISCHARGE switch. In emergency, the APU can be stopped by pushing the APU STOP switch.

Maintenance Practices

Prior to removal of the APU fire shutdown module, the landing gear and door locks must be installed.

WARNING: RAPID ACTION OF DOORS MAY INJURE PERSONNEL OR DAMAGE EQUIPMENT IF LOCKS ARE NOT PROPERLY INSTALLED.

The module is removed by disconnecting the electrical connector and removing six mounting bolts.

APU FIRE EXTINGUISHING

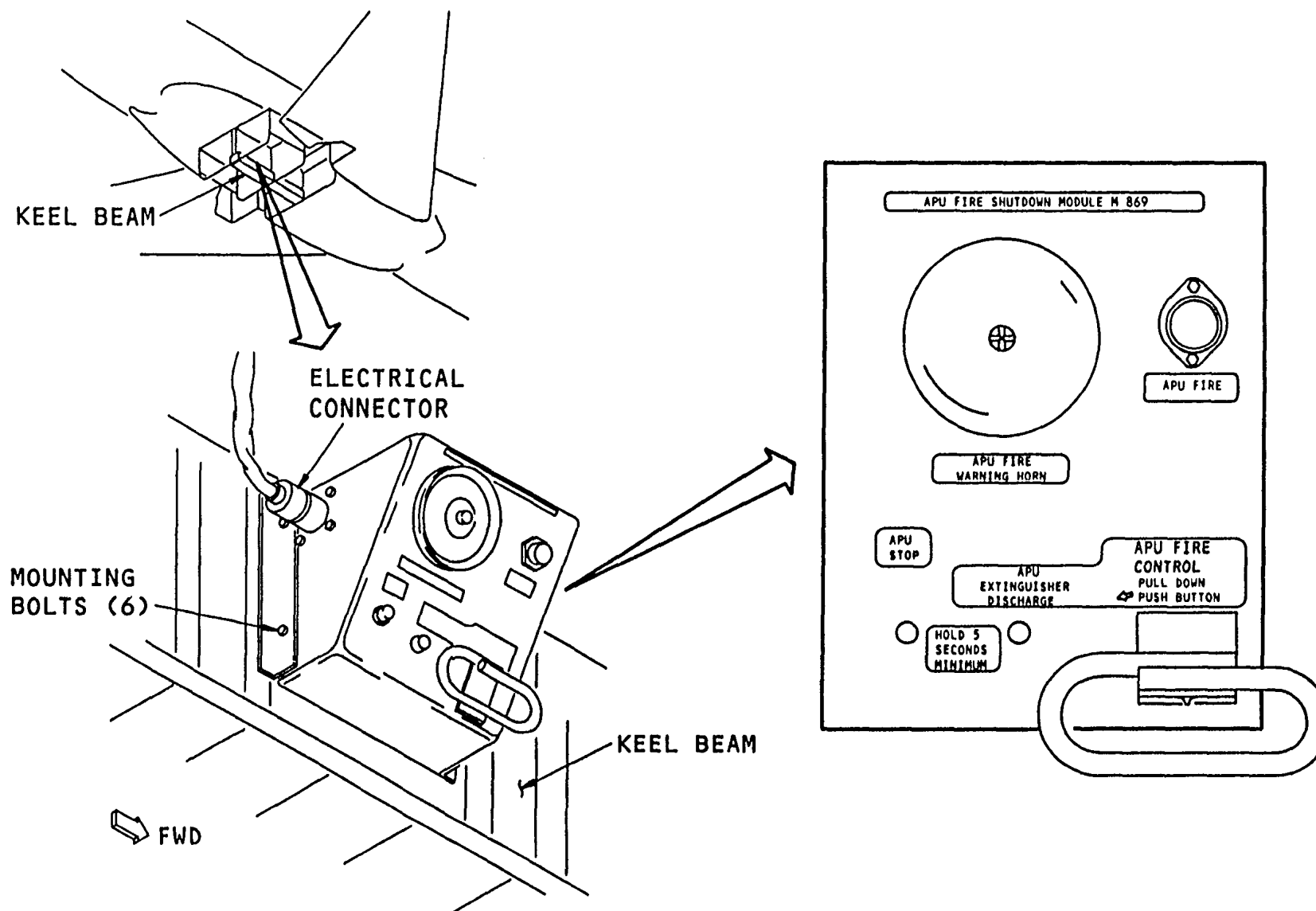


Figure 38 APU FIRE SHUTDOWN MODULE

APU FIRE EXTINGUISHING



APU FIRE SHUTDOWN MODULE CIRCUIT

When the APU fire condition is detected, relay R7792 and R825 energizes, the red light illuminates and the horn operates. The horn operates only on the ground and can be silenced by the APU fire handle switch on P5.

Pulling the fire handle:

- Trips APU generators
- Shuts down APU
- Closes APU isolation valve
- Closes APU fuel shutoff valve
- Arms APU extinguishing system
- Resets the horn

APU FIRE EXTINGUISHING

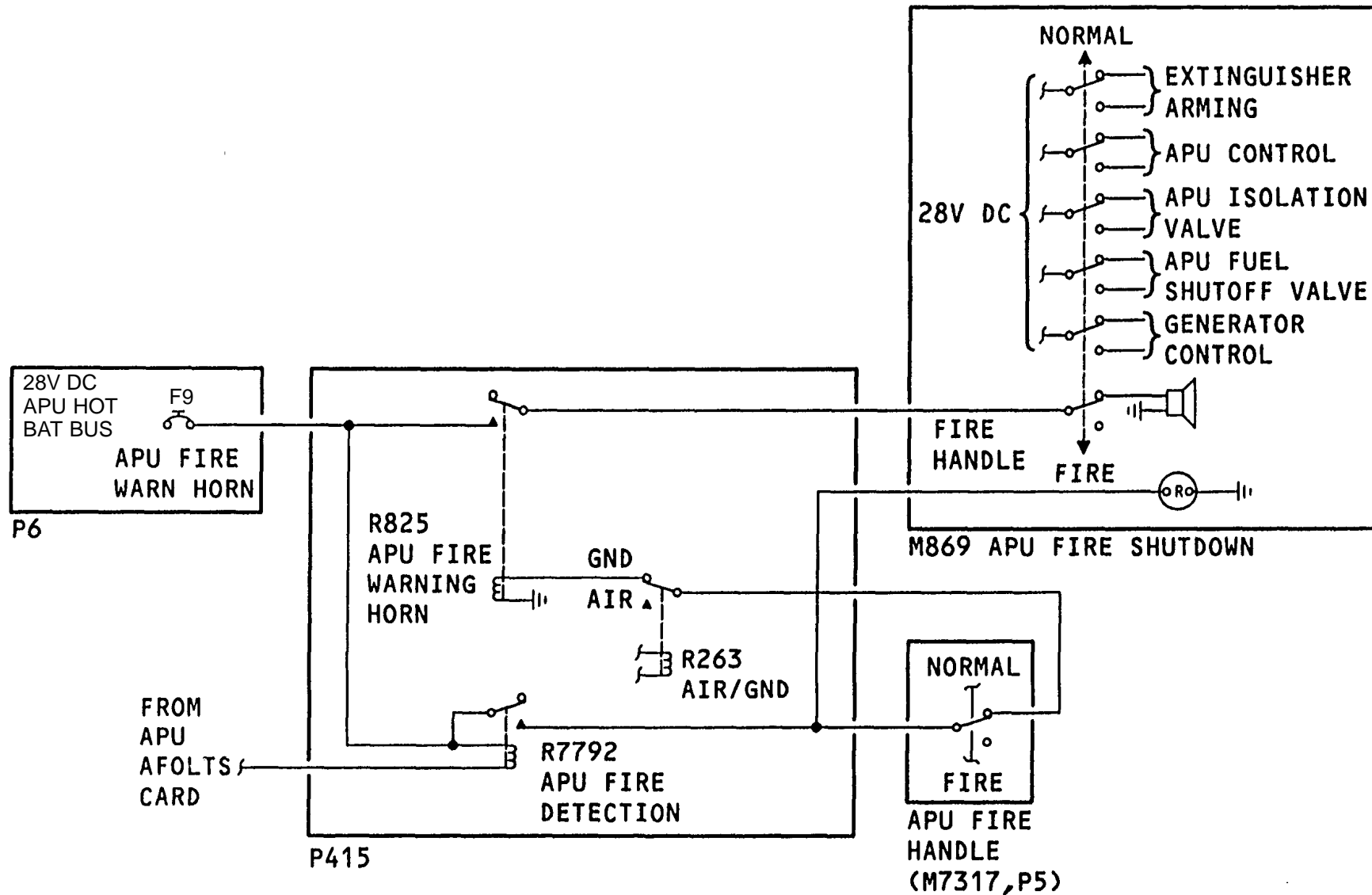


Figure 39 APU FIRE SHUTDOWN MODULE CIRCUIT

APU FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

040.01

26-22

APU FIRE EXTINGUISHING



BOTTLE COMPONENTS

Extinguisher Bottle

The APU fire extinguishing system is of a gaseous smothering type. The APU fire extinguisher bottle is located on the forward side of the APU fire wall and is attached at four points to the support structure. The bottle has a volume of 630 cubic inches and contains 18 pounds of halon pressurized by nitrogen to 600 psi at 70°F (21° C). A heat shield, Consisting of four segments of insulation secured by capstans, surrounds the bottle. It can be removed without removing the bottle. Access to the bottle is through the access door in the rear fuselage, forward of the APU.

Located on the bottle are a squib for discharging the bottle into the APU compartment, a pressure switch for the bottle discharge indication, and a discharge plug port with two orifices for over-pressure discharge. When the pressure in the bottle reaches 1200 to 1400 psig, the discharge plug diaphragm ruptures and the bottle contents discharges into the bottle compartment.

A discharged fire extinguisher bottle must be replaced, it can not be serviced on the airplane.

Prior to a new bottle installation, the gross weight of the bottle has to be checked against the weight marked on the bottle. A weight deviation of more than 0.25 pound is cause for bottle rejection. This prevents installation of an improperly serviced bottle.

WARNING: DO NOT HANDLE BOTTLE WITH DISCHARGE PORT EXPOSED. KEEP PROTECTIVE CAP OVER THE PORT TO PREVENT DAMAGE TO THE DIAPHRAGM. DO NOT PROBE DIAPHRAGM. REMOVE PROTECTIVE CAP ONLY DURING BOTTLE INSTALLATION. DAMAGE TO THE DIAPHRAGM MAY CAUSE ACCIDENTAL BOTTLE DISCHARGE AND CAUSE INJURY TO PERSONNEL.

Extinguisher Bottle Squib

The APU fire extinguisher bottle squib is located at the base of the bottle below the discharge swivel assembly. The squib is for discharging the fire bottle into the APU compartment.

The squib consists of an electrically operated explosive device. When power is supplied to the squib, the explosive device detonates and ruptures a diaphragm in the swivel assembly allowing bottle contents to discharge.

The squib can be removed and replaced without removal of the fire extinguisher bottle.

WARNING: DO NOT APPLY POWER IN ANY FORM (TEST LIGHT OR THE LIKE) TO THE BOTTLE DISCHARGE SQUIB RECEPTACLE. FOR TESTING OF SQUIB CONTINUITY, DO NOT USE OHM-METER CAPABLE OF SUPPLYING MORE THAN 80 MILLIAMPS OR THE SQUIB MAY BE DETONATED. INSTALL SHUNT ACROSS FACE OF BOTTLE SQUIB ELECTRICAL CONNECTOR PRIOR TO REMOVAL OR INSTALLATION OF THE BOTTLE. AN ACCIDENTALLY FIRED BOTTLE MAY CAUSE INJURY TO PERSONNEL.

APU FIRE EXTINGUISHING



Lufthansa Technical Training

B747 - 400

040.01

26-22

Extinguisher Bottle Pressure Switch

The APU fire extinguisher bottle pressure switch is located at the base of the bottle. The switch is for indication of the bottle condition. When the bottle pressure decreases to 225 psig, the switch operates and provides circuit continuity for the indicating system.

The pressure switch operation and the indicating system can be checked on the ground. Pushing the test button the pressure switch checks the indicating circuit continuity, which can be observed in the flight deck on M7326, ENGINE/APU/CARGO FIRE CONTROL on P5 and on the EICAS display.

APU FIRE EXTINGUISHING

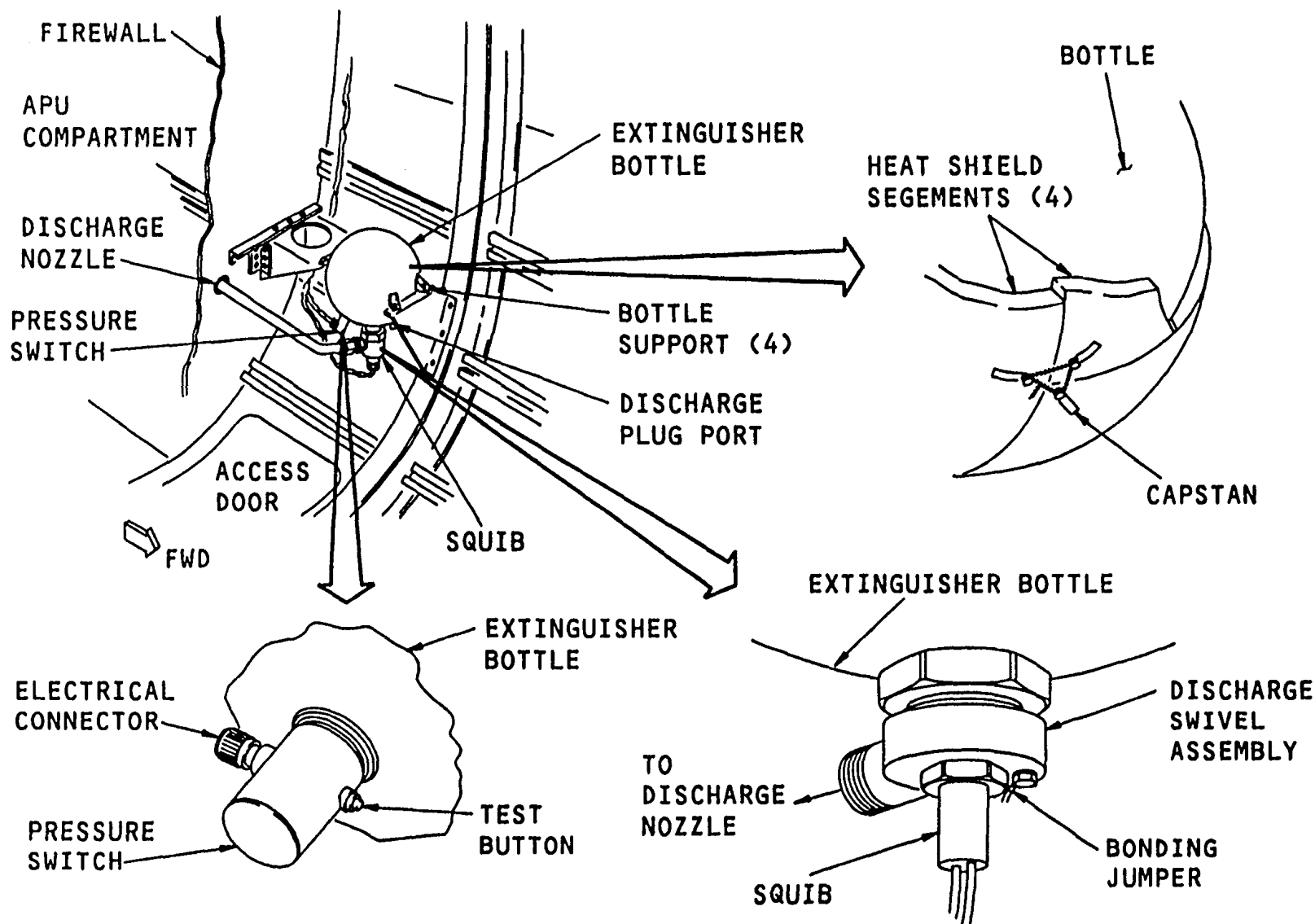


Figure 40 BOTTLE COMPONENTS

APU FIRE EXTINGUISHING



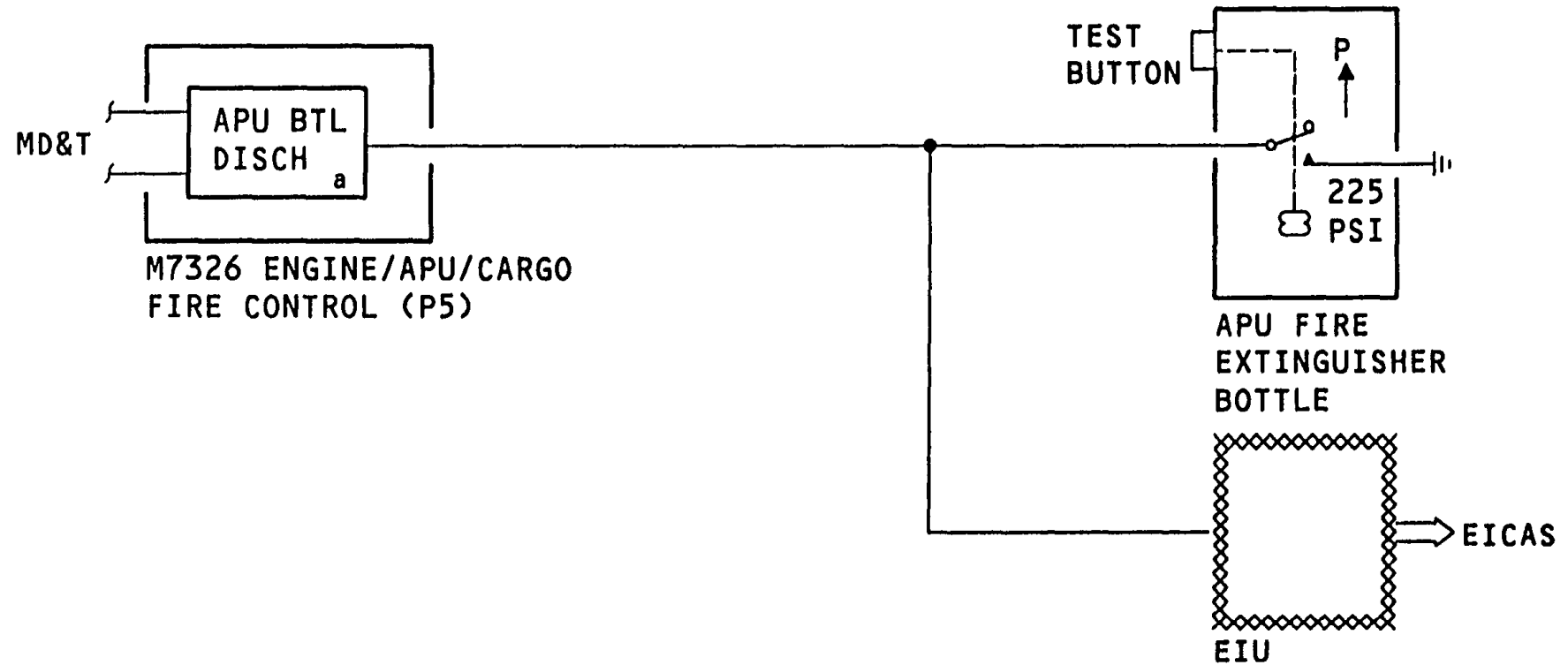
BOTTLE DISCH INDICATION CIRCUIT

When the APU fire extinguisher bottle is discharged, the pressure switch closes at approximately 225 psig. An amber APU BTL DISCH light illuminates on the M7326, ENGINE/APU/CARGO FIRE CONTROL module.

This information is also sent to the EICAS display unit through the EFIS/EICAS Interface units.

The discharge indication can be tested by manual operation of the test button on the pressure switch.

APU FIRE EXTINGUISHING

**Figure 41 BOTTLE DISCH INDICATION CIRCUIT**

APU FIRE EXTINGUISHING



EICAS MESSAGES

The APU fire extinguisher bottle EICAS messages are shown on the main and auxiliary displays.

- >BOTTLE LOW APU: advisory message on main EICAS display. APU fire extinguisher bottle low pressure
- BOTTLE LOW APU: status message on auxiliary EICAS display. APU fire extinguisher bottle low pressure

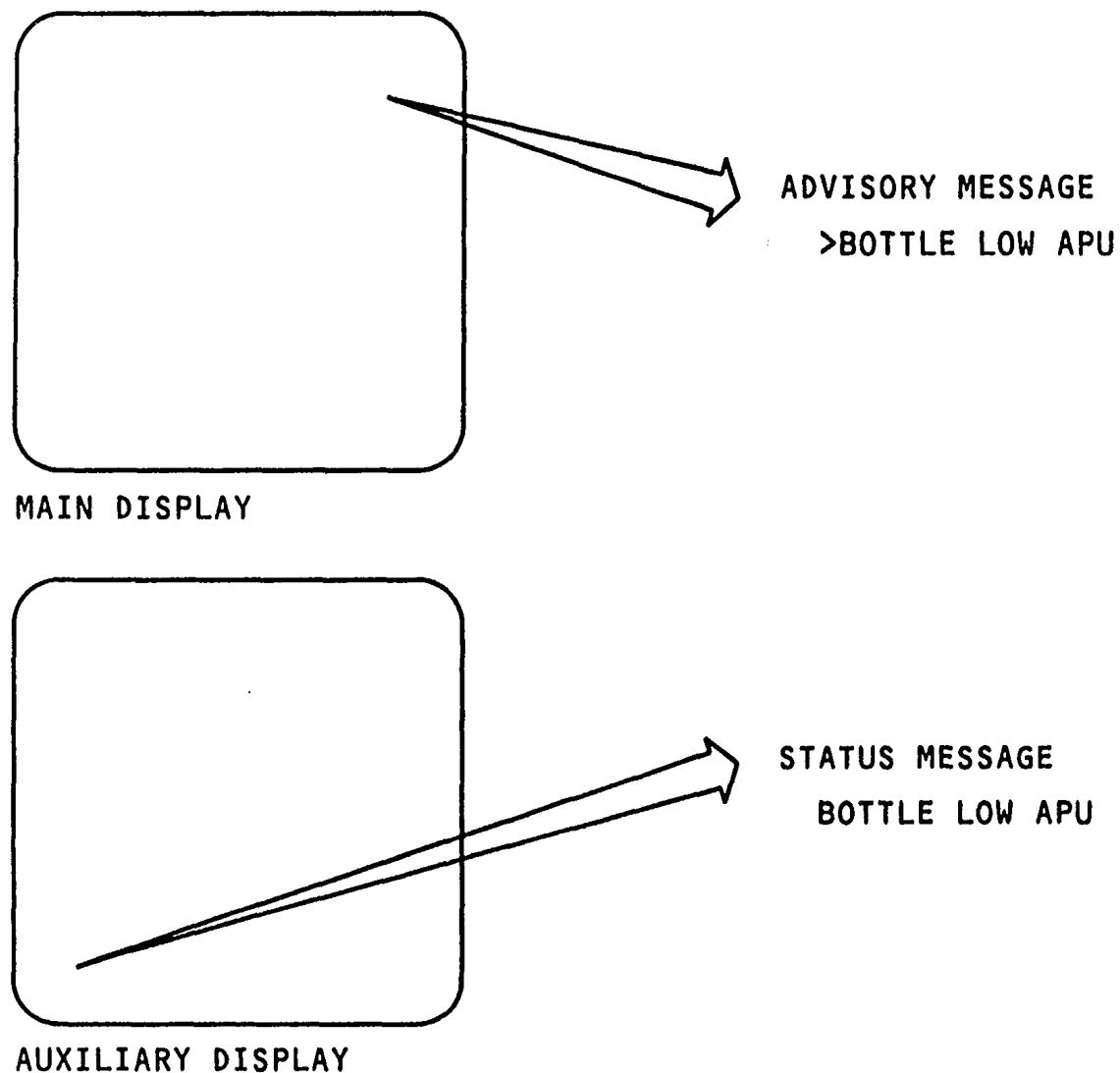


Figure 42 EICAS MESSAGES

APU FIRE EXTINGUISHING



SQUIB TEST CONTROL

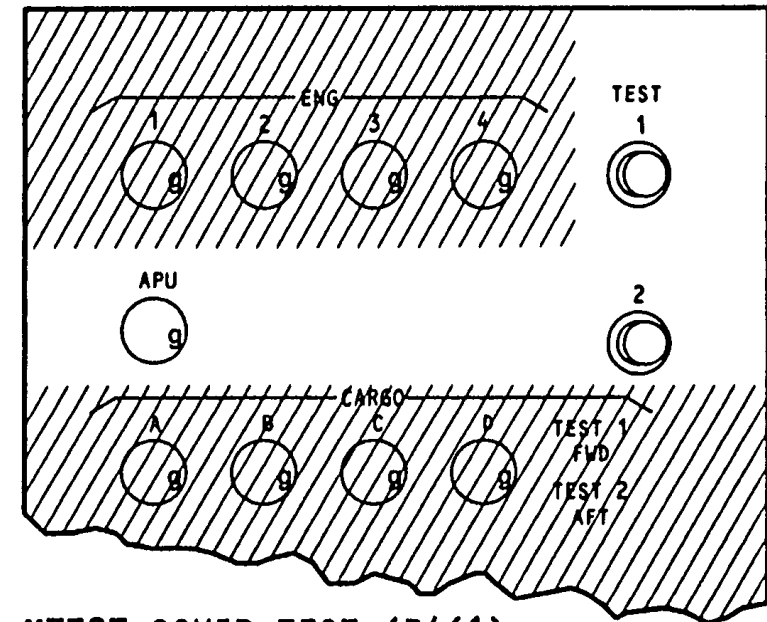
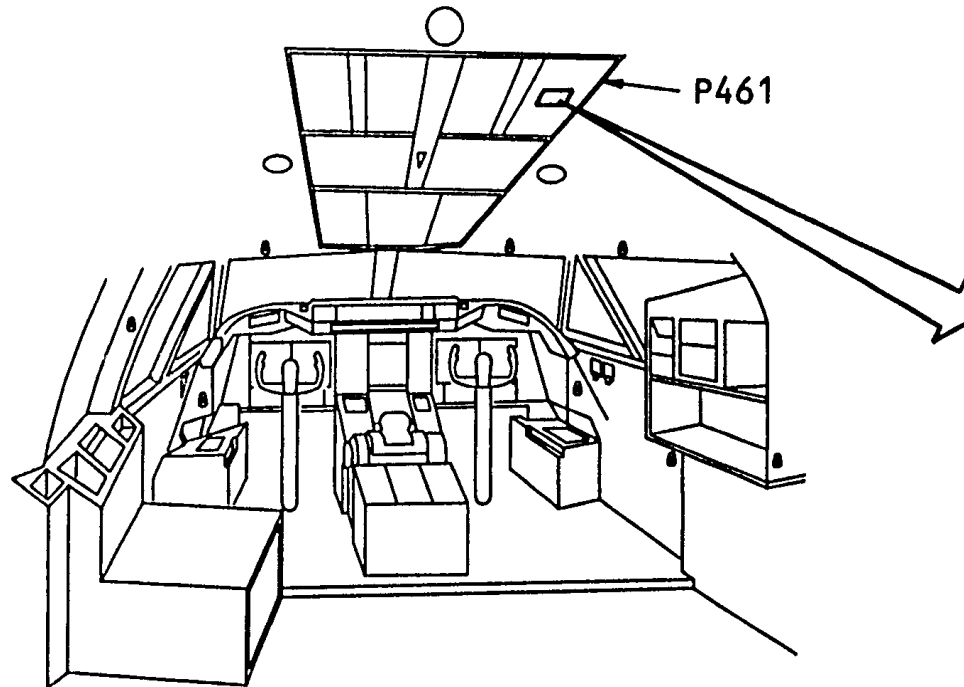
The APU fire extinguisher bottle squib test control is located in module M7327, SQUIB TEST on P461.

The control consists of push-button switches 1 or 2 and a green indicating light.

The test is performed by pushing and holding switch 1 followed by switch 2. If the green light illuminates, the circuit through the squib is verified.

NOTE: WHEN REPLACING BULB IN THE GREEN INDICATING LIGHT, ENSURE THAT A CORRECT BULB IS USED WHICH PROVIDES THE NECESSARY CIRCUIT RESISTANCE. IF AN INCORRECT BULB IS USED, THE SQUIB WILL BE DISCHARGED DURING TEST.

APU FIRE EXTINGUISHING



M7327 SQUIB TEST (P461)

Figure 43 SQUIB TEST CONTROL

APU FIRE EXTINGUISHING



SQUIB TEST CIRCUIT

The APU fire extinguisher bottle squib is tested by either test switch 1 or 2.

Pushing and holding either test switch connects the green indicating light to ground through the extinguisher bottle squib. When the light illuminates, the circuit through the squib is verified.

APU FIRE EXTINGUISHING

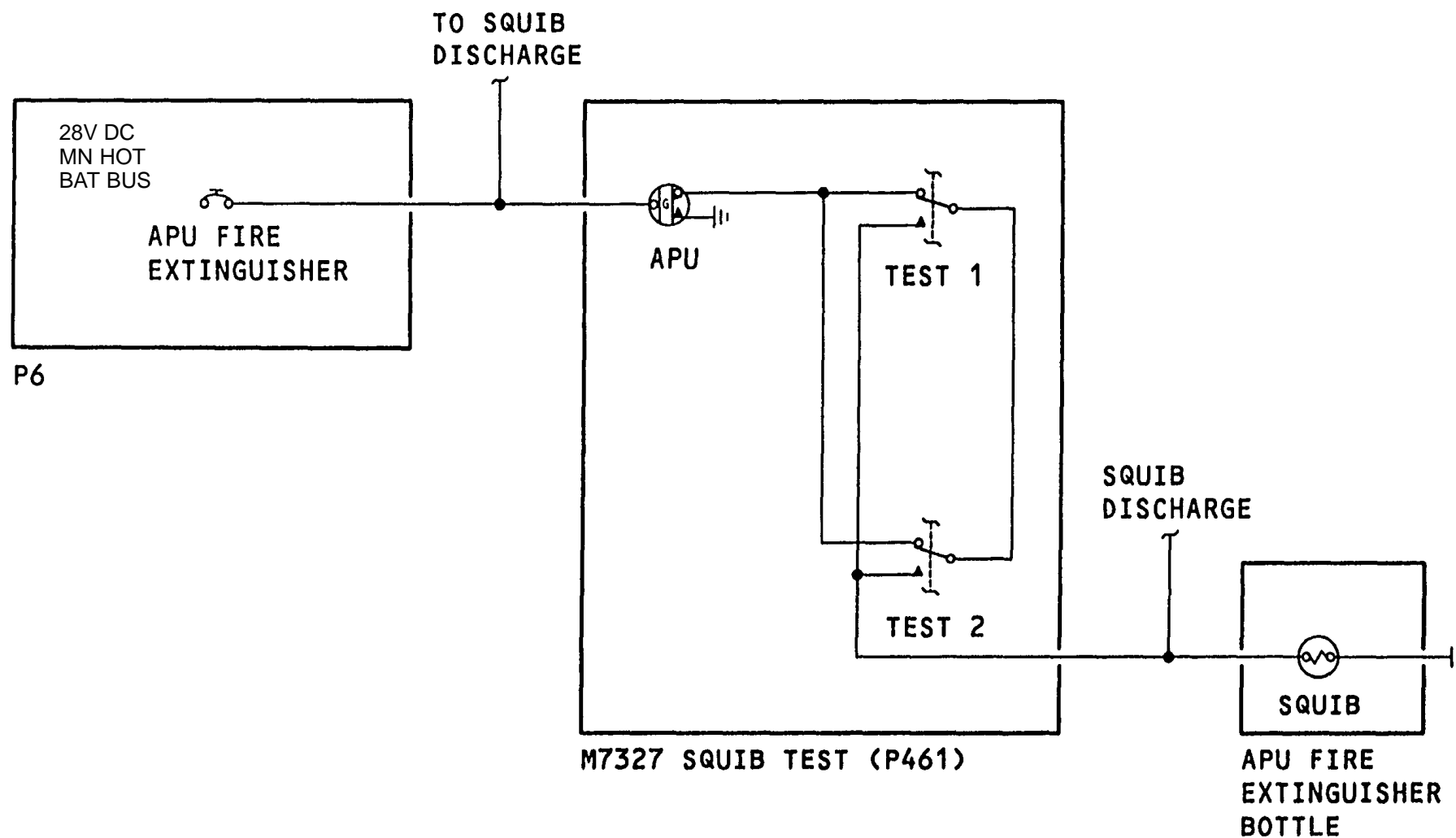


Figure 44 SQUIB TEST CIRCUIT



LOWER CARGO COMPARTMENT SMOKE DETECTION

CARGO COMPARTMENT SMOKE DETECTION

The cargo compartment smoke detection is provided for the forward, aft and bulk cargo compartments. The system consists of a series of smoke sampling ports connected to flow through smoke detectors. A venturi ejector, connected to the pneumatic manifold, provides airflow through the ports to the detectors.

Indication of the cargo compartment smoke detection is in the flight deck.

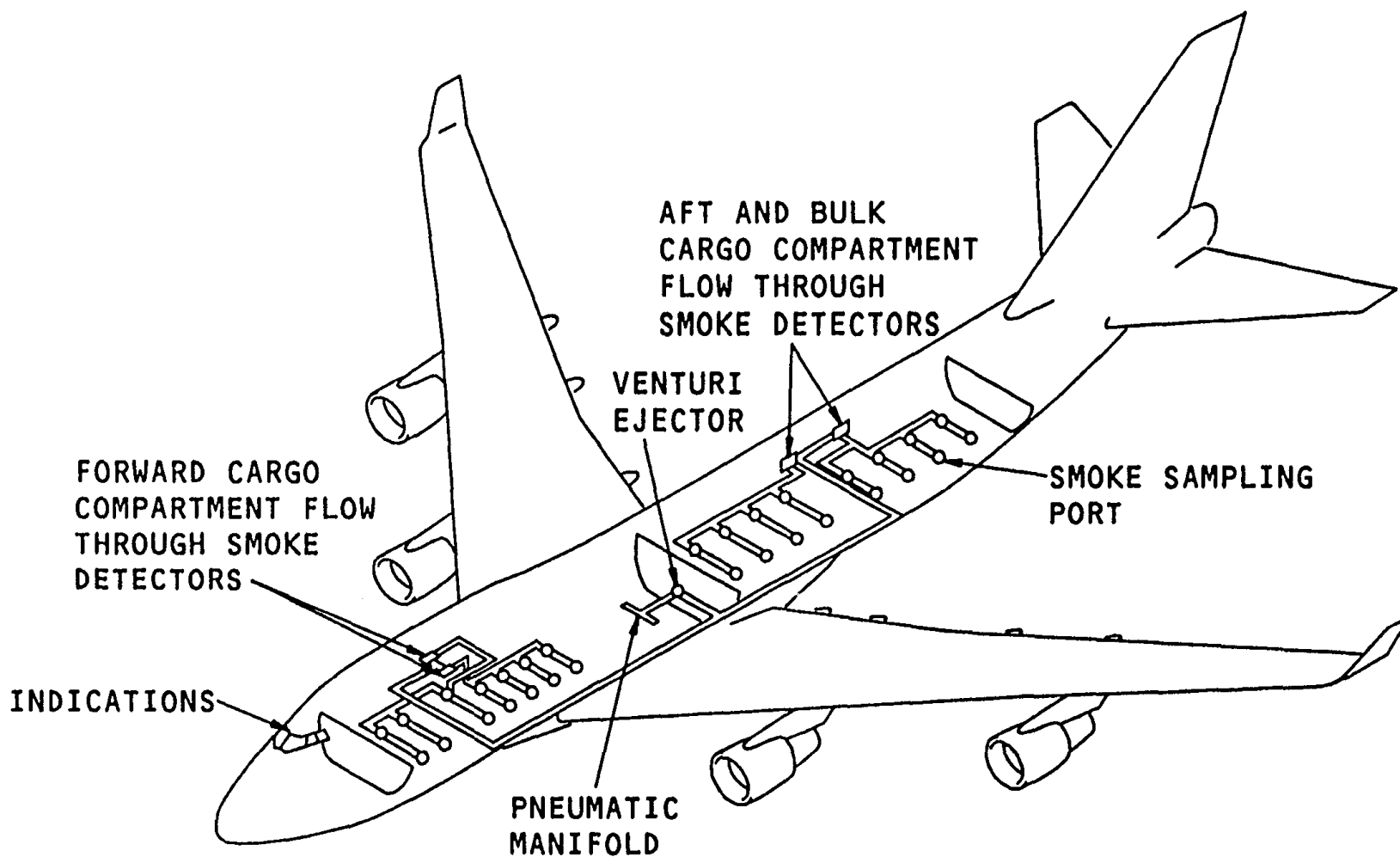


Figure 45 LOWER CARGO COMPARTMENT SMOKE DETECTION

LOWER CARGO COMPARTMENT SMOKE DETECTION



SMOKE DETECTION SYSTEM

General

The smoke detection system continuously samples the air in the forward, aft and bulk cargo compartments for presence of smoke. The system consists of a venturi ejector, smoke sampling ports and smoke detectors.

The venturi ejector provides a vacuum allowing airflow from the sampling ports to pass through the smoke detectors.

Forward Cargo Compartment

The forward cargo compartment smoke detection is divided into zone 1 and 2. Eight smoke sampling ports in zone 1 are connected to smoke detectors A and B, and eight ports in zone 2 are connected to detectors A and B.

The wires to the connectors on smoke detectors are color coded:

- Yellow for detector A in zone 1
- Blue for detector B in zone 1
- Red for detector A in zone 2
- Brown for detector B in zone 2

Aft and Bulk Cargo Compartments

The aft and bulk cargo compartments smoke detection is divided into zone 3 and 4. Ten smoke sampling ports in zone 3 (aft compartment) are connected to detectors A and B? and six ports in zone 4 (bulk compartment) are connected to detectors A and B.

The wires to the connectors on smoke detectors are color coded:

- Yellow for detector A in zones 3 and 4
- Blue for detector B in zones 3 and 4

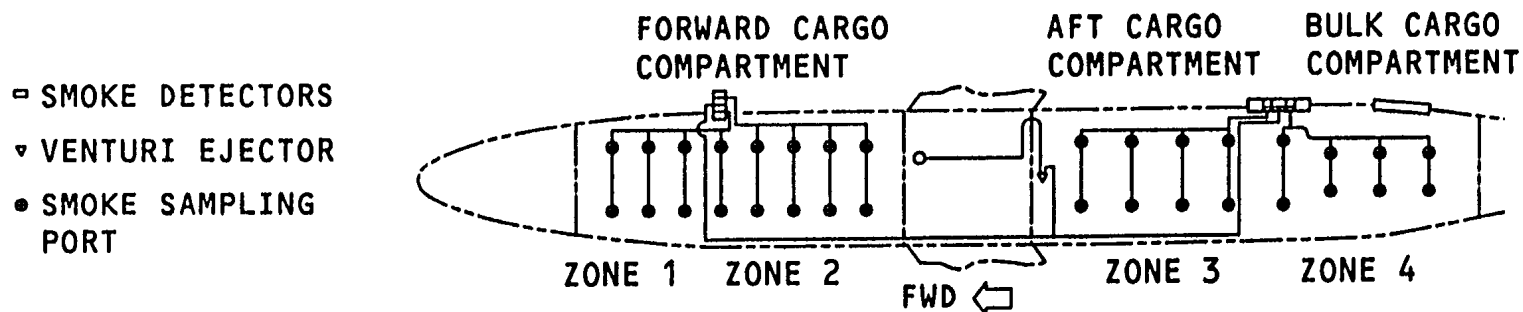
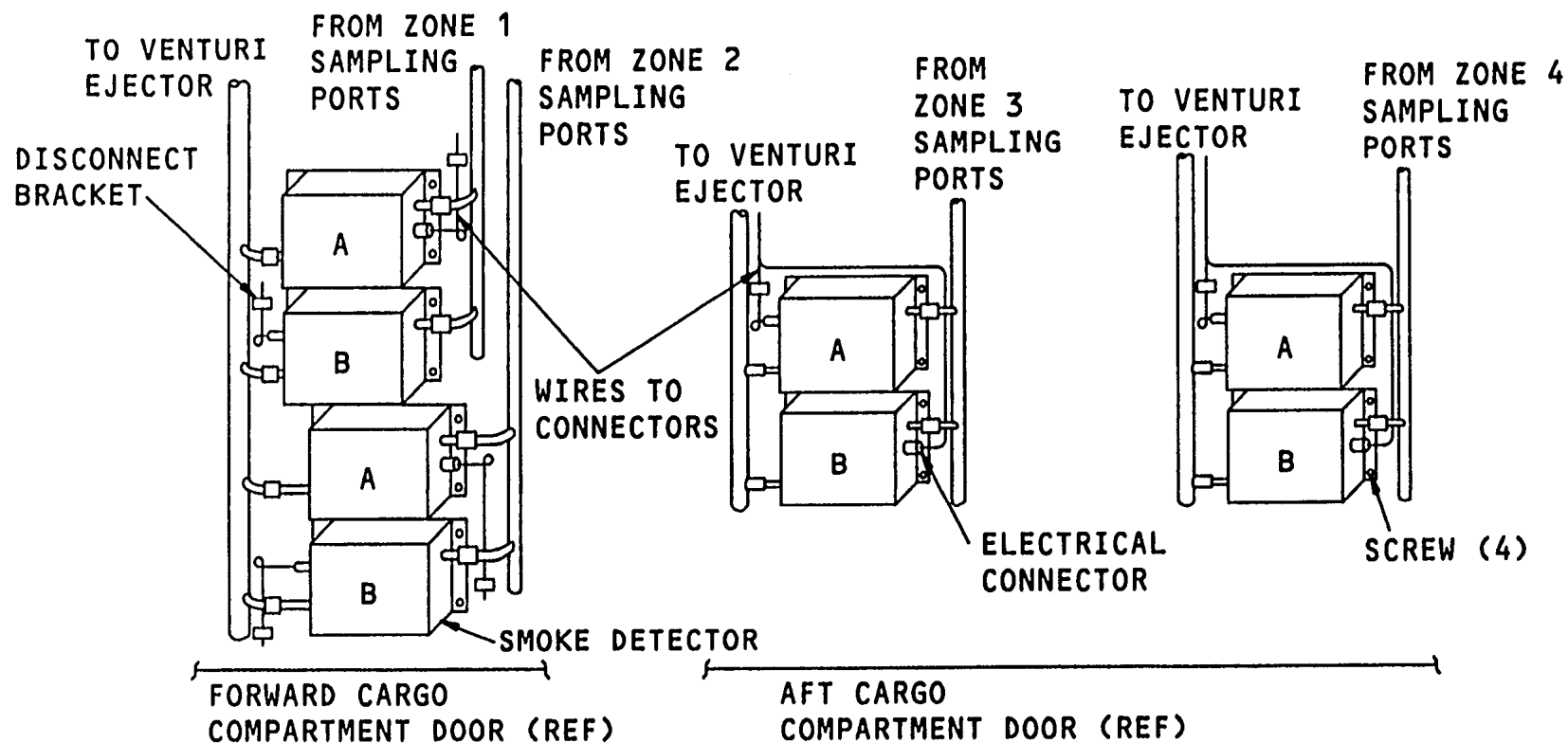


Figure 46 DETECTION SYSTEM



VENTURI EJECTOR

General

The venturi ejector provides a source of low pressure (vacuum) for the smoke detectors and smoke sampling ports. It is located under the floor at the forward end of the aft cargo compartment.

Operation

Air from the pressurized pneumatic manifold flows through the venturi ejector and exhausts into the left sidewall of the cargo compartment. This airflow creates a low pressure (vacuum) in the lines connected to the smoke detectors and sampling ports. A differential pressure between the cargo compartment and the venturi ejector induces air (or air/smoke mixture) to flow through the sampling ports and smoke detectors. A pressure switch, located next to the venturi ejector, monitors the ejector operation. The switch operates between seven and eleven inches of water.

Maintenance Practices

Access to the venturi ejector is by removal of the aft center floor panel. The venturi ejector is removed by disconnecting two pneumatic lines, electrical connector and removing four fasteners from the mounting plate.

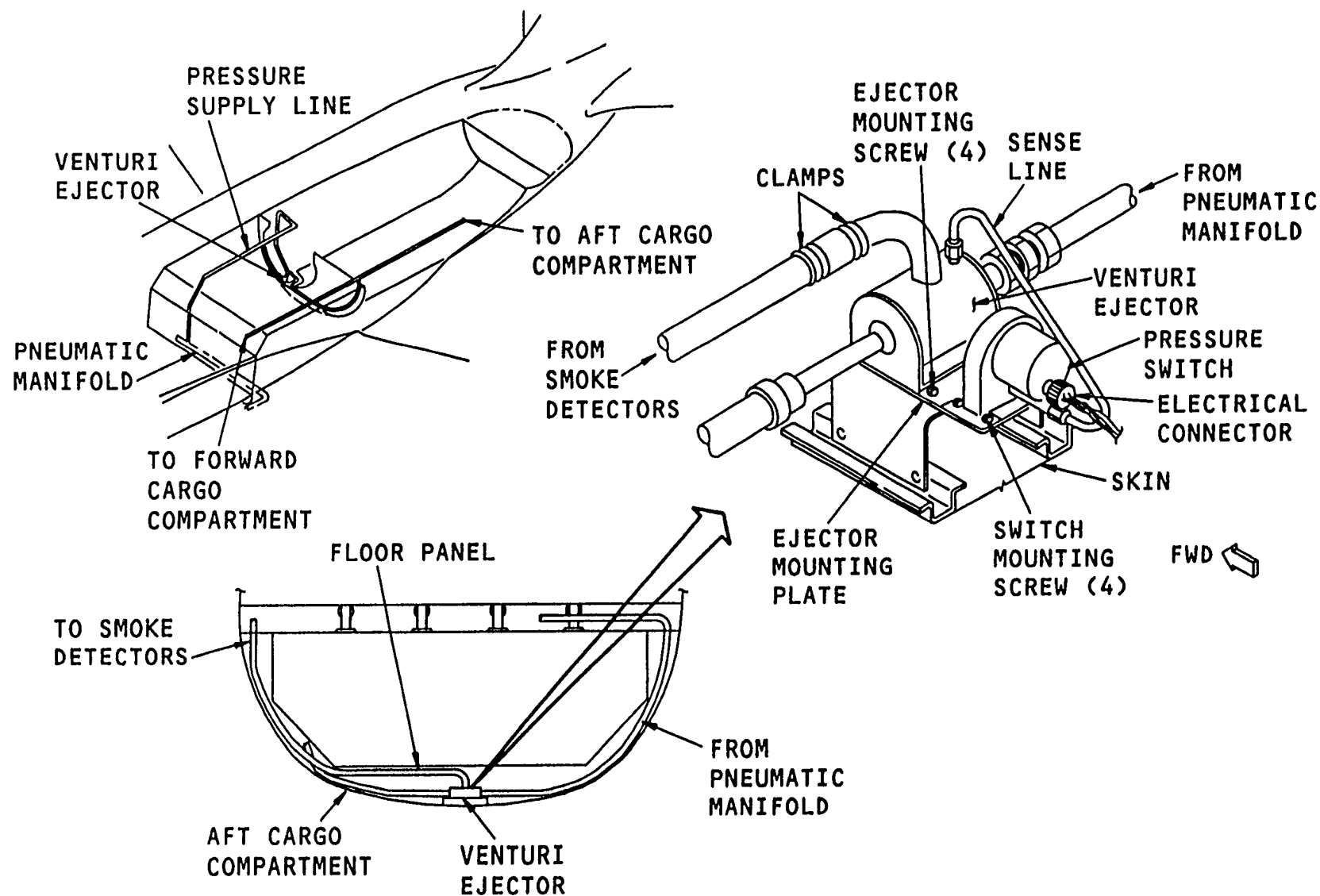


Figure 47 VENTURI EJECTOR



VENTURI EJECTOR PRESSURE SWITCH CIRCUIT

The venturi ejector pressure switch monitors the operation of the airflow through the cargo smoke detectors.

During normal operation of the venturi ejector, the switch senses the pressure and is open above 11 inches of water. When pressure decreases to 7 inches of water, the switch closes and the circuit inside the modular avionics warning electronic assembly (MAWEA) provide an output to the electronic interface units and EICAS display indicating loss of airflow through the smoke detectors. The EICAS message is inhibited with less than any two engines operating.

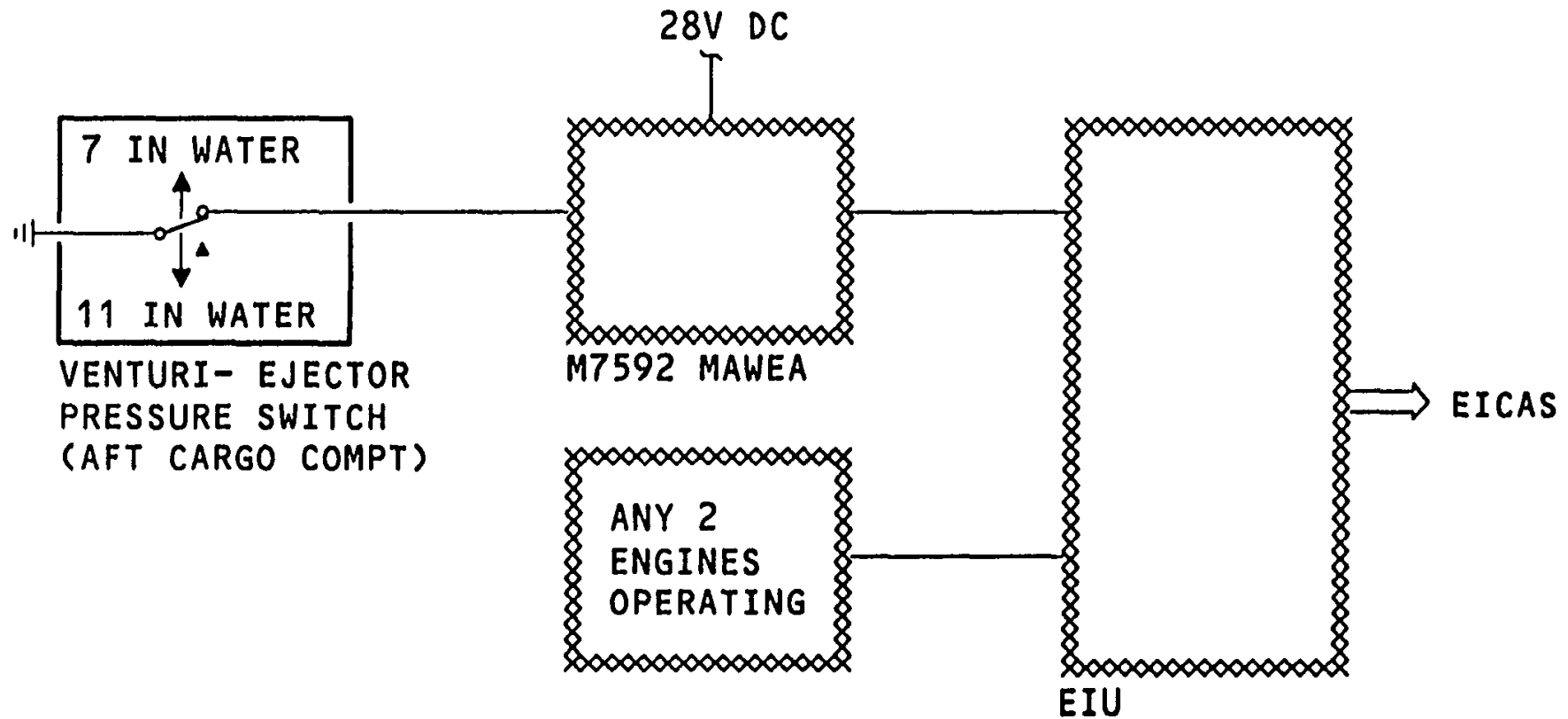


Figure 48 VENTURI EJECTOR PRESSURE SWITCH CIRCUIT



SMOKE DETECTORS**General**

The smoke detectors are located near the door in the forward and aft cargo compartments. The detectors are connected by tubing to the smoke sampling ports and to a vacuum manifold, allowing air from the cargo compartment to pass through the detector.

Maintenance Practices

Access to the detectors is by removal of the ceiling panel near the cargo door. The smoke detector is removed by disconnecting two air lines, electrical connector and removing four fasteners. Alternate detectors are rotated 180° and the electrical connector wire length is sized and staked to prevent improper connecting of the "All and "B" loops.

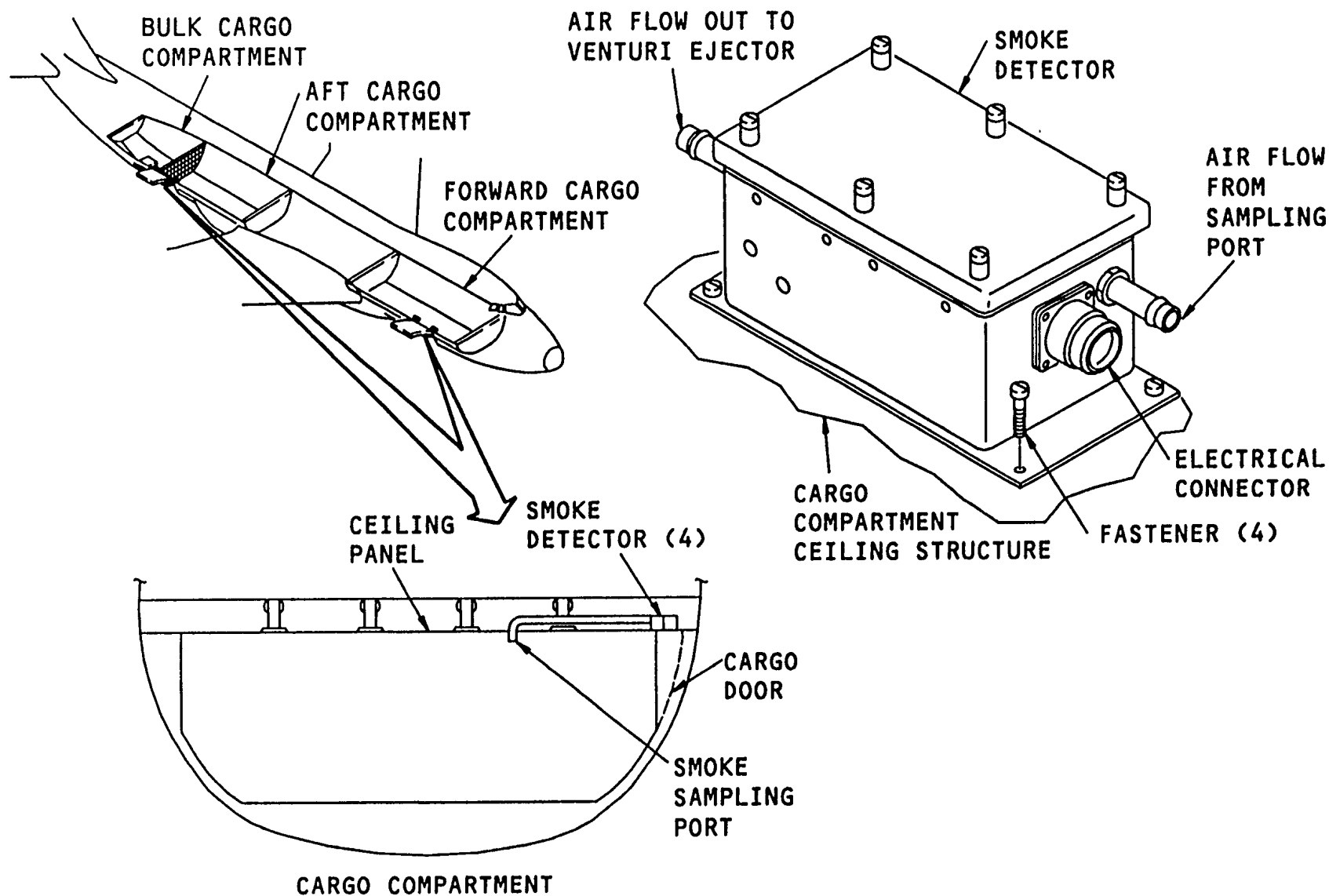


Figure 49 SMOKE DETECTORS



SMOKE DETECTOR

Operation

The detector consists of a pilot lamp, light trap, photo cell, test light emitting diode (LED) and electronic circuit. During normal operation, the pilot light beam shines onto the light trap and the photo cell does not receive any light. When air with smoke passes through the detector, light is reflected from the smoke particles and directed onto the photo cell. The output of the photo cell changes, allowing the electronic Circuit to provide smoke indication.

During test, the test LED is energized providing direct light source to the photo cell.

The smoke detectors installed in the forward and aft cargo compartments, door 5 crew rest area and equipment cooling system are identical.

Maintenance Practices

The detector lamp replacement is accomplished by removal of the protective cover. The replacement lamp must conform to a specific part number for proper detector operation.

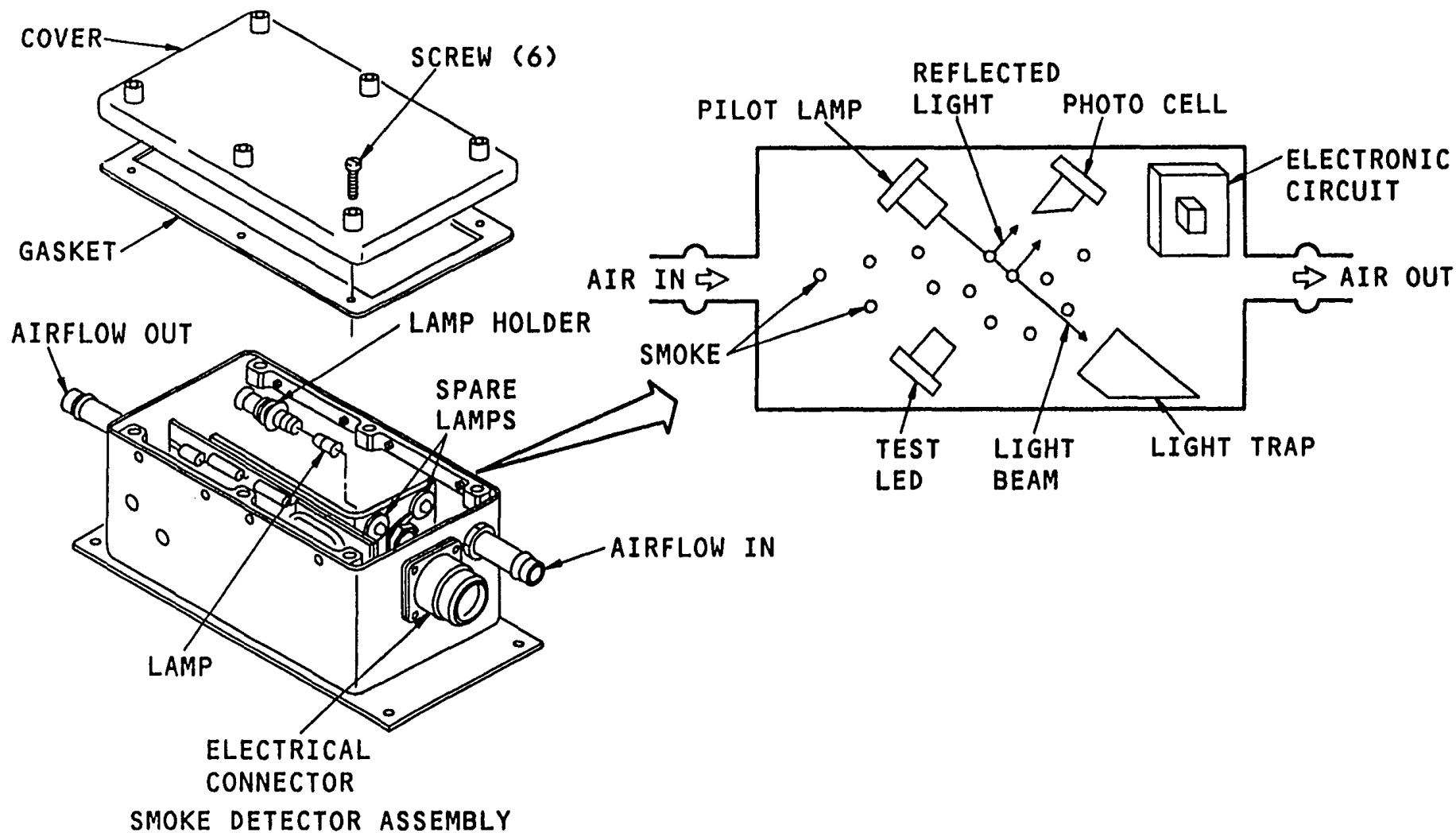


Figure 50 SMOKE DETECTOR



SMOKE DETECTOR CIRCUIT

The pilot lamp in the smoke detector is supplied with regulated power. The light from the lamp does not shine onto the photo cell. When smoke is present, light is reflected by the smoke particles and diverted onto the photo cell. The circuit resistance decreases and relay energizes allowing output to the smoke detection indication.

During test, the pilot lamp and light emitting diode (LED) are supplied with power. Light from the LED shines onto the photocell simulating presence of smoke. The circuit resistance decreases and relay energizes allowing output to the smoke detection indication. If the detector fails to pass the test no indication is provided.

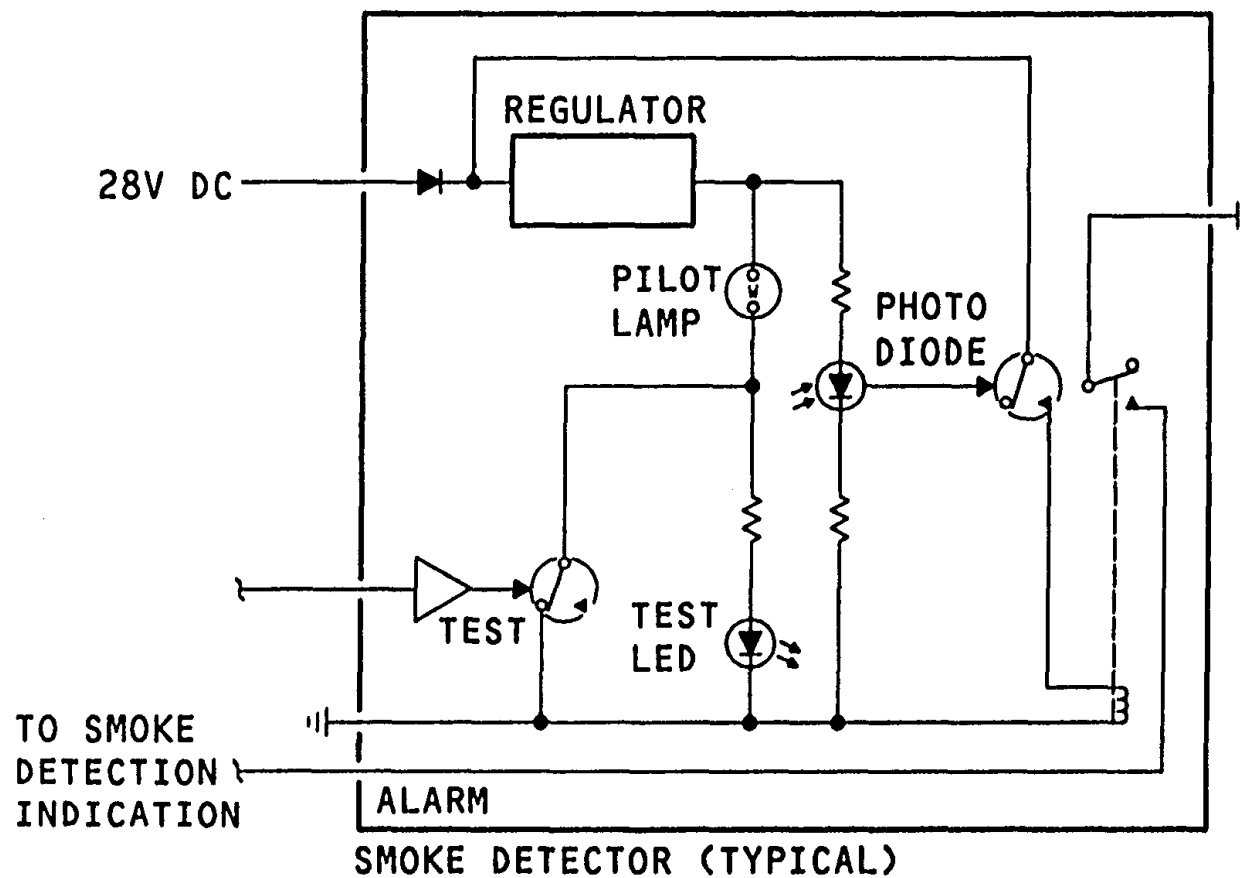


Figure 51 SMOKE DETECTOR CIRCUIT



DETECTION & EXTINGUISHING INDICATION**General**

The cargo compartment smoke detection indication and fire extinguisher bottle discharge controls and indication are located in the module M7326, ENGINE/APU/CARGO FIRE CONTROL on P5.

Smoke Detection

The indications consist of two red FWD and AFT lights, two red master warning lights and EICAS displays. The fire warning bell operates through the speakers.

The smoke detection system is tested by the test switch.

Extinguishing controls

The controls consist of two red, ARMED/FWD and ARMED/AFT, switchlights for arming the discharge system and a guarded momentary DISCH switch for discharging the fire extinguisher bottles.

Extinguishing indication

The indication consists of an amber DISCH light. The light illuminates when the cargo extinguisher bottle is discharged.

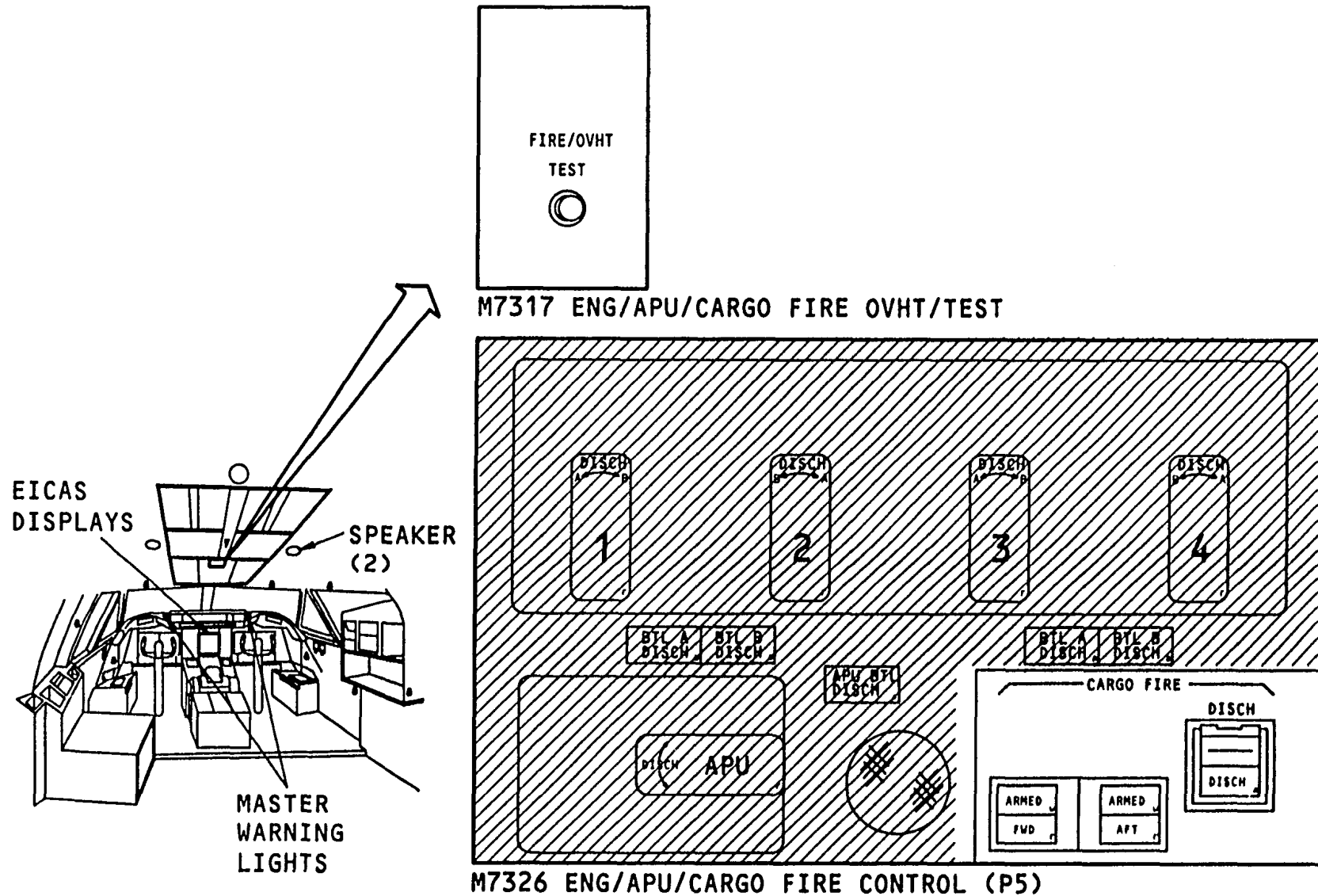


Figure 52 DETECTION & EXTINGUISHING INDICATION

LOWER CARGO COMPARTMENT SMOKE DETECTION



FWD CC SMOKE DETECTION CIRCUIT

Normal Operation

The smoke detection and test indication is processed by the automatic fire/overheat logic test systems (AFOLTS) card.

Normally, the card is configured in a two detector AND logic. A smoke signal from two detectors (A and B) activates the alarm outputs to the modular avionics warning electronic assembly (MAWEA), EICAS and the red FWD light in the M7326 ENG/APU/CARGO FIRE CONTROL on P5. The MAWEA enables operation of the fire warning bell and two master warning lights.

If two detectors (A and B) do not operate, the fault outputs from the card enable the EICAS display.

One Detector Operation

If one detector (A or B) does not operate, the AFOLTS card re-configures to single detector operation at the time of power-up/manual test. If smoke is detected, the card outputs an alarm signal to the MAWEA and the red FWD

light. The MAWEA enables operation of the fire warning bell and two master warning lights and the EICAS displays the operating and failed detectors.

Power-Up Test

When electrical power is provided to the detection system during the initial airplane power-up operation, the AFOLTS card initiates a test sequence of the detectors.

Manual Test

The test switch in M7317 ENG/APU/CARGO FIRE/OVHT TEST on P5 initiates a test sequence of the AFOLTS card and detectors. The normal response is the same as during the smoke detection. Failure of a detector is indicated on the EICAS display.

If one detector (A or B) is not operating (failed), the card will re-configure to the second detector at the time of power-up/manual test allowing the corresponding indication of failure to be displayed on EICAS.

LOWER CARGO COMPARTMENT SMOKE DETECTION



**Lufthansa
Technical Training**

B747 - 400

054.01

26-16

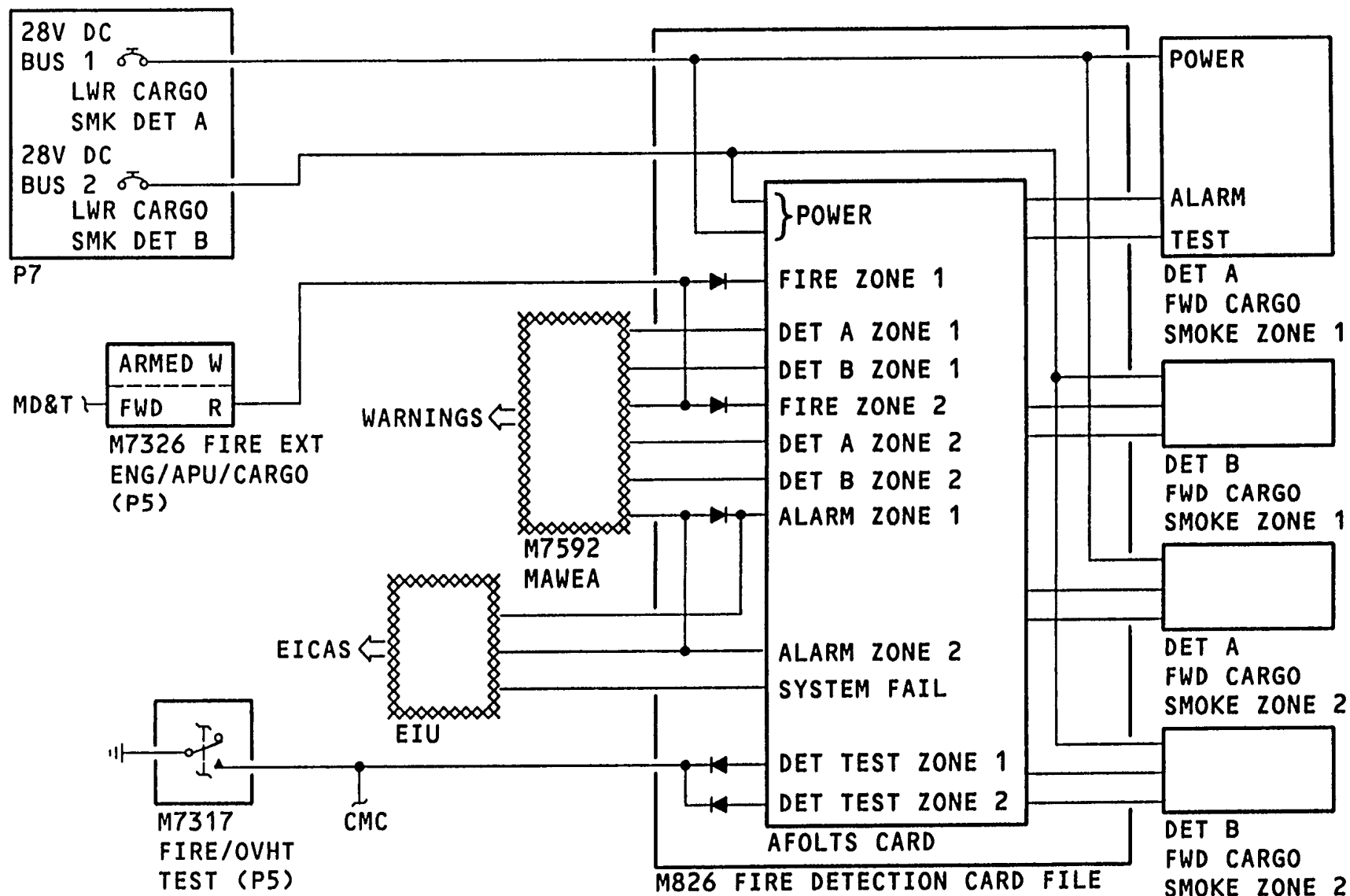


Figure 53 FWD CC SMOKE DETECTION CIRCUIT

LOWER CARGO COMPARTMENT SMOKE DETECTION



AFT & BULK CC SMOKE DETECTION CIRCUIT

Normal Operation

The smoke detection and test indication is processed by the automatic fire/overheat logic test systems (AFOLTS) card.

Normally, the card is configured in a two detector AND logic. A smoke signal from two detectors (A and B) activates the alarm outputs to the modular avionics warning electronic assembly (MAWEA), EICAS and the red AFT light in the M7326 ENG/APU/CARGO FIRE CONTROL on P5. The MAWEA enables operation of the fire warning bell and two master warning lights.

If two detectors (A and B) do not operate, the fault outputs from the card enable the EICAS display.

One Detector Operation

If one detector (A or B) does not operate, the AFOLTS card re-configures to single detector operation at the time of power-up/manual test. If smoke is detected, the card outputs an alarm signal to the MAWEA, EICAS and the red

AFT light. The MAWEA enables operation of the fire warning bell and two master warning lights and the EICAS displays the operating and failed detectors.

Power-Up Test

When electrical power is provided to the detection system during the initial airplane power-up operation, the AFOLTS card initiates a test sequence of the detectors.

Manual Test

The test switch in M7317 ENG/APU/CARGO FIRE/OVHT TEST on P5 initiates a test sequence of the AFOLTS card and detectors. The normal response is the same as during the smoke detection. Failure of a detector is indicated on the EICAS display. If one detector (A or B) is not operating (failed), the card will re-configure to the second detector at the time of power-up/manual test allowing the corresponding indication of failure to be displayed on EICAS.

LOWER CARGO COMPARTMENT SMOKE DETECTION



**Lufthansa
Technical Training**

B747 - 400

055.01

26-16

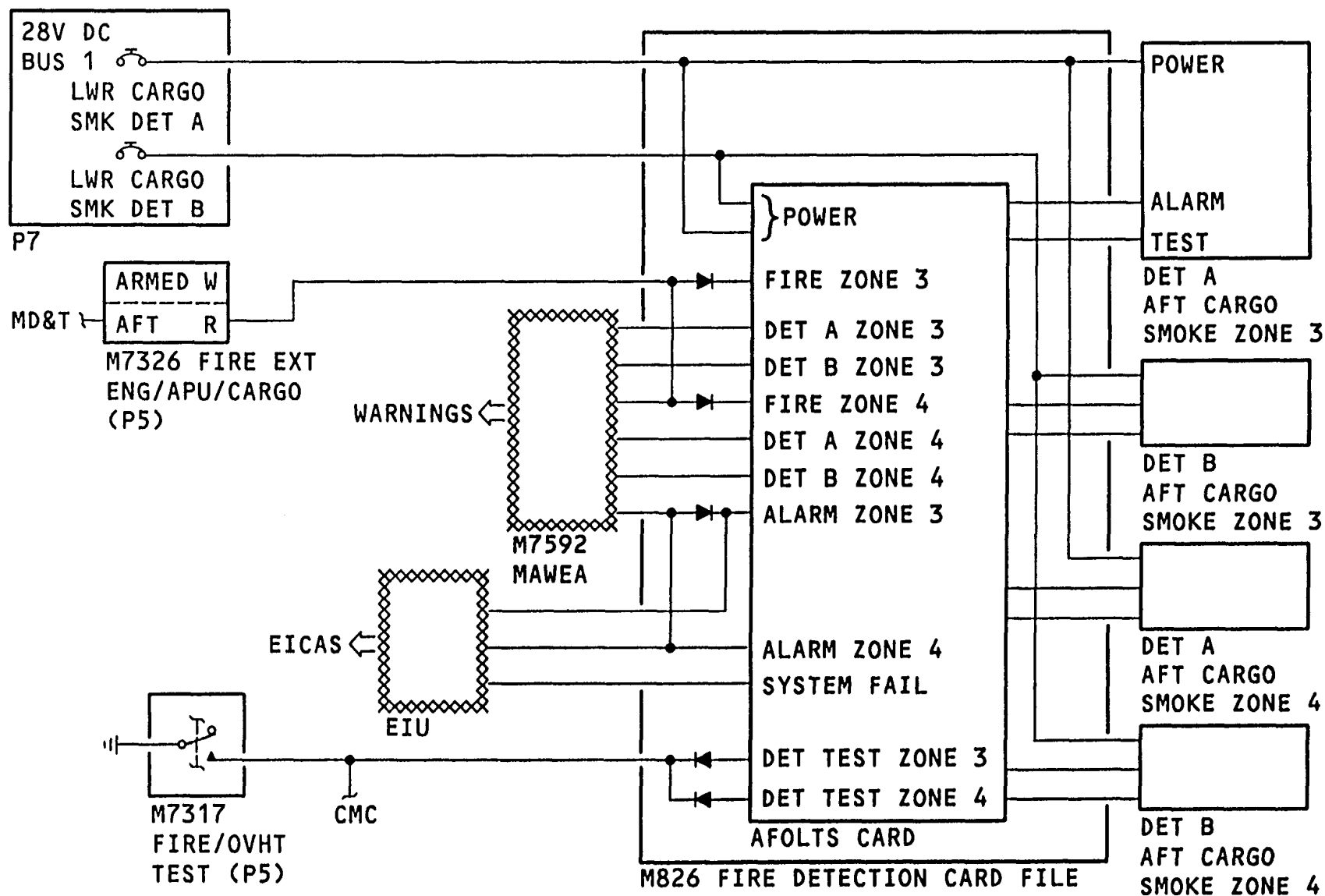


Figure 54 AFT & BULK CC SMOKE DETECTION CIRCUIT

**POWER-UP OPERATION INDICATION**

During the initial airplane power-up, the smoke detection system is automatically tested.

If a detector fails the test, the AFOLTS card automatically reconfigures to one detector operation. The indication of failure is on the EICAS display.

NOTE: THE DETECTORS ARE REFERRED TO AS A AND B IN ZONES 11 21 3 AND 4. THE EICAS DISPLAY REFERS TO THE DETECTORS AS LOOP A AND LOOP B IN ZONE 1 AND 2 IN THE FORWARD, AND 3 AND 4 IN THE AFT CARGO COMPARTMENT.



DETECTOR A	DETECTOR B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	NONE	DUAL DETECTOR
PASSED	FAILED	EICAS - FWD/AFT CARGO 1/4 LP B (S)	DETECTOR A
FAILED	PASSED	EICAS - FWD/AFT CARGO 1/4 LP A (S)	DETECTOR B
FAILED	FAILED	EICAS - CARGO DET FWD/AFT 1/4 (S)	SYSTEM FAIL

Figure 55 POWER-UP OPERATION INDICATION



MANUAL TEST INDICATION

The smoke detection system is tested by the test switch on P5.

Failure of a detector is indicated on the EICAS display. The AFOLTS card reconfigures to an operating detector.

NOTE: THE DETECTORS ARE REFERRED TO AS A AND B IN ZONES 1, 2, 3 AND 4. THE EICAS DISPLAY REFERS TO THE DETECTORS AS LOOP A AND LOOP B IN ZONE 1 AND 2 IN THE FORWARD, AND 3 AND 4 IN THE AFT CARGO COMPARTMENT.



DETECTOR A	DETECTOR B	INDICATION	AFOLTS CONFIGURATION
PASSED	PASSED	EICAS - TEST IN PROGRESS (A) MASTER WARNING, BELL, FWD OR AFT LIGHTS EICAS - TEST PASSED (A)	DUAL DETECTOR
PASSED	FAILED	MASTER WARNING, BELL, FWD OR AFT LIGHTS EICAS - TEST PASSED (A) - FWD/AFT CARGO 1/4 LP B (S)	DETECTOR A
FAILED	PASSED	MASTER WARNING, BELL, FWD OR AFT LIGHTS EICAS - TEST PASSED (A) - FWD/AFT CARGO 1/4 LP A (S)	DETECTOR B
FAILED	FAILED	EICAS - FIRE TEST FAIL (A) - FIRE CARGO FWD/AFT (A) - CARGO DET FWD/AFT 1/4 (S)	SYSTEM FAIL

Figure 56 MANUAL TEST INDICATION

LOWER CARGO COMPARTMENT SMOKE DETECTION



NORMAL OPERATION INDICATION

The two detectors in zones 1 and 2 in the forward and, 3 and 4 in the aft cargo compartments operate in an AND logic. During failure of one detector, the system reverts to OR logic using the non-failed detector at the time of powerup/manual test.

The indications of smoke detection or failure are displayed in the flight deck.

NOTE: THE DETECTORS ARE REFERRED TO AS A AND B IN ZONES 1, 2, 3 AND 4. THE EICAS DISPLAY REFERS TO THE DETECTORS AS LOOP A AND LOOP B IN ZONE 1 AND 2 IN THE FORWARD, AND 3 AND 4 IN THE AFT CARGO COMPARTMENT.



DETECTOR A	DETECTOR B	INDICATION
SMOKE	SMOKE	MASTER WARNING, BELL, FWD OR AFT LIGHT EICAS - FIRE CARGO FWD/AFT (A)
SMOKE	FAULT (OPEN)	EICAS - FWD/AFT CARGO 1/4 LP A (S)
FAULT (OPEN)	SMOKE	EICAS - FWD/AFT CARGO 1/4 LP B (S)
NO SMOKE	FAULT (GRD)	EICAS - FWD/AFT CARGO 1/4 LP B (S)
NO SMOKE	FAULT (OPEN)	NO MESSAGE
SMOKE	FAULT (GRD)	MASTER WARNING, BELL, FWD OR AFT LIGHT - FIRE CARGO FWD/AFT (A)

Figure 57 NORMAL OPERATION INDICATION

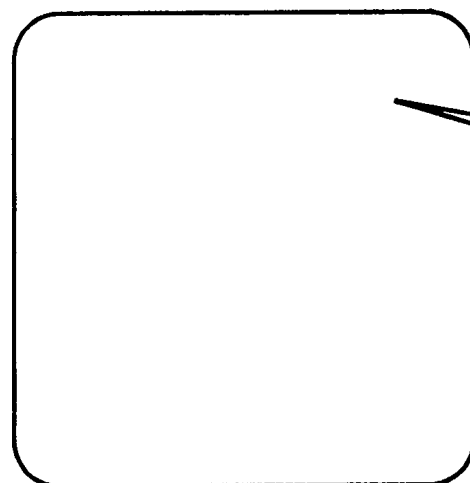
LOWER CARGO COMPARTMENT SMOKE DETECTION



EICAS MESSAGES

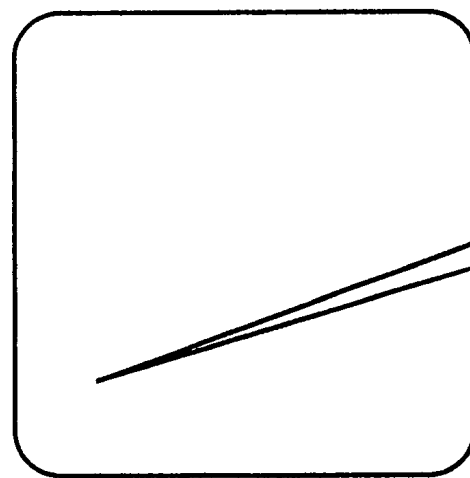
The cargo fire detection EICAS messages are shown on the main and auxiliary displays.

- TEST IN PROGRESS: warning message on main EICAS display. Fire/overheat system test in progress.
- TEST PASSED: warning message on main EICAS display. All fire/overheat test discretes true during test.
- FIRE TEST FAIL: warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- FIRE CARGO FWD: warning message on main EICAS display. Forward cargo compartment smoke detected.
- FIRE CARGO AFT: warning message on main EICAS display. Aft cargo compartment smoke detected.
- > CARGO, DET AIR: advisory message on main EICAS display. Insufficient vacuum for cargo smoke detection system (requires any two engines operating).
- FWD CARGO 1/2 LP A/B: status message on auxiliary EICAS display. Forward cargo compartment smoke detected or fault. (60 sec TD)
- AFT CARGO 3/4 LP A/B: status message on auxiliary EICAS display. Aft cargo compartment smoke detected or fault. (60 sec TD)
- CARGO DET AIR: status message on auxiliary EICAS display. Insufficient vacuum for cargo smoke detection system (requires any two engines operating). (60 sec TD)
- CARGO DET FWD/AFT 1/4: status message on auxiliary EICAS display. Loop A and B of cargo compartment failed. (60 sec TD)



MAIN DISPLAY

WARNING MESSAGES
TEST IN PROGRESS
TEST PASSED
FIRE TEST FAIL
FIRE CARGO FWD
FIRE CARGO AFT
ADVISORY MESSAGE
>CARGO DET AIR



AUXILIARY DISPLAY

STATUS MESSAGES
FWD CARGO 1 LP A
FWD CARGO 1 LP B
FWD CARGO 2 LP A
FWD CARGO 2 LP B
AFT CARGO 3 LP A
AFT CARGO 3 LP B
AFT CARGO 4 LP A
AFT CARGO 4 LP B
CARGO DET AIR
CARGO DET FWD 1
CARGO DET FWD 2
CARGO DET AFT 3
CARGO DET AFT 4

Figure 58 EICAS MESSAGES



SMOKE DETECTOR TUBE HEATING LOCATION**Location Cargo Compartment**

Some airplanes have heaters installed by the smoke detectors to alleviate moisture induced false alarms. In those airplanes there are four heaters and controllers , one per detection zone (Zone 1 and 2 FWD cargo, Zone 3 and 4 AFT cargo compartment).

The heaters and controllers are installed in-line with the smoke detection system tubes.

LOWER CARGO COMPARTMENT SMOKE DETECTION



**Lufthansa
Technical Training**

B747 - 400

060.01

26-16

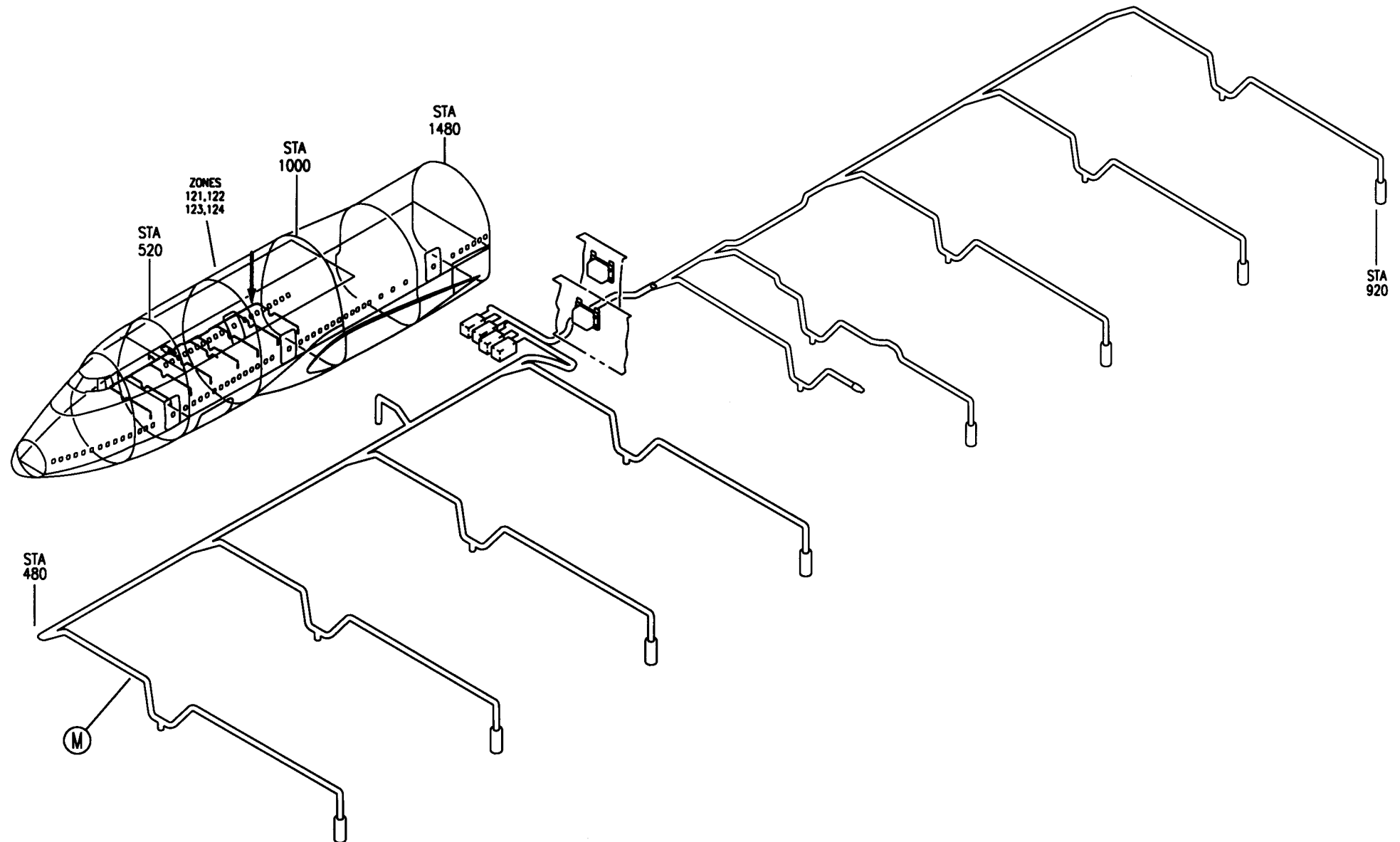


Figure 59 TUBE HEARING COMPONENT LOCATION FWD CC



SMOKE DETECTOR HEATER CONTROL UNITS**CONTROLLER LOCATION**

M5952	FWD CARGO, STA 680, WL 195, RBL 65
M5953	FWD CARGO, STA 700, WL 195, RBL 90
M5954	AFT CARGO, STA 1840, WL 195, RBL 95
M5955	AFT CARGO, STA 1900, WL 195, RBL 95

Heater Control Unit

The heater control unit gets 115 Vac power to control the heater.

The heater control unit regulates the heater to a temperature of 270° (132° C) F to 290° F (143° C). To control these temperature the heater control unit gets a temperature bulb input from the heater.

Heater

The heater is powered from the heater control unit with 115 Vac. In cases the heater control unit has a failure and the heater overheats, an overheat switch protects the heater.

In the heater is a temperature bulb installed for the heater control unit.

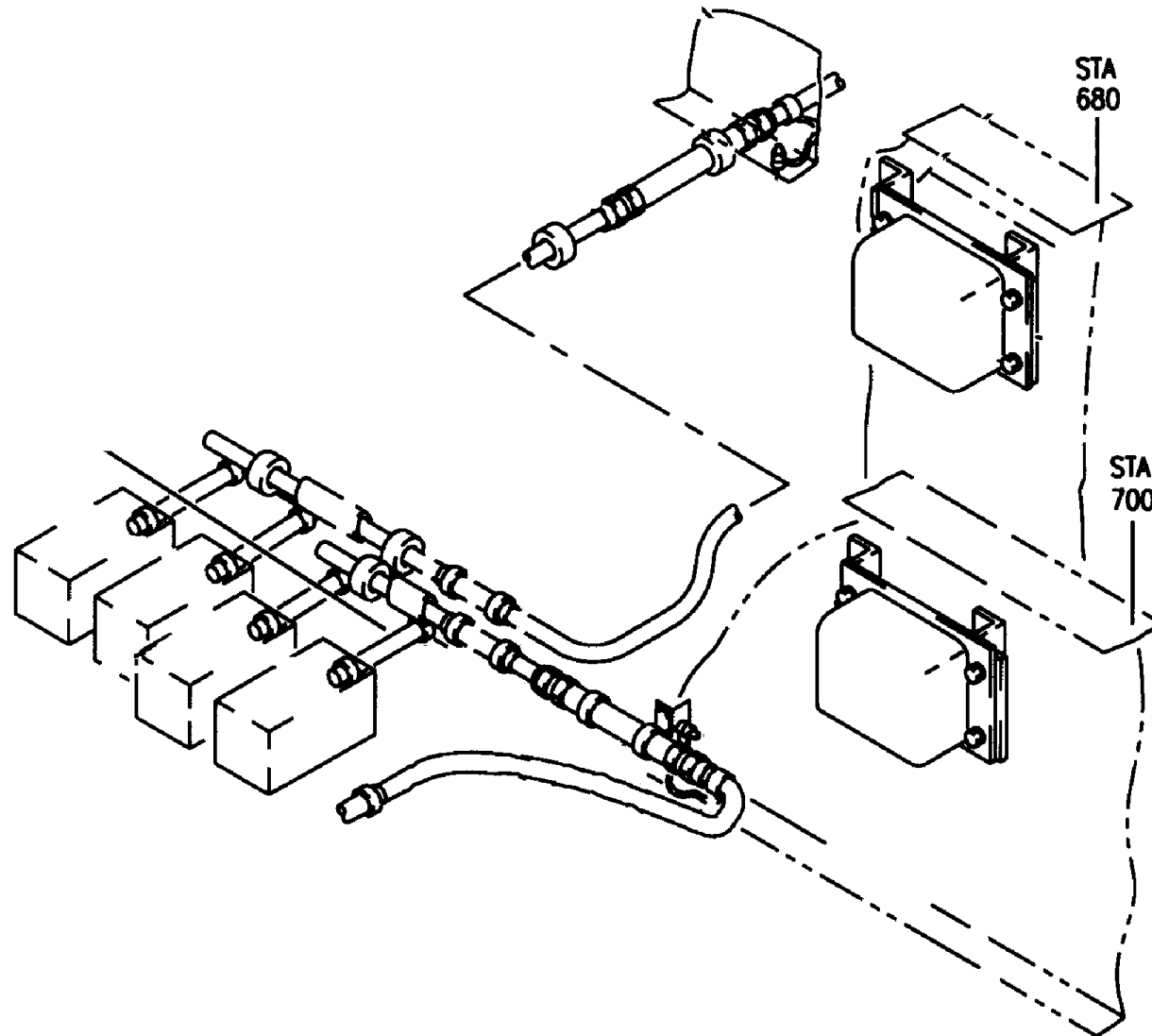


Figure 60 HEATER & CONTROL UNIT



SMOKE DETECTOR TUBE HEATING

Operation

The smoke detector heater control unit is powered with 115 Vac from AC Bus 2 if the relay R888723 is energized. The relay is energized when the air flow detector detects sufficient flow through the pneumatic system (the system must be pressurized with 15 to 50 psig).

Then the heater control unit regulates the output power between 0 percent and 100 percent equal to 0 Vac to 115 Vac.

The heater control unit regulates the heater temperature to a value of 270 F (132 C) to 290 F (143 C). Therefore the heater control unit gets a temperature voltage from the temperature bulb inside of the heater.

In case there is an overheat, the overheat switch in the heater. The overheat switch opens at 375 F (190 C).

CAUTION: HIGH TEMPERATURE DURING OPERATION

LOWER CARGO COMPARTMENT SMOKE DETECTION

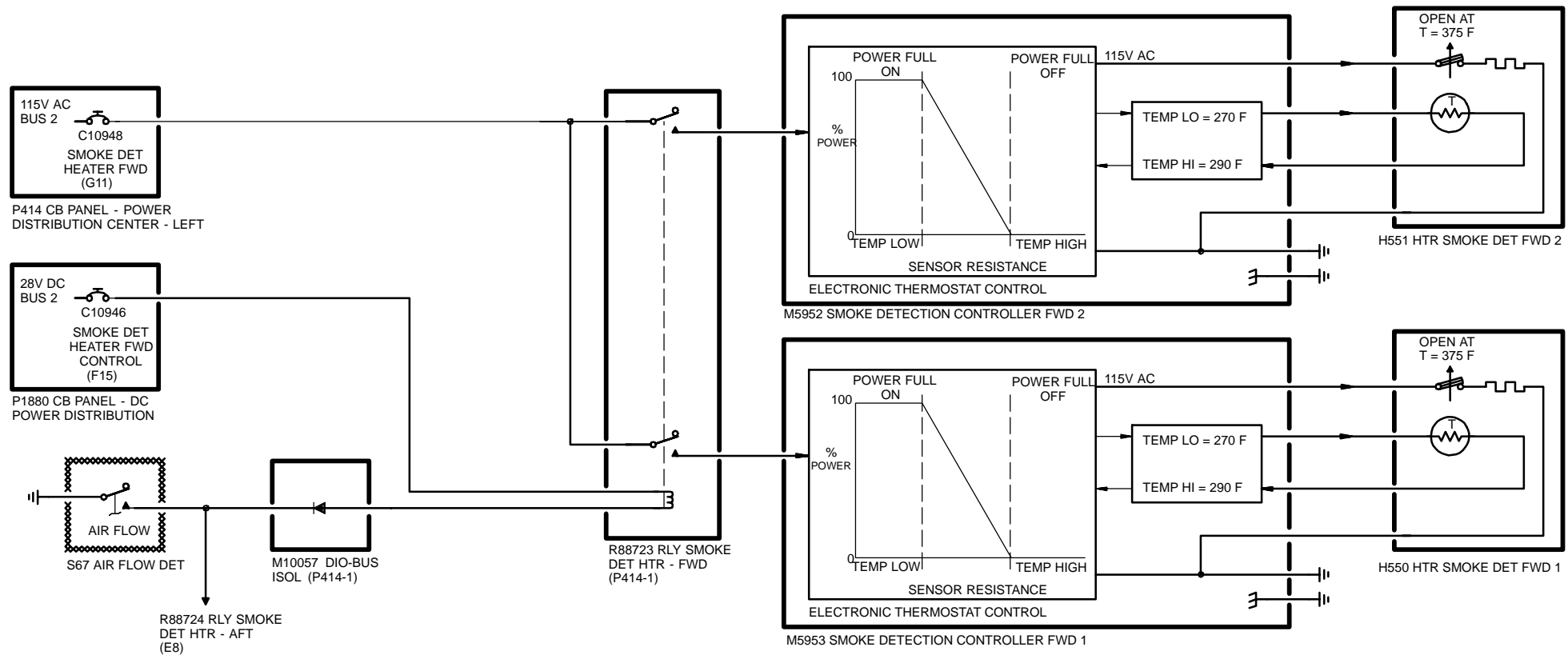


Figure 61 SMOKE DETECTOR TUBE HEATING SCHEMATIC



CARGO FIRE EXTINGUISHING

CARGO FIRE EXTINGUISHING

The cargo fire extinguishing system provides means for smothering a fire in the forward and aft cargo compartments.

The system consists of four fire extinguisher bottles. The bottles are located on the right aft side of the forward cargo compartment behind a cargo liner panel. A discharge manifold connects the bottles to the two cargo compartments. The controls and indications are located in the flight deck.

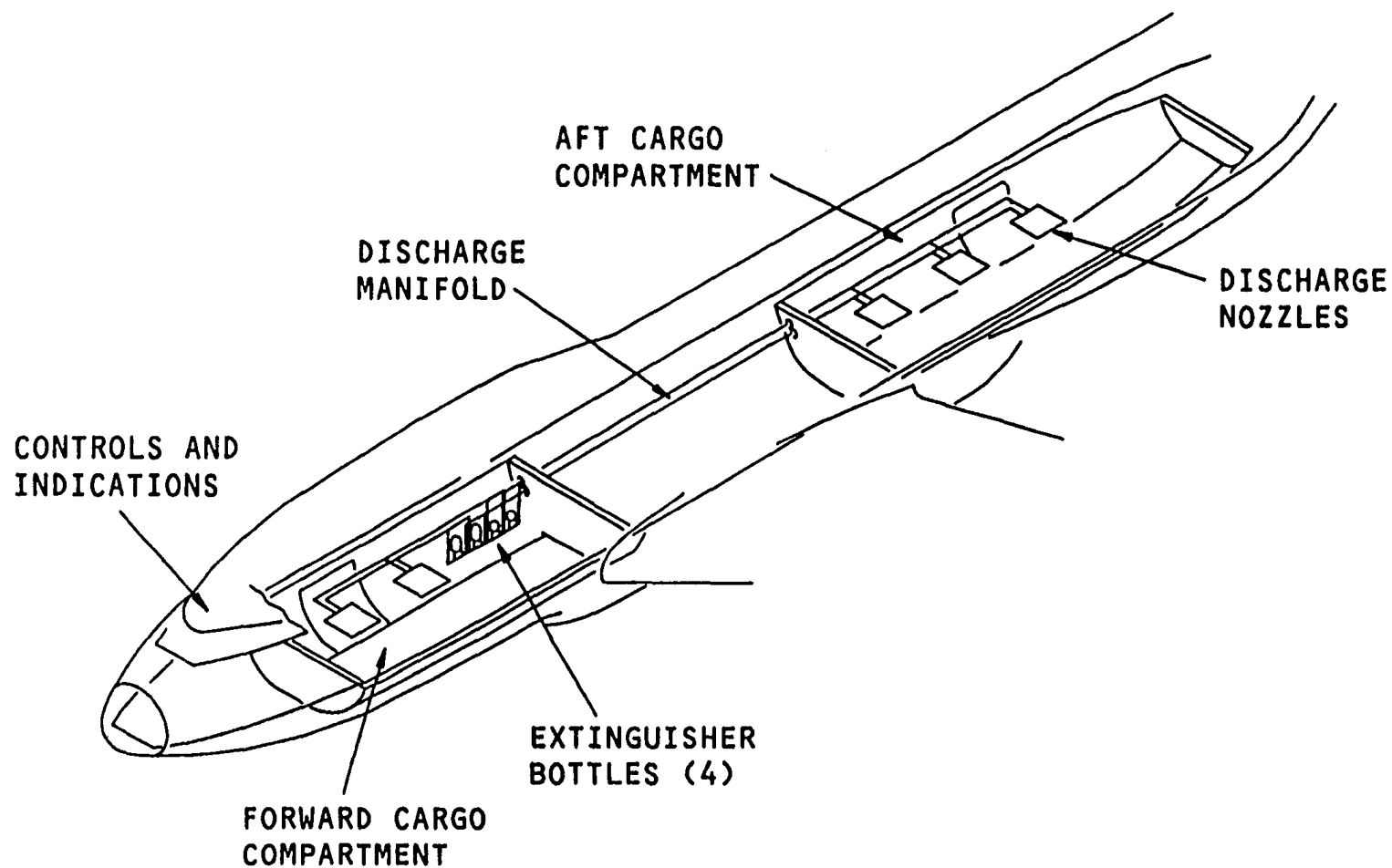


Figure 62 CARGO FIRE EXTINGUISHING



CARGO FIRE EXTINGUISHING SYSTEM

The cargo fire extinguishing system consists of four fire extinguisher bottles, A, B, C and D. Each bottle is equipped with two squibs, a pressure switch and a discharge port.

Discharge lines are connected from the bottles to the discharge nozzles in the forward and aft cargo compartments. Filter/driers and pressure regulators are installed in the discharge lines from bottles C and D. The discharge lines from bottles A and B are larger than the lines from bottle C and D. This ensures that agent from bottles A and B is discharged instantaneously, whereas agent from bottles C and D is discharged gradually after a time delay of 30 minutes.

A pressure switch is installed in the discharge line from bottles A and B to the forward cargo compartment.

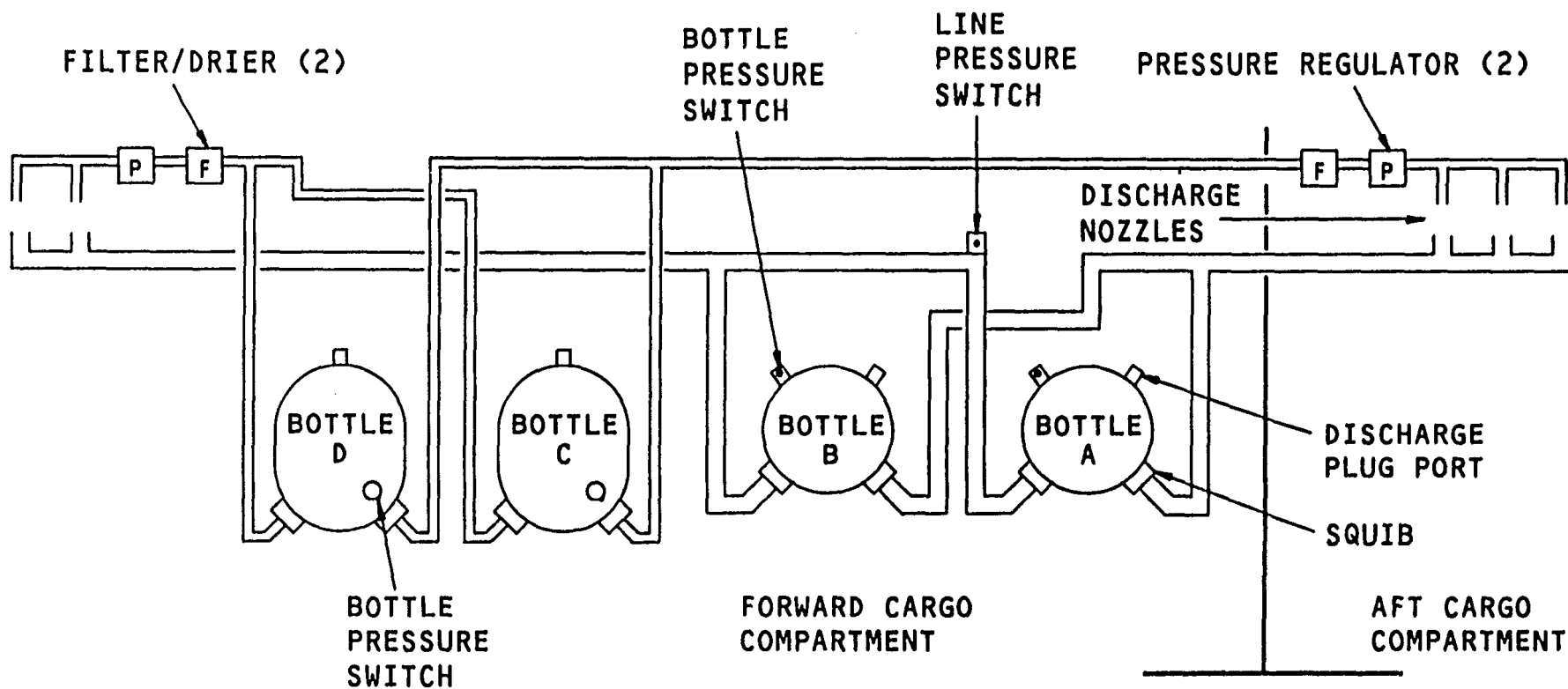


Figure 63 CARGO FIRE EXTINGUISHING SYSTEM

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

066.01

26-23

EXTINGUISHER BOTTLES

General

The cargo fire extinguishing system is of a gaseous smothering type. The four cargo fire extinguisher bottles, A, B, C and D are located in the forward cargo compartment. Each bottle is attached at three points to the support structure. Bottles A and B contain 55 pounds of halon each and bottles C and D contain 80 pounds of halon each. The bottles are pressurized by nitrogen to 360 psig at 70°F (21°C). Access to the bottles is from inside of the forward cargo compartment.

Located on each bottle are two squibs for discharging the bottles into either cargo compartment, a pressure switch for the bottle discharge indication and a discharge plug port. When the pressure in the bottle reaches 1200 to 1400 psig, the discharge plug diaphragm ruptures and the bottle contents discharges into the forward cargo compartment.

Maintenance Practices

A discharged fire extinguisher bottle must be replaced, it can not be serviced on the airplane.

Prior to a new bottle installation, the gross weight of the bottle has to be checked against the weight marked on the bottle. A weight deviation of more than 0.25 pound is cause for bottle rejection.

This prevents installation of an improperly serviced bottle.

WARNING: DO NOT HANDLE BOTTLE WITH DISCHARGE PORTS EXPOSED. KEEP PROTECTIVE CAPS OVER THE PORTS TO PREVENT DAMAGE TO THE DIAPHRAGMS. DO NOT PROBE DIAPHRAGMS. REMOVE PROTECTIVE CAPS ONLY DURING BOTTLE INSTALLATION. DAMAGE TO THE DIAPHRAGMS MAY CAUSE ACCIDENTAL BOTTLE DISCHARGE AND CAUSE INJURY TO PERSONNEL.

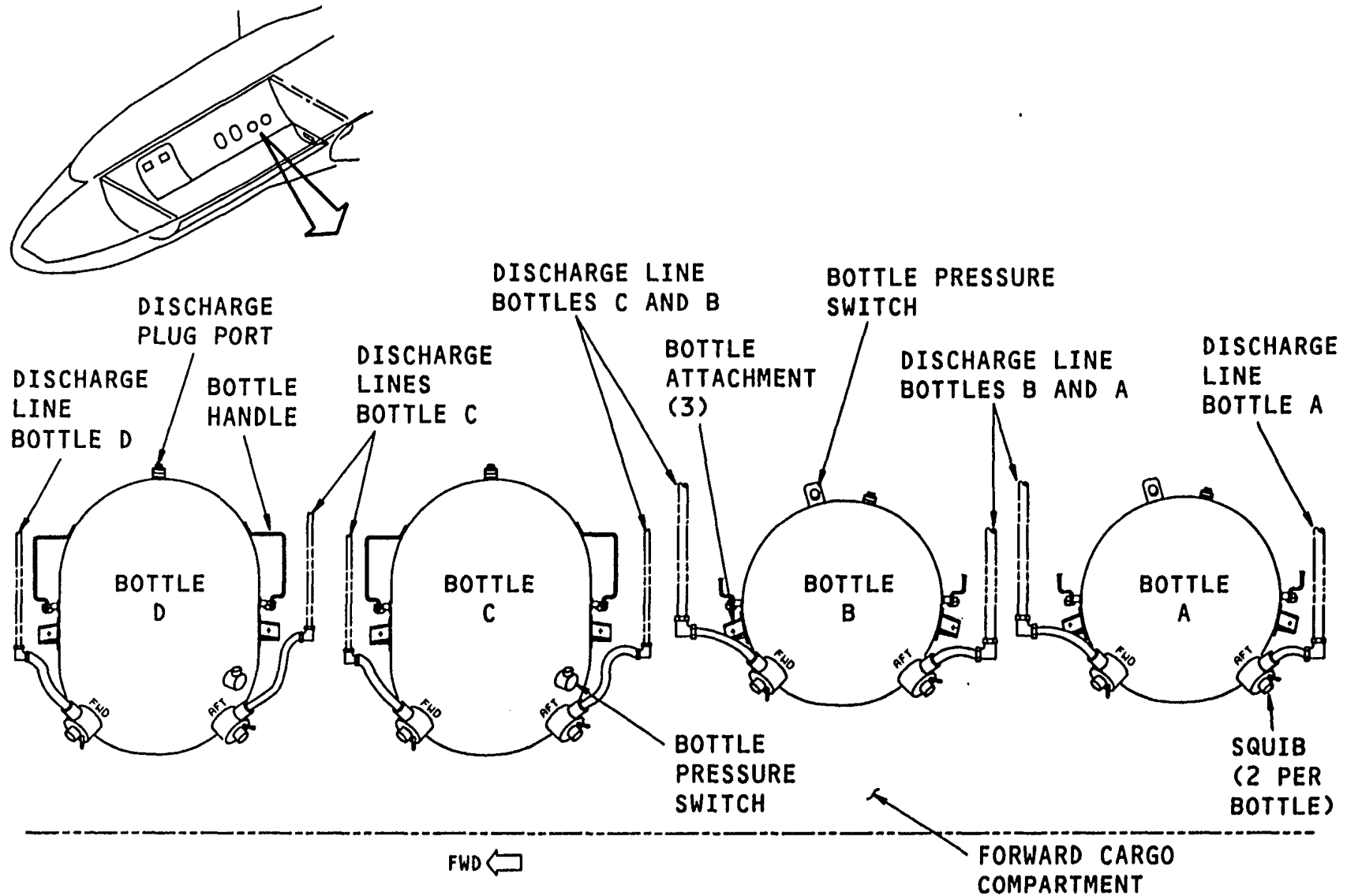


Figure 64 CARGO FIRE EXTINGUISHER BOTTLES



EXTINGUISHER BOTTLE COMPONENTS

Extinguisher Bottle Squib

The cargo fire extinguisher bottle squibs are located at the base of the bottle below the discharge swivel assemblies. The squibs are for discharging the fire bottle into the cargo compartments.

The squib consists of an electrically operated explosive device. When power is supplied to the squib, the explosive device detonates and ruptures a diaphragm in the swivel assembly allowing bottle contents to discharge.

The squibs are connected to the airplane's electrical connectors by different length squib pigtails. The connectors are of different size and are color coded.

- Fwd, yellow
- Aft, blue

This prevents cross connection of squib.

The squib can be removed and replaced without removal of the fire extinguisher bottle.

WARNING: DO NOT APPLY POWER IN ANY FORM (TEST LIGHT OR THE LIKE) TO THE BOTTLE DISCHARGE SQUIB RECEPTACLE. FOR TESTING OF SQUIB CONTINUITY, DO NOT USE OHM-METER CAPABLE OF SUPPLYING MORE THAN 80 MILLIAMPS OR THE SQUIB MAY BE DETONATED. INSTALL SHUNT ACROSS FACE OF BOTTLE SQUIB ELECTRICAL CONNECTOR PRIOR TO REMOVAL OR INSTALLATION OF THE BOTTLE. AN ACCIDENTALLY FIRED BOTTLE MAY CAUSE INJURY TO PERSONNEL.

Extinguisher Bottle Pressure Switch

The cargo fire extinguisher bottle pressure switch is located on each bottle. The switch is for indication of the bottle condition. When the bottle pressure decreases to 300 psig, the switch operates and provides circuit continuity for the indicating system.

The pigtail to the pressure switch is color coded red and is of different size to squib connectors.

The pressure switch operation and the indicating system can be checked on the ground. Pushing the test button on the pressure switch checks the indicating circuit continuity, which can be observed in the flight deck on M7326, ENGINE/APU/CARGO FIRE CONTROL on P5 and on the EICAS display.

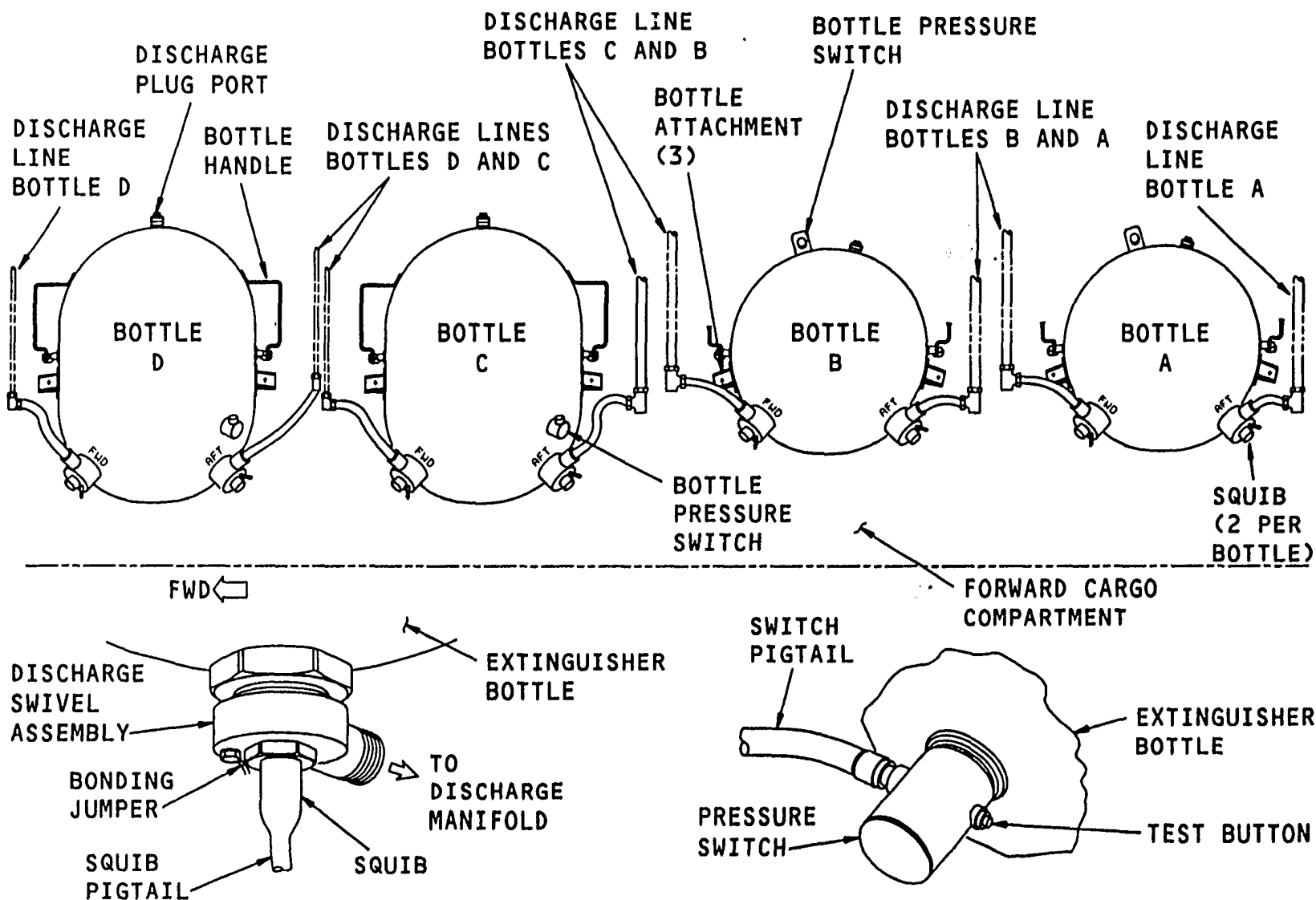


Figure 65 EXTINGUISHER BOTTLE COMPONENTS

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



DISCHARGE MANIFOLD COMPONENTS

Filter/Drier

one filter/drier is located above the ceiling panel of the forward cargo compartment forward of the extinguisher bottles. A second filter/drier is located above the ceiling panel of the aft cargo compartment forward of the main cargo door. During discharge, the filter/drier removes water from the extinguishing agent to prevent the discharge nozzles from freezing. The filter/drier must be replaced after discharge.

Pressure Regulator

One pressure regulator is located above the ceiling of the forward cargo compartment forward of the extinguisher bottles. A second pressure regulator is located above the ceiling panel of the aft cargo compartment forward of the main cargo door. During discharge, the regulator maintains a constant pressure of approximately 100 psig, allowing the bottles to be discharged gradually over a period of approximately two hours.

Discharge Nozzle

Four discharge nozzles are located in the ceiling of the forward cargo compartment and consist of two dump nozzles (from bottles A and B) and two jet nozzles (from bottles C and D). Six similar discharge nozzles are located in the ceiling of the aft cargo compartment. The nozzles are installed in pans and project downwards.

Line Pressure Switch

A pressure switch is installed in the discharge line from bottles A and B to the forward cargo compartment. During discharge, due to a short discharge line and nozzles, a small volume of agent fills the line and hence bottle pressure decreases slowly. The switch operates at 25 psig to provide discharge indication before bottle A and B pressure switches operate. The discharge line to the aft cargo compartment is long, hence a large volume of agent fills the line decreasing pressure in the bottles, causing the bottle switches to operate instantly.

The switch has a manual reset button to reset the switch after discharge of the bottles.

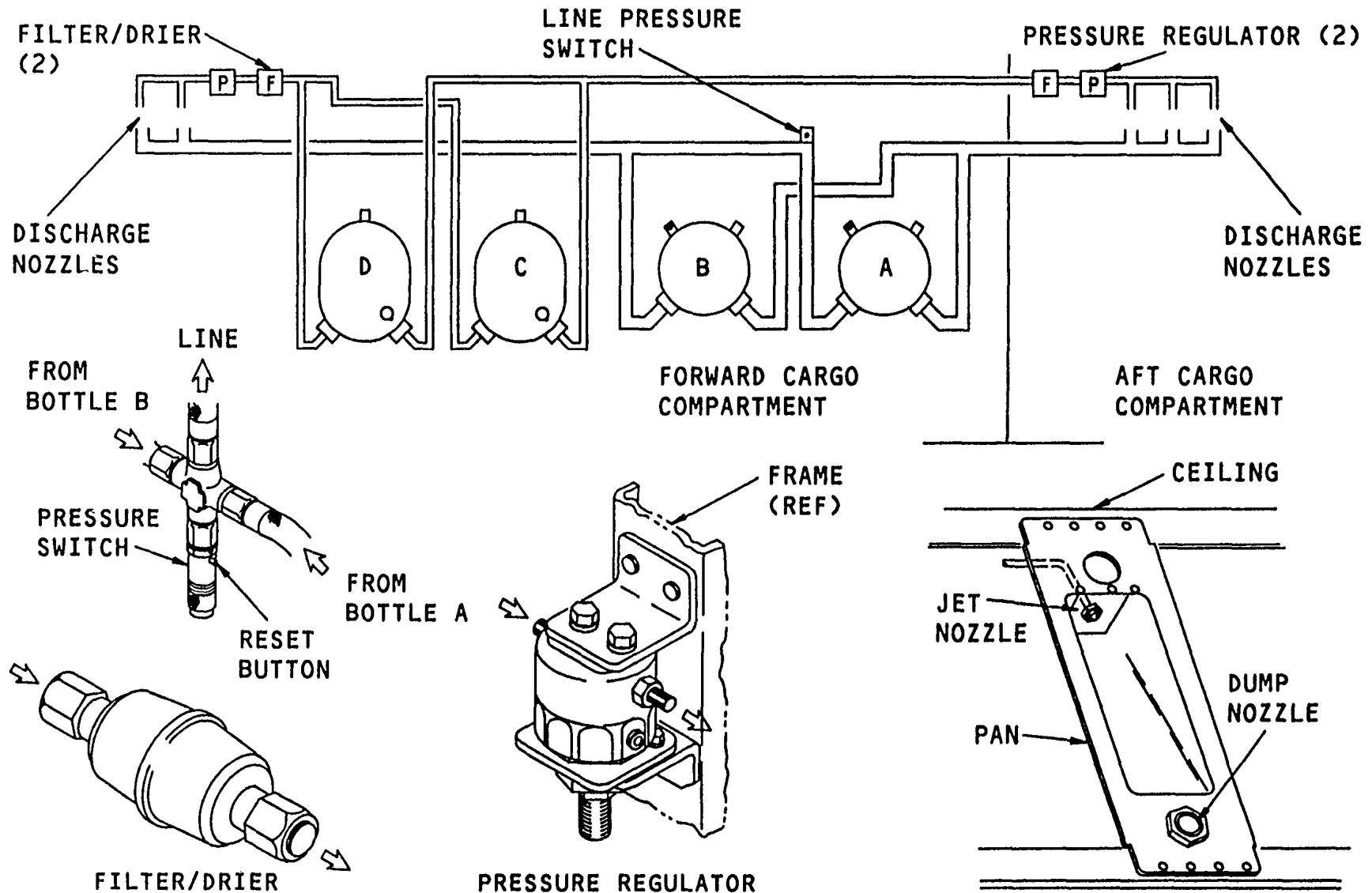


Figure 66 DISCHARGE MANIFOLD COMPONENTS

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

069.01

26-23

FWD CARGO BOTTLE DISCHARGE CIRCUIT

General

The cargo compartment fire extinguisher bottles are discharged by squibs located on the bottles. The power to the squibs is provided by a discharge switch in the flight deck. In flight, the fire extinguisher bottles A and B are discharged simultaneously and bottles C and D are discharged automatically after a time delay of 30 minutes. If the airplane lands prior to expiration of 30 minutes bottles C and D will be discharged upon touchdown. On the ground, bottles A, B, C and D are discharged simultaneously.

Operation

The discharge circuit is armed for the forward cargo compartment by pushing the ARMED/FWD switch light. The white ARMED light illuminates. The switch also shuts down various air conditioning components.

Momentarily pushing the DISCH switch, power is supplied to the extinguisher bottles A and B forward cargo compartment squibs. Power is also supplied through the ARMED/AFT switch light and relaxed relay R7453 to energize relay R7452. Upon release of the discharge switch, relay R7452 remains energized through its own contacts. Power is supplied, in flight, to relay R7454 which will energize after a time delay of 30 minutes. When relay R7454 energizes, power is supplied to the extinguisher bottles C and D forward cargo compartment squibs. On the ground, power is supplied to the extinguisher bottles C and D forward cargo compartment squibs through relay R988 bypassing the time delay circuit and relay R7454. Relay R7452 is reset by momentarily pulling FIRE EXT LOWER CARGO circuit breaker on P6.

NOTE: IF THE FWD AND AFT SWITCH LIGHTS ARE BOTH PUSHED AND THE DISCH SWITCH ACTUATED, BOTTLES A AND B WILL BE DISCHARGED TO BOTH CARGO COMPARTMENTS.

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

069.01

26-23

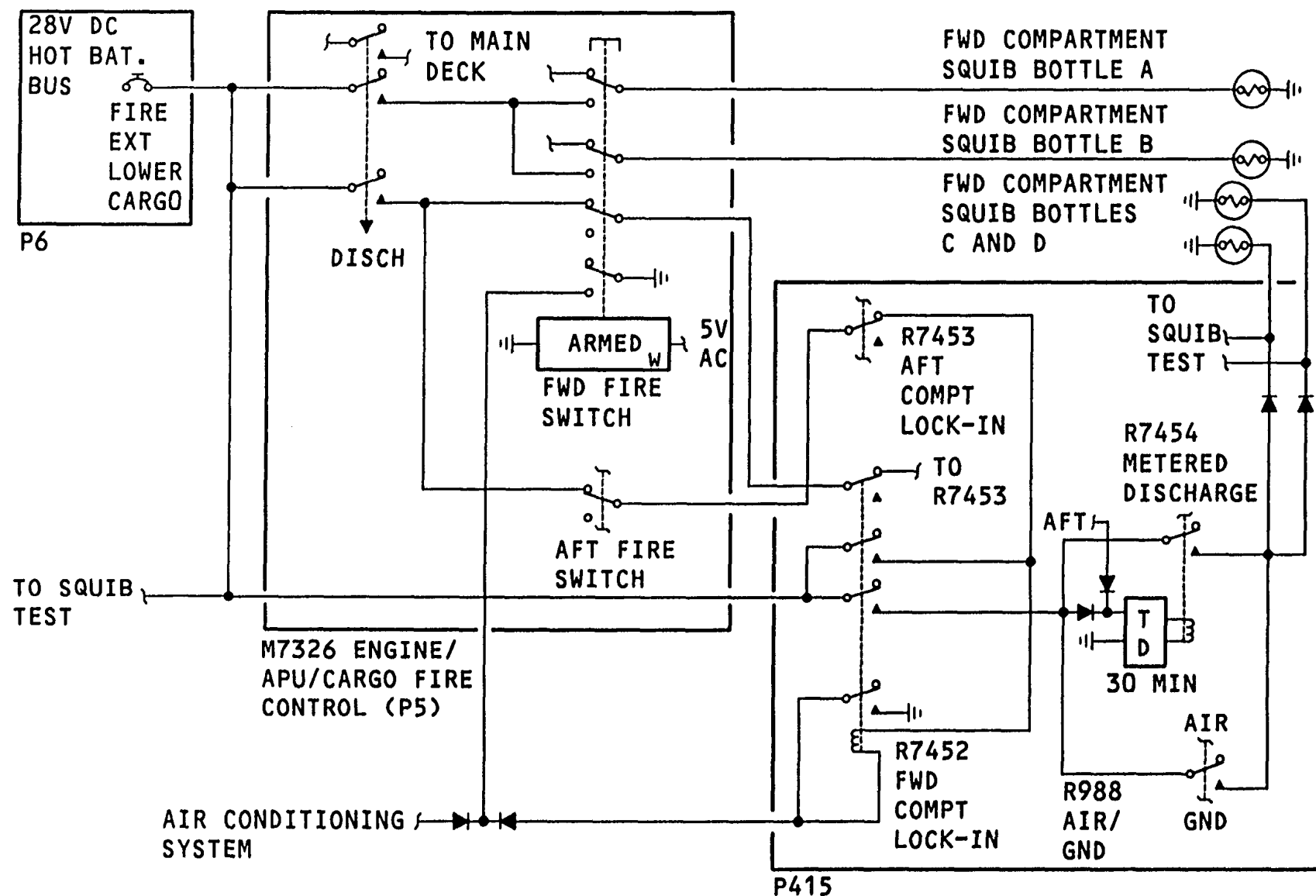


Figure 67 FWD CARGO BOTTLE DISCHARGE CIRCUIT

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



AFT CARGO BOTTLE DISCHARGE CIRCUIT

General

The cargo compartment fire extinguisher bottles are discharged by squibs located on the bottles. The power to the squibs is provided by a discharge switch in the flight deck. In flight, the fire extinguisher bottles A and B are discharged simultaneously and bottles C and D are discharged automatically after a time delay of 30 minutes. If the airplane lands prior to expiration of 30 minutes, bottles C and D will be discharged upon touchdown. On the ground, bottles A, B, C and D are discharged simultaneously.

Operation

The discharge circuit is armed for the aft cargo compartment by pushing the ARMED/AFT switch light. The white ARMED light illuminates. The switch also shuts down various air conditioning components.

Momentarily pushing the DISCH switch, power is supplied to the extinguisher bottles A and B forward compartment

squibs. Power is also supplied through the ARMED/FWD switch light and relaxed relay R7452 to energize relay R7453. Upon release of the discharge switch, relay R7453 remains energized through its own contacts. Power is supplied, in flight, to relay R7454 which will energize after a time delay of 30 minutes. When relay R7454 energizes, power is supplied to the extinguisher bottles C and D aft cargo compartment squibs.

on the ground, power is supplied to the extinguisher bottles C and D aft cargo compartment squibs through relay R988 bypassing the time delay circuit and relay R7454.

Relay R7453 is reset by momentarily pulling FIRE EXT LOWER CARGO circuit breaker on P6.

If the FWD and AFT switch lights are both pushed and the DISCH switch actuated, bottles A and B will be discharged to both cargo compartments.

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING

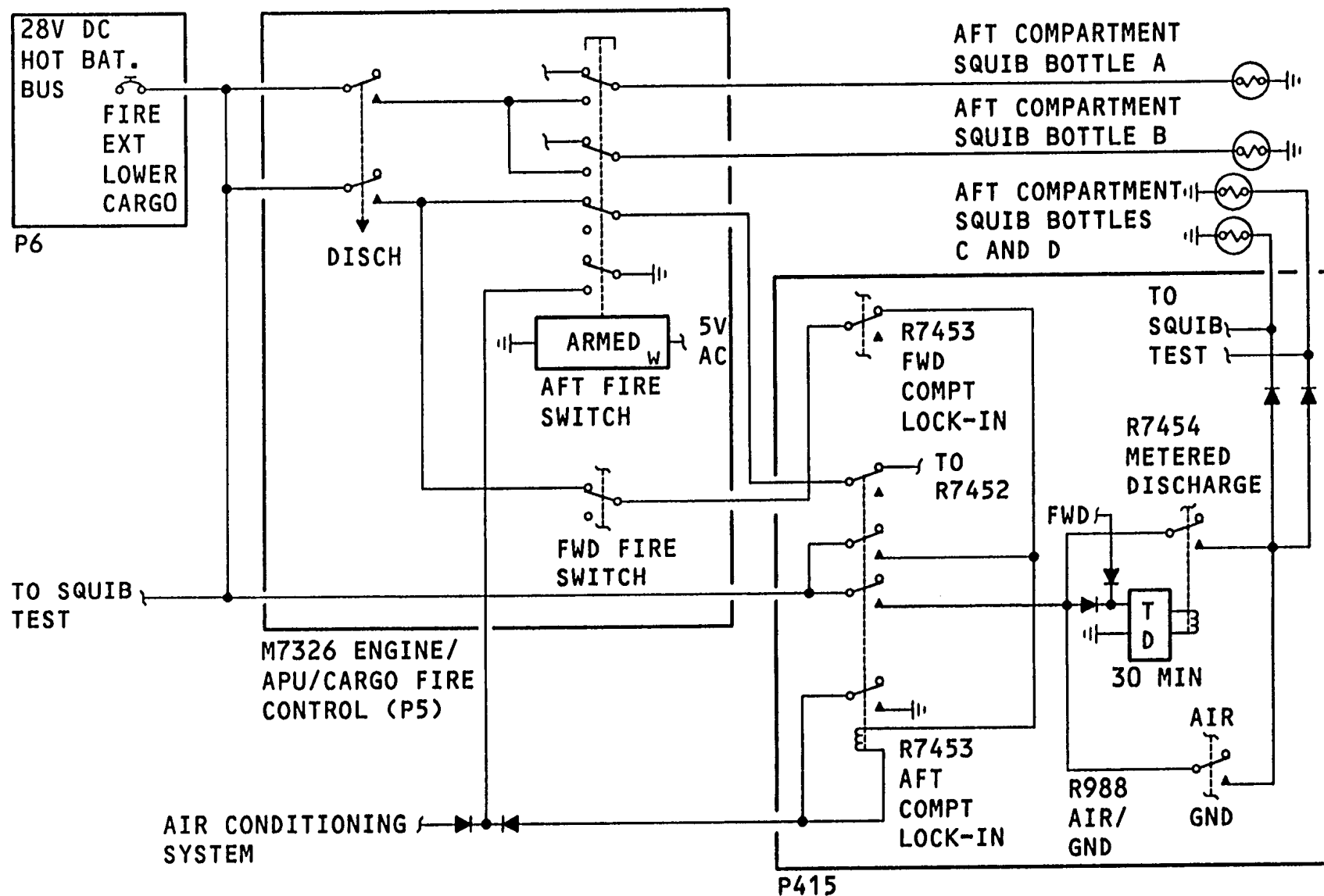
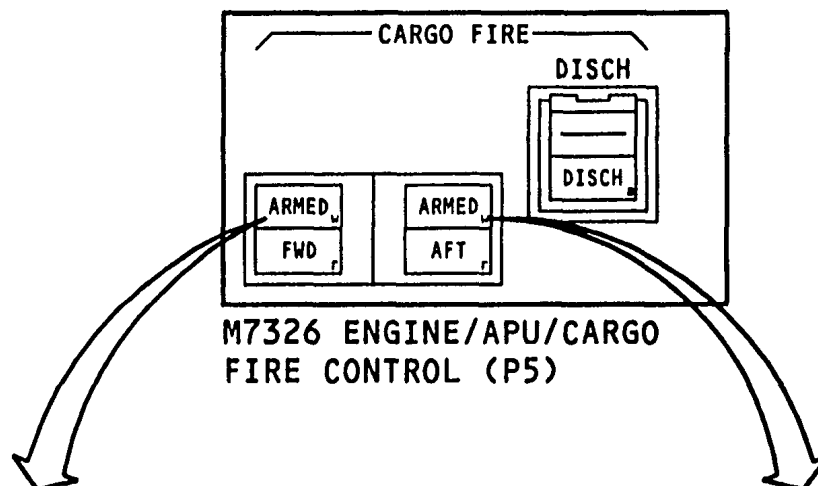


Figure 68 AFT CARGO BOTTLE DISCHARGE CIRCUIT



EXTINGUISHER ARMED SWITCH FUNCTIONS

When the ARMED/FWD or ARMED/AFT switch light is pushed, various components in the air conditioning system are shut down. This action minimizes the airflow from and to the affected cargo compartment.



EQUIPMENT COOLING SYSTEM
 AUTOMATIC TO OVERRIDE
 RECIRCULATION FANS OFF
 LAV/GALLEY FANS OFF
 PACK 3 SHUTDOWN
 FORWARD CARGO HEAT OFF
 FORWARD OVERBOARD VALVE CLOSE
 ARMS DISCHARGE SYSTEM
 OPTIONAL
 GASPER FAN OFF
 CREW REST FAN OFF
 GALLEY CHILLER AND FANS OFF
 CARGO COMPARTMENTS FANS OFF

EQUIPMENT COOLING SYSTEM
 AUTOMATIC TO OVERRIDE
 RECIRCULATION FANS OFF
 LAV/GALLEY FANS OFF
 PACK 3 SHUTDOWN
 FORWARD CARGO HEAT OFF
 AFT CARGO HEAT OFF
 ARMS DISCHARGE SYSTEM
 OPTIONAL
 GASPER FAN OFF
 CREW REST FAN OFF
 GALLEY CHILLER AND FANS OFF
 CARGO COMPARTMENTS FANS OFF

Figure 69 EXTINGUISHER ARMED SWITCH FUNCTIONS



BOTTLES DISCHARGE INDICATION CIRCUIT

During discharge of bottles A and B to the forward cargo compartment, the line pressure switch closes at 25 psig.

When the cargo fire extinguisher bottle A or B is discharged, the bottle pressure switches close at 300 psig. An amber DISCH light illuminates on the M7326, ENGINE/APU/CARGO FIRE CONTROL module.

When the cargo fire extinguisher bottle C or D is discharged, the bottle pressure switches close at 300 psig.

This information is also sent to the EICAS display units through the EFIS/EICAS interface units.

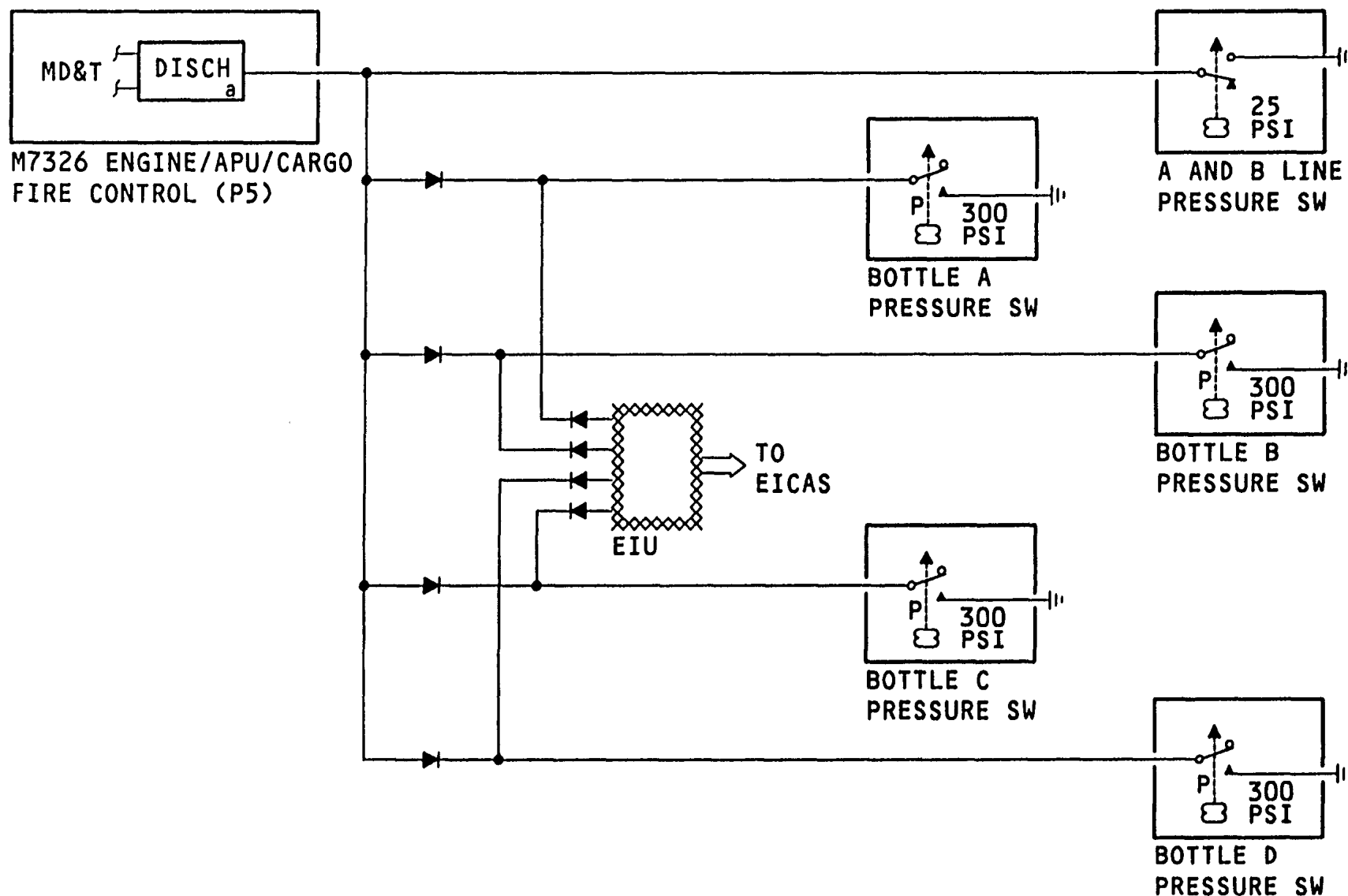
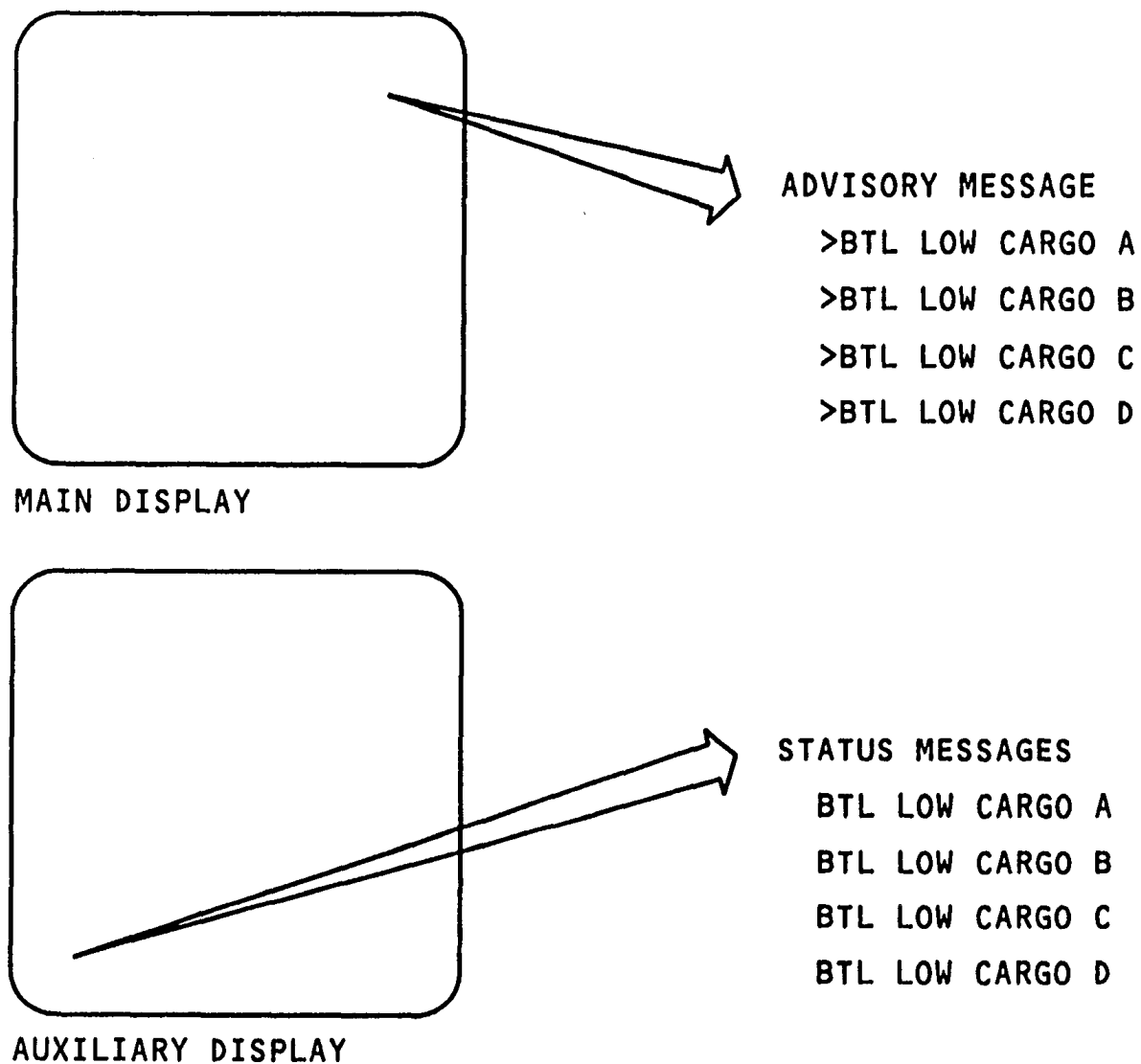


Figure 70 BOTTLES DISCHARGE INDICATION CIRCUIT

**EICAS MESSAGES**

The cargo fire extinguisher bottles EICAS messages are shown on the main and auxiliary displays.

- >BTL LOW CARGO A: advisory message on main EICAS display. Cargo fire extinguisher bottle A low pressure.
- >BTL LOW CARGO B: advisory message on main EICAS display. Cargo fire extinguisher bottle B low pressure.
- >BTL LOW CARGO C: advisory message on main EICAS display. Cargo fire extinguisher bottle C low pressure.
- >BTL LOW CARGO D: advisory message on main EICAS display. Cargo fire extinguisher bottle D low pressure.
- BTL LOW CARGO A: status message on auxiliary EICAS display. Cargo fire extinguisher bottle A low pressure.
- BTL LOW CARGO B: status message on auxiliary EICAS display. Cargo fire extinguisher bottle B low pressure.
- BTL LOW CARGO C: status message on auxiliary EICAS display. Cargo fire extinguisher bottle C low pressure.
- BTL LOW CARGO D: status message on auxiliary EICAS display. Cargo fire extinguisher bottle D low pressure.

**Figure 71 EICAS MESSAGES**

LOWER CARGO COMPARTMENT FIRE EXTINGUISHING



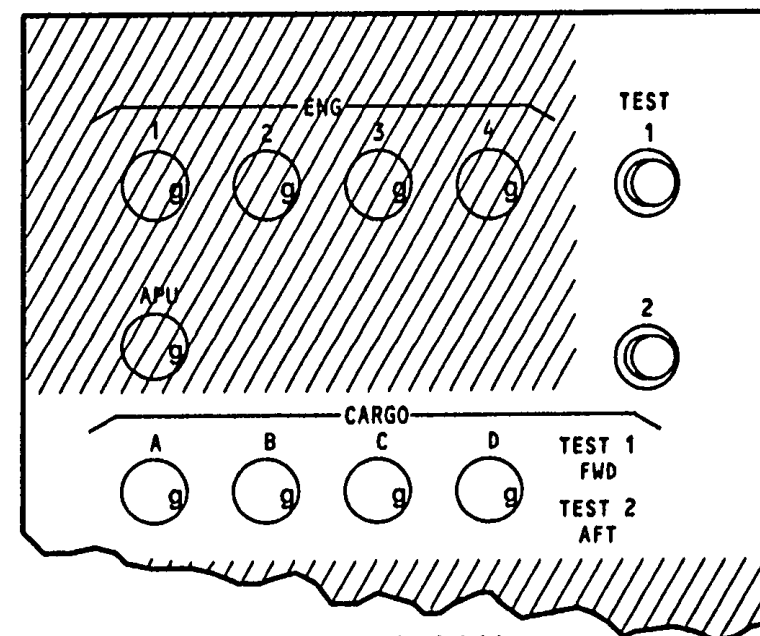
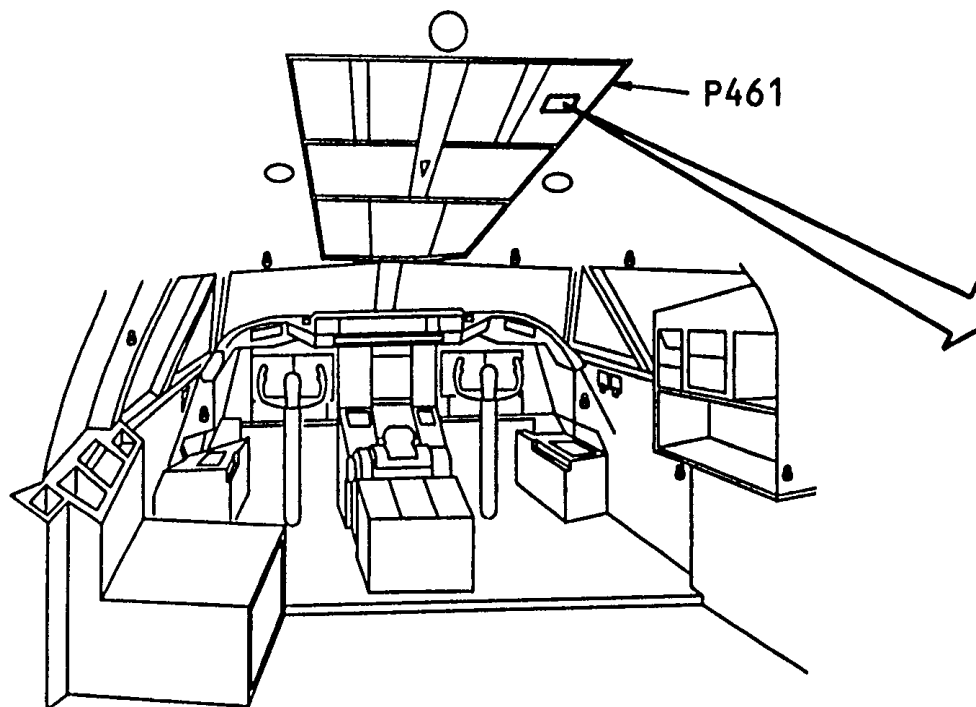
BOTTLES SQUIB TEST CONTROLS

The cargo fire extinguisher bottles squib test controls are located in M7327, SQUIB TEST on P461.

The controls consist of two push-button switches, 1 and 2, and four green indicating lights.

The test is performed by pushing and holding switch 1 followed by switch 2. If the green lights illuminate, the circuit through the eight squibs is verified.

NOTE: WHEN REPLACING BULBS IN THE GREEN INDICATING LIGHTS, ENSURE THAT A CORRECT BULB IS USED WHICH PROVIDES THE NECESSARY CIRCUIT RESISTANCE. IF AN INCORRECT BULB IS USED, THE SQUIB WILL BE DISCHARGED DURING TEST.



M7327 SQUIB TEST (P461)

Figure 72 BOTTLES SQUIB TEST CONTROLS

**BOTTLE SQUIB TEST CIRCUIT**

The cargo fire extinguisher bottle squibs are tested by test switch 1 and 2.

Pushing and holding test switch 1, connects the green indicating light to ground through the forward compartment squib of extinguisher bottle. Test switch 2 connects the light to ground through the aft compartment squib of the extinguisher bottle. When the light illuminates, the circuit through the squib is verified.

NOTE: THE SQUIB TEST IS INHIBITED FOR BOTTLES A AND B, WHEN THE CARGO FIRE SWITCH LIGHT (FWD OR AFT) IS IN THE ARMED POSITION.

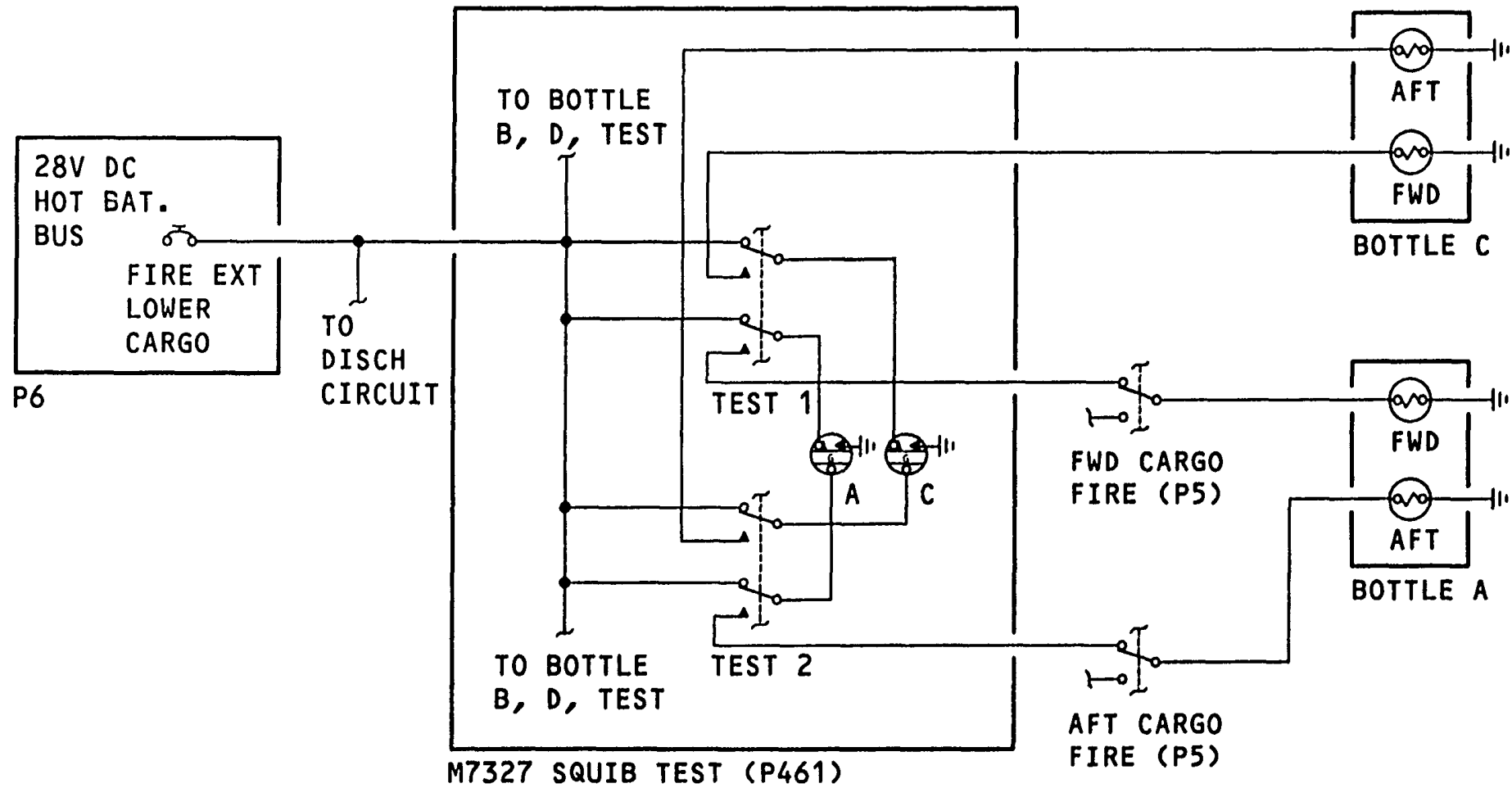


Figure 73 BOTTLE SQUIB TEST CIRCUIT

WHEEL WELL FIRE DETECTION



WHEEL WELL FIRE DETECTION

WHEEL WELL FIRE DETECTION

The wheel well fire detection system provides means for detecting an overheat condition in the left and right wing and body wheel wells.

The system consists of detectors in a continuous loop located in the wheel wells. The indications are located in the flight deck.

WHEEL WELL FIRE DETECTION

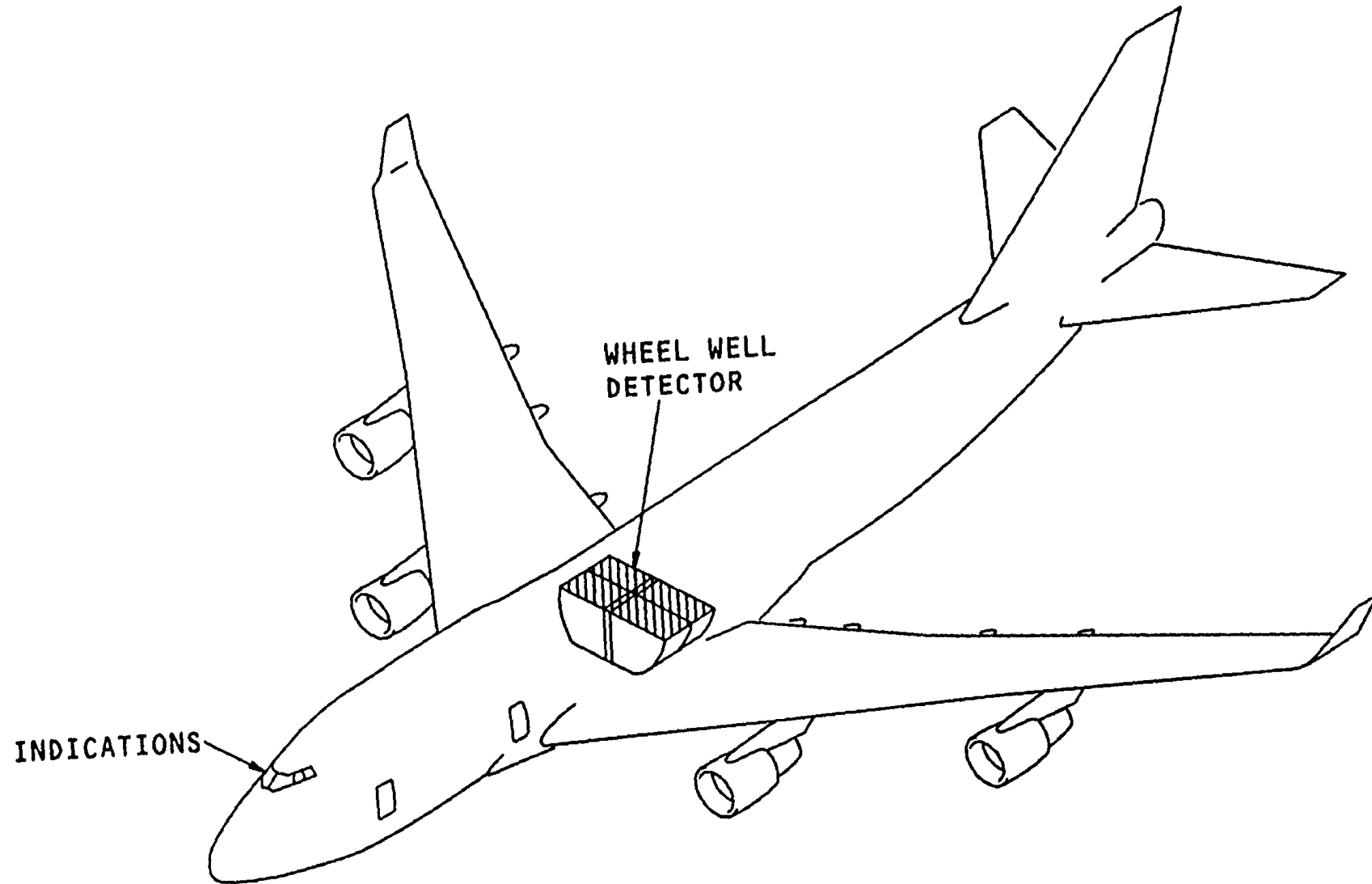


Figure 74 WHEEL WELL FIRE DETECTION

WHEEL WELL FIRE DETECTION



WHEEL WELL FIRE DETECTOR

General

The continuous detector loop circuit consists of eight detectors, two in each wheel well, mounted to the upper firewall by clamps. The detector is an inconel tube filled with saltimpregnated ceramic core and a nickel wire. A power supply is connected to the nickel wire and the inconel tube is grounded. At low temperature, the resistance of the core is high preventing current flow to ground. When the temperature increases to 400°F (204°C), the resistance decreases allowing current flow to ground which actuates the wheel well fire indication.

Maintenance Practices

A section of the detector is removed by disconnecting the electrical connectors at each end and releasing it from supporting clamps.

CAUTION: DO NOT TWIST, PULL OR CLAMP DETECTOR UNDER TENSION DO NOT STRAIGHTEN ACCEPTABLE KINKS, BENDS OR DENTS AS FATIGUE FAILURE WILL RESULT.

WHEEL WELL FIRE DETECTION

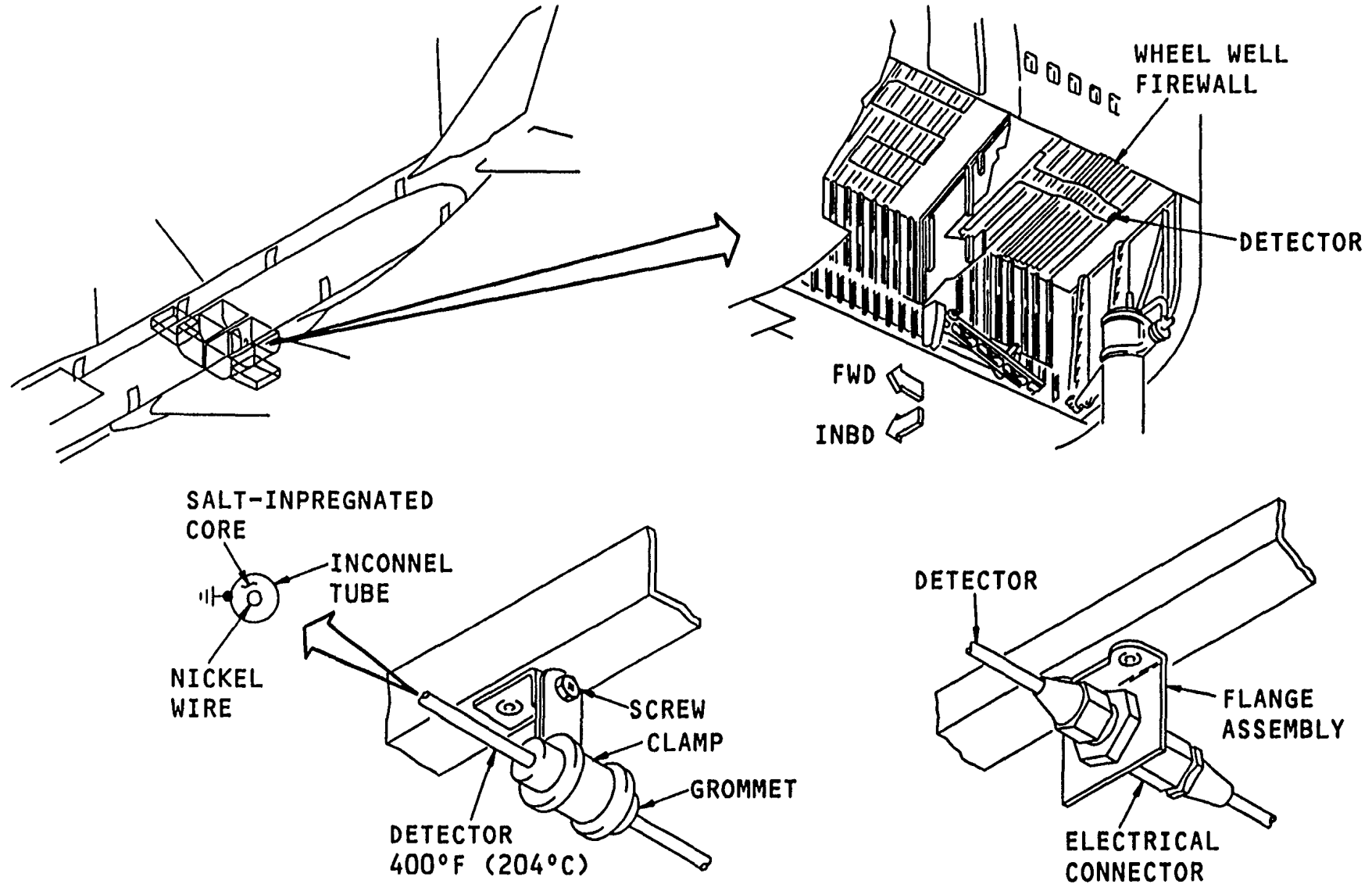


Figure 75 WHEEL WELL FIRE DETECTOR

WHEEL WELL FIRE DETECTION



DETECTION CIRCUIT

General

The wheel well fire detection circuit transformer is supplied with 115 volt ac power. Output from the transformer is supplied to the sensing circuit and the eight wheel well detectors which are connected in series forming a continuous loop .

Fire Detection

When any of the eight detectors are subjected to a temperature of 400°F (204°C), a ground is sensed by the sensing circuit. output from the sensing circuit closes the solid state switch and relay K1 energizes enabling MAWEA and EICAS. The MAWEA enables fire bell and two master warning lights. When the temperature decreases, the sensing circuit is reset.

Test

The sensing element circuit continuity test is by pushing the FIRE/OVHT test switch on M7317 on P5. Relay R8048 energizes and connects the detector

loop to ground simulating a fire condition. If the loop has continuity and the sensing circuit operates correctly, the indications are the same as during the fire detection.

WHEEL WELL FIRE DETECTION

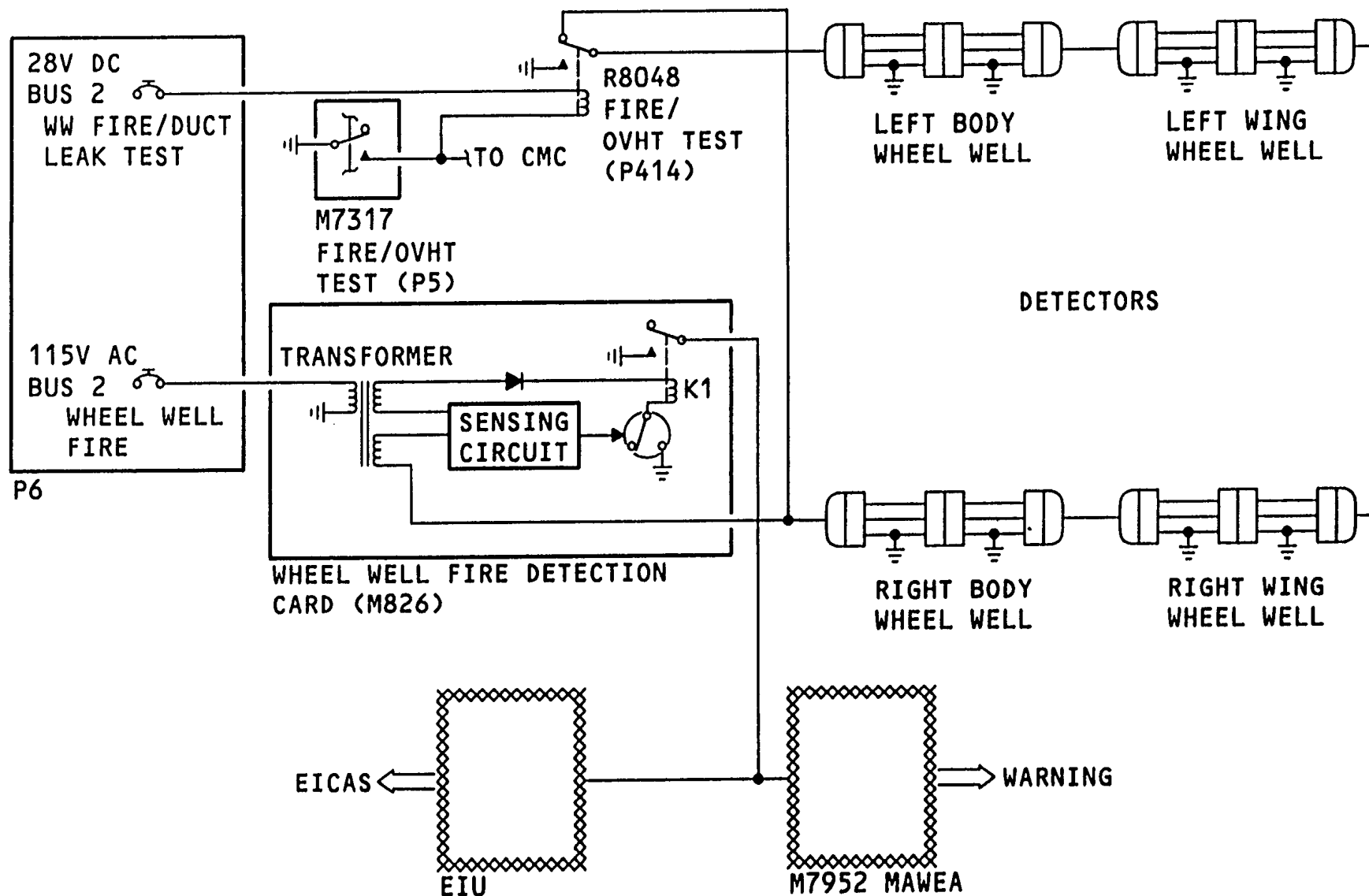


Figure 76 WHEEL WELL FIRE DETECTION CIRCUIT

WHEEL WELL FIRE DETECTION



EICAS MESSAGES

The wheel well fire EICAS messages are shown on the main display.

- TEST IN PROGRESS:
warning message on main EICAS display. Fire/overheat system test in progress.
- TEST PASSED:
warning message on main EICAS display. All fire/overheat test discretes true during test.
- FIRE TEST FAIL:
warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- FIRE WHEEL WELL:
warning message on main EICAS display. Wheel well fire detected.

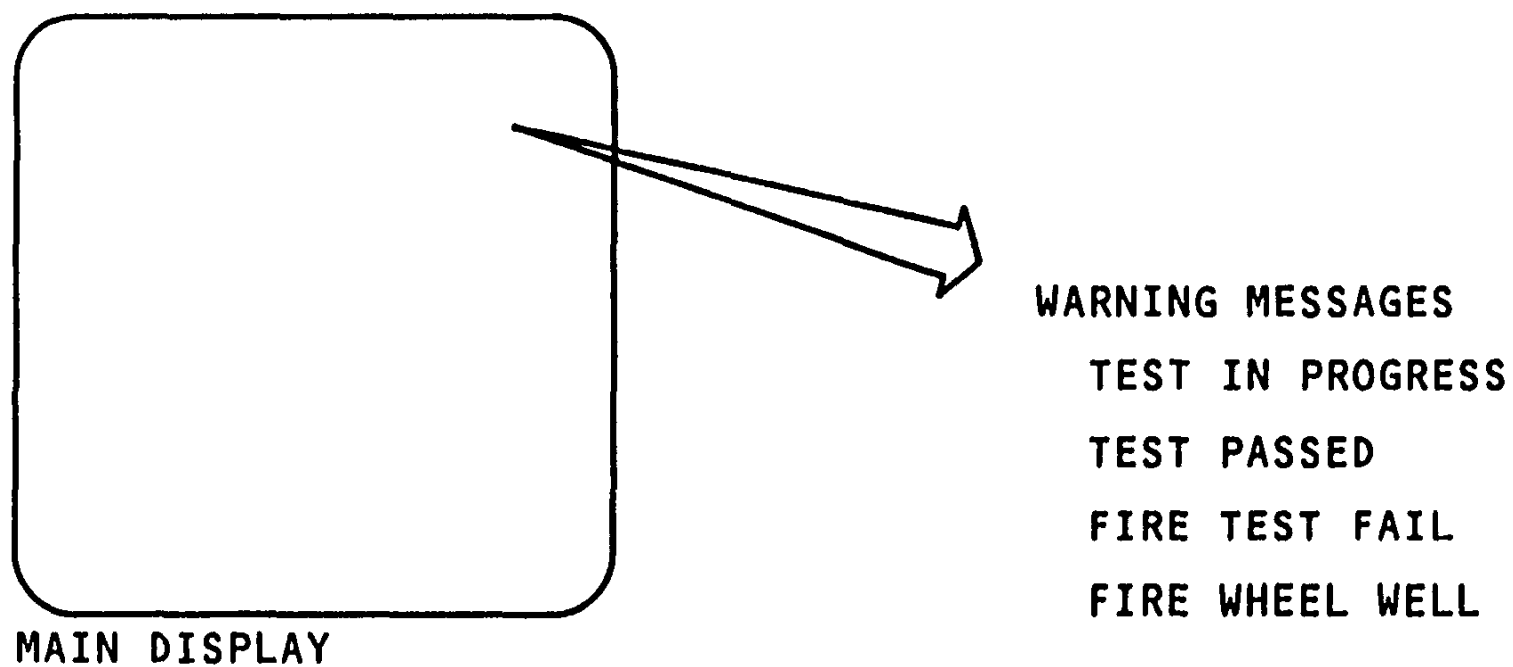


Figure 77 EICAS MESSAGES

WING LEADING EDGE OVHT



WINGLEADING EDGE OVHT

WING LEADING EDGE OVERHEAT DETECTION

The wing leading edge overheat detection system provides overheat protection for the wing leading edge upper skin fiberglass panels and the nacelle struts.

The left, right and the center duct overheat detection provide overheat protection for the air conditioning bay area components.

The system consists of thermal switches located in the wing leading edges, nacelle struts and the center duct areas in the air conditioning bay. The indications are located in the flight deck.

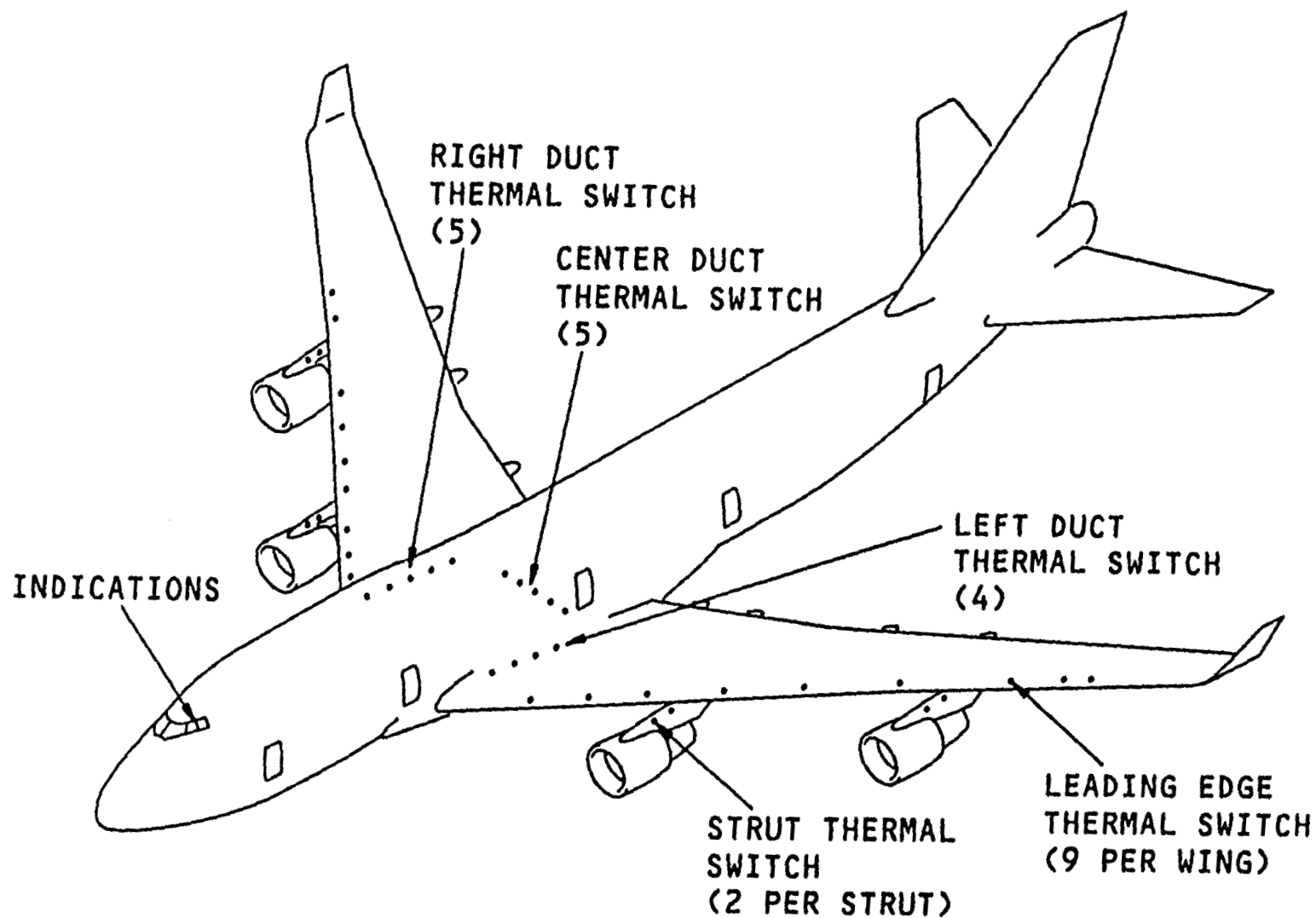


Figure 78 WING LEADING EDGE OVERHEAT DETECTION

WING LEADING EDGE OVHT



OVERHEAT SWITCH LOCATION

Nine thermal switches are located in each wing leading edge, two thermal switches are located in each strut and fifteen thermal switches are located in the air conditioning bays.

Access to the thermal switches in the wing leading edge is by extending the wing leading edge flaps. Access to the thermal switches in the nacelle struts is through access panels on the left side of each strut. Access to the thermal switches in the air conditioning bays is by opening the bay doors.

The thermal switches are connected through Burndy blocks located at wing leading edge station (WLE STA) 631 and fuselage station (STA) 980 outboard of the water tanks. The Burndy blocks are used for isolation of the faulty switch.

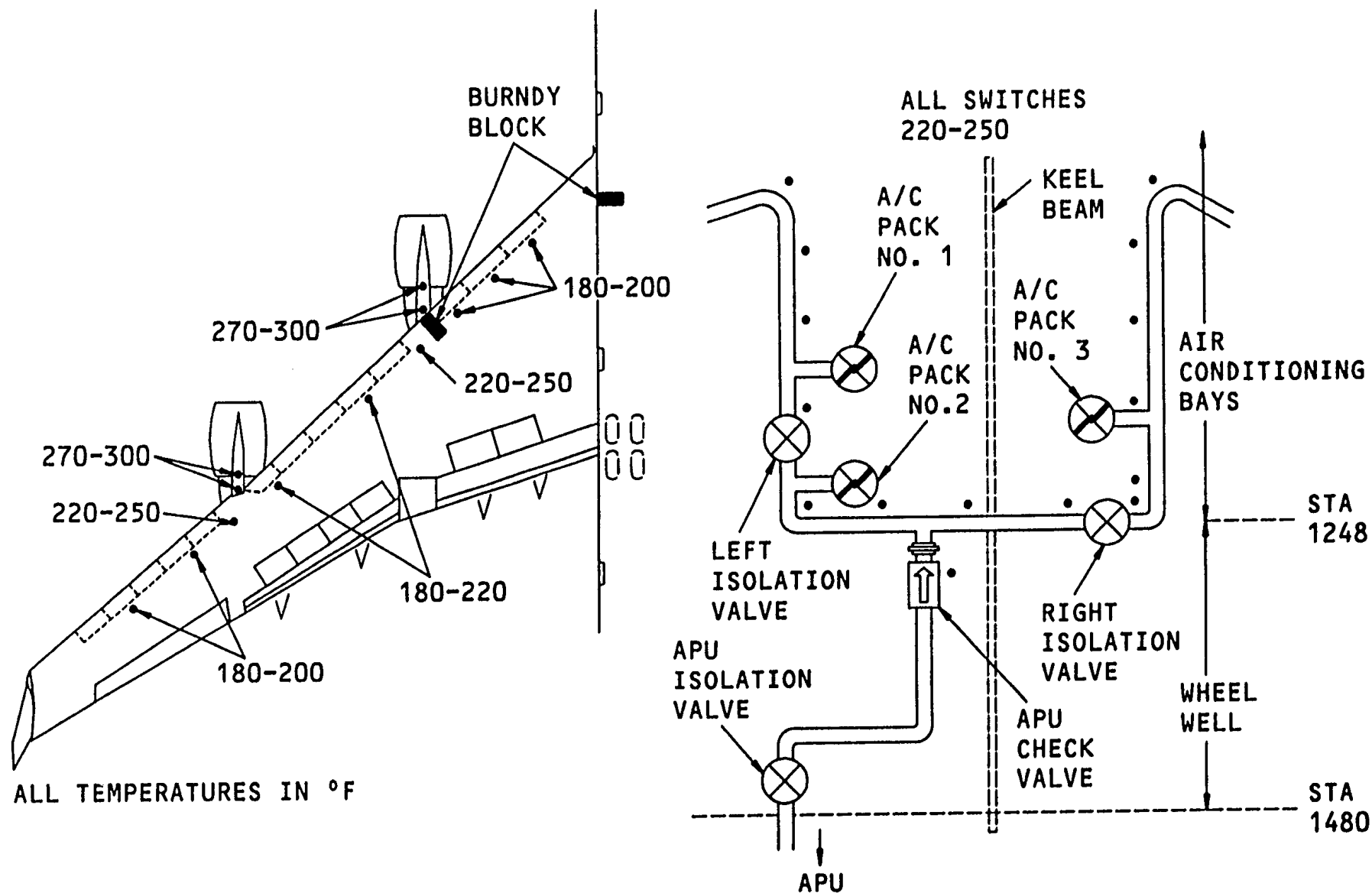


Figure 79 OVERHEAT SWITCH LOCATION

WING LEADING EDGE OVHT



DETECTION THERMAL SWITCHES

General

Nine thermal switches are installed in each wing leading edge. Fourteen thermal switches are in the center areas; 4 on the left, 5 on the right and 5 on the center duct areas. The switches are mounted on brackets installed on rib sections of wing leading edges along pneumatic ducts. Two thermal switches are installed on the midspar of each nacelle strut. The aft switches on number 1 and 4 struts have sealing nutplates to maintain an absolute seal of the midspar. A metal decal with the switch part number is adjacent to each switch.

Maintenance Practices

Access to the thermal switches in the wing leading edge is by extending the wing leading edge flaps.

Access to the thermal switches in the nacelle struts is through access panels on the left side of each strut.

Access to the center area switches is through the air conditioning system access panels.

WING LEADING EDGE OVHT

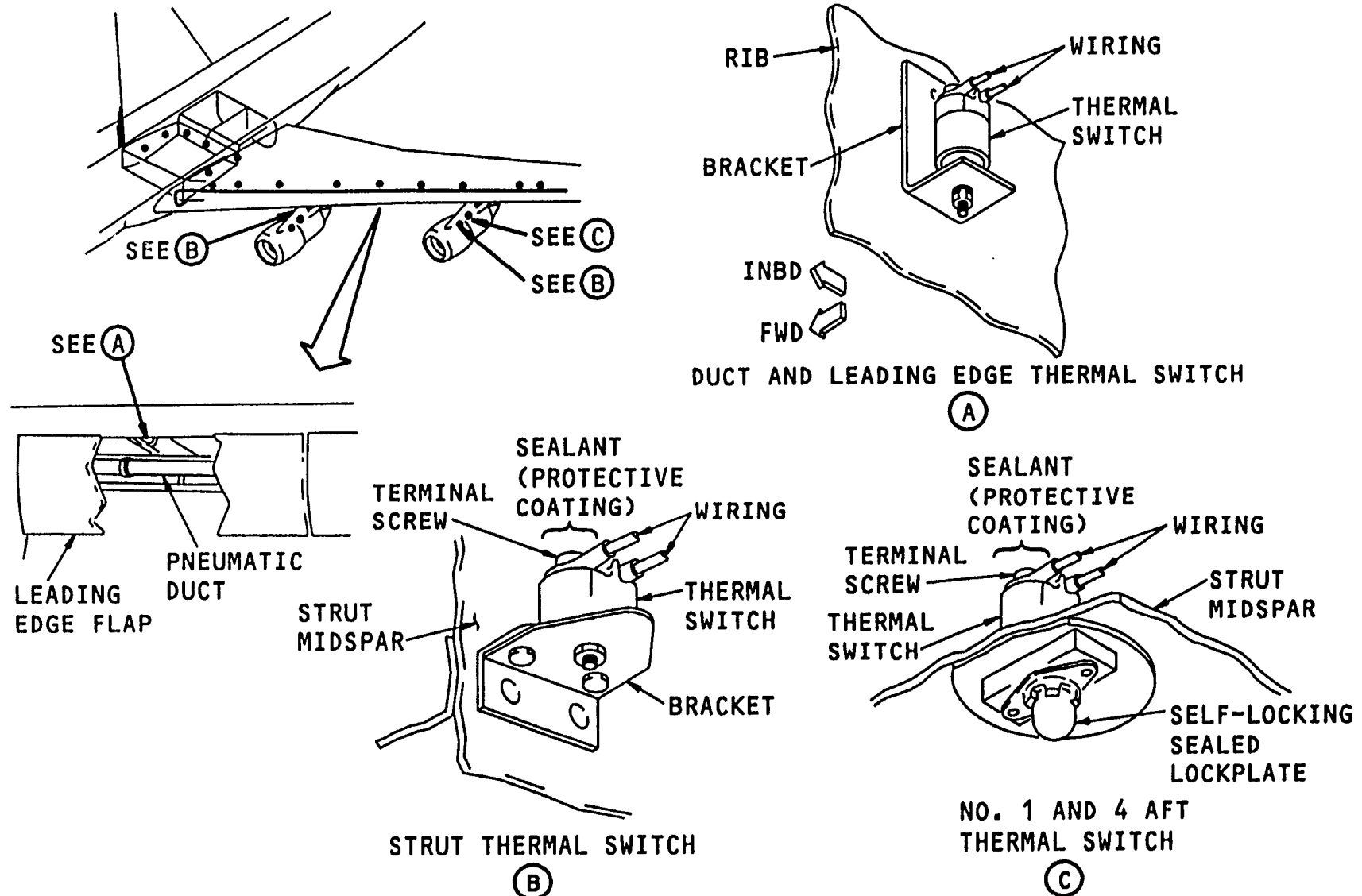


Figure 80 DETECTION THERMAL SWITCHES

WING LEADING EDGE OVHT



DETECTION CIRCUIT

Operation

The thermal switches in the wing leading edge and in the nacelle struts are connected in parallel and are normally open.

The inboard and outboard wing leading edge switches operate at 180-200 °F (82-93°C), inboard and outboard strut switches operate at 270-300 °F (132-149°C), and center wing leading edge switches operate at 220-250 °F (104-121°C) and 180-200 °F (82-93 °C).

The left/right duct thermostats operate at 180-200 °F (82-92 °C) and 220-250 °F (104-121°C).

When hot air from a ruptured pneumatic duct enters the wing leading edge or strut cavities, thermal switch or switches close and relay R7420 energizes. This provides information to the EICAS display.

Test

The wing leading edge overheat detection operation can be checked by the central maintenance computer and by the FIRE/OVHT test switch on P5. During test, relay R8052 is energized and if circuit continuity is verified, relay R7420 energizes. The test results are observed on the EICAS display.

WING LEADING EDGE OVHT

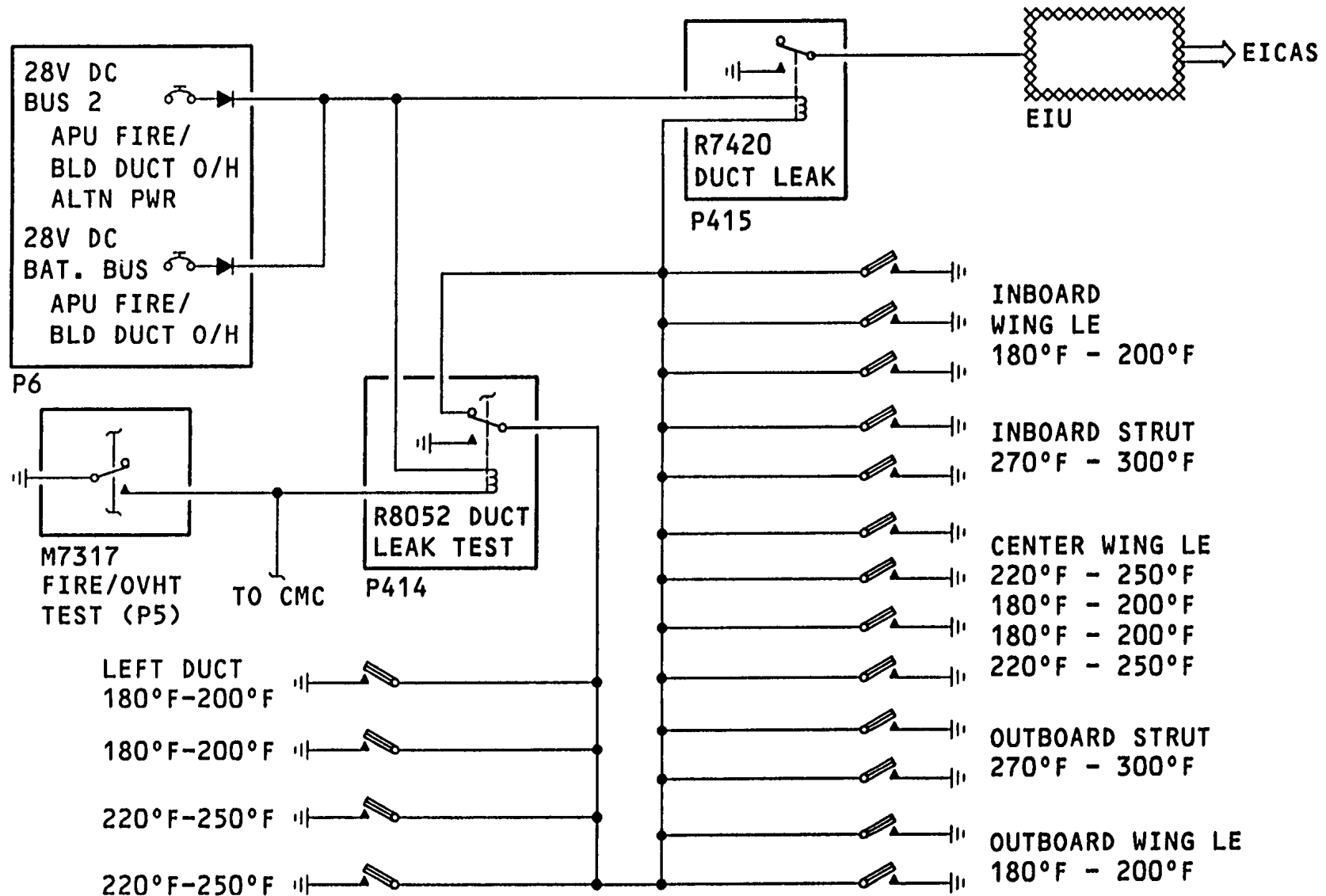


Figure 81 DETECTION CIRCUIT

WING LEADING EDGE OVHT



CENTER DUCT LEAK OVHT DETECTION CIRCUIT

Operation

The thermal switches in the center duct (crossover manifold) are connected in parallel and are normally open.

The switches operate at 220-250°F (104-121°C).

When hot air from a ruptured pneumatic duct enters the center area, thermal switch or switches close and relay R8463 energizes. This provides information to the EICAS display.

Test

The wing leading edge overheat detection operation can be checked by the central maintenance computer and by the FIRE/OVHT test switch on P5. During test, relay R8464 is energized and if circuit continuity is verified, relay R8463 energizes. The test results are observed on the EICAS display.

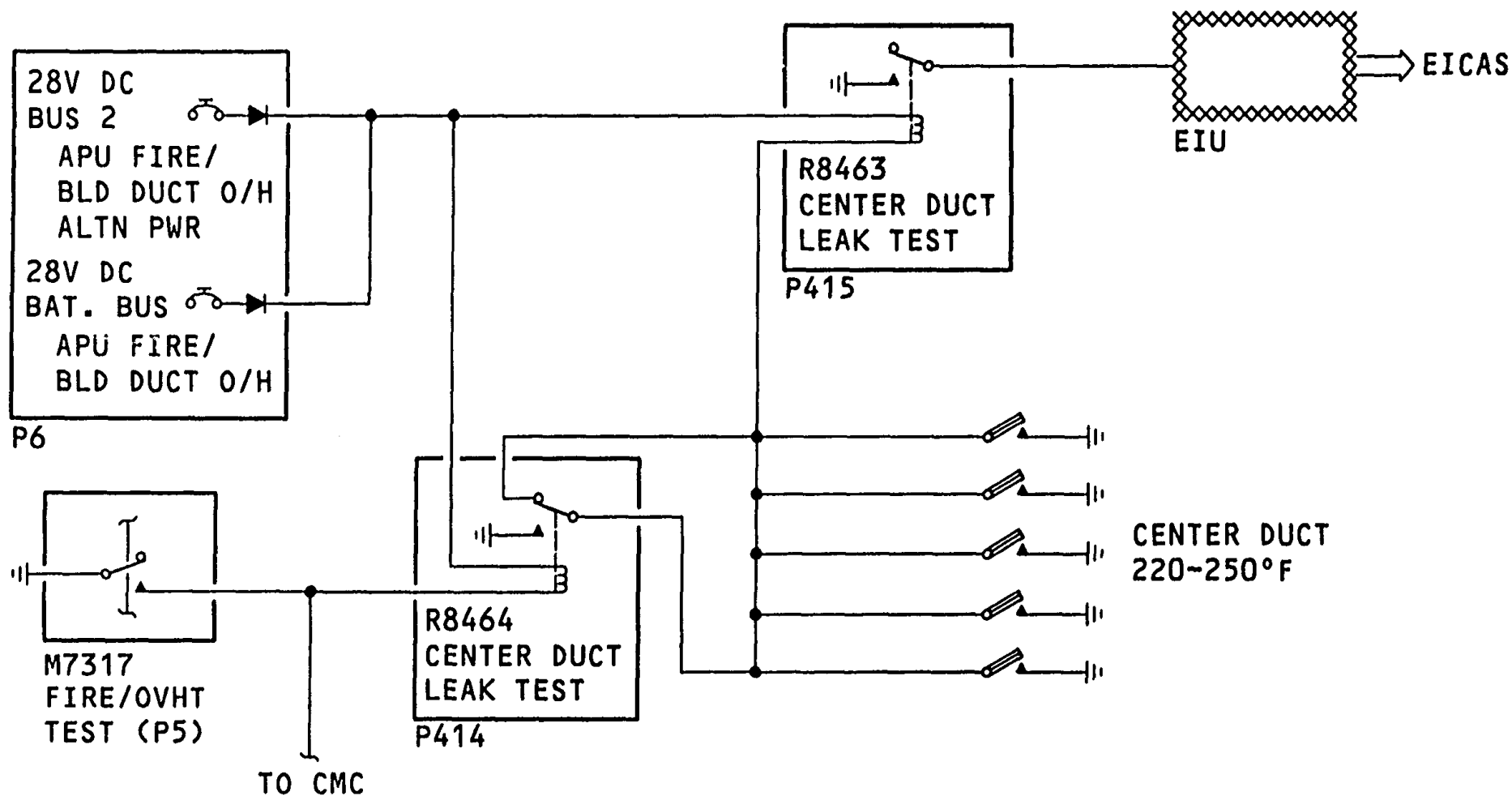


Figure 82 CENTER DUCT LEAK OVHT DETECTION CIRCUIT

WING LEADING EDGE OVHT



EICAS MESSAGES

The wing leading edge overheat detection EICAS messages are shown on the main and auxiliary displays.

- TEST IN PROGRESS: warning message on main EICAS display. Fire/ overheat system test in progress.
- TEST PASSED: warning message on main EICAS display. All fire/ overheat test discretes true during test.
- FIRE TEST FAIL: warning message on main EICAS display. One or more fire/overheat test discretes failed during test.
- BLD DUCT LEAK L: caution message on main EICAS display. overheat in left wing leading edge bleed duct.
- BLD DUCT LEAK R: caution message on main EICAS display. Overheat in right wing leading edge bleed duct.
- BLD DUCT LEAK C: caution message on main EICAS display. overheat in the center bleed duct.
- BLD DUCT LEAK L: status message on auxiliary EICAS display. overheat in left wing leading edge bleed duct. (60 sec TD)
- BLD DUCT LEAK R: status message on auxiliary EICAS display. overheat in right wing leading edge bleed duct. (60 sec TD)
- BLD DUCT LEAK C: Status message on auxiliary EICAS display. Overheat in center bleed duct.

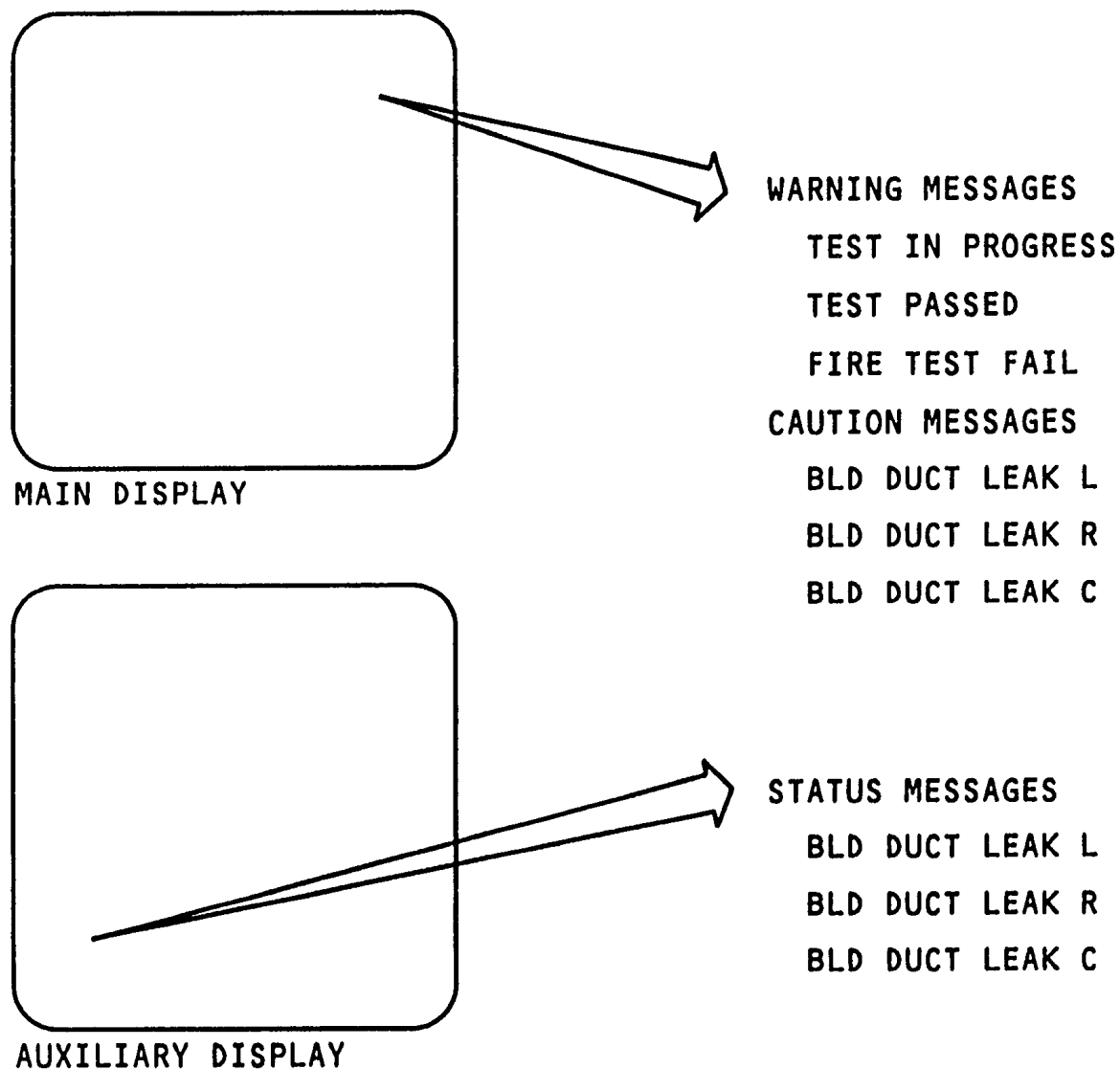


Figure 83 EICAS MESSAGES

LAVATORY SMOKE DETECTION



LAVATORY SMOKE DETECTION

SMOKE DETECTION

The smoke detection system provides means of detecting smoke from cigarettes or fires in the lavatories and door 5 overhead crew rest area.

The system consists of smoke detectors, located in the ceiling of each lavatory and crew rest area.

Indication of smoke detection in the lavatory is by a horn operating on the detector, illumination of call light at the lavatory, attendants' master call lights and chime.

Indication of smoke detection in the crew rest area is by a horn operating in the crew rest area and EICAS message in the flight deck.

LAVATORY SMOKE DETECTION

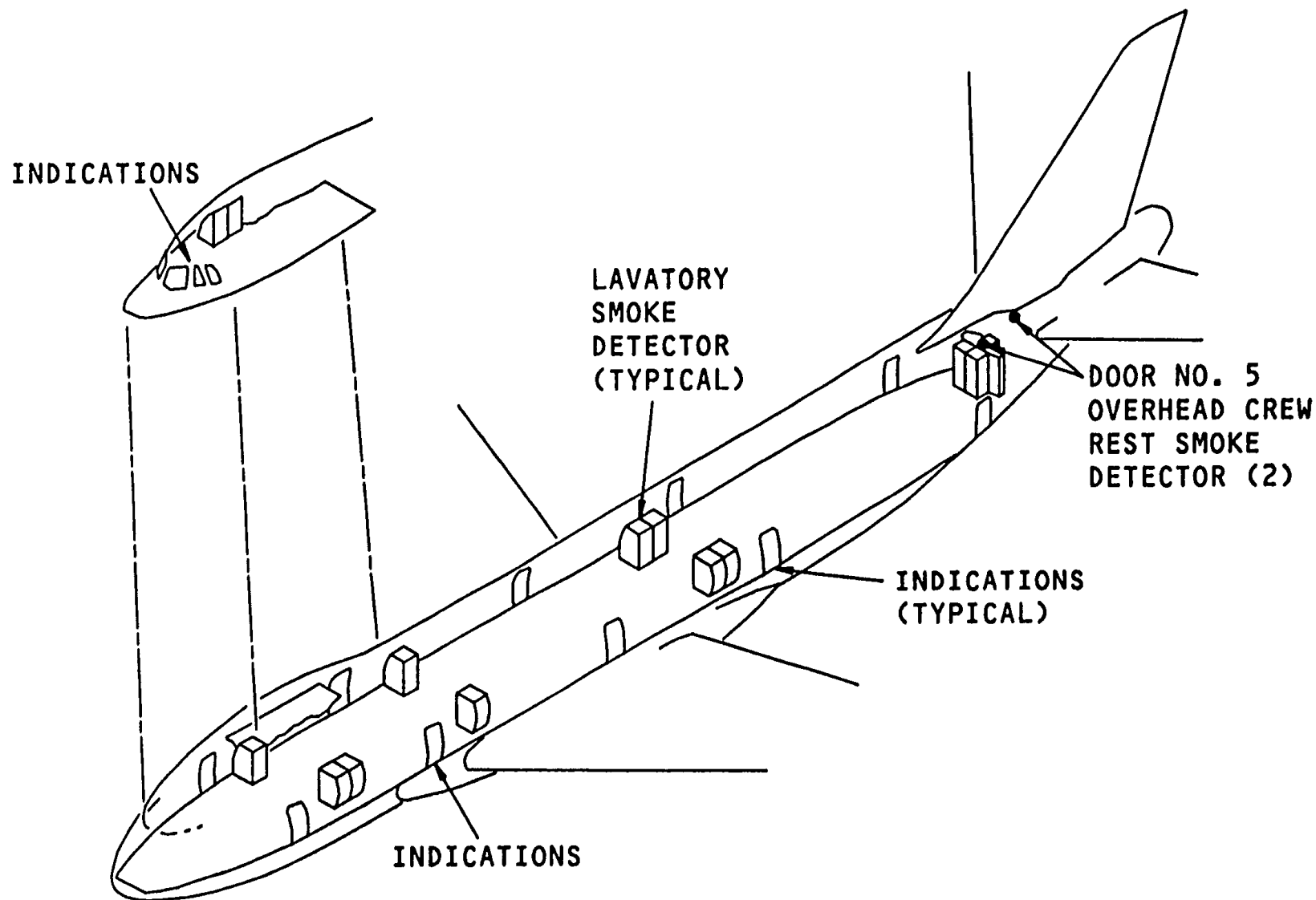


Figure 84 SMOKE DETECTION

LAVATORY SMOKE DETECTION



SMOKE DETECTOR

General

Smoke detectors provide a single tone aural alert and a visual alert to the passengers and flight attendants when smoke is detected in the lavatory.

The detector consists of a faceplate, housing, sensor unit, alarm horn and electronic circuitry. The sensor unit uses the ionization detection principle. A red alarm indicator provides a visual indication when smoke is detected. A green power indicator light, a reset switch and a self-test switch are located on the faceplate.

Operation

Sampling for smoke begins immediately after power is provided to the detector, indicated by illumination of the green light. When smoke is detected, a red alarm light illuminates and the horn operates. Resetting is after the smoke condition has been cleared and the horn interrupt switch pushed. If the switch is used before the smoke has cleared, the alarms will stop and the green light will

extinguish, but when the switch is released, the alarms are reactivated.

Using the self-test switch simulates smoke, resulting in the red light and horn operating.

LAVATORY SMOKE DETECTION

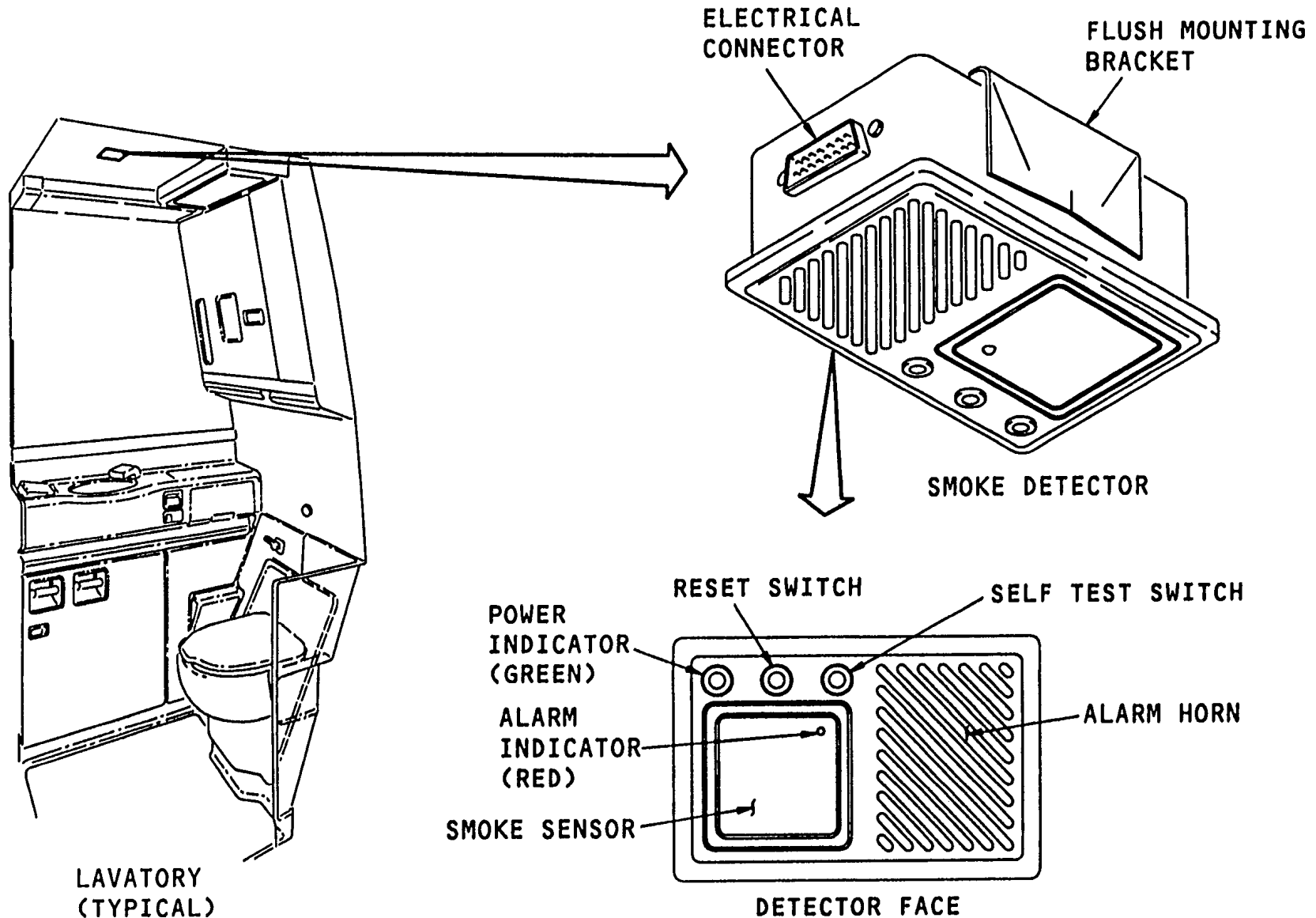


Figure 85 SMOKE DETECTOR

LAVATORY SMOKE DETECTION



DETECTION CIRCUIT

The smoke detection system consists of a smoke detector located in each lavatory.

When smoke is detected, the output from the detector passes through the ACESS system to the lavatory external call light, attendants' master call lights and chime.

LAVATORY SMOKE DETECTION

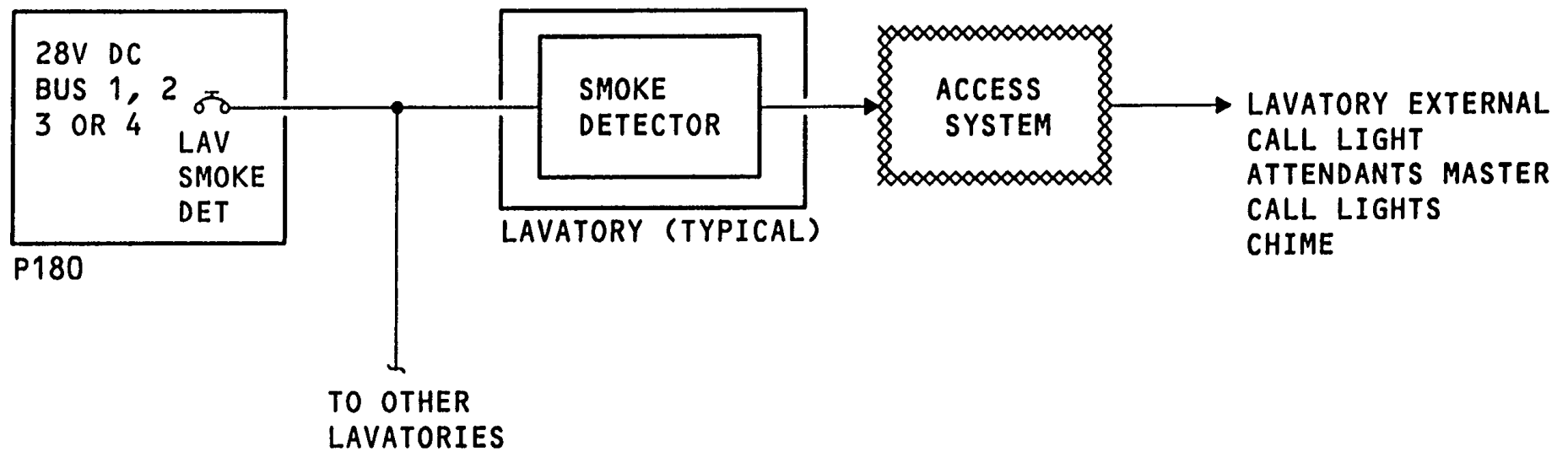


Figure 86 DETECTION CIRCUIT

DR 5 CREW REST SMOKE DETECTION



DOOR 5 CREW REST SMOKE DETECTION

SMOKE DETECTION INDICATION

The door 5 overhead crew rest area smoke detection indication is on the control panel located in the crew rest area. The control panel monitors smoke indication and provides testing for the smoke detectors.

The control panel consists of:

- Four smoke alarm indicator red lights which illuminate when smoke is detected. The lights are also test switches for the individual smoke detector.
- Alarm horn operates during smoke detection or during test.
- Horn reset switch stops the operation of the horn.
- Lights test switch checks the four red lights.

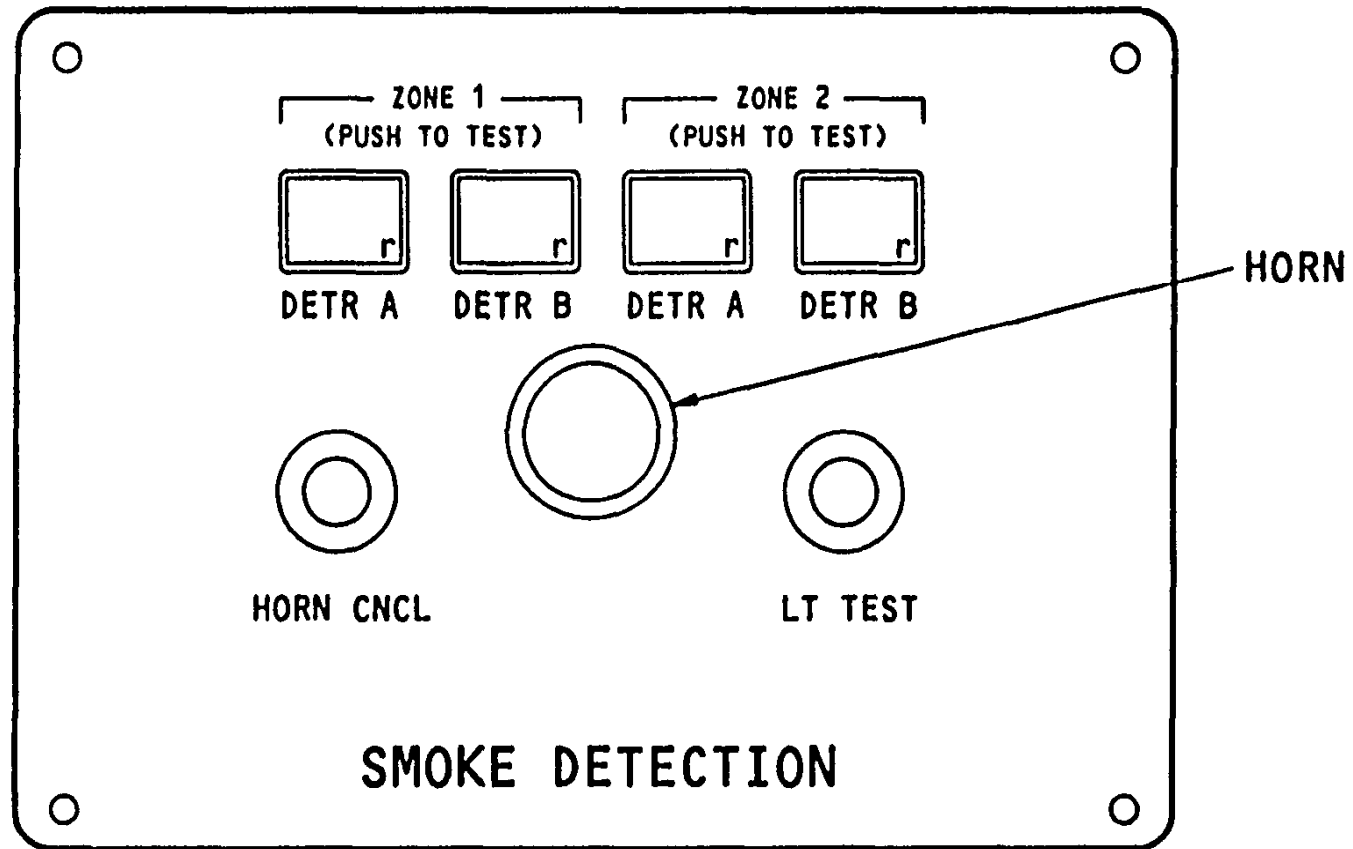


Figure 87 SMOKE DETECTION INDICATION

DR 5 CREW REST SMOKE DETECTION



SMOKE DETECTION CIRCUIT

The crew rest area smoke detection system is automatic in operation provided that 28 volt dc electrical power is available. The smoke detection system consists of four draw through type smoke detectors, control panel with four indicating lights which provide system test, horn, horn cutout and lights test switches.

When smoke is detected, the horn operates and smoke light for the corresponding detector illuminates. Relays R8439, R8133 and R8132 energize allowing main deck indications, air conditioning system components shutdown and EICAS indication.

Pressing the horn cutout switch energizes relay R8438 which stops the horn and remains energized when the switch is released. The corresponding red light remains illuminated as long as smoke is present.

The red lights can be tested by the lights test switch, the horn does not operate during this test. Pressing the individual red light, performs a test of the corresponding smoke detector. Relay R8442 energizes after a 7 second

time delay preventing the shutdown of the air conditioning components.

DR 5 CREW REST SMOKE DETECTION



Lufthansa
Technical Training

B747 - 400

090.01

26-13

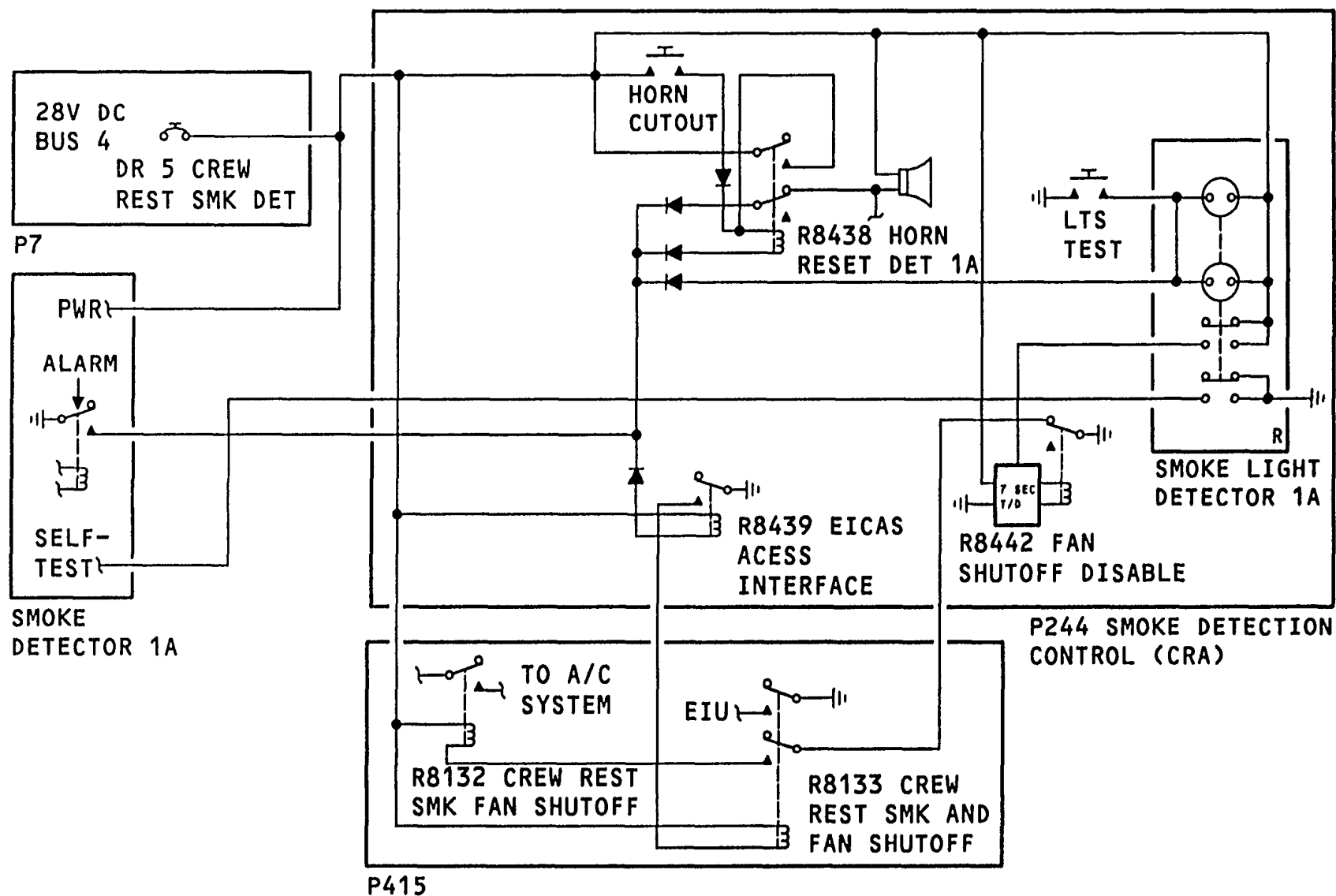


Figure 88 SMOKE DETECTION CIRCUIT

DR 5 CREW REST SMOKE DETECTION



EICAS MESSAGE

The smoke detection EICAS message is shown on the main display.

- >SMOKE DR 5 REST:
caution message on main EICAS display. Door 5 overhead
crew rest area smoke detected

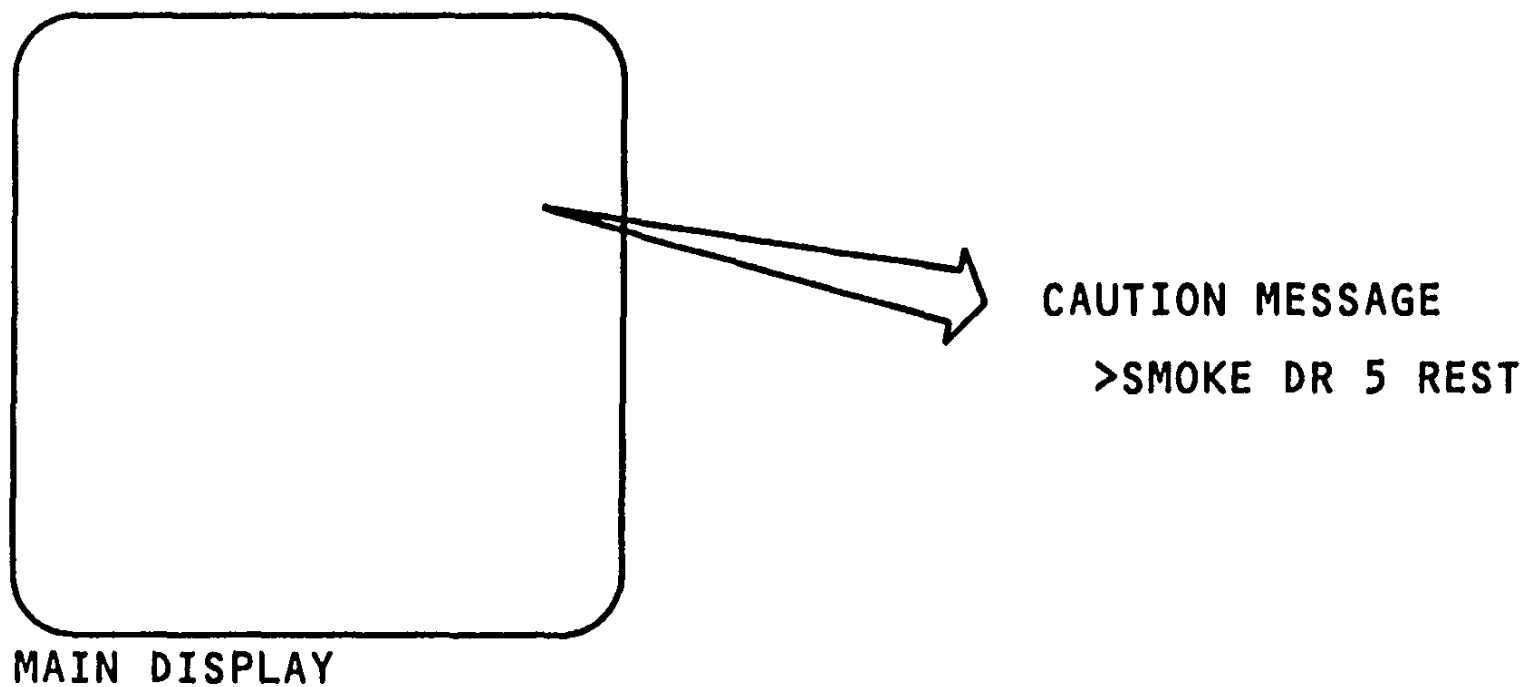


Figure 89 EICAS MESSAGE

LAVATORY FIRE EXTINGUISHING



LAVATORY FIRE EXTINGUISHING

LAVATORY FIRE PROTECTION

The lavatory fire protection system provides fire detection and automatic fire extinguisher discharge for fires in the lavatory waste compartment.

The system consists of a fire extinguisher bottle and a temperature indicator located in each lavatory waste compartment.

LAVATORY FIRE EXTINGUISHING



**Lufthansa
Technical Training**

B747 - 400

092.01

26-27

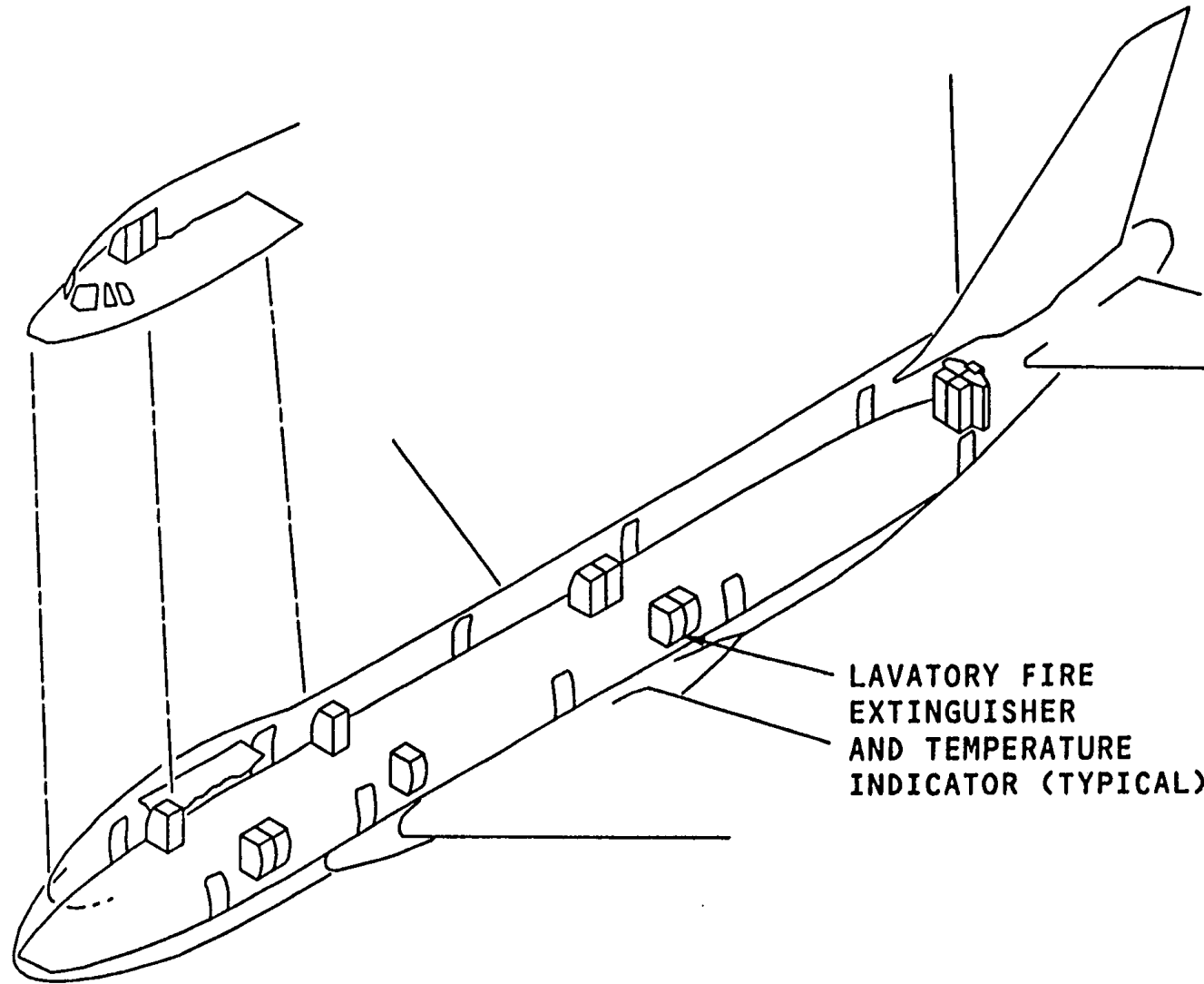


Figure 90 LAVATORY FIRE PROTECTION

LAVATORY FIRE EXTINGUISHING



LAVATORY FIRE EXTINGUISHER

General Description

The lavatory fire extinguisher detects and extinguishes a fire originating in the lavatory waste container and under the sink.

An extinguisher is located in each lavatory in the compartment under the wash basin. It consists of a bottle with two discharge nozzles which are capped and sealed with eutectic solder. One nozzle responds to temperature in the towel chute, and the other responds to temperature beneath the wash basin. The extinguisher provides an extinguishing agent to smother fires occurring in either of the two areas. The bottle weighs approximately 410 grams of which 125 grams is HALON 1301.

When the compartment temperature exceeds approximately 170°F (77°C), the eutectic solder melts and the extinguishing agent is released into the compartment.

The indicator consists of four white temperature sensitive areas which turn black when exposed to high temperature. It is located inside the cabinet on the towel chute.

Maintenance Practices

The temperature indicator strip should be checked for high temperature indication (black) and replaced if high temperature has occurred. The extinguisher bottle must be checked by weighing and if necessary, replaced. It cannot be recharged.

LAVATORY FIRE EXTINGUISHING

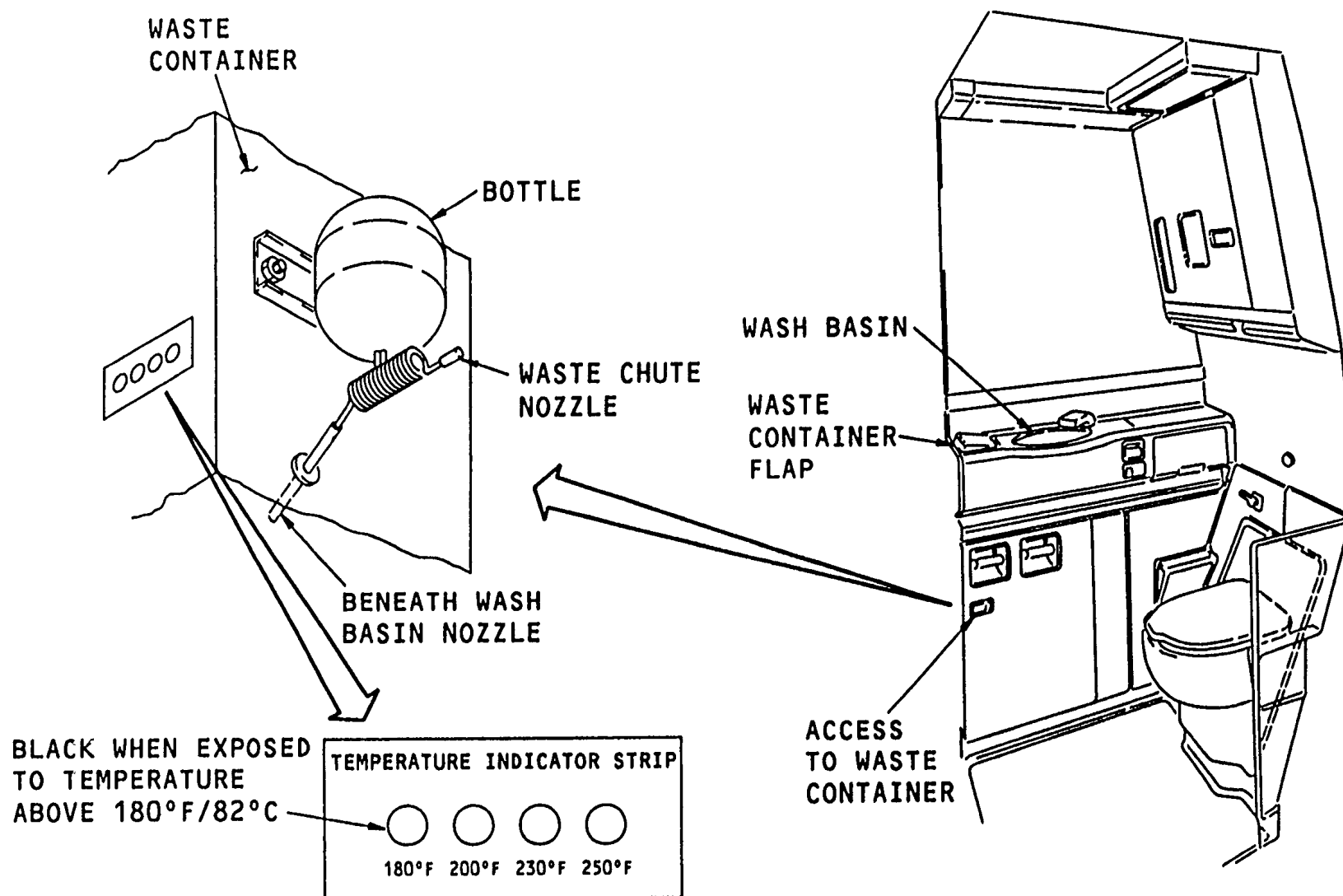


Figure 91 LAVATORY FIRE EXTINGUISHER

PORTABLE FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

094.01

26-26

PORTABLE FIRE EXTINGUISHING

PORTABLE FIRE EXTINGUISHERS

The portable fire extinguishers provide means for extinguishing a fire in the passenger cabin, crew rest areas and flight deck.

The system consists of Halon 1211 (chemical) and water type fire extinguishers located throughout the interior of the fuselage.

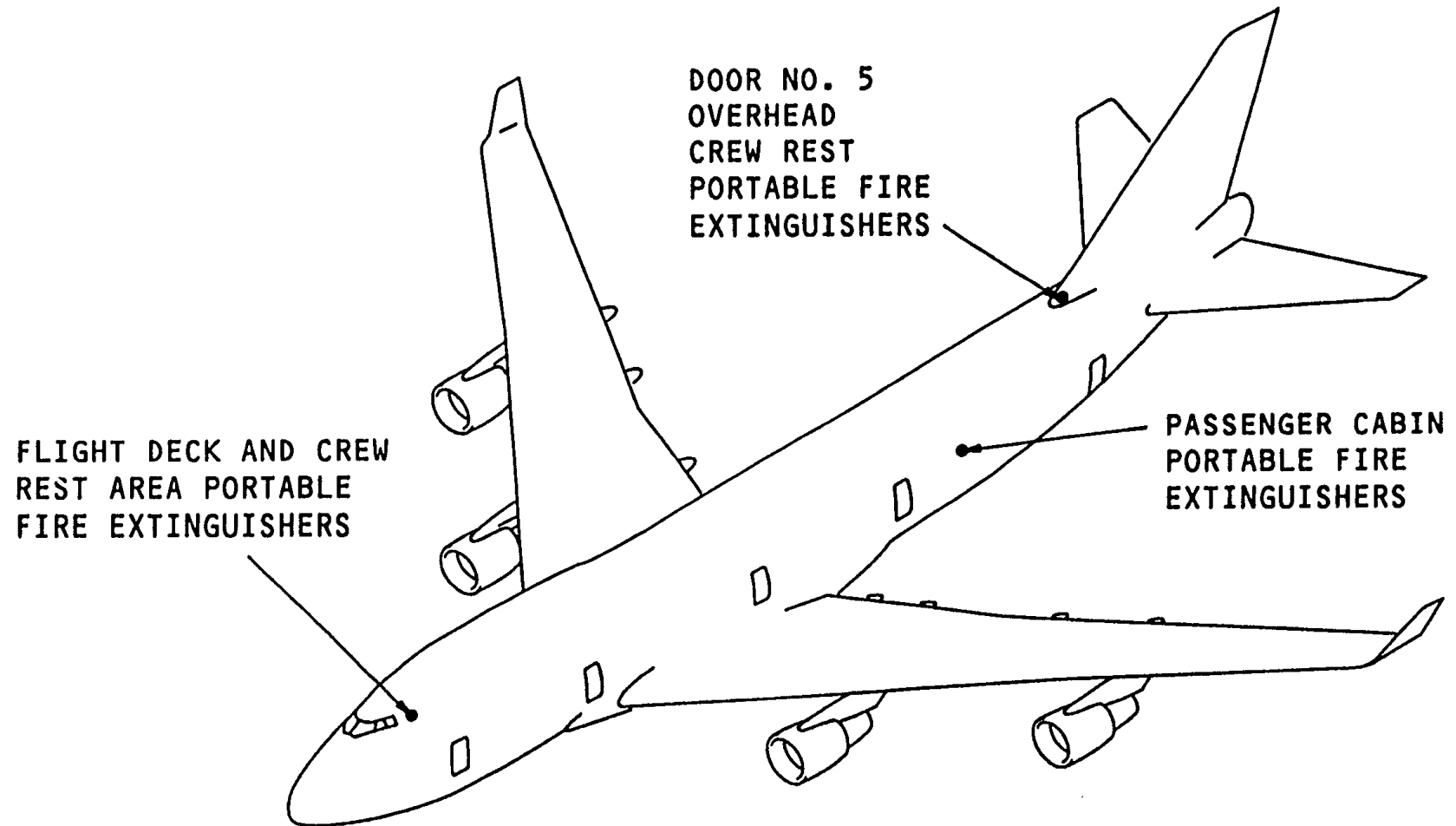


Figure 92 PORTABLE FIRE EXTINGUISHERS

PORTABLE FIRE EXTINGUISHING



HALON 1211 FIRE EXTINGUISHER

The Halon 1211 (chemical) fire extinguisher is suitable for all kinds of fires, but primarily for electrical and volatile liquid fires.

The Halon 1211 extinguishers are located throughout the passenger cabin and the flight deck. The extinguishers are held by quick release brackets.

The extinguisher consists of a bottle containing liquified gas (bromochlorodifluoromethane) pressurized to 204 psig, a pressure gauge and an operating handle. The pressure gauge indicates acceptable recharge and overcharged conditions. It is discharged by removing the locking pin from the handle and depressing the top lever. During operation, the extinguisher has a range of eight feet and a duration of six seconds.

NOTE: IF THE PLASTIC LOCKING PIN IS MISSING, THE EXTINGUISHER MUST BE WEIGHED TO DETERMINE IF IT HAS BEEN DISCHARGED. THE PRESSURE GAUGE IS NOT AN ACCEPTABLE CHECK OF THE BOTTLE. THE MINIMUM BOTTLE WEIGHT IS PLACARDED ON THE EXTINGUISHER.

The locking pin must be replaced before putting the extinguisher back in service.

PORTABLE FIRE EXTINGUISHING

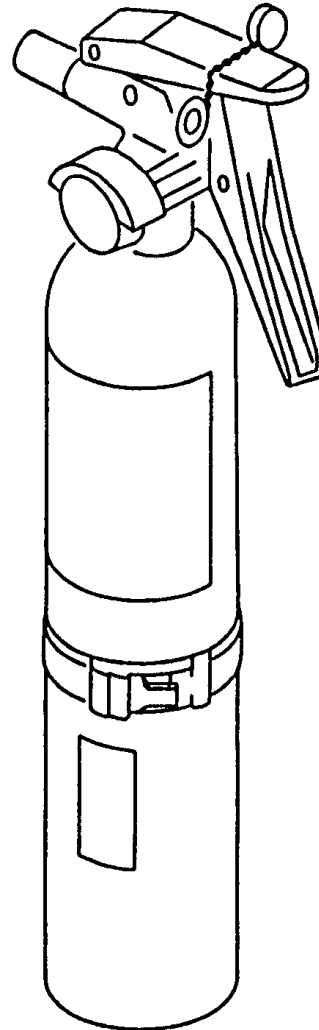


Figure 93 HALON 1211 FIRE EXTINGUISHER

PORTABLE FIRE EXTINGUISHING



Lufthansa
Technical Training

B747 - 400

096.01

26-26

WATER FIRE EXTINGUISHER

The water fire extinguisher is suitable for non-electrical fires.

The water extinguishers are located throughout the passenger cabin. The extinguishers are held by quick release brackets.

The extinguisher consists of a bottle containing water and anti-freeze mixture. A carbon dioxide cartridge is mounted on the handle of the extinguisher. It is discharged by rotating the cartridge and pressing the trigger. The cartridge is punctured by the trigger, releasing the carbon dioxide which pressurizes the bottle.

After refilling the cylinder with water, the carbon dioxide cartridge must be replaced.

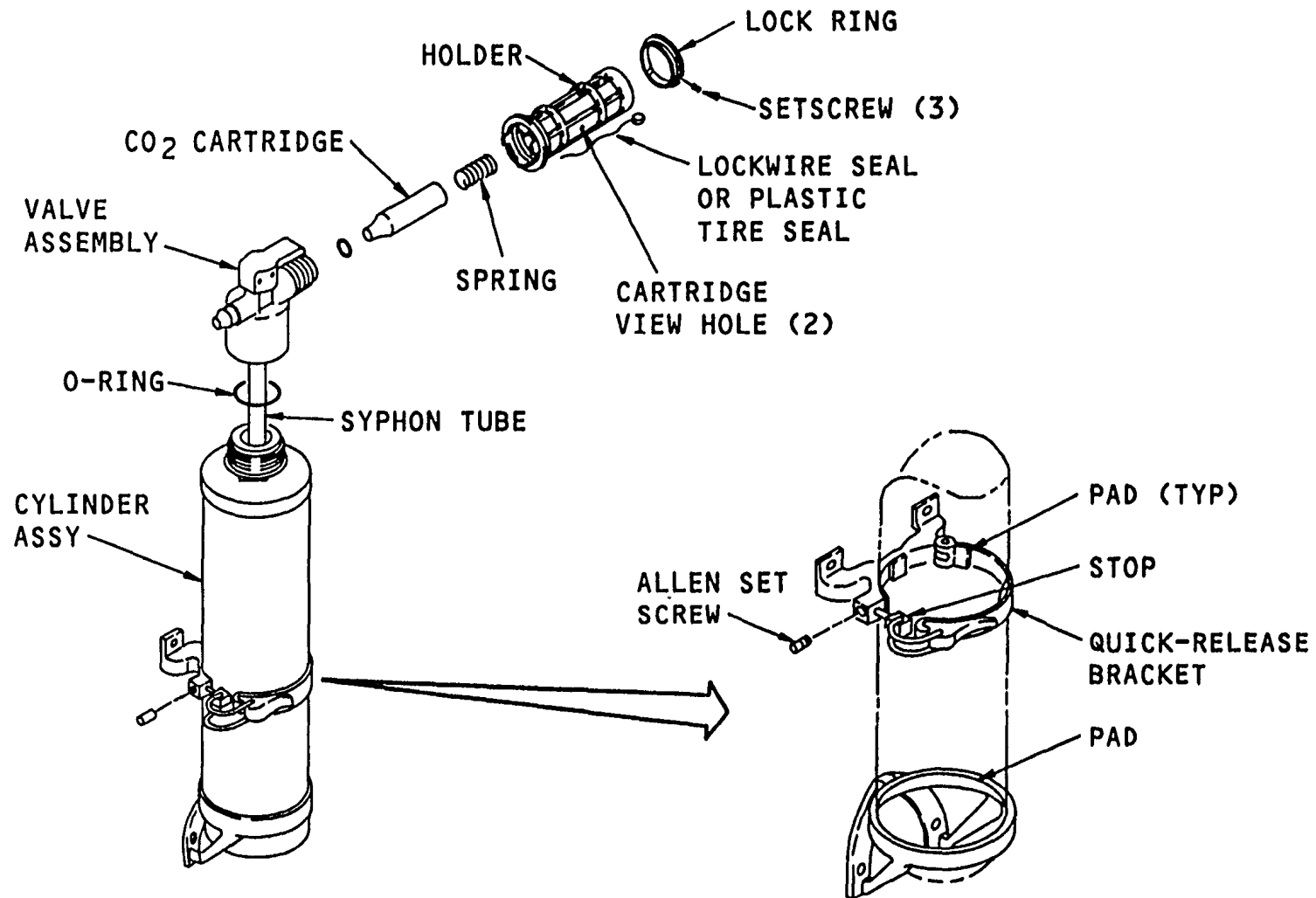


Figure 94 WATER FIRE EXTINGUISHER

PORTABLE FIRE EXTINGUISHING



LOCATIONS

Portable fire extinguishers are located on the main deck, upper deck and door No. 5 overhead crew rest. Seven extinguishers are water type and 8 extinguishers are halon type.

PORTABLE FIRE EXTINGUISHING

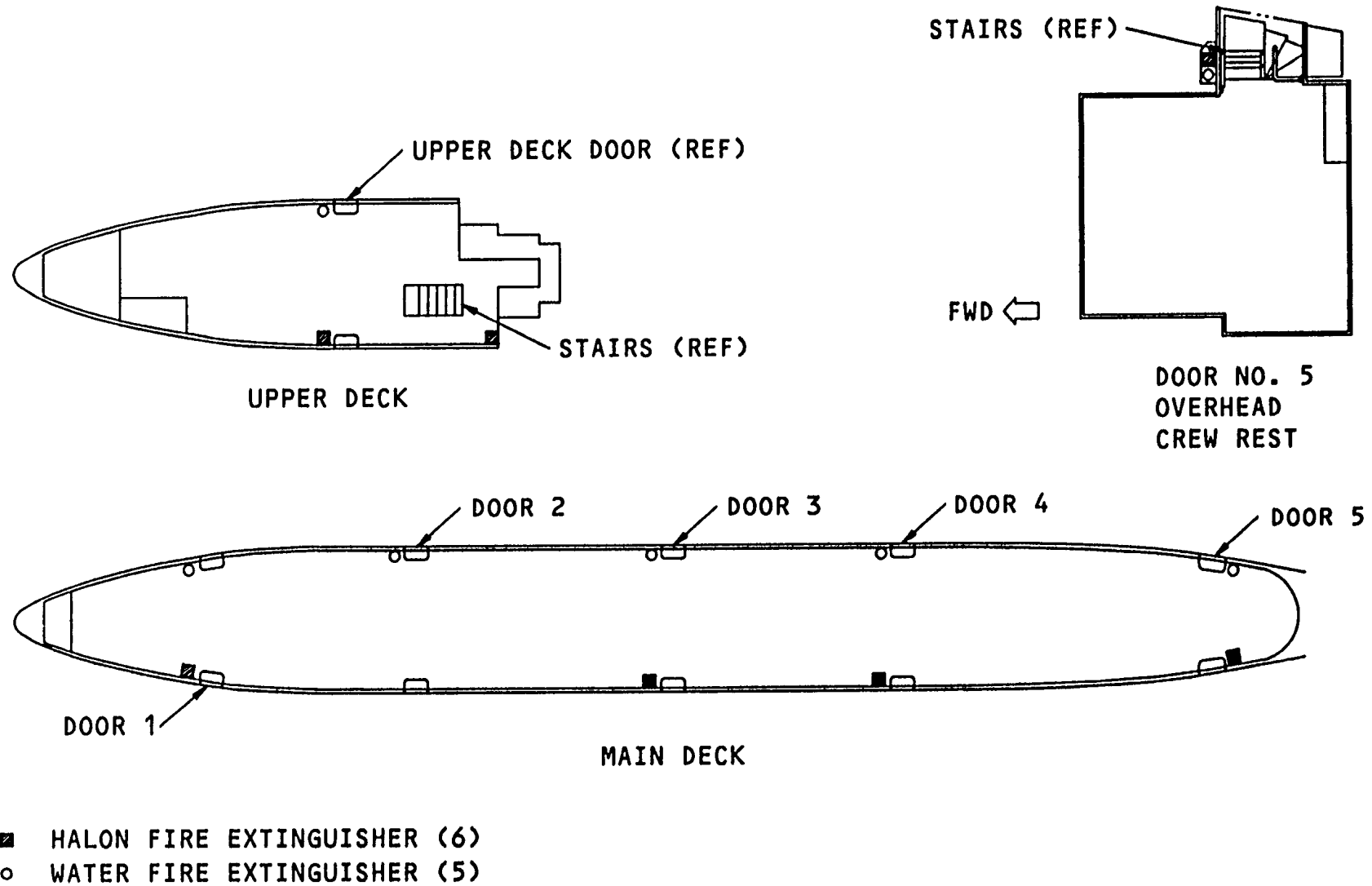


Figure 95 LOCATIONS

TABLE OF CONTENTS

ATA 26 FIRE PROTECTION	1	APU FIRE DETECTOR	58
FIRE PROTECTION	2	DETECTION & EXTINGUISHING INDICATION	60
FIRE PROTECTION GENERAL	2	APU FIRE DETECTION CIRCUIT	62
OVERHEAT, FIRE & SMOKE DETECTION SYSTEM	4	POWER-UP OPERATION INDICATION	64
M826 CARD FILE	6	MANUAL TEST INDICATION	66
FIRE DETECTION TESTS - CMC MESSAGES	8	NORMAL OPS INDICATION	68
ENGINE OVERHEAT AND FIRE PROTECTION	10	EICAS MESSAGES	70
ENGINE OVHT & FIRE DETECTION	12	APU FIRE HANDLE SWITCH	72
ENGINE OVERHEAT AND FIRE DETECTORS	12	APU FIRE HANDLE SWITCH CIRCUIT	74
DETECTION & EXTINGUISHING INDICATION	14	APU FIRE EXTINGUISHING	76
OVERHEAT DETECTION CIRCUIT	16	APU FIRE SHUTDOWN MODULE	76
POWER-UP OPERATION & INDICATION	18	APU FIRE SHUTDOWN MODULE CIRCUIT	78
OVHT DETECTION MANUAL TEST INDICATION	20	BOTTLE COMPONENTS	81
OVHT DETECTION NORMAL OPS & INDICATION	22	BOTTLE DISCH INDICATION CIRCUIT	84
OVERHEAT DETECTION EICAS MESSAGES	24	EICAS MESSAGES	86
ENGINE FIRE DETECTION CIRCUIT	26	SQUIB TEST CONTROL	88
POWER-UP OPERATION & INDICATION	28	SQUIB TEST CIRCUIT	90
MANUAL TEST INDICATION	30	LOWER CARGO COMPARTMENT SMOKE DETECTION	92
NORMAL OPERATION INDICATION	32	CARGO COMPARTMENT SMOKE DETECTION	92
ENGINE FIRE DETECTION EICAS MESSAGES	34	SMOKE DETECTION SYSTEM	94
ENGINE FIRE HANDLE SWITCH	36	VENTURI EJECTOR	96
FIRE HANDLE SWITCH CIRCUIT	38	VENTURI EJECTOR PRESSURE SWITCH CIRCUIT	98
ENGINE FIRE EXTINGUISHING	40	SMOKE DETECTORS	100
ENGINE FIRE EXTINGUISHING SYSTEM	40	SMOKE DETECTOR	102
FIRE EXTINGUISHER BOTTLE	42	SMOKE DETECTOR CIRCUIT	104
EXTINGUISHER BOTTLE COMPONENTS	44	DETECTION & EXTINGUISHING INDICATION	106
BOTTLE DISCHARGE CIRCUIT	46	FWD CC SMOKE DETECTION CIRCUIT	108
BOTTLE DISCH INDICATION CIRCUIT	48	AFT & BULK CC SMOKE DETECTION CIRCUIT	110
BOTTLES EICAS MESSAGES	50	POWER-UP OPERATION INDICATION	112
SQUIB TEST CONTROLS	52	MANUAL TEST INDICATION	114
SQUIB TEST CIRCUIT	54	NORMAL OPERATION INDICATION	116
APU FIRE DETECTION	56	EICAS MESSAGES	118
APU FIRE PROTECTION	56	SMOKE DETECTOR TUBE HEATING LOCATION	120
		SMOKE DETECTOR HEATER CONTROL UNITS	122

TABLE OF CONTENTS

SMOKE DETECTOR TUBE HEATING	124	LAVATORY FIRE EXTINGUISHING	182
CARGO FIRE EXTINGUISHING	126	LAVATORY FIRE PROTECTION	182
CARGO FIRE EXTINGUISHING	126	LAVATORY FIRE EXTINGUISHER	184
CARGO FIRE EXTINGUISHING SYSTEM	128	PORTABLE FIRE EXTINGUISHING	186
EXTINGUISHER BOTTLES	130	PORTABLE FIRE EXTINGUISHERS	186
EXTINGUISHER BOTTLE COMPONENTS	132	HALON 1211 FIRE EXTINGUISHER	188
DISCHARGE MANIFOLD COMPONENTS	134	WATER FIRE EXTINGUISHER	190
FWD CARGO BOTTLE DISCHARGE CIRCUIT	136	LOCATIONS	192
AFT CARGO BOTTLE DISCHARGE CIRCUIT	138		
EXTINGUISHER ARMED SWITCH FUNCTIONS	140		
BOTTLES DISCHARGE INDICATION CIRCUIT	142		
EICAS MESSAGES	144		
BOTTLES SQUIB TEST CONTROLS	146		
BOTTLE SQUIB TEST CIRCUIT	148		
WHEEL WELL FIRE DETECTION	150		
WHEEL WELL FIRE DETECTION	150		
WHEEL WELL FIRE DETECTOR	152		
DETECTION CIRCUIT	154		
EICAS MESSAGES	156		
WINGLEADING EDGE OVHT	158		
WING LEADING EDGE OVERHEAT DETECTION	158		
OVERHEAT SWITCH LOCATION	160		
DETECTION THERMAL SWITCHES	162		
DETECTION CIRCUIT	164		
CENTER DUCT LEAK OVHT DETECTION CIRCUIT	166		
EICAS MESSAGES	168		
LAVATORY SMOKE DETECTION	170		
SMOKE DETECTION	170		
SMOKE DETECTOR	172		
DETECTION CIRCUIT	174		
DOOR 5 CREW REST SMOKE DETECTION	176		
SMOKE DETECTION INDICATION	176		
SMOKE DETECTION CIRCUIT	178		
EICAS MESSAGE	180		

TABLE OF FIGURES

Figure 1	FIRE PROTECTION	3	Figure 36	APU FIRE HANDLE SWITCH	73
Figure 2	OVERHEAT, FIRE AND SMOKE DETECTION SYSTEM	5	Figure 37	APU FIRE HANDLE SWITCH CIRCUIT	75
Figure 3	M826 CARD FILE	7	Figure 38	APU FIRE SHUTDOWN MODULE	77
Figure 4	FIRE DETECTION TESTS - CMC MESSAGES	9	Figure 39	APU FIRE SHUTDOWN MODULE CIRCUIT	79
Figure 5	ENGINE OVERHEAT AND FIRE PROTECTION	11	Figure 40	BOTTLE COMPONENTS	83
Figure 6	ENGINE OVERHEAT AND FIRE DETECTORS	13	Figure 41	BOTTLE DISCH INDICATION CIRCUIT	85
Figure 7	DETECTION & EXTINGUISHING INDICATION	15	Figure 42	EICAS MESSAGES	87
Figure 8	ENGINE OVERHEAT DETECTION CIRCUIT	17	Figure 43	SQUIB TEST CONTROL	89
Figure 9	POWER-UP OPERATION & INDICATION	19	Figure 44	SQUIB TEST CIRCUIT	91
Figure 10	OVHT DETECTION MANUAL TEST INDICATION ...	21	Figure 45	LOWER CARGO COMPARTMENT SMOKE DETECTION	93
Figure 11	OVHT DETECTION NORMAL OPS & INDICATION ..	23	Figure 46	DETECTION SYSTEM	95
Figure 12	OVERHEAT DETECTION EICAS MESSAGES	25	Figure 47	VENTURI EJECTOR	97
Figure 13	FIRE DETECTION CIRCUIT	27	Figure 48	VENTURI EJECTOR PRESSURE SWITCH CIRCUIT	99
Figure 14	POWER-UP OPERATION & INDICATION	29	Figure 49	SMOKE DETECTORS	101
Figure 15	MANUAL TEST INDICATION	31	Figure 50	SMOKE DETECTOR	103
Figure 16	NORMAL OPERATION INDICATION	33	Figure 51	SMOKE DETECTOR CIRCUIT	105
Figure 17	ENGINE FIRE DETECTION EICAS MESSAGES	35	Figure 52	DETECTION & EXTINGUISHING INDICATION	107
Figure 18	ENGINE FIRE HANDLE SWITCH	37	Figure 53	FWD CC SMOKE DETECTION CIRCUIT	109
Figure 19	FIRE HANDLE SWITCH CIRCUIT	39	Figure 54	AFT & BULK CC SMOKE DETECTION CIRCUIT	111
Figure 20	ENGINE FIRE EXTINGUISHING SYSTEM	41	Figure 55	POWER-UP OPERATION INDICATION	113
Figure 21	ENGINE FIRE EXTINGUISHER BOTTLE	43	Figure 56	MANUAL TEST INDICATION	115
Figure 22	EXTINGUISHER BOTTLE COMPONENTS	45	Figure 57	NORMAL OPERATION INDICATION	117
Figure 23	BOTTLE DISCHARGE CIRCUIT	47	Figure 58	EICAS MESSAGES	119
Figure 24	BOTTLE DISCH INDICATION CIRCUIT	49	Figure 59	TUBE HEATING COMPONENT LOCATION FWD CC	121
Figure 25	BOTTLES EICAS MESSAGES	51	Figure 60	HEATER & CONTROL UNIT	123
Figure 26	SQUIB TEST CONTROLS	53	Figure 61	SMOKE DETECTOR TUBE HEATING SCHEMATIC ..	125
Figure 27	BOTTLES SQUIB TEST CIRCUIT	55	Figure 62	CARGO FIRE EXTINGUISHING	127
Figure 28	APU FIRE PROTECTION	57	Figure 63	CARGO FIRE EXTINGUISHING SYSTEM	129
Figure 29	APU FIRE DETECTOR	59	Figure 64	CARGO FIRE EXTINGUISHER BOTTLES	131
Figure 30	DETECTION AND EXTINGUISHING INDICATION ...	61	Figure 65	EXTINGUISHER BOTTLE COMPONENTS	133
Figure 31	APU FIRE DETECTION CIRCUIT	63	Figure 66	DISCHARGE MANIFOLD COMPONENTS	135
Figure 32	POWER-UP OPERATION INDICATION	65	Figure 67	FWD CARGO BOTTLE DISCHARGE CIRCUIT	137
Figure 33	MANUAL TEST INDICATION	67	Figure 68	AFT CARGO BOTTLE DISCHARGE CIRCUIT	139
Figure 34	NORMAL OPS INDICATION	69	Figure 69	EXTINGUISHER ARMED SWITCH FUNCTIONS	141
Figure 35	EICAS MESSAGES	71			

TABLE OF FIGURES

Figure 70	BOTTLES DISCHARGE INDICATION CIRCUIT	143
Figure 71	EICAS MESSAGES	145
Figure 72	BOTTLES SQUIB TEST CONTROLS	147
Figure 73	BOTTLE SQUIB TEST CIRCUIT	149
Figure 74	WHEEL WELL FIRE DETECTION	151
Figure 75	WHEEL WELL FIRE DETECTOR	153
Figure 76	WHEEL WELL FIRE DETECTION CIRCUIT	155
Figure 77	EICAS MESSAGES	157
Figure 78	WING LEADING EDGE OVERHEAT DETECTION ...	159
Figure 79	OVERHEAT SWITCH LOCATION	161
Figure 80	DETECTION THERMAL SWITCHES	163
Figure 81	DETECTION CIRCUIT	165
Figure 82	CENTER DUCT LEAK OVHT DETECTION CIRCUIT .	167
Figure 83	EICAS MESSAGES	169
Figure 84	SMOKE DETECTION	171
Figure 85	SMOKE DETECTOR	173
Figure 86	DETECTION CIRCUIT	175
Figure 87	SMOKE DETECTION INDICATION	177
Figure 88	SMOKE DETECTION CIRCUIT	179
Figure 89	EICAS MESSAGE	181
Figure 90	LAVATORY FIRE PROTECTION	183
Figure 91	LAVATORY FIRE EXTINGUISHER	185
Figure 92	PORTABLE FIRE EXTINGUISHERS	187
Figure 93	HALON 1211 FIRE EXTINGUISHER	189
Figure 94	WATER FIRE EXTINGUISHER	191
Figure 95	LOCATIONS	193

