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FIRE PROTECTION - DESCRIPTION AND OPERATION

1. General
   A. Fire protection consists of a detection system and an extinguishing system. The detection system provides the means to detect a fire and/or overheat condition and alert the crew by aural and visual indications. The extinguisher system provides the means to extinguish a fire.
   B. The detection systems give warning of fire and/or overheat in the following areas: each engine, auxiliary power unit (APU), main wheel well, wings and lower aft body. A smoke detection system is also installed on Passenger/Cargo Convertible Airplanes. The smoke detection system monitors the electronic equipment compartment and the main cabin for the presence of smoke. Fire and smoke warning is indicated by warning lights on the fire protection system module, master warning lights on the lightshield module and an alarm bell in the control cabin. The APU also has a fire warning light located on the APU remote control panel and a warning horn adjacent to the panel in the right main wheel well. Overheat warning is indicated by lights on the air conditioning module and master caution lights on the lightshield module.
      (1) On 737-200 series passenger airplanes incorporating Service Bulletin 26A1081, there are smoke detectors and Cargo Electronic Units (CEU) installed in the forward and aft lower cargo compartments (Fig. 2).
   C. The extinguishing systems include a fixed engine fire-extinguishing system, a fixed APU fire-extinguishing system a fixed lavatory fire-extinguishing system and portable fire extinguishers. The fixed engine fire-extinguishing system consists of two fire extinguisher bottles, providing a two-shot extinguishing capability at either engine. The bottles are connected to each engine by manifolds and tubing. A fire switch for either engine provides the means of selecting either extinguisher bottle for discharge. The fixed APU fire-extinguishing system consists of a single extinguisher bottle connected by tubing to the APU shroud. The engine and APU discharge switches are located on the fire protection module. The APU bottle may be discharged by actuating a discharge switch on the remote APU fire control panel (Fig. 2). The fixed lavatory fire-extinguishing system consists of a heat activated fire extinguisher bottle located in each lavatory. The bottle is provided to extinguish fires under the sink counter and in the towel chute.
      (1) On 737-200 series passenger airplanes incorporating Service Bulletin 26A1081, there is a fire-extinguishing bottle located in the mix manifold bay. Fire-extinguishing tubing and discharge nozzles are installed in the forward and aft lower cargo compartments that direct the extinguishing agent into the cargo compartments (Fig. 2).

D. Portable fire extinguishers (water, carbon dioxide and dry chemical type) are located at various positions in the crew and passenger cabins. They provide fire-extinguishing capability in these cabins and other areas accessible from them.

2. Fire Protection System Module

A. The fire protection system module (P8-1) contains the components necessary to monitor the fire detection system; smoke detection system and wheel well overheat detection system. The fire protection module also has facilities to control and test the fire extinguishing system and smoke detection system. The fire protection system module is located on the aft control stand electronic panel (P8). The front of the module contains the following components for fire and overheat detection: red fire warning lights for each engine and the APU, amber engine overheat lights for each engine, a red wheel well overheat light, an overheat detector switch for each engine, an APU detector inoperative light, a bell cutout switch and a fire test switch. On Passenger/Cargo Convertible Airplanes, the fire protection module also has two red cargo smoke lights. The front of the module also contains the following components for fire extinguishing control: a fire switch for each engine, left, right and APU amber bottle discharge lights, a fire extinguisher test switch, and three green fire extinguisher test circuit lights. Master caution light control circuits and fire extinguisher bottle test circuits are on cards within the module. For detailed coverage of components, refer to applicable system coverage.

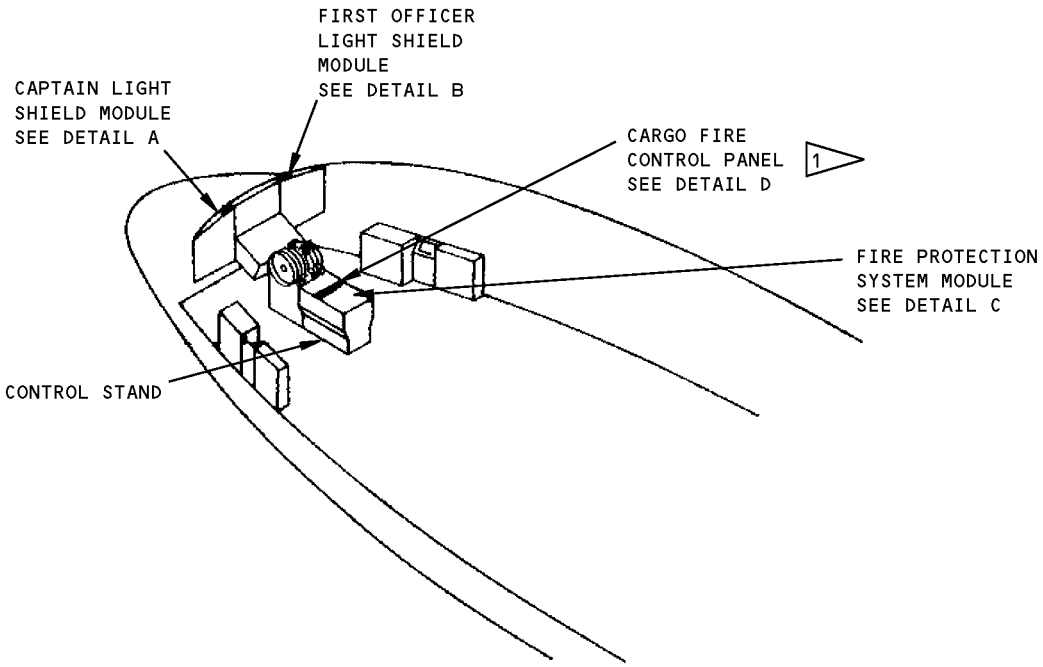
(1) On 737-200 series passenger airplanes incorporating Service Bulletin 26A1081, there is also a cargo fire control panel located on the aft control stand electronic panel (P8), that indicates fire in the cargo areas, and from which fire extinguishing agent can be dispensed to the forward or aft lower cargo area (Fig. 2).

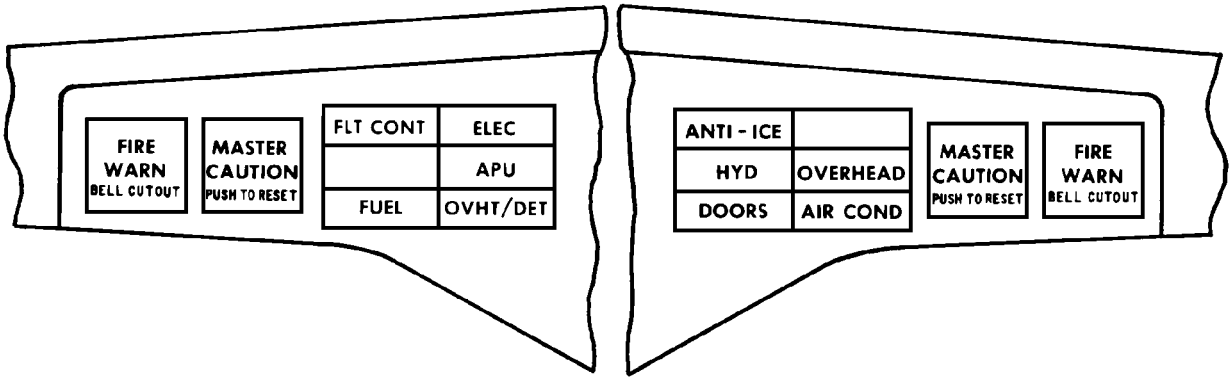
3. Lightshield Module

A. The lightshield module (P7) contains master fire warning and master caution lights and the annunciator lights necessary to warn the captain and first officer of a fire or overheat condition. For further information on the module, refer to system coverage and Chapter 33, Master Caution and Warning Lights.

4. Remote APU Fire Control Panel

A. The remote APU fire control panel (P28) contains the components necessary to visually check for a fire warning in the APU, to control the remote horn and alarm bell and to control the APU fire extinguishing system from the ground. The fire panel is located on the aft bulkhead of the right main wheel well. For detailed coverage of components, refer to applicable system coverage.





DETAIL A

DETAIL B

1 AIRPLANES INCORPORATING SB 26A1081

Fire Protection Systems Panels Locations
Figure 1 (Sheet 1)

EFFECTIVITY

ALL

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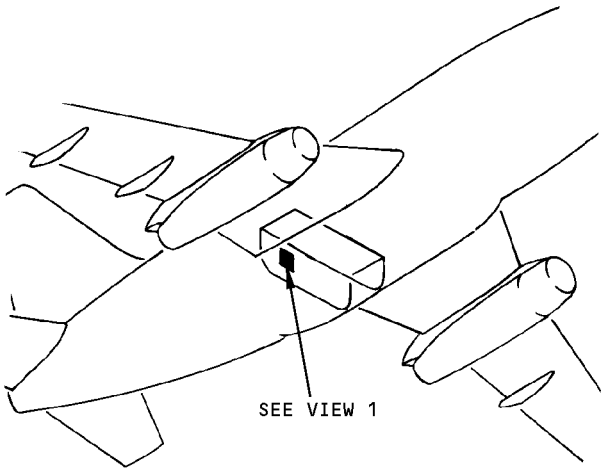
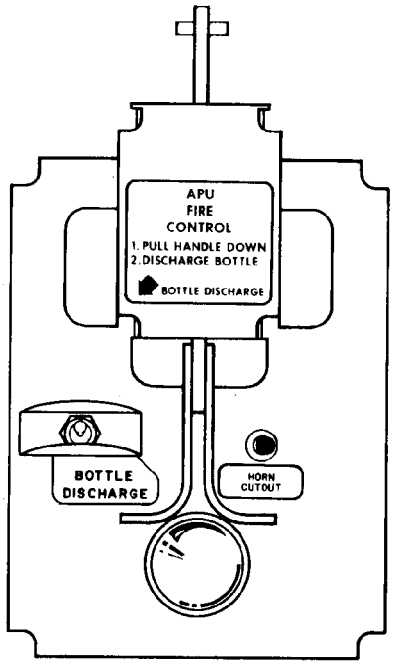
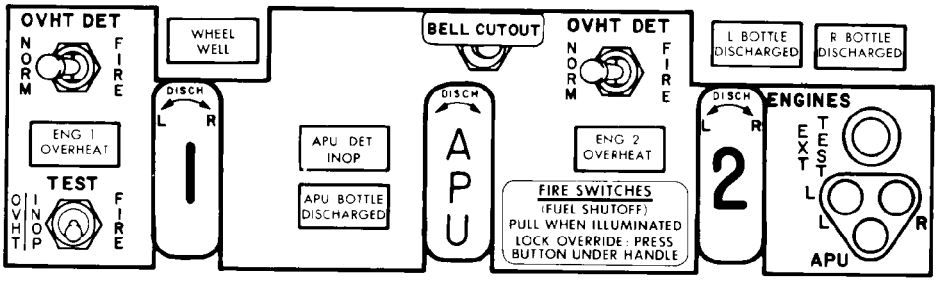
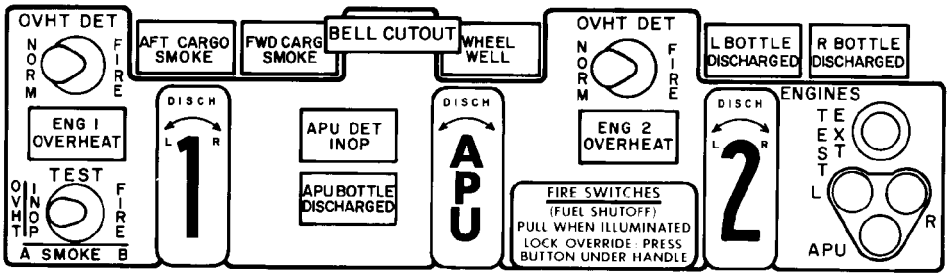




APU GROUND CONTROL PANEL
VIEW 1

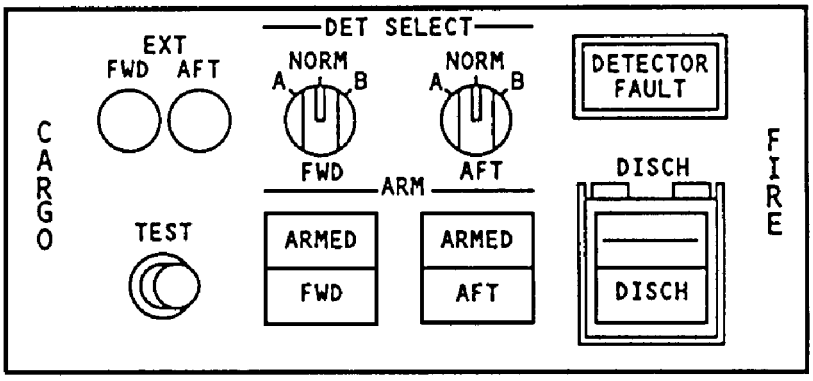


STANDARD PASSENGER AIRPLANES



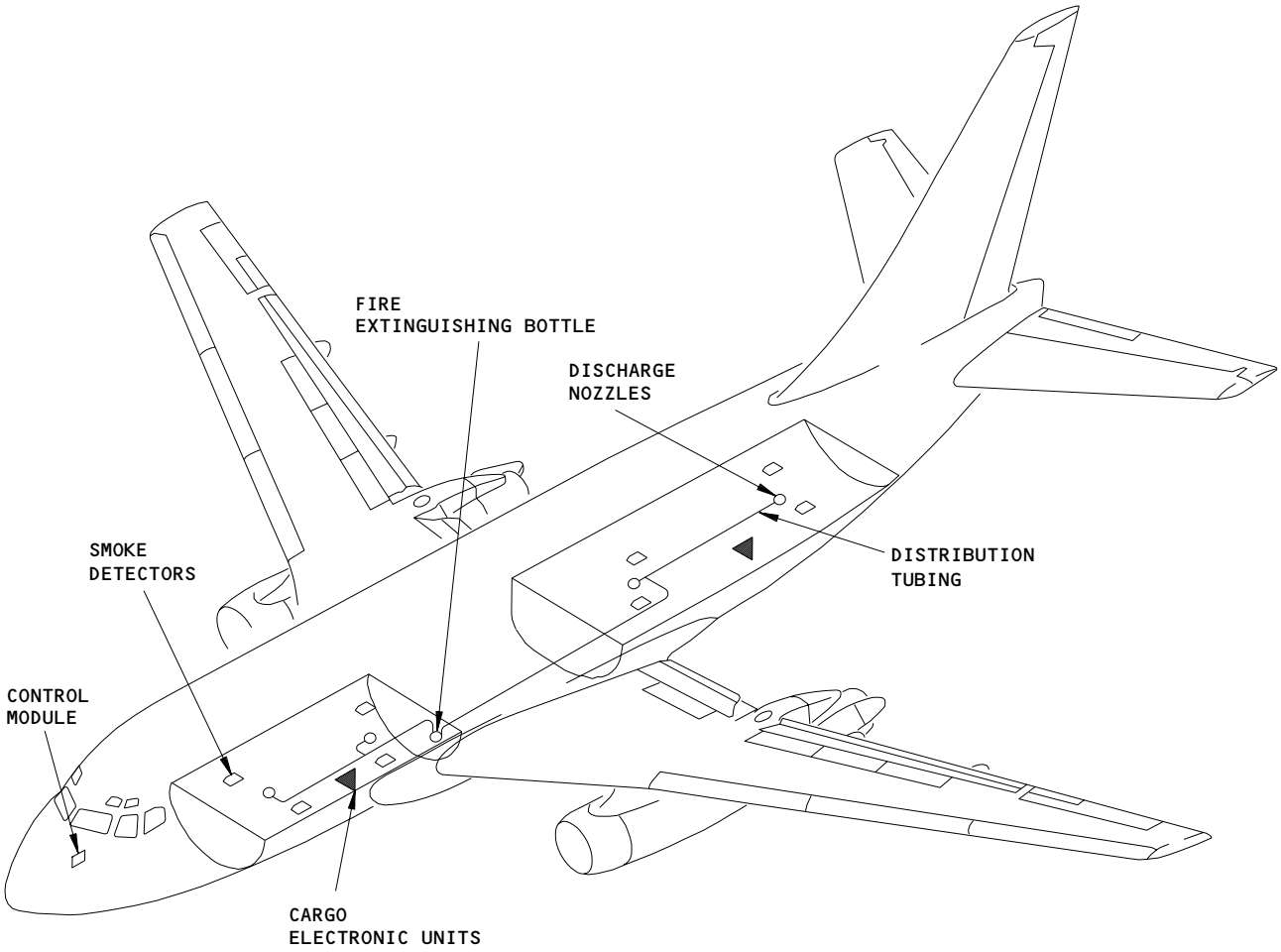
PASSENGER/CARGO CONVERTIBLE AIRPLANES
DETAIL C

Fire Protection System Panel Locations
Figure 1 (Sheet 2)



DETAIL D

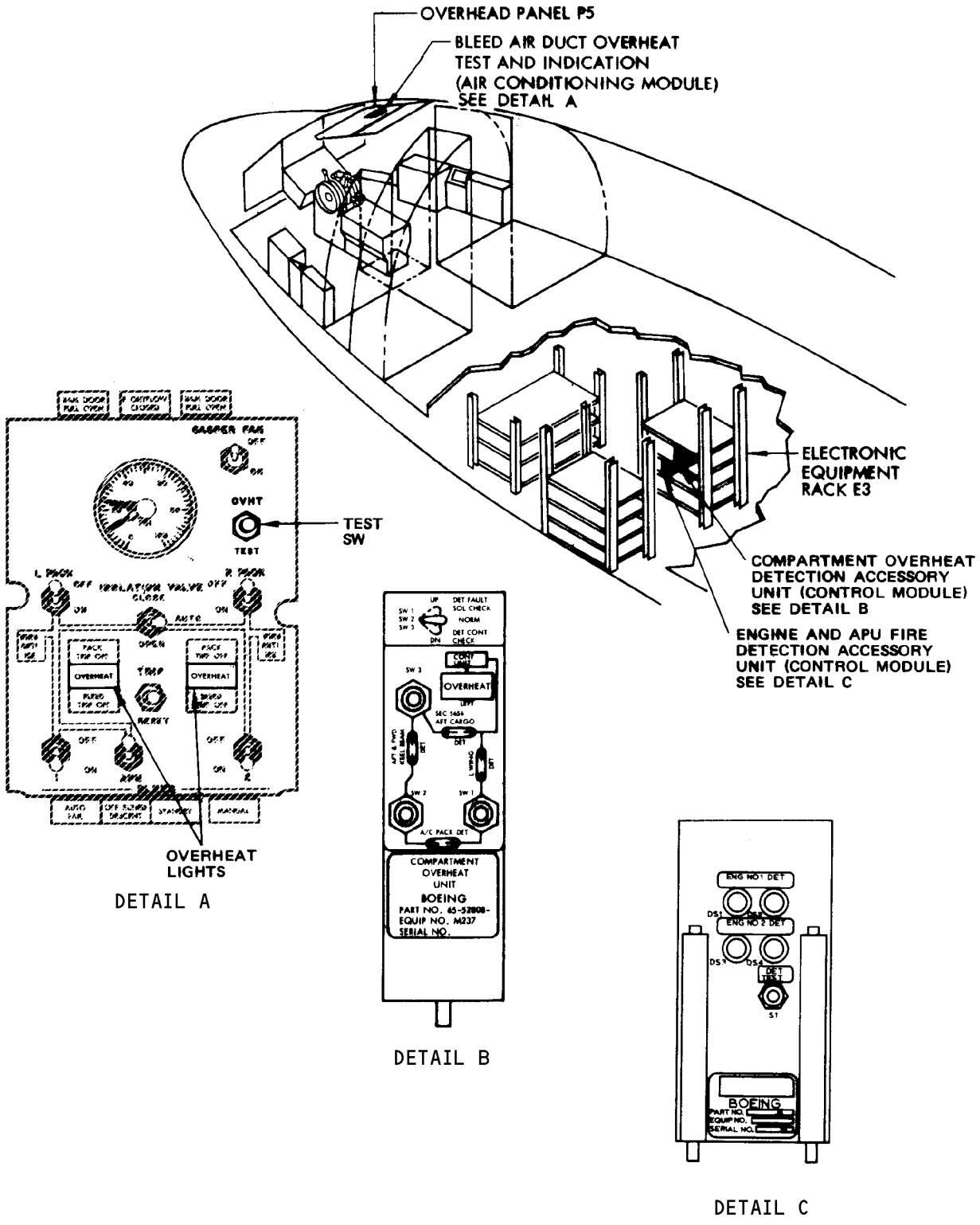
Fire Protection System Panels Locations
Figure 1 (Sheet 3)



Cargo Compartment Smoke Detection and Fire Suppression Component Location
Figure 2

DETECTION - DESCRIPTION AND OPERATION

1. General
   A. Detection is separated into two categories; fire and overheat. The detection systems include the following subsystems; engine fire detection system, auxiliary power unit (APU) fire detection system, wheel wel1 overheat detection system, and wing and lower aft body overheat detection system. The fire detection systems are basically dual loop detectors (engines) and single loop detector (APU) circuits with the sensing elements spirally wrapped about a rigid support tube and connected to the engine and APU fire detection accessory unit. The overheat detection systems are single loop detector circuits connected to the compartment overheat detection accessory unit.
2. Engine and APU Fire Detection Accessory Unit (Control Module)
   A. The engine and APU fire detection accessory unit contains all components necessary for fire detection, except the sensing elements, system control switches and indicators. The accessory unit is located on electronic equipment rack E3 in the electronic compartment. The accessory unit contains a detector control card for each sensing loop in the engine and APU areas, relays for fire warning and short circuit discrimination tests, aural warning and master warning light control circuits, a detector test switch and four amber detector inoperative lights (Fig. 1).
3. Compartment Overheat Detection Accessory Unit (Control Module)
   A. The compartment overheat detection accessory unit contains all components necessary for overheat detection, except the sensing elements, system control switches and indicators. The accessory unit is located on electronic equipment rack E3 in the electronic compartment. The accessory unit contains three overheat control units. An alarm cutout control card. A wheel well overheat test relay. An overheat test relay. test switches and a test light. The overheat control units are connected to sensing loops in the wheel well area, the right overheat section and the left overheat section (Fig. 1).
4. Bleed Air Duct Overheat Test and Indication Section
   A. The bleed air duct overheat test and indication section is part of the air conditioning module P5-10 on overhead panel P5 and contains the left and right overheat detection system lights to provide a visual means of monitoring overheat conditions along the air conditioning bleed air ducts. A test switch provides the means to test the overheat detection system (Fig. 1). For further information on the module, refer to system coverage and Chapter 21, Air Conditioning.



Detection Systems Accessory Unit Location
Figure 1

ENGINE AND APU FIRE DETECTION ACCESSORY UNIT - REMOVAL/INSTALLATION

1. General
   A. The following procedure assures proper mating of electrical connectors while removing and installing the fire detection accessory unit (M279).

      CAUTION: IMPROPER ADJUSTMENT OF ASSEMBLIES ON EQUIPMENT SHELVES MAY CAUSE CIRCUIT MALFUNCTION OR EQUIPMENT DAMAGE.

   B. Lever latches are used for movement and retention of accessory units mounted on racks. This unit consists mainly of a handle and trigger (Fig. 401). Accessory units are held in position by engagement of a hook on the lever-latch handle with a fork-type catch on the rack. Correct adjustment of the lever-latch fork is necessary to assure proper connector engagement.
2. Remove Engine and APU Fire Detection Accessory Unit (Fig. 401)

   CAUTION: SOME E/E BOXES ARE STATIC SENSITIVE. DO NOT HANDLE BEFORE READING PROCEDURE FOR HANDLING ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (REF 20-40-12). BOXES CONTAIN DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

   A. Open these circuit breakers on the P6 panel:
      (1) FIRE PROTECTION DETECTION - ENG NO. 1
      (2) FIRE PROTECTION DETECTION - ENG NO. 2
      (3) FIRE PROTECTION DETECTION - APU
   B. Press on the latch to let the levers move away from handle.
   C. Move the levers down to force the unit away from the shelf-mounted connector.
   D. Remove the unit from the shelf.

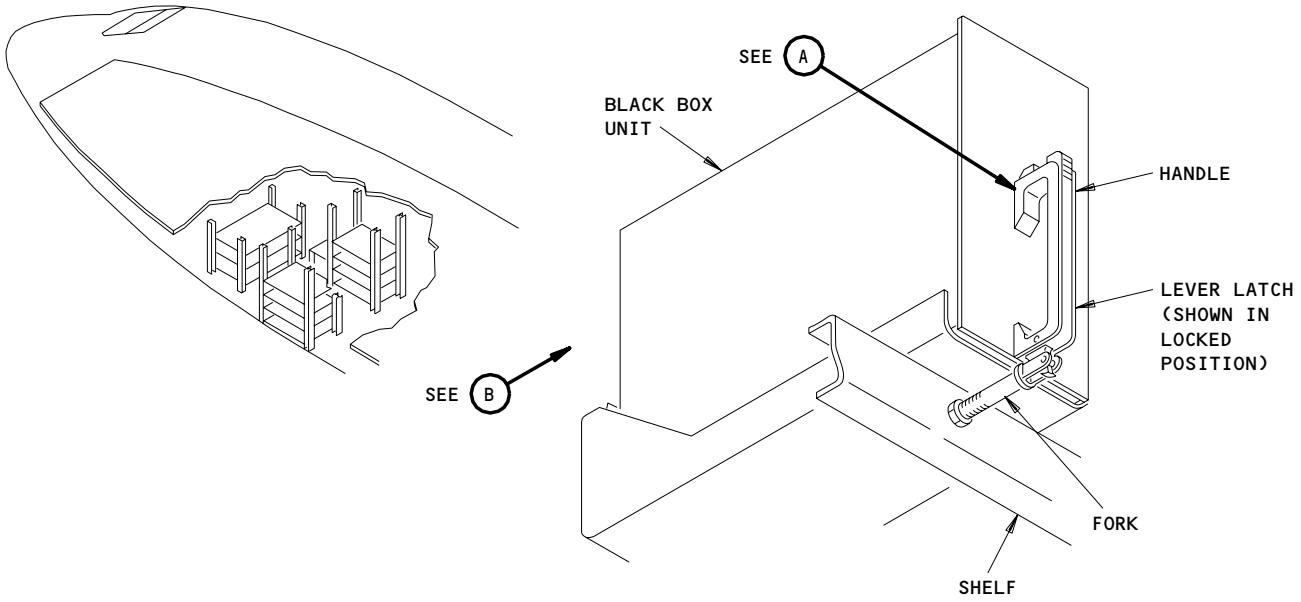
      NOTE: To prevent foreign object contamination or damage, cover all ports, openings and electrical connectors of unit or shelf with plastic caps or bags.

3. Install Engine and APU Fire Detection Accessory Unit (Fig. 401)

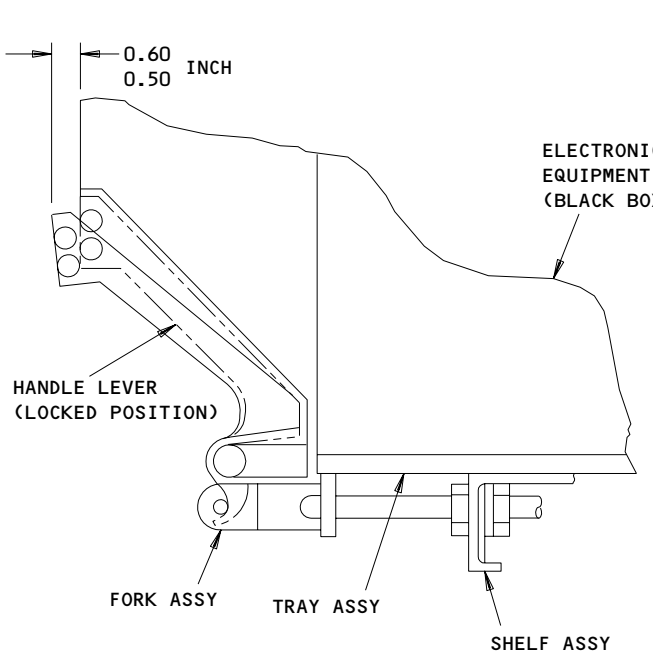
   CAUTION: ELECTRICAL PINS ON E/E BOX CONNECTOR AND TRAY CONNECTOR MUST NOT BE BENT OR DAMAGED. INSTALLATION OF E/E BOX WITH DAMAGED PINS COULD RESULT IN DAMAGE TO E/E BOX, TRAY ELECTRICAL CONNECTOR, OR SYSTEM COMPONENTS.

   A. Slide the unit into shelf with the levers in the open position until the levers engage in the shelf-mounted fork.

      NOTE: Remove any protective caps or bags from unit or shelf prior to installation.



TYPICAL LEVER LATCH TYPE RETENTION



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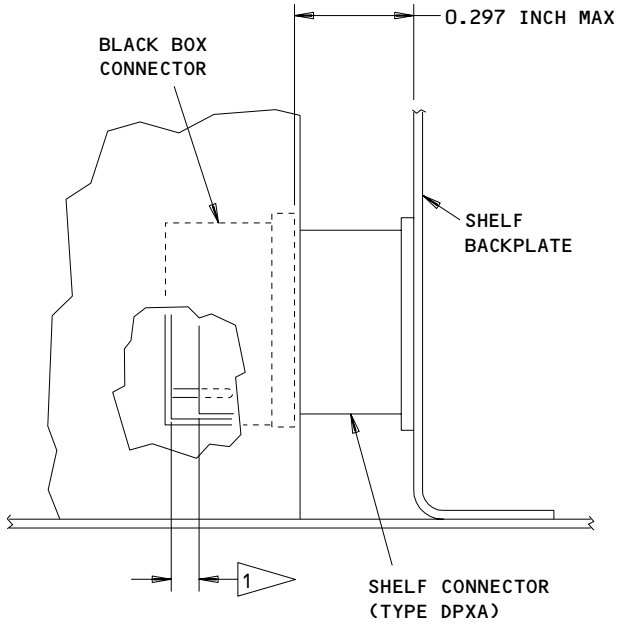


TYPICAL MATED ELECTRICAL CONNECTORS

B

NOTE: DIMENSIONS MAY BE MEASURED BY PUTTY OR A PAPER SLEEVE OR RING OF A SUITABLE LENGTH THAT WILL BE CRUSHED WHEN THE CONNECTOR IS MATED PROPERLY.

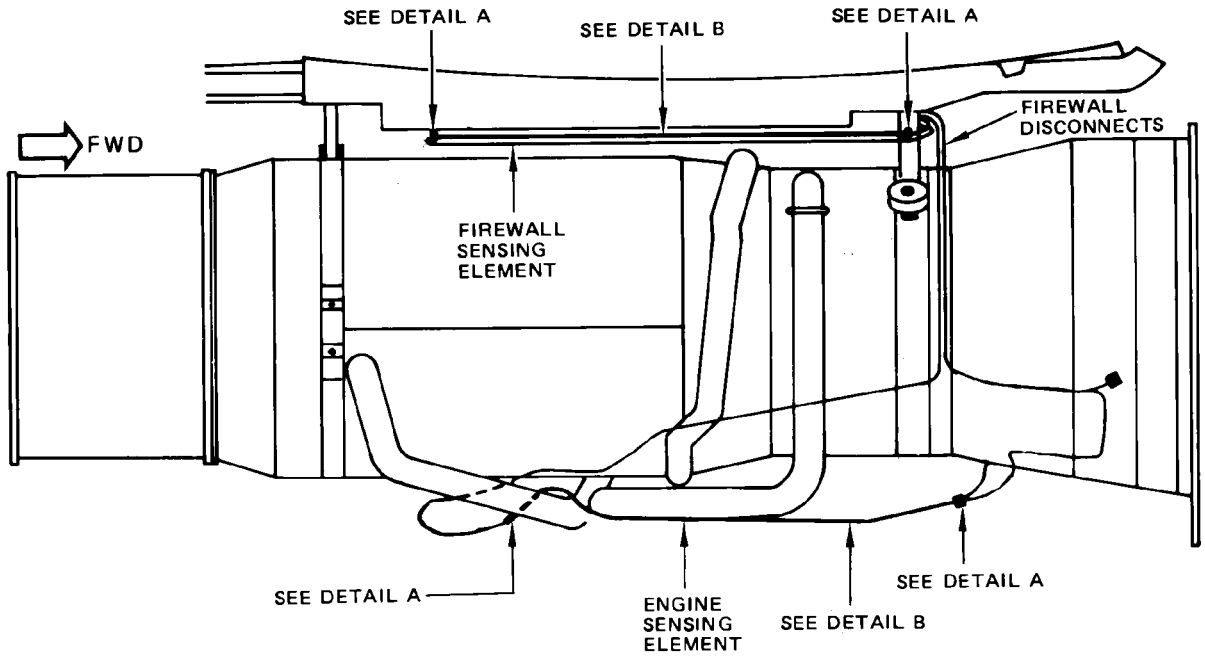
1 0.09 INCH MAX FOR ANY CONNECTOR FULLY MATED (ALTERNATE METHOD)

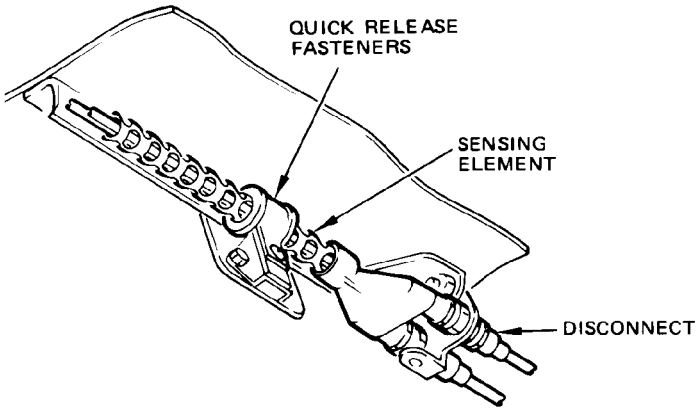
Electrical/Electronic Black Box Installation
Figure 401

B. Move lever-latch to its locked position.
   (1) The connectors shall mate to the dimensions of detail B (Fig. 401).
   (2) If necessary, adjust the fork so that with connector properly mated and the lever open 0.50 to 0.60 inch from the locked position, the fork just puts pressure on the lever (Ref 20-10-111).
C. Do the engine fire detection system test (Ref Engine Fire Detection System - Adjustment/Test).
D. Do the APU fire detection system test (Ref APU Fire Detection System - Adjustment/Test).
E. Restore airplane to normal.

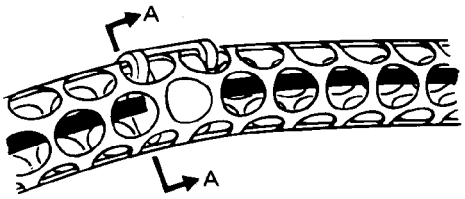
ENGINE FIRE DETECTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The engine fire detection system provides fire detection for each engine and firewall. Fire detection is provided by shrouded sensing elements mounted on the engine side of the horizontal firewall and along the bottom of the engine (Fig. 1). The detection system is an electrical heat sensing system that responds to a general overheat condition or a localized fire condition by activating warning lights and an alarm bell.
   B. The engine fire detection system consists of the fire protection system module; engine and APU fire detection accessory unit (control module), alarm bell, master warning and caution lights and sensing elements. Each engine fire detection system consists of high (fire) and low (overheat) thermistor type sensors enclosed in a shroud. Each sensor is connected to the transistorized engine and APU fire detection accessory unit. The accessory unit contains the high and low detector control cards, test circuits and warning component control circuits. For APU coverage, refer to 26-15-0, APU Fire Detection System. The high or low detector control card monitors the electrical resistance of their associated sensors. The control card circuit discriminates between a fire and overheat condition or a short circuit. The overheat or fire warning lights and alarm bel1 will actuate when a temperature rise causes the sensor resistance to drop to the design value corresponding to the alarm temperature. The detector inoperative light will illuminate when a short is sensed in the detection circuit.
   C. The engine fire detection system can be tested in flight or on the ground by operation of the fire test switch (Fig. 2). The fire test switch circuit checks continuity through the system by electrically simulating a fire or overheat condition on both engines. This energizes overheat warning lights or the alarm bell and fire warning lights. The detector test switch (on engine and APU fire detection accessory unit) supplies a ground across the control card sensing element terminals, causing the detector inoperative lights to illuminate.
2. Fire Protection System Module Components
   A. The fire protection system module components described in the following paragraphs will be only those associated with the engine fire detection system. The fire protection system module is located on aft control stand electronic panel P8. For further information on the fire protection system module, refer to 26-00, Fire Protection.

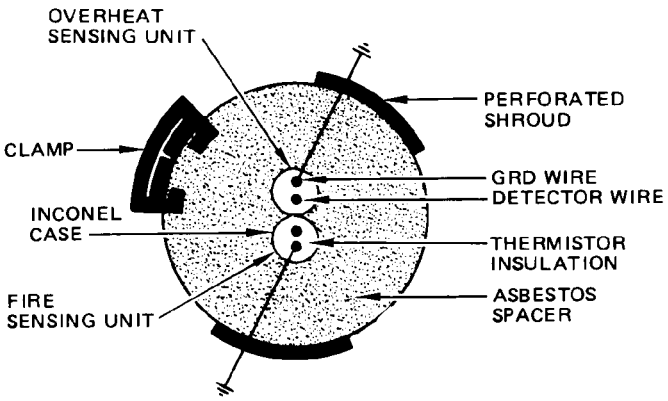




DETAIL A

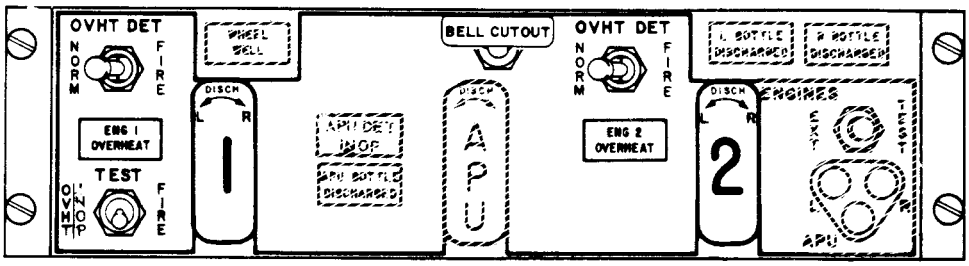


DETAIL B

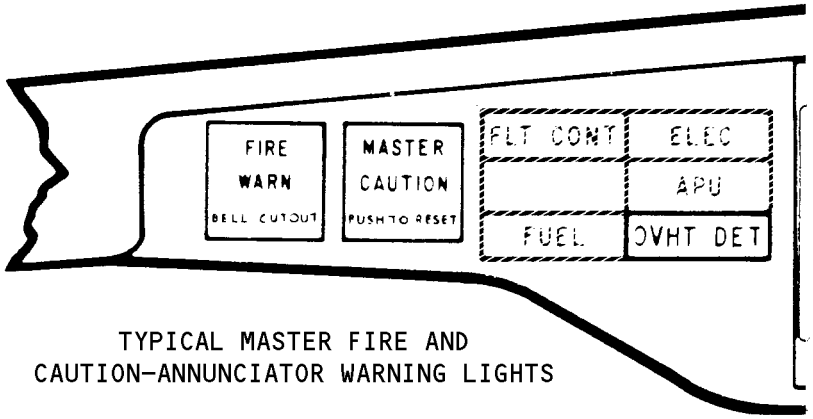


SECTION A-A
(ENLARGED)

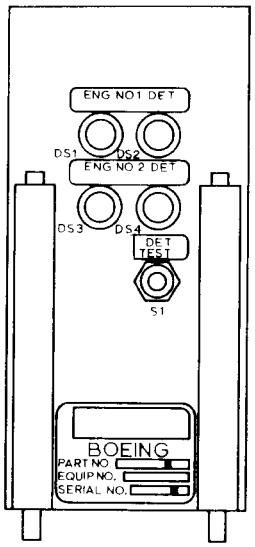
Engine Fire Detection System Component Location
Figure 1 (Sheet 1)



ENGINE FIRE DETECTION INDICATION
AND CONTROLS (FIRE PROTECTION MODULE)

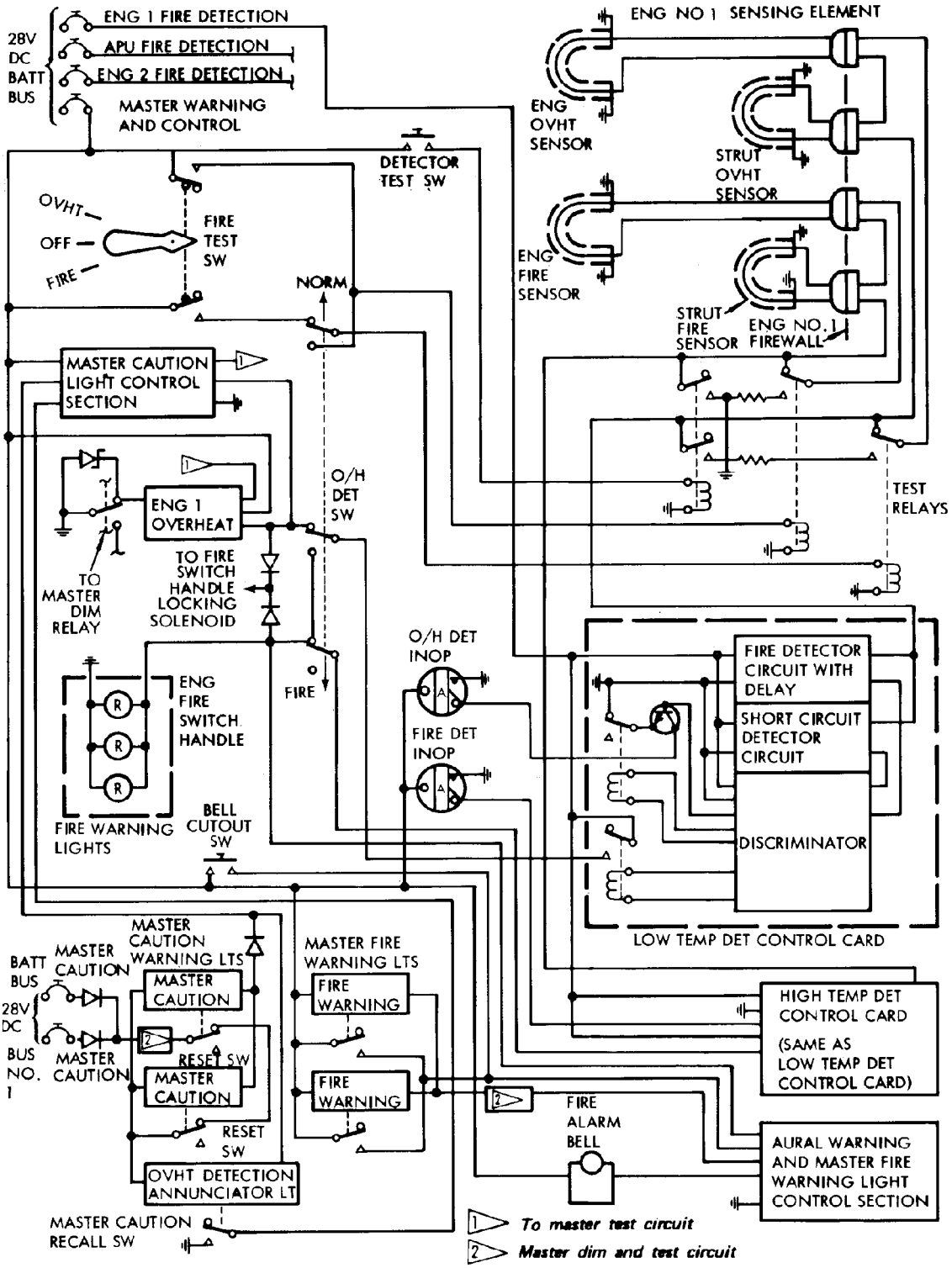


TYPICAL MASTER FIRE AND
CAUTION-ANNUNCIATOR WARNING LIGHTS



ENGINE AND APU FIRE DETECTION
ACCESSORY UNIT (CONTROL MODULE)

Engine Fire Detection System Component Location
Figure 1 (Sheet 2)



Engine Fire Detection System Schematic
Figure 2

B. Overheat Detector Switch

(1) Two double-throw, locking, toggle actuated overheat detector switches permit selection of the overheat detection system as the primary fire detection system if the fire detection system for the associated engine has a malfunction. In the NORM (locked) position, the overheat and fire warning indicators are connected through the overheat detector switch to the applicable high and low temperature detector control cards in the engine and APU fire detection accessory unit. In the FIRE position, the low temperature detector control card is connected to the fire warning indicators and the high temperature control card and overheat warning indicators are isolated from the system (Fig. 2). The switch is locked in the NORM position. FIRE is selected by lifting the handle assembly out of detent and moving the toggle to the FIRE position.

(2) Fire and overheat sensors are on each engine to provide a greater degree of airplane dispatch readiness and to give a clearer indication of an overheat of fire condition. The fire detection system used, is dependent on the overheat detector switch position. If the fire (high temperature) detector system on one engine becomes inoperative and fails to test satisfactorily before an airplane is dispatched, the overheat detector switch may be moved to the FIRE position. The airplane may then be dispatched.

C. Master Caution Lights Control Section

(1) The master caution lights control section provides control of the master caution lights and the overheat detector annunciator light on lightshield module P7. The control section is a solid state switching circuit.

(2) When an overheat condition occurs from either engine, the appropriate overheat detector control card provides a 28-volt dc signal to the control section. The control section provides a ground which allows the master caution lights and overheat detector annunciator light to illuminate. The control section may be reset by pressing the lens cap of either master caution light. When the lens cap is pressed, the light circuit is broken and a silicone controlled rectifier (SCR) in the control section will stop conducting, thus removing the ground and turning out the lights. The associated part of the control section will remain reset until the master caution lights and annunciator light are recalled by pressing the annunciator lights panel.

D. Warning Lights
(1) Red fire warning lights in the fire switch handles provide engine ready fire warning. The warning lights are normally connected to the fire detector control card of the associated engine. The lights may be connected to a overheat detector control card through the overheat detector switch in the event of a high temperature card malfunction. A fire or overheat condition, as applicable, in either engine will cause steady illumination of the associated fire and master fire warning lights (Fig. 2). Each warning light consists of several bulbs covered by a red translucent plastic lens in the fire switch handle.
(2) Amber engine overheat lights are provided for engine overheat warning. The overheat lights are normally connected to the low temperature detector control card of the associated engine. An overheat condition at either engine will cause the steady illumination of the associated overheat and master caution-annunciator warning lights (Fig. 2).
(3) The overheat warning lights may be tested individually by a press-to-test feature or they are tested when the master test switch is closed.

E. Test Switch
(1) The fire test switch has three positions: OVHT-off-FIRE. The switch is spring-loaded to the off position. The switch permits testing of the overheat or fire detection systems by checking sensor continuity and simulating a fire or overheat condition (Fig. 2).

F. Bell Cutout Switch
(1) A pushbutton switch is provided for alarm bell control. Pressing the switch provides 28 volts dc to the aural warning and master fire warning light control section in the fire detection accessory unit. The control circuits then silence the bell and extinguish the master fire warning lights (Fig. 2).

3. Engine and APU Fire Detection Accessory Unit Components
A. The engine and APU fire detection accessory unit (control module) components described in the following paragraphs will be only those associated with the engine fire detection system. The engine and APU fire detection accessory unit is located on electronic equipment rack E3 in the electronic compartment. For further information on the engine and APU fire detection accessory unit, refer to 26-10-0, Fire Detection.

B. Detector Control Cards
   (1) High (fire) and low (overheat) detector control cards for each engine are located in the accessory unit. The control cards contain fire detection and short circuit discrimination circuitry necessary to continuously monitor resistance of the applicable sensing element and to trigger overheat warning, a fire warning or short circuit indication. The control card resistance trip level is fixed during assembly of the card and does not require or permit adjustment. The sensor is connected in series with the control card to form a closed circuit sensing loop. A zener diode regulator in each control card protects the circuit from input voltage transients.
   (2) Each control card consists of two resistance monitoring circuits, a fire warning circuit set to trip at a resistance corresponding to a desired alarm temperature and a short circuit discriminator circuit which can differentiate between a sensing loop resistance drop caused by a mechanical short or by heat (fire). The fire warning circuit is deactivated by the short circuit discriminator if a direct short is applied across the sensor circuits.

C. Aural Warning and Master Fire Warning Lights Control Section
   (1) The aural warning and master fire warning lights control section provides control of the alarm bell in the aural warning devices box and the master fire warning lights on lightshield module P7. The control section consists of solid s- state switching circuit mounted on cards.
   (2) When an alarm condition occurs at either engine, the appropriate control card will supply a 28 volt dc control signal. The warning control signal will supply 28 volts dc to the fire warning lights in the fire switch handle, on the fire protection module, turn on the two transistors in the bell and light control section, and unlock a solenoid holding the fire switch handle. The transistors ground the bell and master fire warning light circuit thus causing them to actuate. When the bell cutout switch or a master fire warning light is pressed, a positive trigger signal is supplied at the gate of an SCR in the bell control circuit. The SCR then conducts and turns off the transistor in the bell control circuit. The transistor stops conducting and de-energizes the bell and extinguishes the master fire warning lights. The SCR will continue to keep the transistor turned off until the alarm condition clears. However, the fire switch handle lights cannot be de-energized as long as a fire signal exists on the selected sensing loop. If the alarm condition clears before the bell cutout switch is pressed, the control signal to the transistors is removed; the transistors stop conducting, the bell and master fire warning lights are de-energized and the fire handle lights are de-energized. Either the fire or overheat control card may supply the warning signal, depending on the position of the overheat detector switch.

D. Detector Test Switch
(1) A pushbutton switch on the front of the accessory unit may be used to test all detector control cards for reaction to a simulated short circuit (Fig. 2). Pressing the test switch causes test relays to energize which then short the sensors and connects a ground to the detector control cards. The short discriminator circuit should detect the ground and cause the detector inoperative lights to illuminate. The lights will extinguish when the test switch is released.

E. Detector Inoperative Lights
(1) Four press-to-test type amber detector inoperative lights, mounted on the front panel, provide an indication of a short circuit in the engine and APU fire and overheat detection systems. A short circuit on the fire or overheat sensors will cause the steady illumination of the applicable detector inoperative light (Fig. 2).

4. Alarm Bell
A. The alarm bell warns of fire conditions in the engine or APU with a steady ringing. The bell is controlled by the aural warning and master fire warning lights control section of the engine and APU fire detection accessory unit (Fig. 2). The alarm bell is located in the aural warning devices box, refer to Chapter 31, Aural Warning and Call Devices.

5. Master Fire Warning and Master Caution Lights
A. The master fire warning and master caution lights are located on lightshield module P7. The lightshield is located in a direct line of sight for both the captain and first officer. When a fire or overheat condition occurs the fire warning or caution lights will alert the crew to the type of problem that exists.
B. The master fire warning light will alert the crew of a fire condition in either engine. The master fire warning lights are controlled by aural warning and master fire warning lights control section of engine and APU fire detection accessory unit (Fig. 2). A warning light is located on each side of the lightshield for the captain and first officer. Either light may be depressed for bell cutout and extinguishing of the master fire warning lights.
C. The master caution and overheat detector annunciator lights alert the crew to an overheat condition at either engine. The master caution and annunciator lights are controlled by the master caution light control section of the fire protection system module (Fig. 2). The overheat detector annunciator light is located at the left side and a master caution light is located at each side of the lightshield. Either master caution light may be pressed to reset the master caution system. The annunciator light panel may be pressed to recall the warning on the lightshield, if the fault still exists. For further information, refer to Chapter 33, Master Caution and Warning Lights.

6. Sensing Elements
   A. Sensing elements provide overheat and fire detection at each engine. Elements are mounted above the engine on the horizontal firewall and on the bottom of the engine, and on some airplanes a third element is installed on the lower surface of each engine tailpipe. The sensing elements are attached by quick-release clamps. Each sensing element consists of two sensors mounted in a perforated metal tube. One sensor detects overheat temperatures and the other fire temperatures (Fig. 1).
   B. The resistance of a sensor varies inversely as it is heated; hence, as sensor temperature is increased, it's resistance decreases. Each sensor is composed of two wires imbedded in thermister material which is encased in a heavy wall inconel tube for high strength at elevated temperatures. The electrical connectors at each end of the sensor are ceramic insulated. The inconel tubes are shrouded in a perforated stainless steel tube and supported by teflon-impregnated asbestos bushings at intervals. The shroud protects the sensor from breakage due to vibration, abrasion against airplane structure and damage from maintenance activity.
   C. The resistance of a sensor also varies inversely with its length, the increments of length being resistances in parallel. The heating of a short length of sensor out of a given length requires that the short length be heated above the temperature alarm point in order that the total resistance of the sensor decrease to the alarm point. This characteristic permits integration of all temperatures through out the length of the installation rather than sensing only the highest local temperature.
   D. The two wires encased within the thermistic material of each inconel tube form a variable resistance network between themselves, between the detector wire and the inconel tube, and between each adjacent incremental length of sensor. These variable resistance networks are monitored by the application of 28 volts dc to the detector wire from the detector control unit.
7. Operation
   A. Normal Operation
      (1) Normal fire detection is automatic when power is supplied to the airplane and the fire detection, master warning and control, and master caution circuit breakers are closed. The overheat detector switch should be locked in the NORM position.

(2) If a fire or overheat condition occurs in the engine area, the two sensors in a shrouded sensing element are subjected to a temperature rise. The fire and overheat sensors are connected to the associated fire and overheat temperature detector control card. The control cards are connected to the associated fire and overheat warning indicators through the overheat detector switch. The temperature rise will cause the resistance value of both sensors to decrease. At a predetermined resistance value corresponding to alarm temperature, the low temperature detection control card will trigger an overheat warning circuits. The circuits will activate the respective engine overheat warning light, release the lock on the engine fire switch and illuminate the master caution and overheat annunciator lights. The master caution and overheat annunciator lights may be extinguished by pressing the master caution light. If the warning is overheat only, no further indication will be received. If a fire condition exists, the temperature in the engine compartment will continue to rise causing the resistance of the high temperature sensor to continue to decrease. At a predetermined resistance value, corresponding to the alarm temperature, the high temperature detector control card will trigger a fire warning circuit. The circuit will activate the associated engine fire switch lights, release the lock on the engine fire switch, illuminate the red master fire warning lights and sound the alarm bell. The alarm bell may be silenced and the master fire warning lights extinguished when either the bell cutout switch or the lens cap of either master fire warning light is momentarily pressed. The associated overheat light will remain on. If an overheat condition exists, the applicable engine should be monitored and corrective action taken. When the fire warning lights come on, a fire is assumed to exist and should be extinguished. Refer to 26-21-0, Engine Fire Extinguishing System. When the fire is extinguished, the compartment temperature and sensor resistance values should return to normal, the fire and overheat signals removed and the fire warning lights extinguished.

(3) During normal operation, if a high temperature (fire) detector control card or sensor becomes inoperative and fails to test satisfactorily, the flight may be dispatched (or continue its flight) by unlocking (pulling) the overheat detector switch and moving it to the FIRE position. With the switch in the FIRE position, the overheat indicating components are bypassed and the warning signal from the low temperature (overheat) detector control card is fed directly to the fire warning indicating components. If a fire warning indication is presented when the overheat detector switch is in the fire position, it should be assumed a fire condition exists and appropriate action taken.

(4) During normal operation, an amber fire or overheat detector inoperative light will illuminate if a sensor or the monitoring circuit should fault to ground. The detector inoperative lights are located on the engine and APU fire detection accessory unit. When a short circuit occurs, the sensing loop resistance drops rapidly to a low value (less than 1/2 the alarm resistance). When the sensing loop resistance is instantly reduced below 1/2 the fire trip resistance, the fire detecting circuit in the engine and APU fire detection accessory unit does not actuate because of a trim delay circuit. The lower resistance actuates the short discriminator circuit which locks out the fire detecting circuit so that the fire warning circuit cannot actuate after the expiration of the delay period. The short discriminator circuit on the control card provides a ground path for the applicable detector inoperative light. Normally, if a fire occurs, the resistance of the sensing loop drops relatively slowly and after reaching the fire trip resistance, will not decrease rapidly enough to reach the short circuit trip resistance before expiration of the time delay period. The fire detector circuit causes a fire alarm relay on the control card to be energized. The relay isolates the short monitoring circuit to prevent a short signal when the fire lowers the sensing loop resistance below the short circuit trip value. Most short circuits are intermittent, and the system is fully capable of detecting fire during the absence of the short. In the case of a steady short, the applicable detector "fails safe," that is, it becomes inoperative but does not give a false alarm.

NOTE: If an overheat or fire detection system fails to test, monitor the detector inoperative light, located on the front of the engine and APU fire detection accessory unit in the electronic compartment, prior to performing any other tests.

B. Test Operation

(1) A fire detection system continuity test can be made by moving the fire test switch, on the fire protection module, to FIRE. The fire warning indicating components should come on and then go off when the switch is released. A test relay for each engine system grounds the high temperature sensor through a resistor thus simulating a fire and providing a fire signal at each high temperature detector control card. The resistor is required to raise the resistance on the associated sensing loop above the short circuit trip resistance during the fire test.

NOTE: Should a fire warning light fail to illuminate during a fire test, a malfunction of the detector circuit is indicated. Fire protection can be maintained by unlocking the overheat detector switch and moving it to the FIRE position.

(2) An overheat detection system continuity test can be made by moving the fire test to OVHT. The overheat warning indicating components should come on and then go off when the switch is released. A test relay for each engine grounds the low temperature sensor through a resistor thus simulating an overheat condition and providing an overheat signal at each low temperature detector control card. The resistor is required to raise the resistance on the associated sensing loop above the short circuit trip resistance during the fire test.

(3) A short circuit discriminator circuit continuity test can be made by pressing the DET TEST switch on the front of the engine and APU fire detection accessory unit. The detector inoperative lights should come on and then go off when the switch is released. A test relay for each detector system grounds the associated sensors thus creating a short across each detector control card sensing element terminals. The short circuit discriminator section of each card wil1 then illuminate the associated detector inoperative light.

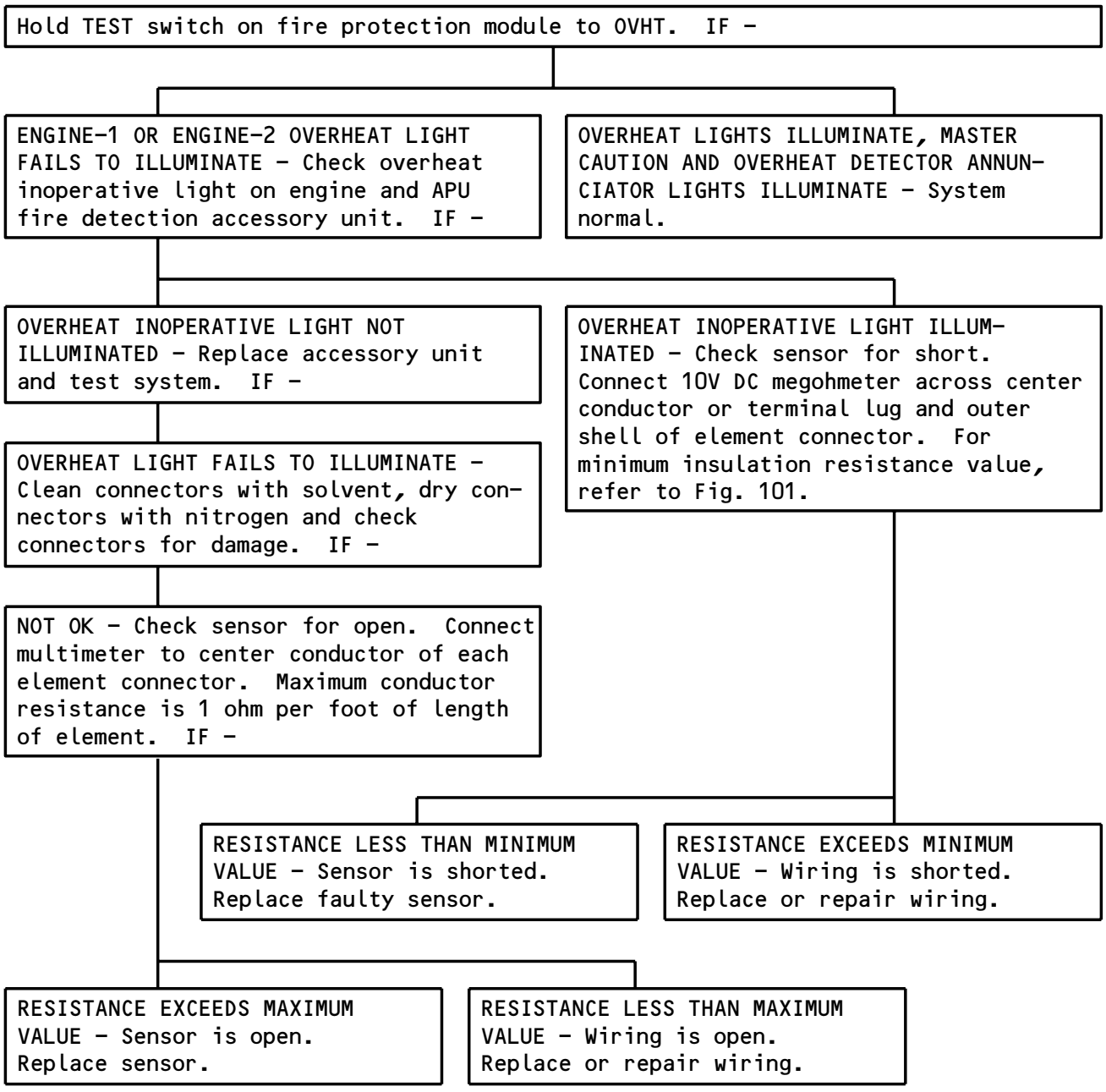
ENGINE FIRE DETECTION SYSTEM - TROUBLESHOOTING

1. General
   A. Fire detection system trouble will usually be indicated by absence of fire warning lights and alarm bell or overheat lights when the test switch is operated on the fire protection module, or by a false alarm. If a short circuit has occurred on a sensing line, the associated detector inoperative light on the engine and APU fire detection accessory unit will probably be illuminated. If an open circuit has occurred, the associated warning lights and detector inoperative lights will not be illuminated when the system is tested. Lights on the fire protection module, master caution annunciator and fire warning lights should be tested before assuming the detection system is faulty by operating the master lights test circuits (Ref 33-15-0 AT). The detector inoperative lights on the accessory unit may be pressed to test operation.
   B. False alarms (engine overheat or fire warnings) are usually intermittent and rarely persist for any length of time. Intermittent false warnings can occur whenever the system is subjected to vibration; i.e. engines running, in flight, taxiing, etc. False warnings can occur with the ENG OVHT DET switch in either NORMAL or FIRE position. If a false alarm should persist, isolation of the individual sensor, connector or interconnecting wiring will be required. Isolation of the faulty component can be accomplished with the help of the trouble shooting charts.
   C. The sensors and interconnecting wiring can be checked with an ohmmeter. An open sensor can be found by making a continuity check between center pins or sockets on connectors on the ends of the elements. Shorts can be found by testing for continuity between the pins or sockets and the shell of the connector. If moisture in a connector is found to be cause of false alarm, remove moisture by blowing connectors with dry nitrogen.
   D. Prior to testing, equivalent connectors should be installed at the plug or receptacle of the sensor or airplane wiring. The test connector should have exposed contact points to attach or touch test probes. If test connectors are not used, an oversized test probe may be forced into a socket of the sensor connector; this may spread the contacts and prevent the pin of the mating connector from making proper contact.
   E. Test fire protection module P8-1 after installation (AMM 26-11-0 501).
2. Prepare to Troubleshoot
   A. Check that the following circuit breakers on panel P6 are closed:
      (1) AURAL WARNING
      (2) MASTER WARN & CONTROL
      (3) All IND LIGHTS
      (4) ENG 1 FIRE DET
      (5) ENG 2 FIRE DET
   B. Open the following circuit breakers on panel P6:
      (1) WHEEL WELL WING AND LWR BODY OVHT

(2) APU FIRE DET

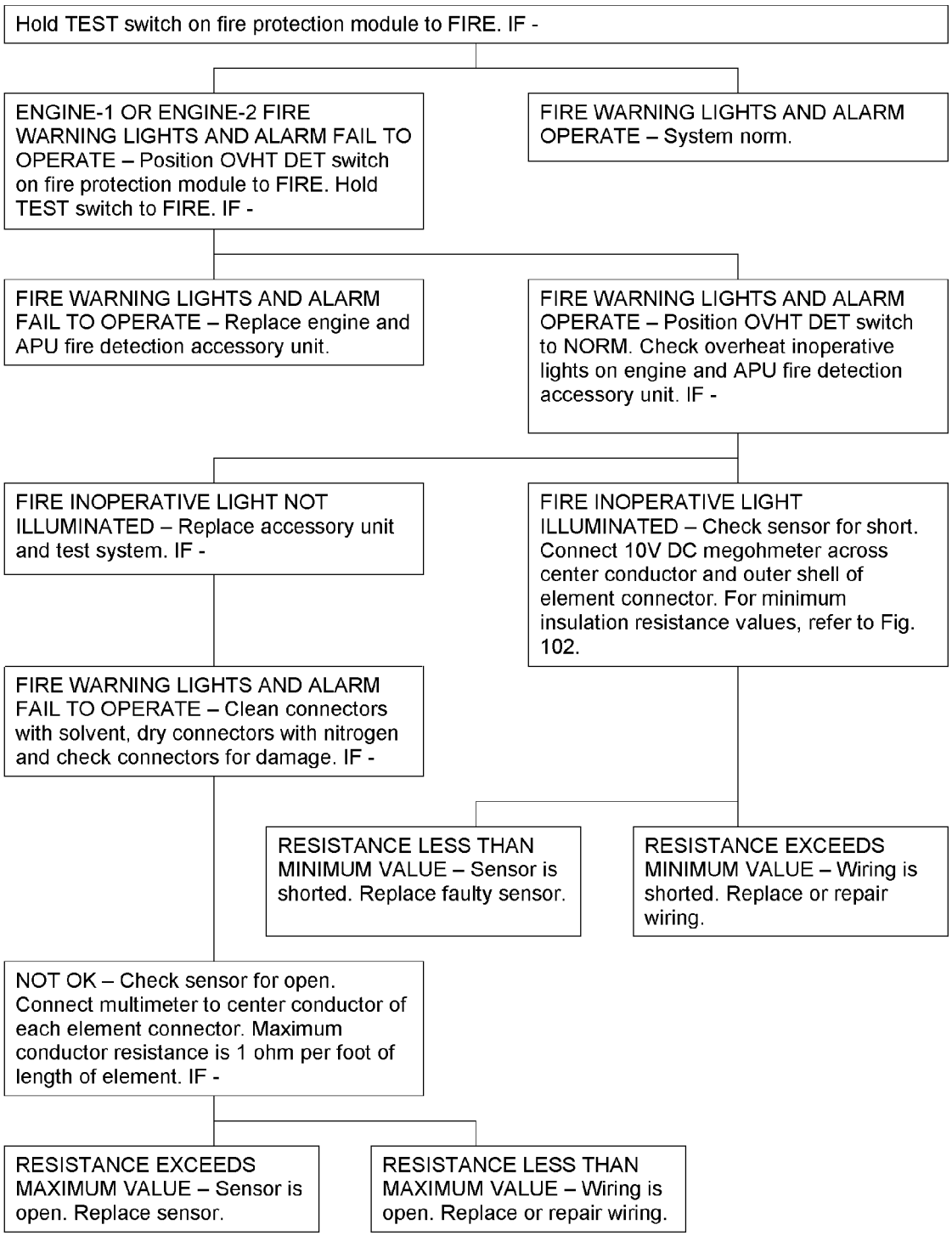
C. Apply power.

3. Overheat Detection Troubleshooting Chart
4. Fire Detection Troubleshooting Chart

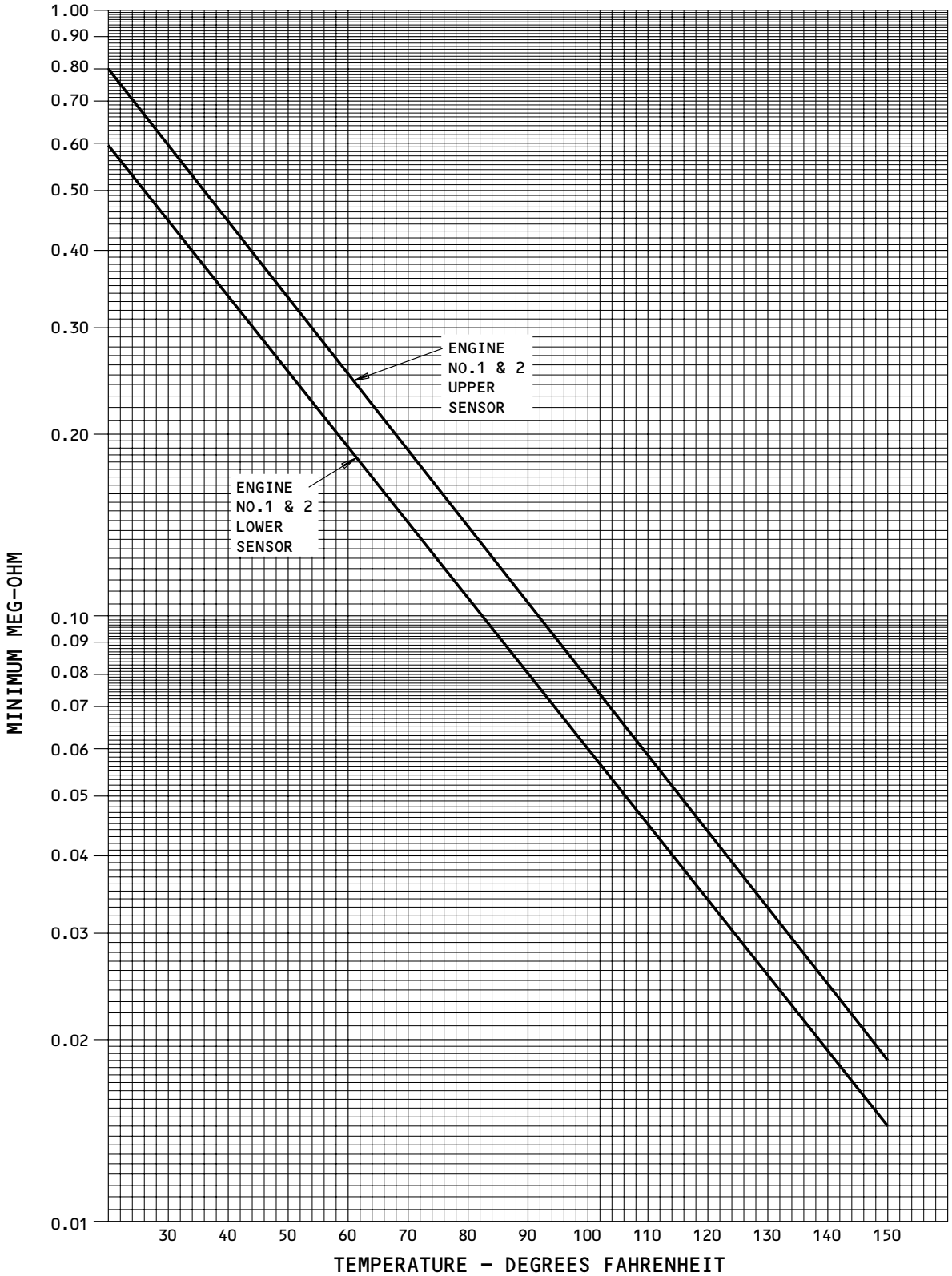


Engine Fire Detection System – Troubleshooting
Figure 101 (Sheet 1)

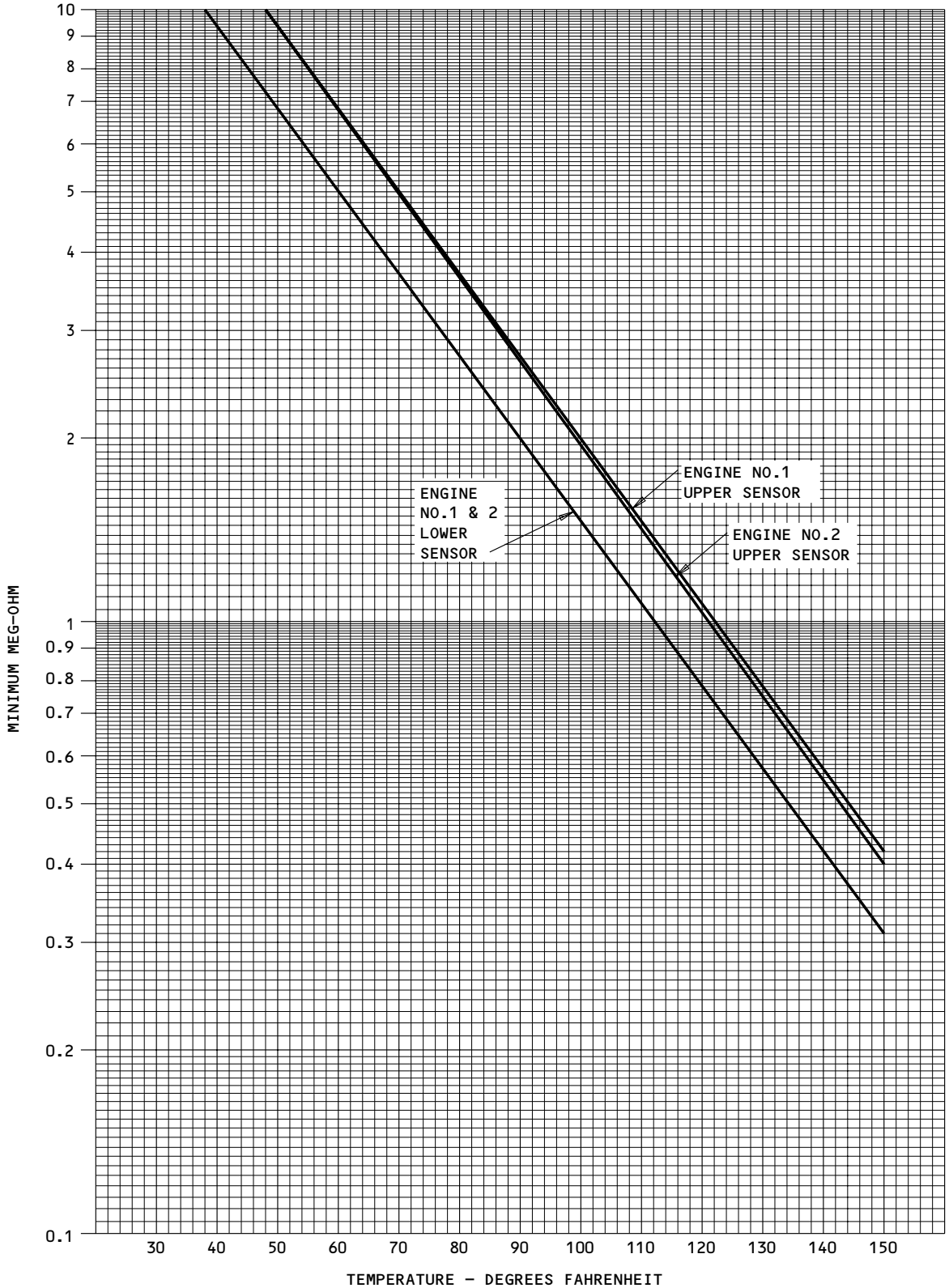
3. Fire Detection Trouble Shooting Chart



Fire Detection – Troubleshooting
Figure 101 (Sheet 2)



Overheat Detection Minimum Insulation Resistance
Figure 102



Fire Detection Minimum Insulation Resistance
Figure 103

ENGINE FIRE DETECTION SYSTEM - ADJUSTMENT/TEST

1. General
   A. The engine fire detection system monitors the engine nacelle temperature for fire and overheat or fire conditions.
   B. The system uses power from the 28-volt dc battery bus. The circuit breakers are on the P6 panel.
   C. The engine fire detection system components are: the fire detectors, the engine and APU fire detection accessory unit, and the engine and APU fire control panel.
   D. There are two tasks in this section:
      (1) Do the Operational Test of the Engine Fire Detection System
         (a) The operational test is done in a minimum of time, and uses equipment installed on the airplane to make sure that the system will operate correctly.
      (2) Do the System Test of the Engine Fire Detection System
         (a) The system test is a full check of the engine fire-detection system.
2. Do the Operational Test of the Engine Fire Detection System
   A. Prepare to do the Operational Test
      (1) Supply electrical power (Ref 24-22-0 MP).
      (2) Make sure these circuit breakers are closed:
         (a) P6 Load Control Center - Right
            1) MASTER WARN & CONTROL
            2) C405 FIRE PROT DET ENG-1
            3) C407 FIRE PROT DET ENG-2
            4) APU FIRE DET
            5) MASTER CAUTION BAT (two)
            6) INDICATOR LIGHTS MASTER DIM (nine)
            7) DIM AND TEST CONTROL
      (3) Open these circuit breakers:
         (a) P6 Load Control Center - Right
            1) WHEEL WELL WING AND LWR BODY OVHT
            2) CARGO SMOKE (Passenger/Cargo Convertible Airplanes)
      (4) Move the two OVHT DET switches on the P8-1 panel to the NORM position.
   B. Procedure
      (1) Open the FIRE PROTECTION DETECTION ENG 2 circuit breaker on the P6-2 panel.
      (2) Hold the TEST switch on the P8-1 panel to the FIRE position.
      (3) Make sure these lights on the P8-1 panel come on:
         (a) all of the lights in the engine-1 fire switch
         (b) all of the lights in the APU fire switch
      (4) Make sure the two FIRE WARN lights on the P7 panel come on.
      (5) Make sure the alarm bell in the control cabin operates.
      (6) Release the TEST switch on the P8-1 panel.

(7) Make sure these lights on the P8-1 panel go off:
    (a) all of the lights in the engine-1 fire switch
    (b) all of the lights in the APU fire switch
(8) Make sure the two FIRE WARN lights on the P7 panel go off.
(9) Make sure the alarm bell in the control cabin makes no sound.
(10) Close the FIRE PROTECTION ENG 2 circuit breaker on the P6-2 panel.
(11) Open the FIRE PROTECTION DETECTION ENG 1 circuit breaker on the P6-2 panel.
(12) Hold the TEST switch on the P8-1 panel to the FIRE position.
(13) Make sure these lights on the P8-1 panel come on:
    (a) All of the lights in the engine-2 fire switch
    (b) All of the lights in the APU fire switch
(14) Make sure the two FIRE WARN lights on the P7 panel come on.
(15) Make sure the alarm bell in the control cabin operates.
(16) Release the TEST switch on the P8-1 panel.
(17) Make sure these lights on the P8-1 panel go off:
    (a) All of the lights in the engine-2 fire switch
    (b) All of the lights in the APU fire switch
(18) Make sure the two FIRE WARN lights on the P7 panel go off.
(19) Make sure the alarm bell in the control cabin makes no sound.
(20) Close the FIRE PROTECTION ENG 1 circuit breaker on the P6-2 panel.
(21) Hold the TEST switch on the P8-1 panel to the OVHT position.
(22) Make sure these lights on the P8-1 panel come on:
    (a) The ENG 1 OVERHEAT light
    (b) The ENG 2 OVERHEAT light
(23) Make sure these lights on the P7 panel come on:
    (a) The two MASTER CAUTION lights
    (b) The OVHT/DET annunciator
(24) Release the TEST switch on the P8-1 panel.
(25) Make sure these lights on the P8-1 panel go off:
    (a) The ENG 1 OVERHEAT light
    (b) The ENG 2 OVERHEAT light
(26) Make sure these lights on the P7 panel go off:
    (a) The two MASTER CAUTION lights
    (b) The OVHT/DET annunciator
(27) Move the two OVHT DET switches on the P8-1 panel to the FIRE position.
(28) Hold the TEST switch on the P8-1 panel to the FIRE position.
(29) Make sure these lights on the P8-1 panel come on:
    (a) All of the lights in the engine-1 fire switch
    (b) All of the lights in the engine-2 fire switch
    (c) All of the lights in the APU fire switch
(30) Make sure the two FIRE WARN lights on the P7 panel come on.
(31) Make sure the alarm bell in the control cabin operates.
(32) Release the TEST switch on the P8-1 panel.

(33) Make sure these lights on the P8-1 panel go off:
(a) All of the lights in the engine-1 fire switch
(b) All of the lights in the engine-2 fire switch
(c) All of the lights in the APU fire switch
(34) Make sure the two FIRE WARN lights on the P7 panel go off.
(35) Make sure the alarm bell in the control cabin makes no sound
(36) Hold the TEST switch on the P8-1 panel to the OVHT position.
(37) Make sure no lights on the P8-1 panel come on.
(38) Release the TEST switch on the P8-1 panel.
(39) Move the two OVHT DET switches on the P8-1 panel to the NORM position.
(40) Close these circuit breakers:
(a) P6 Load Control Center - Right
1) WHEEL WELL WING AND LWR BODY OVHT
2) CARGO SMOKE (Passenger/Cargo Convertible Airplanes)
(41) Remove electrical power if it is no longer necessary (Ref 24-22-0 MP).

3. Do the System Test of the Engine Fire Detection System
A. Standard Tools and Equipment
(1) Multimeter - 0-1 megohm serviceable range
B. Prepare to do the System Test
(1) Supply electrical power (Ref 24-22-0 MP).
(2) Make sure these circuit breakers are closed:
(a) P6 Load Control Center - Right
1) MASTER WARN & CONTROL
2) MASTER CAUTION BAT (two)
3) INDICATOR LIGHTS MASTER DIM (nine)
4) DIM AND TEST CONTROL
(3) Open these circuit breakers:
(a) P6 Load Control Center - Right
1) C405 FIRE PROT DET ENG-1
2) C407 FIRE PROT DET ENG-2
3) APU FIRE DET
4) EXTINGUISHER BOTTLES RIGHT
5) EXTINGUISHER BOTTLES LEFT
6) EXTINGUISHER BOTTLE RIGHT (if installed)
7) EXTINGUISHER BOTTLE LEFT (if installed)
8) EXTINGUISHER BOTTLES APU
9) WHEEL WELL WING AND LWR BODY OVHT
10) CARGO SMOKE (Passenger/Cargo Convertible Airplanes)
(4) Push the left MASTER CAUTION light, or the right MASTER CAUTION light on the P7 panel.
(5) Make sure the two MASTER CAUTION lights and the OVHT/DET annunciator are off.
(6) Move the two OVHT DET switches on the P8-1 panel to the NORM position.
(7) Open the fan cowl panels (Ref 71-11-11).

C. Test the Fire Detection Elements

(1) Make sure (by a visual check) that the fire detection elements on the two engines are the same type as the detection system in the airplane.

CAUTION: MAKE SURE THE DETECTION ELEMENTS ARE OF THE SAME TYPE AS THE DETECTION SYSTEM IN THE AIRPLANE. THE ENGINE FIRE DETECTION SYSTEM WILL NOT OPERATE IF AN INCORRECT FIRE DETECTOR IS INSTALLED.

NOTE: Identification is found at one end of each detector.

(2) Make marks on each detector/connector pair. Use a unique marking (colored tape or equivalent) to prevent cross-connection.

CAUTION: MARK EACH DETECTOR AND ELECTRICAL CONNECTOR PAIR. IF WIRES ARE CROSS-CONNECTED, FALSE INDICATIONS WILL OCCUR.

(3) Remove the electrical connectors from the two ends of each detector.

(4) Install caps on the electrical connectors to prevent contamination.

NOTE: Install the caps when you will not use the connectors for a time. Remove the caps when you do a test or clean the connectors.

(5) Make a continuity check of each detection element.

(a) Make a check for continuity between the contact at the center of one end to the contact at the center of the opposite end.
1) Engine sensing element
2) Firewall sensing element

(b) Make sure that the detector and airplane electrical connectors are clean.
1) Clean the connector when contamination is found (Ref Standard Wiring Practices Manual 20-91-00).

CAUTION: CLEAN THE CONNECTORS WITH METHYL ALCOHOL OR ACETONE ONLY. IF YOU USE A SOLVENT THAT CONTAINS CHLORIDES, IT CAN CAUSE CORROSION IN THE SEALED AREAS.

(c) Shake out all liquid from the detector and airplane electrical connectors.

(d) Dry the detector and airplane electrical connectors with dry compressed air or nitrogen at a pressure of 20-25 psig.

NOTE: A part that is moist can cause low resistance to ground in the subsequent system test.

(e) Apply a very light coat of some DC-4 silicone grease to the copper sealing gasket on the plug connector.

NOTE: Do not let the grease touch the connector pins, contacts or fill the empty space.

(f) Carefully engage the contact pins into the receptacles.

NOTE: The pin plug (male connector) connects to the socket receptacle (female connector). The socket plug (female connector) connects to the pin receptacle (male connector).

(g) Tighten the electrical connectors to 50-70 pound-inches.
(h) Attach the electrical connectors together with some lockwire.

(6) Make a check of the electrical bond between each detector element and the engine case (Ref 20-22-01).
(a) The resistance must be not more than 0.005 ohms.
(7) Close the fan cowl panels (Ref 71-11-11).

D. Test the Operation of the Fire Warning System
(1) Make sure these circuit breakers on the P6-2 panel are open:
(a) FIRE PROTECTION DETECTION - ENG 1
(b) FIRE PROTECTION DETECTION - APU
(2) Close the FIRE PROTECTION DETECTION - ENG 2 CIRCUIT BREAKER ON THE P6-2 panel.
(3) Hold the TEST switch on the P8-1 panel to the FIRE position.
(4) Make sure that these indications occur:
(a) All of the lights in the engine-2 fire switch come on
(b) The two FIRE WARN lights on the P7 panel come on
(c) The alarm bell in the control cabin operates
(5) Release the TEST switch on the P8-1 panel.
(6) Make sure there are no fire indications.
(7) Close the FIRE PROTECTION DETECTION - ENG 1 circuit breaker on the P6-2 panel.
(8) Open the FIRE PROTECTION DETECTION - ENG 2 circuit breaker on the P6-2 panel.
(9) Hold the TEST switch on the P8-1 panel to the FIRE position.
(10) Make sure these indications occur:
(a) All of the lights in the engine-1 fire switch come on
(b) The two FIRE WARN lights on the P7 panel come on

(c) The alarm bell in the control cabin operates.
(11) Release the TEST switch on the P8-1 panel.
(12) Make sure there are no fire indications.
(13) Close these circuit breakers on the P6-2 panel:
(a) FIRE PROTECTION DETECTION - ENG 2
(b) FIRE PROTECTION DETECTION - APU
(14) Hold the TEST switch on the P8-1 panel to the OVHT position.
(15) Make sure these lights on the P8-1 panel come on:
(a) The ENG 1 OVERHEAT light
(b) The ENG 2 OVERHEAT light
(16) Make sure these indications on the P7 panel come on:
(a) The two MASTER CAUTION lights
(b) The OVHT/DET annunciator
(17) Release the TEST switch on the P8-1 panel.
(18) Make sure there are no overheat indications.
(19) Try to pull the engine 1, the engine 2, and the APU fire switches on the P8-1 panel; the switches must stay in the locked position.
(20) Push the override button below the engine-1 fire switch.

CAUTION: DO NOT TURN THE FIRE SWITCH WHILE IT IS IN THE OUT POSITION. THE CONTENTS OF THE FIRE EXTINGUISHER BOTTLE WILL BE LET OUT.

(21) Pull up on the engine-1 fire switch, the lock should be released and the switch pulled out.
(22) Push the override button below the engine-2 fire switch.
(23) Pull up on the engine-2 fire switch, the lock should be released and the switch pulled out.
(24) Push the override button below the APU fire switch.
(25) Pull up on the APU fire switch, the lock should be released and the switch pulled out.
(26) Push in the engine-1 fire switch to close.
(27) Push in the engine-2 fire switch to close.
(28) Push in the APU fire switch to close.
(29) Make sure that the two OVHT DET switches on the P8-1 panel are in the NORM position.

E. Do the test of the circuits that stop the aural and visual fire warnings.
(1) Hold the TEST switch on the P8-1 panel to the FIRE position.
(2) Make sure these lights on the P8-1 panel come on:
(a) All of the lights in the engine-1 fire switch
(b) All of the lights in the engine-2 fire switch
(c) All of the lights in the APU fire switch
(3) Make sure the two FIRE WARN lights on the P7 panel come on.
(4) Make sure the alarm bell in the control cabin operates.
(5) Make sure the warning horn in the main wheel well operates.
(6) Make sure the fire warning light in the main wheel well flashes.

(7) Push the FIRE WARN switch on the left side of the P7 panel momentarily.
(8) Make sure the alarm bell goes silent.
(9) Make sure the warning horn makes no sound in approximately three seconds.
(10) Make sure the two FIRE WARN lights go off.
(11) Make sure the fire warning light in the wheel well comes on continuously.
(12) Release the TEST switch on the P8-1 panel.
(13) Hold the TEST switch on the P8-1 panel to the FIRE position.
(14) Make sure these lights on the P8-1 panel come on:
    (a) All of the lights in the engine-1 fire switch
    (b) All of the lights in the engine-2 fire switch
    (c) All of the lights in the APU fire switch
(15) Make sure the two FIRE WARN lights on the P7 panel come on.
(16) Make sure the alarm bell in the control cabin operates.
(17) Make sure the warning horn in the wheel well operates.
(18) Make sure the fire warning light in the main wheel well flashes.
(19) Push the FIRE WARN switch on the right side of the P7 panel momentarily.
(20) Make sure the alarm bell immediately makes no sound.
(21) Make sure the warning horn makes no sound in approximately three seconds.
(22) Make sure the two FIRE WARN lights go off.
(23) Make sure the fire warning light in the wheel well comes on continuously.
(24) Release the TEST switch on the P8-1 panel.
(25) Hold the TEST switch on the P8-1 panel to the FIRE position.
(26) Make sure these lights on the P8-1 panel come on:
    (a) All of the lights in the engine-1 fire switch
    (b) All of the lights in the engine-2 fire switch
    (c) All of the lights in the APU fire switch
(27) Make sure the two FIRE WARN lights on the P7 panel come on.
(28) Make sure the alarm bell in the control cabin operates.
(29) Make sure the warning horn in the wheel well operates.
(30) Make sure the fire warning light in the main wheel well flashes.
(31) Push the BELL CUTOUT switch on the P8-1 panel momentarily.
(32) Make sure the alarm bell immediately makes no sound.
(33) Make sure the warning horn makes no sound in approximately 3 seconds.
(34) Make sure the two FIRE WARN lights go off.
(35) Make sure the fire warning light in the wheel well comes on continuously.
(36) Release the TEST switch on the P8-1 panel.
(37) Hold the TEST switch on the P8-1 panel to the FIRE position.
(38) Move the LIGHTS switch on the P2-1 panel to the DIM position.

(39) Make sure the two FIRE WARN lights on the P7 panel decrease in intensity.
(40) Move the LIGHTS switch on the P2-1 panel to the BRT position.
(41) Make sure the two FIRE WARN lights on the P7 panel increase in intensity.
(42) Pull the engine 1, the engine 2, and the APU fire switches.

CAUTION: DO NOT TURN THE FIRE SWITCH WHILE IT IS IN THE OUT POSITION. THE CONTENTS OF THE FIRE EXTINGUISHER BOTTLE WILL BE LET OUT.

NOTE: The switches must be free to move up without the use of the override button.

(43) Push in the three fire switches to close.
(44) Hold the TEST switch on the P8-1 panel to the OVHT position.
(45) Move the LIGHTS switch on the P2-1 panel to the DIM position.
(46) Make sure these indications on the P8-1 panel decrease in intensity:
  (a) The ENG 1 OVERHEAT light
  (b) The ENG 2 OVERHEAT light
(47) Make sure these lights on the P7 panel decrease in intensity:
  (a) The two MASTER CAUTION lights
  (b) The OVHT/DET annunciator
(48) Move the LIGHTS switch on the P2-1 panel to the BRT position.
(49) Make sure these lights on the P8-1 panel increase in intensity:
  (a) The ENG 1 OVERHEAT light
  (b) The ENG 2 OVERHEAT light
(50) Make sure these lights on the P7 panel increase in intensity:
  (a) The two MASTER CAUTION lights
  (b) The OVHT/DET annunciator
(51) Pull the engine 1 and the engine 2 fire switches.

CAUTION: DO NOT TURN THE FIRE SWITCH WHILE IT IS IN THE OUT POSITION. THE CONTENTS OF THE FIRE EXTINGUISHER BOTTLE WILL BE LET OUT.

NOTE: The switches must be free to move up without the use of the override button.

(52) Push in the two fire switches to close.
(53) Push the left MASTER CAUTION light or the right MASTER CAUTION light.
(54) Make sure that the two MASTER CAUTION lights and the OVHT/DET annunciator go off.

(55) Make sure these lights stay on:
  (a) The ENG 1 OVERHEAT light
  (b) The ENG 2 OVERHEAT light
(56) Push the left annunciator light or the right annunciator light on the P7 panel.
(57) Make sure the two MASTER CAUTION lights come on.
(58) Make sure the OVHT/DET annunciator light comes on.

NOTE: Ignore other master caution annunciator lights that come on.

(59) Release the TEST switch on the P8-1 panel.
(60) Make sure these lights on the P8-1 panel go off:
  (a) The ENG 1 OVERHEAT light
  (b) The ENG 2 OVERHEAT light
(61) Make sure these lights on the P7 panel go off:
  (a) The two MASTER CAUTION lights
  (b) The OVHT/DET annunciator
(62) Try to pull out the engine 1, the engine 2, and the APU fire switches on the P8-1 panel.

NOTE: The switches must stay in the locked position.

F. Test the OVHT DET Switches
  (1) Move the two OVHT DET switches from the NORM position to the FIRE position.
  (2) Hold the TEST switch on the P8-1 panel to the OVHT position.
  (3) Make sure all overheat indicators stay off.
  (4) Release the TEST switch on the P8-1 panel.
  (5) Hold the TEST switch on the P8-1 panel to the FIRE position.
  (6) Make sure these lights on the P8-1 panel come on:
    (a) All of the lights in the engine-1 fire switch
    (b) All of the lights in the engine-2 fire switch
    (c) All of the lights in the APU fire switch
  (7) Make sure the two FIRE WARN lights on the P7 panel come on.
  (8) Make sure the alarm bell in the control cabin operates.
  (9) Make sure the warning horn in the right main wheel well comes on and goes off continuously.
  (10) Make sure the fire warning light in the main wheel well flashes.
  (11) Release the TEST switch on the P8-1 panel.
  (12) Move the two OVHT DET switches on the P8-1 panel to the NORM position.
  (13) Make sure there are no fire indications.
G. Test the Fault Circuits in the Fire Warning System
  (1) Hold in the DET TEST switch on the M279 module.
  (2) Make sure the four Eng-1 and Eng-2 overheat and fire detector inoperative lights on the M279 module come on.

(3) Release the DET TEST switch.
(4) Make sure the four lights on the M279 module go off.
(5) Make sure all lights on the P8-1 panel are off.

H. Put the airplane back to its usual condition.
(1) Try to pull the engine 1, the engine 2, and the APU fire switches on the P8-1 panel; the switches must stay in the locked position.
(2) Close these circuit breakers:
(a) P6 Load Control Center - Right
1) WHEEL WELL WING AND LWR BODY OVHT
2) EXTINGUISHER BOTTLES RIGHT
3) EXTINGUISHER BOTTLES LEFT
4) EXTINGUISHER BOTTLE RIGHT (if installed)
5) EXTINGUISHER BOTTLE LEFT (if installed)
6) EXTINGUISHER BOTTLES APU
7) CARGO SMOKE (Passenger/Cargo Convertible Airplanes)
(3) Remove electrical power if it is no longer necessary (Ref 24-22-0 MP).

ENGINE FIRE DETECTION SENSING ELEMENT - REMOVAL/INSTALLATION

1. General
   A. One sensing element is installed on the lower right side of each engine, a second element is installed on each engine strut firewall. Access to engine sensor is gained by opening the right cowling panel. Access to the firewall sensor is gained by removing the outboard upper fixed fairing (Ref Chapter 71, Fixed Fairing).
2. Equipment and Materials
   A. Bonding Meter (Ref 20-22-01)
   B. Grease - Silicone, Dow Corning DC-4
3. Sensing Element - Removal/Installation

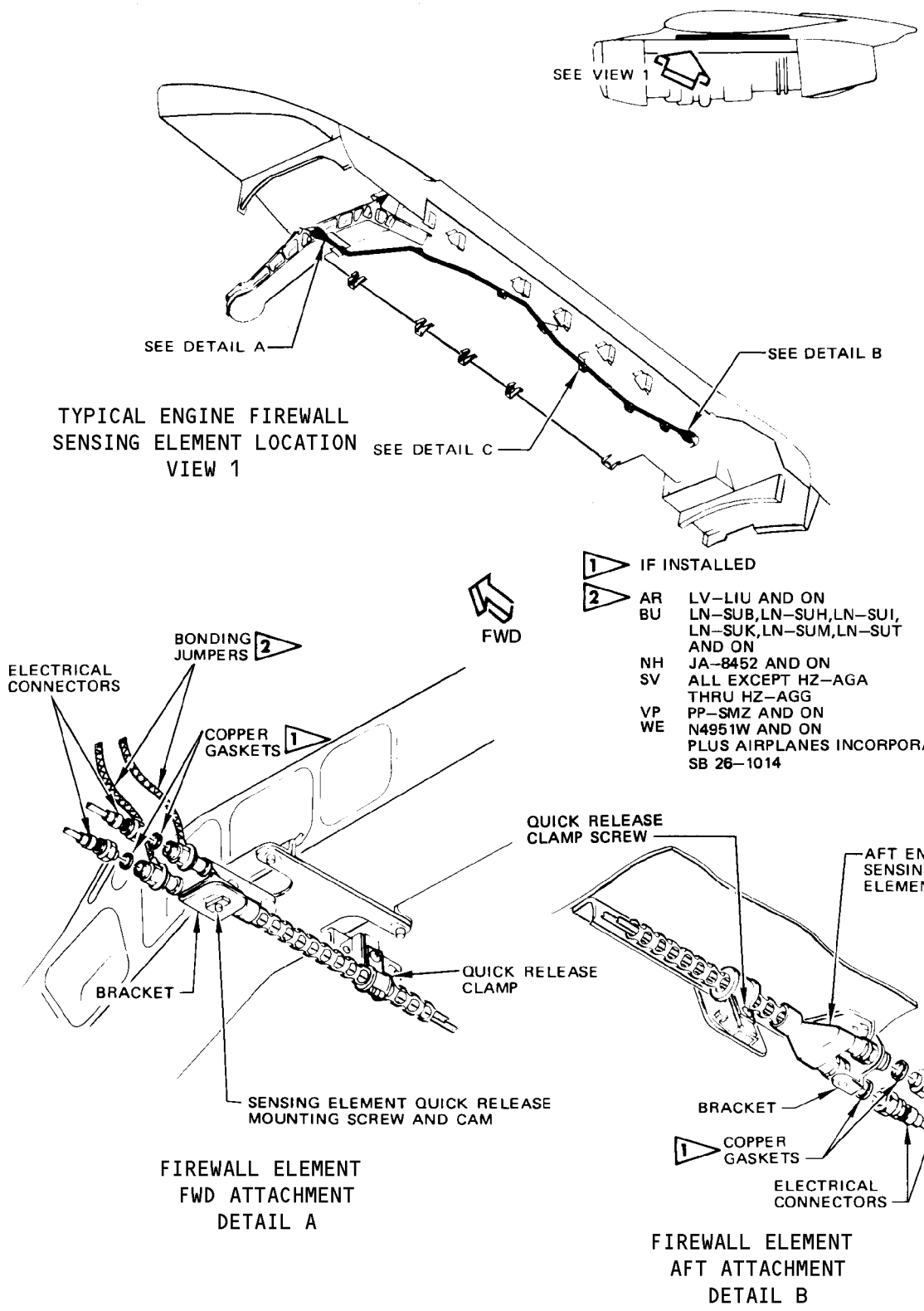
   NOTE: The removal and installation of the sensing elements should be completed one element at a time. The operational test must be performed after each individual sensing element is removed and installed.

   A. Remove Sensing Element (Fig. 401)
      (1) Open applicable FIRE PROT DET ENG circuit breaker on load control center P6.
      (2) Remove lockwiring and electrical connectors from element fittings at each end of element. Discard copper gasket. Install protective caps on electrical connectors.
      (3) Remove jamnuts, and when installed, bonding jumpers from aft element fittings per 20-10-185.
      (4) Remove forward element fitting from structure by loosening mounting screw.
      (5) Release clamps along length of element.

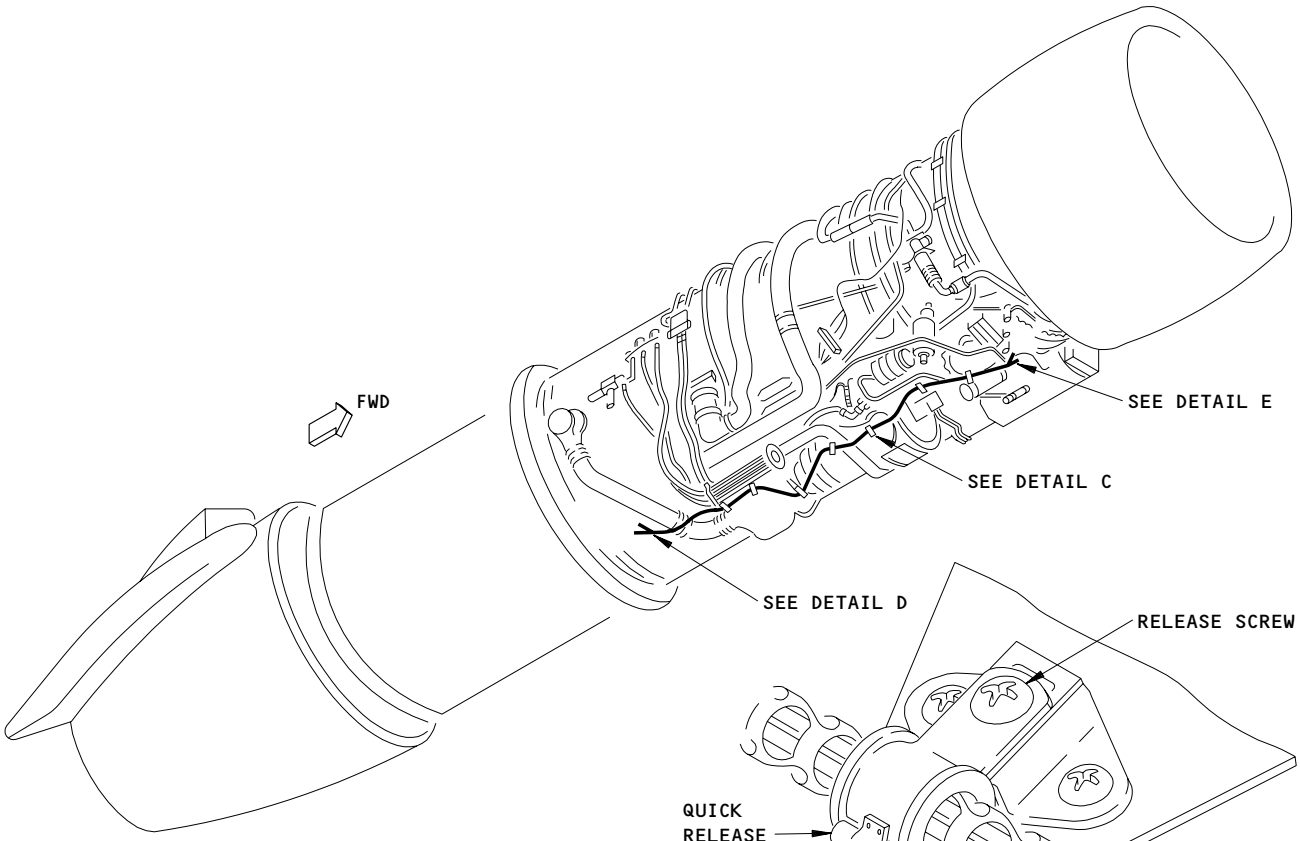
          NOTE: Support element when releasing clamps. Keep bending of element to a minimum.

      (6) Remove aft element fittings from bracket and pull element free of engine.
      (7) Replace jamnuts on element fittings and install protective caps.
   B. Install Sensing Element (Fig. 401, 402)

      CAUTION: IF NEW ELEMENT IS BEING INSTALLED, CHECK THAT PART NUMBER IS IDENTICAL TO THE ELEMENT REMOVED OR AS SPECIFIED IN MEGGITT CMM 26-10-19.
      (1) Remove protective caps from each element fitting and jamnuts from aft element fittings.

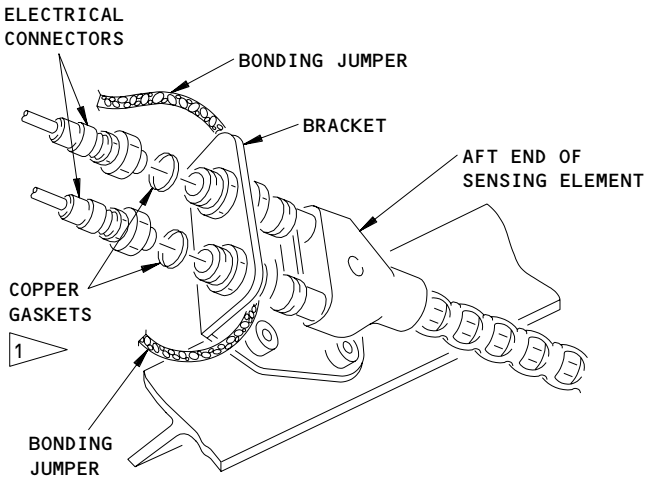


Engine – Firewall Fire Detection Sensing Element Installation
Figure 401 (Sheet 1)

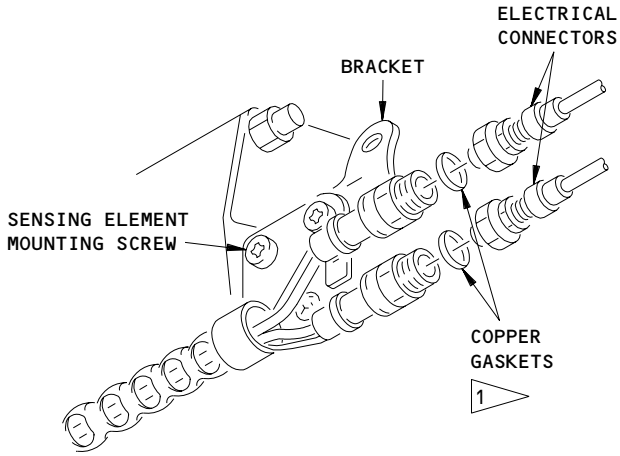


TYPICAL ENGINE SENSING
ELEMENT LOCATION

TYPICAL CLAMP INSTALLATION
DETAIL C



ENGINE ELEMENT AFT ATTACHMENT
DETAIL D 2



ENGINE ELEMENT FORWARD ATTACHMENT
DETAIL E 2

Engine – Firewall Fire Detection Sensing Element Installation
Figure 401 (Sheet 2)

(2) Support element to prevent bending and install aft fittings on mounting bracket. Install bonding jumpers per 20-10-185. Install jamnuts and lockwire together.
(3) Install element in clamps.
(4) Install forward element fitting on bracket with mounting screw.

NOTE: Loosen clamps and adjust element fit as necessary; tighten clamps.

(5) Remove protective caps from electrical connectors and verify detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connector.

CAUTION: CLEAN CONNECTORS USING ISOPROPYL OR METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS AND SHOULD NOT BE USED.

(6) Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-25 psig

CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

(7) On configuration II electrical connector, apply very light coat of DC-4 grease to copper sealing gasket. On configuration I electrical connector, discard old gasket and replace with new copper gasket. Apply light coat of DC-4 grease to copper sealing gasket (Fig. 402).

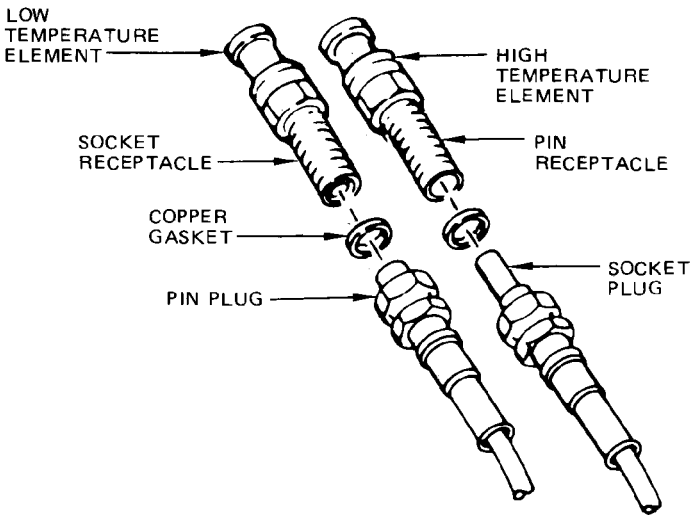
NOTE: Avoid getting grease in connector cavity or on connector pins or contacts.

(8) Carefully engage the contact pins into the receptacles and tighten the electrical connectors to a torque of 50-70 pound-inches. Lockwire electrical connectors together.

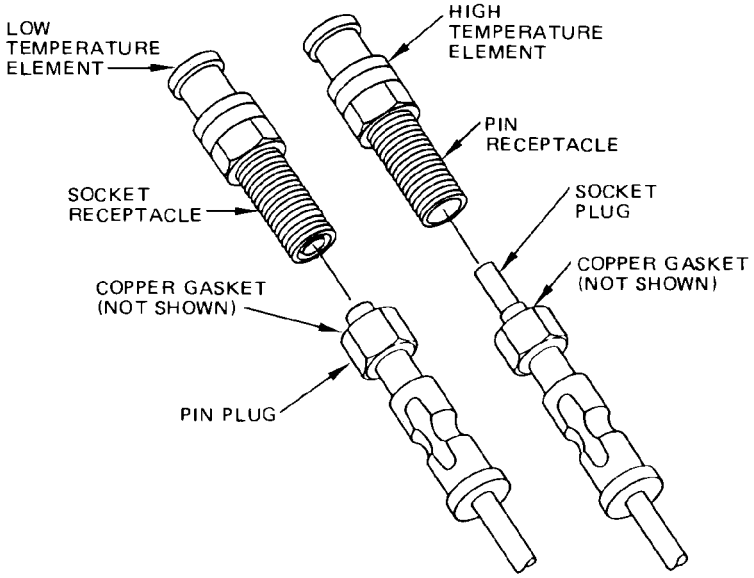
NOTE: Pin plug (male connector) mates to the socket receptacle (female connector) of the low temperature element. Socket plug (female connector) mates to the pin receptacle (male connector) of the high temperature element.

(9) Check electrical bond between electrical connector and engine per 20-22-01. Resistance should not exceed 0.0025 ohms.

C. Perform Operation Test
(1) Operation Test
(a) Provide electrical power (Ref 24-22-0 MP).



CONFIGURATION I (WITH SEPARATE COPPER GASKET)



CONFIGURATION II (WITH INTEGRAL COPPER GASKET)

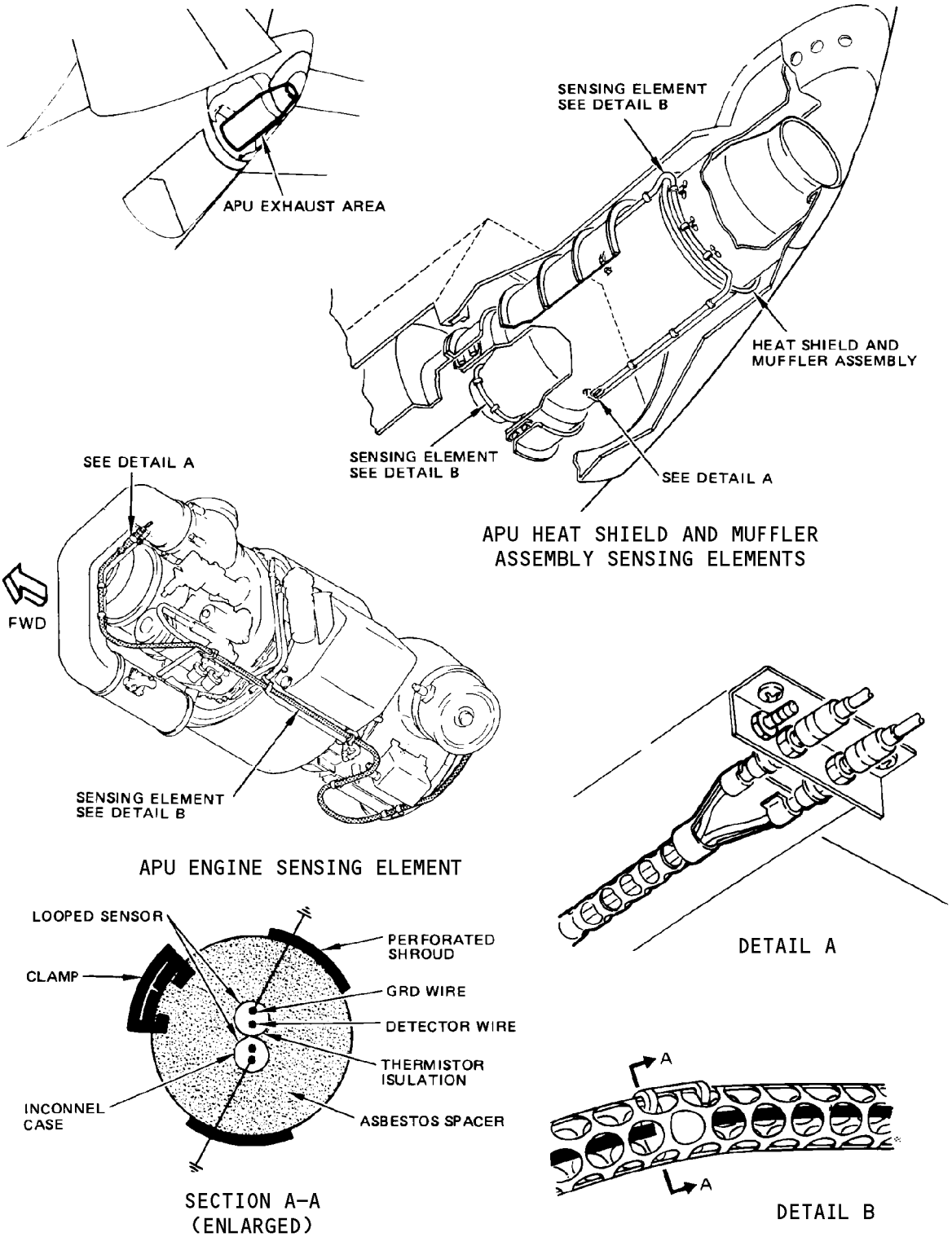
Fire Detector Electrical Connectors
Figure 402

(b) Ensure C405 FIRE PROT DET ENG-1 and C407 FIRE PROT DET ENG-2 circuit breakers are closed.
(c) Press either master caution light on captain's and first officer's lightshield and verify that both master caution and master annunciator lights are off.
(d) Ensure overheat detector switches on fire protection panel are in NORM position.
(e) At the Engine and APU Fire Control Panel P8-1, hold the overheat-fire test switch to the fire position and verify the following indications are present:
1) Both red fire warning lights on P7 panel are illuminated.
2) Eng-1 and Eng-2 fire switch handles are illuminated.
3) The fire bell in control cabin sounds.
(f) Hold the overheat-fire test switch to the overheat position and verify the following indications are present:
1) Eng-1 and Eng-2 overheat lights on fire protection module are illuminated.
2) Both master caution lights and overheat detector annunciator light on panel P7 are illuminated.

D. Restore Airplane to Normal
(1) Remove electrical power if no longer required (Ref 24-22-0 MP).

APU FIRE DETECTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU fire detection system provides fire detection in the auxiliary power unit (APU). Fire detection is provided by shrouded sensing elements mounted on the APU (Fig. 1). The detection system is an electrical, heat sensing system that responds to a general overheat condition or a localized fire condition by activating warning lights, an alarm bell and a remote horn, and shutting down the APU.
   B. Fire detection elements are installed in two areas of the APU: the engine area and the exhaust area. One sensing element is installed on the engine. Two sensing elements are installed on the heat shield and muffler assembly.
   C. The APU fire detection system consists of the fire protection system module, engine and APU fire detection accessory unit, APU remote control panel, alarm bell, remote horn, master fire warning lights and sensing elements. The APU fire detection system sensor (thermistor type) is enclosed in a shrouded sensing element, which is connected to the transistorized engine and APU fire detection accessory unit. The control module contains the APU detector control card and associated wiring to the APU. For engine coverage (Ref 26-11-0, Engine Fire Detection System). The APU detector control card monitors the electrical resistance of the APU sensor. The control card circuit discriminates between an overheat condition or a short circuit. The fire warning lights, alarm bell, (and remote horn if the airplane is on the ground) will actuate when a temperature rise causes the sensor element resistance to drop to the design value corresponding to the alarm temperature. The APU DET inoperative light, on the fire protection module, will illuminate when a short is sensed in the detection circuit.
   D. The APU fire detection system can be tested in flight or on the ground by operation of the fire test switch on the fire protection module (Fig. 2). The fire test switch circuit checks continuity through the system by electrically simulating a fire condition on the APU. This energizes APU fire warning horn and light in the right wheel well, the alarm bell in the aural warning devices box in the control cabin, the fire warning lights on P7, and APU fire handle lights on the fire protection module, or causes the APU detector inoperative light to illuminate.
2. Fire Protection System Module Components
   A. The fire protection system module components described in the following paragraphs will be only those associated with the APU fire detection system. The fire protection system module is located on control stand aft electronic panel P8. For further information on the fire protection system module, refer to 26-00, Fire Protection.



APU HEAT SHIELD AND MUFFLER ASSEMBLY SENSING ELEMENTS

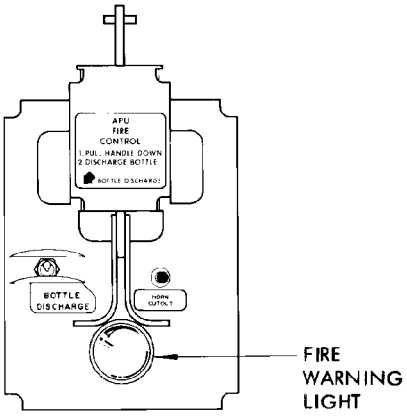
APU ENGINE SENSING ELEMENT

DETAIL A

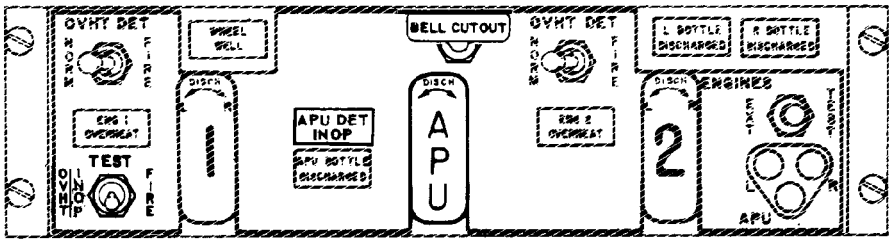
SECTION A-A
(ENLARGED)

DETAIL B

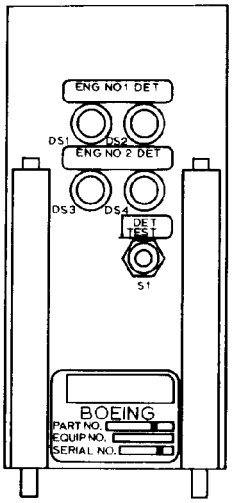
APU Fire Detection System Component Location
Figure 1 (Sheet 1)



APU REMOTE (WHEEL WELL)
CONTROL PANEL

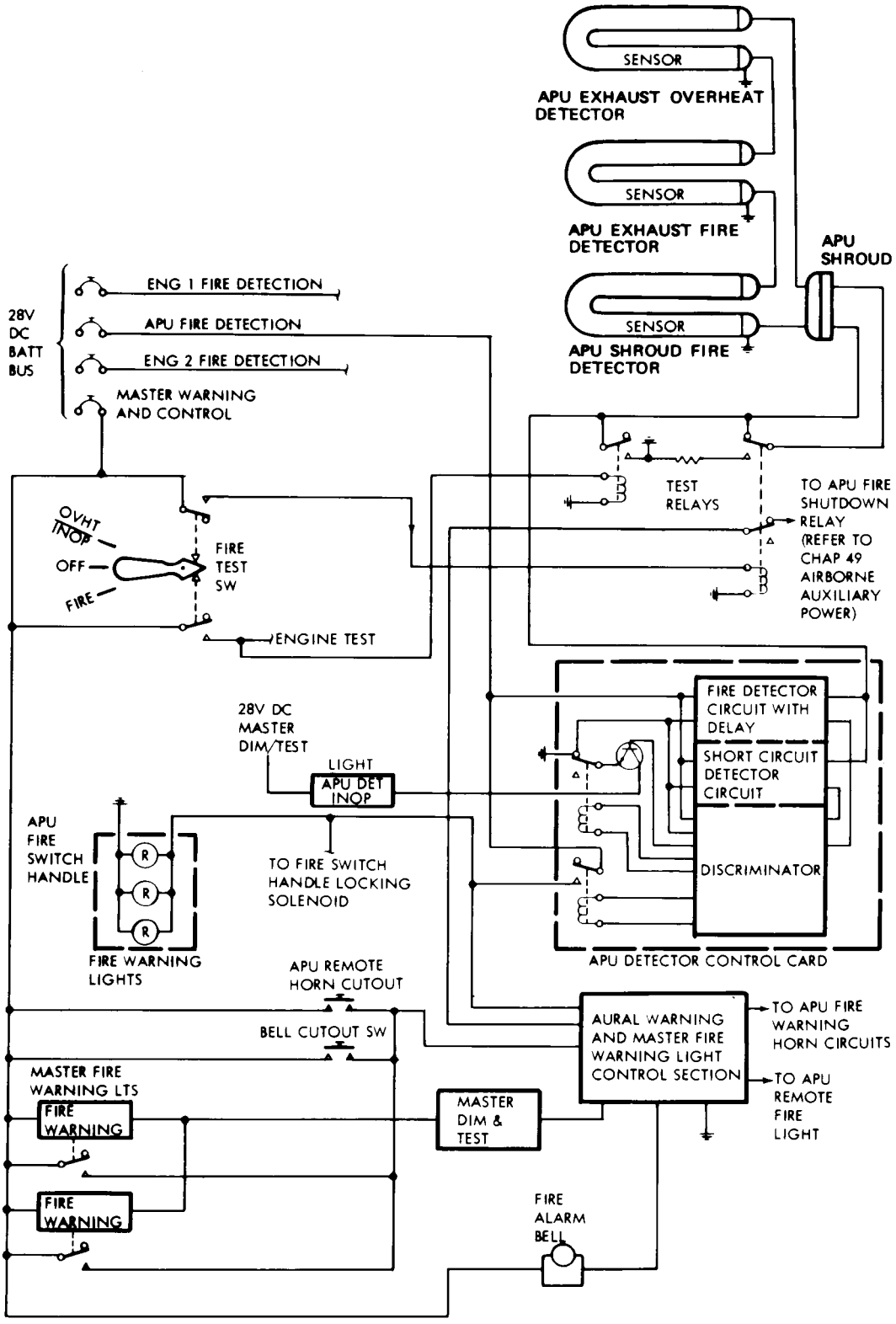


APU FIRE DETECTION, INDICATION AND CONTROL
FIRE PROTECTION MODULE



ENGINE AND APU FIRE DETECTION
ACCESSORY UNIT (CONTROL MODULE)

APU Fire Detection System Component Location
Figure 1 (Sheet 2)



APU Fire Detection System Schematic
Figure 2

B. APU Detector Inoperative Light
   (1) An amber detector inoperative light, mounted on the front panel, provides an indication of a short circuit in the APU fire detection system. A short circuit on the sensors will cause the steady illumination of the APU detector inoperative light. The light is also connected to the master dim/test system (Ref Chapter 33).
C. Warning Light
   (1) A red fire warning light in the APU fire switch handle provides APU area fire warning. The APU fire warning light is connected to the APU detector control card. A fire or overheat condition in the APU shroud will cause steady illumination of the warning light (Fig. 2). The fire warning light consists of several bulbs covered by a red translucent plastic lens cap in the fire switch handle.
D. Test Switch
   (1) The fire test switch has three positions: INOP/OVHT-off-FIRE; The switch is spring-loaded to the off position. The switch permits testing of the APU fire detection system by checking sensor continuity and simulating a fire condition when positioned to FIRE. When in the INOP/OVHT positions the APU sensor is grounded and the inoperative light will illuminate (Fig. 2).
E. Bell Cutout Switch
   (1) A pushbutton switch is provided for alarm bell control. Pressing the switch provides 28 volts dc to the aural warning and master fire warning light control section in the fire detection accessory unit. The control circuits then silence the bell and extinguish the master fire warning lights on P7.

3. Engine and APU Fire Detection Accessory Unit
   A. The engine and APU fire detection accessory unit (control module) components described in the following paragraphs will be only those associated with the APU fire detection system. The engine and APU fire detection accessory unit is located on electronic equipment rack E3. For further information on the engine and APU fire detection accessory unit, refer to 26-10-0, Fire Detection.
   B. APU Detector Control Card
      (1) The control card contains the fire detection and short circuit discrimination circuitry necessary to continuously monitor the resistance of the sensing element and/or wiring and to trigger a fire warning or short circuit indication. The control card resistance trip level is fixed during assembly of the card and does not require or permit adjustment. The sensor is connected in series with the control card to form a closed circuit sensing loop. A zener diode regulator in each control card protects the circuit from input voltage transients.

(2) Each control card consists of two resistance monitoring circuits, a fire warning circuit set to trip at a resistance corresponding to a desired alarm temperature and a short circuit detector circuit which can differentiate between a sensing loop resistance drop caused by a mechanical short or by heat (fire).

C. Aural Warning and Master Fire Warning Lights Control Section

(1) The aural warning and master fire warning lights control section provides control of the alarm bell on the aural warning devices box, the remote horn mounted in the main wheel well, the fire warning light on the remote APU control panel, the master fire warning lights on light shield module P7 and APU shutdown (Fig. 2).

(2) When an alarm condition occurs in the APU, the APU control card will cause a warning signal. The warning signal will supply 28 volt dc to the fire warning lights in the APU fire switch handle on the fire protection module, unlock a solenoid holding the fire switch handle, and energizes a relay in the control section. The energized relay will supply 28 volt dc to the following: to the APU automatic shutdown circuits, turn on the bell control transistor to the remote horn and light flasher unit which controls the flasher relay supplying a pulsating output for the remote horn and light and supplies a ground for the master fire warning lights. The transistor supplies a ground to the alarm bell circuit, thus causing the bell to ring. The flasher relay will pull in and relax, thus causing a pulsating output of the remote horn and light. When either the bell cutout switch, APU remote horn cutout switch, or a master fire warning light is pressed, a positive trigger signal is supplied at the gate of two silicon controlled rectifiers (SCR) in the control section. One SCR will conduct, removing the bias from the transistor in the bell circuit. The transistor will stop conducting and de-energize the bell and the master fire warning lights. The other SCR will conduct, providing a steady ground circuit to the flashing relay. The relay will remain energized, disconnect the horn circuit and cause steady remote fire light illumination on the remote APU control panel. The SCR's will continue to conduct until the alarm condition clears. If the alarm condition clears before the bell cutout switch is pressed, the control relay will relax, remove power from the control section and return the control section to its normal state. However, the fire handle lights cannot be de-energized as long as a fire signal exists on the selected sensing loop.

4. Remote APU Control Panel Components
   A. The remote APU fire control panel components described in the following paragraphs will be only those associated with the APU fire detection system. The remote APU control panel (P28) is located on the aft bulkhead, right side, in the main wheel well. Refer to 26-00, Remote APU Fire Panel.
   B. APU Horn Cutout Switch
      (1) The horn cutout switch can be used to extinguish the master fire warning lights and cut off the fire warning horn or bell from a ground control point. The horn and bell can also be cut off by pressing the bell cutout switch on fire protection system module P8-1 or pressing one of the master fire warning lights on lightshield module P7.
   C. Fire Warning Light
      (1) A fire condition in the APU will cause pulsating illumination of the fire warning light. The warning light is controlled through the aural warning and master fire warning lights control section (Fig. 2). When a bell or horn cutout switch is pressed, the light remains illuminated until the fire warning signal is gone.
      (2) 5 Alarm Bell
   D. The alarm bell warns of fire or overheat conditions in the APU or engine with a steady ringing. The bell is controlled by the aural warning and master fire warning lights control section of the engine and APU fire detection accessory unit (Fig. 2). The alarm bell is located in the aural warning devices box, refer to Chapter 31, Aural Warning and Call Devices.
5. Remote Horn
   A. The remote horn (loudspeaker) warns of fire or overheat conditions in the APU. The remote horn is located in the right main wheel well adjacent to the APU control panel. Audio tones for the horn are generated by a multi-vibrator circuit (in miscellaneous switching module) which is turned on and off by the aural warning and master fire warning lights control section of the engine and APU fire detection accessory unit. The horn will operate only when the airplane is on the ground.
6. Master Fire Warning Lights
   A. The master fire warning lights are located on lightshield module P7. The lightshield is located in a direct line of sight for both the captain and first officer. When a fire or overheat condition occurs the fire warning lights will alert the crew to the type of problem that exists.

B. The master fire warning light will alert the crew of a fire or overheat condition in the APU. The master fire warning lights are controlled by aural warning and master fire warning lights control section of the engine and APU fire detection accessory unit (Fig. 2). A fire warning light is located on either side of the lightshield for the captain and first officer. Either light may be depressed for bell or remote horn cutout and extinguishing the lights. The lights are also used by the engine fire detection system.

7. Sensing Elements

A. A sensing element provides fire detection inside the APU shroud. The element is mounted on the APU. The sensing element is shrouded and attached by quick-release clamps. The sensing element consists of one sensor mounted in a loop within a perforated metal tube.

B. The sensor is a thermistor device, which has a resistance inversely proportional to temperature; that is, as the sensor temperature is raised by heating, its resistance lowers. The sensor is composed of two wires embedded in a thermistor material, which is incased in a heavy wall inconel tube for high strength at elevated temperatures. The electrical connector at each end of the sensor is completely insulated by ceramic insulators. The sensor is completely shrouded in a 1/2-inch diameter perforated stainless steel tube or armor between the electrical connectors. The shroud (armor) protects the sensor from common hazards such as breakage due to vibration, abrasion of sensor against airplane structure and damage from maintenance activity in the area. The sensors are supported away from the sides of the armor by teflon-impregnated asbestos bushings at approximately 2 1/2-inch intervals. The tubing provides sufficient clearance for the sensor, to protect it from objects striking and denting the armor, while also providing a structurally rigid support for the sensors.

C. The resistance of sensor is a logarithmic average function and varies inversely with its length, the increments of length being essentially resistances in parallel. For a given installation, the heating of less than a full length on a sensor will require it to be heated to a higher temperature for the resistance to decrease to the alarm point. This characteristic permits the system to integrate the varying temperatures throughout the installation rather than sensing only the highest local temperature. One wire of the sensor is grounded to the outside case of the sensor. The other wire receives power from the detector control unit. The system is thus continuously monitoring the resistance between the "hot" wire and ground through the sensor case or through the other wire which is grounded to case (Fig. 1).

8. Operation

A. Normal Operation

(1) Normal fire detection is automatic when power is applied to the airplane and the fire detection and aural warning circuit breakers are closed.

(2) If a fire or overheat condition occurs in the APU area, the sensor is subjected to a temperature rise. The temperature rise will cause the resistance value of the sensor to decrease. At a predetermined resistance value corresponding to the alarm temperature, the APU detector control card will trigger a fire warning signal. The signal will activate the circuits which cause the fire bell and warning horn to sound, unlock the APU fire switch, the fire warning lights to illuminate and the APU to shut down. The fire warning horn will sound only if the airplane is on the ground. When the fire warning lights are illuminated, a fire is assumed and should be extinguished. Refer to 26-22-0, APU fire Extinguishing System. When the fire is extinguished, the temperature and sensor resistance value should return to normal. The fire signal will be removed and

(3) The fire warning indicating components will turn off. The alarm bell and remote horn may be silenced at any time when the bell cutout switch, APU remote horn cutout switch or either master fire warning light lens caps are momentarily pressed.

(4) During normal operation, an APU detector inoperative light will illuminate if the sensing element or the monitoring circuit should ground fault (short circuit). When a short circuit occurs, the sensing loop resistance drops rapidly to a low value. When the sensing loop resistance is instantly reduced below 1/2 the fire trip resistance, the fire warning circuit does not actuate because of a built-in time delay. The lower resistance actuates the short discriminator circuit, which nullifies the fire warning signal so that the fire warning circuit cannot actuate after the expiration of the delay period. The short discriminator circuit in the control card provides a ground path for the APU inoperative light on the fire protection system module. When a fire occurs, the resistance of the sensing loop drops relatively slowly and after reaching the fire trip resistance, will not decrease rapidly enough to reach the short circuit trip resistance before expiration of the time delay period. The fire detector circuit causes the fire alarm relay on the control card to be energized. The relay isolates the short monitoring circuit and prevents a short signal when the fire lowers the sensing loop resistance below the short circuit trip value. It should be noted that most short circuits are intermittent, and the system is capable of detecting fire during the absence of the short. In the case of a steady short, the detector "fails safe"; that is, it becomes inoperative but does not give a false alarm.

NOTE: If the fire detection system fails to test, monitor the APU detector inoperative light prior to performing any other tests.

B. Test Operation

(1) A fire detection system continuity test can be made by moving the fire test switch, on the fire protection module, to FIRE. The fire warning indicating components should come on and then go off when the switch is released. A test relay for the APU system grounds the APU sensor through a resistor thus simulating a fire and providing a signal at the APU detector control card. The resistor is required to raise the resistance of the sensing loop above the short circuit trip resistance during the fire test.

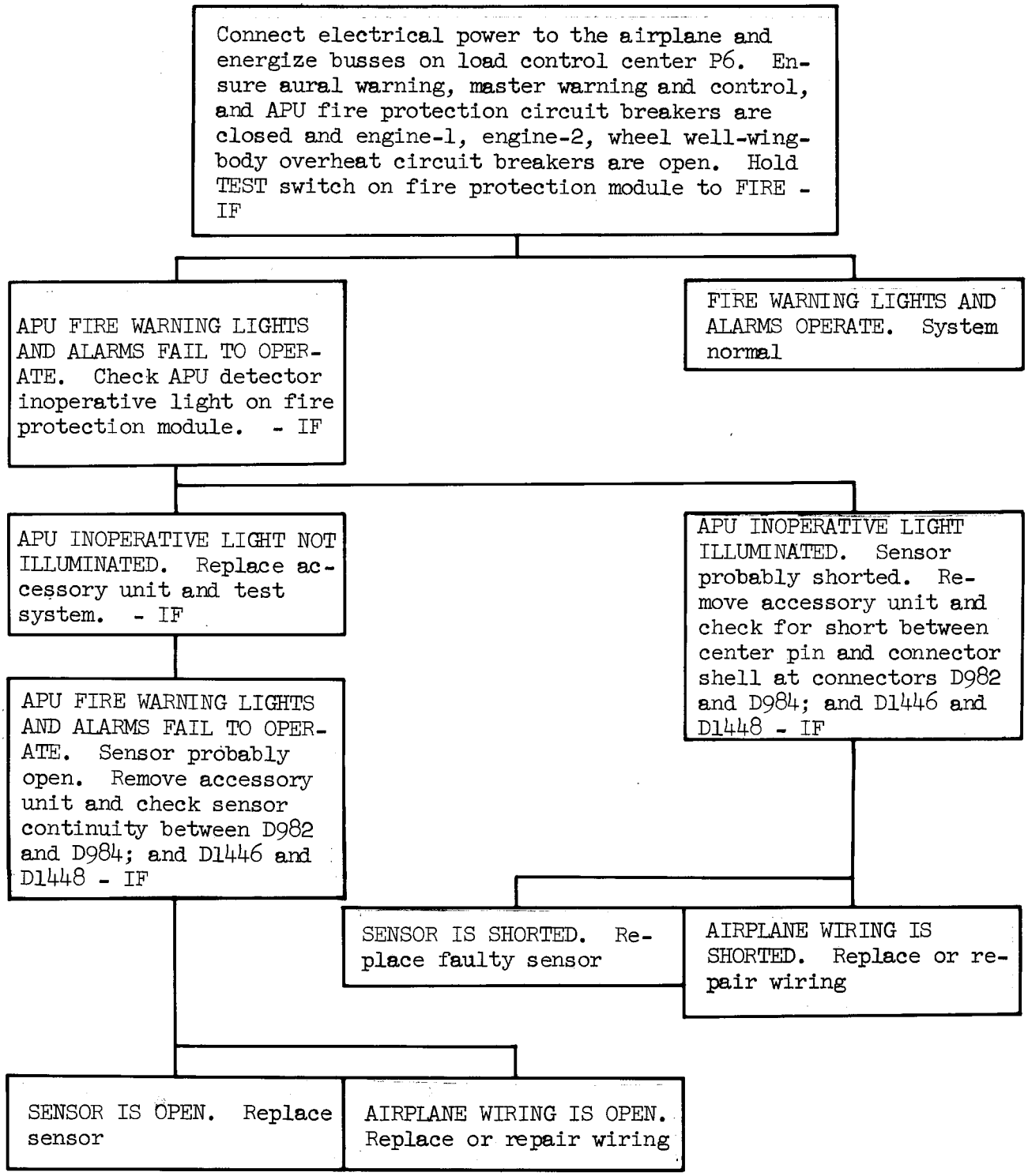
NOTE: The APU will not shut down when the fire test switch is actuated.

(2) A short circuit discriminator circuit continuity test can be made by moving the fire test switch to INOP/OVHT. The APU detector inoperative light should come on and then go off when the switch is released. A test relay for the detector system grounds the sensor thus creating a short across each detector control card sensing element terminals. The short circuit discriminator section of each card will then illuminate the detector inoperative light.

APU FIRE DETECTION SYSTEM - TROUBLESHOOTING

1. General
   A. Trouble with the fire detection system will usually be indicated by absence of fire warning lights or alarm bell when the test switch is operated on the fire protection module, or by a false alarm. If a short circuit has occurred on a sensing line, the APU detector inoperative light will probably be illuminated. If an open circuit has occurred, the APU warning lights will not be illuminated when the system is tested. Lights on the fire protection module, and master fire warning lights should be tested before assuming the detection system is faulty by operating the master lights test circuits (Ref Chapter 33, Master Caution and Warning Lights).
   B. False alarms are usually intermittent and rarely remain for any length of time. High ambient temperature coupled with APU heat may cause a false alarm. The system will usually become operable again after a short time. If a false alarm should remain after the accessory unit is replaced, isolation of the sensor, connector or interconnecting wiring will be required. Isolation of the faulty component can be accomplished with the help of the troubleshooting chart.
   C. The sensor and interconnecting wiring can be checked with an ohmmeter. An open sensor can be found by making a continuity check between center pins or sockets on connectors on the ends of the sensor. Shorts can be found by looking for continuity between the pins or sockets and the shell of the connector. If moisture in a connector is found to be the cause of a false alarm, remove moisture by blowing out connectors with dry nitrogen.
   D. Prior to making any tests, equivalent connectors should be installed at the plug or receptacle of the sensor or airplane wiring. The test connector should have exposed contact points to attach or touch test probes. If test connectors are not used, an oversized tests probe may be forced into a socket of the sensor connector; this may spread the contacts and prevent the pin of the mating connector from making proper contact.
   E. Whenever the fire protection module (P8-1) is removed and replaced, a test must be performed on the APU fire detection system (Ref APU Fire Detection System - Adjustment/Test).

2. APU Trouble Shooting Chart



APU Fire Detection System - Troubleshooting
Figure 101

APU FIRE DETECTION SYSTEM - ADJUSTMENT/TEST

1. APU Fire Detection System Test
   A. Prepare to Test
      (1) Provide power to the airplane and energize buses on load control center P6.
      (2) Make sure the following circuit breakers are closed on load control center P6:
         (a) APU (Fire protection detection)
         (b) Master Warning and Control
         (c) Landing Gear Indicator Lights
      (3) Make sure the following circuit breakers are open on load control center P6:
         (a) Engine-1
         (b) Engine -2
         (c) Wheel Well Wing Body Overheat
         (d) Cargo smoke (Passenger/Cargo Convertible Airplanes only) B Test System
      (4) Attempt to pull APU fire switch on the fire protection module. The switch should remain locked.
      (5) Press override button under APU fire switch and pull switch. Lock should be released and switch pulled out.

         CAUTION: DO NOT ROTATE SWITCH WHILE PULLED OUT. FIRE EXTINGUISHING BOTTLE MAY BE DISCHARGED.

      (6) Close fire switches.
      (7) Hold the overheat-fire test switch to the overheat position. No fire indications should be presented.
      (8) Return the overheat-fire test switch to the off position.
      (9) Hold the overheat-fire test switch to the fire position. The following warning indications should be presented:
         (a) Both red fire warning lights on P7 should be illuminated.
         (b) The APU fire switch handle should be illuminated.
         (c) The APU fire switches should be unlocked. Verify by pulling out switch.

            CAUTION: DO NOT ROTATE SWITCH WHILE PULLED OUT.

         (d) The fire bell in the control cabin should sound with a steady ringing.
         (e) The horn and fire warning light in the right main wheel well should go on and off at a 60 cpm rate.

(10) While the lights are illuminated, position the lights test switch on the P2 panel to DIM and then back to BRT. The master fire warning lights should dim and then return to their original brightness.
(11) Test fire bell and horn silencing and extinguishing of fire warning lights on P7 by pressing switches at each of the following stations:

NOTE: Release the overheat-fire test switch after silencing and again hold it to the fire position to reactivate bell and horn for next station tested. Fire warning light on remote APU control panel should remain illuminated after bell and horn are silenced.

(a) Bell cutout on fire protection panel.
(b) Captain's fire warning light on P7.
(c) First officer's fire warning light on P7.
(d) Horn cutout on APU panel in right wheel well.

(12) Release test switch to off position.
(13) Hold the overheat fire test switch to the fire position. Press the air-sensing switch on the front panel of the landing gear warning module in the electronic equipment rack. Observe that the fire warning light on the APU control panel in the wheel well flashes and the APU horn does not sound.
(14) Release switches.
(15) Attempt to pull out APU fire switch. Switch should remain locked.

B. Restore Airplane to Normal Configuration
(1) Close engine-1, engine-2, wheel well wing body overheat and cargo smoke (Passenger/Cargo Convertible Airplanes only) circuit breakers on load control center P6.
(2) Determine whether there is any further need for electrical power to the airplane; if not, remove external power.

APU FIRE DETECTION SENSING ELEMENT - REMOVAL/INSTALLATION

1. General
   A. Two separate detection elements are installed on the APU. One along the main body area, and the other in the exhaust area. The removal and installation procedures for both elements are the same. Therefore, the following procedures apply to either element.
2. Equipment and Materials
   A. Bonding Meter (Ref 20-22-01)
   B. Grease - Silicone, Dow Corning DC-4
   C. Lacing Tape-BMS13-54, Grade D, Type III, Class 1 Finish C or equivalent
3. Prepare for Removal of Sensing Element
   A. Open APU CONT and APU fire detection circuit breakers on load control center P6.
   B. Open APU compartment access door latches and open access door. Install door support rods.
   C. Support APU lower shroud, open shroud latches and clamps. Remove shroud.
4. Remove Sensing Element (Fig. 401, 402, 403)
   A. Remove lockwiring and electrical connectors from element fittings at each end of element. On configuration I electrical connector, discard copper gasket. On configuration II electrical connector, copper gasket is an integral part and need not be removed. Install protective caps on electrical connectors.
   B. Remove jamnuts from element fittings.
   C. Release clamps along length of element.

      NOTE: Support element when releasing clamps. Keep bending of element to a minimum.

      NOTE: Overheat sensing element M276 may have a short silicone tube installed over the element in critical locations to aid in prevention of false overheat annunciation. When removing this element, discard the lacing tape and retain the silicone tube for re-installation, if it is serviceable.

   D. Slide element clear of grommet in aft flange and remove element.
   E. Replace jamnuts on element fittings and install protective caps.
5. Install Sensing Element (Fig. 401, 402, 403)
   A. Remove protective caps and jamnuts from element fittings.

B. Support element to prevent bending and insert element through grommet in aft flange. Insert element and fitting into bracket and clamp element in position.

NOTE: Overheat sensing element M276 may be covered with a short silicone tube installed over the element to aid in prevention of false overheat annunciation. The tube is slit to fit easily over the element, and must be secured within the mounting clips, and with lacing tape. It is important to position the slit away from the bend in the element.

C. Install jamnuts.
D. Remove protective caps from electrical connectors and verify detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connector.

CAUTION: CLEAN CONNECTORS USING METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS AND SHOULD NOT BE USED.

E. Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-25 psig.

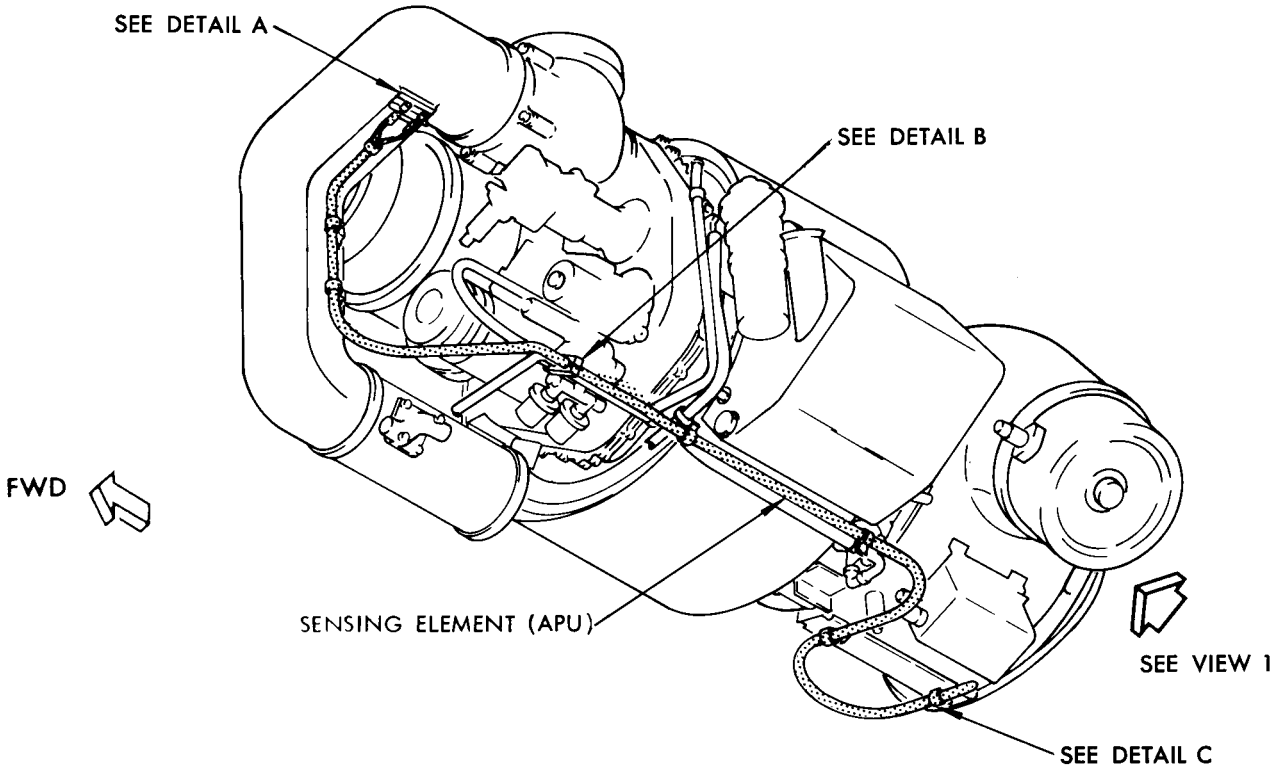
CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

F. On configuration II electrical connectors, apply very light coat of DC-4 grease to copper sealing gasket. On configuration I electrical connector, discard old gasket and replace with new copper gasket (Fig. 402).

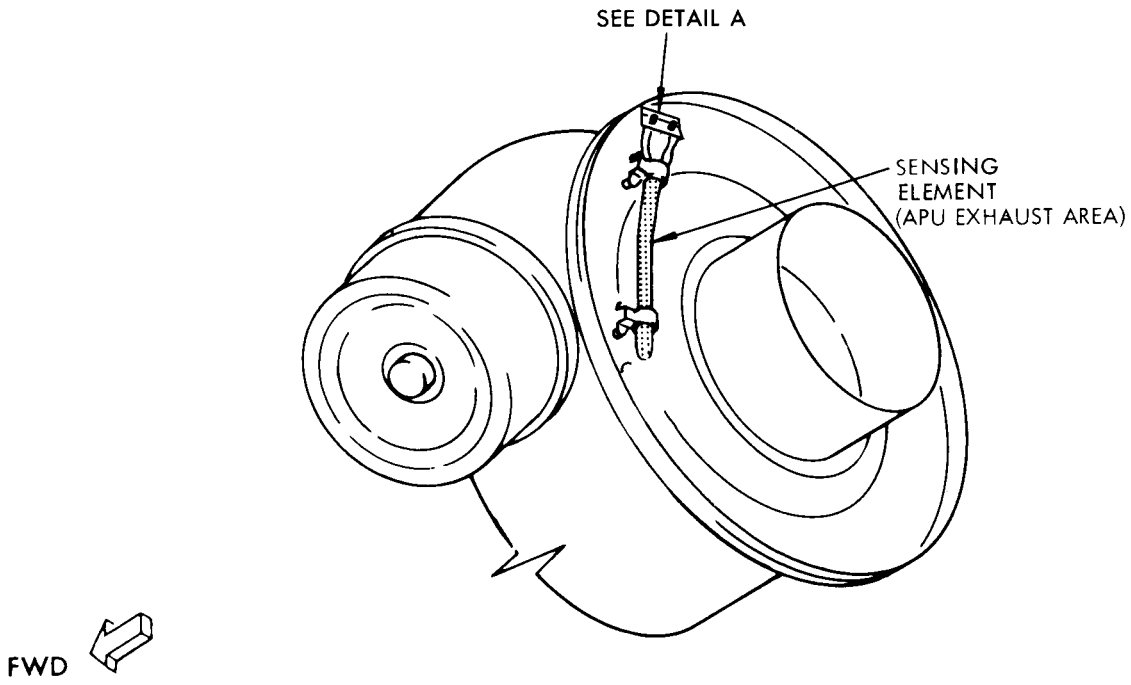
NOTE: Avoid getting grease in connector cavity or on connector pins or contacts.

G. Carefully engage contact pins into receptacles and tighten electrical connectors to a torque of 50-70 pound-inches.
H. Check electrical bond between electrical connector and APU per 20-22-01. Resistance should not exceed 0.0025 ohm.
I. Lockwire element end fittings, jamnuts and electrical connectors together.
J. Test APU fire detection system (Ref APU Fire Detection System A/T).

6. Return Airplane to Normal Configuration
   A. Support APU lower shroud and install shroud.
   B. Remove door support rods and close APU access door.



APU SENSING ELEMENT LOCATION



VIEW 1

APU Fire Detection Sensing Element Installation
Figure 401 (Sheet 1)

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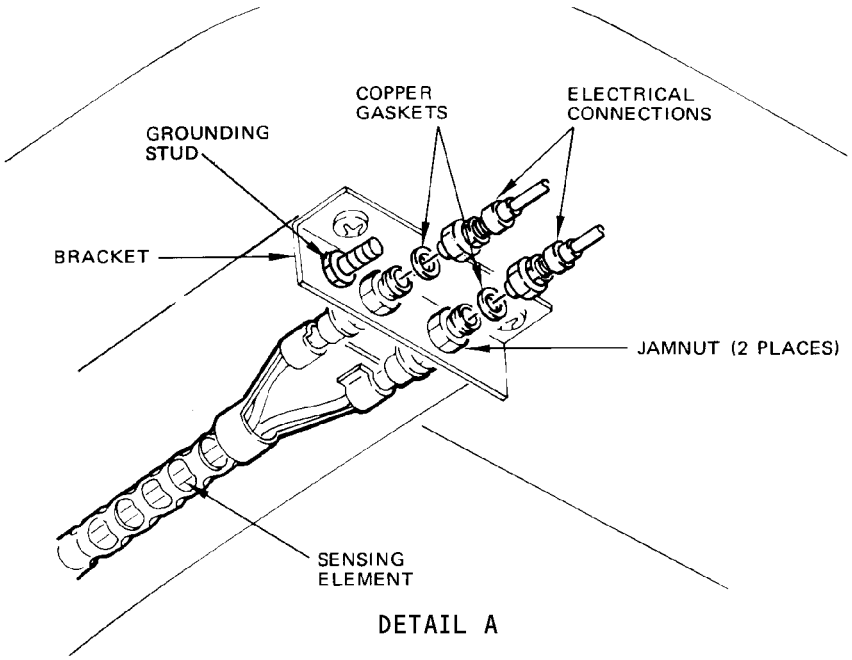
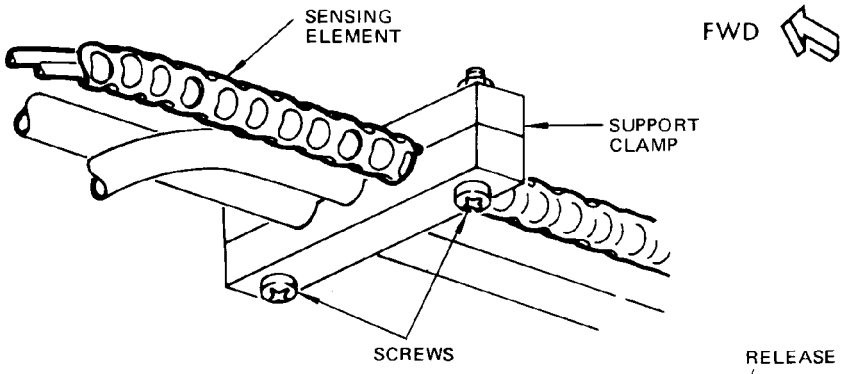
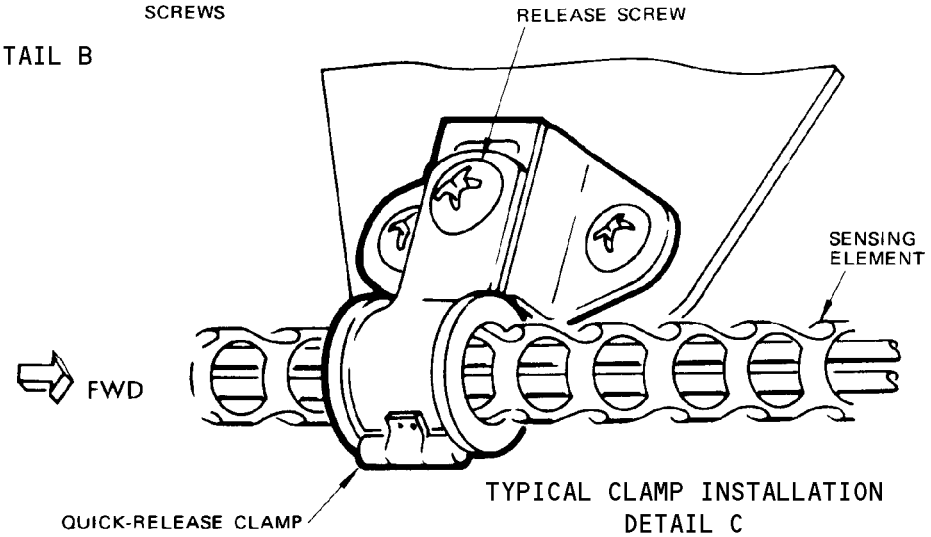


DETAIL A



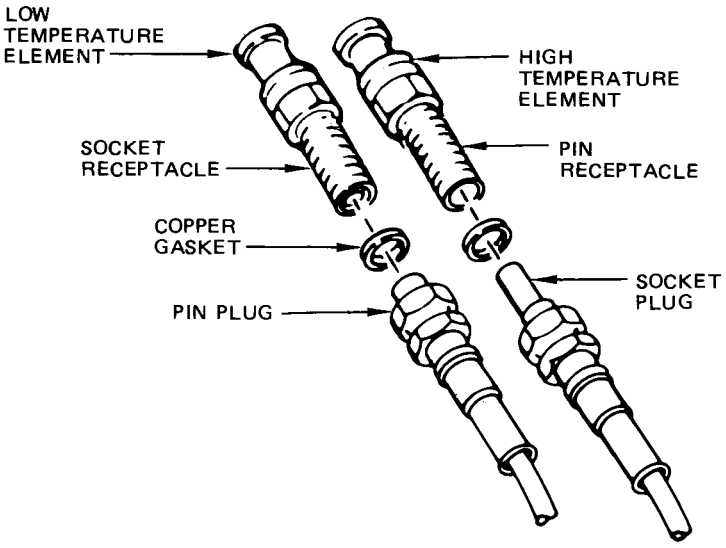
DETAIL B



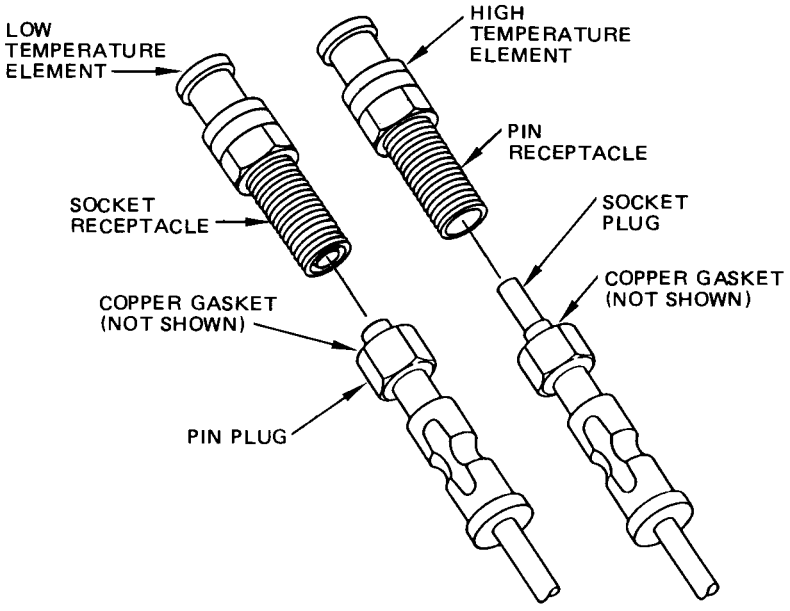
TYPICAL CLAMP INSTALLATION
DETAIL C

APU Fire Detection Sensing Element Installation
Figure 401 (Sheet 2)

C. Close APU CONT and APU fire detection circuit breakers on load control center P6.

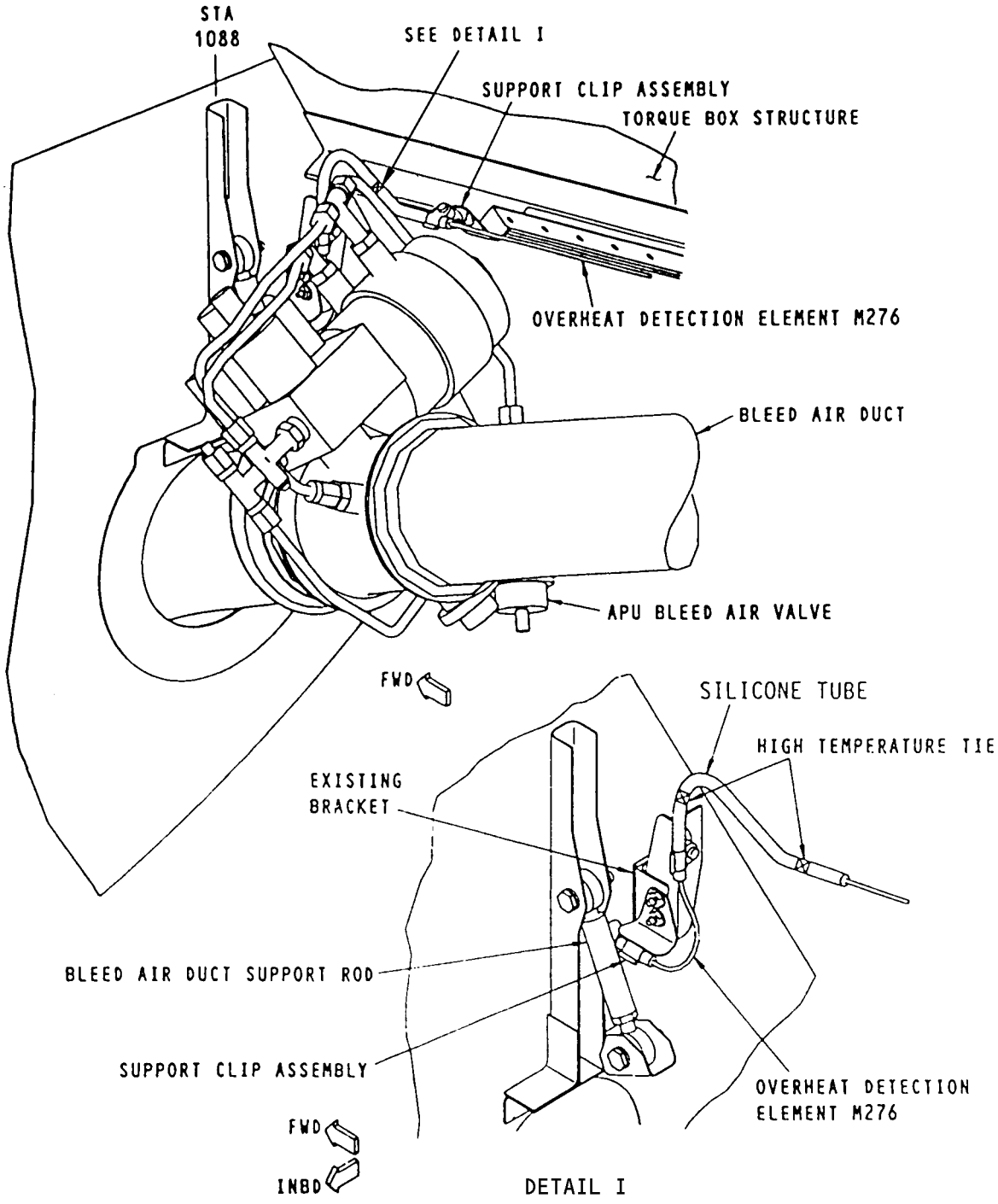


CONFIGURATION I (WITH SEPERATE COPPER GASKET)



CONFIGURATION II (WITH INTEGRAL I COPPER GASKET)

Fire Detector Electrical Connectors
Figure 402



M276 Silicone Tube Installation
Figure 403

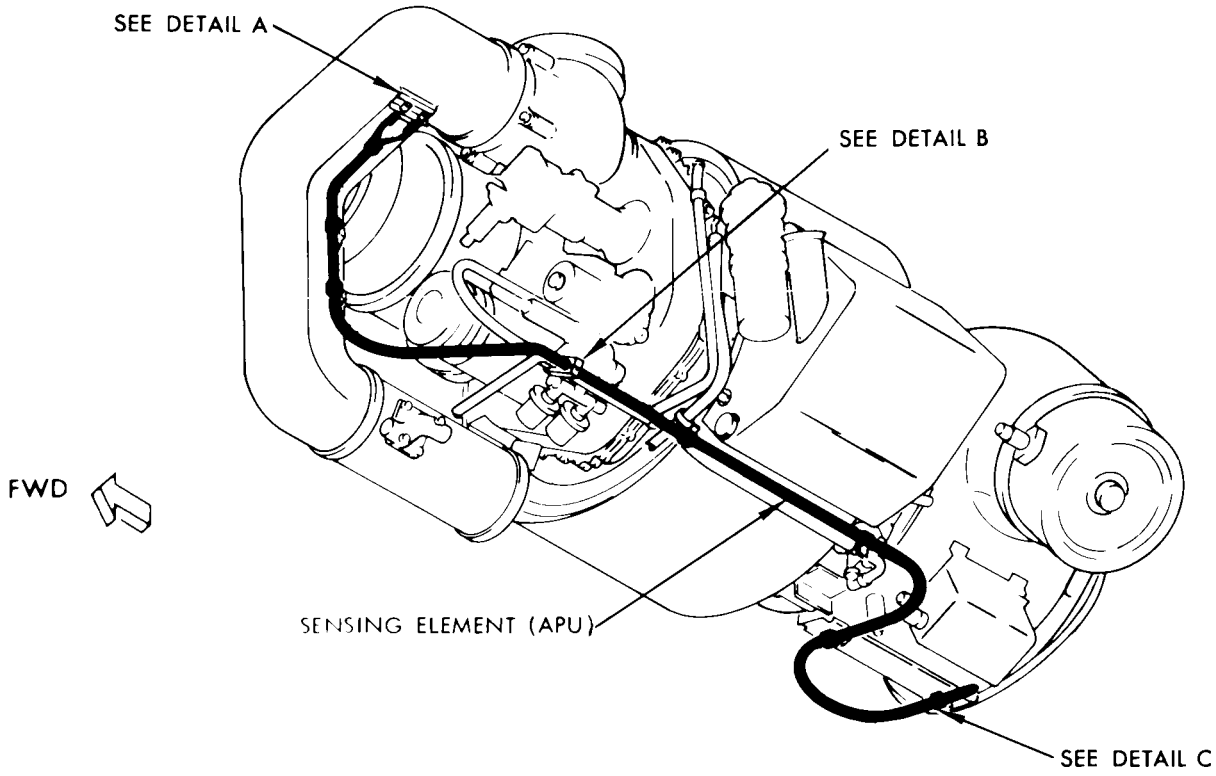
APU FIRE DETECTION SENSING ELEMENT - REMOVAL/INSTALLATION

1. Prepare for Removal of Sensing Element
   A. Open APU CONT and APU fire detection circuit breakers on load control center P6.
   B. Open APU compartment access door latches and open access door. Install door support rods.
   C. Support APU lower shroud, open shroud latches and clamps. Remove shroud.
2. Remove APU Engine Sensing Element (Fig. 401, 402)
   A. Remove lockwire from connectors and disconnect cable from element fittings. Discard copper gasket on configuration I electrical connector. On configuration II electrical connector, copper gasket is an integral part of connector and need not be removed. Install protective caps on electrical connectors.
   B. Remove jamnuts from element fittings.
   C. Release clamps along length of element.

      NOTE: Support element when releasing clamps. Keep bending of element to a minimum.

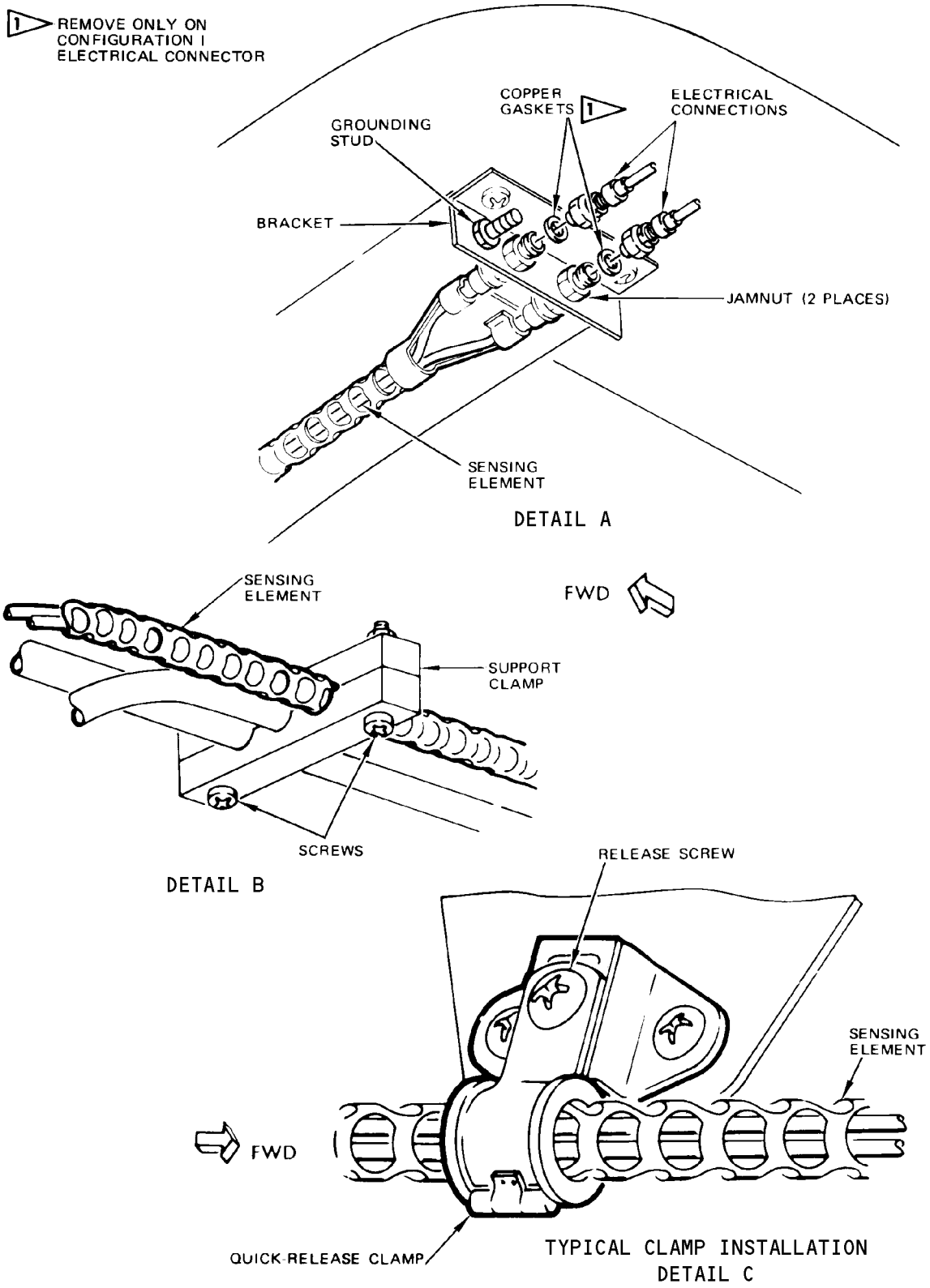
      NOTE: Overheat sensing element M276 may have a short silicone tube installed over the element in critical locations to aid in prevention of false overheat annunciation. When removing this element, discard the lacing tape and retain the silicone tube for re-installation, if it is serviceable.

   D. Slide element clear of bracket and remove.
   E. Replace jamnuts on element fittings and install protective caps.
3. Remove APU Exhaust Sensing Elements (Fig. 401, 402)
   A. Remove lockwire from connectors and disconnect cable from exhaust fire sensing element. Install protective caps on sensing element and connector.
   B. Disconnect cable leading to exhaust overheat sensing element. Install protective caps on connector. Tape sensing element cable and connector to heat shield and muffler assembly.
   C. Gain access through door 3802 and remove four bolts attaching drip pan. Remove drip pan.
   D. Remove screws attaching aft fairing to tail cone.

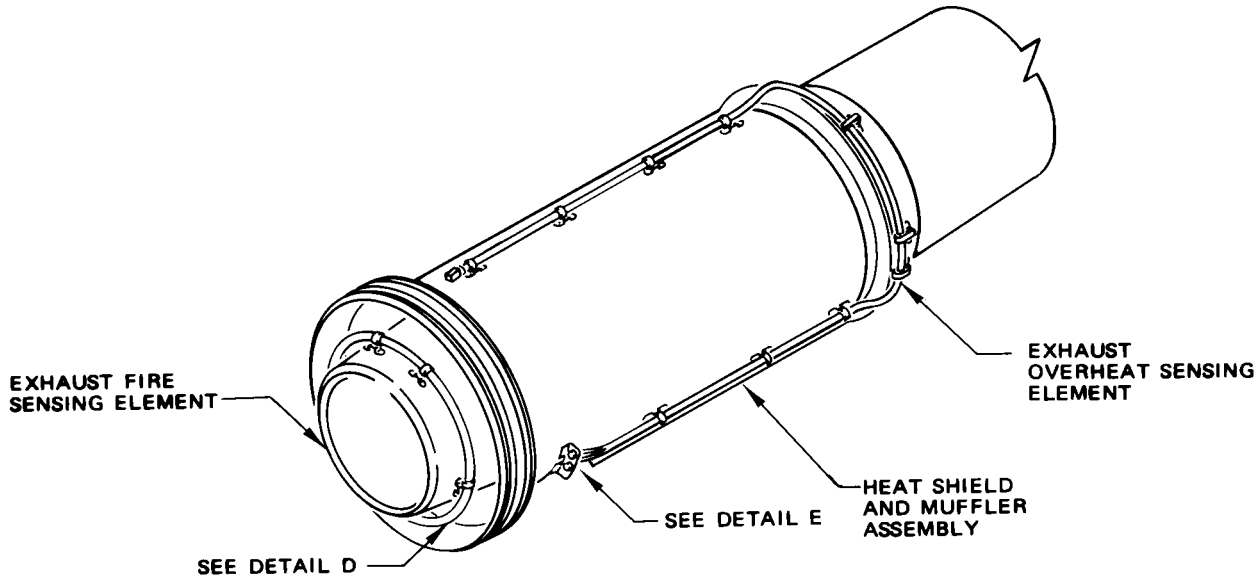


APU ENGINE SENSING ELEMENT LOCATION

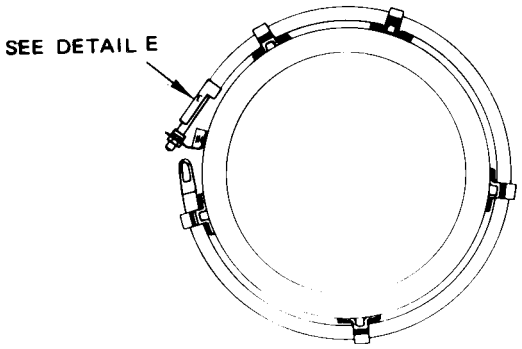
APU Fire Detection Sensor Installation
Figure 401 (Sheet 1)



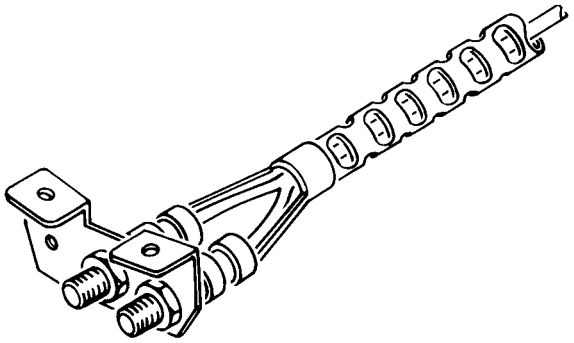
APU Fire Detection Sensor Installation
Figure 401 (Sheet 2)



APU EXHAUST SENSING ELEMENT LOCATION



DETAIL D



DETAIL E

APU Fire Detection Sensor Installation
Figure 401 (Sheet 3)

E. Carefully remove aft fairing heatshield and muffler assembly through opening in tail cone (Ref 49-81-31/401).

CAUTION: EXHAUST SENSING ELEMENTS MAY BE DAMAGED DURING REMOVAL OF HEAT SHIELD AND MUFFLER ASSEMBLY THROUGH TAIL CONE.

F. To remove exhaust fire sensing element, remove jamnuts from element fittings then release clamps along length of element.
G. Slide element fittings clear of bracket and remove.
H. Replace jamnuts on element fittings and install protective caps.
I. Remove exhaust overheat sensing element as follows:
   (1) Remove lockwire from connectors and disconnect cable.
   (2) Remove jamnuts from element fittings.
   (3) Release clamps along length of sensing element.

NOTE: Support sensing element while releasing clamps. Keep bending of element to a minimum.

   (4) Slide element fittings clear of bracket and remove.
   (5) Replace jamnuts on element fittings and install protective caps.

4. Install APU Engine Sensing Element (Fig. 401, 402, 403)

CAUTION: FIRE DETECTION MAY BE DEGRADED WITH INCORRECT UNIT INSTALLED. VERIFY THAT PART NUMBER OF NEW UNIT IS IDENTICAL TO THAT OF UNIT REMOVED.

A. Remove protective caps and jamnuts from element fittings.
B. Support element to prevent bending. Insert element fittings into bracket then clamp sensing element in position.

NOTE: Overheat sensing element M276 may be covered with a short silicone tube installed over the element to aid in prevention of false overheat annunciation. The tube is slit to fit easily over the element, and must be secured within the mounting clips, and with lacing tape. (BMS13-54, Grade D, Type III, Class 1 Finish C or equivalent) It is important to position the slit away from the bend in the element.

C. Install jamnuts.

D. Remove protective caps from electrical connectors and verify that detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connectors.

CAUTION: CLEAN CONNECTORS USING METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS, AND SHOULD NOT BE USED.

E. Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-
25 psig.

CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

F. On configuration II electrical connector, apply very light coat of DC-4 grease to copper sealing gasket. On configuration I electrical connector, discard old copper gasket and replace with new copper gasket (Fig. 402).

NOTE: Avoid getting grease in connector cavity or on connector pins or contacts.

G. Carefully engage contact pins into receptacles and tighten electrical connectors to a torque of 50-70 pound-inches.
H. Check bonding resistance between electrical connector and APU with bonding meter. Observe that resistance is less than 0.0025 ohm.
I. Lockwire element end fittings, jamnuts and electrical connectors together.
J. Test APU fire detection system (Ref APU Fire Detection System A/T).

5. Install APU Exhaust Sensing Element (Fig. 401, 402)

CAUTION: FIRE DETECTION MAY BE DEGRADED WITH INCORRECT UNIT INSTALLED. VERIFY THAT PART NUMBER OF NEW UNIT IS IDENTICAL TO THAT OF UNIT REMOVED.

A. Install exhaust fire sensing element as follows:
   (1) Remove protective caps and jamnuts from element fittings.
   (2) Insert element fittings into bracket on forward muffler cone, then clamp sensing element in position.
   (3) Install jamnuts.
B. Install exhaust overheat sensing element as follows:
   (1) Remove protective caps and jamnuts from element fittings.
   (2) Support element to prevent bending.
   (3) Insert element fitting into bracket on heat shield, then clamp sensing element in position.

(4) Install jamnuts.
(5) Remove protective caps from electrical connectors and verify detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connector.

CAUTION: CLEAN CONNECTORS USING METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS, AND SHOULD NOT BE USED.

(6) Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-25 psig.

CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

(7) On configuration II electrical connector, apply very light coat of DC-4 grease to copper gasket. On configuration I electrical connector, discard old copper gasket and replace with new copper gasket (Fig. 402).

NOTE: Avoid getting grease in connector cavity or on connector pins or contacts.

(8) Carefully engage contact pins into receptacles and tighten electrical connectors to a torque of 50-70 pound-inches.
(9) Lockwire element end fittings, jamnuts and electrical connectors together.
(10) Tape loose end of sensing element cable to heatshield and muffler assembly.

C. Carefully install aft fairing heatshield and muffler assembly through opening in tail cone (Ref 49-81-31/401). Install two screws in aft fairing.

CAUTION: EXHAUST SENSING ELEMENTS MAY BE DAMAGED DURING INSTALLATION OF HEATSHIELD AND MUFFLER ASSEMBLY THROUGH TAIL CONE.

D. Remove protective caps from electrical connectors and verify detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connectors.

CAUTION: CLEAN CONNECTORS USING METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS, AND SHOULD NOT BE USED.

E. Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-25 psig.

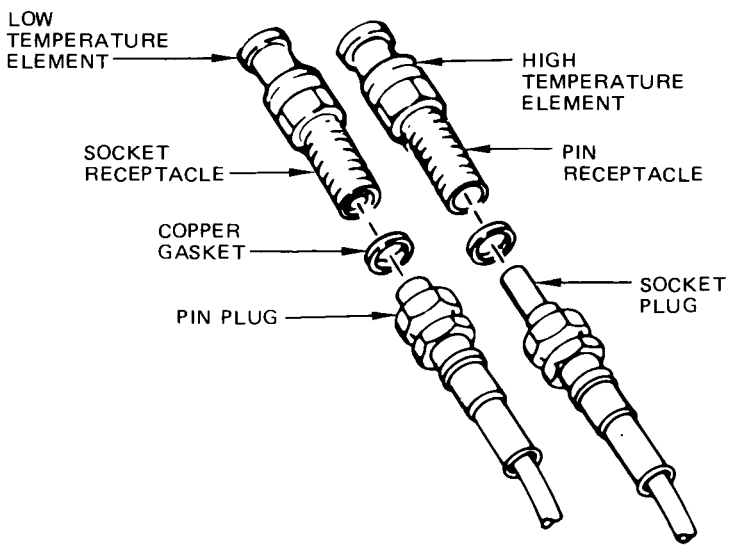
CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

F. On configuration II electrical connector, apply very light coat of DC-4 grease to copper sealing gasket. On configuration I electrical connector, discard old gasket and replace with new copper gasket (Fig. 402).

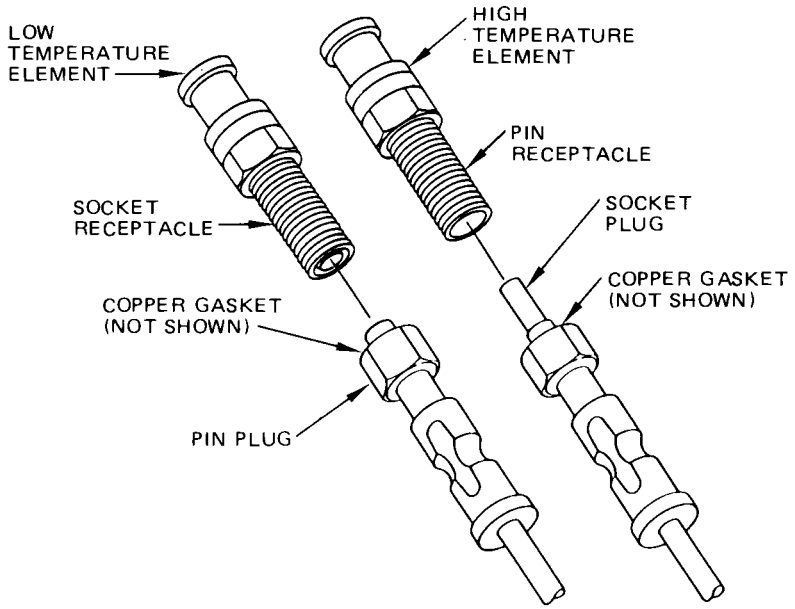
NOTE: Avoid getting grease in connector cavity or on connector pins or contacts.

G. Carefully engage contact pins into receptacles and tighten electrical connectors to a torque of 50-70 pound-inches.
H. Connect cable leading to exhaust overheat sensing element. Clamp cable in place.
I. Test APU sensing elements (Ref APU Fire Detection System A/T).
J. Install drip pan.
K. Install remaining screws in aft fairing.
L. Lockwire exhaust fire sensing element end fittings, jamnuts and electrical connector together.

6. Return Airplane to Normal Configuration
   A. Support APU lower shroud and install shroud.
   B. Remove door support rods and close APU access door.
   C. Close APU CONT and APU fire detection circuit breakers on load control center P6.

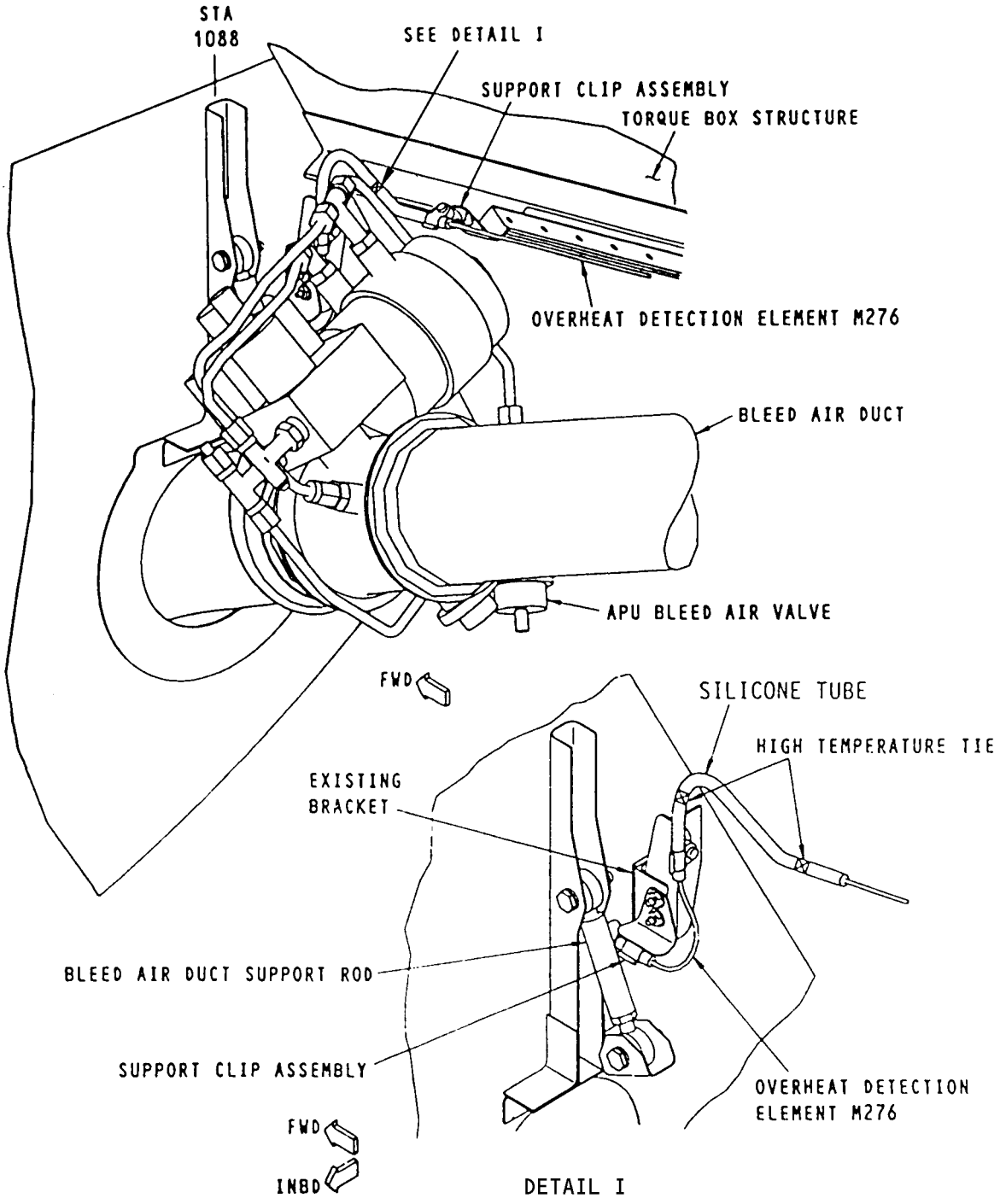


CONFIGURATION I (WITH SEPERATE COPPER WASHER)



CONFIGURATION II (WITH INTEGRAL COPPER WASHER)

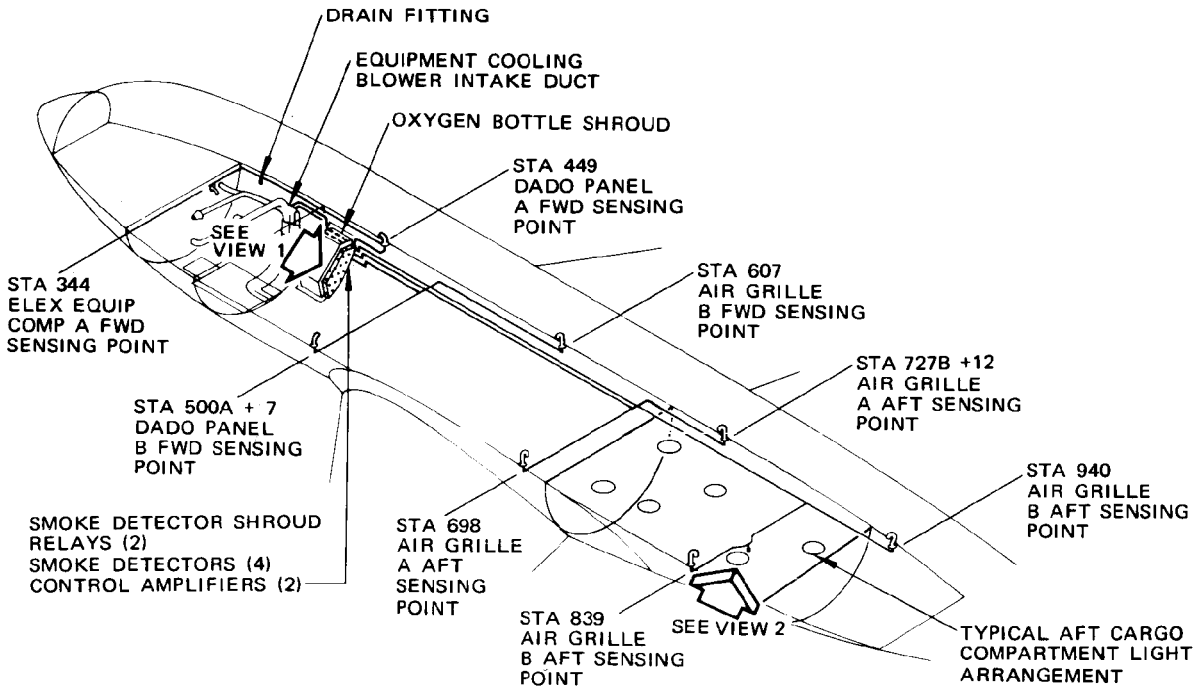
Fire Detector Electrical Connectors
Figure 402

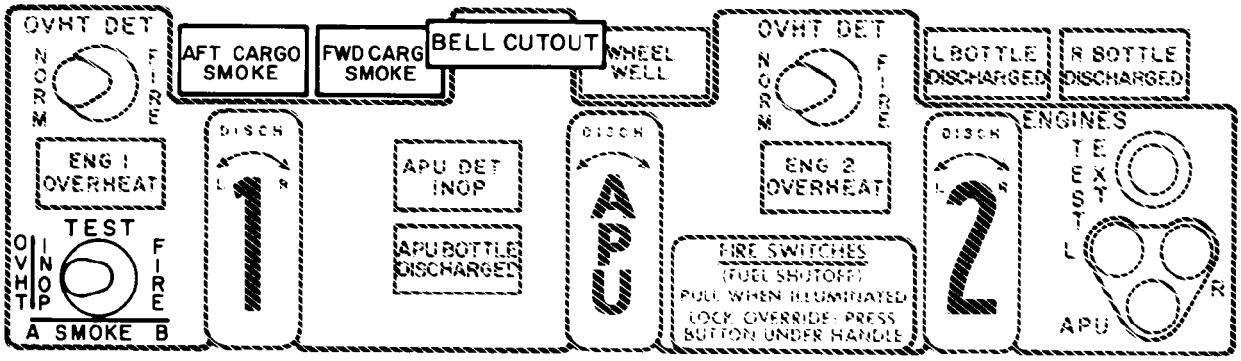


M276 Silicone Tube Installation
Figure 403

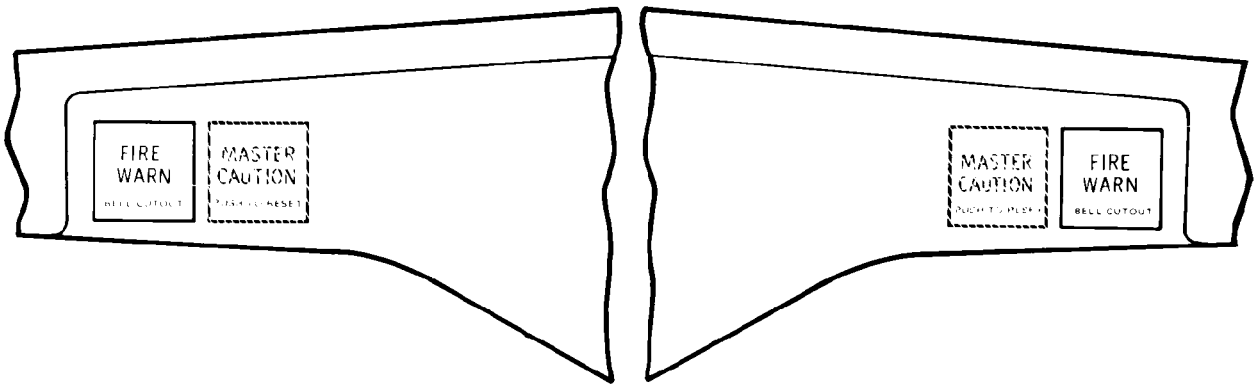
MAIN CABIN SMOKE DETECTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The smoke detection system monitors main cabin air and electronic equipment compartment air for the presence of smoke, or equivalent contaminant, and provides visual and aural warning if smoke is detected. The fire bell sounds, cargo warning lights and master fire warning lights illuminate if smoke is detected or if the system is tested.
   B. Smoke detectors are connected in series between tubing, which is vented into the main cabin and electronic equipment compartment and tubing connected to the equipment cooling blower intake duct. The smoke detectors are electrically connected to control amplifiers, which control the warning devices. When the airplane is pressurized or the equipment-cooling blower is on, differential pressure forces air from the main cabin and electronic equipment compartment through the tubing and smoke detectors and out the equipment cooling blower and air conditioning exhaust. The smoke detector system is split into two separate sections with each section capable of controlling the alarm devices. The forward section consists of A and B smoke detectors, four sensing ports and a control amplifier. The aft section also consists of A and B smoke detectors, four sensing ports and a control amplifier. The forward section monitors the electronic equipment compartment and the area forward of station 650 (approximately) in the main cabin area. The aft section monitors the remaining portion of the main cabin. The four smoke detectors, two control amplifiers and two test relays are located in the forward cargo compartment adjacent to the oxygen bottles. See Fig. 1 and 2 for location and connection of components and sensing ports. The sensing ports in the main cabin are installed behind the dado panels and return air grilles. (Refer to Passenger Cabin Lining and Insulation, Chapter 25.) The electronic equipment compartment sensing port is installed just below the main cabin floor near the center of the compartment.
   C. The main cabin smoke detection system may be tested on the ground or in flight by operation of the test switch on fire protection module P8-1. The test switch energizes an A or B test relay which completes test circuits in the A or B smoke detectors, thereby simulating a smoke condition. If the smoke detectors and control amplifier are operating properly, the fire bell sounds, the forward cargo smoke and aft cargo smoke lights on P8-1 illuminate and the master fire warning lights on pilots' lightshield module P7 illuminate. The bell may be silenced and the master fire warning lights turned off by pressing the bell cutout switch on P8-1 or a master fire warning light. The forward and aft cargo lights go off when the test switch is released (Fig. 3).



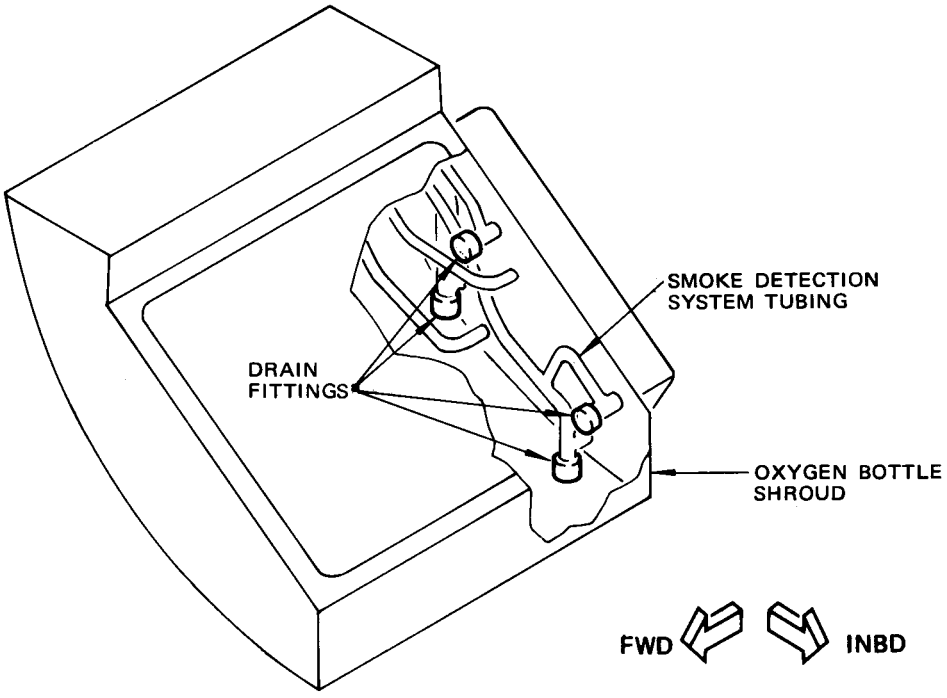


SMOKE DETECTION INDICATION AND CONTROL
(FIRE PROTECTION MODULE)

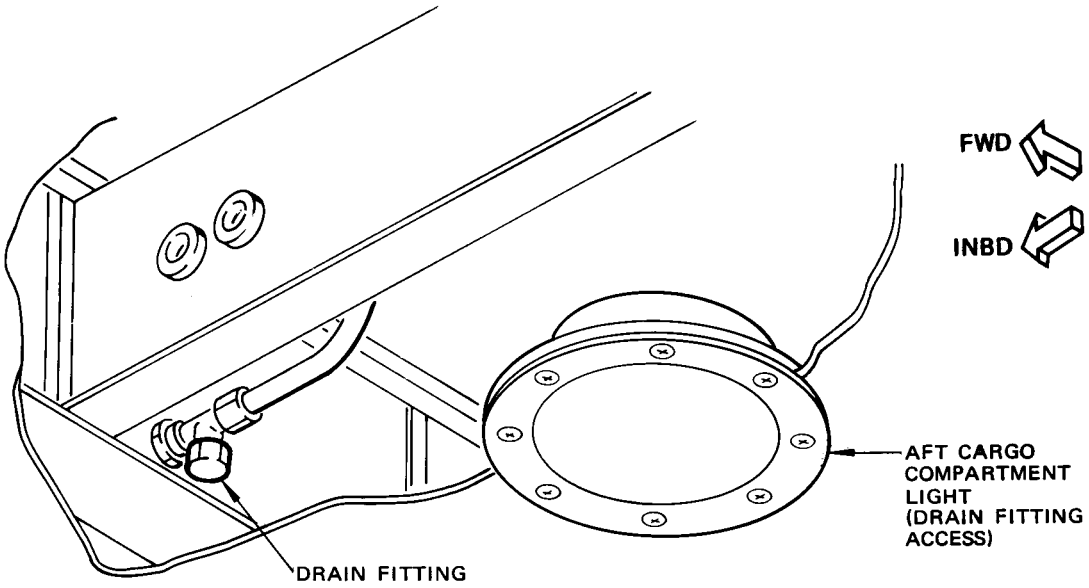


MASTER FIRE WARNING LIGHTS

Main Cabin Smoke Detection System Component Location
Figure 1 (Sheet 1)



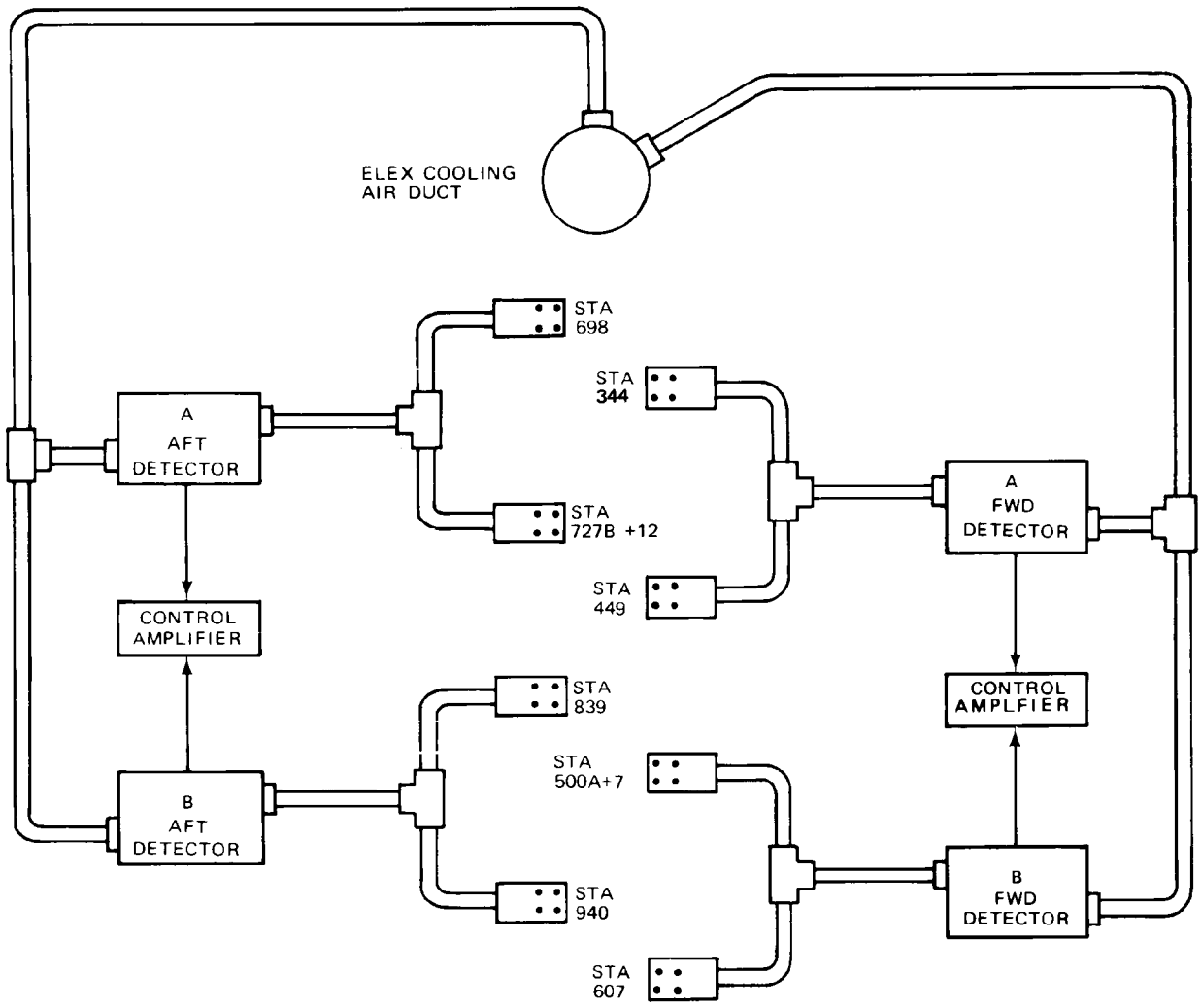
VIEW 1



VIEW 2

Main Cabin Smoke Detection System Component Location
Figure 1 (Sheet 2)

2. Smoke Detectors
   A. The smoke detectors consist of a test lamp, a beacon light, a photoelectric cell, associated circuitry, and a smoke chamber with an inlet port and an exhaust port. The components are arranged in the chamber so that the beacon light projects a beam perpendicular to the line of sight of the photoelectric cell. When smoke is present in the chamber, light from the beacon is reflected from the smoke particles into the photoelectric cell. The photoelectric cell resistance decreases and enough current is passed to the control amplifier to operate the amplifier whenever the existence of smoke reduces the light transmission to approximately 10 percent below that of clear air. The smoke reflects light from the beacon and it is the reflective properties of smoke, not the decrease in light transmission, which is used to actuate the alarm signals. The test lamp is directly in the line of sight of the photoelectric cell. Testing the smoke detectors involves illuminating the test lamp, which simulates light reflection from smoke particles. The system then operates as if smoke were detected and operates the warning devices.
3. Control Amplifier
   A. An A and B smoke detector is connected to each control amplifier. The control amplifier contains two transistors, a relay and associated circuitry. The two transistors amplify the signals from either the A or B smoke detectors and energize the control relay. The control relay then completes voltage to fire protection module P8-1 cargo smoke lights and alarm circuits.
4. Aural and Visual Warning Components
   A. The following aural and visual warning components are used by the smoke detection system. The same components are also used by other fire protection systems.
      (Refer to 26-00, Fire Protection)
   B. Warning Lights
      (1) Two red cargo smoke lights (forward and aft) and two red master fire warning lights provide visual indication of detection of smoke by the smoke detection system. The cargo smoke lights are on fire protection module P8-1. The master fire warning lights are on pilots' lightshield P7. The lights may be pressed to test for normal operation. Pressing a master fire warning light when an alarm has sounded will also cause the master fire warning lights to go off and silence the alarm bell. The cargo smoke lights will not go off until the smoke condition and alarm signal has cleared.
   C. Alarm Bell
      (1) The alarm bell is operated by any of the fire protection systems. The bell is installed in the aural warning devices box adjacent to the control stand in the control cabin.
      (Refer to 31-26-0, Aural Warning and Call Devices)



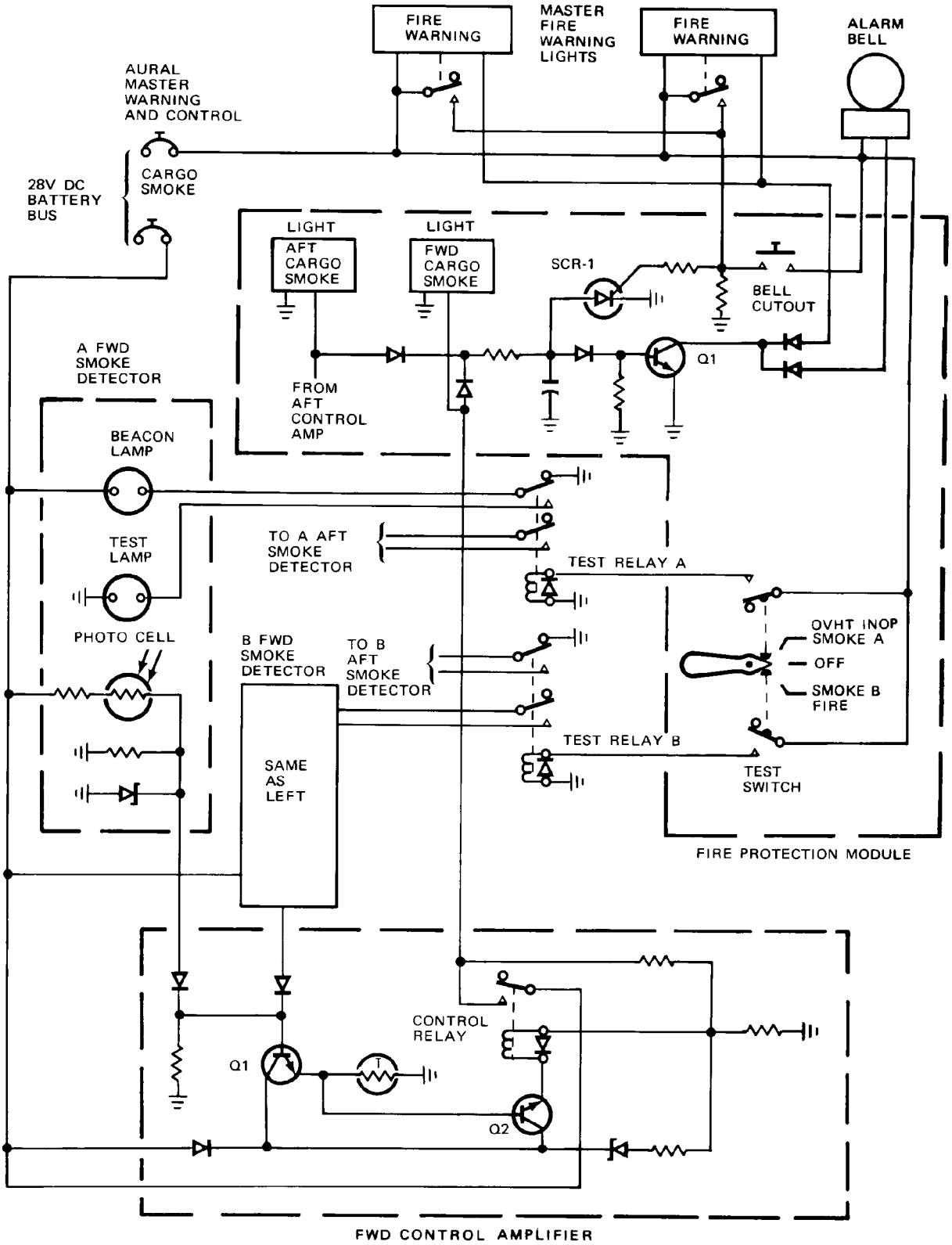
Smoke Detection System Tubing Connections
Figure 2

443233

D. Bell Cutout Switch
(1) The bell cutout switch is on fire protection module P8-1. Pressing the switch causes the bell to silence and turns off the master fire warning lights.

5. Smoke Detector Tubing
A. The smoke detector tubing is aluminum alloy tubing with medium pressure flareless couplings. The main cabin tubes are routed under the floor of the main cabin and connected to a coupling in the crease beam at each station. A short piece of tubing connected to the coupling is then either looped into an air grille or connected to an opening in a dado panel. The tubing in the electronic equipment compartment is mounted under the main cabin floor. Two sensing ports are connected to each tubing run and to a smoke detector. A total of four separate tubing runs, each with two sensing ports are installed. The outlet tubes of the forward smoke detectors are connected together; a single tube then runs forward under the floor and connects to the equipment-cooling duct. The aft smoke detectors and outlets are connected in a similar arrangement.
B. Six drain fittings are installed at low points on the smoke detector tubing (Fig. 1). All drain fittings are easily accessible except the aft drain fitting. Access to the aft drain fitting (station 839) is gained by removing the fifth light assembly in the aft cargo compartment ceiling. The drain fitting can then be reached through the opening.
6 Test Switch
C. The test switch on fire protection module P8-1 has three positions: OVHT INOP-SMOKE A, off, FIRE-SMOKE B. The switch is spring-loaded to the center off position. The test switch is used by the engine and APU fire detection systems as well as the smoke detection system; therefore, when testing the smoke detection system, only the master warning and control, and cargo smoke circuit breakers should be energized to prevent false indications. Holding the switch to either one of the test positions tests the associated smoke detectors and causes the warning devices to operate. The warning devices stop operating when the switch is allowed to return to the center position.

6. Operation
A. Normal Operation
(1) Smoke detection is automatic when power is applied to the airplane and system circuit breakers are closed. When the airplane is on the ground, the equipment-cooling blower draws air through the smoke detection tubing and detectors and exhausts it overboard. When the airplane is airborne, air is forced through the system by pressurization from the air conditioning system.



Main Cabin Smoke Detection System Schematic
Figure 3

(2) Air is directed through each of the smoke detectors. When smoke is present in the air being sampled, by the A or B smoke detector, the smoke particles reflect light from the beacon light onto the photoelectric cell (Fig. 3). When the photoelectric cell resistance decreases enough, Q1 and Q2 in the associated control amplifier turn on and energize the relay.

(3) When the control amplifier relay is energized, voltage is applied to the FWD CARGO SMOKE or AFT CARGO SMOKE light on P8-1. Bias voltage is also applied to the base of transistor Q1 and the anode of SCR1 in P8-1. Transistor Q1 conducts and a ground is provided for the master fire warning lights and the alarm bell.

(4) Bell cutout and master fire warning light extinguishing is accomplished by application of voltage to the gate of SCR1 when the bell cutout switch is pressed or a master fire warning light is pressed. When SCR1 is triggered by the gate voltage, control voltage to Q1 is grounded and Q1 is biased off, thereby removing the ground for the bell and master fire warning lights. The cargo smoke lights remain illuminated until the smoke condition and alarm signal have cleared.

(5) If the FWD CARGO SMOKE light illuminates, smoke is present in either the electronic equipment compartment or in the main cabin area forward of approximately station 650. If the AFT CARGO SMOKE light illuminates, smoke is present in the main cabin area aft of station 650.

B. Test Operation

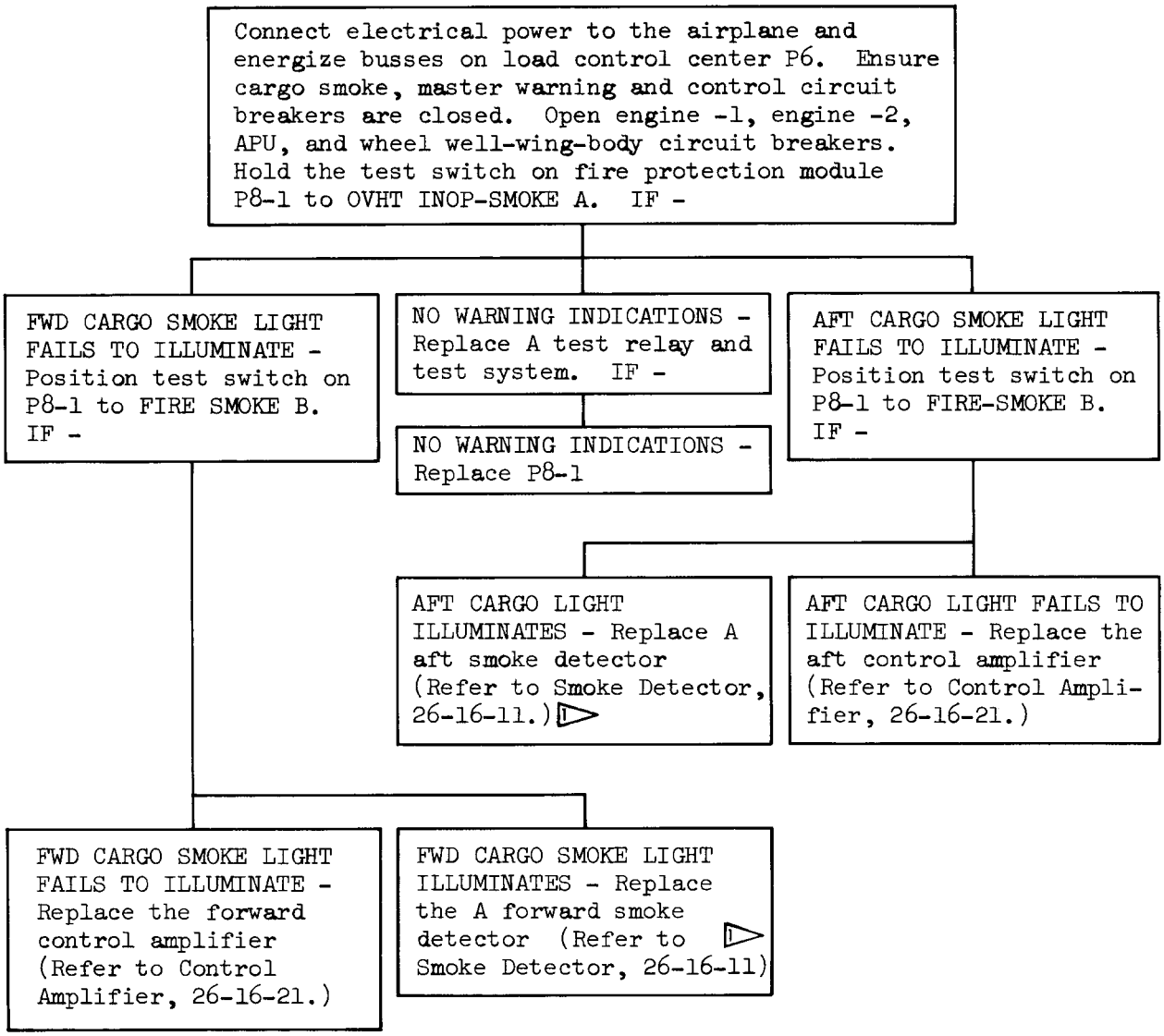
(1) The smoke detection system is tested by moving the test switch on P8-1 to the left or to the right. If the engine, APU, and wheel well fire protection circuit breakers are not pulled, those systems will also be tested. (Refer to Engine Fire Detection System, 26-11-0; APU Fire Detection System, 26-15-0; Wheel Well Overheat Detection System, 26-17-0.) When the test switch is moved to OVHT INOP-SMOKE A, both A smoke detectors are tested. When the switch is moved to FIRE-SMOKE B, both B smoke detectors are tested. Both the FWD CARGO SMOKE and AFT CARGO SMOKE lights illuminate when either A or B smoke detectors are tested.

(2) When the test switch is operated, dc voltage is supplied to either test relay A or test relay B. The energized relay then completes voltage to the test light in both A or both B smoke detectors. If the smoke detection system is operable, the illuminated test lamps simulate a smoke condition and cause the photoelectric cells to apply a signal to the forward and aft control amplifiers, thereby causing the alarm devices to operate. All alarm conditions are removed when the test switch is released.

MAIN CABIN SMOKE DETECTION SYSTEM - TROUBLESHOOTING

1. General
   A. Most main cabin smoke detection system failures can be quickly detected by operation of the test switch on fire protection module P8-1. System faults can be readily recognized by observing the cargo smoke indicator lights on P8-1 and using the associated troubleshooting chart.
   B. System lights should be tested by manually pressing each light before assuming the system is faulty. If both cargo smoke lights illuminate when the system is tested, but the fire warning lights do not illuminate and the fire bell does not ring, P8-1 is faulty.
   C. Since the test switch on P8-1 is used by other systems besides the smoke detector system, it is important to isolate all other systems by pulling their main circuit breakers before attempting to troubleshoot the main cabin smoke detection system. All necessary circuit breakers are under the fire protection detection portion of load control center P6. Refer to the troubleshooting charts.
   D. Whenever the fire protection module (P8-1) is removed and replaced, a test must be performed on the main cabin smoke detection system (Ref Main Cabin Smoke Detection System - Adjustment/Test).
2. Smoke Detector Lamp Checks
   A. The smoke detector test circuit includes the filaments of both lamps in the smoke detector. If either lamp is burned out, there will be no smoke detector response when tested. Before replacing an apparently faulty smoke detector, check lamps as follows:
      (1) Remove smoke detector shroud.
      (2) Remove perforated cover of smoke detector involved by releasing dzus fasteners.
      (3) Unscrew one of the two lamp holder inserts in labyrinth. Replace lamp with one of the two spares located in the spare lamp receptacles mounted on the baseplate. Replace lamp holder insert.
      (4) Repeat smoke detector test. If now operative, replace lamp used from spare lamp receptacle, replace cover and shroud. If not operative, repeat lamp test procedures for the other lamp holder insert.
      (5) If not operative after testing both lamps, replace smoke detector. (Refer to Smoke Detector, 26-16-11.)

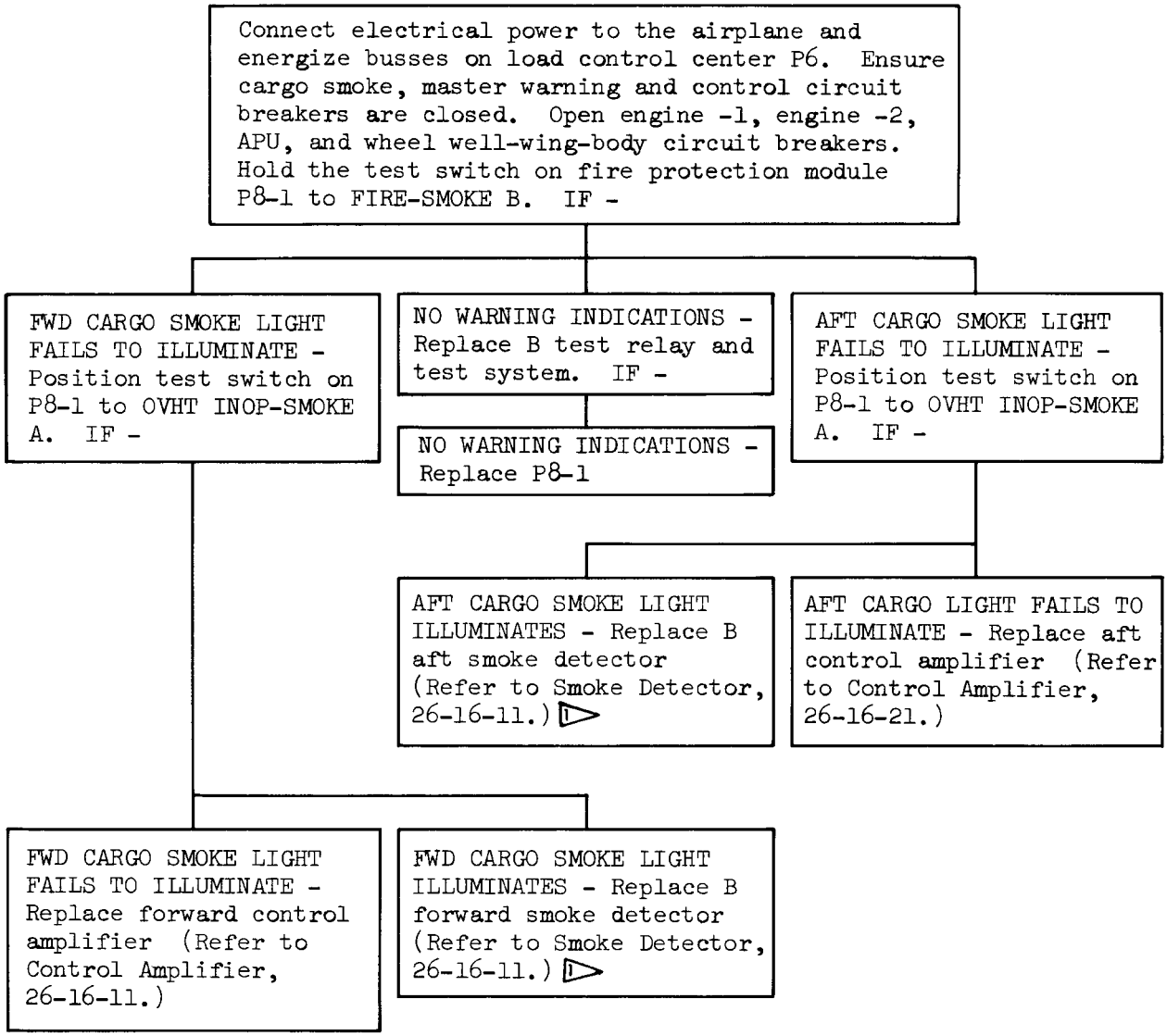
2. Smoke Detection Test A Trouble Shooting Chart



▷1 Prior to replacement of smoke detector, verify lamp operation per paragraph 4.

Smoke Detection Test A Troubleshooting Chart
Figure 101

3. Smoke Detection Test B Trouble Shooting Chart



1 Prior to replacement of smoke detector, verify lamp operation per paragraph 4.

Smoke Detection Test B Troubleshooting Chart
Figure 102

443239

MAIN CABIN SMOKE DETECTION SYSTEM - ADJUSTMENT/TEST

1. General
   A. The smoke detection system tests consist of operationally testing the entire system using the test switch on fire protection module P8-1 and testing system tubing leakage. Test the system whenever an electrical component has been replaced. Test system tubing leakage whenever tubing has been repaired or replaced.
2. Main Cabin Smoke Detection System Test (Fig. 501)
   A. Main Cabin Smoke Detection System Operation Test
      (1) Equipment and Materials
         (a) Smoke source capable of producing small quantities of smoke as required
      (2) Prepare for Test
         (a) Provide electrical power
         (b) Open the following circuit breakers under fire protection detection on panel P6.
            1) Engine-1
            2) Engine-2
            3) APU
            4) Wheel Well Wing-Body Overheat
         (c) Check that the following circuit breakers are closed on panel P6.
            1) Cargo Smoke
            2) Master Warning and Control
      (3) Test Main Cabin Smoke Detection System Operation
         (a) Hold the TEST switch on fire protection module P8-1 to OVHT INOP - SMOKE A. Observe that the FWD and AFT CARGO SMOKE lights and master fire warning lights illuminate and the fire alarm bell sounds.
         (b) While still holding the test switch press the bell cutout switch on P8-1. Observe that the master fire warning lights go out, the alarm bell stops and the cargo smoke lights remain illustrated.
         (c) Release the test switch. Observe that the cargo smoke lights go out.
         (d) Repeat steps (a) through (c) with test switch positioned to FIRE - SMOKE B. Results should be similar.
         (e) Check that the equipment cooling blower is on.

(f) Generate smoke at each of the following sensing ports and observe that the FWD CARGO SMOKE light illuminates, the master fire warning lights illuminate and the fire alarm bell sounds in each case (Fig. 501).

NOTE: Allow the cargo light and alarms to go off before proceeding to the next station.

1) Station 344, electronic equipment compartment
2) Station 449, right side
3) Station 500A + 7, left side
4) Station 607, right side

(g) Generate smoke at each of the following sensing ports and observe that the AFT CARGO SMOKE light illuminates, the master fire warning lights illuminate and the fire alarm bell sounds in each case.

NOTE: Allow the cargo light and alarms to go off before proceeding to the next station.

1) Station 698, left side
2) Station 727B + 12, right side
3) Station 839, left side
4) Station 940, right side

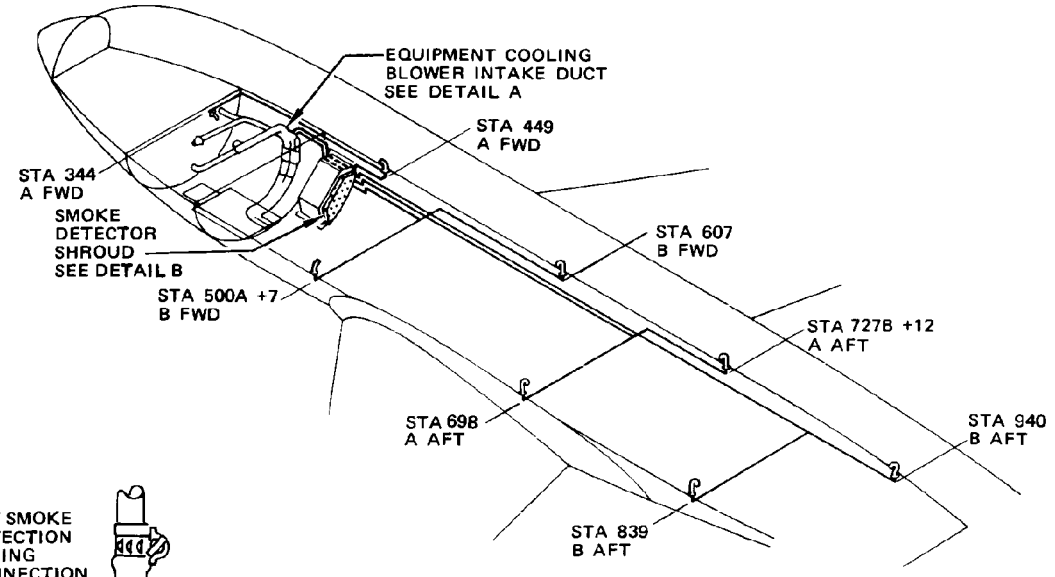
(h) Close the following circuit breakers:
1) Engine-1
2) Engine-2
3) APU
4) Wheel Well Wing-Body Overheat

(i) If no longer required, remove electrical power from airplane.

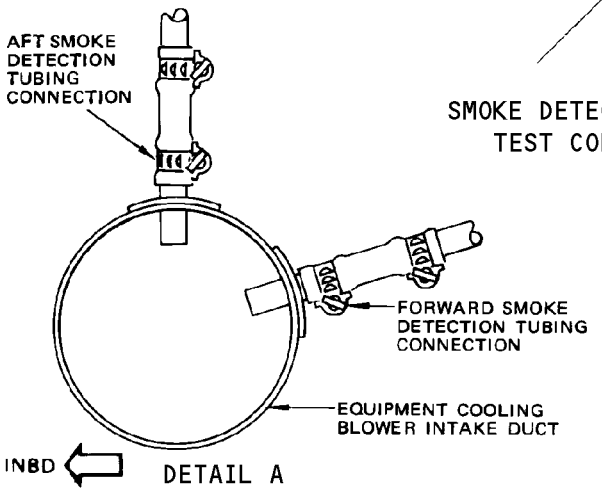
B. Main Cabin Smoke Detection Tubing Leakage Test

NOTE: This test has two methods to measure the leakage of the smoke sense tubes. Method 1 measures the flow rate through the tubes. Method 2 measures the pressure differential in the tubes. You can use whichever method you prefer.

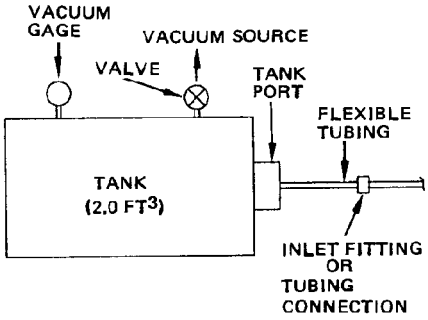
(1) Equipment and Materials
(a) Air vacuum source capable of drawing a continuous airflow of 4.0 scfm at 5 inches of water gage and 4 inches of mercury gage at no flow.
(b) Plugs or tape used for sealing the sensing inlets.
(c) To measure the differential pressure (method 2)
1) Tank (2.0 ft3) with a vacuum gage, valve, and port to connect the tank to the tubing system.



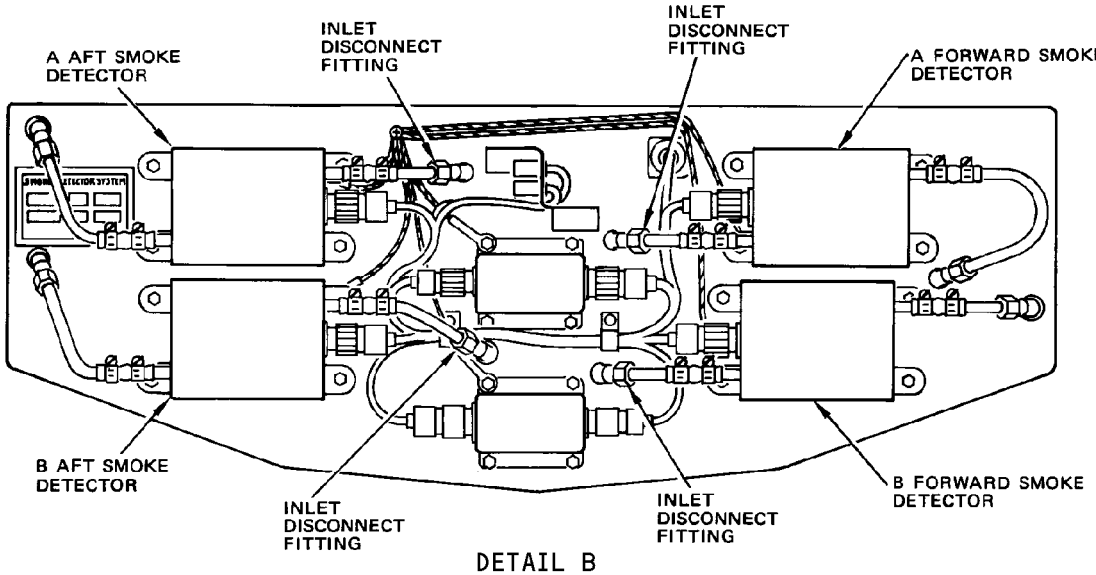
SMOKE DETECTION SYSTEM
TEST CONNECTIONS



DETAIL A



TEST EQUIPMENT (TANK)



DETAIL B

Smoke Detection System test Connections
Figure 501

2) Flexible tubing used to connect the tank port to the tubing system. The tubing length must not exceed 100 ft and the tubing ID must not exceed 3/8 inch.

(d) To measure the flow rate (method 1):

1) Vacuum gage
2) Rotameter - P/N 10A1450N (Stock No. 821A14U45) Fischer & Porter, Warminister, Pennsylvania, 18974

(2) Test Forward Smoke Detector System Tubing

(a) Plug the sensing point inlet tubes in the electronic equipment compartment at station 333 or 334 and in the dado panel at station 449.

(b) Plug the sensing point inlet tubes in the dado panel at station 500A + 7 and in the air grille at station 607.

(c) Remove equipment cooling blower access panel.

(d) Disconnect the forward smoke detection system tubing from the electronic cooling exhaust air duct between stations 344 and 360 (Detail A, Fig. 501).

(e) To measure the differential pressure (method 2), do the steps that follow:

1) Connect the tank to the forward smoke detection tubing at the tubing connection.
2) Connect the vacuum source to the valve on the tank.
3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.
5) Disconnect the vacuum source from the tank and open the valve.
6) Disconnect the tank from the tubing connection.
7) Reconnect the tubing from the sensing inlet to the electronic cooling intake duct at the tubing connection.

(f) To measure the flow rate (method 1), do the steps that follow:

1) Connect vacuum source with rotameter and gage to the forward smoke detection system tubing.
2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.10 scfm.
3) Disconnect the vacuum source and reconnect tubing.

(g) If the leakage is greater than specified, do the Test A and Test B forward smoke detector tubing. If the leakage was less than specified, you do not have to do the Test A or Test B forward smoke detector tubing.

(3) Test A Forward Smoke Detector Tubing

(a) Make sure there is a plug in the sensing point inlet tubes in the electronic equipment compartment at station 333 or 334 and in the dado panel at station 449.

(b) Disconnect inlet tube to the A forward smoke detector from the bulkhead fitting (Detail B, Fig. 501).
(c) To measure the differential pressure (method 2), do the steps that follow:
1) Connect the tank to the tubing at the inlet fitting.
2) Connect the vacuum source to the valve on the tank.
3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.
5) Disconnect the vacuum source from the tank and open the valve.
6) Disconnect the tank from the inlet fitting.
7) Reconnect the tubing from the sensing inlet to the A forward smoke detector at the inlet fitting.
(d) To measure the flow rate (method 1), do the steps that follow:
1) Connect vacuum source with rotameter and gage to the exposed bulkhead fitting.
2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.05 scfm.
3) Disconnect the vacuum source and reconnect inlet tubing.

(4) Test B Forward Smoke Detector Tubing
(a) Make sure there is a plug in the sensing point inlet tubes in the dado panel at station 500A + 7 and in the air grille at station 607.
(b) Disconnect inlet tube to the B forward smoke detector from the bulkhead fitting (Detail B, Fig. 501).
(c) To measure the differential pressure (method 2), do the steps that follow:
1) Connect the tank to the tubing at the inlet fitting.
2) Connect the vacuum source to the valve on the tank.
3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.
5) Disconnect the vacuum source from the tank and open the valve.
6) Disconnect the tank from the inlet fitting.
7) Reconnect the tubing from the sensing inlet to the B forward smoke detector at the inlet fitting.
(d) To measure the flow rate (method 1), do the steps that follow:
1) Connect vacuum source with rotameter and gage to the exposed bulkhead fitting.
2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.05 scfm.
3) Disconnect the vacuum source and reconnect inlet tubing.

(5) Test Aft Smoke Detector System Tubing
  (a) Plug the sensing point inlet tubes in the air grilles at stations 698 and 727B + 12.
  (b) Plug the sensing point inlet tubes in the air grilles at stations 839 and 879.
  (c) Remove equipment cooling blower access panel.
  (d) Disconnect aft smoke detection system tubing from the electronic cooling exhaust air duct between stations 344 and 360 (Detail A, Fig. 501).
  (e) To measure the differential pressure (method 2), do the steps that follow:
    1) Connect the tank to the aft smoke detection system tubing.
    2) Connect the vacuum source to the valve on the tank.
    3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
    4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.
    5) Disconnect the vacuum source from the tank and open the valve.
    6) Disconnect the tank from the tubing connection.
    7) Reconnect the forward smoke detector tubing to the electronic cooling intake duct at the tubing connection.
  (f) To measure the flow rate (method 1), do the steps that follow:
    1) Connect vacuum source with rotameter and gage to the aft smoke detection system tubing.
    2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.10 scfm.
    3) Disconnect the vacuum source and reconnect tubing.
  (g) If the leakage is greater than specified, do the Test A and Test B aft smoke detector tubing. If the leakage was less than specified, you do not have to do the Test A or Test B aft smoke detector tubing.
(6) Test A Aft Smoke Detector Tubing
  (a) Make sure there is a plug in the sensing point inlet tubes in the air grilles at stations 698 and 727B + 12.
  (b) Disconnect inlet tube to the A aft smoke detector from the bulkhead fitting (Detail B, Fig. 501).
  (c) To measure the differential pressure (method 2), do the steps that follow:
    1) Connect the tank to the tubing at the inlet fitting.
    2) Connect the vacuum source to the valve on the tank.
    3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
    4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.

5) Disconnect the vacuum source from the tank and open the valve.
6) Disconnect the tank from the inlet fitting.
7) Reconnect the tubing from the sensing inlet to the A forward smoke detector at the inlet fitting.

(d) To measure the flow rate (method 1), do the steps that follow:
1) Connect vacuum source with rotameter and gage to the exposed bulkhead fitting.
2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.05 scfm.
3) Disconnect the vacuum source and reconnect inlet tubing.

(7) Test B Aft Smoke Detector Tubing
(a) Make sure there is a plug in the sensing point inlet tubes in the air grilles at stations 839 and 879 or 940.
(b) Disconnect inlet tube to B aft smoke detector from the bulkhead fitting (Detail B, Fig. 501).
(c) To measure the differential pressure (method 2), do the steps that follow:
1) Connect the tank to the tubing at the inlet fitting.
2) Connect the vacuum source to the valve on the tank.
3) Open the valve on the tank and pull the tank down to a pressure differential of 3.0 inches Hg.
4) Close the valve on the tank. Verify that the rate of change of the pressure does not exceed 0.75 inch Hg/min.
5) Disconnect the vacuum source from the tank and open the valve.
6) Disconnect the tank from the inlet fitting.
7) Reconnect the tubing from the sensing inlet to the B aft smoke detector at the inlet fitting.
(d) To measure the flow rate (method 1), do the steps that follow:
1) Connect vacuum source with rotameter and gage to the exposed bulkhead fitting.
2) Pull a vacuum of 3 ±0.5 inches of mercury. Observe that the leakage does not exceed 0.05 scfm.
3) Disconnect the vacuum source and reconnect inlet tubing.

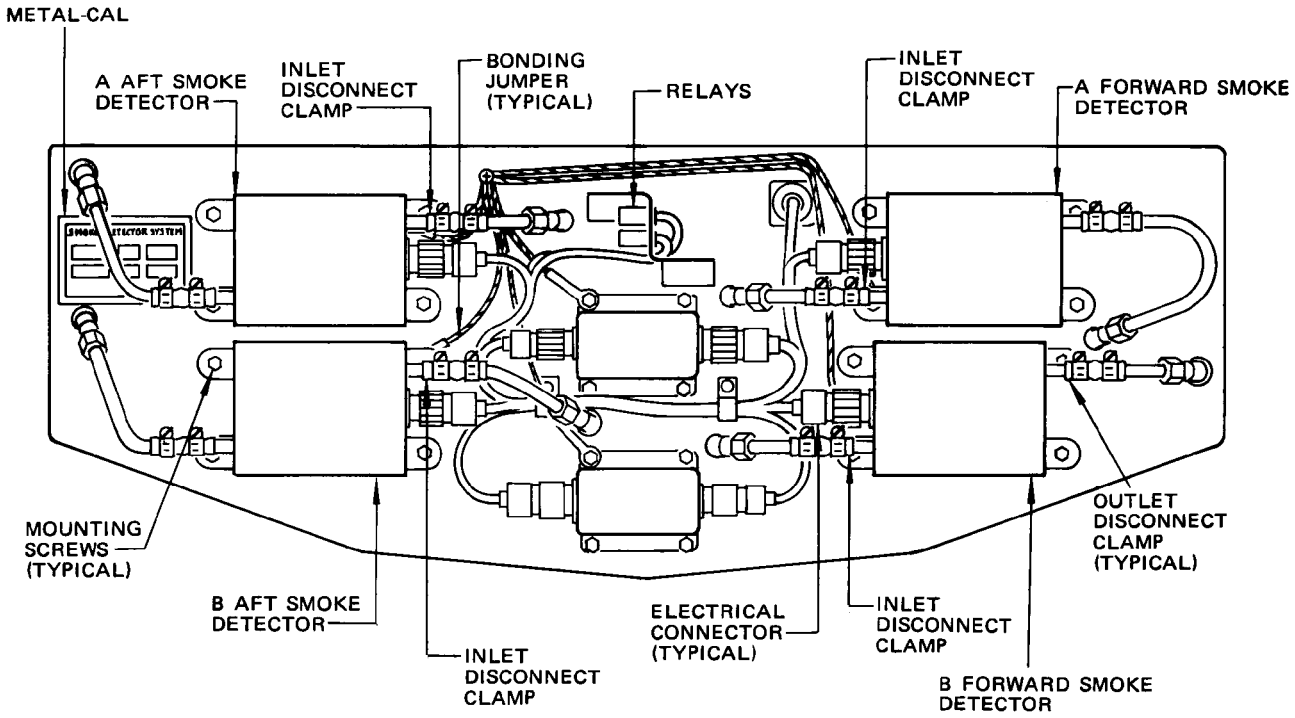
(8) Close Up
(a) Install equipment cooling blower access panel.
(b) Remove plugs from all eight sensing points.
(c) Test operation of system with steps A.(2)(e) thru A.(2)(i).

MAIN CABIN SMOKE DETECTION TUBING - CLEANING/PAINTING

1. General
   A. This section contains the procedure to clean the smoke detection tubing manifolds in the main cabin.
2. Clean the Smoke Sampling Manifold
   A. Standard Tools and Equipment
      (1) Air source - filtered, compressed, 30 psig maximum
      (2) Caps - for the inlet tubes on the detectors
      (3) Mechanical probe
      (4) Tube brush
   B. Consumable Materials
      (1) Soap and water solution - commercially available
   C. References
      (1) 26-16-00/501, Lower Cargo Compartment Smoke Detection System
      (2) 36-00-00/201, Pneumatic System
   D. Procedure
      (1) Remove the pneumatic power (Ref 36-00-00/201).
      (2) Disconnect the sampling manifold from the smoke detectors.
      (3) Install caps on the inlet tubes on the detectors.
      (4) Remove the manifold tees and the applicable weldment assemblies from the manifold.
      (5) Use the soap and water solution and the tube brush to clean the tees and weldment assemblies.
          (a) Flush the tees and weldment assemblies with water.
          (b) Let the tees and weldment assemblies dry.
      (6) Remove all the end caps from the sampling manifold.
          (a) Discard the end caps.
      (7) Remove all unwanted material from the ends of the manifold and from the orifices in the manifold.
      (8) Use the mechanical probe to remove all the contamination from the inner wall of the manifold across from the orifices.
      (9) Install the tees in the manifold.
      (10) Apply pressurized air to each manifold at the end farthest from the detectors.
      (11) Make sure the rubber tubing and tubing connectors are not worn or damaged.
          (a) If there are cracks, holes, or damage to the tubing or connectors, replace them.
      (12) Install new end caps on the manifold.
      (13) Install all weldment assemblies that you removed.
      (14) Remove the caps from the detector inlet tubes.
      (15) Connect the manifold to the smoke detectors.
      (16) Do the operational test and the airflow test for the applicable Cargo Smoke Detection System (AMM 26-16-00/501).

SMOKE DETECTOR - REMOVAL/INSTALLATION

1. General
   A. The smoke detectors are installed in the smoke detection shroud installed on the aft end of the oxygen bottles shroud in the forward cargo compartment. Each detector has a bonding jumper attached, therefore a bonding check is required each time a smoke detector is removed and installed.
2. Equipment and Materials
   A. Low Resistance Testing Set - Microhm Bridge Type W Bonding Meter, Model T-207, Avtron Manufacturing Co., or equivalent
3. Remove Smoke Detector (Fig. 401)
   A. Pull the CARGO SMOKE circuit breaker on panel P6.
   B. Remove smoke detection shroud.
   C. Remove electrical connector from smoke detector.
   D. Loosen clamps on inlet and outlet ports of smoke detectors and disconnect tubing.
   E. Remove mounting screws from smoke detection.
   F. Lift smoke detector; remove bonding jumper from bottom of detector and remove detector.
4. Install Smoke Detector (Fig. 401)
   A. Clean faying surfaces and connect bonding jumper to mounting lug on bottom of smoke detector.
   B. Position smoke detector with electrical connector pointing toward relays, install screws and tighten.
   C. Check bonding resistance between the smoke detector and primary structure with bonding meter. Observe that the resistance is less than 0.0025 ohm.
   D. Connect tubing to inlet and outlet ports and tighten clamps.
   E. Connect electrical connector to smoke detector.
   F. Install smoke detection shroud.
   G. Operationally test smoke detector. (Refer to Main Cabin Smoke Detection System, 26-16-0)



Smoke Detector Installation
Figure 401

SMOKE DETECTOR - CLEANING

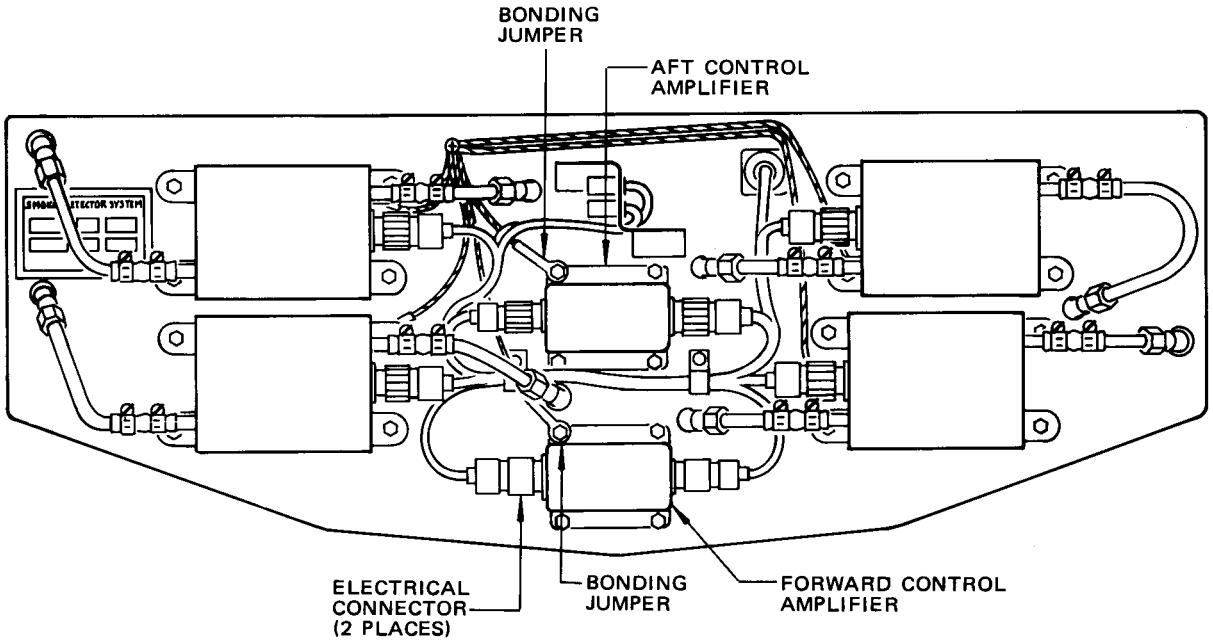
1. Smoke Detector Cleaning
   A. Pull CARGO SMOKE circuit breaker.
   B. Gain access to smoke detectors.
   C. Remove electrical connector from each smoke detector.
   D. Loosen clamps on inlet and outlet ports of smoke detectors and disconnect tubing.
   E. Apply a low velocity source of air (5-psi max) to inlet of each smoke detector for a minimum of 15 seconds. Allow no foreign objects or cleaning agents to enter the smoke detector labyrinth assembly.
   F. Reconnect tubing to inlet and outlet ports and tighten clamps.
   G. Reconnect electrical connector of each smoke detector.
   H. Restore airplane to precleaning configuration.
   I. Push in CARGO SMOKE circuit breaker.
   J. Perform Smoke Detection System Test using smoke (26-16-0, A/T).

CONTROL AMPLIFIER - REMOVAL/INSTALLATION

1. General
   A. The control amplifiers are installed in the smoke detection shroud installed on the aft end of the oxygen bottles shroud in the forward cargo compartment. Each control amplifier has a bonding jumper attached, therefore a bonding check is required each time a control amplifier is removed and installed.
2. Equipment and Materials
   A. Low Resistance Testing Set - Microhm Bridge Type W Bonding Meter, Model T-207, Avtron Manufacturing Co., or equivalent
3. Remove Control Amplifier (Fig. 401)
   A. Pull the CARGO SMOKE circuit breaker on panel P6.
   B. Remove smoke detection shroud.
   C. Remove electrical connectors from control amplifier.
   D. Remove mounting screws and disconnect bonding jumper.
   E. Remove control amplifier.
4. Install Control Amplifier (Fig. 401)
   A. Position control amplifier so that amplifier connectors mate properly with airplane wiring and install three mounting screws.

      NOTE: Connectors on each end of control amplifier are different sizes.

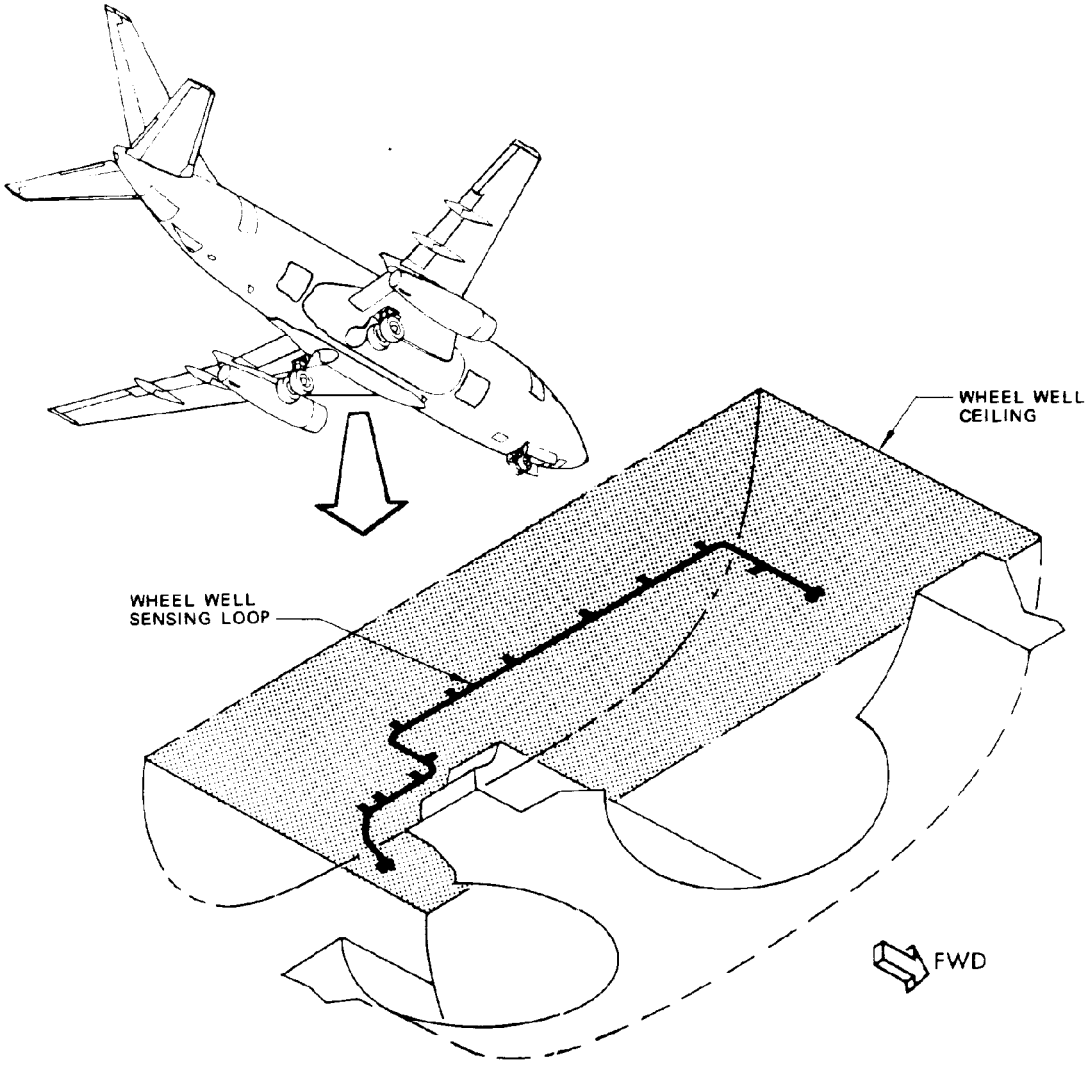
   B. Clean faying surfaces. Connect bonding jumper with fourth mounting screw and tighten all screws.
   C. Check bonding resistance between the control amplifier and primary structure with the bonding meter. Observe that the resistance is less than 0.0025 ohm.
   D. Connect electrical connectors to control amplifier.
   E. Install smoke detection shroud.
   F. Operationally test control amplifier. (Refer to Main Cabin Smoke Detection System, 26-16-0)



Control Amplifier Installation
Figure 401

WHEEL WELL OVERHEAT DETECTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The wheel well overheat detection system provides overheat detection in the main wheel well area. Fire detection is provided by a sensing element along the ceiling of the wheel well (Fig. 1). The detection system is an electrical, heat sensing system that responds to an overheat condition by activating fire warning lights and an alarm bell.
   B. The wheel well overheat detection system consists of the fire protection system module, compartment overheat accessory unit (control module) M237, alarm bell, master fire warning lights and sensing elements. The sensing element is connected to the compartment overheat accessory unit. The accessory unit contains the overheat control unit test relays and alarm control for the wheel well, as well as circuits for the wing and body overheat systems. The overheat control unit monitors the electrical resistance of the sensing element. When a temperature rise causes the element resistance to drop to the value corresponding to the alarm temperature, the control unit will provide a signal to the alarm cutout control card, wheel well warning light and a ground to the master fire warning lights. When the control card receives the signal, it actuates the fire alarm bell in the aural warning devices box.
   C. The overheat detection system can be tested on the ground or in flight by operation of the overheat fire test switch on the fire protection module. The fire test switch tests continuity through the wheel well system by simulating an overheat condition and energizing the alarm bell and warning lights.
2. Fire Protection System Module Components
   A. The fire protection system module components described in the following paragraphs will be only those associated with the wheel well overheat detection system. The fire protection system module is located on the aft electronic panel (P8).
   B. Wheel Well Warning Light
      (1) A red warning light indicates an overheat condition in the wheel well area. An overheat condition in the wheel well area causes the steady illumination of the warning light and the master fire warning light.
   C. Test Switch
      (1) A overheat fire test switch is provided for testing the wheel well overheat detection system. The test switch may be used while the airplane is in flight or on the ground (Fig. 2). Holding the switch to the fire position operates control circuits in the accessory unit, which simulate an overheat condition in the wheel well. The wheel well overheat warning components are then energized.

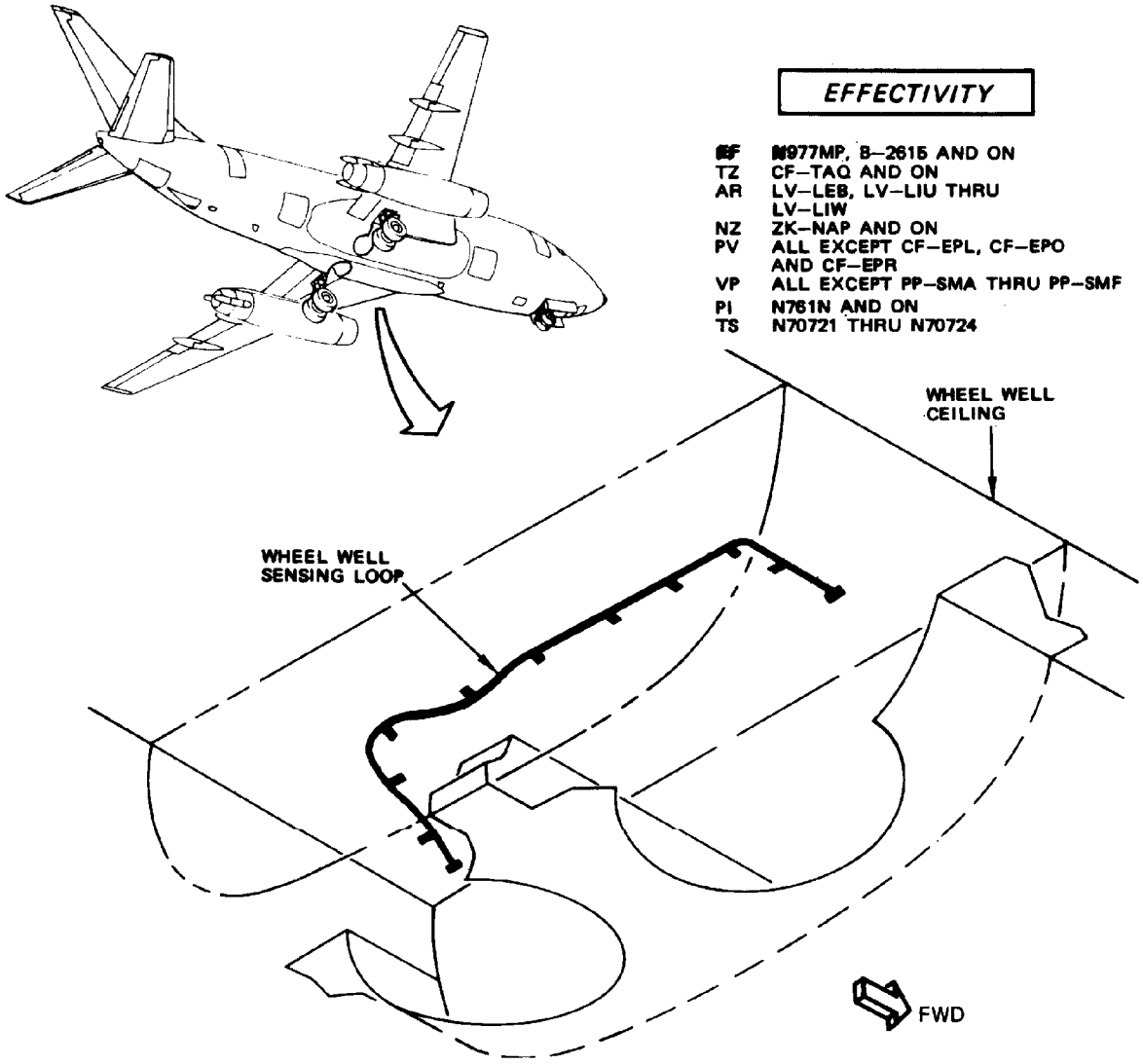


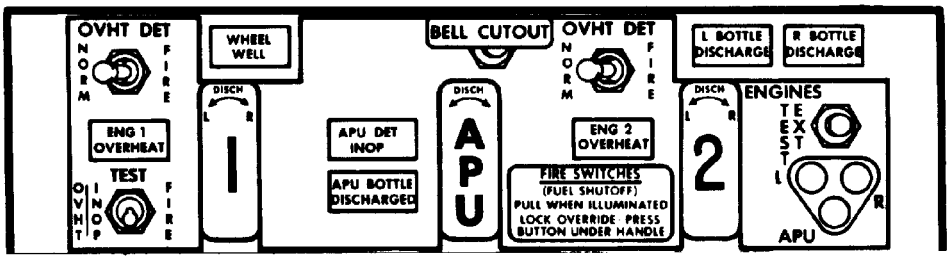
FIRE PROTECTION PANEL

EFFECTIVITY

IN	ALL EXCEPT EI–BEB AND ON
PV	CF–EPL, CF–EPO, AND CF–EPR
VP	PP–SMA THRU PP–SMF
WE	N2711R, N4902W, N4906 AND N4907
PI	N734N THRU N747N
NH	ALL EXCEPT JA–8452 AND ON
TZ	CF–TAN AND CF–TAO
AR	LV–JMW THRU LV–JMZ, LV–JND, LV–JNE, LV–JTD, LV–JTO
NZ	ZK–NAC THRU ZK–NAE, ZK–NAJ THRU ZK–NAM
CP	ALL EXCEPT C–GCPM AND ON

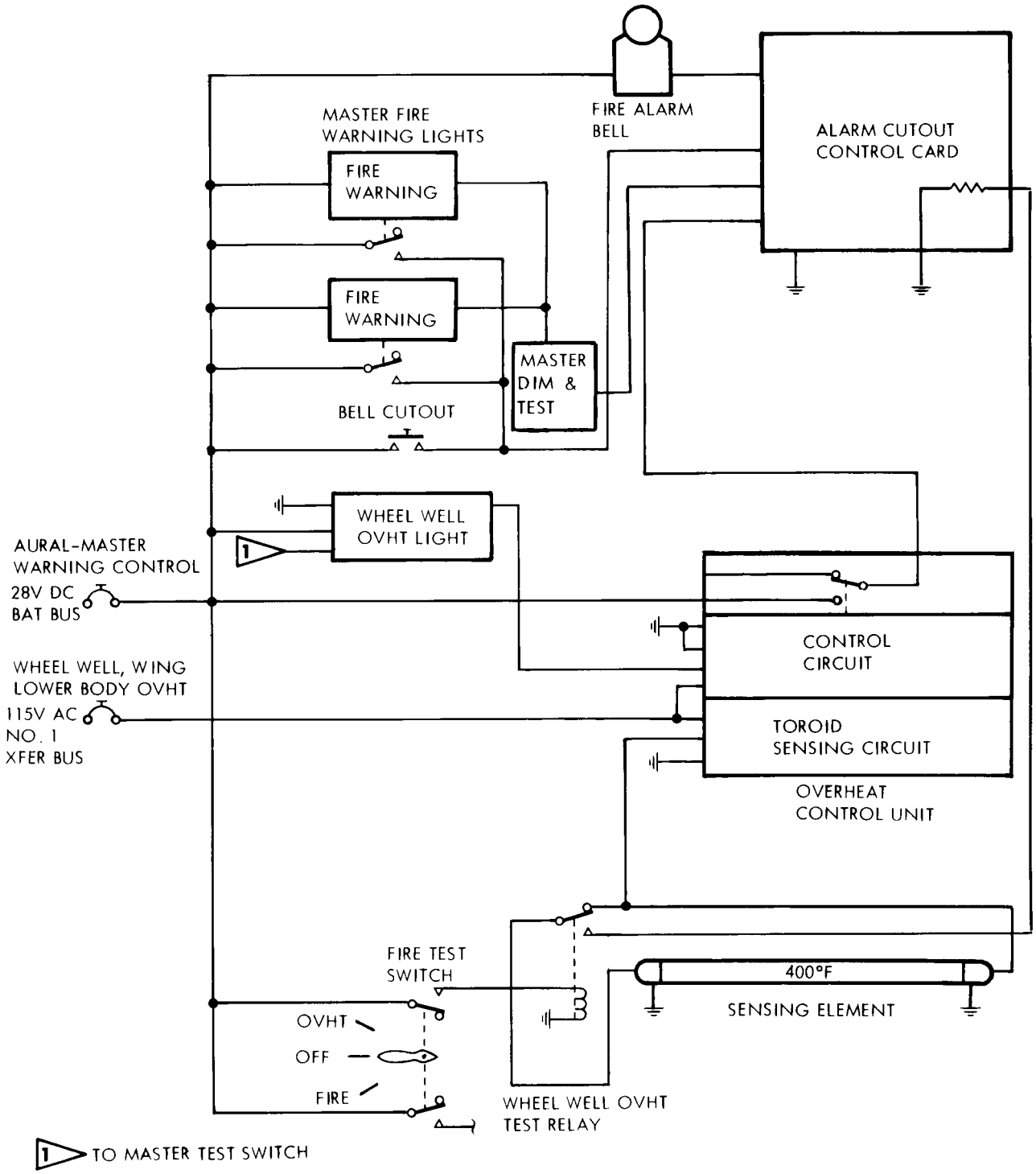
Wheel Well Overheat Detection System Equipment Location
Figure 1 (Sheet 1)





FIRE PROTECTION PANEL

Wheel Well Overheat Detection System Equipment Location
Figure 1 (Sheet 2)



Wheel Well Overheat Detection System Schematic
Figure 2

D. Bell Cutout Switch
(1) The switch can be pressed to cut off the fire alarm bell ringing or extinguish the master fire warning lights (Fig. 2). The fire alarm bell and master fire warning lights can also be cut off by depressing the master fire warning lights.

3. Compartment Overheat Accessory Unit Components
(Airplanes with Boeing M237 compartment overheat accessory unit)
A. The compartment overheat detection control module is located on electronic equipment rack E3 in the electronic compartment.
B. Overheat Control Unit
(1) The overheat control unit plugs into the accessory unit and is held in place by screws. Each control unit contains the overheat detection circuitry necessary to continuously monitor the sensing element resistance and provide an alarm signal when the element resistance drops to the predetermined trip level (Fig 2). When the overheat condition has passed, the system returns to its standby condition.
C. Alarm Cutout Control Card
(1) The alarm cutout control card is a small printed circuit card which plugs into the compartment overheat accessory unit and is held in place by screws. The control card provides turn-on and cutout control of the alarm bell and master fire warning lights when controlled from the wheel well control unit and bell cutout switches (Fig. 2).
D. Test Relay
(1) A wheel well overheat test relay is used in the wheel well test circuit. The relay parallels the sensing circuit to the overheat control unit. When the test circuit is operated, the relay closes and connects a resistor and ground to the sensing circuits, thus simulating a fire condition.

4. Compartment Overheat Accessory Unit Components (Fig. 1) (Airplanes with Fenwal electronic compartment overheat accessory unit)
A. The compartment overheat accessory unit is an electronic equipment rack E3 in the electronic compartment.
B. The compartment overheat accessory unit has a cover plate which contains a numeric LED display, a maintenance advisory LED, and four BITE pushbutton controls identified as; MEM READ, MEM CLEAR, LOC TEST, DISP TEST.
C. The compartment overheat accessory unit contains a power supply card, a control card and a relay card. The compartment overheat accessory unit also serves the functions of the wing and lower aft body overheat detection system (Ref 26-18-00).
(1) The power supply card receives 28-v dc from the battery bus and provides 5-v dc, 19-v dc, and 20-v dc to the control card.

(2) The control card contains a microprocessor and memory, which performs fault detection and BITE functions. If a fault is detected, a record is made in memory to be recalled as required.
(3) The relay card contains three relays, which control the warning indications and test circuit.

5. Alarm Bell
   A. The alarm bell warns of an overheat condition in the wheel well area. The bell is controlled by the overheat control unit through the alarm cutout control card in the compartment overheat accessory unit (Fig. 2). The alarm bell is located in the aural warning devices box.
6. Master Fire Warning Lights
   A. The master fire warning lights are located on the lightshield module (P7). When an overheat condition occurs, the fire warning lights will alert the crew to the type of problem that exists.
   B. The master fire warning light will alert the crew of a wheel well overheat condition. The master fire warning lights are controlled by the wheel well overheat control unit alarm cutout card. Either light may be pressed for bell cutout and for extinguishing the master fire warning lights (Fig. 2).
7. Sensing Element
   A. A sensing element provides overheat detection in the main wheel well. The sensing element is attached to structure in the ceiling of the wheel well. The element is attached at various intervals by quick-release fasteners.
   B. The sensing element is a thermistor type device, which has a resistance inversely proportional to temperature. As the element temperature rises above the alarm temperature, its resistance is lowered. The sensing element consists of a single nickel wire embedded in insulation, which is impregnated with a selected salt compound and sheathed in an Inconel tube.
   C. If any portion of the sensing element is subjected to an overheat condition, the element resistance drops sharply from a relatively high to an extremely low level. The length of element heater or the rate of temperature rise has little effect on the ability of the system to alarm at a fixed temperature. The single wire embedded in the center of the core is the power lead and the outside tubing is grounded. The insulating resistance of the core material decreases abruptly at the alarm temperature. Current flows through the core material to ground when the alarm temperature is sensed.
8. Operation
   A. Normal Operation
      (1) Normal overheat detection is automatic when power is applied to the airplane and the overheat detection and aural warning circuit breakers are closed.

(2) If a fire condition occurs in the wheel well area, the sensing element is subjected to a temperature rise. The temperature rise causes the resistance value of the element to decrease. At a resistance value corresponding to the alarm temperature, the overheat control unit and alarm control card will trigger an overheat warning signal. The signals will activate the fire alarm bell, turn on the wheel well overheat light on the fire protection panel and illuminate the fire warning lights on P7. When the overheat condition is removed, the temperature and sensing element resistance values return to normal. The overheat signal will be removed and the wheel well overheat indicating components will go off. The alarm bell can be silenced when either the bell cutout switch or one of the master fire warning lights are momentarily pressed.

(3) On airplanes with electronic Fenwal compartment overheat accessory unit, when any alarm/fault condition is detected by the compartment overheat accessory unit, the alarm/fault will be stored in the non-volatile memory of the unit for recall as required.

B. Test Operation

(1) A wheel well overheat detection system continuity test can be made by moving the overheat fire test switch on the fire protection module to the fire position. The wheel well overheat indicating components should come on and then go off when the switch is released. The wheel well test relay in the accessory unit grounds the wheel well sensing elements simulating an overheat condition and causing the warning components to operate. During the continuity test, should all overheat warning lights fail to illuminate and the alarm bell to sound, an open in the detector circuit is indicated.

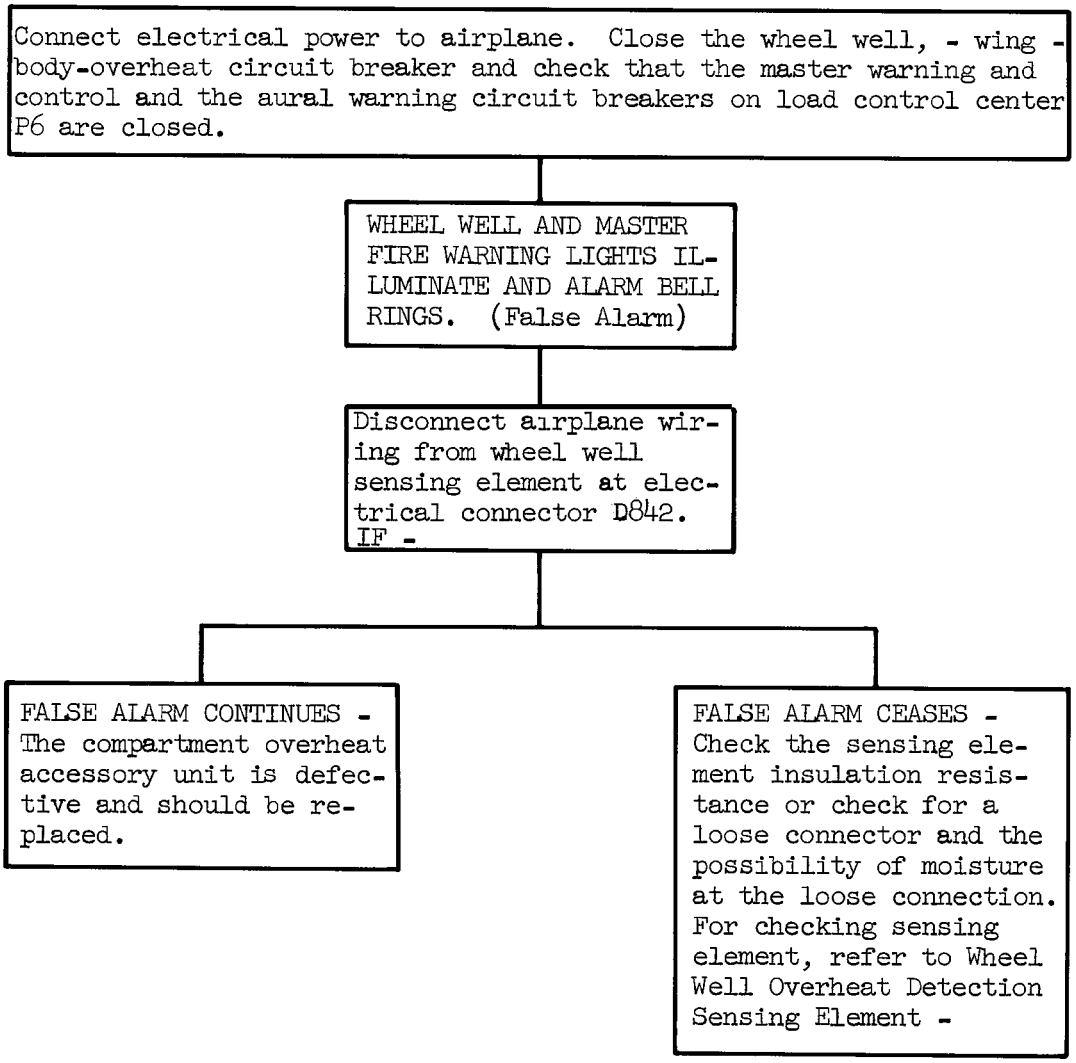
WHEEL WELL OVERHEAT DETECTION SYSTEM - TROUBLESHOOTING

1. General
   A. The two basic troubles for the wheel well fire detection system are a false alarm or no alarm. If either the wheel well warning light, master fire warning lights or alarm bell do not operate, the trouble can be assumed to be in the associated circuit. These circuits should be checked before proceeding to the applicable trouble chart. The most frequent cause of trouble is breaking of the power wire in a flexible lead or sensing element.
   B. The adjustment/test procedures in 26-17-0, Wheel Well Overheat Detection System - Adjustment/Test, may be used to assist in troubleshooting this system.
   C. A false alarm is usually due to a direct short to ground in the power wire of a heat sensing loop. If troubleshooting per the chart isolates the trouble to the heat-sensing loop, test the insulation resistance of the sensing loop. If the resistance of the sensing element is okay, but a loose or improper connected electrical connection was noted during the test, moisture may have entered at the improper connection. Remove moisture by blowing out connectors with dry nitrogen.
   D. Prior to making any tests, equivalent test connectors (wire end fittings) should be installed at the receptacle. The test connector should have exposed contact points or wires to attach to or touch test probes. The test connector protects airplane wire from the possibility of arcing or other damage and provides position contact for attachment of test equipment.

      NOTE: If precautions are not taken, occasionally an oversized test probe may be forced into the sockets of a sensing element, this may spread the contacts and prevent the mating pin from making contact in the sleeve.

   E. Whenever the fire protection module (P8-1) is removed and replaced, a test must be performed on the wheel well overheat detection system (Ref Wheel Well Overheat Detection System - Adjustment/Test).

2. Wheel Well Overheat Detection Trouble Shooting Chart



Wheel Well Overheat Detection Sensing Element
Figure 101

Connect electrical power to airplane. Close the wheel well, - wing - body-overheat circuit breaker and check that the master warning and control and the aural warning circuit breakers on load control center P6 are closed.

WHEEL WELL AND FIRE WARNING LIGHTS DO NOT ILLUMINATE AND ALARM DOES NOT SOUND - Remove the compartment overheat control unit from the E3-2 shelf in the E/E bay. Measure the resistance between pins 21 and 24 of connector D742. Refer to Table A for acceptable resistance values. If the resistance is too high, disconnect and clean the connectors in the main wheel well loop and/or replace the wheel well element as necessary. IF -

WHEEL WELL AND MASTER FIRE WARNING LIGHTS DO NOT ILLUMINATE AND ALARM BELL DOES NOT RING.

Disconnect airplane wiring from wheel well sensing element electrical connectors D840 and D842. Short the center pins of D840 and D842 together. IF -

WARNING LIGHTS DO NOT ILLUMINATE AND ALARM BELL DOES NOT RING - Replace the compartment overheat accessory unit (M237) on rack E3 in electronics compartment. IF -

WARNING COMPONENTS DO NOT OPERATE - Replace fire protection module P8-1. IF -

WARNING COMPONENTS DO NOT OPERATE - Replace or repair defective airplane wiring.

WARNING LIGHTS ILLUMINATE AND ALARM BELL RINGS - Airplane wiring and compartment overheat accessory unit (M237) are okay. Check continuity and insulation resistance of sensing element and replace as necessary. For checking sensing element, refer to Wheel Well Overheat Detection Sensing Element - Adjustment/Test. IF -

WARNING COMPONENTS DO NOT OPERATE - Replace or repair defective airplane wiring.

Wheel Well Overheat Detection System Troubleshooting Chart (No Alarm)
Figure 102

MAIN WHEEL WELL CENTER CONDUCTOR RESISTANCE TABLE A		
DETECTOR LOOP	D742 PINS	LOOP CENTER CONDUCTOR RESISTANCE (75°F)
MAIN WHEEL WELL	21 TO 24	15 ohm max

WHEEL WELL OVERHEAT DETECTION SYSTEM - ADJUSTMENT/TEST

1. General
   A. The following procedure tests only the lights, components and airplane wiring associated with the wheel well overheat detection system. Other lights, components and wiring associated with the overheat detection system are checked when the wing and lower aft body overheat detection system is tested.
2. Wheel Well Overheat Detection System Test
   A. Prepare Wheel Well Overheat Detection System for Test
      (1) Connect external electrical power.
      (2) Open the following circuit breakers under fire protection detection on circuit breaker panel P6:
         (a) Engine-1
         (b) Engine-2
         (c) APU (fire protection detection)
         (d) Cargo Smoke (Passenger/Cargo Convertible Airplanes only)
      (3) Ensure that the following circuit breakers on circuit breaker panel P6 are closed:
         (a) Wheel well-wing-body overheat
         (b) Master warning and control
   B. Test Wheel Well Overheat System
      (1) Check that wheel well warning light on the fire protection system module P8 illuminates when lens cap is pressed.
      (2) Hold the overheat-fire test switch on the fire protection control module to the fire position.
         (a) Master fire warning lights should illuminate.
         (b) Wheel well warning light should illuminate.
         (c) Alarm bell should ring.
      (3) Press BELL CUTOUT switch.
         (a) Alarm bell should stop ringing.
         (b) Master fire warning lights should be extinguished.
         (c) Wheel well warning light should remain illuminated.
      (4) Release test switch to reset and repeat step B.(2).

         NOTE: Master fire and wheel well warning lights should go off when switch is released.

      (5) Press either master fire warning lens cap
         (a) Alarm bell shall stop ringing.
         (b) Wheel well warning lights should remain illuminated.
         (c) Master fire warning lights should be extinguished.
      (6) Release test switch.
         (a) Alarm bell should cease ringing.
         (b) Master fire and wheel well warning lights should go off.

C. Restore Airplane to Normal Configuration
   (1) Close the following circuit breakers on circuit breaker panel P6:
      (a) Engine-1
      (b) Engine-2
      (c) APU
      (d) Cargo Smoke (Passenger/Cargo Convertible Airplanes only)
   (2) Determine if there is any further need for electrical power on airplane; if not, remove external power.

WHEEL WELL OVERHEAT DETECTION SENSING ELEMENT - REMOVAL/INSTALLATION

1. General
   A. The following practices must be adhered to when installing a sensing element:
      (1) Minimum element bend radius is approximately 3 inches.
      (2) A minimum element straight run of 1 inch from all connectors and mounting clips is required prior to starting a bend. A straight run next to connectors shall be as long as possible.
2. Equipment and Materials
   A. Bonding Meter (Ref 20-22-01)
   B. Grease - Silicone, Dow Corning DC-4
3. Remove Wheel Well Overheat Detection Sensing Element
   A. Open wheel well-wing-body overheat circuit breaker on circuit breaker panel P6.
   B. Disconnect electrical connector at either end of sensing element. Cover open end of electrical connectors with tape or suitable protective caps to ensure exclusion of dirt (Fig. 401).
   C. Start at one end and slip sensing element out of each mounting clip. Hold element carefully to prevent excessive bending.
   D. Remove jamnut from end fitting at each end of sensing element and remove element and end fitting from flange fitting from flange fitting. Cover open ends of end fittings with tape or suitable protective caps to ensure exclusion of dirt.

      NOTE: To facilitate installation and provide for proper routing of sensing element, sensing element being replaced may remain in approximate position supported by tubes and brackets in the area. Rubber bushings may be retained for use on new sensing element dependent on bushing condition.

   E. Remove sensing element by carefully working sensing element out from beneath tubing brackets.

      NOTE: For ease of handling and disposition, carefully roll sensing element into a coil approximately 4 inches in diameter. Tape as necessary to retain coil shape.

4. Install Wheel Well Overheat Detection Sensing Element

   CAUTION: IF NEW SENSING ELEMENT IS BEING INSTALLED, CHECK THAT PART NUMBER IS IDENTICAL TO THE ONE THAT WAS REMOVED.

A. Carefully begin to unroll sensing element and locate in approximate position.

CAUTION: SENSING ELEMENT SHALL NOT BE TWISTED, PULLED, OR CLAMPED UNDER TENSION. DO NOT STRAIGHTEN ACCEPTABLE KINKS, BENDS, OR DENTS AS A FATIGUE FAILURE WILL RESULT. SENSING ELEMENT MUST ALWAYS BE ROLLED OR UNROLLED FROM COIL, NEVER PLAY OFF SIDE OF COIL.

B. Remove protective cap from end fitting at one end of sensing element and loosely install in applicable flange fitting. Bend element to contour of clamps and loosely install other end fitting (Fig. 401).

C. Install silicone rubber bushings on element so that each is centered on mounting clip and slit of each bushing faces outside of nearest bend.

D. Install bushings in each mounting clip. Mounting clips and bushings must fit element snugly.

NOTE: If old sensing element has been left in position reference, it should be removed at this time.

E. Tighten jamnuts on end fittings. Torque to 50 to 60 pound-inches and lockwire jamnut to flange fitting and end fittings.

NOTE: Check that end-fitting hex is inside hex retainer on flange fitting prior to tightening.

F. Retrace sensing element, taking up and providing slack as necessary.

NOTE: Elements shall clear structure by a minimum of 0.50 inch except at mounting clips. As much clearance as possible is desired from units that are displaced by torque or vibrate. Double-check all bends and clearance after securing element.

G. Remove protective caps from electrical connectors and verify detector and airplane electrical connectors are dry, clean and free of contaminates. If contamination is found, clean connector.

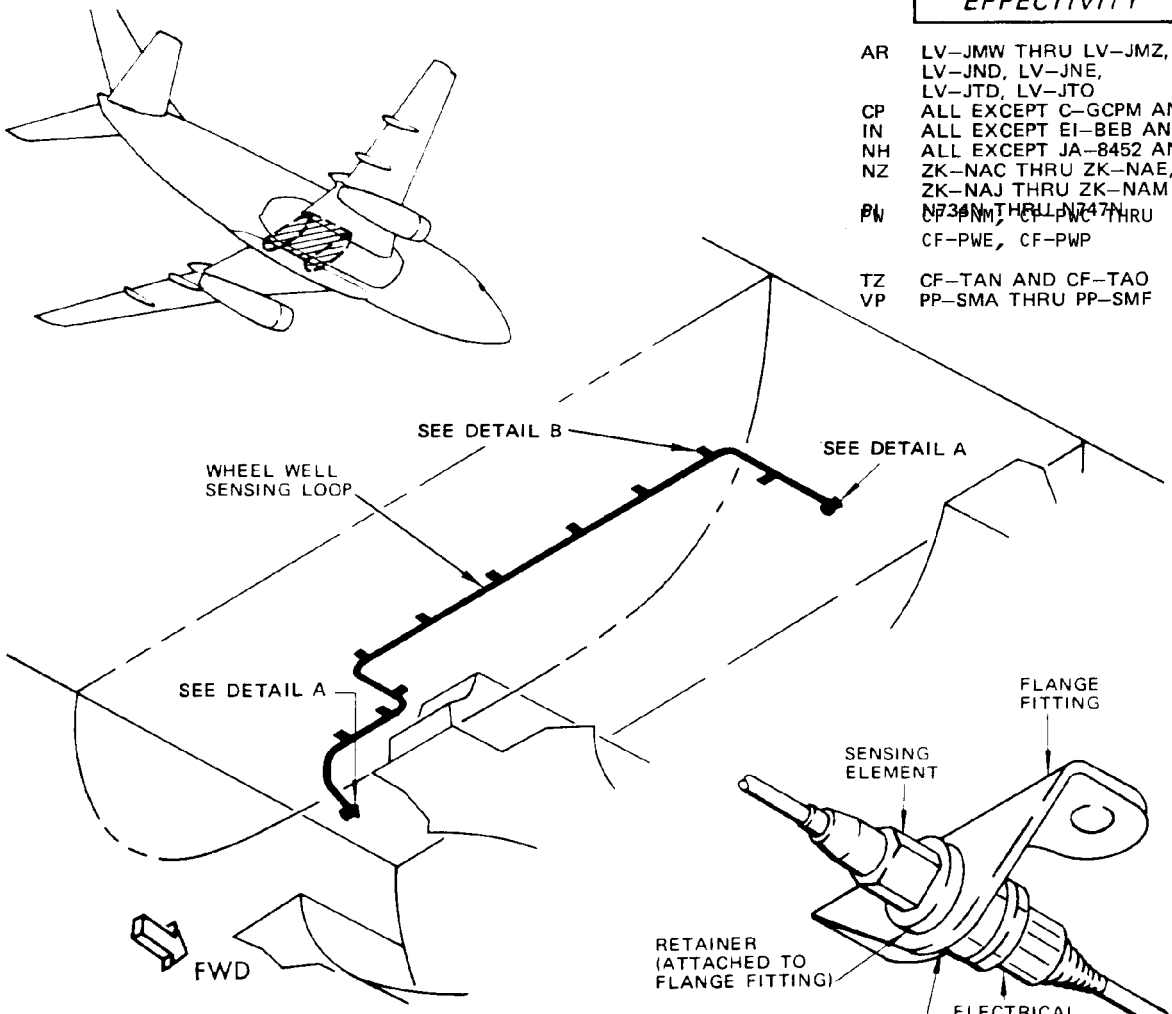
CAUTION: CLEAN CONNECTORS USING METHYL ALCOHOL OR ACETONE ONLY. DO NOT USE OTHER CLEANING SOLVENTS FOR THIS PURPOSE. COMMERCIALLY AVAILABLE CONTACT CLEANERS MAY CONTAIN CHLORIDES WHICH PROMOTE CORROSION IN SEALED AREAS AND SHOULD NOT BE USED.

H. Shake out excess liquid and dry with either dry compressed air or nitrogen at a pressure of 20-25 psig.

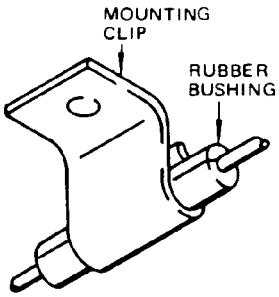
CAUTION: CONNECTOR MUST BE THOROUGHLY DRY OR CORROSION MAY RESULT.

EFFECTIVITY

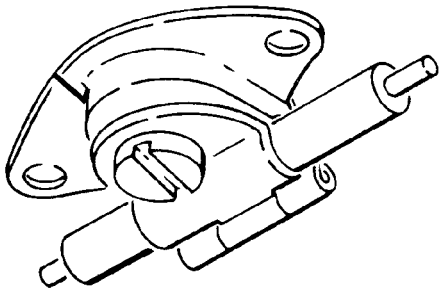
AR LV–JMW THRU LV–JMZ, LV–JND, LV–JNE, LV–JTD, LV–JTO
CP ALL EXCEPT C–GCPM AND ON
IN ALL EXCEPT EI–BEB AND ON
NH ALL EXCEPT JA–8452 AND ON
NZ ZK–NAC THRU ZK–NAE, ZK–NAJ THRU ZK–NAM
PW N734N THRU N747N, CF–PWC THRU CF–PWE, CF–PWP
TZ CF–TAN AND CF–TAO
VP PP–SMA THRU PP–SMF



ELECTRICAL CONNECTION
DETAIL A



SENSING ELEMENT MOUNTING CLIP (TYP)



OPTIONAL SENSING ELEMENT CLIP (TYP)

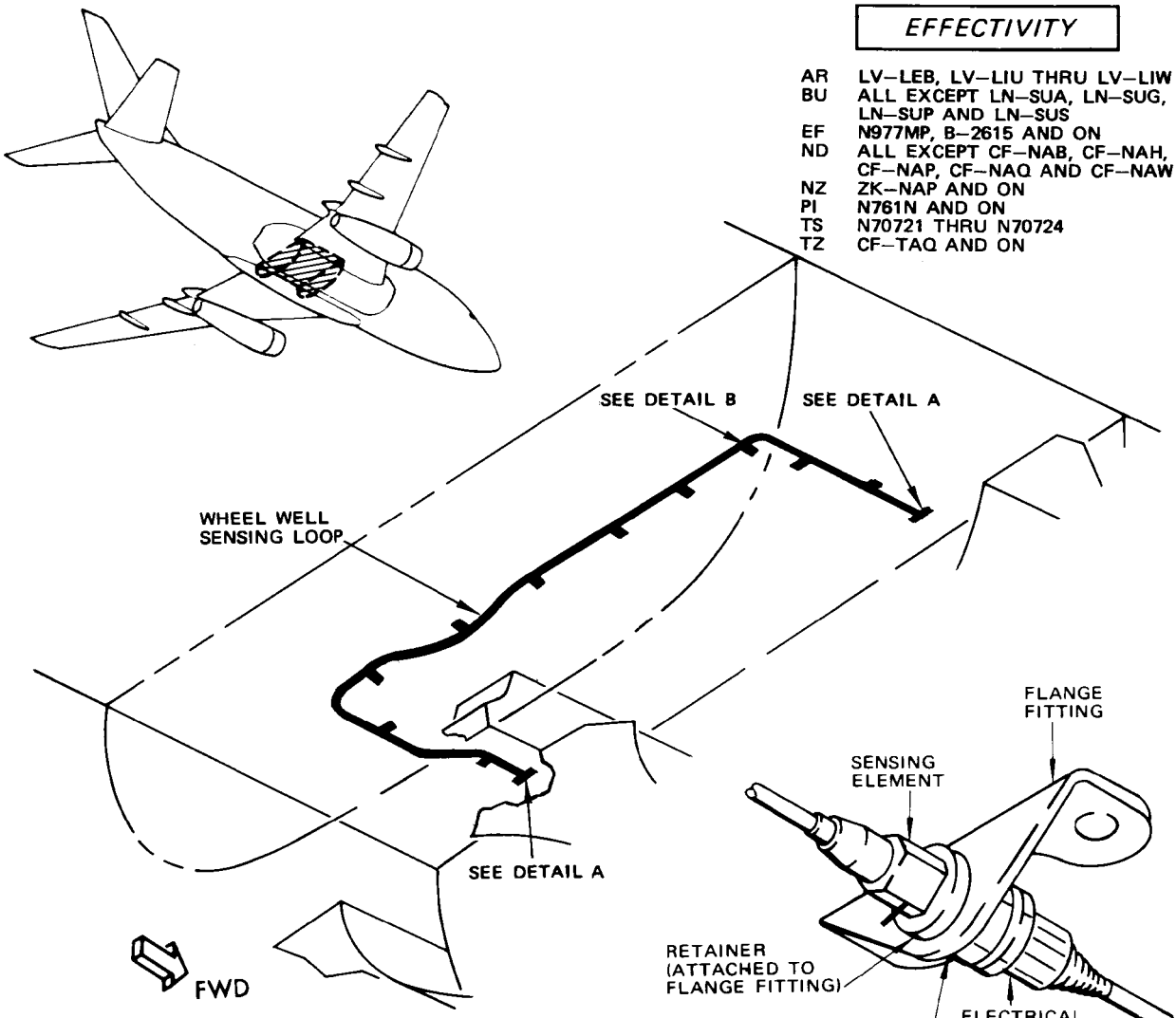
DETAIL B

Wheel Well Overheat Detection Sensing Element Installation
Figure 401 (Sheet 1)

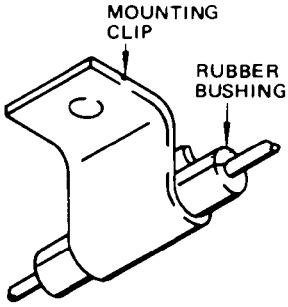
443288

EFFECTIVITY

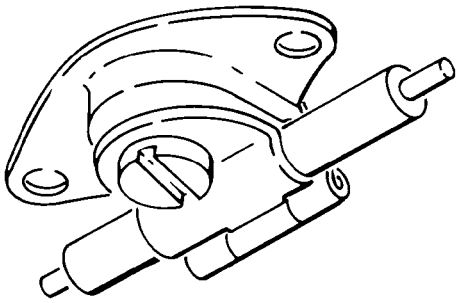
AR	LV–LEB, LV–LIU THRU LV–LIW
BU	ALL EXCEPT LN–SUA, LN–SUG, LN–SUP AND LN–SUS
EF	N977MP, B–2615 AND ON
ND	ALL EXCEPT CF–NAB, CF–NAH, CF–NAP, CF–NAQ AND CF–NAW
NZ	ZK–NAP AND ON
PI	N761N AND ON
TS	N70721 THRU N70724
TZ	CF–TAQ AND ON



ELECTRICAL CONNECTION
DETAIL A



SENSING ELEMENT MOUNTING CLIP (TYP)



OPTIONAL SENSING ELEMENT CLIP(TYP)

DETAIL B

Wheel Well Overheat Detection Sensing Element Installation
Figure 401 (Sheet 2)

I. Apply a very light coat of DC-4 grease to copper sealing gasket.
J. Install electrical connectors on end fitting and lockwire to flange fitting.
K. Check electrical bond between element connector shell and primary structure per 20-22-01. Resistance should not exceed 0.005 ohm.
L. Close applicable circuit breaker on panel P6-2.
M. Check wheel overheat detection system (Ref 26-17-0 A/T).

WHEEL WELL OVERHEAT DETECTION SENSING ELEMENT - ADJUSTMENT/TEST

1. General
   A. Attachment of test equipment should be made by using a wire end fitting between the element end fitting and test equipment. Attach the test leads to the center contacts or the center contacts and outer shell of the wire end fittings as applicable. Use of the wire end fittings reduce the possibility of any damage to the electrical contact surface and provide a positive attach point for test equipment during test. Extreme care must be taken during the tests to keep end fittings free from dirt and other foreign substances. Replace the electrical connector or protective caps upon completion of the tests.
2. Wheel Well Overheat Detection Sensing Element Test
   A. Sensing Element Test
      (1) General
         (a) No test of sensing loop should be done unless all units in the system are stabilized at ambient temperature. Failure of an element to meet the electrical specification noted in the following paragraphs is cause for replacement.

            CAUTION: DO NOT USE A MULTIMETER ON THE SENSOR ELEMENTS IF THE ELEMENT TEMPERATURE IS ABOVE 155°F (68°C). IF THE TEMPERATURE IS BELOW 155°F (68°C), BUT ABOVE 70°F (21°C), LIMIT METER USE TO 5-SECOND APPLICATIONS WITH NO MORE THAN TWO APPLICATIONS PER MINUTE. IF THESE REQUIREMENTS ARE NOT FOLLOWED, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

      (2) Equipment and Materials
         (a) Multimeter
         (b) Wire End Fitting 35303-10, Fenwal, Inc., Ashland, MA.

            NOTE: The wire end fittings are to be used for attachment of test equipment to the sensing elements during test procedures.

      (3) Test Sensing Element
         (a) Disconnect wire end fittings D840 and D842 on ceiling of main wheel well.

(b) Test for center conductor continuity by connecting multimeter to center conductor at each end of sensing element.
1) Resistance of center conductor shall not exceed 0.2 ohm per foot of element length at any temperature below 120°F ambient.

NOTE: Element length in inches may be determined from vendor sensing element part number of subtracting 35500 from first five digits of vendor part number.

(c) Test insulation resistance by connecting multimeter across center conductor and outer shell at either element or fitting.
1) Using R x 1 scale, insulation resistance shall be 50 megohms or greater at any temperature below 120°F ambient.
(d) Connect wire end fittings D840 and D842 to sensing element on ceiling of main wheel well. Lockwire end fittings to sensing element.

B. Sensing Element Wire End Fittings Test
(1) Equipment and Materials
(a) Megohm Bridge, General Radio Model 544B
(b) Wire End Fitting 35303-11, Fenwal Incorp., Ashland, Mass.

NOTE: The wire end fittings are to be used for attachment of test equipment to the airplane wiring during test procedures.

(2) Prepare Sensing Element Wire End Fittings for Test
(a) Disconnect wire end fitting D840 and D842 on ceiling of main wheel well.
(b) Remove compartment overheat control module on rack E3-2 in electrical/electronic equipment compartment.
(c) Connect wire end fittings to D840 and D842.
(3) Test Sensing Element Wire End Fittings and Airplane Wiring
(a) Test insulation resistance by connecting megohm bridge across center conductor and outer shell at wire end fitting D840.
1) Insulation resistance shall be 50 megohms or greater at 500 volt DC when measured at any temperature below 120°F ambient.
(b) Repeat step (a) for wire end fitting D842.
(4) Restore Airplane to Normal Configuration
(a) Remove wire end fittings from D840 and D842.

(b) Connect wire end fittings from D840 and D842 to sensing element on ceiling of main wheel well. Lockwire end fittings to sensing element.
(c) Install compartment overheat control module on rack in electrical/electronic equipment compartment.

WHEEL WELL OVERHEAT DETECTION SENSING ELEMENT - INSPECTION/CHECK

1. General
   A. Physically check each sensing element and electrical connector to determine whether and faults have occurred to make the element unacceptable.
2. Wheel Well Overheat Detection Sensing Element Check
   A. Check Wheel Well Overheat Detection Sensing Element
      (1) Check that all diameter variation have smooth contours and that no abrasions or wear spots are deeper than 0.002 inch.
      (2) Check that no section of element has a diameter of less than 0.070 inch.

          NOTE: Smoothly contoured dents and kinks which have not reduced tubing diameter beyond acceptable limits are not cause for replacement.

          CAUTION: DO NOT ATTEMPT TO STRAIGHTEN ANY ACCEPTABLE DENT OR KINK, AS STRESSES SET UP IN TUBING MAY CAUSE A POSSIBLE FAILURE.

      (3) Check for any radial marks (nicks or gouges) that are more than 0.005 inch deep or extending more than 50% across seal face of end of electrical connectors.

          NOTE: These gouges would prevent an adequate water vapor seal from being made when connectors are mated.

      (4) Check for dirt or other foreign substances on seal face of end connectors.

WING AND LOWER AFT BODY OVERHEAT DETECTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The wing and lower aft body overheat detection system provides overheat detection along the engine bleed air ducts in the left and right wing, along the auxiliary power unit (APU) bleed air duct from the APU installation to the air conditioning distribution bay, and along the ceiling of the air conditioning distribution bay (Fig 1). The detection system is an electrical, heat sensing system that responds to an overheat condition by activating warning lights.
   B. Airplanes with Boeing M237 compartment overheat accessory unit:
      (1) The wing and lower aft body overheat detection system consists of an overheat test switch and overheat lights on air conditioning module P5-10, compartment overheat accessory unit (control module), master caution lights and sensing elements. The sensing elements are connected to the compartment overheat accessory unit. The accessory unit contains left and right overheat control units, a wheel well alarm cutout control card and associated test circuits. The overheat control units monitor the electrical resistance of the sensing elements. When a temperature rise causes the element resistance to drop to a value corresponding to the alarm temperature, the control unit will provide a signal to the applicable warning light and the master caution light control section in the air conditioning module.
      (2) The wing and lower aft body overheat detection system is divided into two sections; the left and right overheat sections. The right overheat section consists of sensing elements connected in series with the right overheat control unit to form a closed circuit sensing loop. The left overheat section consists of sensing elements connected in series through three test switches to the left and APU overheat control unit to form a closed circuit sensing loop. The test switches on the compartment overheat accessory unit enable a malfunction in the left overheat section to be isolated.
      (3) The overheat detection system can be tested on the ground and in flight by an overheat test switch on the air conditioning module. The overheat test switch tests continuity through the wings and lower aft body by simulating an overheat condition, thereby energizing the warning lights. If the left detection system fails to test, the area of the malfunction can be isolated to one of the four sections of the airplane by operating the auxiliary test switches on the compartment overheat accessory unit.

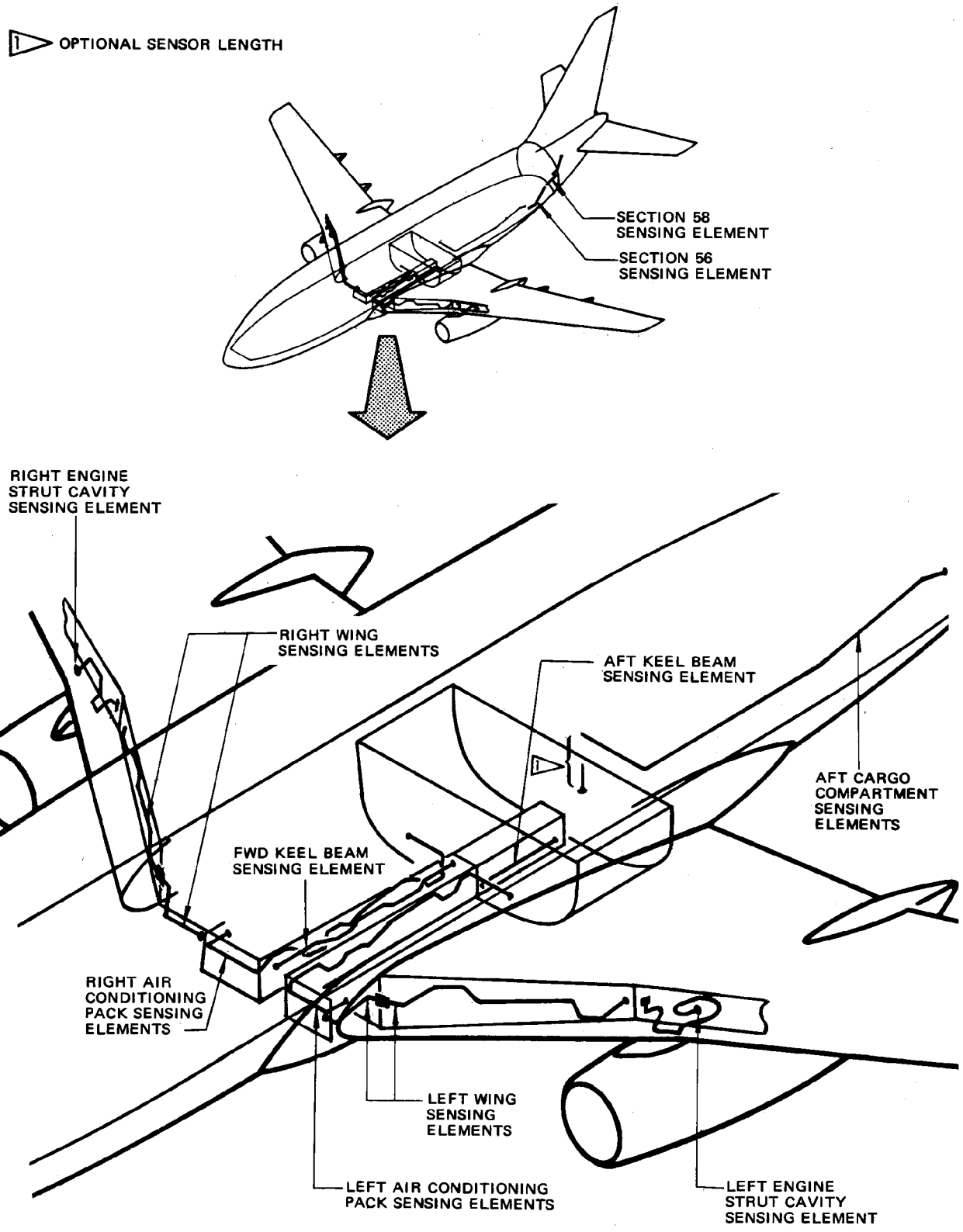
(4) The right sensing loop elements are at engine 2-strut cavity, right wing bleed air duct, right wing leading edge, and right air conditioning packs. The left sensing loop elements are at engine 1 strut cavity, left wing bleed air duct, left wing leading edge, left air conditioning packs, keel beam, aft cargo compartment, and APU cavity.

C. Airplanes with electronic Fenwal M237 engine overheat accessory unit:

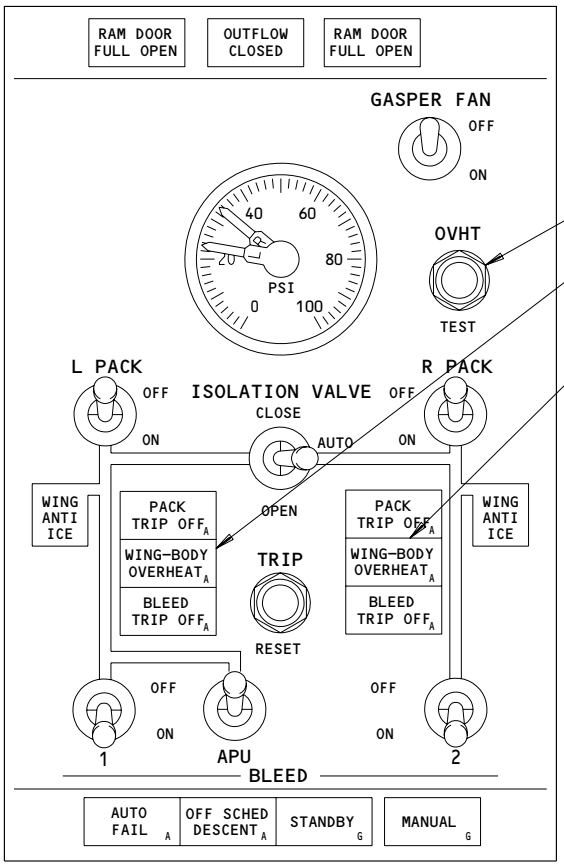
(1) The wing and lower aft body overheat detection system consists of an overheat test switch and overheat lights on air conditioning module P5-10, compartment overheat accessory unit, master caution lights, and sensing elements. The sensing elements are connected to the compartment overheat accessory unit. The accessory unit contains a control card which has a microprocessor and a relay board which monitor the resistance of the sensing elements. When a temperature rise causes the resistance to drop to a value corresponding to the alarm temperature, the compartment overheat accessory unit will provide a signal to the applicable warning light and the master caution light control section in the air conditioning module. When an alarm/fault condition is found, the condition is stored in the non-volatile memory of the Fenwal compartment overheat accessory unit, the MAINT ADV light will illuminate when a condition is stored in memory. The MAINT ADV light will not extinguish until the condition is corrected and the memory is cleared.

(2) The wing and lower aft body overheat detection system is divided into left and right sections. The right overheat section consists of a single detector loop with sensing elements connected in series. The left overheat section consists of four separate detector loops with sensing elements connected in series. All five loops are monitored by the control card in the compartment overheat accessory unit. The compartment overheat accessory unit can isolate an alarm/fault condition to each of the five loops which can be displayed as a code on the LED display. The codes, as defined on the compartment overheat accessory unit cover plate, isolate the condition to the specific location and condition; an alarm, an open loop fault, or a short circuit loop fault.

(3) The right sensing loop elements are at engine 2 strut cavity, right wing bleed air duct, right wing leading edge, and right air conditioning packs. The left sensing loop elements are at engine 1 strut cavity, left wing bleed air duct, left wing leading edge, left air conditioning packs, keel beam, aft cargo compartment, and APU cavity.



Wing and Lower Aft Body Overheat Detection System Component Location
Figure 1 (Sheet 1)

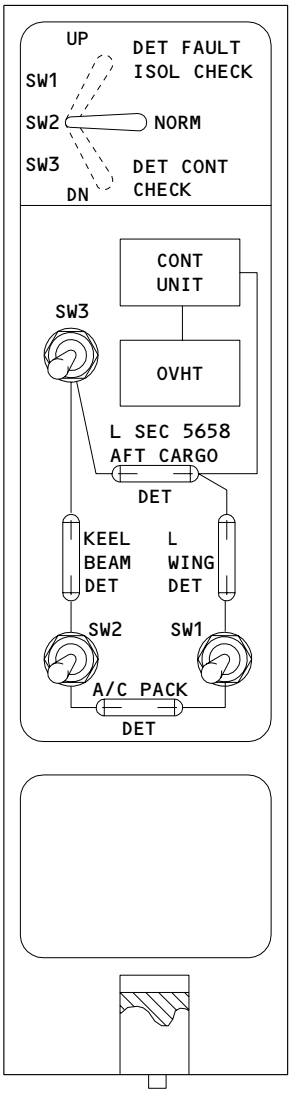


AIR CONDITIONING MODULE

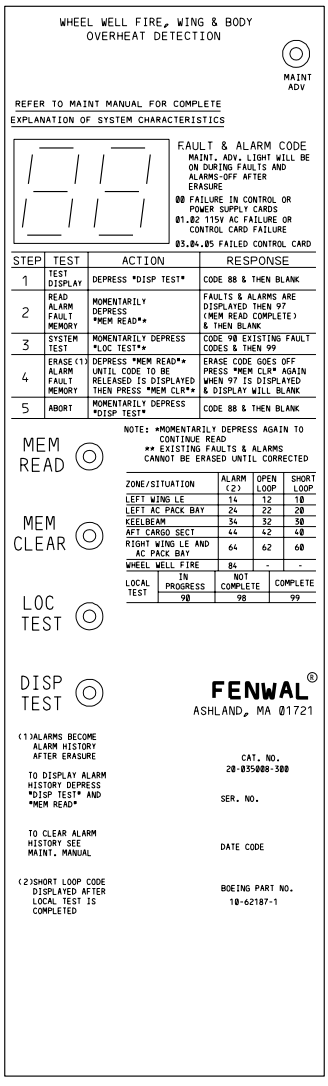
OVERHEAT TEST SWITCH

LEFT OVERHEAT LIGHT
(LEFT WING, LEFT A/C PACK
KEEL BEAM, AFT CARGO, 56,58)

RIGHT OVERHEAT LIGHT
(RIGHT WING AND RIGHT A/C PACK)



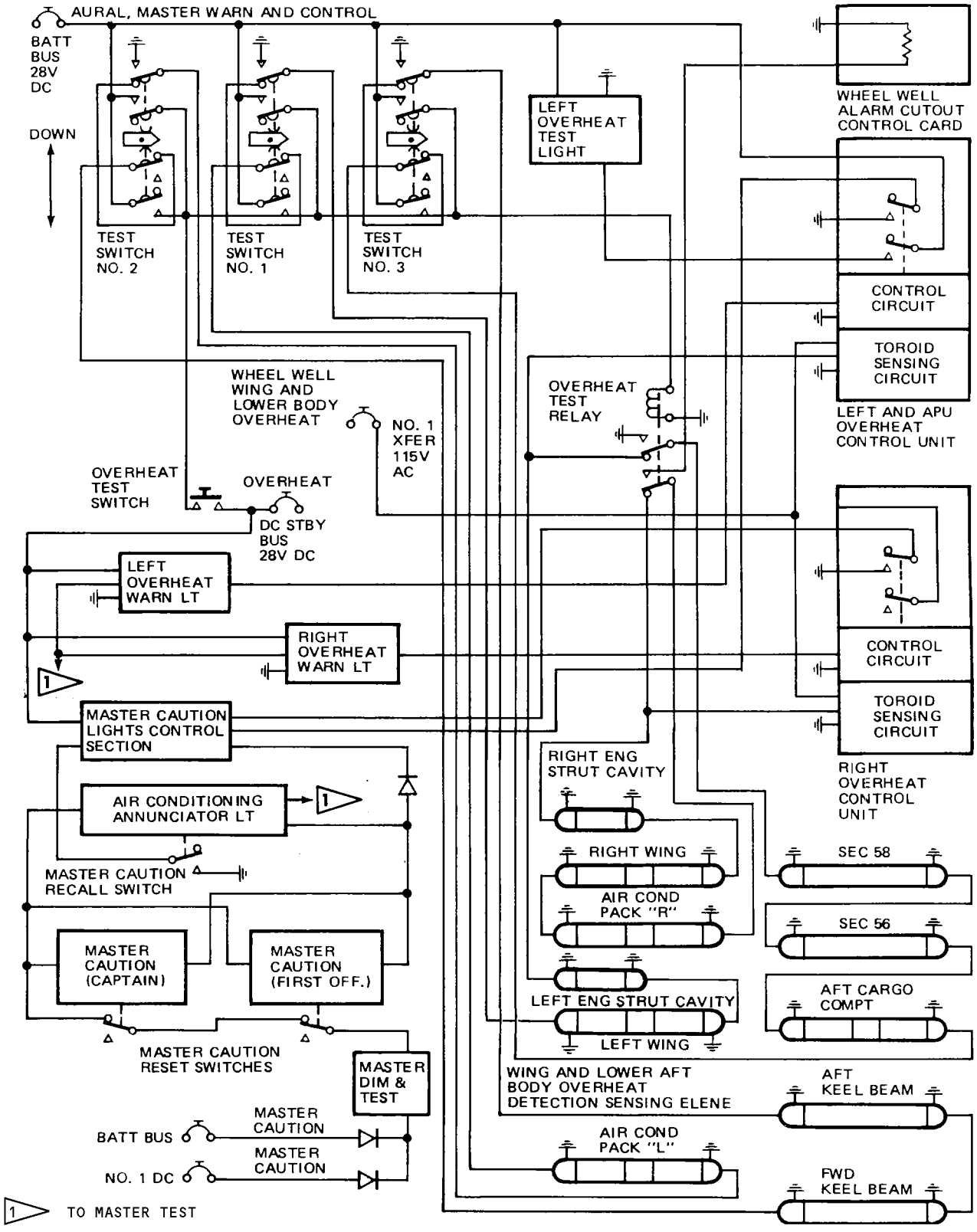
BOEING MODULE



FENWAL MODULE

COMPARTMENT OVERHEAT ACCESSORY UNIT

Wing and Lower Aft Body Overheat Detection System Component Location
Figure 1 (Sheet 2)



Wing and Lower Aft Body Overheat Detection System Schematic
Figure 2

(4) The wing and lower aft body overheat detection system can be tested by an overheat test switch on the air conditioning module. The overheat test switch tests continuity through the sensing loops by simulating an overheat condition.

NOTE: With the Fenwal compartment overheat accessory unit, the alarm indications require approximately 4 seconds to appear during wing and aft body overheat test.

2. Bleed Air Duct Overheat Test and Indication Section Components

A. The bleed air duct overheat test and indication section components are in the air conditioning module (P5-10).

B. Overheat Warning Lights

(1) Two amber overheat warning lights are provided for overheat indication in the wing and lower aft body area. An overheat condition will cause the steady illumination of either the left or right overheat warning light and the master caution lights.

(2) The warning lights may be tested individually by a press-to-test feature or tested when the master caution test switch is closed.

C. Test Switch

(1) A switch is provided for testing the wing and lower aft body overheat detection system. The switch may be used either while the airplane is in flight or on the ground (Fig. 1, Sheet 2). Pressing the test switch grounds the sensing elements. If all circuits are operating correctly, the overheat lights will illuminate.

NOTE: On airplanes with the Fenwal M237 compartment overheat accessory unit, the overheat warning indications require a holding the test switch for approximately 4 seconds.

D. Master Caution Lights Control Section

(1) The master caution lights control section provides control of the master caution lights and air condition annunciator light on the lightshield module (P7). The control section is a solid-state switching circuit.

(2) When an overheat warning occurs, the applicable overheat control unit provides a ground to the control section. The ground completes switching circuits which allow the master caution lights and master caution air conditioning annunciator light on P7 to illuminate. Either master caution light may be depressed to reset the master caution lights and annunciator light.

3. Compartment Overheat Accessory Unit Components

A. Airplanes with Boeing M237 Overheat Accessory Unit

(1) The compartment overheat accessory unit (control module) components described in the following paragraphs will be only those associated with the wing and lower aft body overheat detection system. The compartment overheat accessory unit is located on electronic equipment rack E3 in the electronic compartment. Refer to 26-10-0 for additional information on the compartment overheat detection control module.

B. Overheat Control Unit

(1) The overheat control units plug in to the accessory unit and are held in place by screws. monitor the sensing element resistance and provide an alarm signal when the element resistance drops to the predetermined trip level (Fig. 2). When the overheat condition has passed, the system returns to its standby condition.

C. Left Overheat Test Light

(1) The overheat test light is provided to facilitate testing the left overheat section to determine whether a malfunction exists. The test light controlled by the left and APU overheat control unit. An overheat or a simulated overheat condition in the left overheat section will energize the output relay of the left and APU overheat control unit and provide a signal for the steady illumination of the test light. The light has a press-to-test feature. The test light will also illuminate whenever the left overheat light on the air conditioning module illuminates.

D. Test Switches

(1) Three switches in the left sensing loop facilitate isolating and locating a malfunction. Each switch has three positions and is spring loaded to a normal position.

(2) The test switches are in series with the sensing elements (Fig 3). Each test switch may be actuated in turn to determine which section of the detection system has malfunctioned. When a test switch is pushed up, the applicable part of the detector circuit is tested for a pushed down, the applicable part of the detector circuit is checked for continuity.

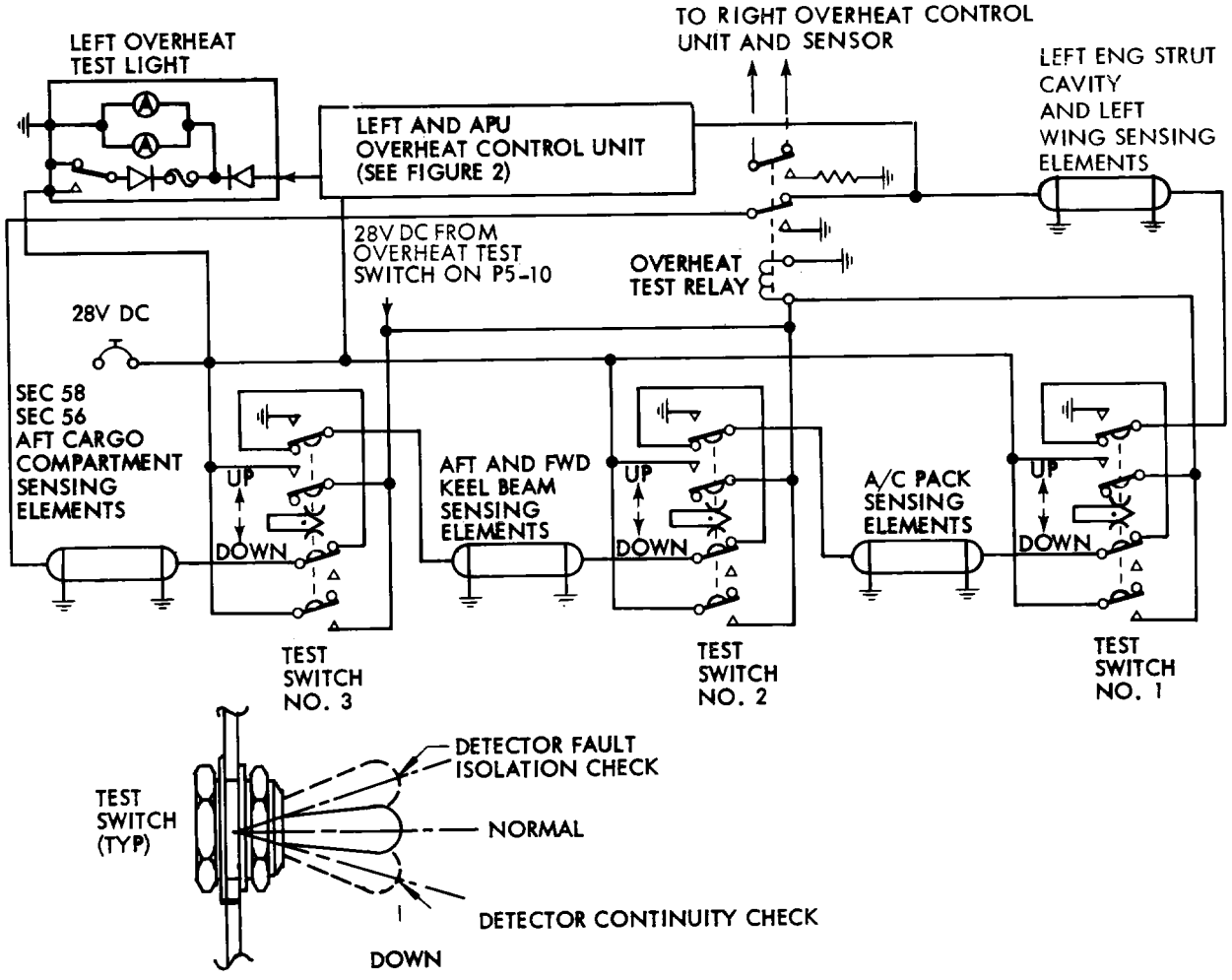
(3) Test switch No. 1 tests the detector circuit from the control unit through the left wing sensing elements to the test switch. Test switch No. 2 tests the detector circuit from test switch No. 1 through the air conditioning pack sensing elements to test switch No. 2. Test switch No. 3 tests the detector circuit from test switch No. 2 through the forward and aft keel beam sensing elements to test switch No. 3. If the malfunction still exists, it is assumed that it is located somewhere in the aft cargo sensors, section 58 or section 56 sensors (Fig. 2 and 3).

E. Overheat Test Relay
(1) A test relay is used in the wing and lower aft body test circuit. The test relay completes grounding circuits which enable checking the continuity at the overheat detection system.

4. Compartment Overheat Accessory Unit Components (Fig. 2)
(Airplanes with Fenwal M237 compartment overheat accessory unit)
A. The compartment overheat accessory unit is on electronic equipment rack E3 in the electronic compartment.
B. The cover plate of the M237 compartment overheat accessory unit contains an LED display, a MAINT ADV light, and four BITE pushbutton controls as follows:
(1) MEM READ - Accesses the non-volatile memory.
(2) MEM CLEAR - Clears the non-volatile memory.
(3) LOC TEST - Initiates self-test of the control circuits and sensing elements.
(4) DISP TEST - Initiates self-test of the control circuits and the LED display.

5. Master Caution and Annunciator Lights
A. The master caution and annunciator lights are located on the lightshield module (P7). When an overheat condition occurs, the master caution and annunciator lights will illuminate.
B. The master caution lights and master caution air conditioning annunciator light will alert the crew to an overheat warning light on the air conditioning module (P5-10). The master caution annunciator lights are controlled by the master caution lights control section of the air conditioning module (Fig. 2). The air conditioning annunciator light is located at the right side of the lightshield. A master caution light is located at either side of the lightshield for the captain and first officer, respectively. The annunciator light panel may be pressed to recall the warning on the lightshield if the fault still exists (Fig. 2). For information, refer to Chapter 33, Master Caution and Warning Lights.

6. Sensing Element
A. The sensing element is a thermistor type device which has a resistance inversely proportional to the alarm temperature, that is, as the element temperature rises above the alarm temperature, its resistance is lowered. The sensing element consists of a single nickel wire embedded in insulation, which is impregnated with a selected salt compound and sheathed in an Inconel tube. The elements are all set to actuate at approximately 255°F.



Left Overheat Section Test Circuit
Figure 3

B. If any portion of the sensing element is subjected to an overheat condition, the element resistance drops sharply from a relatively high to an extremely low level. The single wire embedded in the center of the core is the power lead, and the outside tubing is grounded. The insulating resistance of the core material decreases abruptly at the alarm temperature. Current flows through the core material to ground when the alarm temperature is sensed.

7. Operation

A. Normal Operation

(1) Normal overheat detection is automatic when power is applied to the airplane and the overheat detection and aural, master warning and control circuit breakers are closed (Fig 2).

(2) Airplanes with Boeing M237 compartment overheat accessory unit, the sensing element is subjected to a temperature rise causing the resistance value of the element to decrease. At a resistance value corresponding to the alarm temperature, the overheat control unit will trigger an overheat warning signal. The signal will activate the respective left or right overheat warning lights on the air conditioning module and the master caution and master caution air conditioning annunciator lights on P7. When the overheat condition is removed, lights will go out. The master caution lights may be reset by momentarily depressing either master caution light. The annunciator light may be depressed to "recall" the overheat warning to the master caution lights and the air conditioning annunciator light. The master caution and annunciator light will illuminate if the overheat condition still exists.

(3) Airplanes with electronic Fenwal M237 compartment overheat accessory unit, temperature rise of an element causes the resistance to decrease. At a resistance corresponding to the alarm temperature, the control card of the compartment overheat accessory unit will trigger an overheat warning signal. The signal will activate the left or right overheat warning lights on the air conditioning module, the master caution and master caution air conditioning annunciator lights on P7, and the MAINT ADV light on the M237 module. The condition is stored in the non-volatile memory of the M237 module for recall as required. When the element cools, the temperature and sensing element resistance values return to normal and the lights will go out, the MAINT ADV light will remain illuminated until the memory is read and cleared. The master caution lights may be reset by momentarily pressing either master caution light. The annunciator light may be pressed to recall the overheat warning to the master caution and the annunciator lights. The master caution and annunciator light will illuminate if the overheat still exists.

B. Test Operation

(1) A test of the wing and lower aft body overheat detection system may be made with the overheat test switch on the air conditioning module. The wing and lower aft body overheat indicating components should illuminate and then go off when the switch is released. The test switch provides power to the overheat test relay which grounds the overheat system sensing elements causing an overheat signal to the left and right overheat section warning lights and to the master caution and annunciator lights. If the left or right overheat warning light fails to illuminate, there is either an open circuit in the associated detector circuit or the sensor loop resistance exceeds the alarm threshold of the M237 compartment overheat accessory unit. The Fenwall M237 unit has an alarm threshold of 115 ohms. The Boeing M237 unit has an alarm threshold between 25 and 50 ohms. If the lights burn continually, (test switch not operated) a ground fault (false alarm) in the sensing elements or associated wiring is indicated.

(2) Airplanes with Boeing M237 compartment overheat accessory unit, when the left overheat section fails to test or ground faults, the malfunction can be isolated to a specific area of the airplane by operation of the test switches on the compartment overheat accessory unit. When performing the isolation test, always start with test switch No. 1. The left overheat test light on the accessory unit should illuminate during the continuity check and remain off during the ground fault check.

(a) Move test switch No. 1 to the DOWN position. In the DOWN position, the associated sensing elements are grounded, thus checking continuity from the control unit to the test switch. The energized overheat test relay isolates the remaining sensing elements and airplane wiring between the test switch and the test relay. If the overheat test light on the control module illuminates, the circuit being checked is okay. Continue to the next test switch and repeat the above procedure. If the test light fails to illuminate, the malfunction is located in the sensing elements and airplane wiring associated with the test switch.

(b) When a ground fault occurs in the left overheat section, actuate the test switches to determine the location of the malfunction. Move test switch No. 1 to the UP position. In the UP position, the associated sensing element circuit is opened. The closed overheat test relay isolates the remaining sensing elements and airplane wiring between the test switch and the test relay. If the left overheat test light should go out, the circuit being checked is okay. Continue to the next test switch and repeat the above procedure. If the light remains on, the ground fault is located in the sensing elements or airplane wiring associated with the test switch.

(3) Airplanes with electronic Fenwal compartment overheat accessory unit, faults can be isolated by accessing the non-volatile memory of the compartment overheat accessory unit. The non-volatile memory stores each condition with a 2-digit code which is read by using the BITE pushbuttons on the cover plate (Ref 26-18-00 MP). The non-volatile memory is capable of holding ten alarm/fault codes. The MAINT ADV light illuminates when a condition is stored in the non-volatile memory and will remain so until all active codes have been cleared. The compartment overheat accessory unit contains a fault history memory which holds the last ten codes cleared from the active non-volatile memory. Active codes cannot be cleared until the alarm/fault condition is corrected.

C. BITE Operation (Airplanes with Fenwal compartment overhead accessory unit)

(1) The system has both hardware and software built in test features. A description of BITE follows and the BITE operating instructions are posted on the cover plate of the M237 module.

(a) Pushing the OVHT TEST switch on the P5-10 panel tests all detectors for continuity and faults. All flight compartment displays of compartment overheat will display if each loop is operating correctly. Any faults detected during the test will be stored in the non-volatile memory for recall as required.

(b) At the M237 compartment overheat accessory unit, pushing the DISP TEST switch initiates a self test of the display and associated circuits. Code 88 is displayed as long as the switch is held if there is no failed dc power source.

(c) Momentarily pushing the LOC TEST switch initiates a self test of the control circuits code 90. If a fault condition is detected during the test sequence, the code for that fault condition is indicated by the display for approximately two minutes. Another momentary push of the LOC TEST switch during the 2-minute display interval causes the test sequence to continue. If not continued, the test sequence terminates after approximately 2 minutes. When the entire test sequence has been performed, code 99 is displayed for approximately 1 minutes. The test sequence initiated by the LOC TEST switch can be terminated at any time by pushing the DISP TEST switch.

(d) When an alarm/fault condition is identified, the code is stored in the non-volatile memory for recall as required. The condition is stored in non-volatile memory until the condition is resolved, and the memory is cleared. The fault history stores the last ten codes that were cleared from the active non-volatile memory. Access to these functions is gained through the four BITE pushbutton switches on the M237 module cover plate (Ref 26-18-00 MP).

WING AND LOWER AFT BODY OVERHEAT DETECTION SYSTEM - TROUBLESHOOTING

1. General

A. The two basic troubles which the wing and lower aft body overheat detection system may have are: a false alarm or no alarm. Proper utilization of the test switches within the system will isolate most trouble spots. The main system test switch is on air conditioning module P5-10. Pressing the switch should cause the overheat lights on the module to illuminate. If the right overheat light fails to illuminate, the right strut cavity sensor, right wing sensor, right air conditioning pack sensor or the right control unit in the compartment overheat accessory unit may be faulty. Troubleshoot per right overheat system troubleshooting chart. If the left overheat light on the module fails to illuminate, the left overheat sensors may be tested and isolated utilizing the toggle switches on the compartment overheat accessory unit. The toggle switches provide continuity and ground fault checks of each sensor. Troubleshoot per left overheat system troubleshooting chart.

NOTE: The Fenwal M237 control unit has an alarm threshold of approximately 115 ohms. The BECO M237 control unit has an alarm threshold between 25 and 50 ohms. Because of this, when you check the resistance of the sensor loops, you check for a different resistance if the Fenwal unit is installed than if the BECO unit is installed. The higher the alarm threshold, the higher the resistance for which you check.

B. A false alarm is usually due to a direct short to ground in the power wire of a heat sensing loop. If troubleshooting per the chart isolates the trouble to the heat sensing loop or airplane wiring, check for improperly installed electrical connectors; moisture may have entered at the improper connection. Remove moisture by blowing out connectors with dry nitrogen.

C. Prior to making any tests, equivalent test connectors (wire end fittings) should be installed at the receptacle. The test connector should have exposed contact points or wires to attach to or touch test probes. The test connector protects airplane wire from the possibility of arcing or other damage and provides position contact for attachment of test equipment.

NOTE: If precautions are not taken, occasionally an oversized test probe may be forced into the sockets of a sensing element, this may spread the contacts and prevent the mating pin from making contact in the sleeve.

PREREQUISITES

MAKE SURE THE AIRPLANE IS IN THIS CONFIGURATION:
ELECTRICAL POWER IS ON (AMM 24-22-00/201)
EQUIPMENT:
(1) BK PRECISION 875B LCR METER OR TEGAM INC. 252/SP2596 LCR METER OR EQUIVALENT
(2) WIRE END FITTING 35303-10, FENWAL INCORP., ASHLAND, MA.
(3) WIRE END FITTING 35303-11, FENWAL INCORP., ASHLAND, MA.

CAUTION: DO NOT USE A MULTIMETER TO MEASURE DETECTOR ELEMENT RESISTANCES, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

LEFT WING-BODY OVERHEAT TROUBLE-SHOOTING DIAGRAM (FOR AIRPLANES WITH BECO M237 COMPARTMENT OVERHEAT CONTROL UNIT)

1 PUSH THE S1 OVHT TEST SWITCH ON THE P5-10 PANEL.
DOES THE LEFT WING-BODY OVERHEAT LIGHT, L1, COME ON?

NO → 21 PUSH THE LEFT WING-BODY OVERHEAT LIGHT, L1, TO MAKE SURE THE BULB OPERATES.
DOES THE L1 LIGHT COME ON?

NO → 41 REPLACE THE BULB IN THE L1 LIGHT OF THE P5-10 PANEL (WDM 26-12-11).

YES → SEE SHEET 2 (BLOCK 2)

YES → 22 REMOVE THE COMPARTMENT OVERHEAT CONTROL UNIT FROM THE E3-2 SHELF IN THE E/E BAY. MEASURE AND RECORD THE RESISTANCE WITH A LCR METER BETWEEN THESE PINS ON THE D742 CONNECTOR:

PIN	TO PIN	LOOP
13	27	AFT CARGO COMP
4	12	L STRUT/WING LE
8	2	L FWD/AFT PACK
9	29	L FWD/AFT KEEL

ADD THE RESISTANCE VALUES OF THE FOUR LOOPS TOGETHER.
IS THE TOTAL RESISTANCE OF THE FOUR LOOPS MORE THAN 40 OHMS?

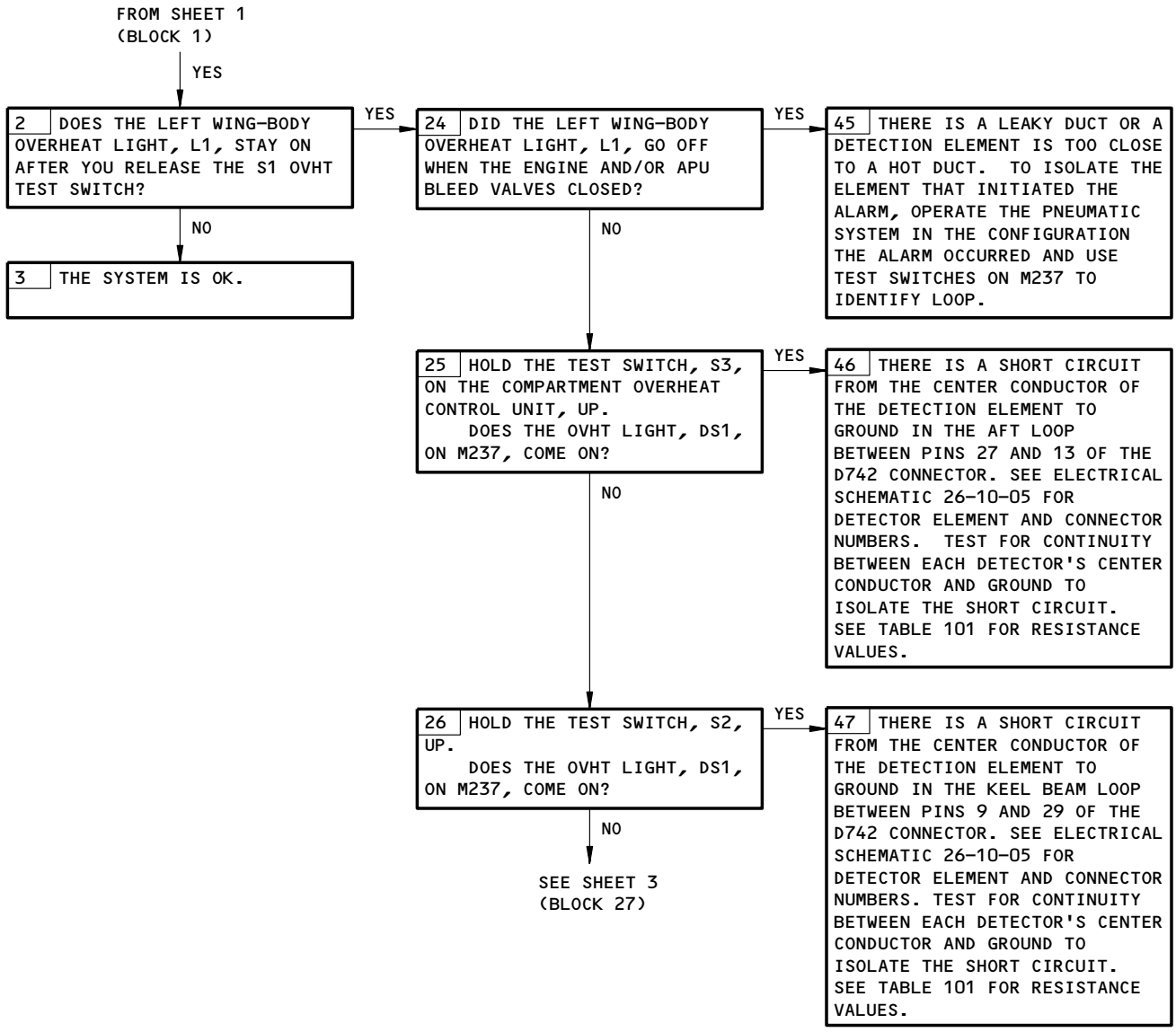
NO → 42 REPLACE THE COMPARTMENT OVERHEAT CONTROL UNIT, M237 (WDM 26-12-11).
IF THE PROBLEM CONTINUES, ISOLATE THE ELECTRICAL FAULT BETWEEN PIN 19 OF THE D742 CONNECTOR AND THE LEFT WING-BODY OVERHEAT LIGHT, L1, ON THE P5-10 PANEL (WDM 26-12-11).

YES → 23 DISCONNECT AND CLEAN THE CONNECTORS OF THE LOOPS THAT EXCEED THE VALUE SHOWN IN TABLE A, (SWPM 20-60-01. SEE FIG. 105 FOR PROPER CONNECTOR ASSEMBLY PUSH THE TEST SWITCH, s1, ON THE P5-10 PANEL.
DOES THE LEFT WING-BODY OVERHEAT LIGHT, L1, COME ON?

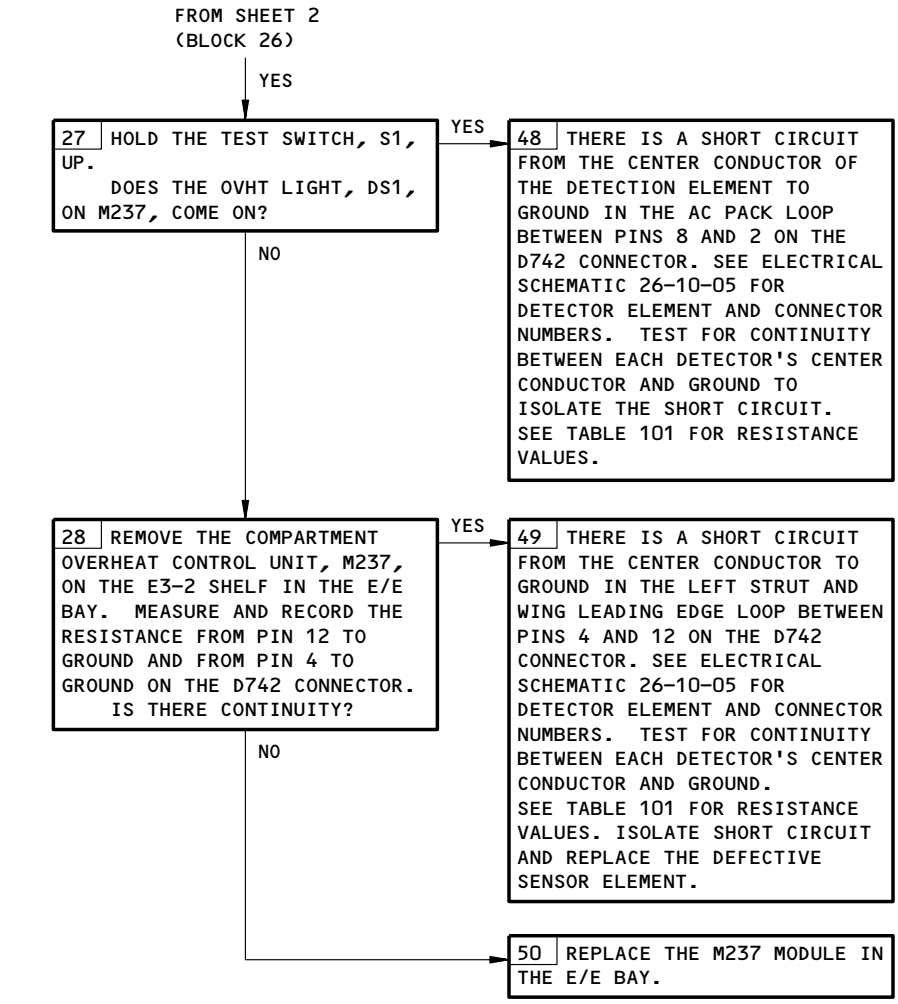
NO → 43 REPLACE DETECTOR ELEMENTS WITH HIGH CENTER CONDUCTOR RESISTANCE VALUES.

YES → 44 THE SYSTEM IS OK.

Left Wing-Body Overheat Troubleshooting Diagram
Figure 101 (Sheet 1)



Left Wing-Body Overheat Troubleshooting Diagram
Figure 101 (Sheet 2)



Left Wing-Body Overheat Troubleshooting Diagram
Figure 101 (Sheet 3)

DEFLECTOR LOOP	D742 PINS	LOOP CENTER CONDUCTOR RESISTANCE (75°F)
AFT CARGO COMPARTMENT	13 TO 27	20 ohms max
STRUT AND WING LEADING EDGE	4 TO 12	10 ohms max
FORWARD AND AFT PACK	8 TO 2	10 ohms max
FORWARD AND AFT KEEL BEAM	9 TO 29	10 ohms max
TOTAL LEFT LOOP CENTER CONDUCTOR		50 ohms max

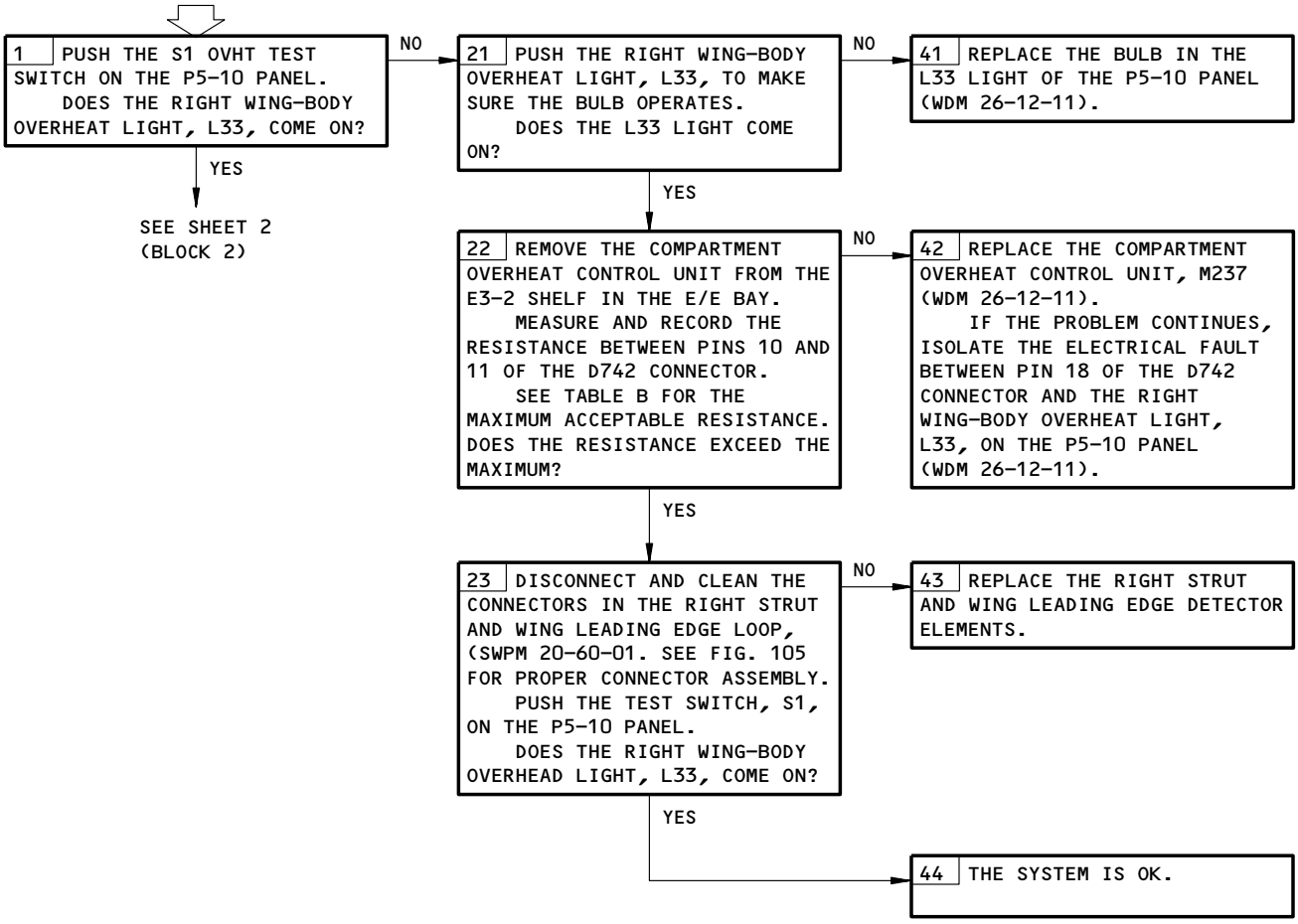
NOTE: THE RESISTANCE MEASUREMENTS IN THIS TABLE INCLUDE CONNECTOR RESISTANCES.

LEFT LOOP CENTER CONDUCTOR RESISTANCE
(FOR AIRPLANES WITH BECO M237 COMPARTMENT OVERHEAT CONTROL UNIT)
TABLE A

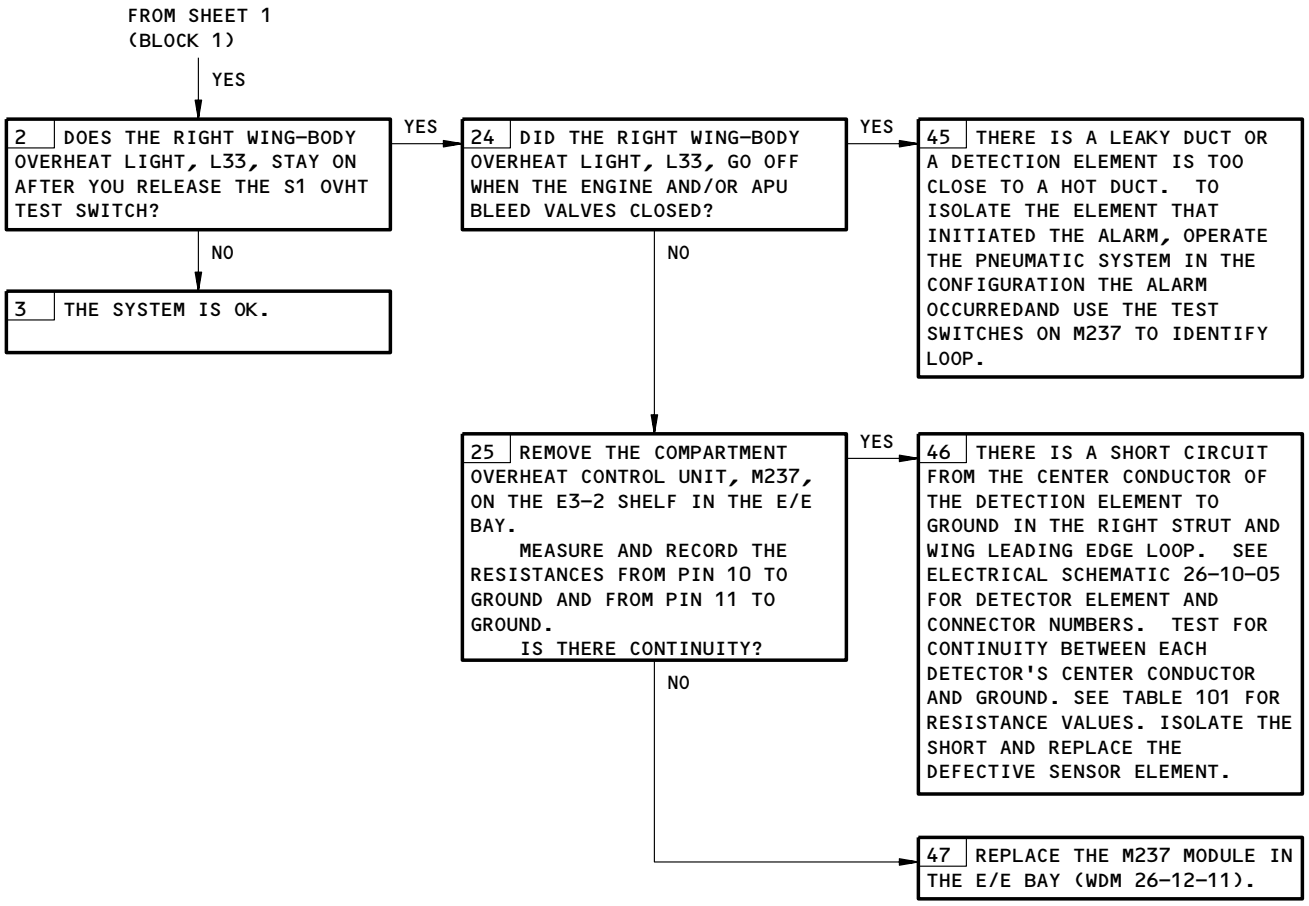
PREREQUISITES

MAKE SURE THE AIRPLANE IS IN THIS CONFIGURATION:
ELECTRICAL POWER IS ON (AMM 24-22-00/201)
EQUIPMENT:
(1) BK PRECISION 875B LCR METER OR TEGAM INC. 252/SP2596 LCR METER OR EQUIVALENT
(2) WIRE END FITTING 35303-10, FENWAL INCORP., ASHLAND, MA.
(3) WIRE END FITTING 35303-11, FENWAL INCORP., ASHLAND, MA.

CAUTION: DO NOT USE A MULTIMETER TO MEASURE DETECTOR ELEMENT RESISTANCES, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.



Right Wing-Body Overheat Troubleshooting Diagram
Figure 102 (Sheet 1)



Right Wing-Body Overheat Troubleshooting Diagram
Figure 102 (Sheet 2)

DEFLECTOR LOOP	D742 PINS	LOOP CENTER CONDUCTOR RESISTANCE (75°F)
STRUT AND WING LEADING EDGE	10 TO 11	20 ohms max

NOTE: THE RESISTANCE MEASUREMENTS IN THIS TABLE INCLUDE CONNECTOR RESISTANCES.

RIGHT LOOP CENTER CONDUCTOR RESISTANCE
(FOR AIRPLANES WITH BECO M237 COMPARTMENT OVERHEAT CONTROL UNIT)
TABLE B

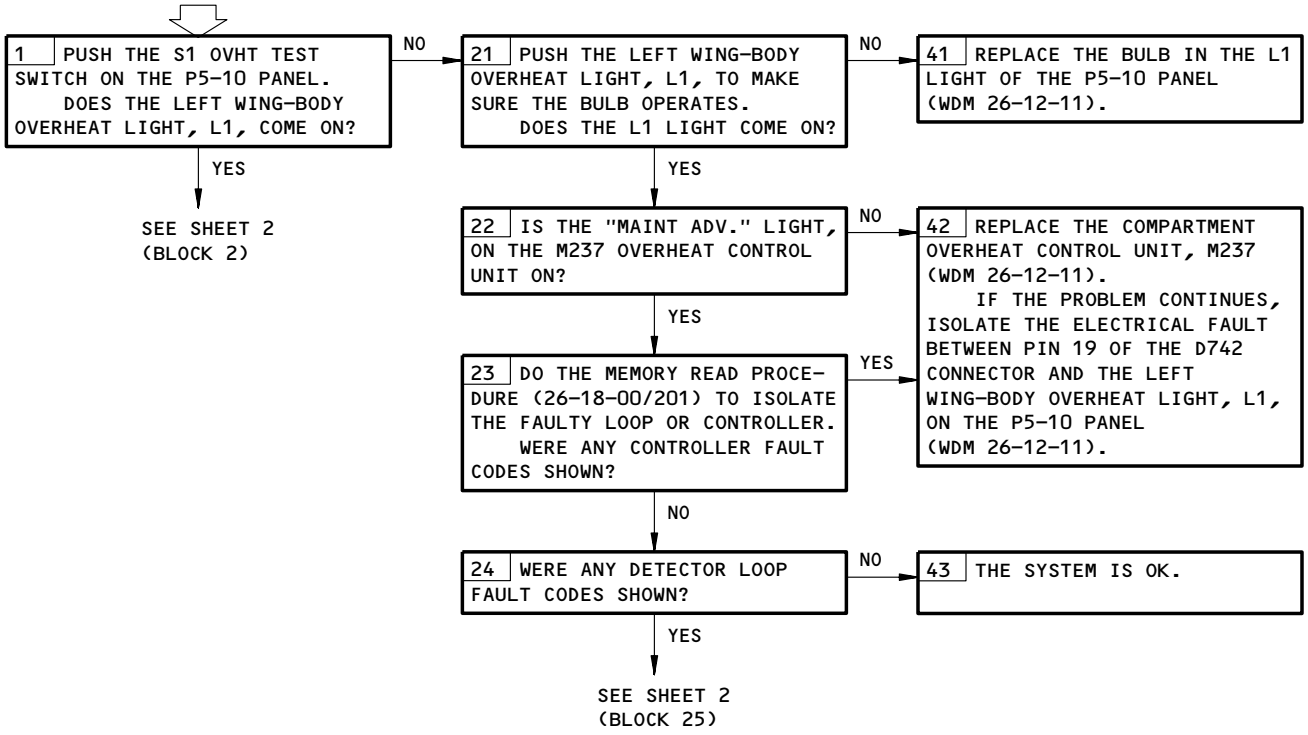
2. Overheat Detector Element Resistance Values

PREREQUISITES

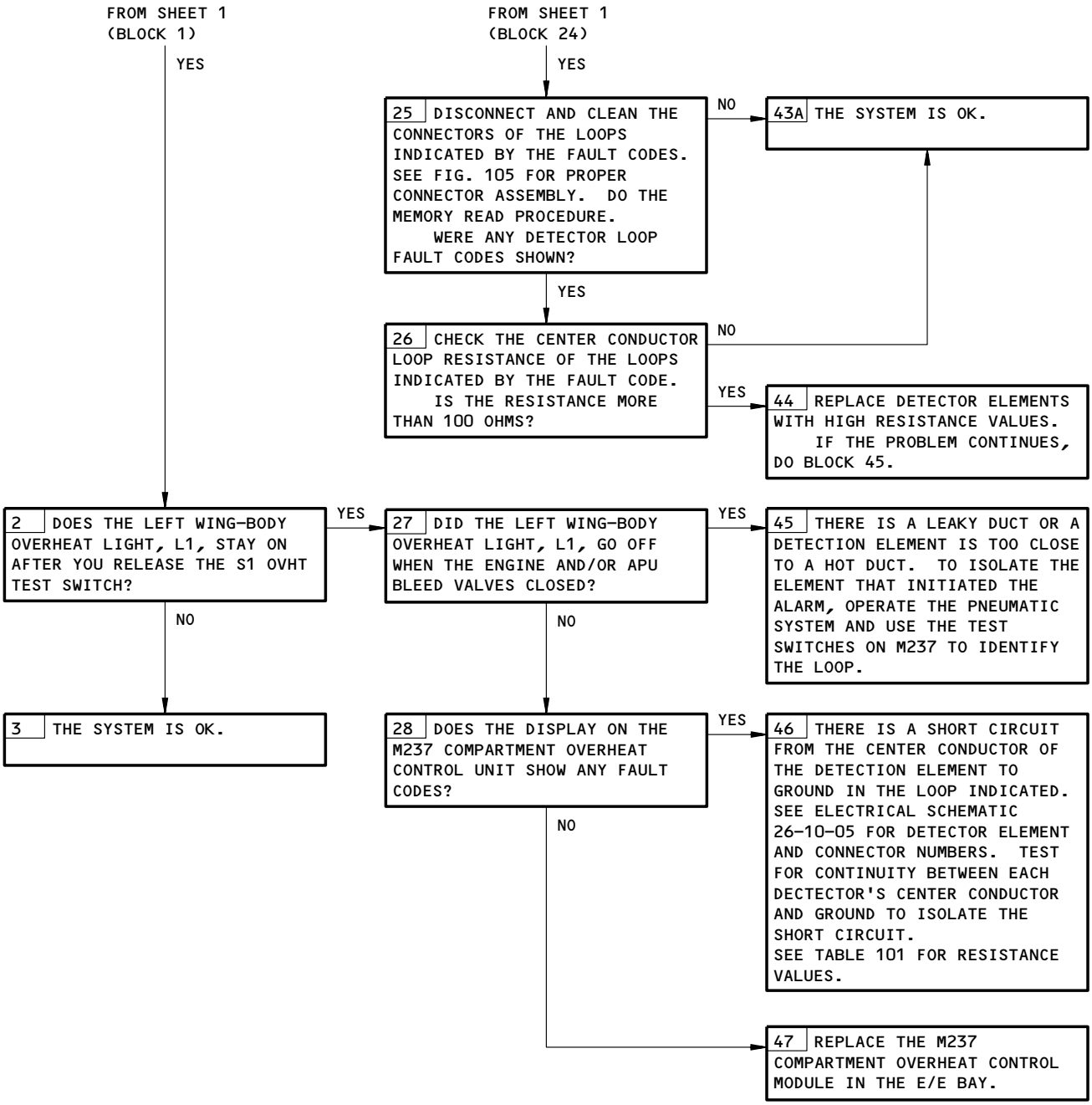
MAKE SURE THE AIRPLANE IS IN THIS CONFIGURATION:
ELECTRICAL POWER IS ON (AMM 24-22-00/201)
EQUIPMENT:
(1) BK PRECISION 875B LCR METER OR TEGAM INC. 252/SP2596 LCR METER OR EQUIVALENT
(2) WIRE END FITTING 35303-10, FENWAL INCORP., ASHLAND, MA.
(3) WIRE END FITTING 35303-11, FENWAL INCORP., ASHLAND, MA.

CAUTION: DO NOT USE A MULTIMETER TO MEASURE DETECTOR ELEMENT RESISTANCES, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

LEFT WING-BODY OVERHEAT TROUBLE-SHOOTING DIAGRAM (FOR AIRPLANES WITH FENWALL M237 COMPARTMENT OVERHEAT CONTROL UNITS)



Left Wing-Body Overheat Troubleshooting Diagram
Figure 103 (Sheet 1)



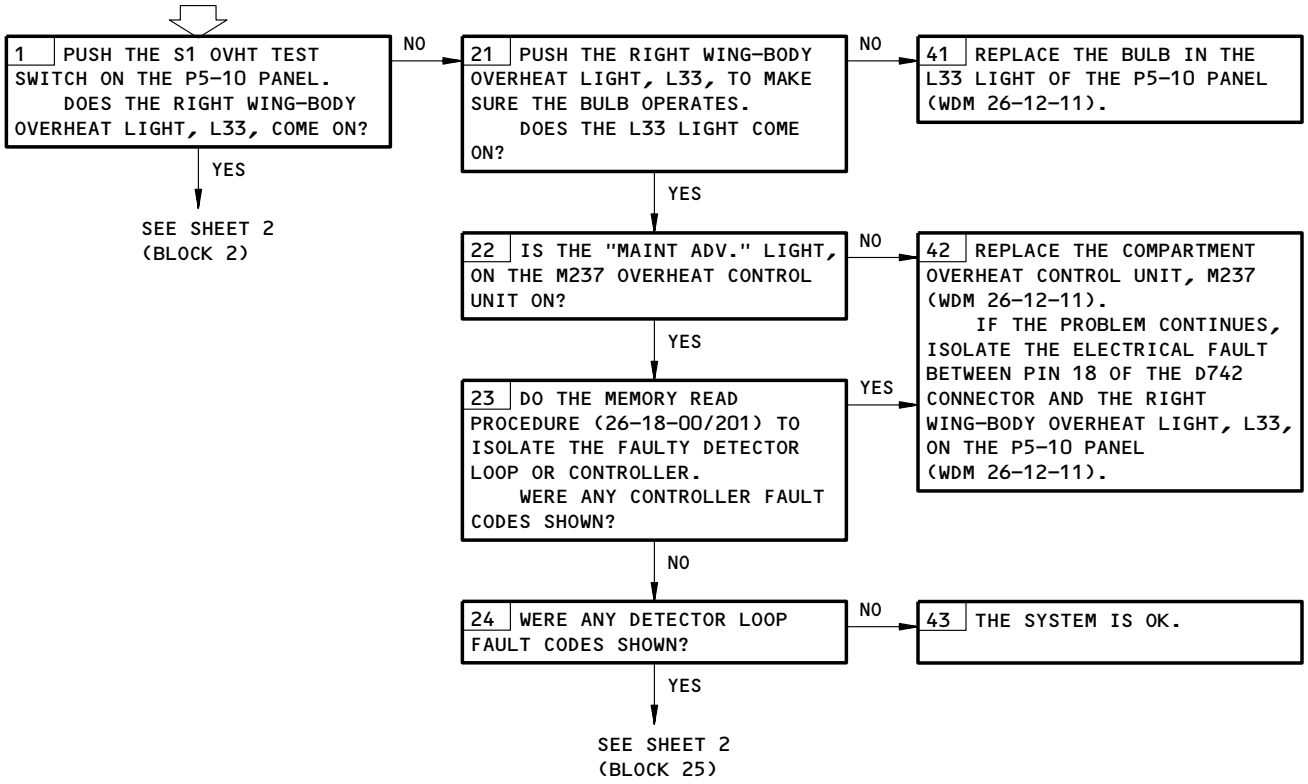
Left Wing-Body Overheat Troubleshooting Diagram
Figure 103 (Sheet 2)

PREREQUISITES

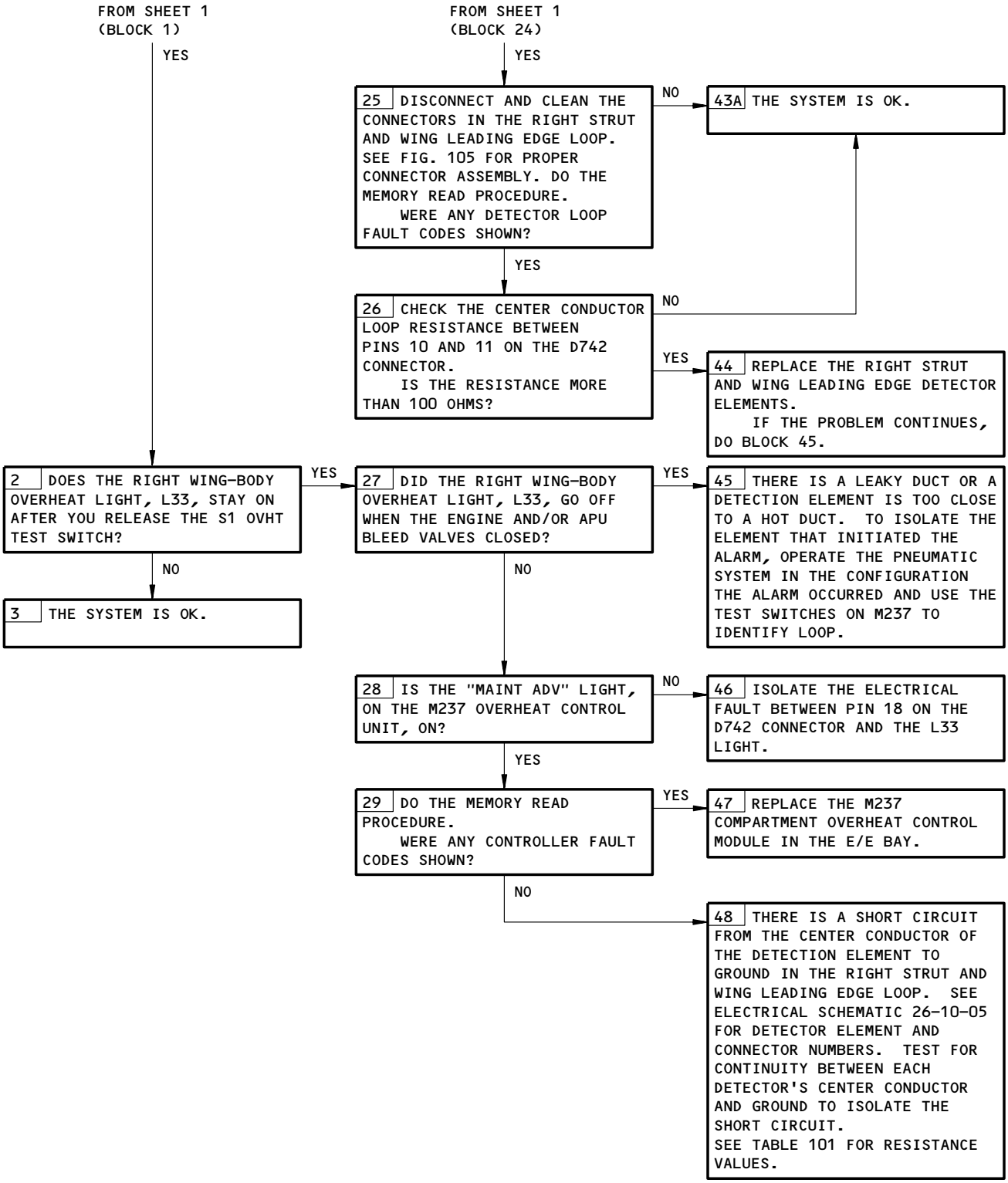
MAKE SURE THE AIRPLANE IS IN THIS CONFIGURATION:
ELECTRICAL POWER IS ON (AMM 24-22-00/201)
EQUIPMENT:
(1) BK PRECISION 875B LCR METER OR TEGAM INC. 252/SP2596 LCR METER OR EQUIVALENT
(2) WIRE END FITTING 35303-10, FENWAL INCORP., ASHLAND, MA.
(3) WIRE END FITTING 35303-11, FENWAL INCORP., ASHLAND, MA.

CAUTION: DO NOT USE A MULTIMETER TO MEASURE DETECTOR ELEMENT RESISTANCES, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

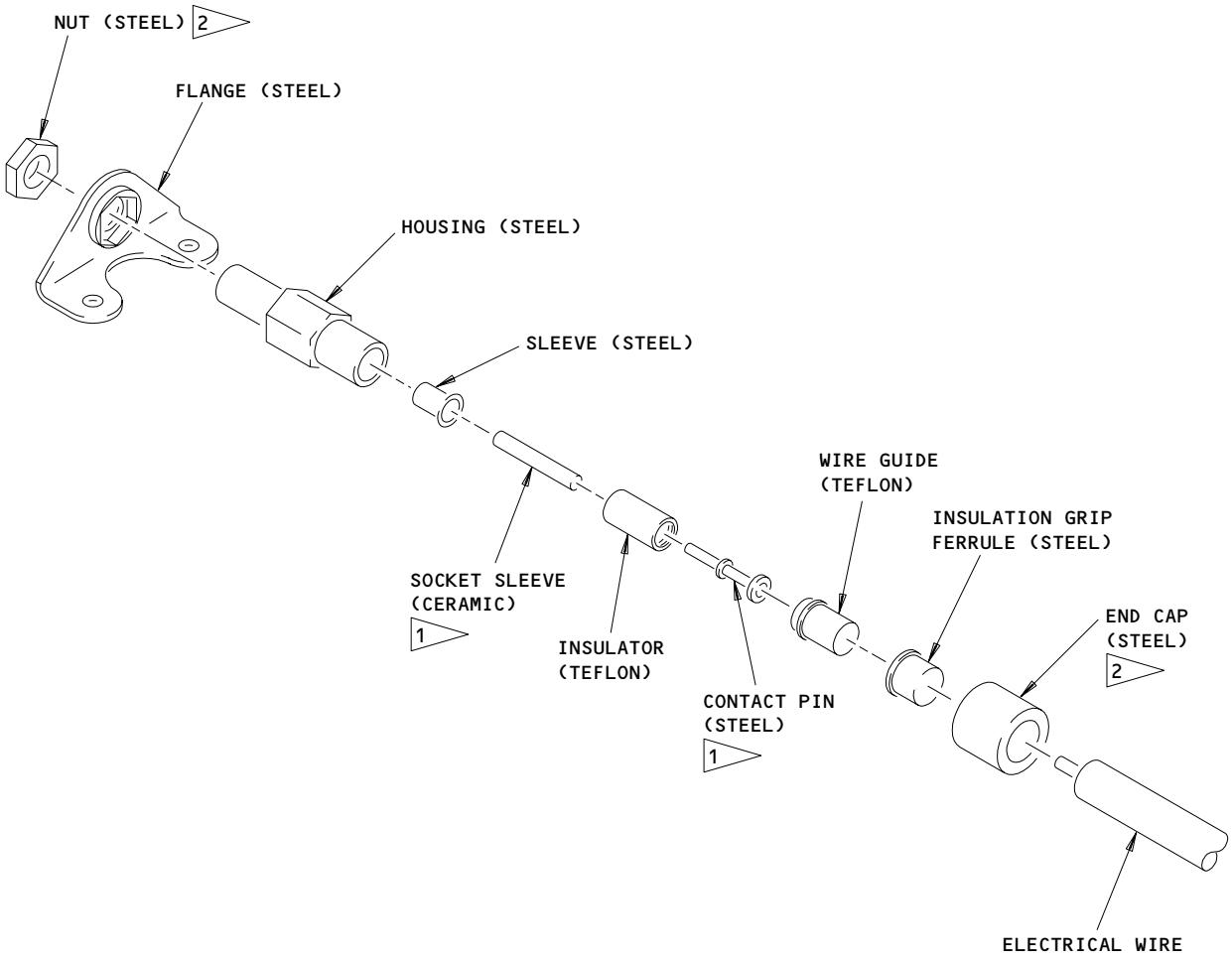
RIGHT WING-BODY OVERHEAT TROUBLE-SHOOTING DIAGRAM (FOR AIRPLANES WITH FENWAL M237 COMPARTMENT OVERHEAT CONTROL UNITS)



Right Wing-Body Overheat Troubleshooting Diagram
Figure 104 (Sheet 1)



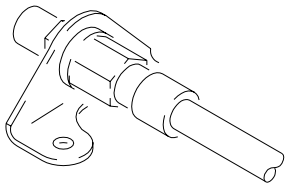
Right Wing-Body Overheat Troubleshooting Diagram
Figure 104 (Sheet 2)



EXPLODED VIEW

1 THE CONTACT PIN IS INSERTED THRU THE INSULATOR AND IS ATTACHED TO THE SOCKET SLEEVE END WITH A SMALL DOT BY SCREWING THE SOCKET SLEEVE ONTO THE CONTACT PIN

2 TIGHTEN THE END CAP TO 55 ±5 INCH-LBS
TIGHTEN THE NUT TO 55 ±5 INCH-LBS



ASSEMBLED VIEW

Connector Assembly
Figure 105

TABLE 101 - OVERHEAT DETECTOR ELEMENT RESISTANCE VALUES			
EQUIPMENT NUMBER	VENDOR PART NUMBER	MINIMUM RESISTANCE CORE-TO-CASE GROUND (Megohms)	MAXIMUM RESISTANCE CORE-TO-CORE (Milliohms)
M488	35557-4-255 35560-4-310	1.75 0.33	444 465
M371	35604-2-255 35577-4-255	0.96 1.30	573 584
M269	35585-4-255 35594-4-255 35577-4-255	1.18 1.06 1.30	640 703 584
M271	35585-4-255 35588-4-255 35594-4-255 35598-4-255 35577-4-255	1.18 1.14 1.06 1.02 1.30	640 661 703 731 584
M356	35620-2-255 35624-2-255 35628-2-255	0.83 0.81 0.78	885 913 941
M270	35604-4-400	0.96	773
M276	35625-4-255	0.80	920
M348	35594-4-255 35618-4-255 35658-4-255	1.06 0.85 0.63	703 871 1151
M347	35646-2-255	0.68	1067
M275	35572-4-255	1.39	549
M273	35557-4-255	1.75	444
M272	35618-4-255	0.85	871
M355	35624-2-255 35628-2-255	0.81 0.78	913 941
M274	35585-4-255 35586-4-255 35594-4-255 35577-4-255	1.18 1.16 1.06 1.30	640 647 703 584

TABLE 101 – OVERHEAT DETECTOR ELEMENT RESISTANCE VALUES			
EQUIPMENT NUMBER	VENDOR PART NUMBER	MINIMUM RESISTANCE CORE-TO-CASE GROUND (Megohms)	MAXIMUM RESISTANCE CORE-TO-CORE (Milliohms)
M487	35548-4-255 35560-4-310 35572-4-255	2.08 0.33 1.39	381 465 549
M268	35585-4-255 35594-4-255 35577-4-255	1.18 1.06 1.30	640 703 584
M370	35604-2-255 35577-4-255	0.96 1.30	773 584
M574	35604-2-255	0.96	773

WING AND LOWER AFT BODY OVERHEAT DETECTION SYSTEM - MAINTENANCE PRACTICES

1. General
   A. This section provides the operating procedures for the electronic Fenwal compartment overheat accessory unit.
   B. The following procedures are included in this section:
      (1) Local Test Procedure
      (2) Memory Read Procedure
      (3) Memory Clear Procedure
      (4) Alarm History Memory Read Procedure
      (5) Alarm History Memory Clear Procedure
2. Built-in Test Procedures
   A. Prepare for Procedure
      (1) Provide electrical power (Ref 24-22-00 MP).
      (2) Ensure the following circuit breakers on the P6 panel are closed:
         (a) FIRE PROTECTION DETECTION OVHT WHL WELL WNG BDY
         (b) FIRE PROTECTION DETECTION MASTER WARN & CONTROL
         (c) MASTER CAUTION AIR COND
   B. Local Test Procedure
      (1) Push the LOC TEST switch on the M237 compartment overheat accessory unit.
         (a) Code 90 is displayed on the M237 LED display while the self test is being performed.
      (2) If alarm/fault condition is detected, the code for that fault will be displayed. Push the LOC TEST switch to continue the test.
      (3) When the test is complete, code 99 is displayed.
      (4) Push the LOC TEST switch to blank the display.

         NOTE: If the LOC TEST switch is not pushed, the display will blank in approximately 2 minutes.

   C. Memory Read Procedure
      (1) Push the MEM READ switch on the M237 compartment overheat accessory unit.

         NOTE: Up to ten alarm/fault codes can be stored in non-volatile memory. Code 97 indicates all codes have been read.

      (2) Repeat step (1) until all alarm/fault codes have been read and code 97 is displayed.
      (3) Push the MEM READ switch to blank the display.
   D. Memory Clear Procedure
      (1) Push the DISP TEST switch on the M237 compartment overheat accessory unit.
         (a) Ensure code 88 is displayed.

(2) Push the LOC TEST switch on the M237 compartment overheat accessory unit.
    (a) Ensure code 99 is displayed.
(3) Push the MEM READ switch until the alarm/fault code to be cleared is displayed.

    NOTE: Existing alarm/fault conditions cannot be cleared until the condition is corrected.

(4) Repeat steps (3) and (4) until all selected codes have been cleared.
(5) Push MEM READ switch until code 97 appears.
(6) Push either MEM READ switch or MEM CLEAR switch to blank the display.

E. Alarm History Memory Read Procedure
(1) Push the LOC TEST switch on the M237 compartment overheat accessory unit until code 99 is displayed.
(2) Push the MEM READ switch on the M237 compartment overheat accessory unit until code 97 is displayed.
(3) Push and hold the DISP TEST switch and then push and hold the MEM READ switch.
(4) Release the DISP TEST switch.
(5) Release the MEM READ switch.
    (a) The display will show the latest alarm/fault history code.
(6) Push the MEM READ switch to display the next code.
(7) Repeat step (6) until code 97 appears.
(8) Push the MEM READ switch to clear the display.

F. Alarm History Memory Clear Procedure
(1) Push the LOC TEST switch on the M237 compartment overheat accessory unit until code 99 is displayed.
(2) Push the MEM READ switch until code 97 is displayed.
(3) Push and hold the LOC TEST switch.
(4) Push and hold the MEM READ switch.
(5) Release the LOC TEST switch.
(6) Release the MEM READ switch.
    (a) Code 96 will be displayed for approximately 5 seconds.
(7) During the 5 seconds that code 96 is displayed, push the MEM CLEAR switch.
(8) Push the MEM CLEAR switch to clear the displayed code.

    NOTE: The LED display will blank.

(9) Push the MEM READ switch to display the next code.
(10) Repeat steps (8) and (9) until code 97 is displayed.
(11) Push either MEM READ or MEM CLEAR switch to blank the display.

G. Restore Airplane to Normal
(1) Remove electrical power if no longer required (Ref 24-22-00 MP).

WING AND LOWER AFT BODY OVERHEAT DETECTION SYSTEM - ADJUSTMENT/TEST

1. Wing and Lower Aft Body Overheat Detection System Test
   A. General
      (1) The following procedure tests only the lights, components and airplane wiring associated with the wing and lower aft body overheat detection system. Other lights, components and wiring associated with the overheat detection systems are checked when the wheel well overheat detection system is tested. See Chapter 26-17-13.
   B. Prepare System for Test
      (1) Connect external power to the airplane.
      (2) Ensure the following circuit breakers on load control center P6 are closed.
         (a) Wheel well-wing-body-overheat (fire protection).
         (b) Master warning and control (fire protection).
         (c) Overheat (air conditioning).
         (d) Master caution bus-1.
         (e) Master caution battery bus.
         (f) Indicator lights - Master dimming bus (nine circuit breakers).
         (g) Dim and Test.
   C. Test System
      (1) Press the overheat test switch on air conditioning module P5-10. The following lights should illuminate.
         (a) Left overheat light (P5-10).
         (b) Right overheat light (P5-10).
         (c) Both master caution lights.
         (d) Master caution air conditioning annunciator light.
      (2) While holding test switch, position the lights test switch on the P2 panel to DIM and then back to BRT. The lights should dim and then return to their original brightness.
      (3) Press either master caution light. The master caution lights and the air conditioning annunciator light should extinguish.
      (4) Press the first officer's annunciator light panel. The master caution and air conditioning annunciator lights should again be illuminated.
      (5) Release overheat test switch. The following lights should extinguish:
         (a) Left overheat light on P5 panel.
         (b) Right overheat light on P5 panel.
         (c) Air conditioning annunciator light.

         NOTE: Any other lights on annunciator or P5 panel that might be illuminated should be ignored when performing this test.

(6) Press either master caution light. Both master caution lights should extinguish.
(7) Determine whether there is any further need for electrical power on the airplane; if not, remove external power.

WING AND LOWER AFT BODY OVERHEAT DETECTION SENSING ELEMENT - REMOVAL/INSTALLATION

1. General
   A. The following requirements must be met when installing a sensing element:
      (1) Minimum element bend radius is 1 inch and optimum bend radius is approximately 3 inches.
      (2) A minimum element straight run of 1 inch from all connectors and mounting clips is required prior to starting a bend. A straight run next to connectors shall be as long as possible.
2. Equipment and Materials
   A. Bonding Meter (Ref 20-22-01)
   B. Lacing Tape-BMS13-54, Grade D, Type III, Class 1 Finish C or equivalent
3. Remove Sensing Element (Fig 401,402)
   A. Open wheel well-wing-body-overheat circuit breaker on load control center P6.
   B. Disconnect electrical connector at either end of sensing element. Cover open end of electrical connectors with tape or suitable protective caps to ensure exclusion of dirt (Fig. 401).
   C. Start at one end and slip sensing element out of each mounting clip. Hold element carefully to prevent excessive bending.
   D. Remove jamnut from end fitting at each end of sensing element and remove element and end fittings from flange fitting. Cover open ends of end fittings with tape or suitable protective caps to ensure exclusion of dirt.

      NOTE: To facilitate installation and provide for proper routing of sensing element, sensing element being replaced may remain in approximate position supported by tubes and brackets in the area. Rubber bushings may be retained for use on new sensing element dependent on bushing condition.

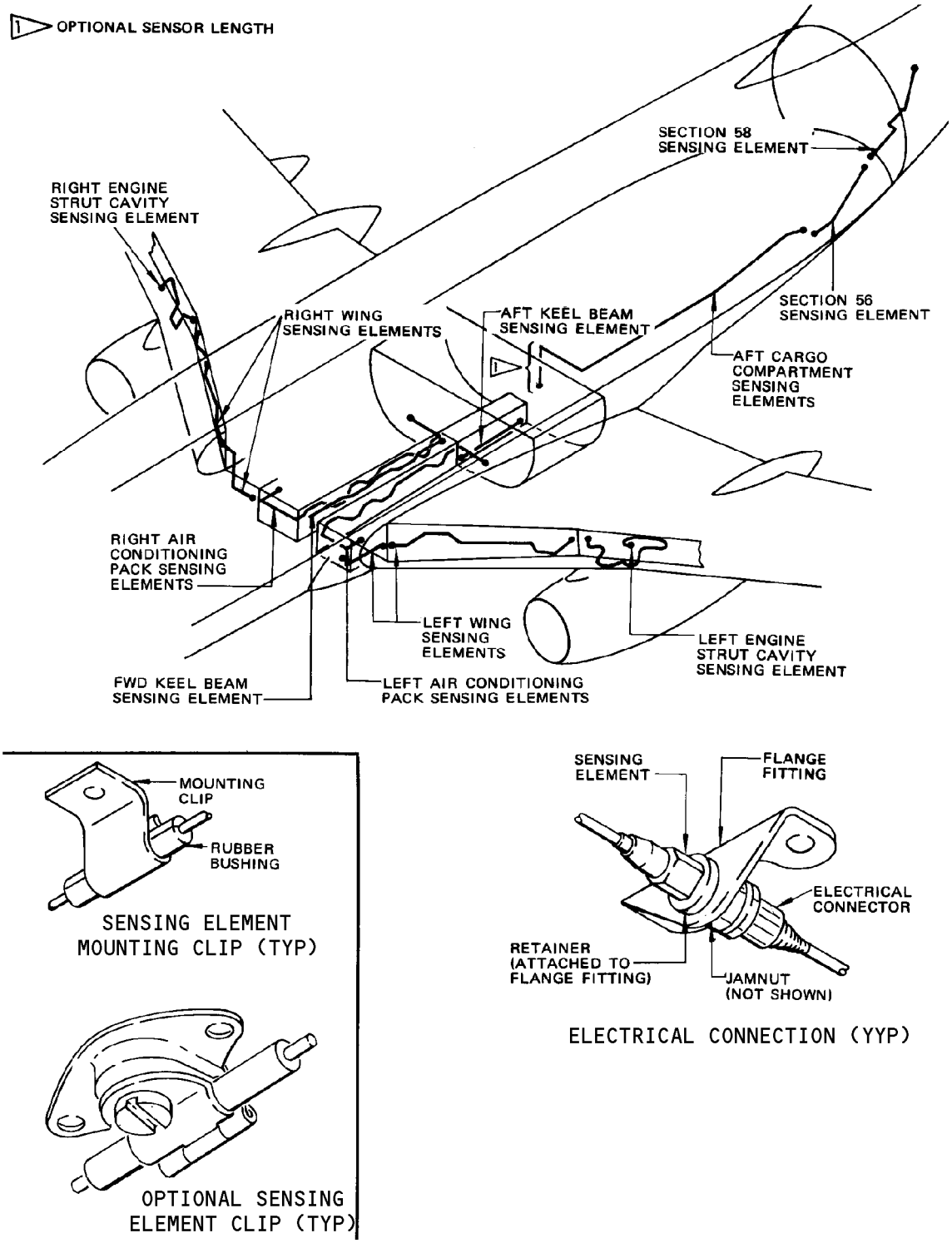
      NOTE: Overheat sensing elements M370 and M371 may have short silicone tubes installed over the elements in critical locations to prevent false overheat annunciation. When removing these elements, discard the lacing tape and retain the silicone tube for re-installation, if it is serviceable.

   E. Remove sensing element by carefully working sensing element out from beneath tubing and brackets.

      NOTE: For ease of handling and disposition, carefully roll sensing element into a coil approximately 4 inches in diameter. Tape as necessary to retain coil shape.

4. Install Sensing Element (Fig. 401, 402)

   CAUTION: IF NEW SENSING ELEMENT IS BEING INSTALLED, CHECK THAT PART NUMBER IS IDENTICAL TO THE ONE THAT WAS REMOVED.



Wing and Lower Aft Overheat Detection Sensing Element Installation
Figure 401

A. Carefully begin to unroll sensing element and locate in approximate position.

CAUTION: SENSING ELEMENT SHALL NOT BE TWISTED, PULLED, OR CLAMPED UNDER TENSION. DO NOT STRAIGHTEN ACCEPTABLE KINKS, BENDS, OR DENTS AS A FATIGUE FAILURE WILL RESULT. SENSING ELEMENT MUST ALWAYS BE ROLLED OR UNROLLED FROM COIL; NEVER PLAY OFF SIDE OF COIL.

B. Remove protective cap from end fitting at one end of sensing element and loosely install end fitting in applicable flange fitting. Bend element to contour of clamps and loosely install other end fitting (Fig. 401).

C. Install silicone rubber bushings on element so that each is centered on mounting clip and slit of each bushing faces outside of nearest bend.

D. Install bushings in each mounting clip. Mounting clips and bushings must fit element snugly.

NOTE: If old sensing element has been left in position as reference, it should be removed at this time.

NOTE: Overheat sensing elements M370 and M371 may have short silicone tubes installed over the elements in critical locations to prevent false overheat annunciation. The tube is slit to fit easily over the element, and it must be secured within the mounting clips and with lacing tape. It is important to position the slit away from the bend in the element.

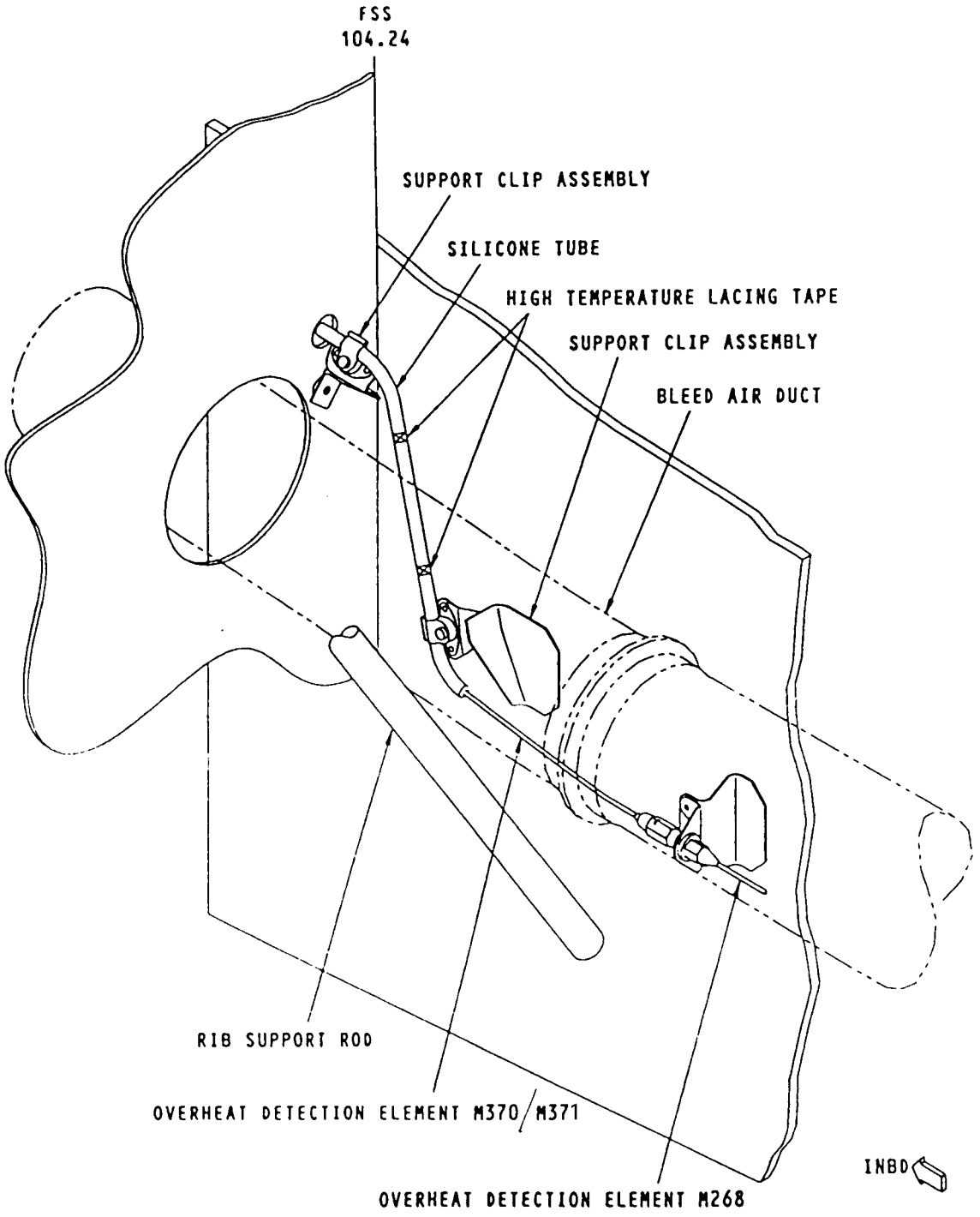
E. Tighten jamnuts on end fittings. Torque jamnut 50 to 60 pound-inches and lockwire jamnut to flange fitting and end fittings.

NOTE: Check that end fitting hex is inside hex retainer on flange fitting prior to tightening jamnut.

F. Retrace sensing element, taking up and providing slack as necessary.

NOTE: Elements shall clear structure by a minimum of 0.50 inch except at mounting clips. As much clearance as possible is desired from units that are displaced by torque or vibrate. Double check all bends and clearance after securing element. On airplanes incorporating SB 26-1060 which replaced one sensor mounting bracket and modified the route of the sensor, maintain a minimum clearance of 1.0 inch between the sensor and APU bleed air ducts.

G. Deleted
H. Install electrical connectors on end fitting and lockwire to flange fitting.
I. Check electrical bond between element connector shell and primary structure per 20-22-01. Resistance should not exceed 0.005 ohm.
J. Test wing and lower aft body overheat detection system (Ref 26-18-0 A/T).



M370/M371 Silicone Tube Installation (Typ)
Figure 402

WING AND LOWER AFT BODY OVERHEAT DETECTION SENSING ELEMENT - ADJUSTMENT/TEST

1. General
   A. Use Fenwal wire-end connectors to attach test leads to the 2 element-end connectors. Use of the wire end fittings reduce the possibility of damage to the electrical contact surface and provide a positive attach point for test equipment during test. Extreme care must be taken during the tests to keep end fittings free from dirt and other foreign substances. Replace the electrical connector or protective caps upon completion of the tests.
2. Sensing Element Test
   A. General
      (1) Sensing loop should be stabilized at ambient temperature prior to test. Replace elements that fail test.

          CAUTION: FOR SENSING ELEMENTS NOT IN THE STRUT AREA, OR NOT IN THE WING LEADING EDGE; DO NOT USE A MULTIMETER ON THE SENSOR ELEMENTS IF THE ELEMENT TEMPERATURE IS ABOVE 155°F (68°C). IF THE TEMPERATURE IS BELOW 155°F (68°C), BUT ABOVE 70°F (21°C), LIMIT METER USE TO 5-SECOND APPLICATIONS WITH NO MORE THAN 2 APPLICATIONS PER MINUTE. IF THESE REQUIREMENTS ARE NOT FOLLOWED, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

          CAUTION: FOR SENSING ELEMENTS IN THE STRUT AREA, OR IN THE WING LEADING EDGE; DO NOT USE A MULTIMETER ON THE SENSOR ELEMENTS IF THE ELEMENT TEMPERATURE IS ABOVE 300°F (149°C). IF THE TEMPERATURE IS BELOW 300°F (149°C), BUT ABOVE 70°F (21°C), LIMIT METER USE TO 5-SECOND APPLICATIONS WITH NO MORE THAN TWO APPLICATIONS PER MINUTE. IF THESE REQUIREMENTS ARE NOT FOLLOWED, DAMAGE TO THE SENSOR ELEMENT MAY OCCUR.

      (2) Equipment and Material
          (a) Multimeter
          (b) Wire End Fitting - 35303-10, Fenwal, Inc., Ashland, Mass.

              NOTE: The wire end fittings are to be used for attachment of test equipment to the sensing elements during test procedures.

Sensing Loop Test Figure 501			
LOOP CONNECTOR AND LOCATION		SENSORS AND WIRING RESISTANCE (75°F)	SENSORS
D858 Left forward A/C pack	D856 Left aft A/C pack	2.05 ohms max	M274, M355
D854 Aft keel beam	D848 Forward keel beam	1.89 ohms max	M272, M273
D866 Aft end of Section 58	D1070 Forward end of aft cargo compartment	5.80 ohms max	M275, M276, M347, M348 if installed M574
D832 Inboard left wing	D1392 Left engine strut cavity	2.54 ohms max	M268, M370, M487
D846 Right aft A/C pack	D1396 Right engine strut cavity	4.89 ohms max	M269, M271, M356, M371 and M488
D840 Main Wheel Well	D842 Main Wheel Well	0.96 ohms max	M270

NOTE: The resistance measurements are for the sensing elements and interconnecting airplane wiring, if applicable.

B. Test Sensing Loop (Fig. 501)
   (1) Disconnect airplane wiring-end connectors from both ends of a sensing loop.
   (2) Attach test wire-end connectors to each element-end connector. Torque jamnuts to 50 to 60 inch pounds.

(3) Test for element continuity by connecting multimeter to the center conductor of each added test wire-end connector. Resistance shall be per Fig. 501.
(4) Removed the 2 added test wire-end connectors from the element.
(5) Repeat steps (1) thru (4) for remaining loops.

C. Restore Airplane to Normal
(1) Reconnect the airplane wiring-end connectors to both ends of each sensor loop.
(2) Torque each jamnut to 50 to 60 inch pounds and lockwire.

WING AND LOWER AFT BODY OVERHEAT DETECTION SENSING ELEMENT - INSPECTION/CHECK

1. General
   A. Physically check each sensing element and electrical connector to determine whether and faults have occurred to make the element unacceptable.
2. Wing and Lower Aft Body Overheat Detection Sensing Element Check
   A. Check Sensing Element
      (1) Check that all diameter variation have smooth contours and that no abrasions or wear spots are deeper than 0.002 inch.
      (2) Check that no section of element has a diameter of less than 0.070 inch.

          NOTE: Smoothly contoured dents and kinks which have not reduced tubing diameter beyond acceptable limits are not cause for replacement.

          CAUTION: DO NOT ATTEMPT TO STRAIGHTEN ANY ACCEPTABLE DENT OR KINK, AS STRESSES SET UP IN TUBING MAY CAUSE A POSSIBLE FAILURE.

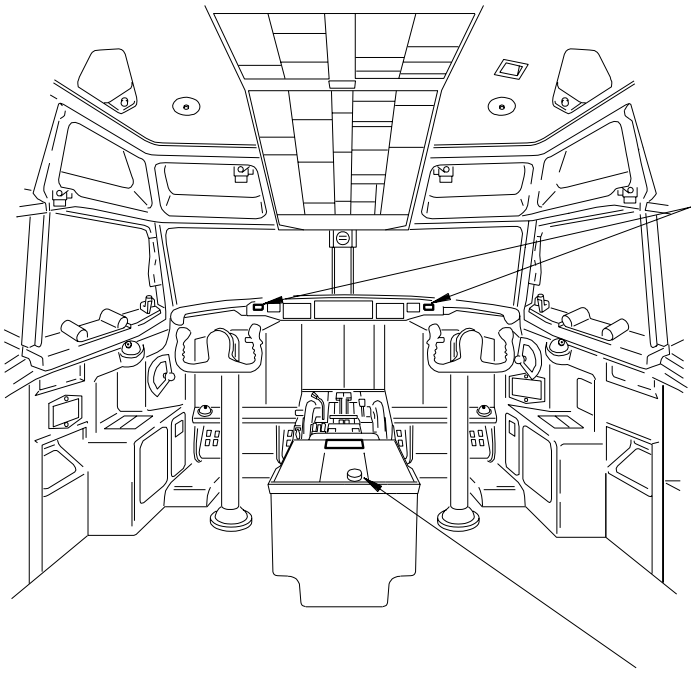
      (3) Check for any radial marks (nicks or gouges) that are more than 0.005 inch deep or extending more than 50% across seal face of end and electrical connectors.

          NOTE: These gouges would prevent an adequate water vapor seal from being made when connectors are metal.

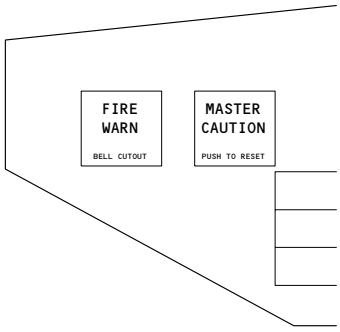
      (4) Check for dirt or other foreign substances on seal face of end connectors.

CARGO COMPARTMENT SMOKE DETECTION SYSTEM – DESCRIPTION AND OPERATION

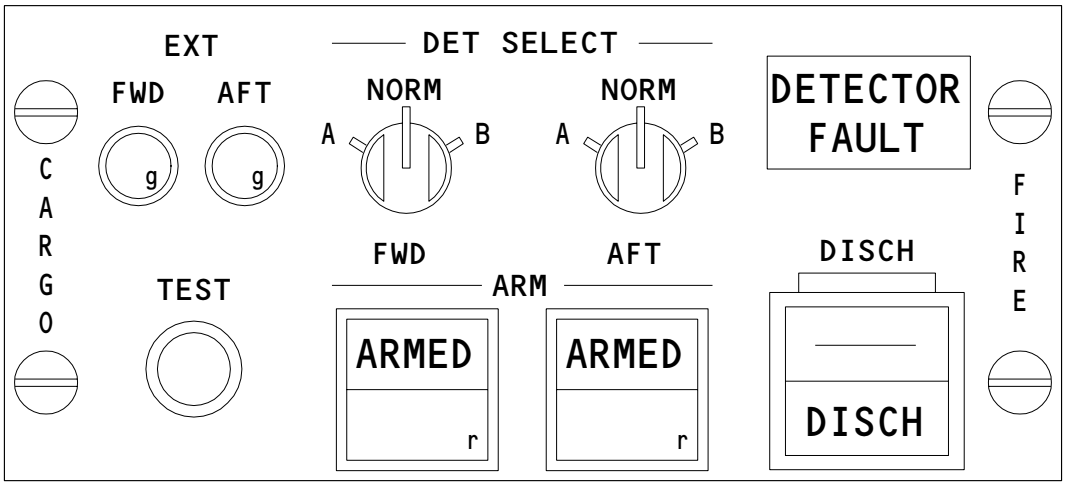
1. General
   A. The cargo compartment smoke detection system is used to monitor smoke in the forward and aft cargo compartments. The system includes these parts:
      (1) Smoke Detectors
      (2) Cargo Electronic Units (CEU)
      (3) Cargo Fire Control Panel (P8)
   B. The cargo compartment smoke detection system uses 28 volts dc power. The power is supplied through the circuit breakers on the P6 or P18 panel.
2. Component Details (Fig. 1)
   A. Cargo Smoke Detector
      (1) Cargo Smoke detectors are installed in the ceiling of the forward and aft cargo compartment. A screen is installed over the smoke detector to keep it from being damaged. The smoke detectors are controlled and monitored by the CEUs. The smoke detectors send alarm signals and status signals to the CEUs.
      (2) The smoke detectors use an ionization sensor to detect smoke. A very small amount of radioactive material ionizes the air between two electrodes allowing current to flow through the air between the electrodes. Any smoke particles present interfere with this current flow. The change in current flow is sensed by a current amplifier which outputs a signal to the applicable CEU.
   B. Cargo Electronic Unit (CEU)
      (1) One CEU is installed in the ceiling of each cargo compartment. An access panel is installed over the CEU to keep it from being damaged. The CEU in the aft cargo compartment controls and monitors the smoke detectors in the aft cargo compartment. The CEU in the forward cargo compartment controls and monitors the smoke detectors in the forward cargo compartment.
      (2) The CEU has two test buttons. The LAMP TEST button will make sure that all the indication lamps on the CEU will come on. The PRESS–TO–TEST button will initiate a signal to do a test of all the smoke detectors in its cargo compartment.
      (3) The CEU has lamps for each smoke detector in its cargo compartment. If a smoke detector fails or a smoke alarm is initiated by a smoke detector, then the lamp for that smoke detector will come on.
   C. Cargo Fire Control Panel
      (1) The Cargo Fire Control Panel is installed in P8 panel in the flight compartment. The control panel is used to initiate a test of the cargo smoke detection system and to indicate when a failure or a smoke alarm has been initiated.
         (a) The TEST switch, on the control panel, will initiate a test of the cargo smoke detection system. The test will make sure that the CEU and the smoke detectors are operating correctly.



FLIGHT COMPARTMENT



MASTER CAUTION AND
FIRE WARN LIGHTS (P7)
(EXAMPLE)
A



CARGO FIRE CONTROL PANEL (P8)
B

Cargo Bay Smoke Detection Test
Figure 1 (Sheet 1)

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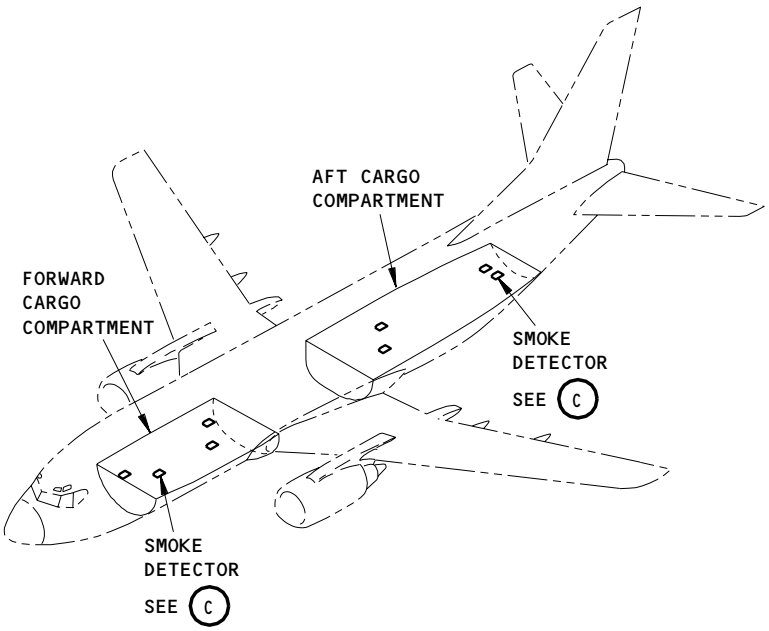
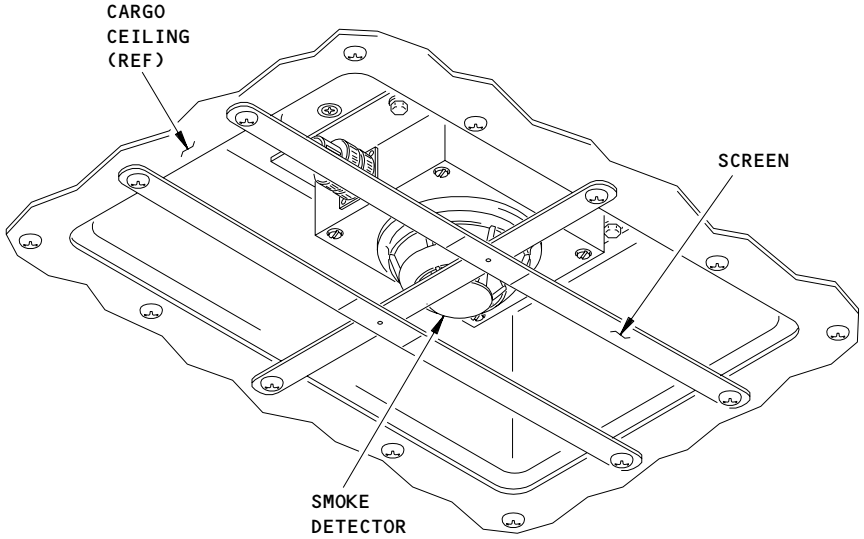




(EXAMPLE)

C

Cargo Bay Smoke Detection Test
Figure 1 (Sheet 2)

(b) The DETECTOR FAULT light (Amber) will come on whenever a smoke detector or a CEU has a power failure. The light will also come on if a detector fails to respond to the test.
(c) The DET SELECT switches control whether the system will operate in dual loop mode or single loop mode. When the switch is in the NORM position, the system will operate in the dual loop mode. When the switch is in the A position or the B position, the system will operate in the single loop mode.
(d) The applicable FWD or AFT ARM warning light (Red) will come on when smoke is sensed in one of the cargo compartments.

3. Operation
A. Functional Description (Fig. 2)
(1) The Cargo Smoke Detection System usually operates in the dual loop mode. In the dual loop mode, two detectors in a loop must sense smoke before a smoke alarm is initiated. If one of the detectors in a loop fails, then the system will automatically change to the single loop mode. In the single loop mode, the smoke alarm will be initiated if only one smoke detector senses smoke.
(2) When smoke is sensed in one of the cargo compartments, a smoke alarm signal will be initiated by the CEU. The CEU will send the signal to the flight compartment and the following conditions will occur.
(a) The applicable FWD or AFT ARM light (Red), on the Cargo Fire Control Panel (P8), will come on.
(b) The two FIRE WARN lights, on the Glareshield Panel (P7), will come on.
(c) The fire warning bell will sound.
(3) If you push the BELL CUTOUT switch, on the Engine and APU Fire Control Panel P8-1, the fire warning bell will stop. Also, if you push one of the FIRE WARN lights the bell will stop.
(4) If a detector loses power, then the DETECTOR FAULT light (Amber) will come on. The light on the CEU will show which detector or wiring circuit failed.

(5) Fault and Fire Indications are shown in Table 1:

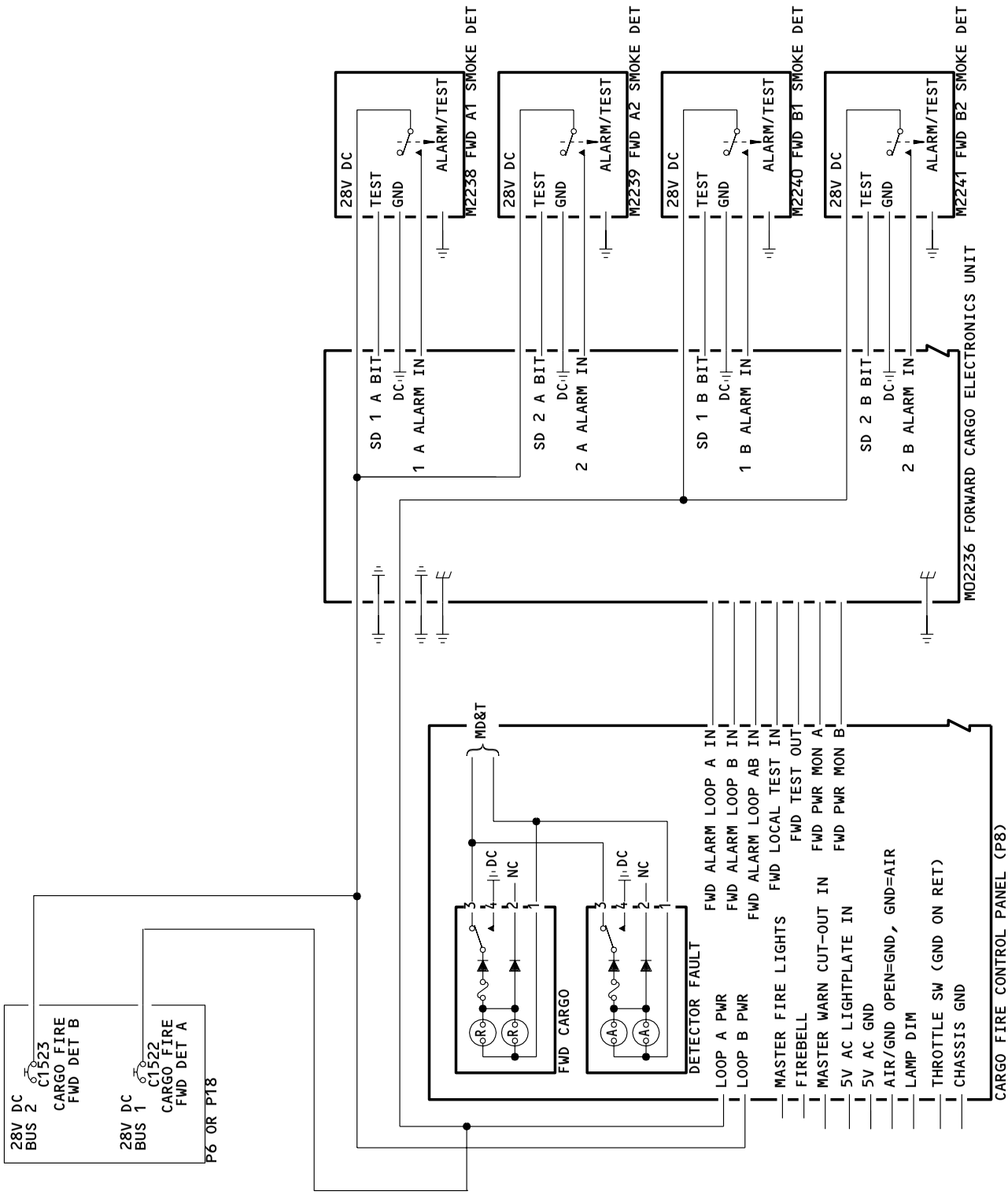
TABLE 1

LOOP A	LOOP B	INDICATION
Normal	Normal	Normal
Normal	Fault	Fault
Normal	Fire	Normal
Normal	Inop	Normal
Fault	Normal	Fault
Fault	Fault	Fault
Fault	Fire	Fire
Fault	Inop	Fault
Fire	Normal	Normal
Fire	Fault	Fire
Fire	Fire	Fire
Fire	Inop	Fire
Inop	Normal	Normal
Inop	Fault	Fault
Inop	Fire	Fire
Inop	Inop	Normal

B. Tests

(1) Circuit Test (AMM 26-20-0/501)

(a) This test will make sure that the smoke detection circuit and all the components operate correctly. When you push the TEST switch on the cargo fire control panel (P8), it will initiate a test of the CEU. The CEU will initiate a test of all the smoke detectors and will initiate the fire warning indications.



Forward Cargo Compartment Detection Schematic
Figure 2

443325

(2) Smoke Test (AMM 26-20-0/501)
(a) This test will make sure that the smoke detectors and the smoke detection circuit operate correctly. Supply a set amount of smoke near one of the smoke detectors and ensure all the fire warning indications come on.

C. Manual Operation
(1) Supply Electrical Power (AMM 24-22-0/201).
(2) Close these circuit breakers, on the circuit breaker panel P6 or P18:
(a) CARGO FIRE FWD DET A
(b) CARGO FIRE FWD DET B
(c) CARGO FIRE AFT DET A
(d) CARGO FIRE AFT DET B

CARGO COMPARTMENT SMOKE DETECTION - ADJUSTMENT/TEST

1. General
   A. Both lower cargo compartments have smoke detectors installed in the ceiling. When the concentration of smoke at the sensor gets to a preset threshold, the smoke detector alarm sounds.
   B. This procedure consists of these tasks:
      (1) Cargo Smoke Detection - Operational Test
      (2) Cargo Smoke Detection - Smoke Test
2. Cargo Smoke Detection - Operational Test (Fig. 501)
   A. Reference
      (1) AMM 24-22-0/201, Manual Control (Apply Power)
   B. Access
      (1) Location Zones
          121 Control Cabin - Left
          122 Control Cabin - Right

   C. Prepare for the Operational Test
      (1) Supply Electrical Power, Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).
      (2) Make sure these circuit breakers are closed:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
                 a) Make sure the FWD and AFT DET SELECT switches on cargo fire control panel (P8), are in the NORM position.
      (3) Depress and hold the TEST switch on cargo fire control panel (P8).
          (a) Look for these results which will indicate a properly working system:
              1) The Fire Warning Bell will sound after a momentary delay.
              2) The Captain's and First Officer's FIRE WARN lights (Red) will illuminate on Pilots' lightshield panel (P7).
              3) Push the Captain's or First Officer's FIRE WARN switch to cancel the FIRE WARN light (Red) on Pilots' lightshield panel (P7), and the Fire Warning Bell.
              4) Verify the FIRE WARN light (Red) and the Fire Warning Bell cancel.

                 NOTE: If you push either of the FIRE WARN lights, or the BELL CUTOUT switch on the Engine and APU Fire Control Panel, the same conditions occur. The FIRE WARN and BELL CUTOUT switches cause the same resets, but from different locations.

5) Both Cargo Fire FWD and AFT (Red) warning lights will illuminate.
6) Verify the DETECTOR FAULT light (Amber) remains off.

NOTE: If the DETECTOR FAULT light (Amber) illuminates, this indicates one of the selected detectors has failed to respond to the test or the Cargo Electronic Unit (CEU) or a Detector has a power failure.

7) The FWD and AFT EXT (Green) test lights will illuminate indicating discharge squib circuitry is normal.
8) Verify the cargo fire bottle DISCHARGE light (Amber) is illuminated.

(4) Release the TEST switch (P8).
(a) On the Cargo Fire Control Panel, look for these indications:
1) Both Cargo Fire FWD and AFT (Red) warning lights go off.
2) The FWD and AFT EXT (Green) test lights go off.
3) The cargo fire bottle DISCHARGE light (Amber) goes off.

3. Cargo Smoke Detection - Smoke Test (Fig. 501)

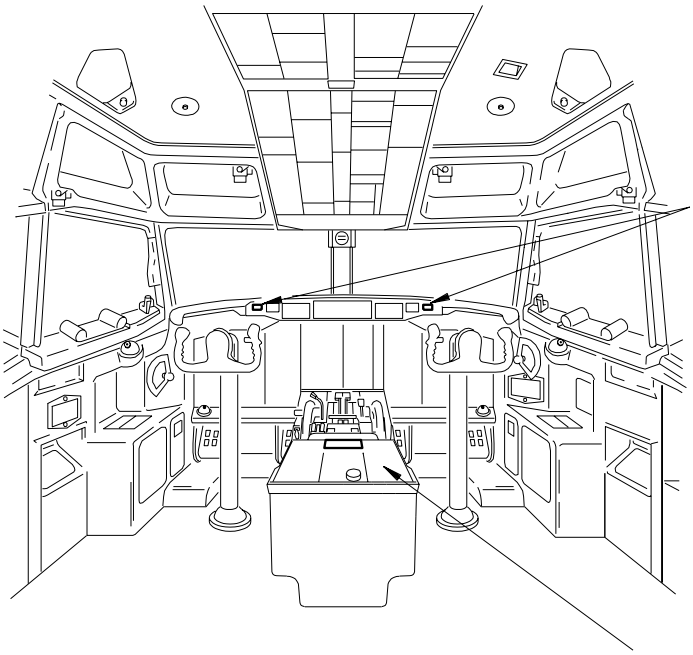
A. Equipment
(1) Generator - Fog/Smoke (preferred) 86807 Rosco Laboratories, 36 Bush Ave, Port Chester, NY 10573-3904
(2) 458481 Tube-Smoke - Ventilation (alternate) 8F723 Mine Safety Appliances Co., Corporate Hq RIDC Park, 121 Gamma Dr, PO Box 426, Pittsburgh, PA 15230-0426

B. Reference
(1) AMM 24-22-0/291, Manual Control (Apply Power)

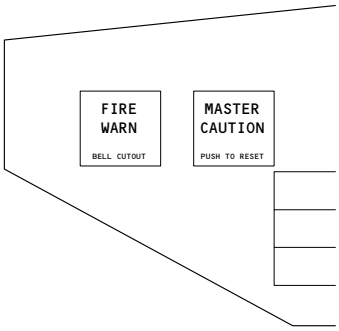
C. Access
(1) Location Zones
121 Control Cabin - Left
122 Control Cabin - Right
213 Forward Cargo Compartment
215 Aft Cargo Compartment

(2) Access Panels
4404R Forward Cargo Door
4504R Aft Cargo Door

D. Prepare for the Test
(1) Supply Electrical Power, Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).
(2) Make sure these circuit breakers are closed:
(a) Circuit breaker panel P6 or P18:
1) CARGO FIRE FWD DET A
2) CARGO FIRE FWD DET B
3) CARGO FIRE AFT DET A
4) CARGO FIRE AFT DET B

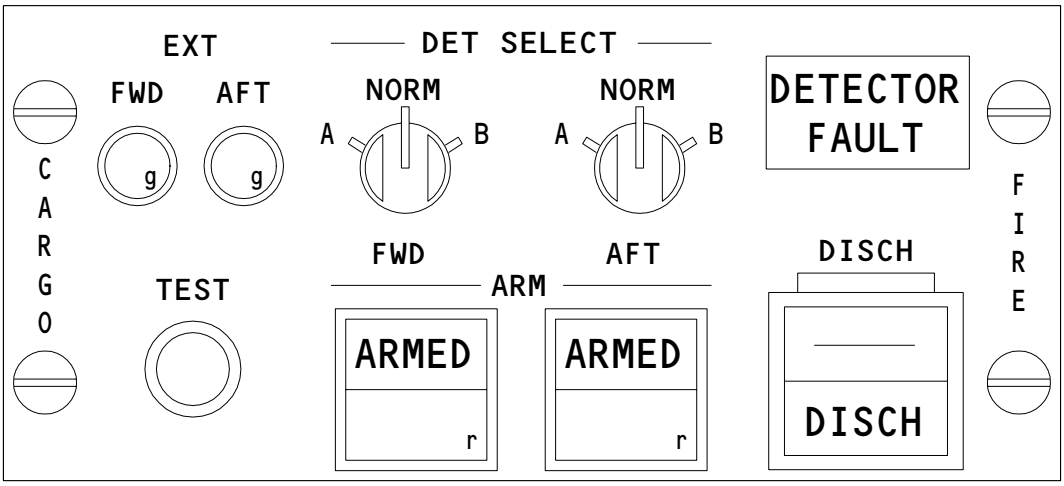


FLIGHT COMPARTMENT



MASTER CAUTION AND
FIRE WARN LIGHTS (P7)
(EXAMPLE)

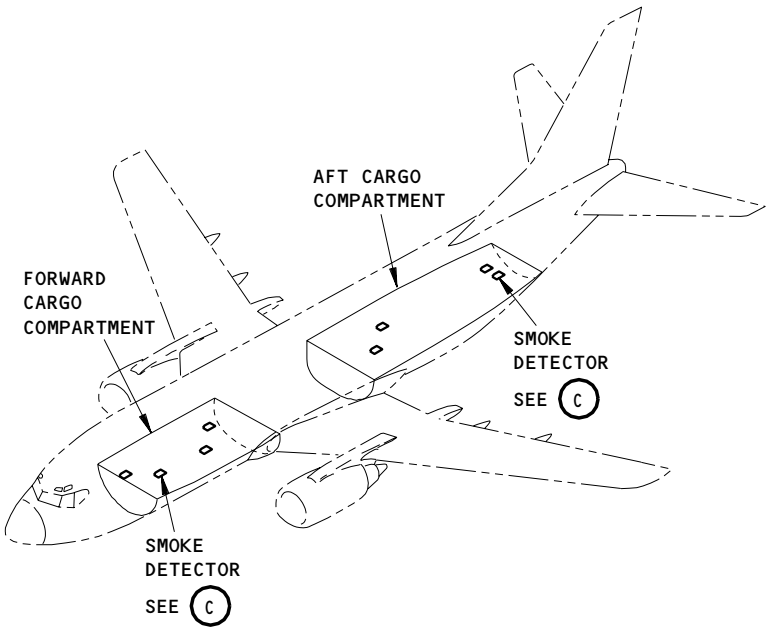
A

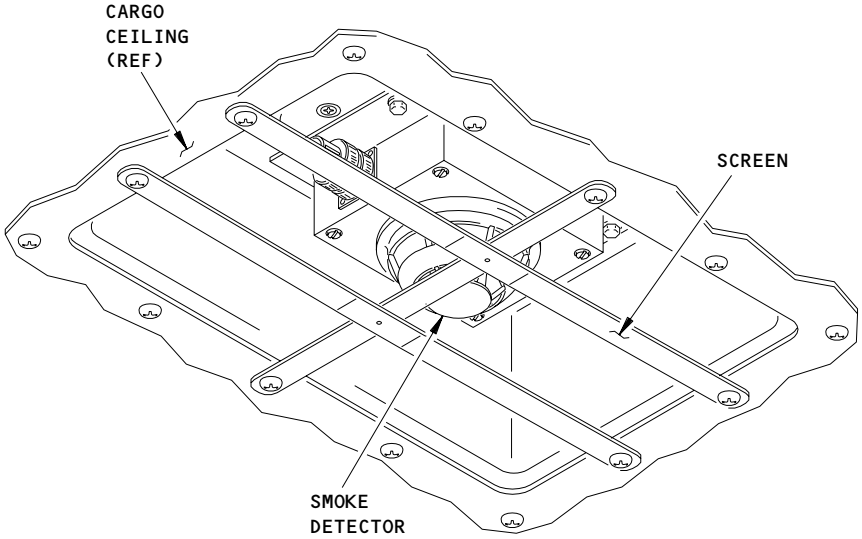


CARGO FIRE CONTROL PANEL (P8)

B

Cargo Bay Smoke Detection Test
Figure 501 (Sheet 1)





(EXAMPLE)

C

Cargo Bay Smoke Detection Test
Figure 501 (Sheet 2)

(3) Open 4404R, Forward Cargo Door.
(4) Open 4504R, Aft Cargo Door.

E. Smoke Test
(1) On cargo fire control panel (P8), set the DET SELECT FWD switch to the A position.
(2) On cargo fire control panel (P8), set the DET SELECT AFT switch to the NORM position.
(3) Use Smoke Generator to make smoke adjacent to forward left detector in forward cargo compartment.

WARNING: DO NOT INHALE SMOKE. ALWAYS USE EYE PROTECTION. IF USING VENTILATION SMOKE TUBE, AVOID SKIN CONTACT WITH CONTENTS OF TUBE AND CLEAN HANDS AFTER USE. IF THERE IS NOT SUFFICIENT AIR MOVEMENT IN AREA OR YOU EXPERIENCE RESPIRATORY PROBLEMS, USE AN APPLICABLE RESPIRATOR. TOO MUCH SMOKE FROM TUBE CAN CAUSE CORROSION TO MATERIALS IN SMOKE DETECTION SYSTEM. IF THESE INSTRUCTIONS ARE NOT ADHERED TO, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR. SPEAK TO SAFETY ENGINEER FOR NECESSARY SAFETY PRECAUTIONS.

(a) Make sure Cargo Fire (FWD) Warning light (Red) illuminates on cargo fire control panel (P8).
(b) Make sure Captain's and First Officer's FIRE WARN lights (Red) on Pilots' lightshield panel (P7) illuminates.
(c) Make sure you can hear the flight compartment fire bell.
(4) On cargo fire control panel (P8), set FWD DET and AFT DET select switch to NORM.
(a) Ensure all alarm indications stop.
(5) Clear smoke from forward cargo compartment.

NOTE: If smoke is not cleared from the cargo compartment within 60 seconds, the smoke indication will occur again.

(6) Repeat smoke test for each of the other cargo compartment smoke detectors (Table 501).

F. Return airplane to its normal condition.
(1) On cargo fire control panel (P8), set FWD DET select and AFT DET select switches to NORM.
(2) Close 4404R, Forward Cargo Door.
(3) Close 4504R, Aft Cargo Door.
(4) Remove electrical power if not needed (AMM 24-22-0/201).

FWD DET SWITCH POSITION	AFT DET SWITCH POSITION	CARGO COMPARTMENT	DETECTOR LOCATION
A	NORM	FWD	FWD LEFT
A	NORM	FWD	AFT LEFT
B	NORM	FWD	FWD RIGHT
B	NORM	FWD	AFT RIGHT
NORM	A	AFT	FWD LEFT
NORM	A	AFT	AFT LEFT
NORM	B	AFT	FWD RIGHT
NORM	B	AFT	AFT RIGHT

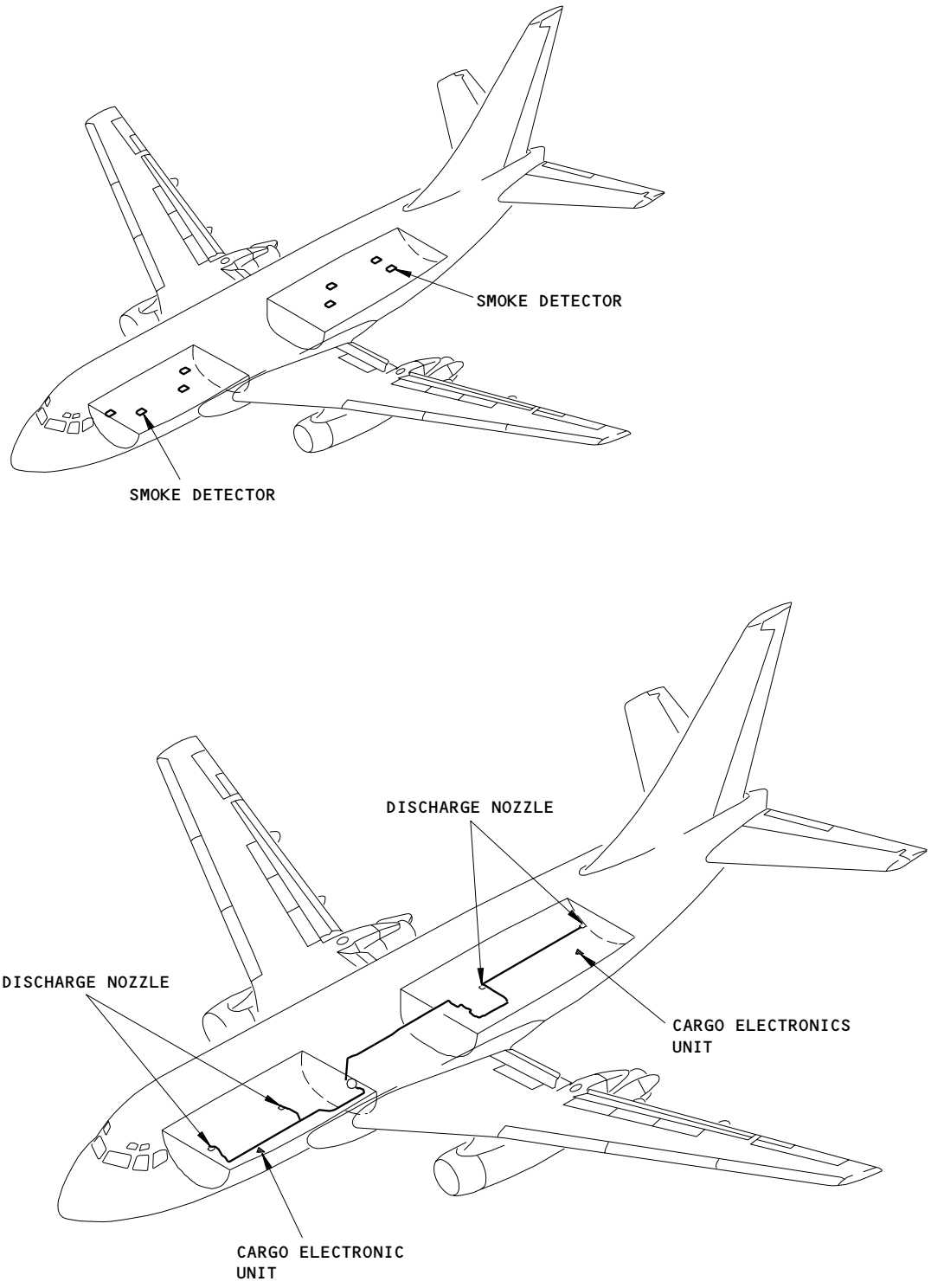
CARGO COMPARTMENT SMOKE DETECTOR - REMOVAL/INSTALLATION

1. General
   A. This procedure has these tasks:
      (1) Removal of the cargo compartment smoke detector(s).
      (2) Installation of the cargo compartment smoke detector(s).
2. Cargo Compartment Smoke Detector Removal
   A. Reference
      (1) AMM 26-20-11/701, Cargo Compartment Smoke Detectors
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

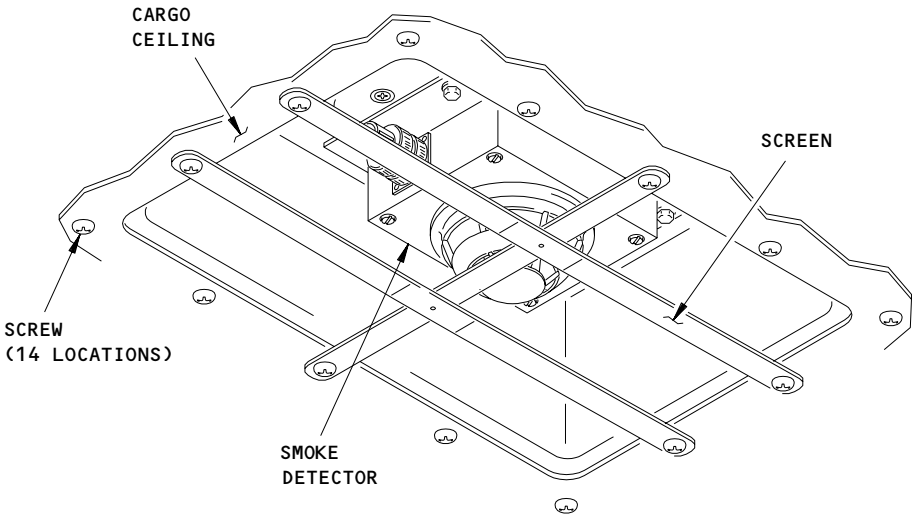
      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

   C. Prepare for Removal
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
      (2) Open 4404R, Forward Cargo Door
      (3) Open 4504R, Aft Cargo Door
   D. Remove Cargo Compartment Smoke Detector
      (1) Remove screws that hold cover plate to smoke detector.
      (2) Remove screws that hold smoke detector to ceiling bracket.
      (3) Disconnect electrical connector from smoke detector.
      (4) If necessary, perform this task: Clean Cargo Compartment Smoke Detectors, (AMM 26-20-11/701).
3. Cargo Compartment Smoke Detector Installation (Fig. 401)
   A. References
      (1) AMM 24-22-0/201, Manual Control (Apply Power)
      (2) AMM 26-20-0/501, Cargo Smoke Detection - Smoke Test
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

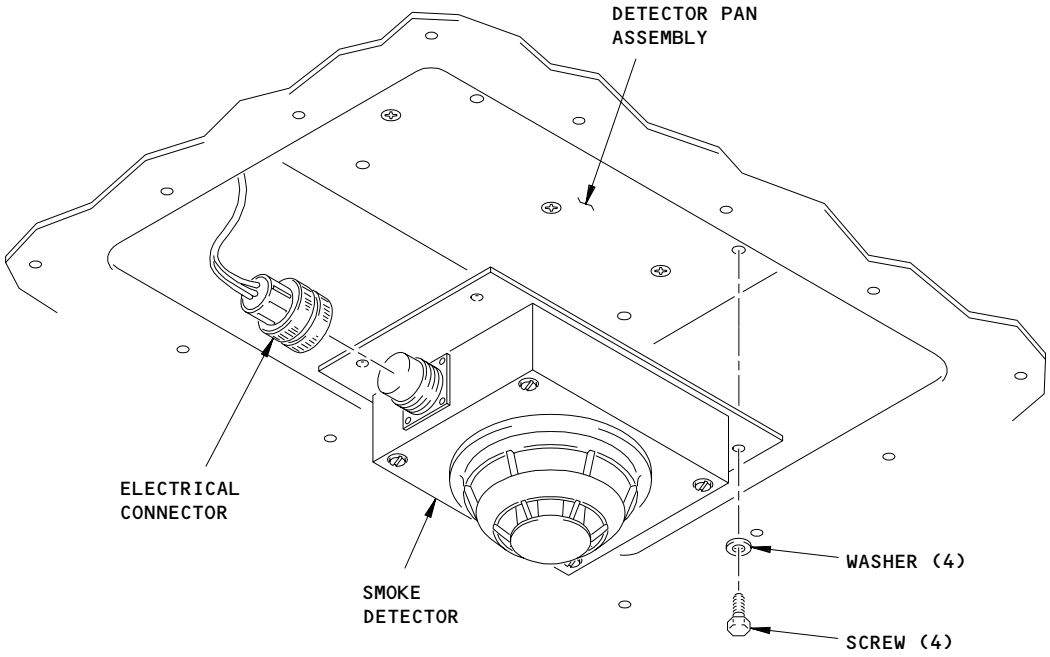
      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door



Cargo Compartment Smoke Detector Installation
Figure 401 (Sheet 1)

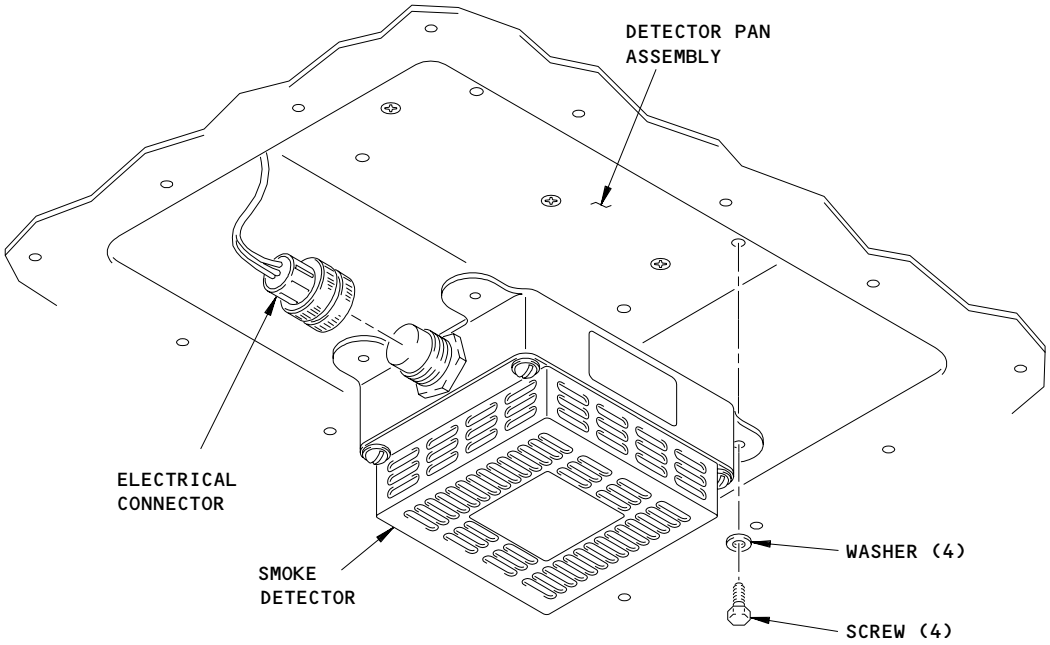


(EXAMPLE)

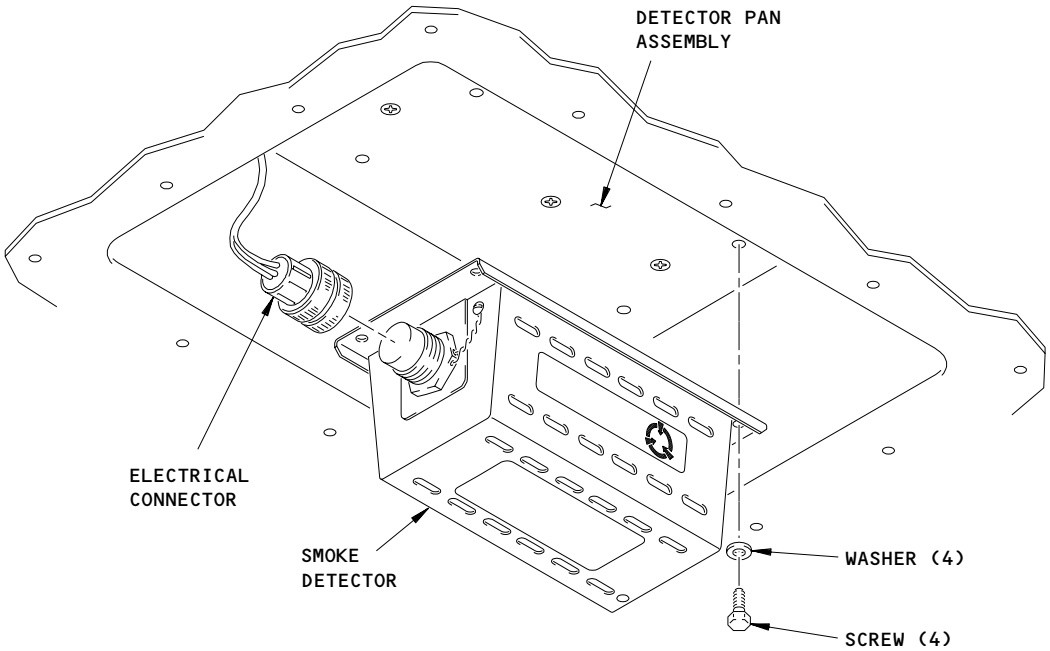


SMOKE DETECTOR
(CERBERUS GUINARD)

Cargo Compartment Smoke Detector Installation
Figure 401 (Sheet 2)



SMOKE DETECTOR
(WHITTAKER)



SMOKE DETECTOR
(FENWAL)

Cargo Compartment Smoke Detector Installation
Figure 401 (Sheet 3)

C. Prepare for Installation
   (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
      (a) Circuit breaker panel P6 or P18:
         1) CARGO FIRE FWD DET A
         2) CARGO FIRE FWD DET B
         3) CARGO FIRE AFT DET A
         4) CARGO FIRE AFT DET B
   (2) Open 4404R, Forward Cargo Door.
   (3) Open 4504R, Aft Cargo Door
D. Install Cargo Compartment Smoke Detector
   (1) Connect airplane electrical connector to smoke detector.
   (2) Position smoke detector on ceiling bracket and secure with mounting screws.
   (3) Position faceplate on smoke detector and secure with mounting screws.
E. Cargo Compartment Smoke Detector Installation Test
   (1) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
      (a) Circuit breaker panel P6 or P18:
         1) CARGO FIRE FWD DET A
         2) CARGO FIRE FWD DET B
         3) CARGO FIRE AFT DET A
         4) CARGO FIRE AFT DET B
   (2) Accomplish this task: Cargo Compartment Smoke Detection - Smoke Test (AMM 26-20-0/501).
F. Return Airplane to its Normal Condition.
   (1) Close 4404R, Forward Cargo Door, or
   (2) Close 4504R, Aft Cargo Door
   (3) Remove electrical power if not needed (AMM 24-22-0/201).

CARGO COMPARTMENT SMOKE DETECTOR - CLEANING/PAINTING

1. General
   A. This procedure has a task to clean the cargo bay smoke detectors
   B. The forward and aft cargo compartments have four ceiling-mounted smoke detectors each. The cleaning procedure is the same for each smoke detector.
2. Clean the Cargo Compartment Smoke Detectors
   A. References
      (1) AMM 24-22-0/201, Manual Control (Apply Power)
      (2) AMM 26-20-11/401, Cargo Compartment Smoke Detector
   B. Equipment
      (1) Air Source - Regulated, Dry Filtered, 0-10 psig
      (2) Gloves-Rubber (Commercially available)
      (3) Pocket Scale
   C. Consumable Materials
      (1) B00065 Alcohol, Denatured O-A-396
      (2) B00541 Cleaner, General Purpose Detergent P-D-220
      (3) G0034 Cloth, Process Cleaning Absorbent Wiper (cheesecloth, gauze) BMS15-5
   D. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

   E. Clean the Smoke Detector
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
      (2) Open 4404R, Forward Cargo Door or 4504R, Aft Cargo Door.

(3) Remove smoke detector (AMM 26-20-11/401).
(4) Put on rubber gloves.

WARNING: WHEN YOU CLEAN THE SMOKE DETECTOR AND SENSOR, MAKE SURE THE AREA HAS SUFFICIENT VENTILATION. KEEP ALCOHOL AWAY FROM HEAT, SPARKS OR FLAMES. DO NOT BREATHE FUMES FROM ALCOHOL. WEAR RUBBER GLOVES. ALCOHOL IS A FLAMMABLE AND POISONOUS SOLVENT WHICH CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE EQUIPMENT.

(5) Remove dirt from the exterior of smoke detector with BMS15-5 cloth, soaked with O-A-396 alcohol.
(6) Perform the following steps to disassemble smoke detector:
  (a) Insert a thin-edged pocket scale between smoke sensor and smoke detector.
  (b) Push lock release lever with pocket scale, then pull out smoke sensor.
  (c) Slide screwdriver between sensor assembly and sensor cover.
  (d) Twist screwdriver to release lock on sensor cover.
  (e) Remove sensor cover from sensor assembly.

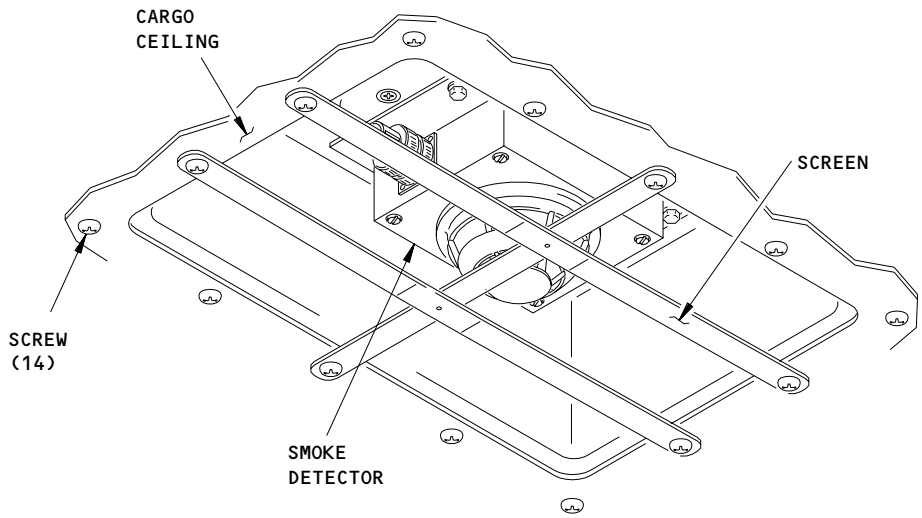
CAUTION: DO NOT TOUCH ELECTRODE IN SENSOR ASSEMBLY OR DAMAGE TO SMOKE SENSOR CAN OCCUR.

  (f) Pull out mesh from sensor assembly.
(7) Perform these steps to clean mesh and sensor assembly.
  (a) Examine mesh for dirt or other contamination.
  (b) If mesh is dirty, wash with P-D-220 cleaner and lukewarm water.
  (c) If mesh is very dirty, replace with new mesh.

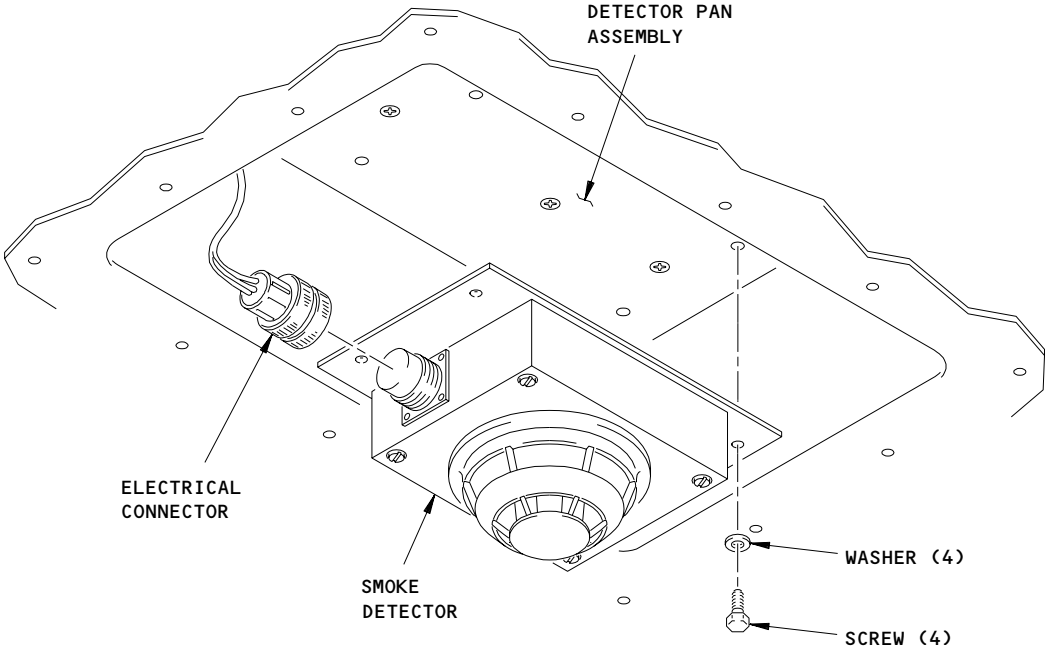
CAUTION: BLOW AIR LIGHTLY INTO THE SENSOR ASSEMBLY. IF AIR IS BLOWN WITH TOO MUCH FORCE, IT CAN CAUSE A STATIC CHARGE ON THE ELECTRODES WHICH COULD CAUSE DAMAGE TO SMOKE SENSOR.

  (d) Dry mesh completely with dry filtered air source (0-10 psig).
  (e) Lightly blow any dirt or particles out of detector assembly with air source (0-10 psig).
(8) Perform these steps to install smoke detector.
  (a) Install mesh on sensor assembly.
  (b) Align sensor cover with applicable hole in sensor assembly.
  (c) Install sensor cover, sensor assembly, and smoke sensor.
(9) Install smoke detector (AMM 26-20-11/401).
(10) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
  (a) Circuit breaker panel P6 or P18:
    1) CARGO FIRE FWD DET A
    2) CARGO FIRE FWD DET B
    3) CARGO FIRE AFT DET A
    4) CARGO FIRE AFT DET B
(11) Perform the Cargo Compartment Smoke Detection Operational Test (AMM 26-20-0/501).

F. Return Airplane to its Normal Condition
   (1) Close 4404R, Forward Cargo Door, or 4504R, Aft Cargo Door.
   (2) Remove electrical power if not needed (AMM 24-22-0/201).

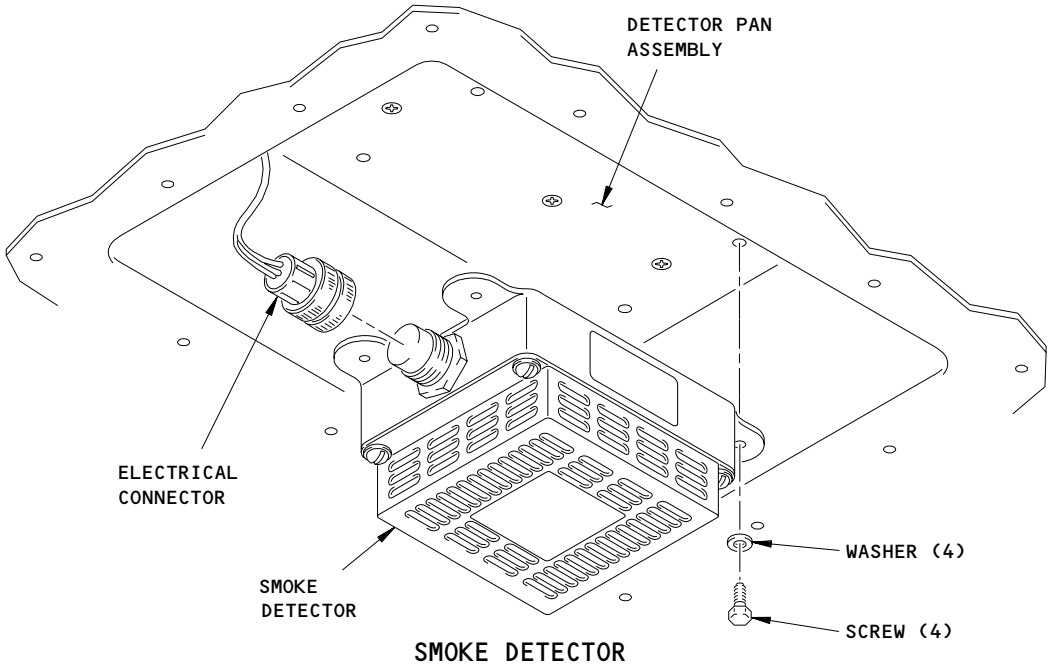


(EXAMPLE)

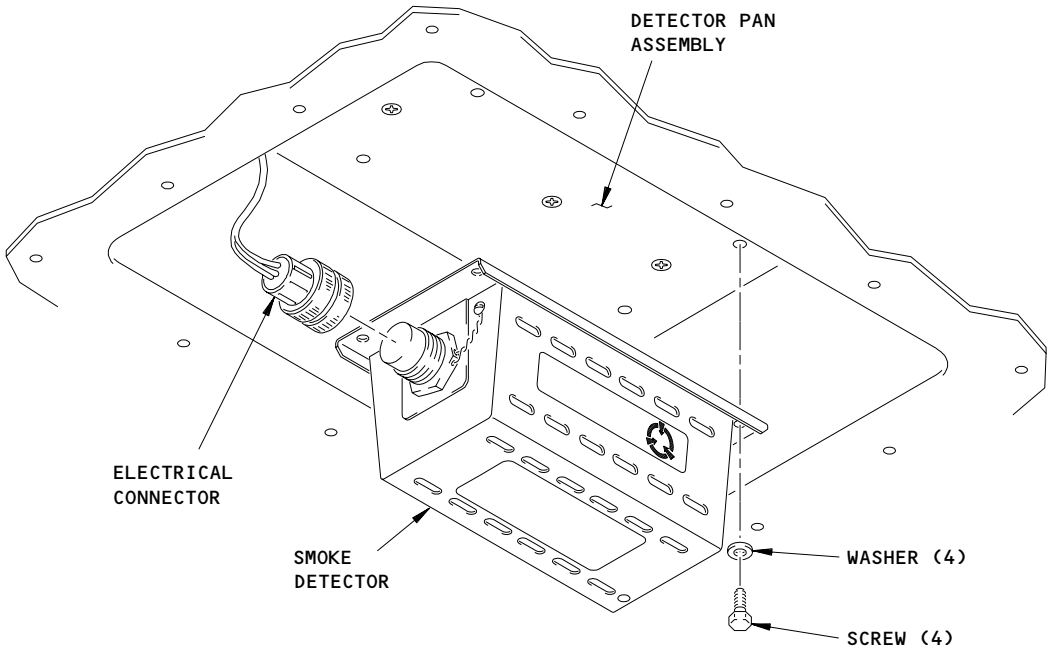


SMOKE DETECTOR
(CERBERUS GUINARD)

Cargo Compartment Smoke Detector
Figure 701



SMOKE DETECTOR
(WHITTAKER)



SMOKE DETECTOR
(FENWAL)

Cargo Compartment Smoke Detector Installation
Figure 702

CARGO ELECTRONIC UNIT - REMOVAL/INSTALLATION

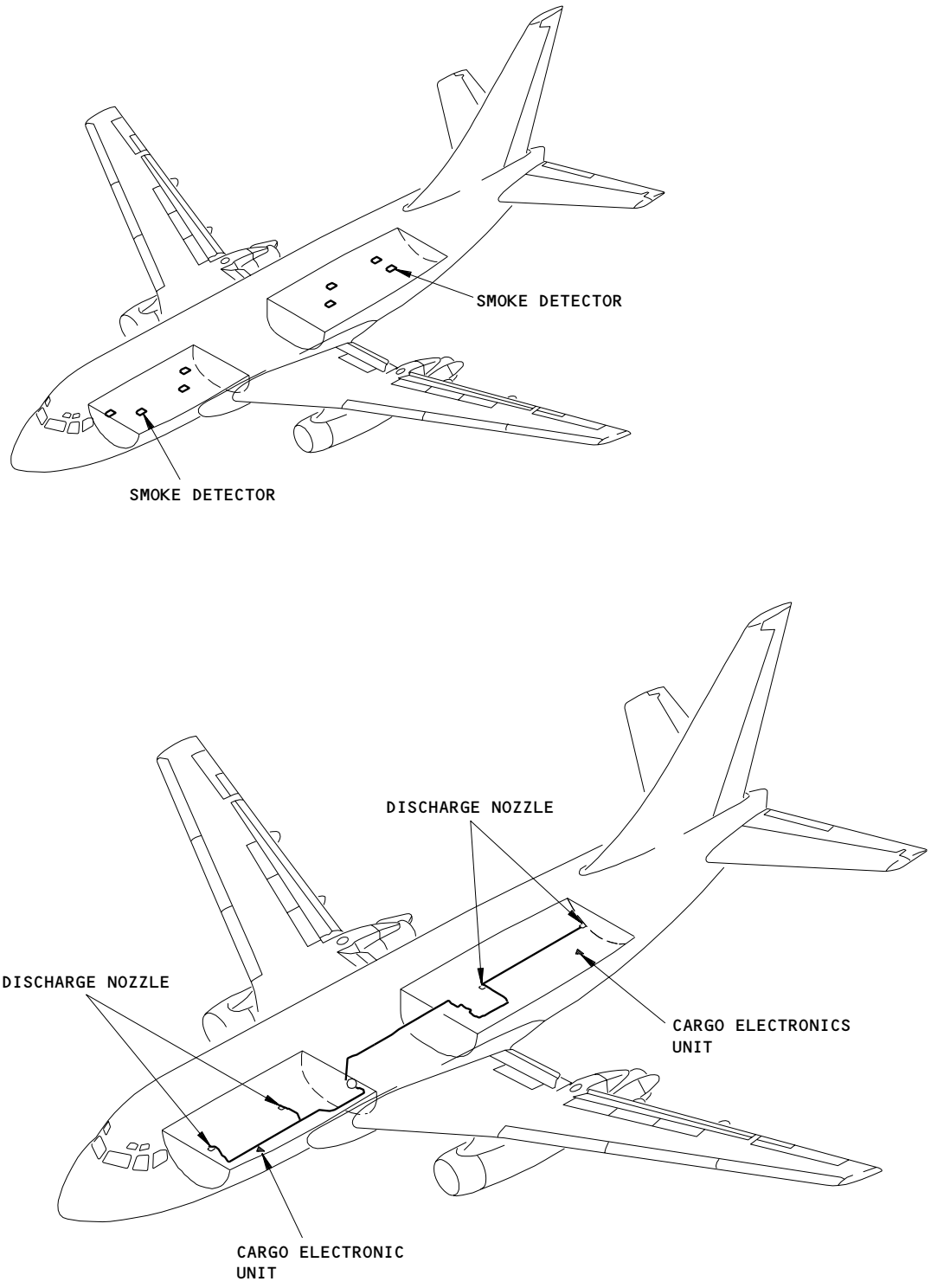
1. General
   A. This procedure has the following tasks:
      (1) Removal of Cargo Electronic Unit (CEU).
      (2) Installation of CEU.
   B. A CEU is installed in the ceiling of the FWD and AFT Cargo Compartment.
2. Cargo Electronic Unit Removal (Fig. 401)
   A. Reference
      (1) AMM 24-22-0/201, Manual Control (Apply Power)
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

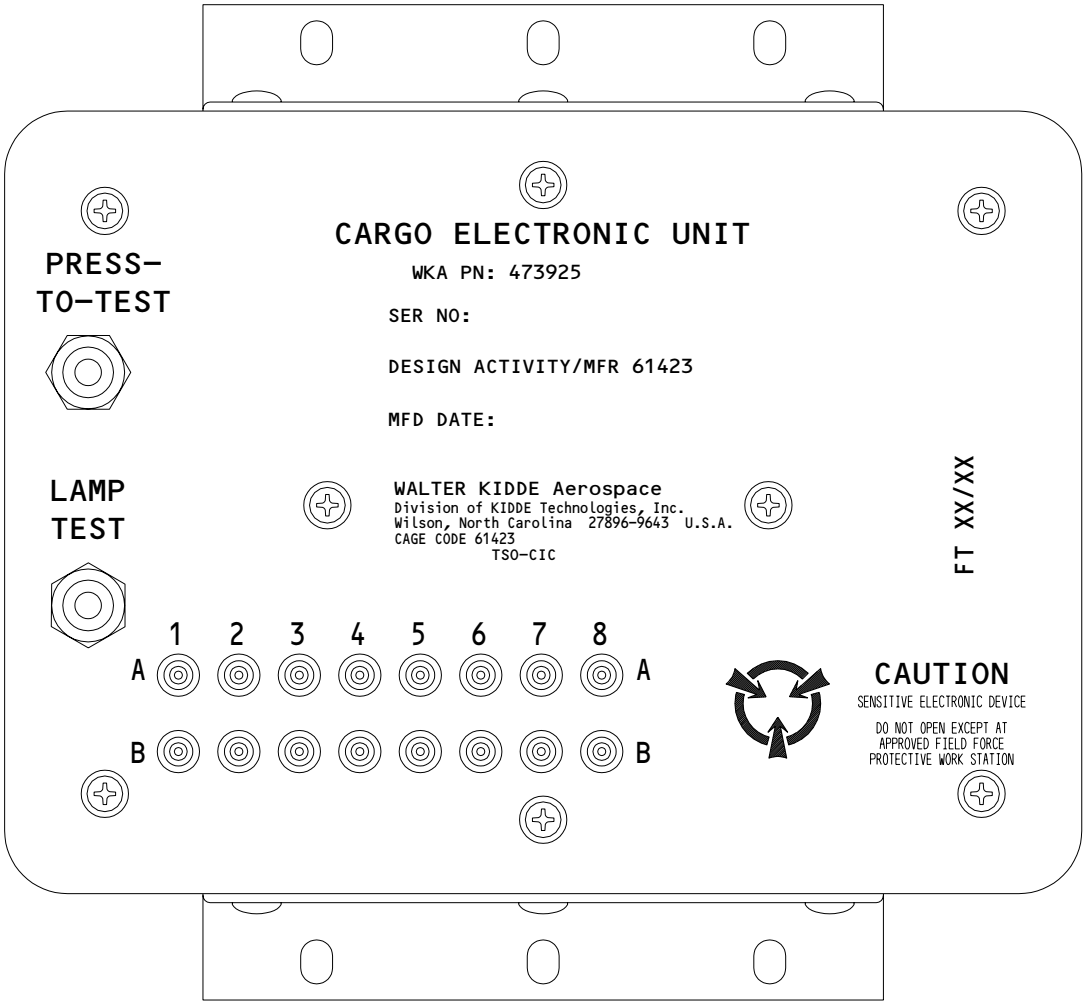
   C. Prepare for Removal
      (1) Open the following circuit breakers and install DO-NOT-CLOSE tags:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
      (2) Open applicable (FWD/4404R or AFT/4504R) Cargo Compartment Door.
   D. Remove CEU
      (1) Remove screws attaching cover to cargo compartment ceiling.
      (2) Remove screws attaching CEU to ceiling bracket.
      (3) Disconnect electrical connector from CEU.
      (4) Remove CEU.
3. Cargo Electronic Unit Installation (Fig. 401)
   A. Reference
      (1) AMM 24-22-0/201, Manual Control (Apply Power)
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

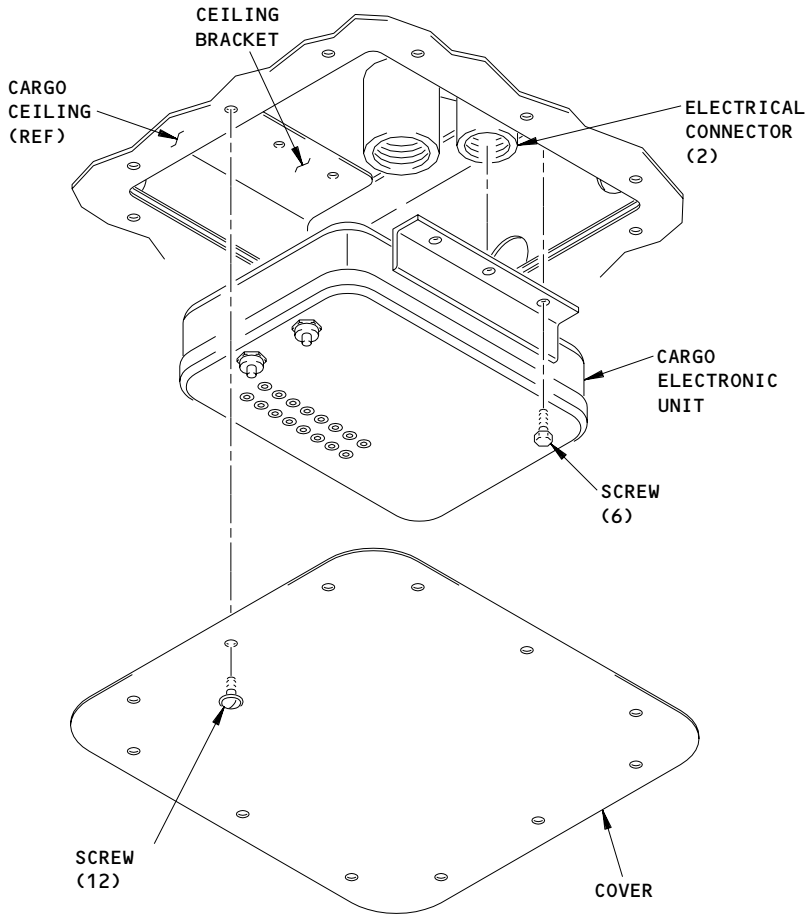
      (3) Open applicable (FWD/4404R or AFT/4504R) Cargo Compartment Door.



Cargo Electronic Unit Installation
Figure 401 (Sheet 1)



Cargo Electronic Unit Installation
Figure 401 (Sheet 2)



CARGO ELECTRONIC UNIT
(EXAMPLE)

Cargo Electronic Unit Installation
Figure 401 (Sheet 3)

C. Prepare for Installation
   (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
      (a) Circuit breaker panel P6 or P18:
         1) CARGO FIRE FWD DET A
         2) CARGO FIRE FWD DET B
         3) CARGO FIRE AFT DET A
         4) CARGO FIRE AFT DET B

D. Install CEU
   (1) Connect electrical connectors to CEU.
   (2) Put CEU into position in ceiling bracket.
   (3) Install screws to hold CEU in place.

E. Perform Installation Test
   (1) Supply electrical power (AMM 24-22-0/201).
   (2) Remove DO-NOT-CLOSE tags and close the following circuit breakers:
      (a) Circuit breaker panel P6 or P18:
         1) CARGO FIRE FWD DET A
         2) CARGO FIRE FWD DET B
         3) CARGO FIRE AFT DET A
         4) CARGO FIRE AFT DET B
   (3) Test the CEU
      (a) Push and hold LAMP TEST switch on CEU.
         1) Ensure all smoke detector indicators (loop A and B) on CEU illuminate.
      (b) Release LAMP TEST switch.
         1) Ensure all smoke detector indicators (loop A and B) on CEU go out.
      (c) Push and hold PRESS TO TEST switch on CEU.
         1) Ensure all smoke detector indicators (loop A and B) on CEU illuminate.
      (d) Release PRESS TO TEST switch.
         1) Ensure all smoke detector indicators (loop A and B) on CEU go out.
   (4) Put cover over CEU.
   (5) Install screws to hold cover in place.

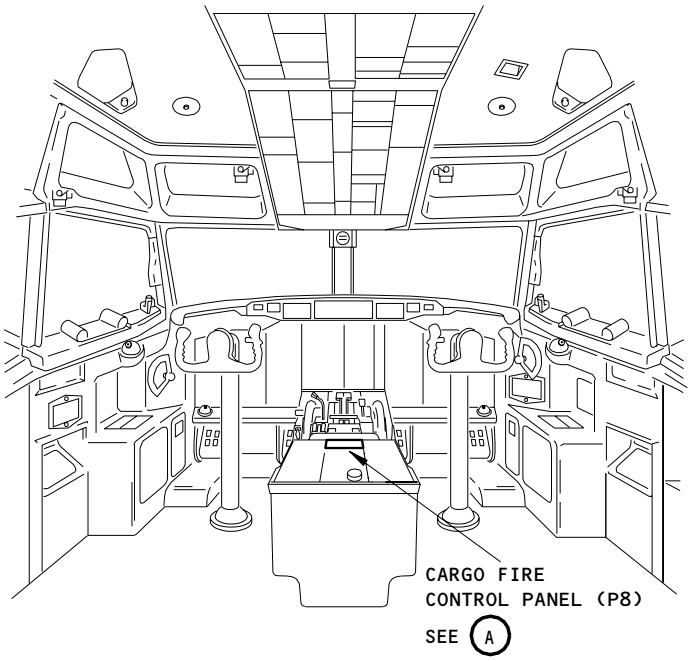
F. Return Airplane to its Normal Condition
   (1) Close the applicable (FWD/4404R or AFT/4504R) Cargo Compartment Door.
   (2) Remove electrical power if no longer required (AMM 24-22-0/201).

CARGO FIRE CONTROL PANEL - REMOVAL/INSALLATION

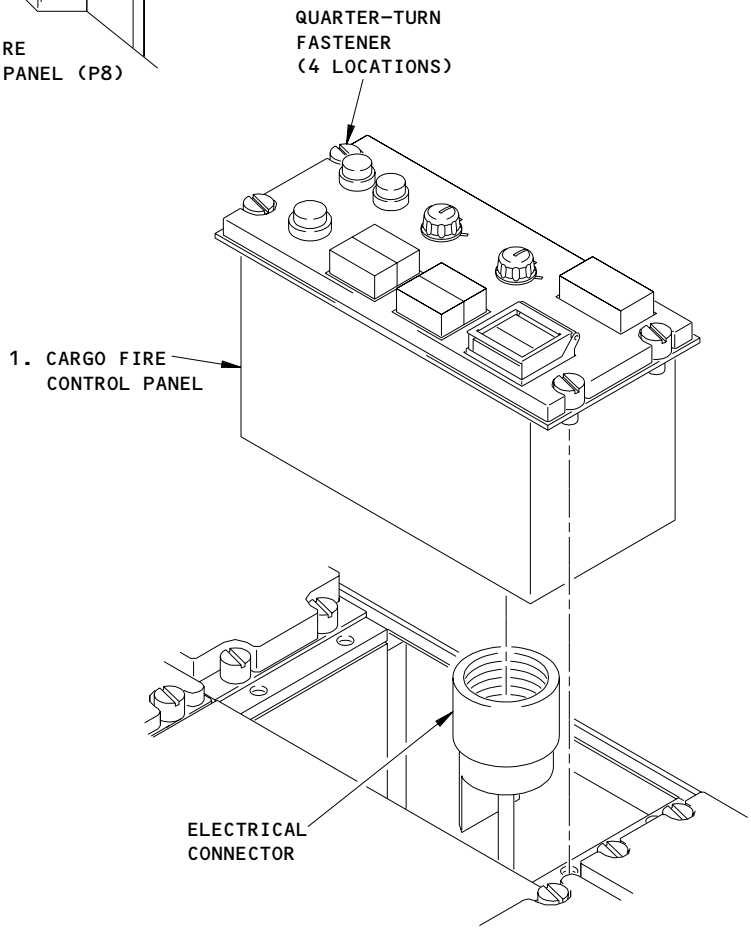
1. General
   A. This procedure has these tasks:
      (1) Removal of the Cargo Fire Control Panel (P8).
      (2) Installation of Cargo Fire Control Panel (P8).
   B. The Cargo Fire Control Panel is installed on the P8 panel.
2. Cargo Fire Control Panel Removal (Fig. 401)
   A. Access
      (1) Location Zones
          121 Control Cabin - Left
          122 Control Cabin - Right

   B. Cargo Fire Control Panel Removal
      (1) Open these circuit breakers and install DO-NOT-CLOSE tags:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
              5) CARGO FIRE EXT 1
      (2) Loosen the four quarter-turn fasteners securing the cargo fire control panel (P8), to the frame.
      (3) Slide cargo fire control panel out of the frame.
      (4) Disconnect electrical connector from cargo fire control panel (P8).
3. Cargo Fire Control Panel Installation (Fig. 401)
   A. References
      (1) AMM 26-20-0/501, Cargo Smoke Detection - Operational Test
      (2) AMM 26-25-01/401, Fire Extinguishing Bottle Pressure Switch Test
      (3) AMM 26-25-01/401, Squib Circuit Test
   B. Access
      (1) Location Zones
          121 Control Cabin - Left
          122 Control Cabin - Right

   C. Cargo Fire Control Panel Installation
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) Circuit breaker panel P6 or P18:
              1) CARGO FIRE FWD DET A
              2) CARGO FIRE FWD DET B
              3) CARGO FIRE AFT DET A
              4) CARGO FIRE AFT DET B
              5) CARGO FIRE EXT 1
      (2) Connect electrical connector to cargo fire control panel (P8).
      (3) Slide cargo fire control panel (P8), into frame and secure with quarter-turn fasteners.
      (4) Tighten the quarter-turn fasteners to hold the cargo fire control panel (P8), in place.



FLIGHT COMPARTMENT



CARGO FIRE CONTROL PANEL (P8)

(A)

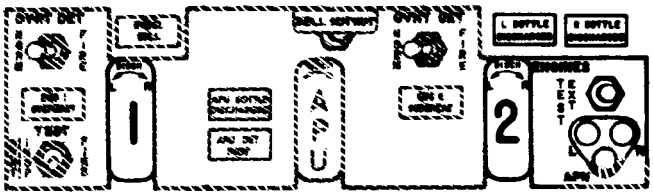
Cargo Fire Control Panel Installation
Figure 401

443336

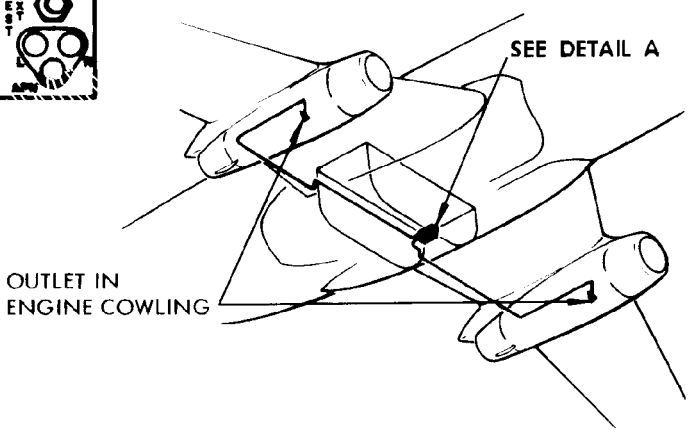
D. Cargo Fire Control Panel (P8), Installation Test
   (1) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
      (a) Circuit breaker panel P6 or P18:
         1) CARGO FIRE FWD DET A
         2) CARGO FIRE FWD DET B
         3) CARGO FIRE AFT DET A
         4) CARGO FIRE AFT DET B
         5) CARGO FIRE EXT 1
   (2) Perform the Cargo Smoke Detection-Operational Test (AMM 26-20-0/501).
   (3) Perform the Fire Extinguishing Bottle Pressure Switch Test (AMM 26-25-01/401).
   (4) Perform the Squib Circuit Test (AMM 26-25-01/401).

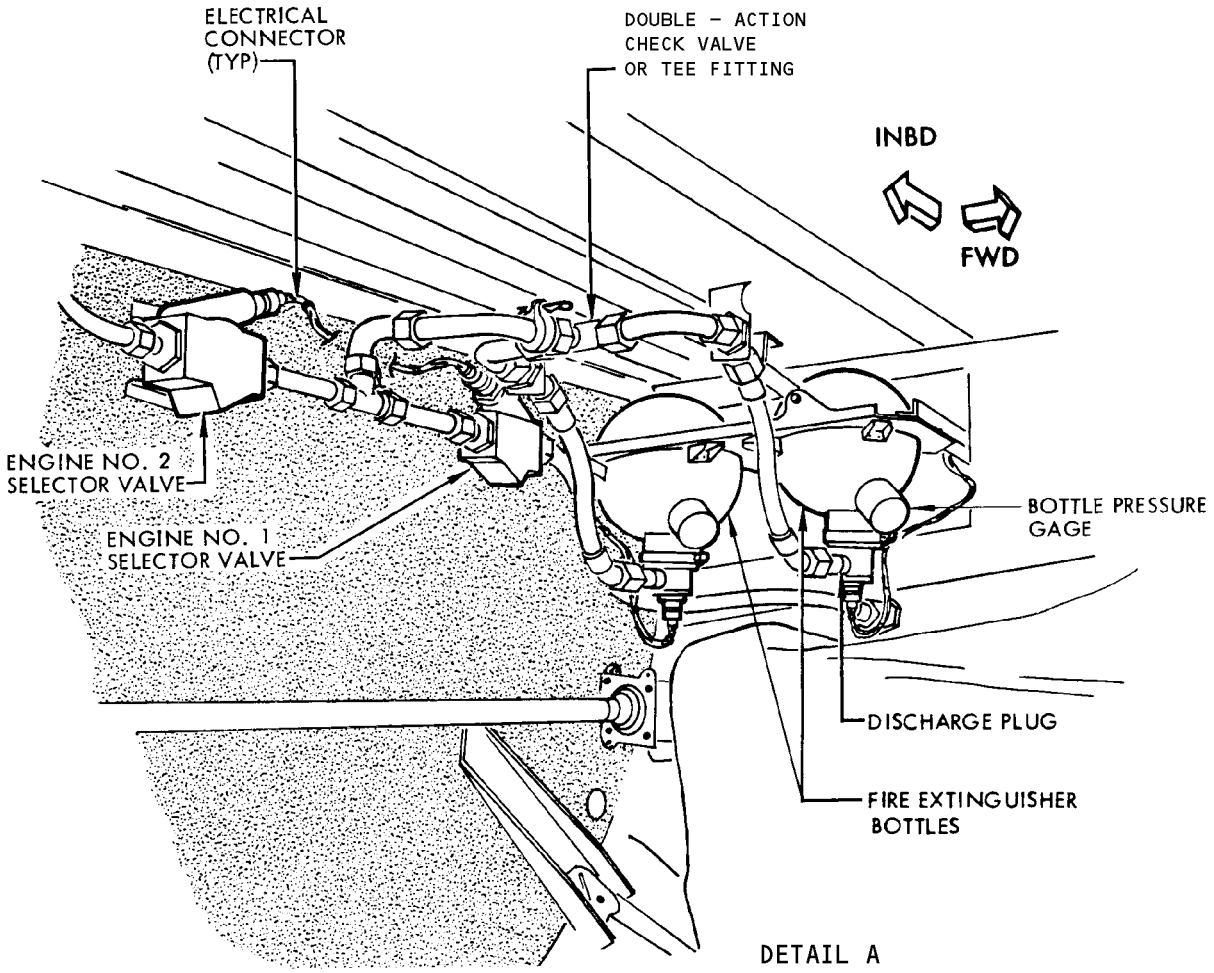
ENGINE FIRE EXTINGUISHING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The engine fire extinguishing system is a fixed system providing fire extinguishing capability to each engine. The extinguishing system is a gaseous smothering system designed to flood either engine cowling area with an inert gas in case of fire. The fire extinguishing system is electrically controlled by a fire switch for each engine.
   B. The engine fire extinguishing system consists of the fire protection system module, fire extinguisher bottles and bottle fittings, selector control valves and associated tubing (Fig. 1). The fire extinguisher bottle fittings and selector valves are connected by airplane wiring to the engine fire switches and bottle discharge lights on the fire protection system module. The fire protection system module contains the fire switches, discharge lights, test lights and circuitry necessary to isolate the affected engine and discharge the extinguishing agent of either fire extinguisher bottle into the affected engine cowling.
   C. When a fire is sensed in either engine, the applicable fire switch handle is unlocked. The fire switch handle may then be pulled arming the fire extinguishing system and shutting down the engine and associated components. After the system is armed the handle may be rotated either clockwise or counterclockwise discharging the right or left bottle respectively.
   D. The fire extinguishing system can be tested in flight or on the ground by operation of the fire extinguisher test switch (Fig. 2). The fire extinguisher test circuit shows continuity through the bottle discharge squib and selector control valves. Bottle pressure will be checked by monitoring the pressure gages only.
   E. The engine cowls have fire extinguisher access holes, which eliminate need to open cowls in event of fire. The holes are in the left cowl of each engine and are identified by red band around hole and FOR FIRE EXTINGUISHER placard.
2. Fire Protection System Module Components
   A. The fire protection system module components described in the following paragraphs will be only those associated with the engine fire extinguishing system. The fire protection system module (P8-l) is located on the aft electronic panel (P8). For further information on the fire protection system module, refer to 26-00, Fire Protection.

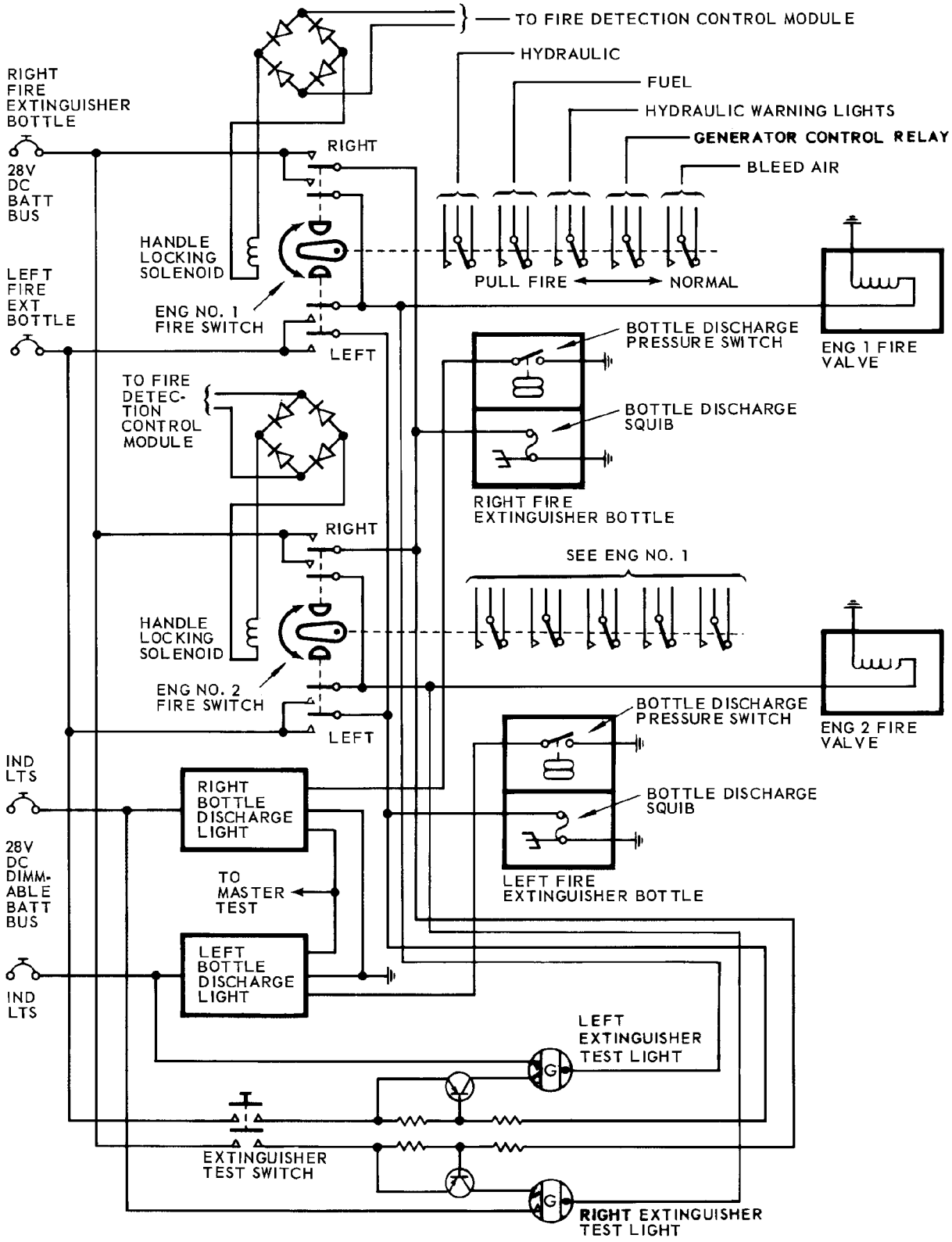


ENGINE FIRE EXTINGUISHING
(FIRE PROTECTION MODULE)





Engine Fire Extinguishing System Component Location
Figure 1



Engine Fire Extinguishing System Circuit
Figure 2

B. Fire Switch
   (1) The fire switch is a combination seven-pole, double-throw, push-pull and a four-pole single-throw rotary switch with a holding solenoid and lighted handle (Fig. 2). Two poles of the rotary switch are actuated by clockwise rotation of the handle and the other two poles are actuated by counterclockwise rotation of the handle. The handle is spring-loaded to the normal position. The solenoid is provided with a mechanical override to be used in event of a malfunction.
   (2) The engine fire switches give a visual indication of a fire warning for their associated engine. The fire warning signal will also actuate the solenoid in the fire switch for the associated engine. Actuation of the solenoid will permit the shaft and handle to be pulled. When the fire condition is confirmed the applicable fire switch is pulled to shut off the flow of engine bleed air, inflammable fluids and electrical power to and from the fire zone and arm the fire extinguishing system for subsequent action.

C. Bottle Discharge Light
   (1) An illuminated amber (bottle discharge) light indicates that the associated bottle has been bled off. When either the left or right bottle has been discharged or the safety relief valve has melted and bottle pressure is bled off, the associated bottle discharge light will illuminate.
   (2) The warning lights may be tested individually by a press-to-test feature in the light assembly or all the lights may all be tested simultaneously when the master test switch is closed.

D. Test Switch
   (1) A three-pole, double-throw, pushbutton switch is provided to permit testing of the fire extinguishing system through a test circuit connected to the bottle discharge squib and selector control valves. The system may be tested either while the airplane is in flight or on the ground.
   (2) The fire extinguisher test circuit provides the means to check the bottle discharge squib for continuity without actually discharging the squib and checks control valve continuity.
   (3) Pressing the EXT TEST switch sends a very small current through each bottle discharge squib. Each selector control valve is in series with the associated test light ground. If the circuits are complete, a transistor in each circuit is biased. The biased transistors will conduct a signal to illuminate the associated extinguisher test lights. The extinguisher test lights are green press-to-test lights located on the face of the fire protection system module (P8-1).

3. Fire Extinguisher Bottle Assemblies
   A. The two fire extinguisher bottle assemblies each consist of a spherical steel container fitted with a filling port plug, pressure gage, metal sealing disc in the discharge port and discharge plug. Each spherical steel container (extinguisher bottle) is about 8 1/2 inches in diameter and has a volume of approximately 224 cubic inches. The bottles are used to store the extinguishing agent under pressure until released by fire extinguishing discharge action. Each bottle is filled with 3.5 pounds of freon, and charged with dry nitrogen.
   B. The two extinguisher bottles are mounted in brackets on the aft bulkhead on the upper left side of the left main wheel well (Fig. 1).
   C. The filling port plug is a fusible metal plug acting as a safety relief valve. If the bottle temperature rises to or above approximately 266°F the fusible plug will melt and the bottle pressure is released to ambient inside the wheel well area.
   D. The pressure gage indicates pressure in the extinguisher bottle. The gage also contains a pressure switch that will activate the bottle discharge lights when the bottles are discharged or pressure drops. The pressure gages are visible on the left side of the main wheel well.
   E. The discharge port is sealed by a metal seal disk to retain the pressurized extinguishing agent. The discharge plug is installed at the discharge port and serves as an adapter between the bottle and manifold, and provides the means to discharge the bottle. The discharge plug consists of a cutting sleeve and squib (powder charge). When the squib receives a signal from the applicable fire switch, the powder charge is detonated (Fig. 2). The detonation creates a force pushing the cutting sleeve up through the metal sealing disk allowing the extinguishing agent to escape. When installed, the yellow indicator will then be broken by the pressurized extinguishing agent.

      NOTE: The fire extinguisher bottles are not designed for recharging while installed in the airplane. A low pressure or discharged bottle should be replaced with a charged bottle.

4. Selector Control Valves
   A. Two selector control valves are provided, one for each engine (Fig. 1). Each valve is solenoid controlled by the appliable fire switch handle (Fig. 2). The valves are mounted on the aft bulkhead in the left wheel well on the outboard side.

B. Each selector valve is solenoid controlled, pressure actuated. When the fire switch handle is turned, the squib is detonated and the solenoid energized, directing the bottle pressurized gas to a pilot valve in the control valve. The pressurized gas opens the pilot valve and directs the extinguishing agent into the applicable discharge line.

C. The discharge lines disperse the released extinguishing agent from the selector valves to the selected fire area. The lines to each engine are routed along the rear spar and forward along the top of the engine to approximately the center or the engine. Nozzles disperse the extinguishing agent around the engine at a proper rate for effective extinguishing.

D. A manifold connecting the two bottles includes a tee fitting or a double check valve. The check valve (if installed) prevents extinguishing agent from entering a discharged bottle. A tee fitting in the manifold connects each engine selector valve with both extinguisher bottles.

E. When a fire warning indication is received, the associated fire switch handle will be unlocked. When it is determined a fire condition exists and corrective action must be taken, pull up on the fire switch handle. When the handle is pulled up the fire extinguisher system is armed, and the cam is moved into position to actuate the associated control valve and discharge squib. Besides arming the fire extinguisher system, the engine fire switches perform the following functions:
   (1) Closes the fuel shutoff valve on the affected engine.
   (2) Closes the hydraulic fluid shutoff valve.

       NOTE: When the hydraulic fluid shutoff valve is closed the associated low pressure lights are bypassed to prevent a false low pressure warning.

   (3) Closes the air bleed valve.
   (4) Trips the generator control relay for affected engine. The relay de-energizes the generator field and disconnects the generator from the ac bus within 5 to 10 seconds (AMM 76-21-00/001).

F. When the system is armed, the fire switch handle may be rotated to the left or right to discharge the left or right bottle respectively. When the handle is rotated to the right (for at least one second) the engine selector control valve solenoid is energized and the squib on the right bottle is fired, cutting or rupturing the sealing diaphragm and releasing the extinguishing agent. The extinguishing agent flows through the double-action check valve into the manifold. The energized engine selector valve directs pressurized gas to the pilot valve section of the control valve. The pilot valve opens the main valve and allows the extinguishing agent to discharge into the engine. The main valve of the selector valve will remain open until the discharge pressure drops to 25 pounds per square inch (Fig. 2). When the bottle pressure approaches approximately 250 psi, the right bottle discharge light illuminates, indicating the right bottle is discharged and inactive.

   NOTE: For additional information on engine shutdown, refer to Chapter 76, Engine Fire Emergency Shutdown.

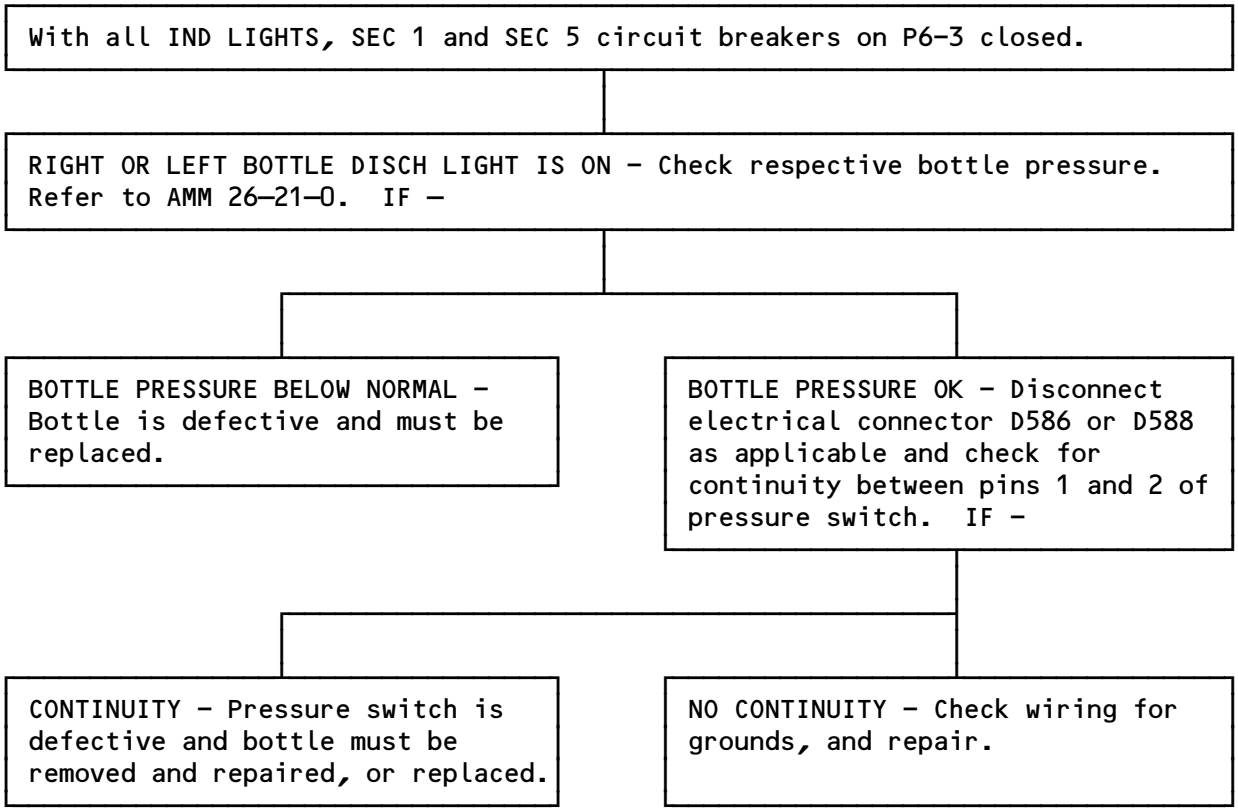
G. If it is necessary to discharge the left bottle to the same area, rotate the handle to the left. The left bottle will discharge and the extinguishing agent will go through the same check valve and selector valve as the discharge from the right bottle. When the pressure has dropped sufficiently the left bottle discharge light will illuminate.

ENGINE FIRE EXTINGUISHING SYSTEM - TROUBLESHOOTING

1. General
   A. Whenever the fire protection module (P8-1) is removed and replaced, a test must be performed on the engine fire extinguishing system (AMM 26-21-0, Adjustment/Test).
2. Equipment and Materials
   A. Ohmmeter incapable of supplying more than 35 milliamperes.

      WARNING: CURRENT FLOW EXCEEDING 35 MILLIAMPERES MAY DETONATE THE BOTTLE DISCHARGING SQUIB.

3. Troubleshooting Charts



With RIGHT FIRE EXTINGUISHER BOTTLE and LEFT FIRE EXTINGUISHER BOTTLE circuit breakers on P6-2 closed, press EXT TEST switch on P8-1. IF -

RIGHT EXT TEST OR LEFT EXT TEST LIGHT FAILS TO ILLUMINATE -

WARNING: CURRENT FLOW OF MORE THAN 35 MILLIAMPS WILL DETONATE DISCHARGE SQUIBS.
Disconnect electrical connector D582 or D584 as applicable. Connect ohmmeter across pins 1 and 2 of discharge squib. IF -

NO CONTINUITY - Replace discharged squib.

CONTINUITY - Disconnect electrical connector D590 or D592 as applicable. Connect ohmmeter accross pins 1 and 2 of selector valve. IF -

NO CONTINUITY - Replace valve.

CONTINUITY - Check wiring continuity. Repair or replace faulty wiring.

ENGINE FIRE EXTINGUISHING SYSTEM - ADJUSTMENT/TEST

1. General
   A. This section contains a tubing leak check, a discharge circuits test and a system test. The tubing leak check tests the integrity of the tubing connections and seals. The discharge circuits test uses special equipment to provide a check of the squib discharge circuit resistance. The system test checks the entire system tubing and circuitry.
2. Tubing Leakage Test
   A. Equipment
      (1) Source of dry compressed air - regulated to 35(± 5) psig, and equipped with a pressure gage
      (2) Leak Detection Bubble Solution - TDL 28B
      (3) Electrical power source - 28 Volts DC
   B. Prepare to Test

      NOTE: This test should be performed any time the discharge tubing has been disturbed.

      (1) Disconnect bottle discharge lines from bottle discharge plugs.

         WARNING: THE BOTTLE DISCHARGE PLUG CONNECTOR MUST BE DISCONNECTED. OPERATION OF THE FIRE SWITCH WILL DETONATE THE EXPLOSIVE CHARGE IF THE CONNECTOR IS NOT REMOVED FROM THE DISCHARGE PLUG.

      (2) Cap bottle discharge lines.
      (3) Disconnect electrical connectors D590 and D592 at engine selector valves.
      (4) Connect supply of compressed air to left bottle discharge line.
   C. Test for Leakage
      (1) Supply pressure to discharge lines.
      (2) Actuate both engine selector valves to open by applying 28 Volts DC to electrical connector of each solenoid. Do not energize solenoids for more than 15 seconds at a time.

         CAUTION: ENERGIZING SOLENOIDS FOR MORE THAN 15 SECONDS WILL DAMAGE SOLENOIDS.

(3) Apply bubble solution to tubing connections and seals. There must not be any leakage.
(4) If engine selector valves close prior to end of test, repeat steps (2) and (3) until test is complete.

D. Restore Airplane to Normal
(1) Disconnect air source and remove plug from discharge lines.
(2) Connect electrical connectors D590 and D592 to engine selector valves.
(3) Remove cap or plug from Eng-1 and Eng-2 discharge lines.

3. Tubing Continuity and Electrical Circuit Test

A. Equipment
(1) Test Box, Boeing F80229
(2) Source of dry compressed air - regulated to 35(±5) psig, and equipped with a pressure gage

B. Prepare to Test

WARNING: ALL BOTTLE DISCHARGE PLUG CONNECTORS MUST BE DISCONNECTED. OPERATION OF FIRE SWITCH WILL DETONATE EXPLOSIVE CHARGES IF CONNECTORS ARE NOT REMOVED FROM DISCHARGE PLUGS.

(1) Disconnect electrical connectors D582 and D584.
(2) Install protective covers to fire extinguisher bottle squibs.
(3) Disconnect connectors D586 and D588 at bottle pressure gages or, when installed, pressure switches.
(4) Check that EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers on panel P6-2 and all IND LIGHTS, SEC 1, and SEC 5 circuit breakers on panel P6-3 are closed.
(5) Disconnect both discharge line from bottle discharge plugs.
(6) Connect test box to each electrical connectors D582 and D584.
(7) Connect source of compressed air to fwd bottle discharge hose.
(8) Apply electrical power.

C. Test Engine Fire Extinguishing System Tubing Continuity and Electrical Circuit Operation
(1) Pressurize the system tubing to 35(±5) psig. Verify that no air is escaping from the Eng-1 and Eng-2 fire extinguishing discharge outlets, confirming that the Eng-1 and Eng-2 selector valves are closed.
(2) Arm the No. 1 fire switch by pressing the override button behind the fire switch handle and pulling up on the handle.
(3) Turn the No. 1 fire switch handle counterclockwise as far as it will go. Hold the handle for approximately 5 seconds and release. Check that the light on the test box connected to D582 illuminates while the switch is held.
(a) Air should be heard escaping at the Eng-1 fire extinguishing discharge outlet, providing that the Eng-1 selector valve is functioning and the discharge line is continuous.
(4) Shut off air supply.

(5) Allow several minutes for the air pressure in the tubing to bleed off and the Eng-1 selector valve to close. Airflow stops when the valve closes.
(6) Repressurize system tubing to 35(±5) psig.
(7) Check that no air is escaping from the Eng-1 and Eng-2 fire extinguishing discharge outlets, confirming that the Eng-1 and Eng-2 selector valves are closed.
(8) Repeat steps (1) thru (7) for the No. 2 fire switch. For step (3).(a), verify that air is heard escaping at the Eng-2 fire extinguishing discharge outlet, providing that the Eng-2 selector valve is functioning and the discharge line is continuous.
(9) Check that the light on the test box connected to D582 illuminates while the switch is held.
(10) Reset the fire switch handles to NORM position.
(11) Disconnect the compressed air source from the fwd bottle discharge hose and connect it to the aft bottle discharge hose.
(12) Repeat steps (1) thru (7) with the No. 1 fire switch handle turned fully clockwise at step (3). For step (3)(a), verify that air is heard escaping at the Eng-1 fire extinguishing discharge outlet. Providing the Eng-1 selector valve is functioning and the discharge line is continuous, check that the light on the test box connected to D584 illuminates while the switch is held.
(13) Repeat steps (1) thru (7) with the No. 2 fire switch handle turned fully clockwise at step (3). For step (3)(a), verify that air is heard escaping at the Eng-1 fire extinguishing discharge outlet. Providing the Eng-2 selector valve is functioning and the discharge line is continuous, check that the light on the test box connected to D584 illuminates while the switch is held.
(14) Reset the fire switch handles to the NORM position.
(15) Apply a jumper across pins 1 and 2 of electrical connector D586. Check that the left bottle discharge light on P8-1 fire protection module illuminates.
(16) Apply a jumper across pins 1 and 2 of electrical connector D588. Check that the left bottle discharge light on P8-1 fire protection module illuminates.

D. Restore Airplane to its Normal Configuration
(1) Disconnect the air source and cap. Connect the bottle discharge hoses to their associated bottle discharge plugs.
(2) Disconnect the test box at electrical connectors D582 and D584.
(3) Remove the protective covers from the fire extinguisher bottle squibs.
(4) Connect the electrical connectors to the appropriate bottle discharge plugs.
(a) D582 is connected to the aft fire bottle.
(b) D584 is connected to the fwd fire bottle.
(5) Connect electrical connectors D586 and D588 at the bottle pressure gages.

4. Squib and Selector Control Valve Continuity Test
A. Prepare for Squib Continuity Test
(1) Apply electrical power.
(2) Check that EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers on panel P6-2 and all IND LIGHTS, APU EXT BTL, SEC 1 and SEC 5 circuit breakers on P6-3 are closed.
B. Test Squib Continuity

WARNING: THE BOTTLE DISCHARGE PLUG CONNECTOR MUST BE DISCONNECTED. OPERATION OF THE FIRE SWITCH WILL DETONATE THE EXPLOSIVE CHARGE IF THE CONNECTOR IS NOT REMOVED FROM THE DISCHARGE PLUG.

(1) Disconnect electrical connectors D582 and D584 from the bottle discharge plugs.
(2) Press the EXT TEST press-to-test light on panel P8-1 fire protection module and verify the L and R lights do not illuminate (APU light will illuminate).
(3) Connect the electrical connector D582 to the fwd bottle discharge plug.
(4) Press the EXT TEST press-to-test light on panel P8-1 fire protection module.
(a) Check that the L light illuminates and stays on until the press-to-test light is released.
(5) Connect electrical connector D584 to the aft bottle discharge plug.
(6) Press the EXT TEST press-to-test light on panel P8-1 fire protection module.
(a) Check the that L and R lights illuminate and stay on until the press-to-test light is released.

NOTE: Ground for the light is through the associated selector control valve. The light may not illuminate if the valve is faulty.

C. Restore Airplane to Normal Configuration
(1) Remove electrical power if no longer required.

5. Engine Fire Extinguishing System Test

ENGINE FIRE EXTINGUISHER BOTTLE - REMOVAL/INSTALLATION

1. General
   A. Removal and installation procedure for both bottles is identical.
   B. Check pressure of each fire extinguisher bottle before installation to prevent installing a bottle that has been improperly serviced (AMM 26-21-11, Inspection/Check).
2. Engine Fire Extinguisher Bottle - Removal/Installation
   A. Remove Engine Fire Extinguisher Bottle (Fig. 401)

      NOTE: The operational test must be performed after each removal and installation of the engine fire extinguisher bottle(s).

      (1) Open EXTINGUISHER BOTTLES LEFT and EXTINGUISHER BOTTLES RIGHT and all IND LIGHTS circuit breakers on load control center P6.
      (2) Disconnect electrical connectors from discharge squib.

      WARNING: THE SQUIB IS AN EXPLOSIVE. A PROTECTIVE CAP MUST BE INSTALLED ON THE END OF THE SQUIB OR A PROTECTIVE COVER WHEN HANDLING THE SQUIB.

SAA SAA (3) Cap the end of the discharge squib or install a protective cover over the electrical pins.
ANZ (4) Remove the discharge squib from the bottle.
      (5) Disconnect the electrical connector from the pressure gage.
      (6) Disconnect the discharge line from the fire extinguisher bottle discharge plug.
      (7) Remove four mounting bolts and remove the fire extinguisher bottle.
   B. Install Engine Fire Extinguisher Bottle (Fig. 401)
      (1) Position the fire extinguisher bottle in the support frame and install the mounting bolts.
      (2) Apply a layer of BMS 3-28 (preferred) to the outlet threads, outlet end, and outlet inner diameter where the tube assembly attaches to the discharge head.
         (a) BMS 3-27 or BMS 3-38 are also acceptable alternatives as anti-corrosion compounds to use in this location.

      CAUTION: LOOSEN JUST ENOUGH SO THAT THE PLUG TURNS EASILY. DO NOT FORCE AS DAMAGE TO THE O-RING SEAL WILL RESULT.

      (3) Connect the discharge line to the discharge plug.

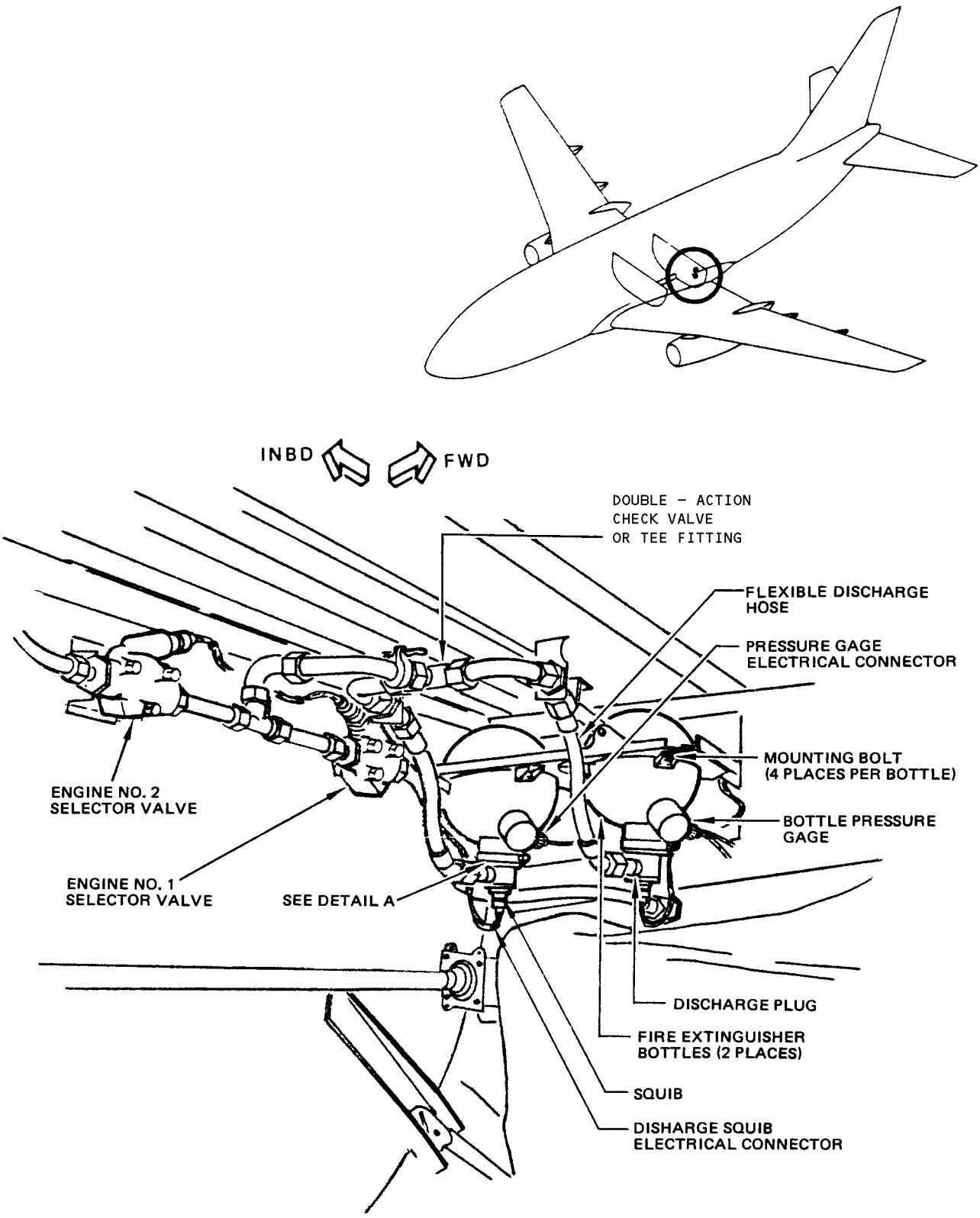
         NOTE: The bottle discharge plug may be repositioned as required for installation by loosening the clamp nut until the discharge plug is free to move.

(4) Connect the electrical connector to the pressure gage.
(5) Torque the clamp nut to 75 pound-inches. Ensure that equal radial openings exist, and that good thread length shows as shown in Detail A.
(6) Install the discharge squib in the fire extinguisher discharge plug. Torque the squib to 96 ±12 inch-pounds and lockwire.

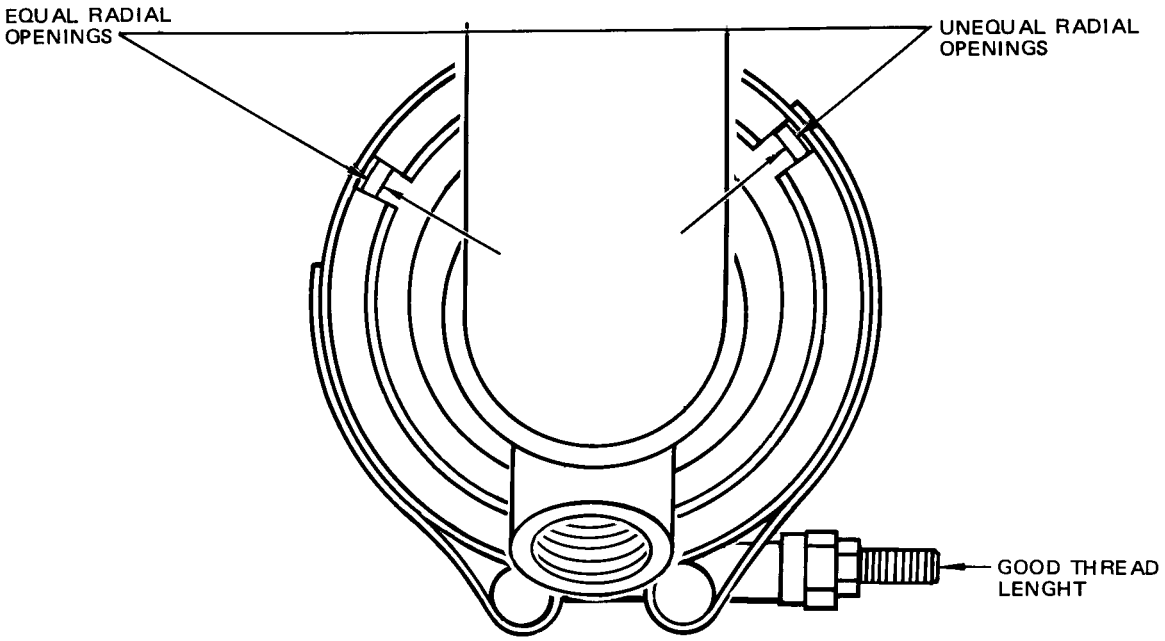
NOTE: The squib must be inspected for damage with special attention given to the soft seal, opposite the electrical connector, which protects the explosive charge. If punctured or otherwise damaged, the squib must be replaced with a new part.

(7) Remove the protective cap or cover.

C. Perform Operation Test
(1) Prepare for Test
(a) Apply electrical power.
(b) Ensure all electrical connectors (D582 and D584) are disconnected from discharge squibs.
(c) Check that EXTINGUISHER BOTTLES RIGHT, EXTINGUISHER BOTTLES LEFT and EXTINGUISHER BOTTLES APU circuit breakers on panel P6-2 and all IND LIGHTS, SEC 1 and SEC 5 circuit breakers on P6-3 are closed.
(2) Operational Test
(a) Press EXT TEST press-to-test light on P8-1 fire protection module and verify no lights illuminate, except APU light.
(b) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(c) Reconnect electrical connector D582 to the fwd bottle discharge squib.
(d) Press EXT TEST press-to-test light on P8-1 fire protection module.
(e) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
1) Check that the L light illuminates and stays on until press-to-test light is released.
(f) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.



Engine Fire Extinguishing Bottle Installation
Figure 401 (Sheet 1)



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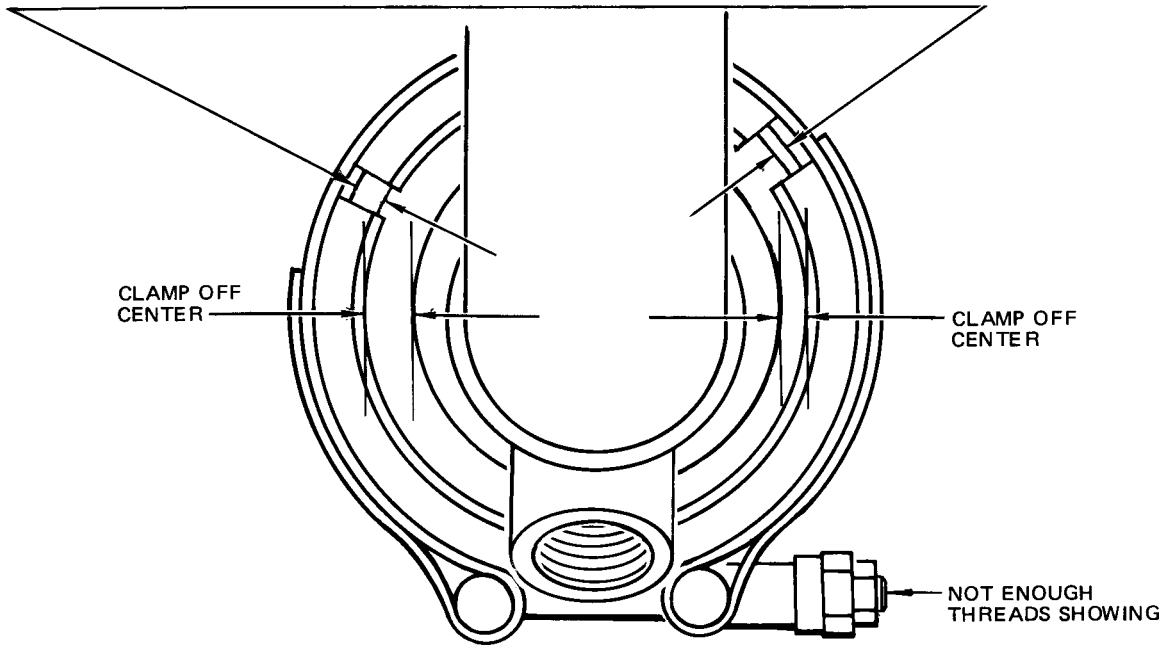


IMPROPERLY ASSEMBLED
DETAIL A

Engine Fire Extinguishing Bottle Installation
Figure 401 (Sheet 2)

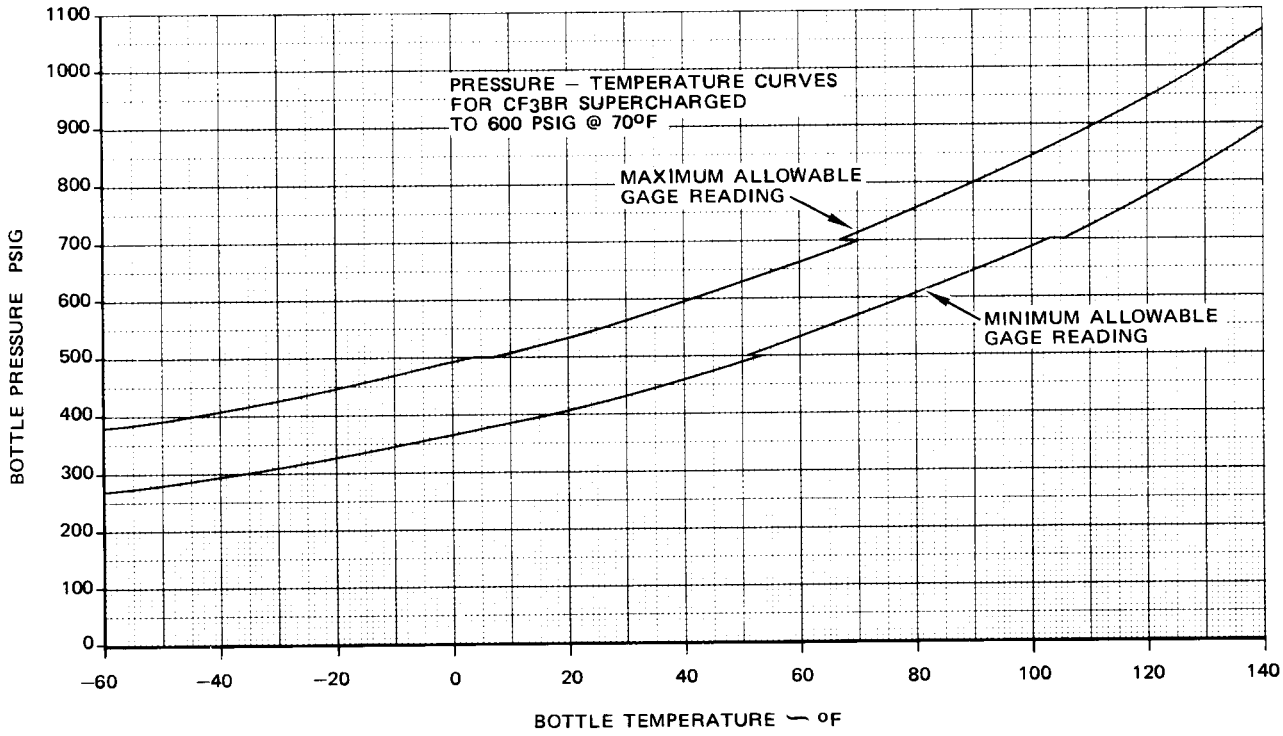
(g) Reconnect electrical connector D584 to the aft bottle discharge squib.
(h) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(i) Press EXT TEST press-to-test light on P8-1 fire protection module.
1) Check that the L and R lights illuminate and stay on until press-to-test light is released.

NOTE: Ground for light is through the associated selector control valve. The light may not illuminate if valve is faulty.

(3) Restore Airplane to Normal Configuration
(a) Remove electrical power if no longer required.

ENGINE FIRE EXTINGUISHER BOTTLE - INSPECTION/CHECK

1. Fire Extinguisher Bottle Check
   A. Check Bottle Pressure
      (1) When checking pressure in fire extinguisher bottle, see Fig. 601 to determine maximum and minimum pressure allowances at bottle temperature. If pressure is outside tolerances shown, bottle should be replaced. Bottle, not ambient, temperature must be measured.
   B. Check Discharge Squib Service Life
      (1) To ascertain unexpired service life of bottle discharge squib under normal conditions, check manufacturer's data for recommended maximum life.
      (2) If squib is subjected to high temperatures or unusual conditions, service life may very from value given. For further information, contact Accessory Products Company, Whittier, California, 90602.



Fire Extinguisher Bottle Pressure – Temperature Curve
Figure 601

ENGINE SELECTOR CONTROL VALVE – REMOVAL/INSTALLATION

1. Selector Control Valve – Removal/Installation

NOTE: The removal and installation of the selector control valve(s) should be performed one valve at a time. The operational test must be performed at the completion of any removal and installation.

A. Remove Engine Selector Control Valve (Fig. 401)
   (1) Remove electrical connector.
   (2) Disconnect discharge line at each end of valve.
   (3) Remove mounting bolts.
   (4) Remove valve.

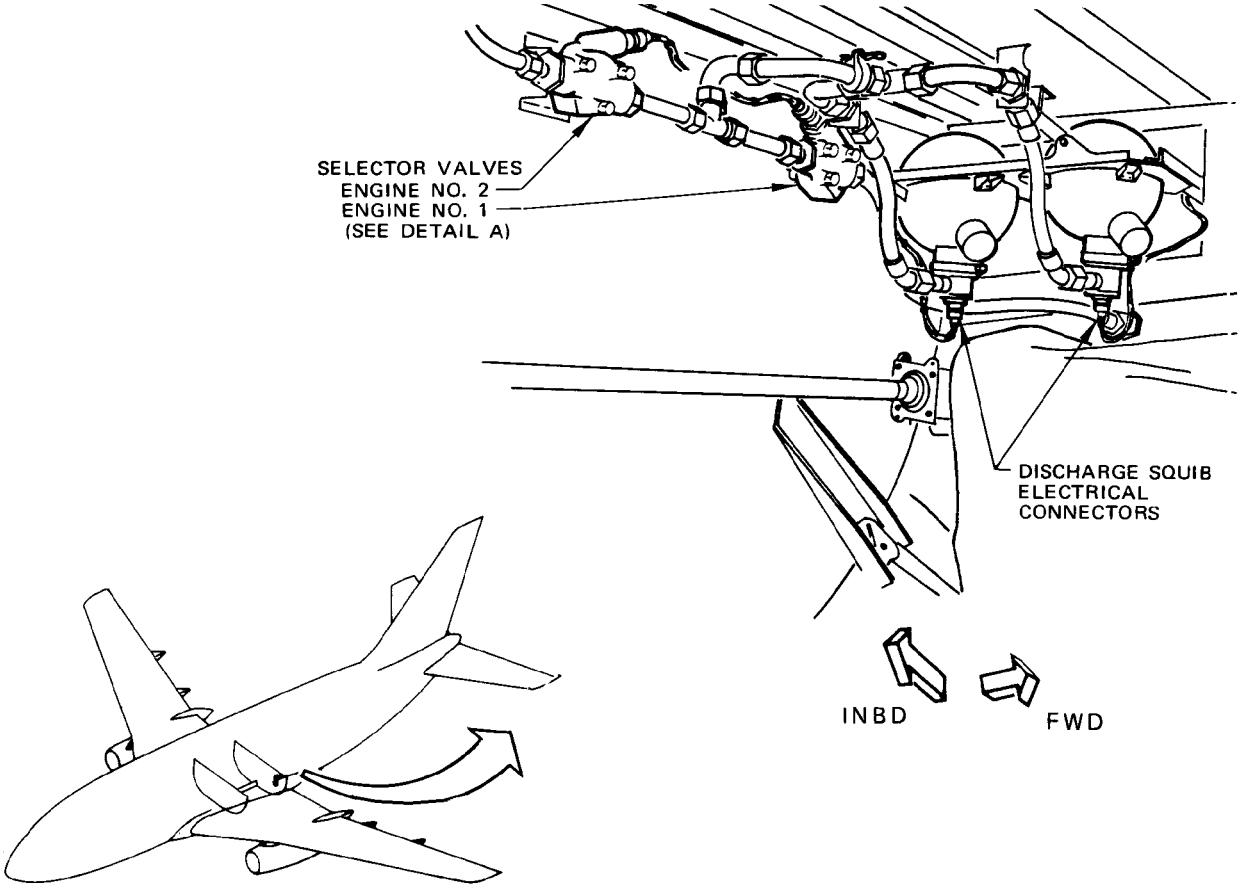
B. Install Engine Selector Control Valve (Fig. 401)
   (1) Install O-rings on reducers and install reducers on valve.
   (2) Position valve on mounting bracket and install mounting bolts but do not tighten.
   (3) Connect discharge lines at each end of valve.
   (4) Tighten mounting bolts.
   (5) Replace electrical connector.

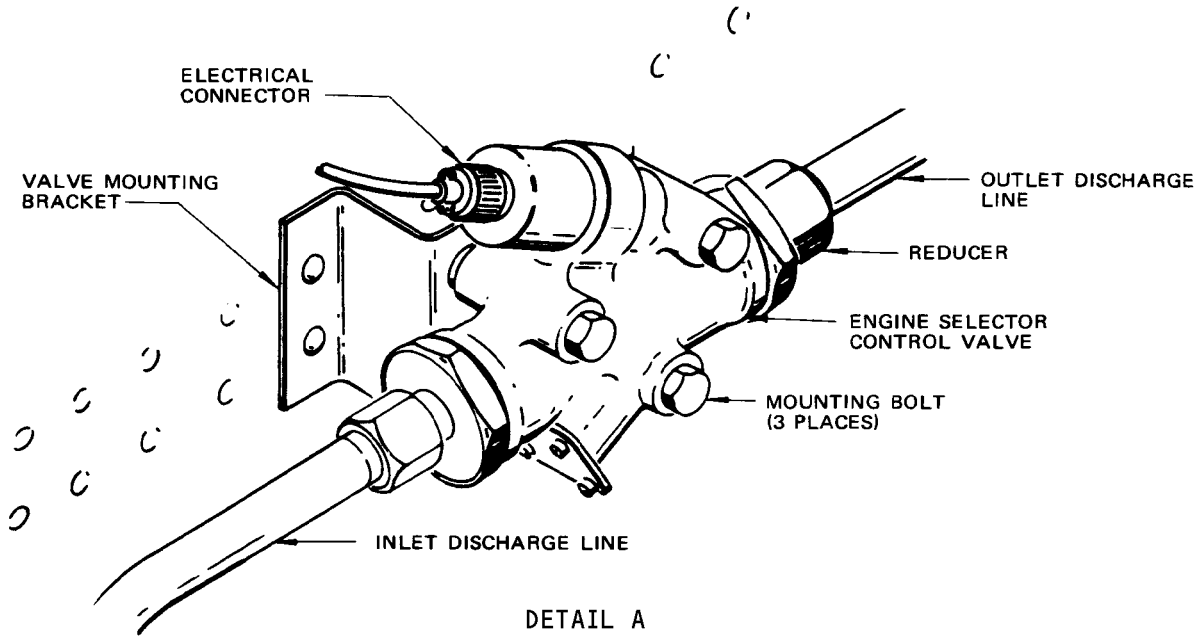
C. Perform Operational Test
   (1) Equipment and Materials
      (a) Source of compressed air – regulated to 210 ±50 psig, equipped with a pressure gage and an inlet tube with a 0.56-inch (or greater) inside diameter
   (2) Prepare to Test
      (a) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
      (b) Disconnect electrical connectors D582 and D584.

         WARNING: ALL BOTTLE DISCHARGE PLUG CONNECTORS MUST BE DISCONNECTED. OPERATION OF FIRE SWITCH WILL DETONATE EXPLOSIVE CHARGES IF CONNECTORS ARE NOT REMOVED FROM DISCHARGE PLUGS.

      (c) Install protective covers on the fire extinguisher bottle squibs.
      (d) Remove the tubes from the discharge heads.
      (e) Plug the left tube.
      (f) Connect a source of compressed air to the right hose.
      (g) Apply electrical power.
      (h) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
   (3) Operational Test
      (a) Use an inlet tube with a 0.56-inch (or greater) diameter to pressurize system tube to 210 ±50 psig.

(4) Make no air is flowing from the Eng-1 and/or Eng-2 discharge outlets.
  (a) Arm the ENG No. 1 fire switch handle by pushing the override button behind the fire switch handle and pulling up on handle.
  (b) Turn the ENG No. 1 fire handle fully counterclockwise and hold it for approximately 5 seconds.
(5) Make sure airflow is flowing from engine 1.
  (a) Turn the ENG No. 1 fire handle counterclockwise and hold it for approximately 5 seconds.
    1) Make sure air is flowing from the ENG-1 discharge outlet.
  (b) Shut off air supply. Allow several minutes for the air pressure to bleed off and the ENG-1 selector valve to close.
  (c) Pressurize the discharge tube to 210 ±50 psig.
  (d) Turn the ENG 1 fire handle fully clockwise and hold for approximately 5 seconds.
(6) Make sure air is flowing from the ENG 1 discharge outlets.
  (a) Shut off the air supply. Allow several minutes for the air pressure to bleed off and the ENG 1 selector valve to close.
  (b) Push the fire handle to its usual position.
  (c) Pressurize the discharge tube to 210 ±50 psig.
  (d) Arm the ENG 2 fire switch by pushing the override button behind the fire switch handle and pulling up on the handle.
  (e) Turn the ENG 2 fire handle fully counterclockwise and hold it for approximately 5 seconds.
(7) Make sure air is flowing from the ENG 2 discharge outlets.
  (a) Shut off the air supply. Allow serveral minutes for the air pressure to bleed off and the ENG 2 selector valve to close.
  (b) Pressurize the discharge tube to 210 ±50 psig.
  (c) Turn the ENG 2 fire handle fully clockwise and hold it for approximately 5 seconds.
(8) Make sure air is flowing from the ENG 2 discharge outlets.
  (a) Shut off the air supply. Allow serveral minutes for the air pressure to bleed off and the ENG 2 selector valve to close.
  (b) Push the fire handle to its usual position.
(9) Restore Airplane to Normal
  (a) Disconnect air source from right discharge hose.
  (b) Connect right discharge line to the bottle discharge plug.
  (c) Remove protective covers from fire extinguisher bottle squibs.
  (d) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
  (e) Connect electrical connectors to the appropriate bottle discharge squibs.
    1) D582 is connected to the fwd fire bottle.
    2) D584 is connected to the aft fire bottle.
  (f) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.





DETAIL A

Engine Selector Control Valve Installation
Figure 401

(g) Remove electrical power if no longer required.

ENGINE SELECTOR CONTROL VALVE - ADJUSTMENT/TEST

1. General
   A. The following test procedure checks only wiring continuity and solenoid operation. Air pressure is required at the valve inlet port to check complete valve operation. To test actual valve operation refer to paragraph 1.B. of the Fire Extinguisher System - Adjustment/Test, 26-21-0.
2. Test Engine Selector Control Valve
   A. Remove electrical power from the system by opening all fire extinguisher circuit breakers on panel P6.
   B. Disconnect electrical connectors from both fire extinguisher discharge squibs at the base of each fire extinguisher bottle. (See 26-21-21, figure 401.)
   C. Close all fire extinguisher circuit breakers on P6 panel.
   D. Arm No. 1 fire switch handle by pressing override button behind handle and pulling up on handle.
   E. Turn No. 1 fire switch handle counterclockwise as far as it will go. Hold for approximately 5 seconds.
   F. Check for indication of No. 1 engine selector control valve operation by listening for the solenoid to CLICK. Refer to 26-21-21,figure 401 for selector valve location.
   G. Return No. 1 fire switch to normal position.
   H. Repeat the same procedure with No. 2 fire switch handle for checking No. 2 engine selector valve.
   I. On completion of testing restore the installation to normal operating condition.

ENGINE FIRE EXTINGUISHER BOTTLE SQUIB - MAINTENANCE PRACTICES

1. General
   A. The engine fire extinguisher bottle squib is normally serviced more frequently than the fire extinguisher bottle. A manufacturer's date stamp is on the edge of the cartridge. (See manufacturer's recommendations for specific maximum service life.)

      WARNING: THE SQUIB IS AN EXPLOSIVE. PROTECTIVE CAPS MUST BE INSTALLED ON ENDS OF SQUIB OR ELECTRICAL CONNECTOR PINS SHOULD BE JUMPERED WITH METAL FOIL WHENEVER HANDLING CARTRIDGE.

2. Engine Fire Extinguisher Bottle Squib - Removal/Installation

   NOTE: The operation test must be performed after any removal and installation of the bottle squib.

   A. Remove Squib
      (1) Open EXTINGUISHER BOTTLES RIGHT, EXTINGUISHER BOTTLES LEFT, and all IND LIGHTS circuit breakers on load control center P6.
      (2) Remove electrical connector from squib.
      (3) Place metal foil or protective cap over squib.
      (4) Remove lockwire and unscrew squib from bottle. Cap squib end and cap bottle fitting.
   B. Check Squib
      (1) Check for damage with special attention given to the soft seal, opposite the electrical connector, which protects the explosive charge.
         (a) If seal is punctured, broken, cut and/or corroded, replace with new part.
         (b) If squib has corrosion on threads, replace with new part.
   C. Install Squib
      (1) Remove cap from bottle and screw squib into bottle fitting. Tighten squib to 96 ±12 pound-inches.
      (2) Install lockwire.
      (3) Remove protective metal foil or cap from squib.
   D. Perform Operational Test
      (1) Prepare to Test
         (a) Apply electrical power.
         (b) Check that EXTINGUISHER BOTTLES RIGHT, EXTINGUISHER BOTTLES LEFT and EXTINGUISHER BOTTLES APU circuit breakers on panel P6-2 and all IND LIGHTS, SEC 1 and SEC 5 circuit breakers on P6-3 are closed.
      (2) Operational Test
         (a) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.

(b) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(c) Press EXT TEST press-to-test switch on P8-1 fire protection module and verify no lights illuminate except APU light.
(d) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(e) Reconnect electrical connector D582 to the fwd bottle discharge squib.
(f) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(g) Press EXT TEST press-to-test switch on P8-1 fire protection module.
    1) Check that the L and APU lights illuminate and stay on until press-to-test switch is released.
(h) Open EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(i) Reconnect electrical connector D584 to the aft bottle discharge squib.
(j) Close EXTINGUISHER BOTTLES RIGHT and EXTINGUISHER BOTTLES LEFT circuit breakers.
(k) Press EXT TEST press-to-test switch on P8-1 fire protection module.
    1) Check that L and R and APU lights illuminate and stay on until press-to test switch is released.

        NOTE: Ground for light is through associated selector control valve. Light may not illuminate if valve is faulty.

(3) Restore Airplane to Normal Configuration
    (a) Remove electrical power if no longer required.

ENGINE/APU FIRE CONTROL MODULE - REMOVAL/INSTALLATION

1. General
   A. The engine and APU fire control module is located at the pilot's control stand.
2. Remove Fire Control Module
   A. Open the circuit breakers that follow on the load control center P6:
      (1) EXTINGUISHER BOTTLES LEFT
      (2) EXTINGUISHER BOTTLES RIGHT
      (3) APU FIRE EXT BOTTLES
   B. Loosen the module mounting screws.
   C. Pull the module out and disconnect the electrical connectors.
   D. Remove the module.
   E. Perform engine and APU fire extinguishing system test (Ref 26-22-0 A/T)
   F. Retain the lightplate for installation.
3. Install Fire Control Panel
   A. Mount the lightplate in place.
   B. Connect the electrical connectors to the module.
   C. Install the module and tighten the mounting screws.
   D. Close the circuit breakers that follow on the load control center P6:
      (1) EXTINGUISHER BOTTLES LEFT
      (2) EXTINGUISHER BOTTLES RIGHT
      (3) APU FIRE EXT BOTTLES
   E. Test control module installation.
      (1) Perform engine and APU fire control module operational test (Ref 26-21-41 A/T).
      (2) Perform engine and APU fire extinguishing system test (Ref 26-22-0 A/T)
   F. Remove electrical power if no longer required (Ref 24-22-0 MP).

ENGINE/APU FIRE CONTROL MODULE - ADJUSTMENT/TEST

1. General
   A. This is an optional procedure to verify the engine fire switch functions. The engine fire control switches are located on the control stand panel P8.

      CAUTION: AN ACTUAL ENGINE SHUT-DOWN BY MEANS OF THE FIRE SWITCH IS NOT A RECOMMENDED TEST PROCEDURE.

2. Prepare for Test
   A. Provide electrical power (Ref 24-22-0 MP).
   B. Set dc voltmeter selector switch on panel P5 to TEST.
   C. On power system test module M400 on panel P6, set switch S1 to 2 and switch S2 to A. Check that dc voltmeter reads 28 volts.
   D. Set switch S2 to B and check that dc voltmeter reads 28 volts.
   E. Open the valves.
      (1) Open the boost pump circuit breakers on the P6-3 panel.
      (2) Open the igniter circuit breakers on the P6-2 panel.
      (3) Set the engine start switches to IDLE.
         (a) Make sure the FUEL VALVED CLOSED lights on the P5 panel come on while the valves are opening and then go out when the valves are fully open (Ref 28-22-0, D & 0).
      (4) Set the engine bleed switches to ON.
         (a) Make sure the bleed valves move to the open position.
      (5) If the GEN-1 LV or GEN-2 LV light on the M238 panel is on, set the generator switch to ON.
         (a) Make sure the GEN-1 LV or GEN-2 LV light goes off.
      (6) Make sure the hydraulic system fluid shutoff valves are open.
   F. Prepare the engine fire valves
      (1) Open the left and right fire extinguisher bottle circuit breakers
      (2) Remove these connectors from the engine fire bottles:
         (a) D582 from M194, left bottle squib
         (b) D590 from V24, engine-1 fire valve
         (c) D584 from M195, right bottle squib
         (d) D592 from V25, engine-2 fire valve
      (3) Close the left and right fire extinguisher bottle circuit breakers
3. Test Engine Fire Switch Functions
   A. Set TEST switch on the control stand panel P8 to FIRE. Observe that fire warning switch lights illuminate and that alarm bell sounds.

      NOTE: Disregard other warnings which may occur.

   B. Press override button under engine-1 fire handle and pull the handle out.
      (1) Set switch S2 on M400 module to A and check that dc voltmeter reads zero.

(2) Observe that engine-1 FUEL VALVE CLOSED light on panel P5 illuminates bright while valve is in-transit and dims to indicate valve is fully closed (Ref 28-22-0 A/T).
(3) Observe that hydraulic system A fluid shutoff valve 1, V33, indicator at the valve moves to the closed position.
(4) Observe that engine-1 bleed air valve indicator at the valve moves to the closed position.
(5) Make sure the GEN 1 LV light on the M238 panel comes on.
(6) Set the engine start switch to CUTOFF.
(7) Check the engine-1 fire extinguishing system
(a) Rotate the engine-1 fire handle counterclockwise.
1) Check for 0 volts dc between D592 pins 2 and 1.
2) Check for 28 volts dc between D590 pins 2 and 1.
(b) Rotate the engine-1 fire handle clockwise.
1) Check for 0 volts dc between D592 pins 2 and 1.
2) Check for 28 volts dc between D590 pins 2 and 1.
(c) Release the engine-1 fire handle.
(8) Reset the engine-1 fire handle to the normal position.

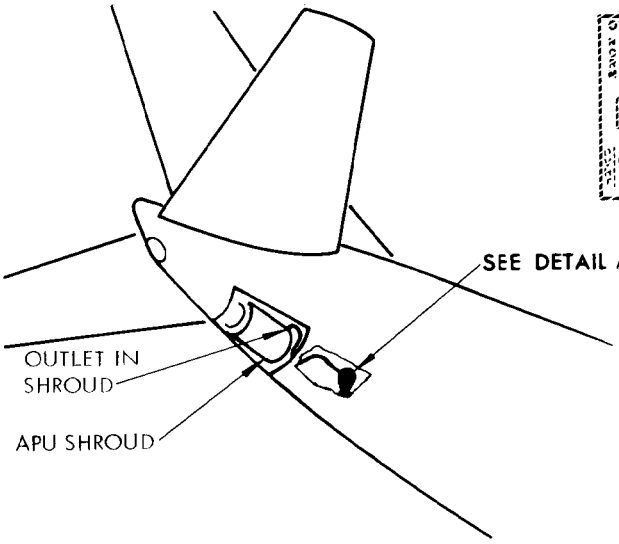
C. Press override button under engine-2 fire handle and pull the handle out.
(1) Set switch S2 on M400 module to B and check that dc voltmeter reads zero.
(2) Observe that engine-2 FUEL VALVE CLOSED light on panel P5 illuminates bright while valve is in-transit and dims to indicate valve is fully closed (Ref 28-22-0, A/T).
(3) Observe that hydraulic system A shutoff valve 2, V34, indicator at the valve moves to the closed position.
(4) Observe that engine-2 bleed air valve indicator at the valve moves to the closed position.
(5) Make sure the GEN 2 LV light on the M238 panel comes on.
(6) Set the engine-2 start switch to CUTOFF.
(7) Check the engine-2 fire extinguishing system.
(a) Rotate the engine-2 fire handle counterclockwise.
1) Check for 0 volts dc between D590 pins 2 and 1.
2) Check for 28 volts dc between D592 pins 2 and 1.
(b) Rotate the engine-2 fire handle clockwise.
1) Check for 0 volts dc between D590 pins 2 and 1.
2) Check for 28 volts dc between D592 pins 2 and 1.
(c) Release the engine-2 fire handle.
(8) Reset the engine-2 fire handle to the normal position.

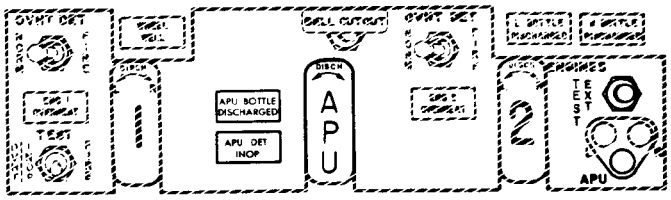
D. Restore the system to normal.
(1) Set the engine bleed switches to OFF.
(2) Keep switch S2 on M400 module set at position B.
(3) Close the boost pump circuit breakers on the P6-3 panel.
(4) Close the igniter circuit breakers on the P6-2 panel.
(5) Remove electrical power if it is not necessary (Ref 24-22-0 MP).
(6) Open the left and right fire extinguisher bottle circuit breakers.

(7) Connect these connectors to the engine fire bottles:
    (a) D592 to V25, engine-2 fire valve.
    (b) D584 to M195, right bottle squib.
    (c) D590 to V24, engine-1 fire valve.
    (d) D582 to M194, left bottle squib.
(8) Close the left and right fire extinguisher bottle circuit breakers.
(9) Push the EXT TEST switch on the fire control panel.
    (a) Make sure the L and R lights come on.

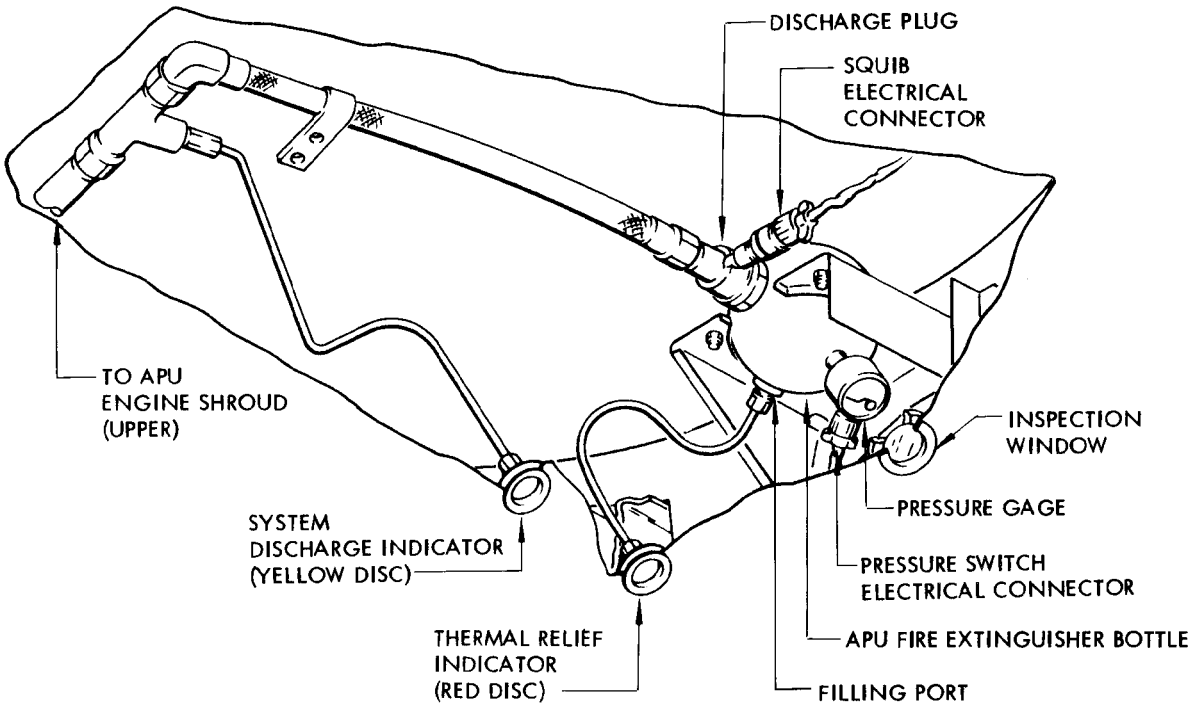
APU FIRE EXTINGUISHING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The APU fire extinguishing system is a fixed system providing fire extinguishing capability to the APU. The extinguishing system is a gaseous smothering system designed to flood the APU shroud with an inert gas in case of a fire. The fire extinguishing system is electrically controlled by a fire switch.
   B. The APU fire extinguishing system consists of the fire protection system module, fire extinguisher bottle and bottle fittings, remote APU fire control panel, indicators and associated tubing (Fig. 1). The fire extinguisher bottle fittings are connected by airplane wiring to the APU fire switch and bottle discharge light on the fire protection system module. The fire protection system module contains the APU fire switch, discharge light, test light and circuitry necessary to shut down the APU and discharge the extinguishing agent into the APU shroud. For engine coverage, refer to 26-21-0, Engine Fire Extinguishing System.
   C. When a fire is sensed in the APU, the APU fire switch handle is unlocked. The fire switch handle may then be pulled arming the fire extinguishing system and shutting down the APU and associated components (if not already automatically shut down by APU fire warning circuit). After the system is armed, the handle may be rotated either clockwise or counterclockwise to discharge the APU fire extinguisher bottle. The fire extinguishing system for the APU may also be controlled from the remote APU fire control panel.
   D. The fire extinguishing system can be tested in flight or on the ground by operation of the fire extinguisher test switch (Fig. 2). The fire extinguisher test circuit shows continuity through the bottle discharge squib. Bottle pressure and indicator disks may be checked by monitoring the pressure gage and indicator disks (system discharge and thermal relief) on the lower skin of the empennage section.
   E. The fire extinguisher container has a thermal relief feature with discharge through the filling port and thermal relief indicator (Fig. 401) when excess temperature occurs. In addition to the thermal relief, it has a pressure relief feature built into the discharge diaphragm with venting into the normal discharge line when excess pressure occurs.
2. Fire Protection System Module Components
   A. The fire protection system module components described in the following paragraphs will be only those associated with the APU fire protection system. The fire protection system module (P8-l) is located on the aft electronic panel (P8). For further information on the fire protection system module, refer to 26-00, Fire Protection.

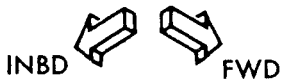




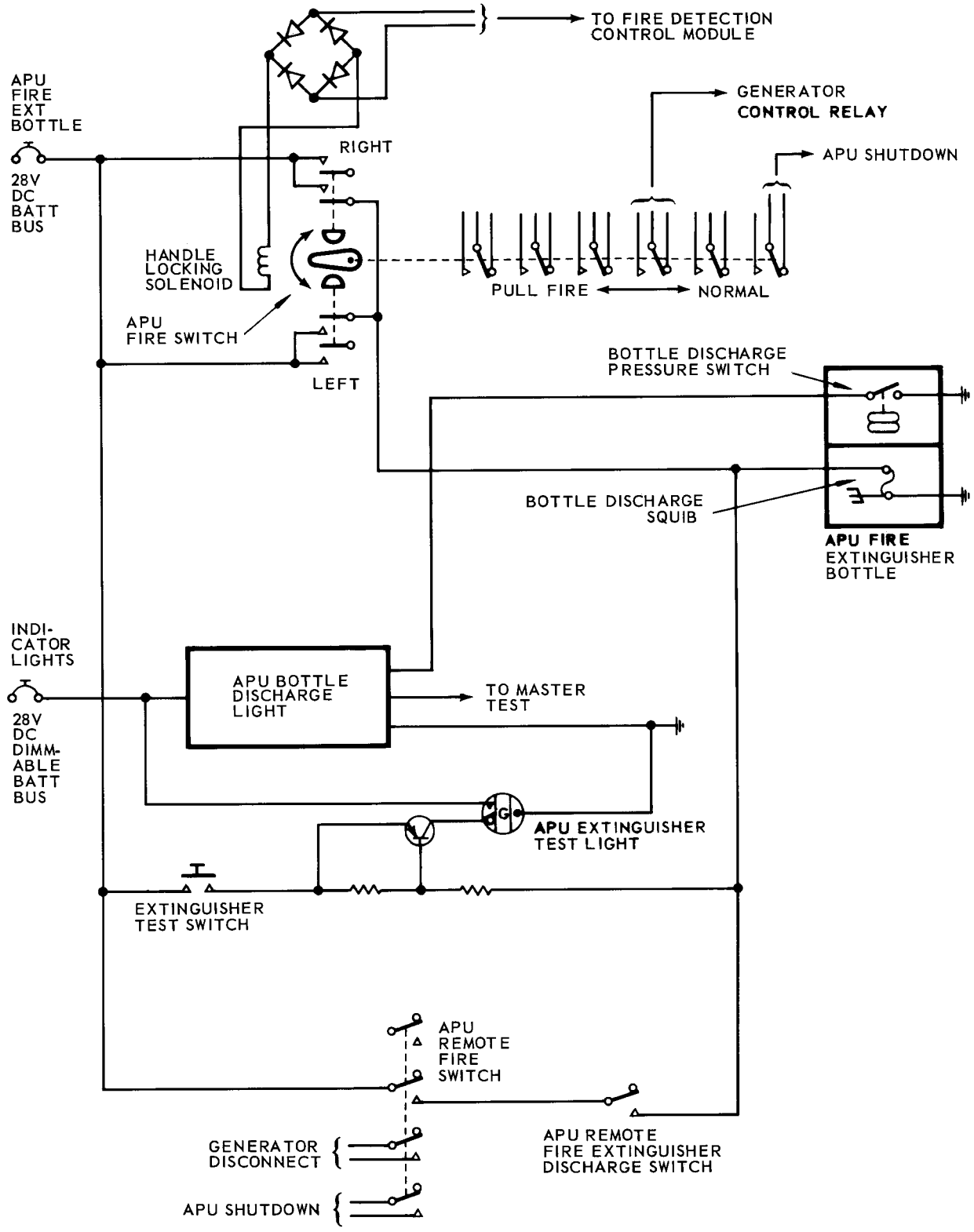
APU FIRE EXTINGUISHING
(FIRE PROTECTION MODULE)



DETAIL A



APU Fire Extinguishing System Component Location
Figure 1



APU Fire Extinguishing System Circuit
Figure 2

B. Fire Switch
   (1) The fire switch is a combination seven-pole, double-throw, push-pul1 and a four-pole single-throw rotary switch with a holding solenoid and lighted handle (Fig. 2). Two poles of the rotary switch are actuated by clockwise rotation of the handle and the other two poles are actuated by counterclockwise rotation of the handle. The handle is spring-loaded to the normal position. The solenoid is provided with a mechanical override to be used in event of a malfunction.
   (2) The APU fire switch gives a visual indication of a fire warning. The fire warning signal will also actuate the solenoid in the APU fire switch. Actuation of the solenoid will permit the shaft and handle to be pulled. When the fire condition is confirmed the fire switch is pulled, shutting down the APU and arming the fire extinguishing system for subsequent action. The arming action moves a cam into position to actuate the rotary switch.

C. Bottle Discharge Light
   (1) An amber bottle discharge light is provided to indicate that the extinguisher bottle has been bled off. When the bottle has been discharged or the safety relief valve has relieved and bottle pressure is bled off, the associated bottle discharge light will illuminate.
   (2) The warning lights may be tested individually by a press-to-test feature in the light assembly or the lights may all be tested simultaneously when the master test switch is closed.

D. Test Switch
   (1) A three-pole, double-throw, pushbutton switch is provided to permit testing of the fire extinguishing system through a test circuit connected to the bottle discharge squib. The system may be tested either while the airplane is in flight or on the ground.
   (2) The extinguisher test circuit provides the means to check the bottle discharge squib for continuity without actually discharging the squib.
   (3) When the system is being tested, press the EXT TEST switch; if satisfactory, an indication should occur almost immediately. The test switch sends a very small current through the APU bottle discharge squib. If the circuits are complete, a transistor in the circuit is biased. The biased transistors will conduct a signal to illuminate the APU extinguisher test light. The APU extinguisher test light is green press-to-test lights located on the face of the fire protection system module (P8-1).

3. Fire Extinguisher Bottle Assembly
   A. The fire extinguisher bottle assembly consists of a spherical steel container fitted with a filling port plug, pressure gage, metal sealing disc in the discharge port and discharge plug. The spherical steel container (extinguisher bottle) is about 5 inches in diameter and has a volume of approximately 78 cubic inches. The bottle is used to store the extinguishing agent under pressure until released by fire extinguishing discharge action. The bottle is filled with 1.1 pounds of freon, and charged with dry nitrogen to 600-625 psi at 70°F.
   B. The APU fire extinguisher bottle is mounted in brackets on the lower right side of the empennage section at approximately station 1064 (Fig. 1).
   C. The filling port plug is a metal plug with a fusible metal core which acts as a safety relief valve. From the safety relief valve on the bottle a tube leads to the lower empennage skin near the bottle, where it is capped with a red indicator disc. If the bottle temperature rises to or above approximately 266°F the fusible core will melt and the bottle pressure will rupture the indicator disc dumping the bottle gas charge overboard.
   D. The pressure gage indicates pressure in the extinguisher bottle. The gage also contains a pressure switch that will close and activate the bottle discharge lights when the bottles are discharged or pressure drops. The pressure gage is visible through an inspection window on the lower right side of the empennage (Fig. 1).
   E. The discharge port is sealed by a frangible restraining diaphragm to retain the pressurized extinguishing agent. The discharge plug is installed at the discharge port and serves as an adapter between the bottle and manifold, and provides the means to discharge the bottle. When the squib receives a signal from the applicable fire switch, it is detonated (Fig. 2). The detonation creates a shock wave which ruptures the diaphragm allowing the extinguishing agent to escape.

      NOTE: The fire extinguisher bottle is not designed for recharging while installed in the airplane. A low pressure or discharged bottle should be replaced with a charged bottle.

4. Remote APU Fire Control Panel Components
   A. The remote APU fire panel components described in the following paragraphs will be only those associated with the APU fire extinguishing system. The remote APU fire panel (P28) is located on the aft bulkhead, right side of main wheel well. For further information of the remote APU fire panel, refer to 26-00, Fire Protection.

B. APU Remote Fire Switch
   (1) The remote fire switch is a multi-pole, double-throw, pushbutton switch actuated by a pul1-type handle on the front of the panel (P28). When the fire handle is pulled down, the fire switch shuts down the APU and arms the fire extinguishing system for subsequent action.

C. APU Remote Fire Extinguisher Switch
   (1) The remote fire extinguisher switch is a single-pole, double-throw, toggle switch spring-loaded to the OFF position. When the fire switch has been pulled and the extinguisher system is armed the extinguisher switch may be moved to the discharge position, discharging the APU bottle.

5. Discharge Line
   A. The discharge line disperses the released extinguishing agent from the discharge plug to the APU shroud. The line is routed from the bottle installation aft into the APU compartment and into the APU shroud. A nozzle disperses the extinguishing agent around the APU at a proper rate for effective extinguishing.
   B. A tee in the discharge line connects the discharge line to the system discharge indicator. The indicator is on the lower empennage near the extinguisher bottle. When the bottle is discharged, pressure in the discharge line is suddenly increased, causing a plunger in the indicator to knock out a yellow disc. The plunger then blocks the line preventing any extinguisher agent from being dumped overboard.

6. Indicators Discs
   A. Two indicators, a red and a yellow, are installed in the airplane skin (Fig. 1). The indicators are on the lower right side of the empennage section at approximately station 1064. The red thermal relief indicator disc is blown out in event of an extinguisher bottle overheat. The yellow system discharge indicator disc is knocked out by a plunger in the event of a normal fire extinguisher discharge.

7. Operation
   A. The APU fire extinguisher system may be controlled from two locations on the airplane. The two methods of control are normal operation and remote operation. Normal operation is control of an APU compartment fire using the APU fire switch on the fire protection system module. Remote operation is the control of an APU compartment fire using the APU remote fire switch and extinguisher switch on the remote APU fire control panel.

B. Normal Operation

(1) When a fire warning indication is received, the APU fire switch handle in the control cabin will be unlocked. When it is determined a fire condition exists and corrective action must be taken, pull out on the fire switch handle. When the handle is pulled out, the fire extinguisher system is armed. Besides arming the fire extinguishing system, the APU fire switch performs the following functions:

(a) Close the APU fuel valve and close the inlet door.

(b) Disconnect the APU generator by tripping the generator control relay. The relay de-energizes the generator field and disconnects the generator from the ac bus within 5 to 10 seconds.

NOTE: APU fire warning circuit normally automatically shuts down APU. For additional information on APU shutdown, refer to Chapter 49, Airborne Auxiliary Power.

(2) When the system is armed the APU fire switch handle may be rotated either to the left or right to discharge the APU bottle. When the handle is rotated in either direction (for at least one second), the squib is fired, rupturing the sealing diaphragm and releasing the extinguishing agent. The extinguishing agent flows directly from the bottle to the APU shroud. The pressure of extinguishing agent in the discharge line causes the yellow disc in the discharge indicator to be knocked out, showing the system has been actuated. When the bottle pressure approaches approximately 250 psi, the APU bottle discharge light illuminates, indicating the APU bottle is discharged and inactive.

C. Remote Operation

(1) When the APU is being operated for maintenance purposes and no one is in the control cabin, the APU can be controlled for shutdown and fire extinguishing purposes from outside the airplane. The APU is controlled from the remote APU fire control panel (P28) located on the aft bulkhead on the right side of the main wheel well. When it is determined a fire condition exists and corrective action must be taken, pull down on the remote fire switch handle. When the handle is pulled the fire extinguishing system is armed. Besides arming the system, the remote APU fire switch performs the following function;

(a) Close the APU fuel valve and close the inlet door.

(b) Disconnect the APU generator.

NOTE: For additional information on APU shutdown, refer to Chapter 49 APU Engine Controls.

(2) When the system is armed, the APU remote fire extinguisher switch is positioned to DISCHARGE for at least 1 second. The squib is fired, rupturing the sealing diaphragm and releasing the extinguishing agent. The extinguishing agent flows directly from the bottle to the APU shroud. The pressure of extinguishing agent in the discharge line causes the yellow disc in the discharge indicator to be knocked out, showing the system has been actuated.

ENGINE FIRE EXTINGUISHING SYSTEM - TROUBLESHOOTING

1. General
   A. Whenever the fire protection module (P8-1) is removed and replaced, a test must be performed on the APU fire extinguishing system (Ref 26-22-0, A/T).
2. Equipment and Materials
   A. Ohmmeter incapable of supplying more than 35 milliamperes.

      WARNING: CURRENT FLOW EXCEEDING 35 MILLIAMPERES MAY DETONATE THE BOTTLE DISCHARGE SQUIB.

3. Troubleshooting Charts

With all IND LIGHTS, and SEC 5 circuit breakers on P6-3 closed.

APU BOTTLE DISCH LIGHT IS ON - Check bottle pressure (Ref 26-21-0). IF -

BOTTLE PRESSURE BELOW NORMAL - Bottle is defective and must be replaced.

BOTTLE PRESSURE OK - Disconnect electrical connector D1176 and check for continuity between pins 1 and 2 of pressure switch. IF -

CONTINUITY - Pressure switch is defective and bottle must be removed and repaired or replaced.

NO CONTINUITY - Check wiring for grounds and repair.

APU Fire Extinguishing System - Troubleshooting
Figure 101

With APU FIRE EXTINGUISHER BOTTLE circuit breaker on P6-2 closed, press EXT TEST switch on P8-1. IF -

APU TEST LIGHT FAILS TO TURN ON.

Disconnect electrical connector. Connect ohmmeter across pins 1 and 2 of discharge squib.

WARNING: CURRENT FLOW OF MORE THAN 35 MILLIAMPS WILL DETONATE DISCHARGE SQUIB.

IF -

NO CONTINUITY - Replace discharge squib.

CONTINUITY - Check wiring for grounds and repair.

Discharge Squib - Troubleshooting
Figure 102

APU FIRE EXTINGUISHING SYSTEM - ADJUSTMENT/TEST

1. APU Fire Extinguishing System Test
   A. Tubing Leakage Test
      (1) Do the Tubing Leakage Test for the Engine Fire Extinguishing System (Ref 26-21-0, Page 501).
   B. Electrical Circuit Operation Test
      (1) Equipment and Materials
         (a) Test box, Boeing F80229
      (2) Prepare Electrical Circuit for Test
         (a) Open APU access door and access door 3701.
         (b) Remove electrical connector D594 from bottle discharge plug.

            WARNING: BOTTLE DISCHARGE PLUG CONNECTOR MUST BE DISCONNECTED. OPERATION OF FIRE SWITCH WILL DETONATE EXPLOSIVE CHARGE IF CONNECTOR IS NOT REMOVED FROM DISCHARGE PLUG.

         (c) Connect test box to electrical connector D594.
         (d) Connect electrical power to airplane.
         (e) Check that EXTINGUISHER BOTTLES APU circuit breaker on panel P6-2 and all IND LIGHTS (3) and SEC 5 circuit breakers on panel P6-3 are closed.
         (f) Disconnect electrical connector D1176 at APU bottle pressure gage.
      (3) Test Circuit Operation
         (a) Arm APU fire switch by pressing override button behind switch handle and pulling up on handle.
            1) Make sure the APU LV light on the M238 panel comes on.
         (b) Turn APU fire switch clockwise as far as it will go. Hold in that position for approximately 5 seconds. Check that light on test box illuminates while discharge switch is held.
         (c) Repeat step (b) except turn APU fire switch handle counterclockwise.
         (d) Pull down on APU FIRE CONTROL handle on remote APU fire control panel in main wheel well.
         (e) Actuate BOTTLE DISCHARGE switch. Check that light on test box illuminates while discharge switch is held.
         (f) Jumper pins 1 and 2 of electrical connector D1176. Check that APU BOTTLE DISCHARGED light on P8-1 fire protection module illuminates.
      (4) Restore Airplane to Normal
         (a) Reset APU fire switch to NORMAL.
         (b) Disconnect test box at electrical connector D594 and connect electrical connector to bottle discharge plug.
         (c) Connect electrical connector D1176 to pressure gage.

(d) Press TEST EXT switch on P8-1. Check that APU, L and R lights illuminate and stay on until switch is released.
(e) Remove electrical power if no longer required.

C. Squib Continuity Test
(1) Prepare APU Fire Extinguishing System Squib for Continuity Test
(a) Connect electrical power to airplane.
(b) Check that EXTINGUISHER BOTTLES APU circuit breaker on panel P6-2 and all IND LIGHTS (3) and SEC 5 circuit breakers on panel P6-3 are closed.
(2) Test Squib Continuity
(a) Press TEST EXT switch on P8-1. Check that APU, L and R lights illuminate and stay on until switch is released.
(b) Disconnect electrical connector D594 from bottle discharge plug and press TEST EXT switch. Check that APU light does not illuminate.
(3) Restore Airplane to Normal
(a) Connect electrical connector D594 to APU bottle discharge plug.
(b) Repeat step (2)(a).
(c) Remove electrical power if no longer required.
(d) Close access door 3701.
(4) Test Squib Continuity
(a) Press lens cap for APU extinguish test light on P8-1 fire protection module to ensure lights are operative.
1) APU light should illuminate.
(b) Press EXT TEST switch.
1) APU light should illuminate immediately and stay on until switch is released. L and R lights may also illuminate.
(c) To assure freedom from shorts or grounds, disconnect electrical connector D594 from bottle discharge plug and press EXT TEST switch.
1) APU light shall not illuminate.
(5) Restore Airplane to Normal Configuration
(a) Connect electrical connector D594 to APU bottle discharge plug.
(b) Determine if there is any further need for electrical power on airplane; if not, remove electrical power.
(c) Close access door 3701.

APU FIRE EXTINGUISHER BOTTLE - REMOVAL/INSTALLATION

1. General
   A. As a safety precaution, new bottles are supplied with discharge squib disassembled from the bottle. The squib is installed after the bottle is installed in the airplane.
   B. Check the pressure and weight of the APU fire extinguisher bottle before installation to prevent installing a bottle that has been improperly serviced. For proper fire extinguisher bottle pressure, see Fig. 601. The weight of a properly serviced bottle (squib not installed) is 4.26 -.04 pounds.
2. Prepare APU Fire Extinguisher Bottle for Removal
   A. Open APU extinguisher bottle and all IND LIGHTS circuit breakers on load control center P6.
   B. Remove access panel 3701.
3. Remove APU Fire Extinguisher Bottle
   A. Disconnect electrical connectors from fire extinguisher discharge squib (Fig. 401).
   B. Remove discharge squib from bottle and cap ends or install protective cover over electrical pins.

      WARNING: SQUIB IS AN EXPLOSIVE. PROTECTIVE CAPS MUST BE INSTALLED ON ENDS OF SQUIB OR METAL FOIL SHUNT INSTALLED OVER ELECTRICAL PINS WHEN HANDLING SQUIB.

   C. Disconnect tubing from thermal relief discharge port.
   D. Disconnect discharge line from fire extinguisher bottle discharge plug.
   E. Remove three mounting bolts and remove fire extinguisher bottle.
4. Install APU Fire Extinguisher Bottle
   A. Position fire extinguisher bottle in support frame and install mounting bolts.
   B. Apply a layer of BMS 3-28 (preferred) to the outlet threads, outlet end, and outlet inner diameter where the tube assembly attaches to the discharge head.
      (1) BMS 3-27 or BMS 3-38 are also acceptable alternatives as anti-corrosion compounds to use in this location.

      NOTE: If necessary, install additional washers under bottle mounting lugs to provide 0.03-inch minimum clearance between pressure gage and window. Four washers maximum. Adjust bolt grip length if required.

   C. Connect discharge line to discharge plug.
   D. Connect and lockwire safety discharge tubing (if applicable) to safety discharge port.

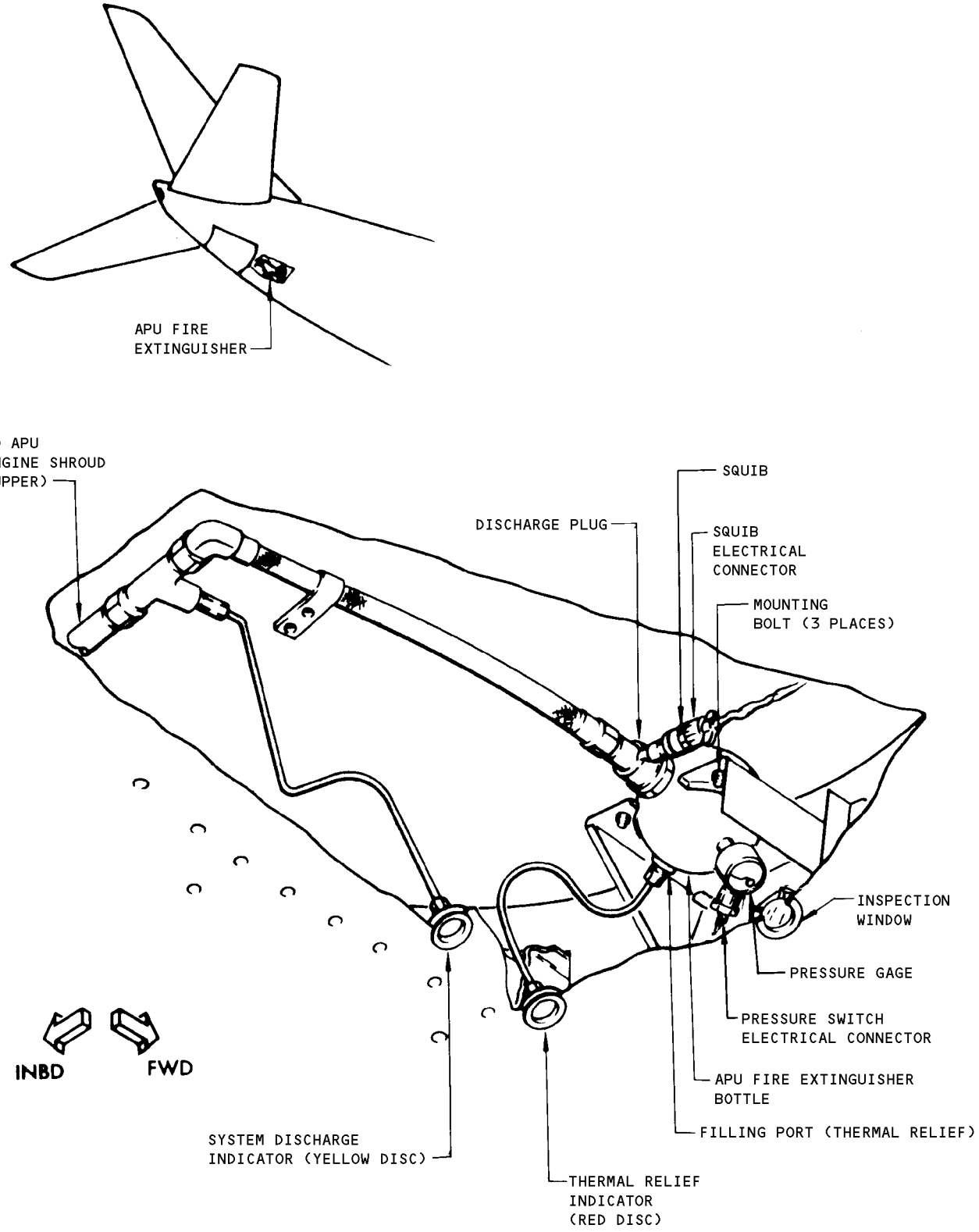
E. Remove protective caps and install discharge squib in fire extinguisher discharge plug. Torque squib to 96 (±12) pound-inches and lockwire.

NOTE: The squib must be inspected for damage with special attention given to the soft seal, opposite the electrical connector, which protects the explosive charge. If punctured or otherwise damaged, the squib must be replaced with a new part.

F. Connect electrical wiring to discharge squib and pressure gage.

NOTE: If protective cover is installed across squib connecting pins remove protective cover prior to connecting electrical wiring.

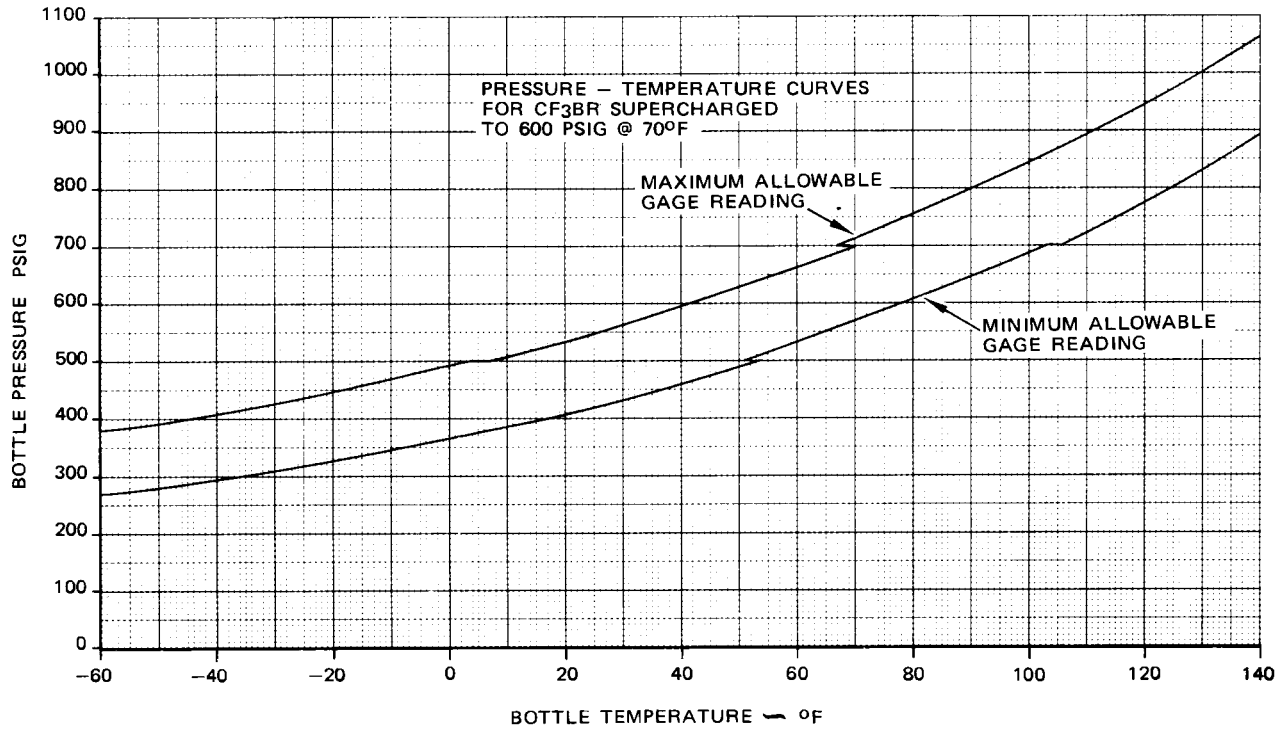
G. Test wiring, and discharge plug squib for continuity as described in 26-22-0, APU Fire Extinguishing System - Adjustment/Test.
H. Close access panel 3701.



APU Fire Extinguishing Bottle Installation
Figure 401

APU FIRE EXTINGUISHER BOTTLE - INSPECTION/CHECK

1. APU Fire Extinguisher Bottle Check
   A. Check Bottle Pressure
      (1) When checking pressure in fire extinguisher bottle, see Fig. 601 to determine maximum and minimum pressure allowances at bottle temperature. If pressure is outside tolerances shown, bottle should be replaced. Bottle, not ambient, temperature must be measured.
   B. Check Discharge Squib Service Life
      (1) To ascertain unexpired service life of bottle discharge squib under normal conditions, check manufacturer's date stamp on edge of squib. See manufacturer's data for recommended maximum life.
      (2) If squib is subjected to high temperatures or unusual conditions, service life may vary from value given. For further information contact Accessory Products Company, Whittier, California, 90602.



APU Fire Extinguisher Bottle Pressure-Temperature Curve
Figure 601

APU FIRE EXTINGUISHER BOTTLE SQUIB - MAINTENANCE PRACTICES

1. General
   A. The APU fire extinguisher bottle squib is normally serviced more frequently than the fire extinguisher bottle. A manufacturer's date stamp is on the edge of the cartridge. (See manufacturer's recommendations for specific maximum service life.)

      WARNING: THE SQUIB IS AN EXPLOSIVE. PROTECTIVE CAPS MUST BE INSTALLED ON ENDS OF SQUIB OR ELECTRICAL CONNECTOR PINS SHOULD BE JUMPERED WITH METAL FOIL WHENEVER HANDLING CARTRIDGE.

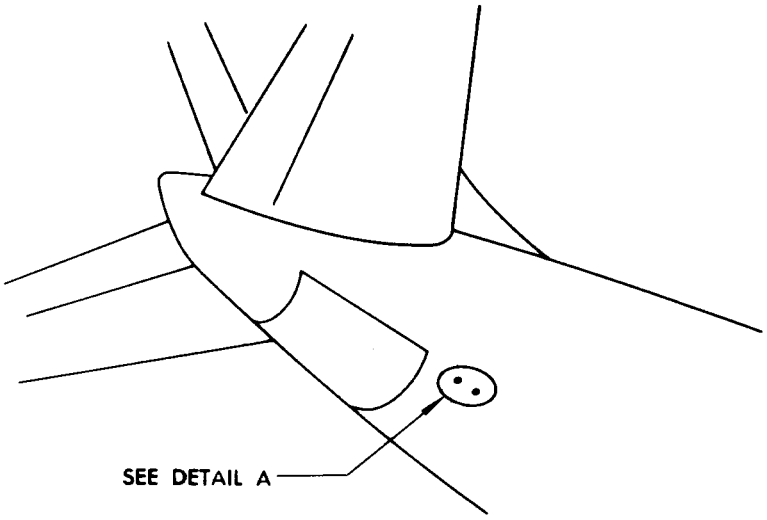
2. Remove Cartridge
   A. Open EXT BOTTLE APU and all IND LIGHTS circuit breakers on load control center P6.
   B. Remove access panel 3701.
   C. Remove electrical connector from squib.
   D. Place metal foil or protective cap over squib connector.
   E. Remove lockwire and unscrew squib from bottle. Cap squib end and cap bottle fitting.
3. Check Cartridge
   A. On fire extinguisher bottles with tin plated squibs, check for damage with special attention given to the soft seal, opposite the electrical connector, which protects the explosive charge.
      (1) If seal is punctured, broken, cut and/or corroded, replace with new part.
      (2) If squib has corrosion on threads, replace with new part.
4. Install Cartridge
   A. Remove caps and screw squib into bottle fitting. Torque squib to 96 ±12 pound-inches.
   B. Install lockwire.
   C. Remove protective metal foil or cap from squib and connect electrical connector.
   D. Test bottle firing circuit continuity (Ref 26-22-0, A/T).
   E. Close access panel 3701.

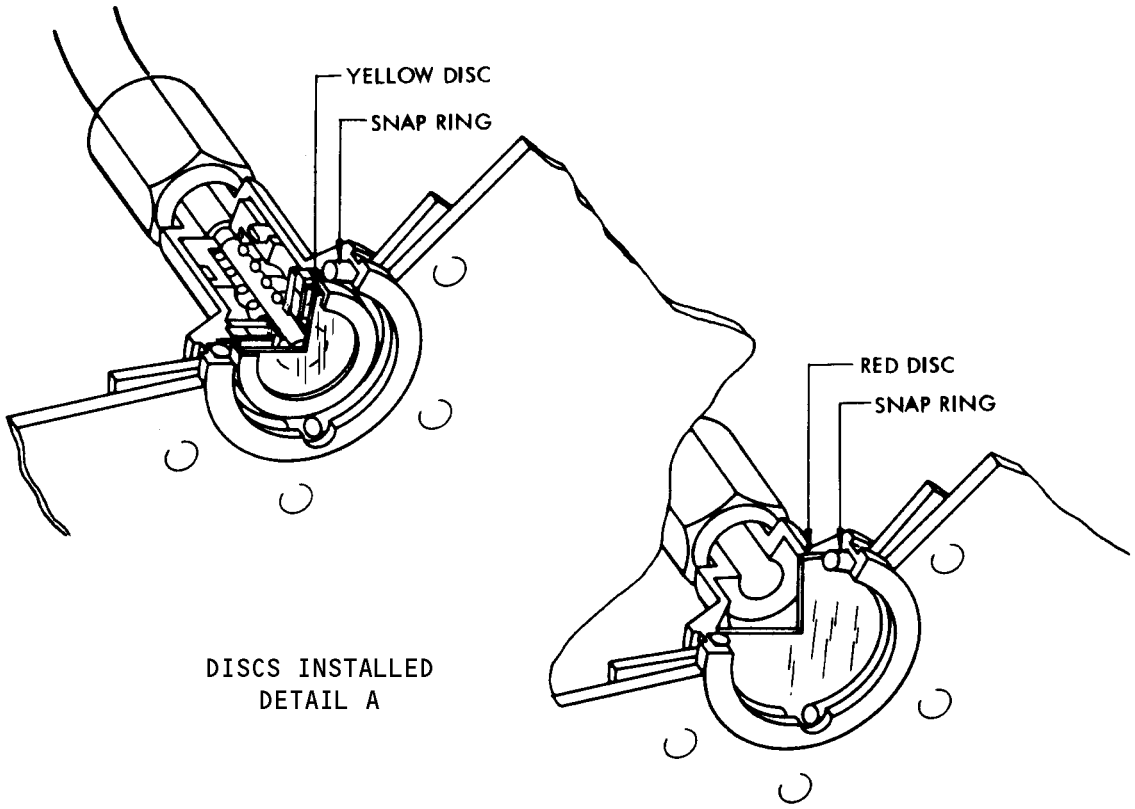
APU FIRE EXTINGUISHER BOTTLE INDICATOR DISCS - REMOVAL/INSTALLATION

1. General
   A. One red indicator disc (bottle thermal discharge) and one yellow indicator disc (bottle discharge) are located on the lower right side of the empennage section at approximately station 1064.
2. Removal/Installation Red Indicator Disc (Fig. 401)
   A. Remove Red Disc
      (1) Remove snap ring.
      (2) Remove disc using a suction cup or any small pointed tool.
   B. Install Red Disc
      (1) Place disc in receptacle.
      (2) Push snap ring in place.
3. Removal/Installation Yellow Indicator Disc (Fig. 401)
   A. Remove Yellow Disc
      (1) Remove snap ring.
      (2) Remove disc assembly using a suction cup or any small pointed tool.

          NOTE: Check that retainer washer is removed from receptacle.

      (3) Remove retainer washer from disc assembly if necessary.
      (4) Remove yellow disc from retainer.
   B. Install Yellow Disc
      (1) Place yellow disc on retainer.
      (2) Install retainer washer on disc and retainer.
      (3) Place disc assembly in receptacle.
      (4) Install snap ring.

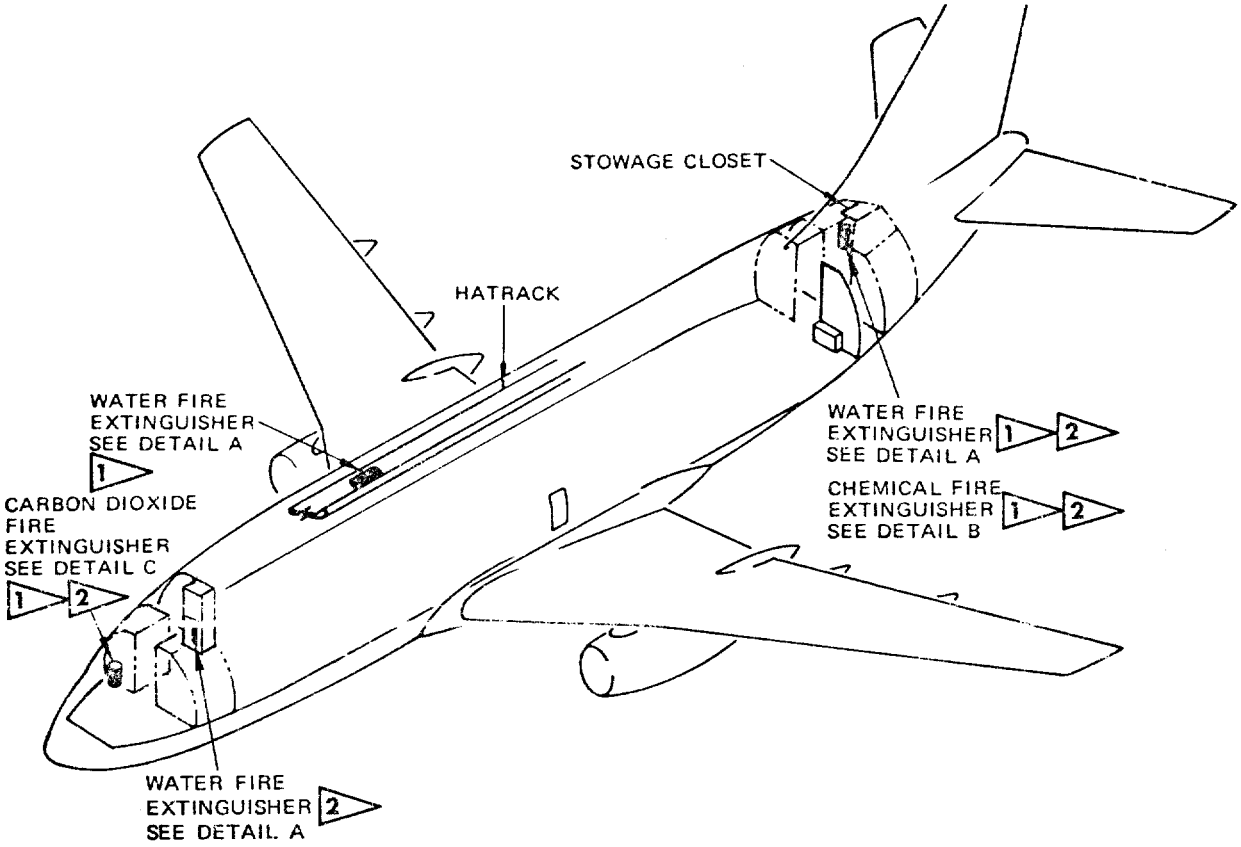




APU Fire Extinguisher Bottle Indicator Discs Installation
Figure 401

PORTABLE FIRE EXTINGUISHERS - DESCRIPTION AND OPERATION

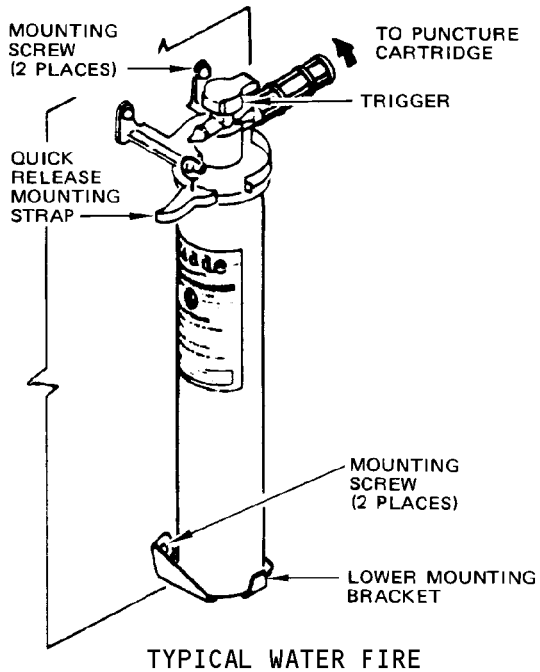
1. General
   A. Portable fire extinguishers (water, carbon dioxide and dry chemical type) are located at various positions in the crew and passenger cabins. They provide fire extinguishing capability in these cabins or other areas accessible from them.
2. Carbon Dioxide (CO2) Type
   A. A carbon dioxide extinguisher is located in the control cabin adjacent to the first officer's seat. The carbon dioxide extinguisher is identified by the horn type nozzle, and is intended primarily for use in extinguishing electrical fires. Operation is controlled by a trigger mechanism in the handle. Until operated, the trigger is lockwired and sealed (Fig. 1).
3. Water Type
   A. Two water type fire extinguishers are located in the passenger cabin. One is in the right forward windscreen, and the other is in the aft stowage closet. The water type extinguishers are intended for extinguishing nonelectrical fires, and contain an antifreeze agent to retain serviceability at low temperatures. Discharge is effected by pressure from a carbon dioxide cartridge in the extinguisher handle. The pressure is released by twisting the handle of the extinguisher to puncture the cartridge. Operation is controlled by actuation of a thumb-operated lever. Until operated, the handle is lockwired and sealed (Fig. 1).
4. Dry Chemical Type
   A. A dry chemical type extinguisher is located in the aft stowage closet in the passenger cabin. The dry chemical type extinguishers are intended for use in extinguishing all fires in the passenger cabin areas.
   B. The dry chemical type extinguisher is discharged by actuating the operating lever (Fig. 1). After use of the extinguisher, all residue should be cleaned up with a vacuum cleaner or damp cloth. Normally, it has no deleterious effects except for slight stripping and staining of zinc chromate primer; however, due to high temperatures, surfaces may be pitted.



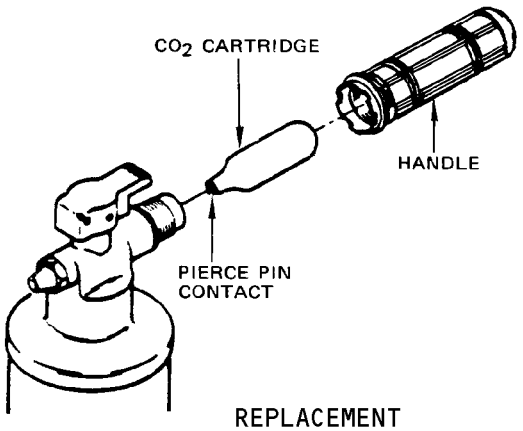
1 LV–LEB
LV–JMW THRU LV–JMZ
LV–JND AND LV–JNE
LV–JTD
LV–JTO

2 LV–LIU THRU LV–LIW

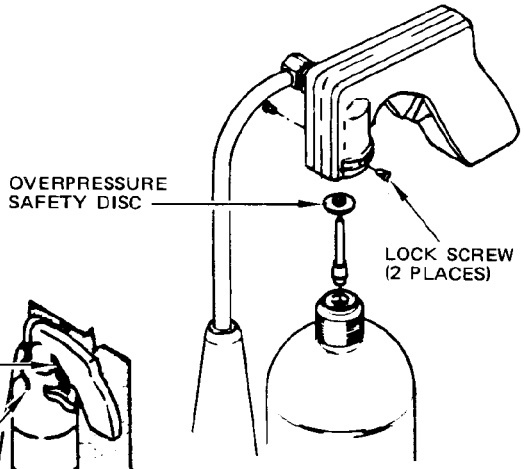
Portable Fire Extinguishers Location
Figure 1 (Sheet 1)



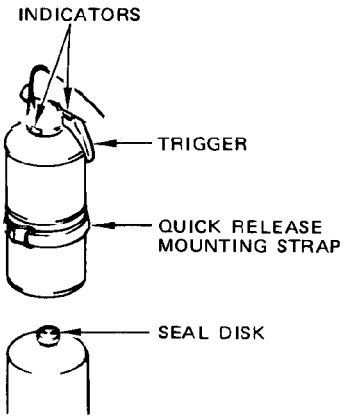
TYPICAL WATER FIRE EXTINGUISHER INSTALLATION DETAIL A



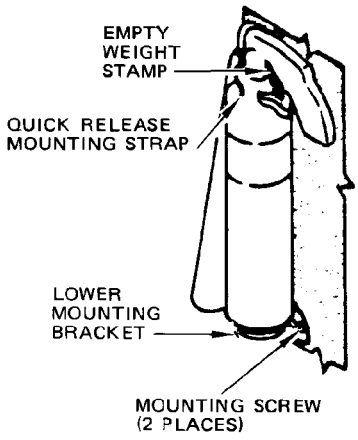
REPLACEMENT OF CO_2 CARTRIDGE



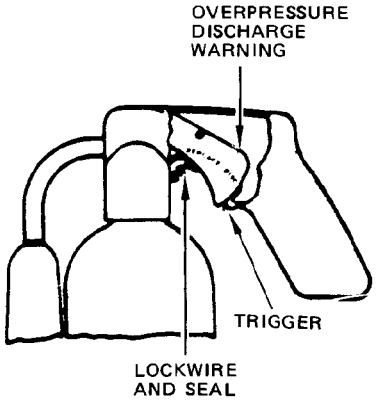
REPLACEMENT OF SAFETY DISC



DRY CHEMICAL FIRE EXTINGUISHER INSTALLATION DETAIL B



TYPICAL CO_2 FIRE EXTINGUISHER INSTALLATION



DETAIL C

Portable Fire Extinguishers Location
Figure 1 (Sheet 2)

DRY CHEMICAL FIRE EXTINGUISHER (ANSUL G-A-2-1/2E) - MAINTENANCE PRACTICES

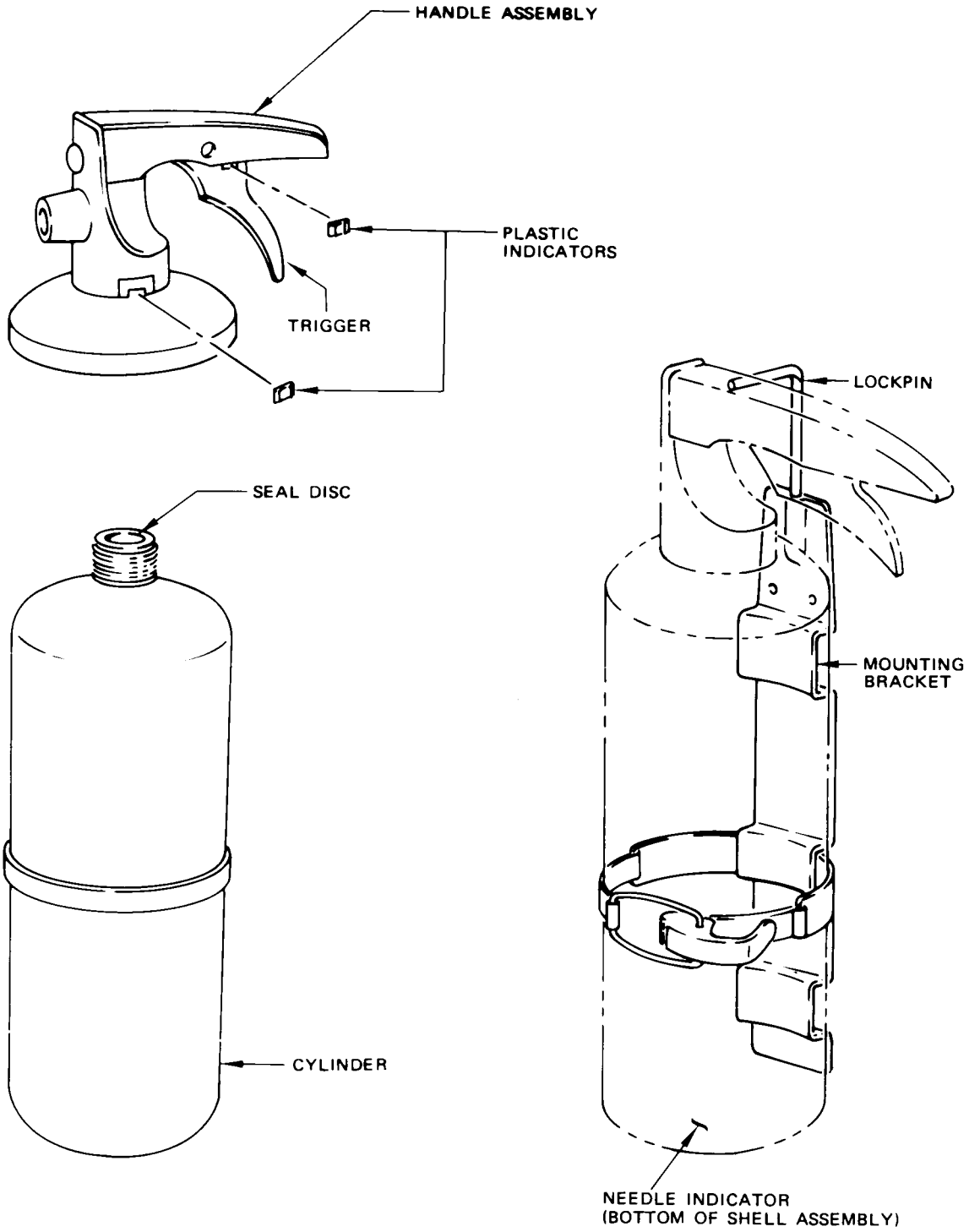
1. Equipment and Materials
   A. Dry Chemical Cylinder - 12692, Ansul Chemical Company
2. Removal/Installation (Fig. 201)
   A. Install
      (1) Check security of mount bracket.
      (2) Insert mount bracket prong into hole in one side of trigger.
      (3) Fasten clamp.
3. Inspection/Check (Fig. 201)
   A. Check
      (1) Security and condition of mount bracket and extinguisher.
      (2) Both plastic indicators are intact.

          NOTE: Indicators are broken if trigger is operated or cylinder is unscrewed from valve assembly.

      (3) Pressure indicator for low pressure on bottom of cylinder.
          (a) If the needle indicator is in the red area of the gauge the shell assembly should be replaced.
      (4) Prong on mount bracket engages hole in trigger.
4. Servicing (Fig. 201)
   A. Replace charge cylinder.
      (1) Unscrew discharged cylinder from handle assembly.

          NOTE: Plastic indicator on handle assembly will break.

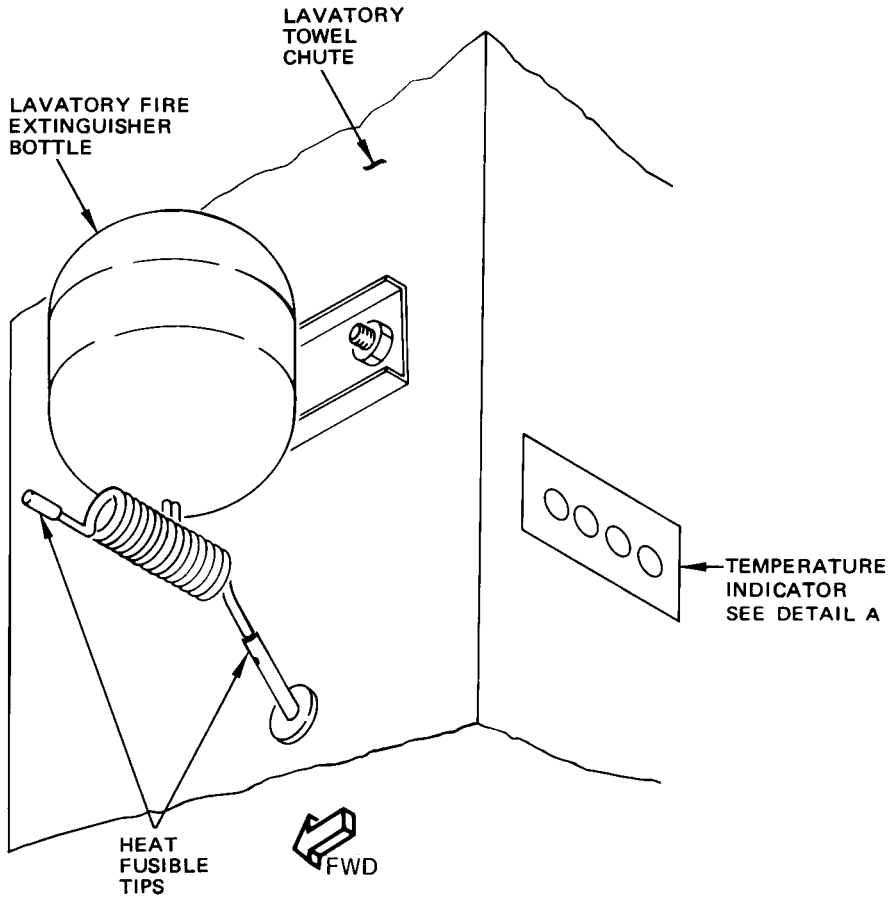
      (2) Attach new indicator to trigger.
      (3) Attach new cylinder to handle assembly.
      (4) Attach new indicator to handle assembly.

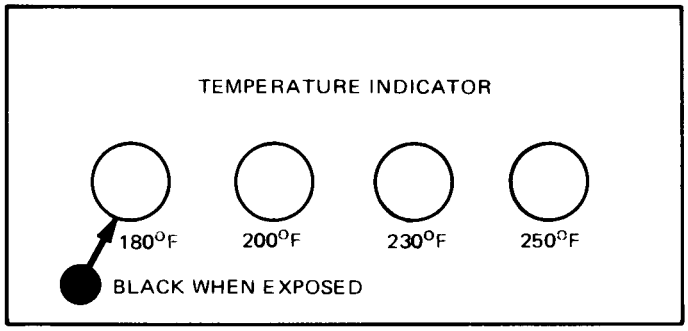


Installation of Dry Extinguisher
Figure 201

LAVATORY FIRE EXTINGUISHING SYSTEM – DESCRIPTION AND OPERATION

1. General
   A. The lavatory fire extinguishing system is a fixed system providing fire extinguishing capability to the lavatory cabinet assembly. Extinguishing is accomplished by flooding the cabinet area with an inert gas.
   B. The fire extinguishing system consists of a single heat activated extinguisher bottle and a temperature indicator (Fig. 1).
2. Fire Extinguisher Bottle Assembly
   A. The fire extinguisher bottle assembly consists of an elongated spherical steel container fitted with two discharge tubes having fusible tips and a mounting bracket. The container is about 2.5 inches in diameter and has a volume of approximately 10.6 cubic inches. The bottle is used to store an extinguishing agent (freon) under pressure until released.
   B. The lavatory fire extinguisher bottle is mounted inside the lavatory cabinet assembly (Fig. 1).
3. Temperature Indicator (Fig. 1)
   A. The temperature indicator is a thin vinyl plate containing four heat sensitive patches. Each patch will change color from grey to black when exposed to temperatures from 180 to 250°F (Fig. 1).
   B. The temperature indicator with self-adhesive backing is located inside the lavatory cabinet assembly.
4. Operation
   A. The extinguisher bottle contains two fusible tips which have a melting temperature of 174°F. When a fire or overheat condition occurs in the cabinet raising the ambient temperature to 174°F or above the tips will melt causing the bottle to discharge and the temperature indicator to change color.





DETAIL A

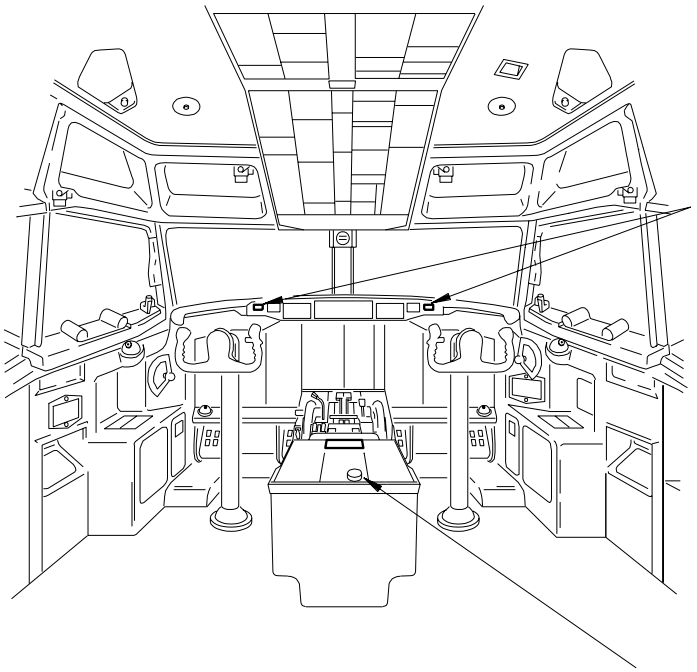
Lavatory Fire Extinguishing System Component Location (Typical)
Figure 1

LAVATORY FIRE EXTINGUISHER BOTTLE - INSPECTION/CHECK

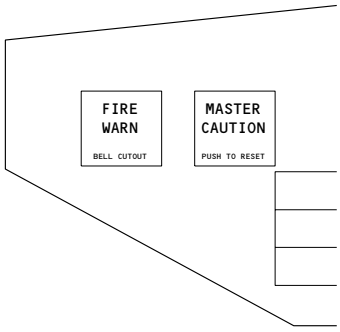
1. Lavatory Fire Extinguisher Bottle Check
   A. Gain access to inside of lavatory sink cabinet and check temperature indicator mounted on towel chute.
   B. If any of the four patches on temperature indicator have changed color from grey to black, determine if bottle has been discharged by removing bottle from towel chute then weighing. Total weight of freon and bottle is provided on label of each bottle. Bottle should be replaced if weight is 10 grams less than weight stated on label.
   C. If bottle has been discharged, replace bottle and temperature indicator. If bottle has not been discharged, only replace temperature indicator.
   D. Check bottle for corrosion, scratches, dents or leakage. Dents deeper than 1/16 inch per inch of average dent diameter or scratches deeper than 0.004 inch are cause for rejection and replacement. Determine leakage by removing bottle and weighing.
   E. Replace the bottle if the weight is 10 grams less than the weight stated on the label.

CARGO COMPARTMENT FIRE EXTINGUISHING SYSTEM - DESCRIPTION/OPERATION

1. General
   A. The cargo compartment fire extinguishing system is used to control or extinguish fires that occur in the forward or aft cargo compartments. The system uses halon as the extinguishant. The system includes these parts:
      (1) Fire Extinguishing Bottle, which has two squibs and a low-pressure indication switch.
      (2) Tubing, to distribute the halon to the applicable area.
      (3) Nozzles, to release the halon efficiently.
      (4) Cargo Fire Control Panel (P8), to test the system and control the release of the halon.
   B. The cargo compartment fire extinguishing system uses 28 volt dc power. The power is supplied through the circuit breaker CARGO FIRE EXT 1, installed on the P6 or P18 panel.
2. Component Details (Fig. 2)
   A. Cargo Fire Extinguishing Bottle
      (1) One cargo fire extinguishing bottle is installed in the mix manifold bay, located in the aft end of the forward cargo compartment. The bottle is a hermetically sealed container which is filled with bromotriflouromethane (halon) and nitrogen. The nitrogen is added to increase the pressure in the bottle. The bottle includes two discharge heads, a temperature compensated pressure switch, and a filler/safety port.
         (a) Two discharge heads are installed on the bottle to release the halon to the applicable areas. The FWD head will release halon into the tubing that goes to the forward cargo compartment. The AFT head will release halon into the tubing that goes to the Aft cargo compartment. The FWD discharge port is a different size than the AFT discharge port to prevent cross connecting the tubing. Also, the electrical receptacle on the FWD and AFT squib are different sizes to prevent cross connection of the wiring. The discharge heads contain a disc that holds the halon in the bottle. When the disc is broken, the halon from the bottle is released through the discharge ports into the tubing. The disc is ruptured by an electrically stimulated squib. The squib breaks the disc using shock wave propagation (a small explosion) not a mechanical cutting device.

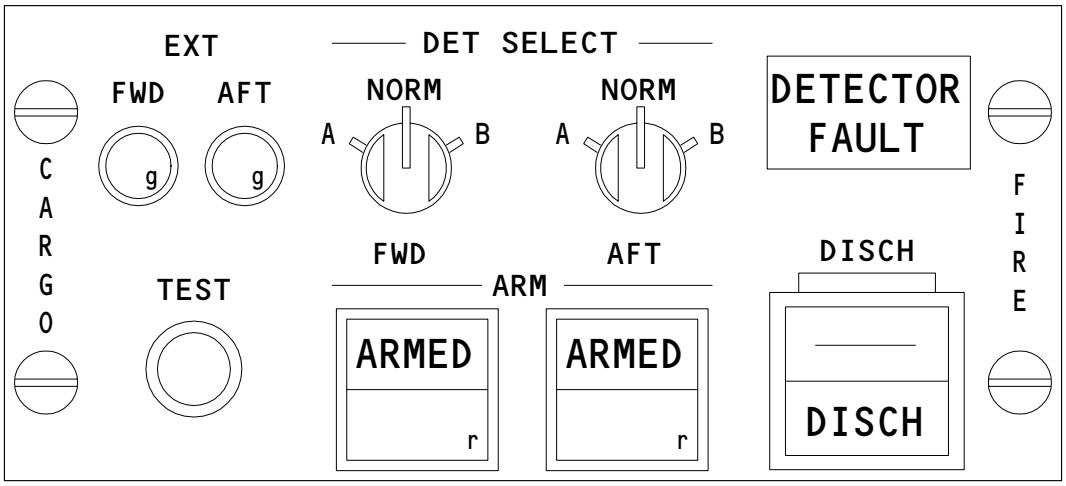


FLIGHT COMPARTMENT



MASTER CAUTION AND
FIRE WARN LIGHTS (P7)
(EXAMPLE)

A



CARGO FIRE CONTROL PANEL (P8)

B

Cargo Bay Smoke Detection Test
Figure 1

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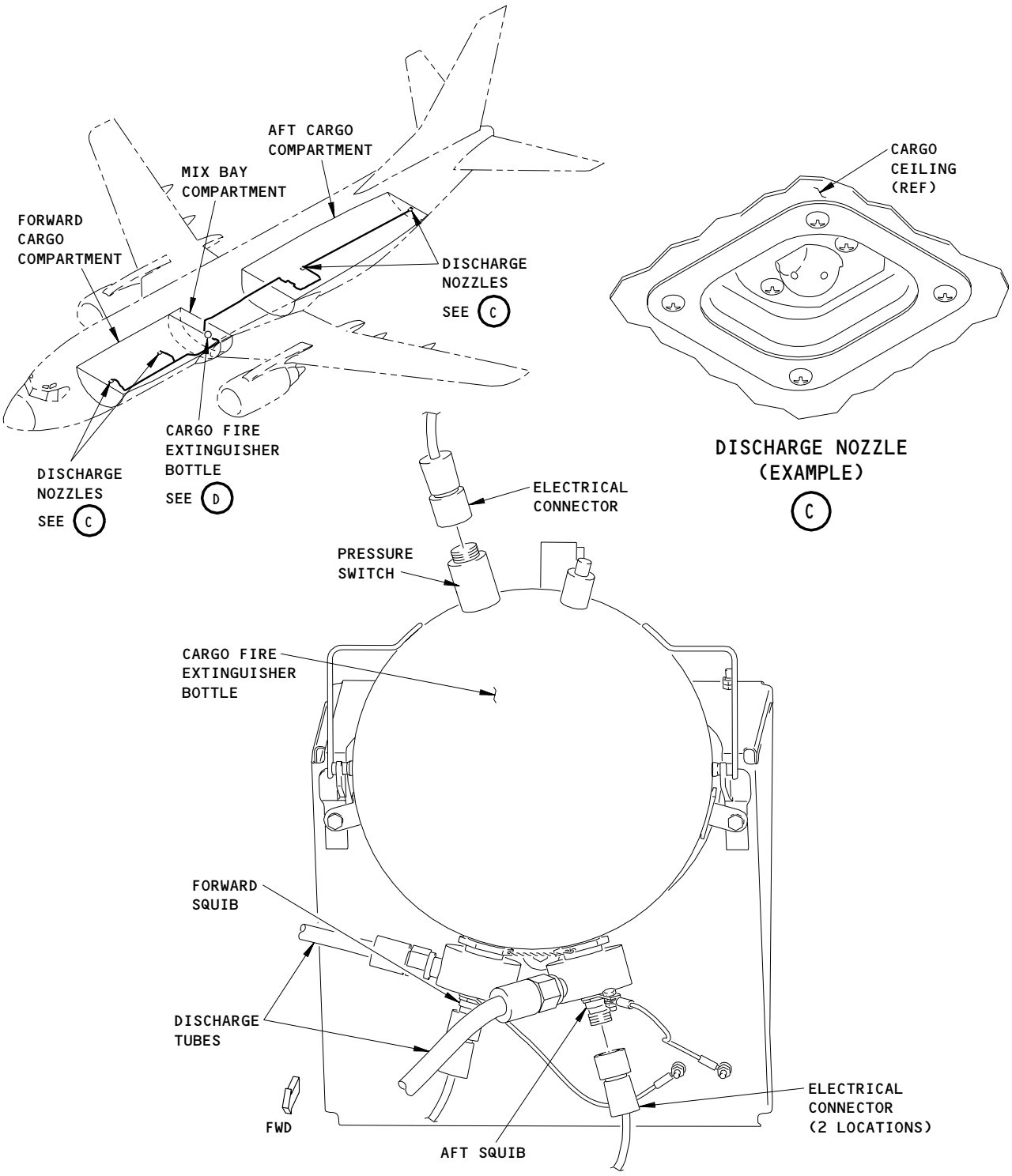


Cargo Bay Fire Extinguishing Test
Figure 2

(b) The Pressure Switch monitors the pressure in the bottle. The switch will be open when the bottle is fully charged. If the pressure in the bottle is below 300 psig (at 70°F), then the switch will close and will send a signal to the flight compartment that the pressure in the bottle is too low. The pressure switch compensates for the temperature of the bottle to maintain an accurate pressure indication.

(c) The Filler/Safety Port contains a fusible metal plug that acts as a safety relief valve if excessive temperature causes an over-pressure condition in the bottle.

B. Cargo Fire Control Panel (P8)

(1) The Cargo Fire Control Panel is installed in the flight compartment in the P8 panel. The components on the panel that control and monitor the cargo fire extinguishing system are the TEST switch, the ARM switches, The DISCH switch and the EXT lights.

(a) The TEST switch is used to initiate a test of the squib circuit and the cargo smoke detection system (AMM 26-26-50/401). When the TEST switch is pushed, a low circuit (1 amp) signal is sent through the FWD and AFT squibs to check for continuity. If the squib circuit is continuous, then the FWD EXT and AFT EXT lights (Green) will illuminate.

(b) When smoke is detected in the forward or aft cargo compartments, then the applicable FWD or AFT ARM light will come on. The appropriate FWD or AFT ARM switch must be pushed to the ARMED position before the bottle can be discharged. When the ARMED switch is pushed and then the DISCH switch is pushed, a signal is sent to the applicable squib to fire the squib and release the halon to the applicable area.

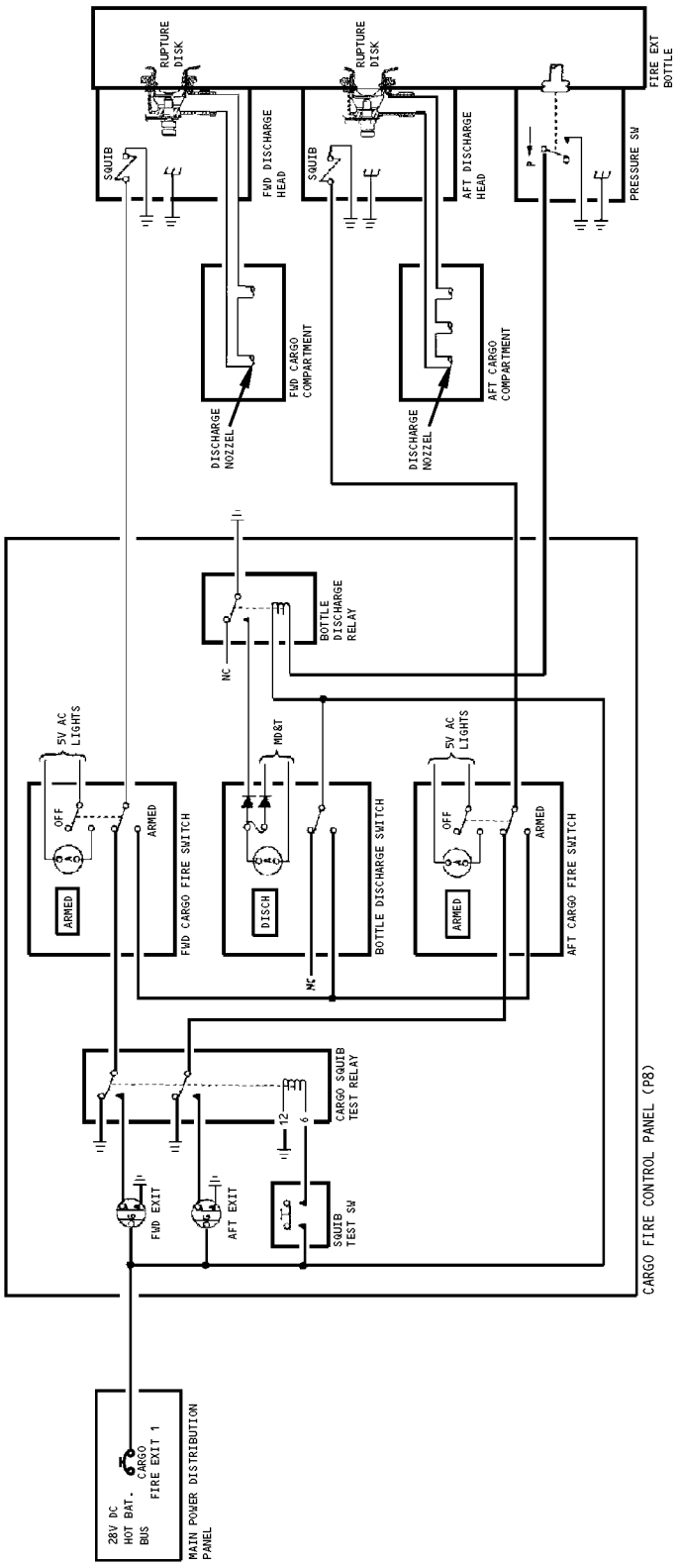
(c) When the cargo fire extinguishing bottle is discharged, or the pressure in the bottle is too low, the DISCH light (Amber) will illuminate. The DISCH light can only be tested by the Master Dim and Test switch.

(d) The DISCH switch is a guarded, momentary action switch. The ARMED switch is an alternate (latched) action switch.

3. Operation (Fig. 3)

A. Functional Description

(1) When smoke is detected in the forward or aft cargo compartments, then the applicable FWD or AFT ARM light, on the cargo fire control panel, (P8), will illuminate. The appropriate FWD or AFT ARM switch must be pushed to the ARMED position before the bottles can be discharged. A white ARMED sign will appear on the ARM switch when the system is armed. When the ARM switch is in the ARMED position and then the DISCH switch is pushed, a signal is sent to the applicable squib to fire the squib and release the halon to the applicable area.



Cargo Compartment Extinguishing Schematic
Figure 3

(2) When the applicable discharge disc is ruptured by the squib explosion, the halon flows through that discharge port, into the tubing to the nozzles. The nozzles spray the halon throughout the cargo compartment. Flooding the compartment with halon gas decreases the amount of oxygen in the compartment and extinguishes the fire. The halon does not leave any residue and does not require any cleanup afterwards.

(3) When the cargo fire extinguishing bottle is discharged, or the pressure in the bottle is too low, the DISCH light (Amber) will illuminate.

(4) After a bottle is discharged, you must ensure there are no disc particles in the tubing or nozzles (AMM 26-25-0/701) and the bottle must be replaced.

B. Testing

(1) Squib Test

(a) The TEST switch on the cargo fire control panel (P8) will initiate a continuity test of the fire extinguishing squib circuits. When you push the TEST switch, a low current signal will be sent through the FWD and AFT squib circuits. If both squib circuits are continuous, then the FWD EXT light (Green) and the AFT EXT light (Green) will illuminate. If one of the squib circuits is not continuous, then the applicable EXT light will not illuminate.

(b) The squib test will not work if the FWD ARM switch or the AFT ARM switch is in the ARMED position.

C. Manual Control

(1) Supply Electrical Power (AMM 24-22-0/201).

(2) Close the CARGO FIRE EXT 1 circuit breaker on the P6 or P18 panel.

(3) If the FWD ARM light (Red) illuminates on the cargo fire control panel, depress the FWD ARM switch and then the DISCH switch.

(4) If the AFT ARM light (Red) illuminates on the cargo fire control panel, depress the AFT ARM switch and then the DISCH switch.

CARGO COMPARTMENT FIRE EXTINGUISHING SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure has the following tasks:
      (1) Test of the cargo compartment fire bottle squib(s) circuitry.
      (2) Test of the cargo compartment fire bottle low pressure switch circuitry.
      (3) Airflow test through the cargo compartment fire discharge tubing and nozzles.
      (4) Pressure test of the cargo compartment fire bottle discharge tubing.
2. Squib Circuit Test (Fig. 501)
   A. General
      (1) The squib circuit test should be performed every time the cargo fire control panel or the fire bottle squibs are disconnected from the airplane wiring.
   B. References
      (1) AMM 20-40-12/201, Electrostatic Sensitive Devices
      (2) AMM 24-22-0/201, Manual Control (Apply Power)
   C. Equipment
      (1) Multimeter (Commercially available)
   D. Access
      (1) Location Zones

121	Control Cabin - Left
122	Control Cabin - Right
213	Forward Cargo Compartment
214	Mix Manifold Bay

      (2) Access Panel

4404R	Forward Cargo Door

   E. Prepare for the Test
      (1) Supply Electrical Power, Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).
      (2) Open this circuit breaker and install DO-NOT-CLOSE tag:
         (a) Circuit breaker panel P6 or P18:
            1) CARGO FIRE EXT 1
      (3) Open 4404R, Forward Cargo Door.
      (4) Remove lining at the aft end of the forward cargo compartment to gain access to the cargo fire bottle (AMM 25-52-131/401).
      (5) If needed, remove the air conditioning duct in front of the cargo fire bottle (AMM 21-21-11/401).

F. Squib Circuit Test

WARNING: REFER TO AMM 20-40-12 BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

(1) Prior to touching either squib, perform procedure for devices that are sensitive to electrostatic discharge (AMM 20-40-12/201).
(2) Disconnect the electrical connectors from the squibs on the cargo fire bottle.
    (a) Disconnect D12794 connector from FWD squib M2249.
    (b) Disconnect D12796 connector from AFT squib M2250.

WARNING: INSTALL PROTECTIVE COVERS ON THE SQUIBS. IF YOU DO NOT PUT PROTECTIVE COVERS ON THE SQUIBS, THE FIRE BOTTLE CAN DISPENSE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONNEL.

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

(3) Install a protective cover on each squib.
(4) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
    (a) Circuit breaker panel P6 or P18:
        1) CARGO FIRE EXT 1
(5) Perform a test of the cargo fire bottle forward squib circuit.
    (a) Use a multimeter to accomplish a check for less than 1 volt dc between pins 1 and 3 on connector D12794.
    (b) Depress the FWD ARM switch on the cargo fire control panel (P8), to the ARMED position.
        1) The ARMED light (White) will illuminate.
    (c) Depress and hold the DISCH switch on the cargo fire control panel (P8).
    (d) Perform a check for more than 16 volt dc between pins 1 and 3 on connector D12794.
    (e) Release the DISCH switch on the cargo fire control panel (P8).
        1) Voltage at connector D12794 will read 0 volt dc.
    (f) Depress the FWD ARM switch on the cargo fire control panel (P8), to normal position.
(6) Perform a test of the cargo fire bottle aft squib circuit.
    (a) Use a multimeter to perform a check for less than 1 volt dc between pins 1 and 3 on connector D12796.

(b) Depress the AFT ARM switch on the cargo fire control panel (P8), to the ARMED position.
1) The ARMED light (White) will illuminate.
(c) Depress and hold the DISCH switch on the cargo fire control panel.
(d) Perform a check for more than 16 volt dc between pins 1 and 3 on connector D12796.
(e) Release the DISCH switch on the cargo fire control panel (P8).
1) Voltage at connector D12796 will read 0 volt dc.
(f) Depress the FWD ARM switch on the cargo fire control panel (P8), to the normal position.
(7) Open this circuit breaker and install DO-NOT-CLOSE tag:
(a) Circuit breaker panel P6 or P18:
1) CARGO FIRE EXT 1
(8) Remove protective covers from squibs.
(9) Connect electrical connectors to FWD and AFT squibs.
(a) Connect D12794 connector to FWD squib M2249.
(b) Connect D12796 connector to AFT squib M2250.
(10) Remove DO-NOT-CLOSE tag and close this circuit breaker:
(a) Circuit breaker panel P6 or P18:
1) CARGO FIRE EXT 1
(11) Depress and hold TEST switch on cargo fire control panel (P8).
(a) Make sure the FWD EXT and AFT EXT lights (Green) illuminate.

NOTE: Other indications may occur during this test. The other indications are not important for this test.

(12) Release the cargo fire control TEST switch.

G. Return the Airplane to its Normal Condition.
(1) If removed, install air conditioning duct in front of the cargo fire bottle (AMM 21-21-11/401).
(2) Install the lining at aft end of forward cargo compartment (AMM 25-52-131/401).
(3) Close 4404R, Forward Cargo Door.
(4) Remove electrical power if not needed (AMM 24-22-0/201).

3. Fire Extinguishing Bottle Pressure Switch Test (Fig. 501)
A. General
(1) The pressure switch test should be performed every time the cargo fire control panel (P8), or the pressure switch is disconnected from the airplane wiring.
B. Reference
(1) AMM 24-22-0/201, Supply Electrical Power, Manual Control (Apply Power)
C. Access
(1) Location Zones
121 Control Cabin - Left
122 Control Cabin - Right
213 Forward Cargo Compartment
214 Mix Manifold Bay

(2) Access Panel
4404R Forward Cargo Door

D. Prepare for the Test
(1) Supply Electrical Power, Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).
(2) Open this circuit breaker and install DO-NOT-CLOSE tag:
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1
(3) Open 4404R, Forward Cargo Door
(4) Remove lining at the aft end of forward cargo compartment to access the cargo compartment fire bottle (AMM 25-52-131/401).

E. Pressure Switch Test
(1) Remove connector from pressure switch D12816 from the pressure switch.
(2) Install a jumper between pins 2 and 3 on the connector D12816.
(a) Make sure the DISCH light on the cargo fire control panel (P8) comes on.
(3) Remove the jumper from the connector D12816.
(a) Make sure the DISCH light on the cargo fire control panel (P8), goes out

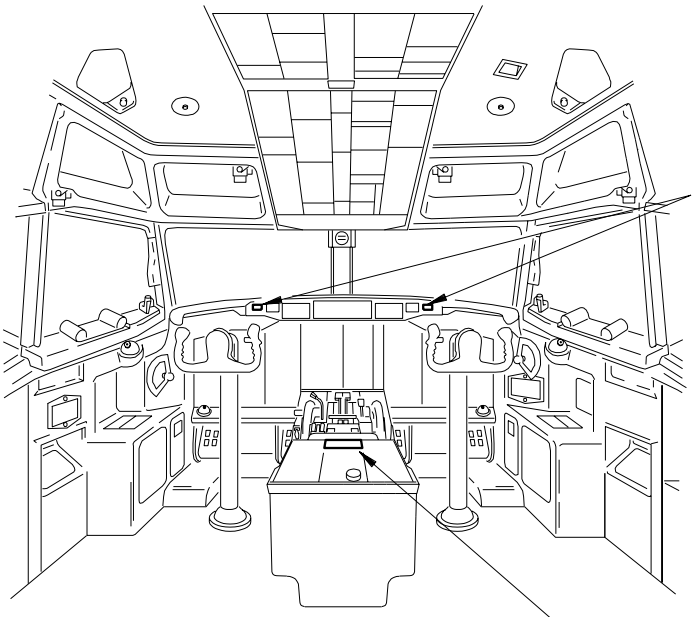
F. Return Airplane to its Normal Condition
(1) Install lining at aft end of forward cargo compartment (AMM 25-52-131/401).
(2) Remove DO-NOT-CLOSE tag and close this circuit breaker:
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1
(3) Close 4404R, Forward Cargo Door.
(4) Remove electrical power if not needed (AMM 24-22-0/201).

4. Cargo Fire Extinguishing Discharge Tube Flow Test (Fig. 502)
A. General
(1) The cargo fire extinguishing discharge tube flow test ensures there is nothing blocking flow through the discharge tubes.

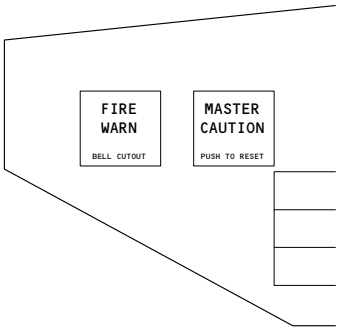
B. Equipment
(1) Source - Air pressure, capable of supplying 30-40 psig

C. Consumables
(1) C00913 Compound - Non-drying Resin Mix Corrosion-Inhibiting Material BMS 3-27

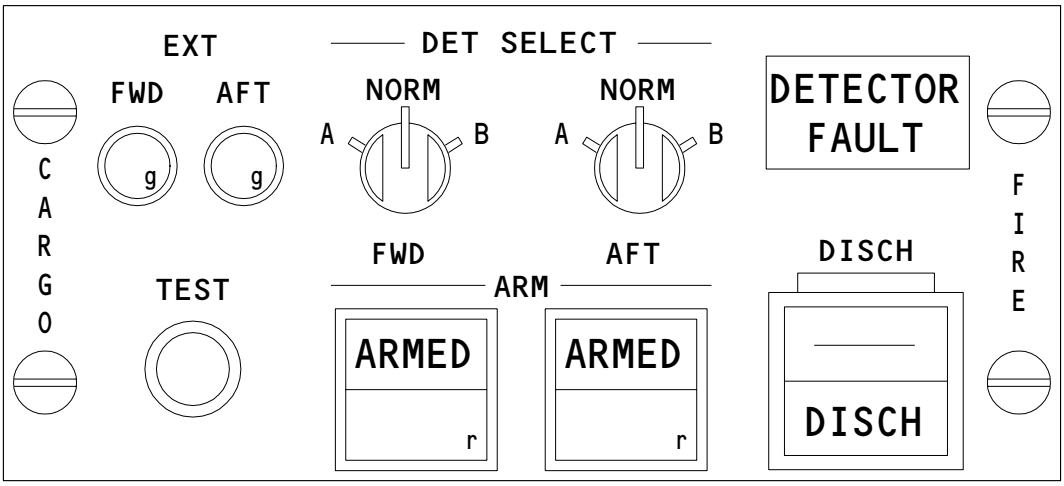
D. Access
(1) Location Zones
121 Control Cabin - Left
122 Control Cabin - Right
213 Forward Cargo Compartment
214 Mix Manifold Bay



FLIGHT COMPARTMENT

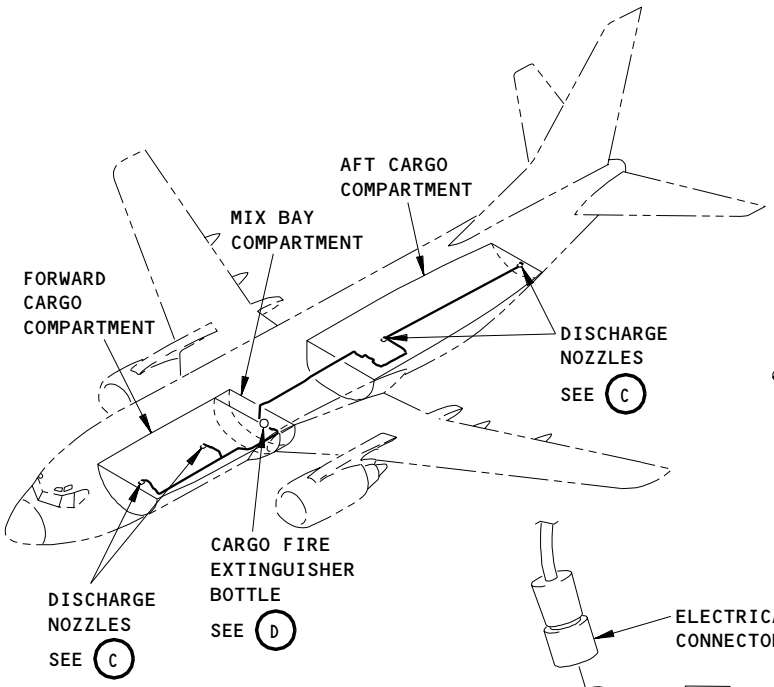


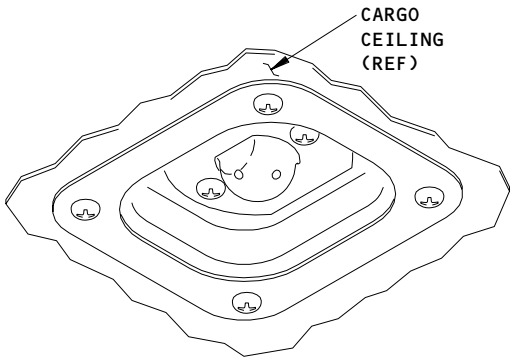
MASTER CAUTION AND
FIRE WARN LIGHTS (P7)
(EXAMPLE)
A



CARGO FIRE CONTROL PANEL (P8)
B

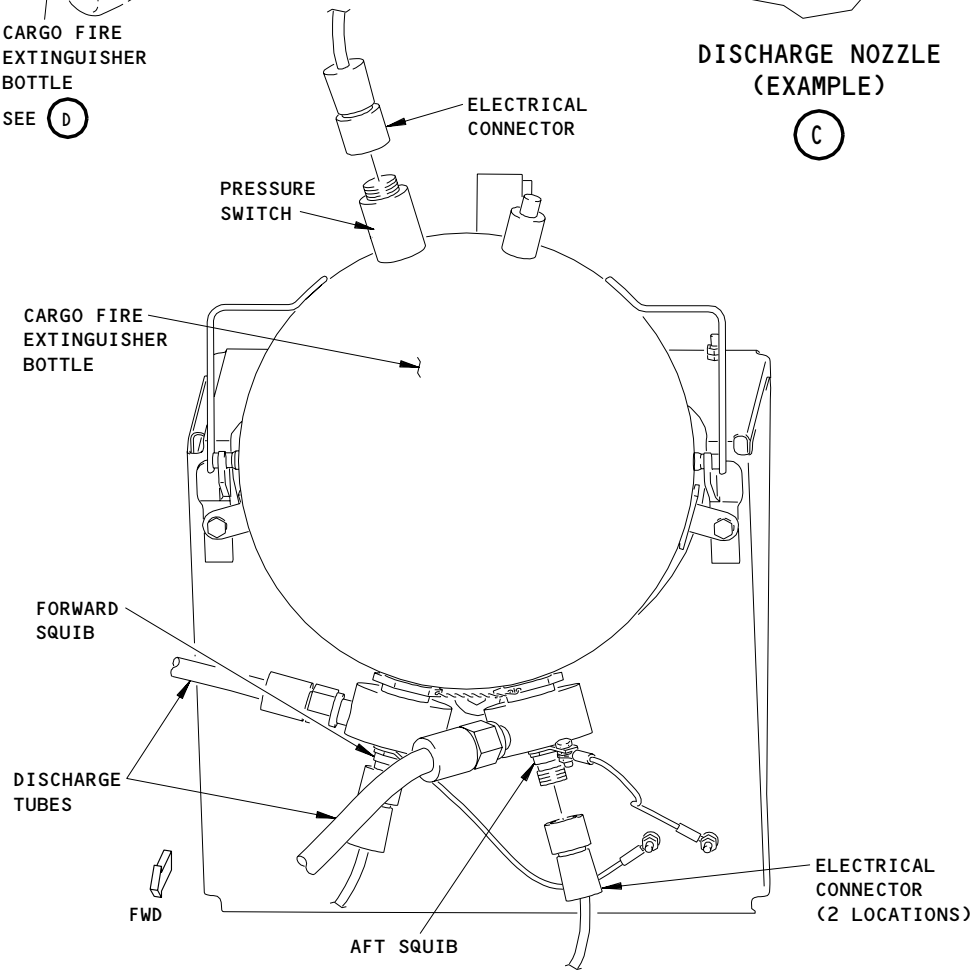
Cargo Bay Fire Extinguishing Test
Figure 501 (Sheet 1)





DISCHARGE NOZZLE
(EXAMPLE)

C



CARGO FIRE EXTINGUISHER BOTTLE

D

Cargo Bay Fire Extinguishing Test
Figure 501 (Sheet 2)

443499

(2) Access Panel
4404R Forward Cargo Door

E. Prepare for Test
(1) Open this circuit breaker and install DO-NOT-CLOSE tag:
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1
(2) Open 4404R, Forward Cargo Door
(3) Remove lining at aft end of forward cargo compartment to gain access to the cargo fire bottle (AMM 25-52-131/401).
(4) If necessary, remove the air conditioning duct in front of the cargo compartment fire bottle, (AMM 21-21-11/401).

F. Cargo Fire Extinguishing Discharge Line Flow Test

WARNING: DO NOT REMOVE PARTS THAT ARE UNDER PRESSURE. THIS CAN CAUSE INJURY TO PERSONNEL OR DAMAGE TO PROPERTY. SPEAK TO THE SAFETY ENGINEER FOR THE NECESSARY SAFETY PRECAUTIONS.

(1) Remove discharge tube from discharge outlets on cargo fire bottle.

CAUTION: APPLY PRESSURE SLOWLY TO THE FIRE EXTINGUISHING TUBING.

(2) Connect the pressure source to the cargo fire bottle forward discharge tube.
(a) Make sure air is flowing from all nozzles in the forward cargo compartment.
(b) Make sure air is not flowing from any nozzles in the aft cargo compartment.
(3) Remove pressure source from discharge tube.
(4) Connect pressure source to cargo fire bottle aft discharge tube.
(a) Make sure air is flowing from all nozzles in the aft cargo compartment.
(5) Remove pressure source from discharge tube.
(6) Connect discharge tubes to discharge outlets on the fire bottle.
(a) Apply a layer of compound BMS3-27 to the outlet threads, outlet end, and outlet inner diameter where the tube assembly attaches to the discharge head.
(b) Connect tube assembly to discharge head.

NOTE: Yellow indicates the plumbing that supplies halon to the forward cargo compartment. Blue indicates the plumbing that supplies halon to the aft cargo compartment.

(c) Remove any excess compound BMS 3-27.
(d) Tighten discharge tubing to 266-294 inch-pounds for the FWD connector (1/2 inch) and 342-378 inch-pounds for the AFT connector (5/8 inch).

G. Return Airplane to its Normal Condition
(1) If removed, install air conditioning duct in front of fire bottle (AMM 21-21-11/401).
(2) Install lining at aft end of forward cargo compartment (AMM 25-52-131/401).
(3) Close 4404R, Forward Cargo Door.

5. Discharge Tube Pressure Test (Fig. 502)
A. General
(1) The discharge tube pressure test should be performed every time a cargo fire bottle is removed from the discharge tube.
(2) The pressure test is the same for the FWD or AFT cargo compartment.
B. Equipment
(1) Source - Air Pressure, capable of supplying 50-55 psig
(2) B26002-1 - Test Equipment - Discharge Lines, Cargo Fire Extinguisher The Boeing Company, 81205 7755 E Marginal Way, P.O. Box 3707, Seattle, WA 98124
C. Consumables
(1) C00913 Compound - Non-drying Resin Mix Corrosion-Inhibiting Material BMS 3-27
D. Access
(1) Location Zones

121	Control Cabin - Left
122	Control Cabin - Right
213	Forward Cargo Compartment
214	Mix Manifold Bay

(2) Access Panels

4404R	Forward Cargo Door

E. Prepare for Test
(1) Open this circuit breaker and install DO-NOT-CLOSE tag:
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1
(2) Open 4404R, Forward Cargo Door.
(3) Remove lining at aft end of forward cargo compartment to gain access to the cargo fire bottle (AMM 25-52-131/401).
(4) If needed, remove the air conditioning duct in front of the cargo compartment fire bottle, (AMM 21-21-11/401).
F. Discharge Tube Pressure Test

WARNING: DO NOT REMOVE PARTS THAT ARE UNDER PRESSURE. THIS CAN CAUSE INJURY TO PERSONNEL OR DAMAGE TO PROPERTY. SPEAK TO THE SAFETY ENGINEER FOR THE NECESSARY SAFETY PRECAUTIONS.

(1) Remove discharge tubes from discharge outlets on cargo fire bottle.

CAUTION: APPLY PRESSURE SLOWLY TO THE FIRE EXTINGUISHING TUBING.

(2) Connect pressure source to the cargo fire bottle forward discharge tube.
(3) Install plugs in discharge nozzle tubing in forward cargo compartment.
(4) Pressurize discharge tubing to 50-55 psig.
    (a) Wait at least 3 minutes for air pressure to stabilize.
(5) Turn off pressure source.
    (a) Record stabilized air pressure.
    (b) Wait 10 minutes, then check the pressure.
        1) Ensure pressure loss during the 10-minute waiting period does not exceed .5 psig.
(6) Bleed discharge tubing to 0 psig, then disconnect pressure source.
(7) Remove plugs from discharge nozzle tubing, and reinstall discharge nozzles.
    (a) Tighten to 45-55 pound-feet and install lockwire.
(8) Connect air source to cargo fire bottle aft discharge tube.
(9) Install plugs on discharge nozzles in aft cargo compartment.
(10) Pressurize discharge tubing to 50-55 psig.
    (a) Wait at least 3 minutes for air pressure to stabilize.
(11) Turn off pressure source.
    (a) Record stabilized air pressure.
    (b) Wait 10 minutes, then check the pressure.
        1) Ensure pressure loss during the 10-minute waiting period does not exceed .5 psig.
(12) Bleed discharge tubing to 0 psig, then disconnect pressure source.
(13) Remove plugs from discharge nozzle tubing, and reinstall discharge nozzles.
    (a) Tighten to 45-55 pound-feet and install lockwire.
(14) Connect discharge tubes to discharge outlets on the fire bottle.
    (a) Apply a layer of compound BMS3-27 to the outlet threads, outlet end and outlet inner diameter where tube assembly attaches to discharge head.
    (b) Connect discharge tube assembly to discharge head.

        NOTE: Yellow indicates the plumbing that supplies halon to the forward cargo compartment. Blue indicates plumbing that supplies halon to the aft cargo compartment.

    (c) Remove any excess compound BMS3-27.
    (d) Tighten discharge tubing to 266-294 inch-pounds for the FWD connector (1/2 inch) and 342-378 inch-pounds for the AFT connector (5/8 inch).

G. Return Airplane to its Normal Condition
(1) If removed, install air conditioning duct in front of cargo fire bottle (AMM 21-21-11/401).

(2) Install lining at aft end of forward cargo compartment (AMM 25-52-131/401).
(3) Close 4404R, Forward Cargo Door.

CARGO COMPARTMENT FIRE EXTINGUISHING SYSTEM - CLEANING/PAINTING

1. General
   A. This procedure has tasks to clean the cargo fire extinguishing system.
   B. The cargo fire extinguishing system should be cleaned whenever the cargo fire bottle has been discharged.
   C. Only components in the compartment in which the cargo fire bottle was discharged need to be cleaned.
   D. Cleaning procedures are the same for the forward and aft cargo compartment systems.
2. Cargo Fire Extinguishing System Cleaning
   A. Equipment
      (1) Air pressure source - capable of supplying 30-40 psig.
   B. Consumable Materials
      (1) C00913 Compound, Non-drying Resin Mix Corrosion-Inhibiting Material - BMS3-27
   C. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          214 Mix Manifold Bay
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

   D. Prepare for Cleaning
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) Circuit Breaker Panel P6 or P18:
              1) CARGO FIRE EXT 1
      (2) Open 4404R Forward Cargo Door, or 4504R Aft Cargo Door.
      (3) Gain access to the discharge nozzles in the forward or aft cargo compartment.
      (4) Remove the lining at the aft end of the forward cargo compartment, to gain access to the cargo fire bottle (AMM 25-52-131/401).
      (5) If required, remove the air conditioning duct in front of the cargo fire bottle (AMM 21-21-11/401).
      (6) Disconnect the appropriate discharge tube from the cargo fire bottle discharge head.
      (7) Remove discharge nozzles from the discharge tubing in the applicable cargo bay (Fig. 701).
          (a) Remove four screws securing pan cover retainer to ceiling bracket.
          (b) Remove cargo compartment ceiling panel as required to gain access to discharge tubing connection (AMM 25-52-111/401).
          (c) Remove the two discharge nozzle screws. Retain discharge nozzle spacer, pan cover assembly, pan cover spacer and discharge nozzle.

(d) Remove lockwire and discharge nozzle from discharge tube.

E. Procedure

(1) Make sure discharge nozzle is free of unwanted debris.

(2) Connect air pressure source to selected cargo fire bottle discharge tube.

(a) Make sure air is flowing from all discharge nozzles in the selected cargo compartment.

(3) Remove the pressure source from the selected cargo fire bottle discharge tube.

F. Return Airplane to its Normal Condition

(1) Connect discharge tubing to discharge head on cargo fire bottle.

(a) Apply a layer of BMS3-27 compound to outlet threads, outlet end, and outlet inner diameter where tube assembly attaches to discharge head.

(b) Connect tube assembly to discharge head.

NOTE: Yellow indicates the plumbing that supplies halon to the forward cargo compartment. Blue indicates the plumbing that supplies halon to the aft cargo compartment.

(c) Remove any excess BMS3-27 compound.

(d) Tighten discharge tubes to 266-294 pound-inches for the FWD (1/2 inch) connector and 342-378 pound-inches for the AFT (5/8 inch) connector.

(2) If removed, install air conditioning duct in front of cargo fire bottle (AMM 21-21-11/401).

(3) Install lining at the aft end of forward cargo compartment (AMM 25-52-131/401).

(4) Install discharge nozzles on the discharge tubes.

(a) Install discharge nozzle, spacers and pan cover assembly on discharge tube and hand tighten.

NOTE: Make sure pan cover assembly holes and pan cover spacer line up with those in ceiling bracket. Make sure holes in discharge nozzle and discharge nozzle spacer line up with those in pan cover assembly.

(b) Torque discharge tube nut to 45-55 pound-feet, and install lockwire.

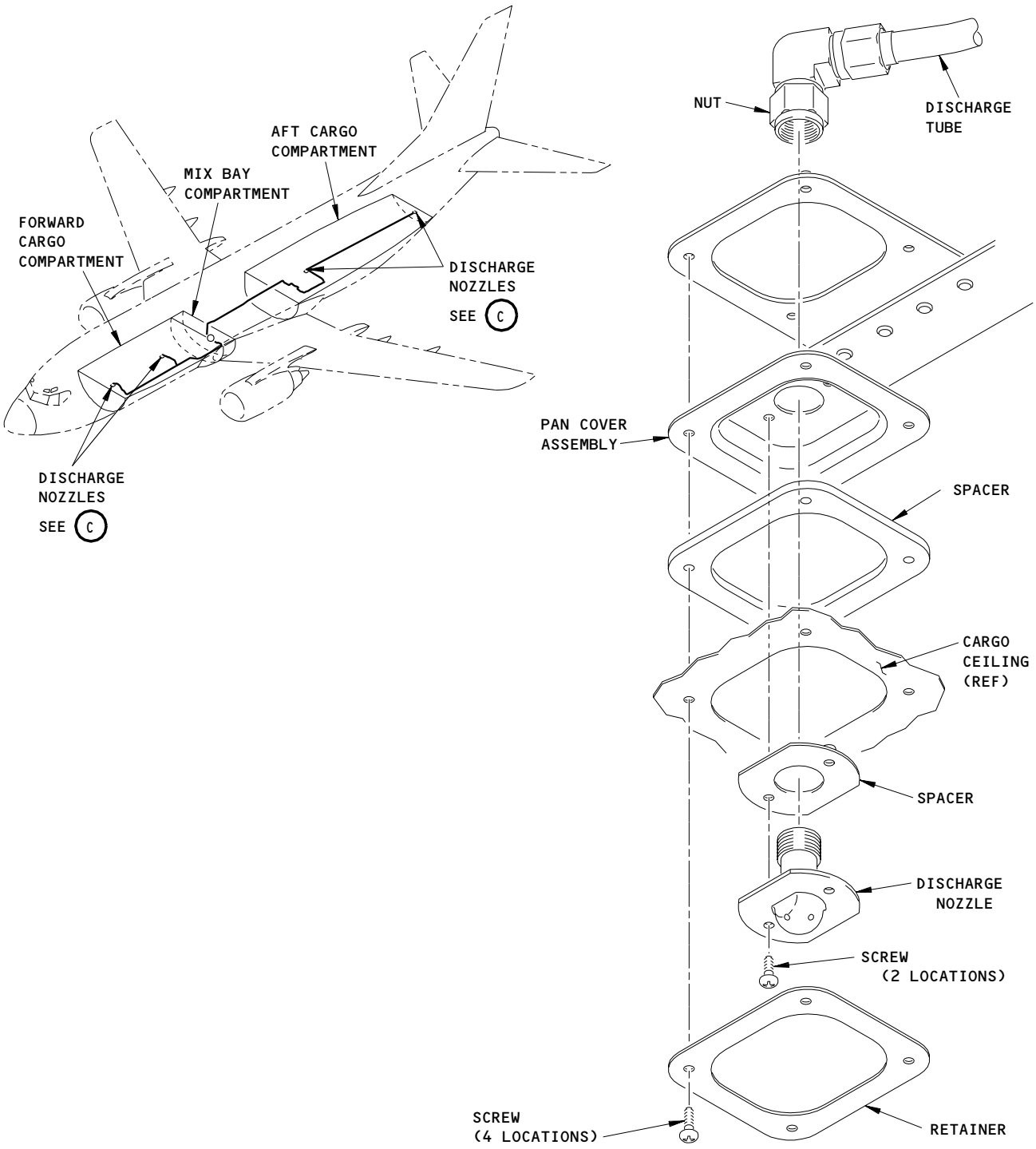
(c) Secure discharge nozzle to pan cover assembly with two mounting screws.

(d) Align pan cover spacer and retainer, secure with four mounting screws.

(e) Install cargo compartment ceiling panel (AMM 25-52-111/401).

(f) If removed, install air conditioning duct in front of cargo fire bottle (AMM 21-21-11/401).

(5) Close this circuit breaker and remove DO-NO-CLOSE tag:
    (a) Circuit Breaker Panel P6 or P18:
        1) CARGO FIRE EXT 1
(6) Close 4404R, Forward Cargo Door, or 4504R, Aft Cargo Door.



Cargo Bay Fire Extinguishing System Tubing Cleaning
Figure 701

CARGO COMPARTMENT FIRE EXTINGUISHING BOTTLE - REMOVAL/INSTALLATION

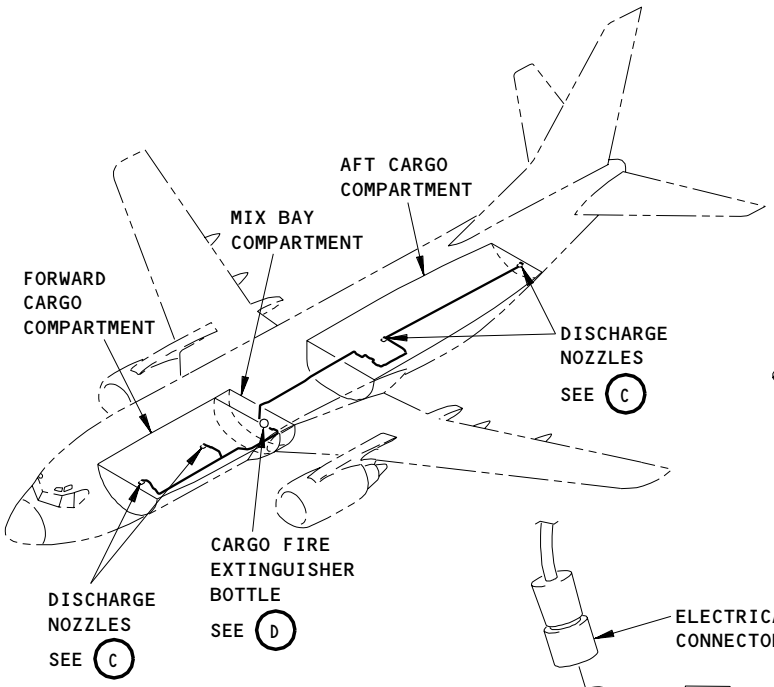
1. General
   A. A cargo fire extinguishing bottle is installed in the mix manifold bay, in the aft end of the forward cargo compartment.
   B. This procedure has tasks to remove and install the cargo fire extinguishing bottle.
2. Remove Cargo Fire Extinguishing Bottle (Fig. 401)
   A. Equipment
      (1) Squib Protective Cover
         (a) M83723/60-28-AN or AC (Fwd Squib)
         (b) M83723/60-210-AN or AC (Aft Squib)
      (2) Discharge Port Cap (Fwd Port - 1/2 inch, Aft Port - 5/8 inch) - Supplied with the cargo fire bottle
   B. References
      (1) AMM 20-40-12/201, Electrostatic Discharge Sensitive Devices
      (2) AMM 24-22-0/201, Manual Control (Apply Power)
      (3) AMM 25-52-131/401, Cargo Compartment Bulkhead Lining
   C. Access
      (1) Location Zones
         213 Forward Cargo Compartment
         214 Mix Manifold Distribution Bay

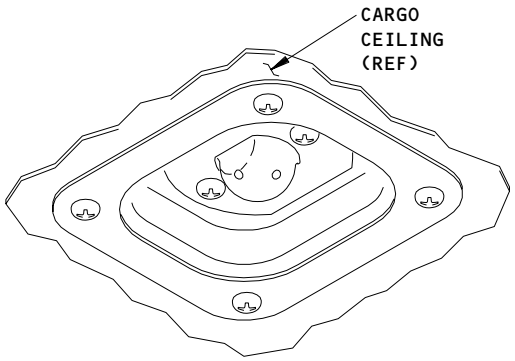
      (2) Access Panel
         4404R Fwd Cargo Door

   D. Prepare for Removal
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
         (a) Circuit Breaker Panel P6 or P18:
            1) CARGO FIRE EXT 1
      (2) Open 4404R, Forward Cargo Door
      (3) Remove lining at the aft end of the forward cargo compartment to gain access to mix manifold bay (AMM 25-52-131/401).
      (4) If necessary, remove air conditioning duct in front of fire extinguishing bottle (AMM 21-21-11/401).

         WARNING: REFER TO AMM 20-40-12 BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

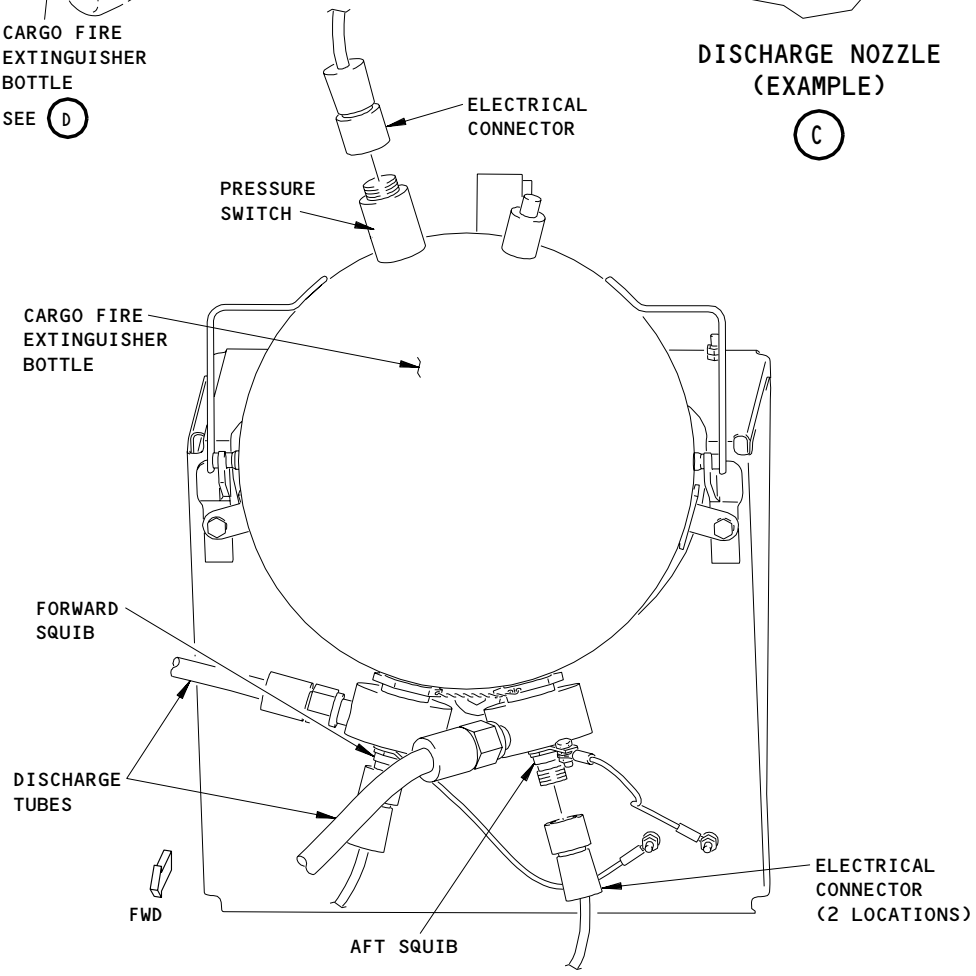
      (5) Before touching squibs, perform procedure for devices that are sensitive to electrostatic discharge (AMM 20-40-12/201).
   E. Remove Fire Extinguishing Bottle
      (1) Disconnect the electrical connectors from the bottle.
         (a) Disconnect pressure switch connector D12792
         (b) Disconnect FWD Squib (M2249) connector D12794





DISCHARGE NOZZLE (EXAMPLE)

C



CARGO FIRE EXTINGUISHER BOTTLE

D

Cargo Bay Fire Extinguishing Test
Figure 401

443502

(c) Disconnect AFT Squib (M2250) connector D12796

WARNING: PUT A PROTECTIVE COVER ON THE FIRE BOTTLE SQUIB. FAILURE TO PUT A PROTECTIVE COVER ON THE FIRE BOTTLE SQUIB CAN CAUSE THE FIRE BOTTLE TO RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.

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

(2) Put a protective cover on FWD and AFT bottle squibs.
(3) Remove nut to disconnect ground strap from bottle ground lug.
(4) Disconnect the discharge tubes from the bottle discharge ports.
(5) Install a cap on bottle discharge ports.
(6) Install a cap on discharge tubes.
(7) Remove bolts (three places) from support bracket.
(8) Use service handles to remove cargo fire bottle.

3. Install Cargo Fire Extinguishing Bottle (Fig. 401)

A. Equipment
(1) Voltmeter - with a 10k ohm or greater resistance
(2) Ohmmeter - capable of measuring 0.0001 ohm

B. References
(1) AMM 20-40-12/201, Electrostatic Sensitive Devices
(2) AMM 24-22-0/201, Manual Control (Apply Power)
(3) AMM 25-52-131/401, Cargo Compartment Bulkhead Lining

C. Consumables
(1) C00913, Compound, Nondrying Resin Mix Corrosion Inhibiting Material - BMS 3-27
(2) B00083, Solvent, Aliphatic Naphtha - TT-N-95

D. Access
(1) Location Zones
213 Forward Cargo Compartment
214 Mix Manifold Bay

(2) Access Panel
4404R Forward Cargo Door

E. Prepare for Installation
(1) Supply Electrical Power Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).
(2) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1
(3) Open 4404R, Forward Cargo Door.
(4) Remove lining at aft end of forward cargo compartment to gain access to mix manifold bay (AMM 25-52-131/401).

(5) If necessary, remove air conditioning duct in front of fire extinguishing bottle (AMM 21-21-11/401).

WARNING: REFER TO AMM 20-10-12 BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

(6) Before touching squib, do the procedure for devices sensitive to electrostatic discharge (AMM 20-40-12/201).

F. Install Bottle

WARNING: DO NOT MOVE BOTTLE WITHOUT A CAP ON PORTS. DO NOT LET BOTTLE HIT THE AIRPLANE. BE CAREFUL NOT TO CAUSE DAMAGE TO BOTTLE. DAMAGE TO BOTTLE CAN CAUSE IT TO RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Before installing bottle, make sure its weight is not more than 0.1 pound from weight marked on ID plate of bottle.

NOTE: The measured weight of bottle includes; charged bottle, discharge outlets, ground lug and squibs. If the squibs are not installed on bottle, do not install them. Weigh the squibs as loose parts. Include weight of squibs in the measured weight but do not install them. If squibs are installed, weigh bottle with squibs. Remove protective caps when weighing parts.

(2) Lift bottle using service handles and set it on support brackets.
(3) Install bolts and washers to hold bottle in position.
(4) If discharge ports are not aligned with discharge tubes, perform this step:
  (a) Remove lockwire from gland nuts.
  (b) Loosen discharge head gland nuts.
  (c) Adjust discharge heads to give best possible access to tube connections.
(5) Remove caps from discharge port and discharge tube.
(6) Connect FWD (yellow) and AFT (blue) discharge tubes to discharge ports.
  (a) Apply a layer of compound, BMS 3-27 to threads where tube attaches to discharge port.
  (b) Connect the discharge tubes to the discharge ports.
  (c) Refer to outlet identification above each discharge outlet to ensure tubes are connected to correct ports.
  (d) Remove all unwanted compound, BMS 3-27.
(7) If discharge head was adjusted, perform these steps:
  (a) Tighten gland nuts to 540-660 pound-inches.
  (b) Attach a lockwire from one gland nut to the other gland nut.
(8) Tighten the discharge tubes to 266-294 pound-inches for the FWD (1/2 inch) connector and 342-378 pound-inches for the AFT (5/8 inch) connector.

(9) Install the nuts to connect the ground straps to the ground lugs.
(10) Use an ohmmeter to check resistance between fire extinguishing bottle and mounting pan.
  (a) Make sure resistance is less than 0.0025 ohm.
  (b) If resistance is greater than 0.0025 ohm, clean the faying surfaces with solvent TT-N-95.
  (c) Do the resistance check again.

WARNING: REFER TO AMM 20-10-12 BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

(11) If discharge cartridge (squib) is not installed on fire extinguisher bottle, perform the steps that follow:
  (a) Install squib in discharge head (AMM 26-25-02/401).
(12) AIRPLANES WITHOUT FIRE BOTTLES WITH MANUAL-OVERRIDE ON THE PRESSURE SWITCH;
do a test of the fire extinguisher pressure switch.
  (a) Connect a jumper wire between pins 2 and 3 on D12792.
    1) Make sure the DISCH light on the Cargo Fire Control Panel comes on.
  (b) Remove the jumper wire.
  (c) Install the electrical connector to the pressure switch on bottle 1.
    1) Make sure the DISCH light on the Cargo Fire Control Panel is off.
(13) AIRPLANES WITH FIRE BOTTLES WITH MANUAL-OVERRIDE ON THE PRESSURE SWITCH;
do a test of the fire extinguisher pressure switch.
  (a) Install the electrical connector to the pressure switch on bottle 1.
  (b) Push and hold the pressure switch manual-override button on the fire extinguisher bottle.
    1) Make sure the DISCH light on the Cargo Fire Control Panel comes on.
  (c) Release the pressure switch manual-override button on the fire extinguisher bottle.
    1) Make sure the DISCH light on the Cargo Fire Control Panel goes off.
(14) Connect and perform a test of FWD squib to fire extinguishing bottle.
  (a) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
    1) Circuit Breaker Panel P6 or P18:
      a) CARGO FIRE EXT 1

(b) Perform these steps to connect electrical connector, D12794, to FWD squib of bottle.
1) Remove protective cover from FWD squib.

WARNING: MAKE SURE THERE IS NO VOLTAGE AT ELECTRICAL CONNECTOR. IF THERE IS A VOLTAGE AT ELECTRICAL CONNECTOR, SQUIB CAN RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.

2) Make sure there is no voltage between pins 1 and 2 of electrical connector, D12794.

NOTE: Connect a 10K ohm resistor across meter leads to remove all stray voltage from electrical connector.

3) Make sure squib pins are not bent or damaged.
4) Make sure electrical connector is not damaged.

NOTE: The squib pins can cause damage to the connector if the pins do not enter electrical connector receptacle correctly.

5) Connect electrical connector, D12794, to FWD squib of fire bottle.
(c) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) Circuit Breaker Panel P6 or P18:
a) CARGO FIRE EXT 1
(d) On the cargo fire control panel (P8), push and hold TEST switch.
1) Make sure FWD EXT light (Green) on cargo fire control panel (P8) illuminates.
2) Make sure AFT EXT light (Green) stays off.
(e) Release TEST switch.
1) Make sure FWD EXT light (Green) goes off.
(15) Connect and perform a test of the AFT squib to the fire extinguishing bottle.
(a) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
1) Circuit Breaker Panel P6 or P18:
a) CARGO FIRE EXT 1
(b) Perform these steps to connect electrical connector D12796, to AFT squib of bottle.
1) Remove protective cover from AFT squib.

WARNING: MAKE SURE THERE IS NO VOLTAGE AT ELECTRICAL CONNECTOR. IF THERE IS A VOLTAGE AT ELECTRICAL CONNECTOR, THE SQUIB CAN RELEASE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONS.

2) Make sure there is no voltage between pins 1 and 2 of electrical connector, D12796.

NOTE: Connect a 10K ohm resistor across meter leads to remove all stray voltage from electrical connector.

3) Make sure squib pins are not bent or damaged.
4) Make sure electrical connector is not damaged.

NOTE: The squib pins can cause damage to the connector if the pins do not enter the electrical connector receptacle correctly.

5) Connect electrical connector D12796, to AFT squib of fire bottle.

(c) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) Circuit Breaker Panel P6 or P18:
a) CARGO FIRE EXT 1

(d) On the cargo fire control panel (P8), push and hold TEST switch.
1) Make sure FWD and AFT EXT lights (Green) on the cargo fire control panel (P8) illuminate.

(e) Release TEST switch.
1) Make sure FWD and AFT EXT lights (Green) go off.

G. Return the Airplane to Its Usual Condition
(1) If removed, install air conditioning duct in front of fire extinguishing bottle (AMM 25-52-131/401).
(2) Install lining at aft end of forward cargo compartment (AMM 25-52-131/401).
(3) Close 4404R, Forward Cargo Door.
(4) Remove electrical power if not needed (AMM 24-22-0/201).

CARGO COMPARTMENT FIRE EXTINGUISHER BOTTLE SQUIB - REMOVAL/INSTALLATION

1. General
   A. This procedure has tasks to remove and install the cargo fire bottle squibs.
   B. The cargo fire bottle is installed in the mix manifold bay, in the aft end of the lower fwd cargo compartment. The cargo fire bottle has two discharge cartridges (squibs).
2. Remove the Cargo Fire Extinguisher Bottle Squib (Fig. 401)
   A. Equipment
      (1) Squib Protective Cover
          (a) M83723/60-28-AN or AC (Fwd Squib)
          (b) M83723/60-210-AN or AC (Aft Squib)
      (2) Discharge port cap (Fwd Port - 1/2 inch, Aft Port - 5/8 inch)
   B. Reference
      (1) AMM 20-40-12/201, Electrostatic Discharge Sensitive Devices
   C. Access
      (1) Location Zone
          214 Air Conditioning Distribution Bay

      (2) Access Panel
          4404R Forward Cargo Door

   D. Prepare for Removal
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) Circuit Breaker Panel P6 or P18:
              1) CARGO FIRE EXT 1
      (2) Open 4404R, Forward Cargo Door.
      (3) Remove lining at the aft end of forward cargo compartment to gain access to the mix manifold bay (AMM 25-52-131/401).

          WARNING: REFER TO AMM 20-40-12 BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

      (4) Prior to touching squibs, perform procedure for devices that are sensitive to electrostatic discharge (AMM 20-40-12/201).
   E. Remove Squib
      (1) The procedure is the same for the removal of the FWD or AFT squib.
      (2) Disconnect the electrical connector from selected squib.
          (a) FWD Squib (M2249) connector D12794.

(b) AFT Squib (M2250) connector D12796.

WARNING: INSTALL PROTECTIVE COVERS ON THE SQUIBS. IF YOU DO NOT PUT PROTECTIVE COVERS ON THE SQUIBS, THE FIRE EXTINGUISHING BOTTLE CAN DISPENSE ITS CONTENTS SUDDENLY AND CAUSE INJURY TO PERSONNEL.

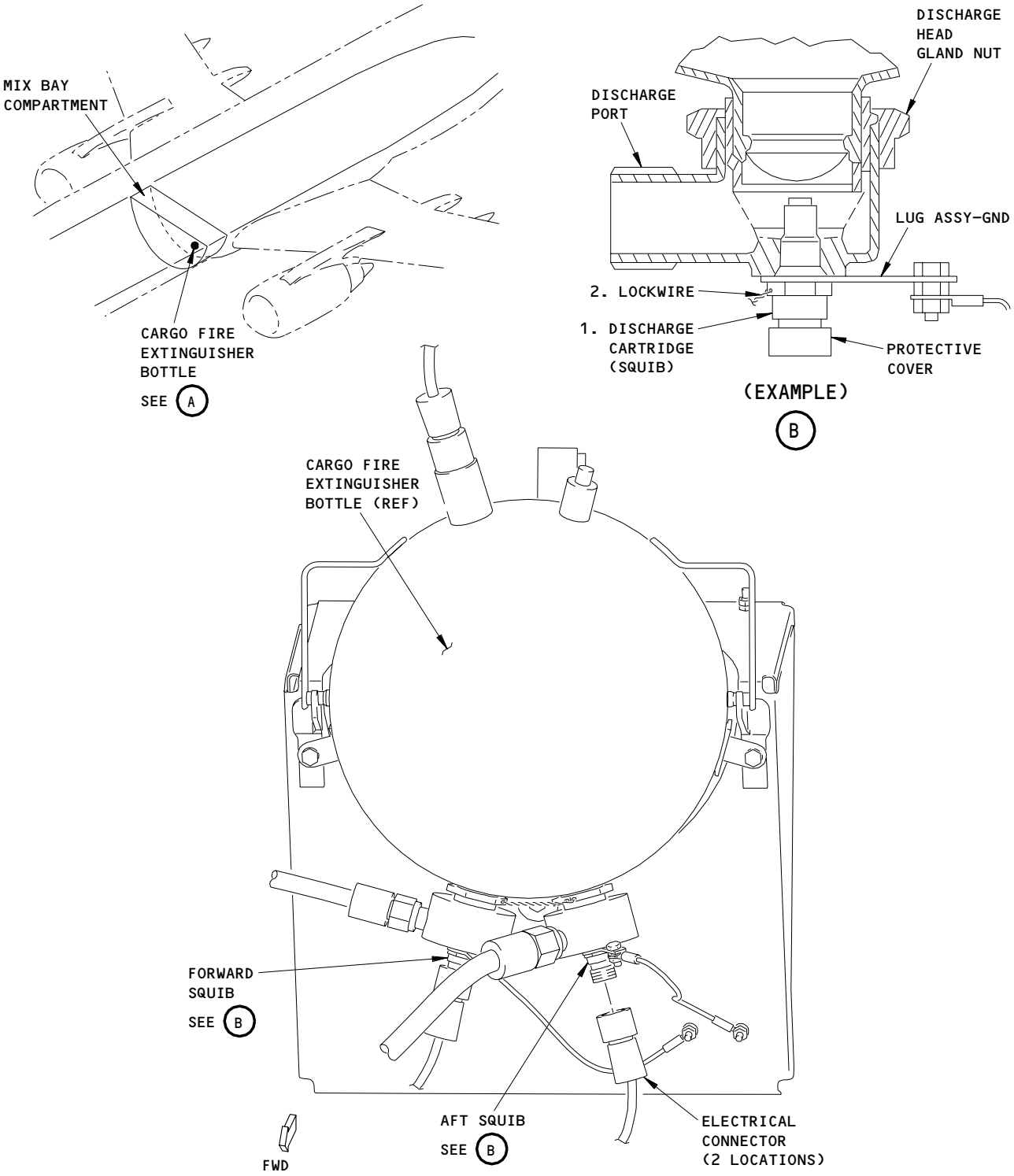
CAUTION: DO NOT PUT A SHUNT PLUG ON THE FIRE BOTTLE SQUIB. THE SHUNT PLUG CAN CAUSE DAMAGE TO THE SQUIB CONNECTOR PINS.

(3) Install protective cover on the cargo fire bottle squib.
(4) Remove lockwire from the squib.
(5) Remove squib from the discharge head.

3. Install the Cargo Fire Extinguisher Bottle Squib (Fig. 401)
   A. Equipment
      (1) Voltmeter with a 10K ohm or greater resistance
   B. References
      (1) AMM 20-40-12/201, Electrostatic Discharge Sensitive Devices
      (2) AMM 24-22-0/201, Manual Control (Apply Power)
   C. Access
      (1) Location Zone
          214 Mix Manifold Distribution Bay

      (2) Access Panel
          4404R Forward Cargo Door

   D. Prepare for Installation
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) Circuit Breaker Panel P6 or P18:
              1) CARGO FIRE EXT 1
      (2) Open 4404R, Forward Cargo Door.
      (3) Remove lining at aft end of forward cargo compartment to gain access to the mix manifold bay (AMM 25-52-131/401).



CARGO FIRE EXTINGUISHER BOTTLE

A

Cargo Compartment Fire Extinguisher Bottle Squib Installation
Figure 401

(4) If necessary, remove the air conditioning duct that is in front of the fire-extinguishing bottle (AMM 21-21-11/401).

E. Install Squib

(1) The procedure is the same for installation of either the FWD or AFT squib.

(2) Accomplish these steps to install the squib.

WARNING: REFER TO AMM 20-40-12/201, BEFORE PROCEEDING WITH THE FOLLOWING STEPS. ELECTROSTATIC DISCHARGE CAN CAUSE THE FIRE BOTTLE SQUIB TO FIRE AND RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

(a) Prior to touching squibs, perform procedure for devices that are sensitive to electrostatic discharge (AMM 20-40-12/201).

(b) Install squib in the discharge head.

(c) Torque squib to 90-100 pound-inches.

(d) Install lockwire on the squib.

(e) Remove protective cover from the squib.

WARNING: MAKE SURE THERE IS NO VOLTAGE AT THE ELECTRICAL CONNECTOR. IF THERE IS VOLTAGE AT THE ELECTRICAL CONNECTOR, THE SQUIB CAN RELEASE THE BOTTLE CONTENTS SUDDENLY, CAUSING INJURY TO PERSONNEL.

(f) Make sure there is no voltage between pins 1 and 2 of electrical connector.

NOTE: Connect a 10K-ohm resistor across the meter leads to remove all stray voltage from the electrical connect.

(g) Make sure squib pins are not bent or damaged.

(h) Make sure electrical connector is not damaged.

NOTE: Squib pins can cause damage to the connector if pins do not enter electrical connector receptacle correctly.

(i) Connect electrical connector to the cargo fire bottle squib.

F. Perform an Installation Test of the Squib.

(1) Supply Electrical Power, Manual Control - Maintenance Practices (Apply Power) (AMM 24-22-0/201).

(2) Remove the DO-NOT-CLOSE tags and close this circuit breaker:

(a) Circuit Breaker Panel P6 or P18:

1) CARGO FIRE EXT 1

(3) Push and hold the TEST switch on the cargo fire control panel (P8).

(a) Ensure FWD and AFT EXT lights (Green) on the cargo fire control panel illuminate.

(4) Release TEST switch on the cargo fire control panel (P8).

(a) FWD and AFT EXT lights (Green) will go out.

G. Return the airplane to its normal condition.
   (1) If it was removed, reinstall the air conditioning duct that goes in front of the fire bottle (AMM 21-21-11/401).
   (2) Install lining at the aft end of the forward cargo compartment (AMM 25-52-131/401).
   (3) Close 4404R, Forward Cargo Door.
   (4) Remove electrical power if it is no longer needed (AMM 24-22-0/201).

NOZZLE-CARGO COMPARTMENT DISCHARGE - REMOVAL/INSTALLATION

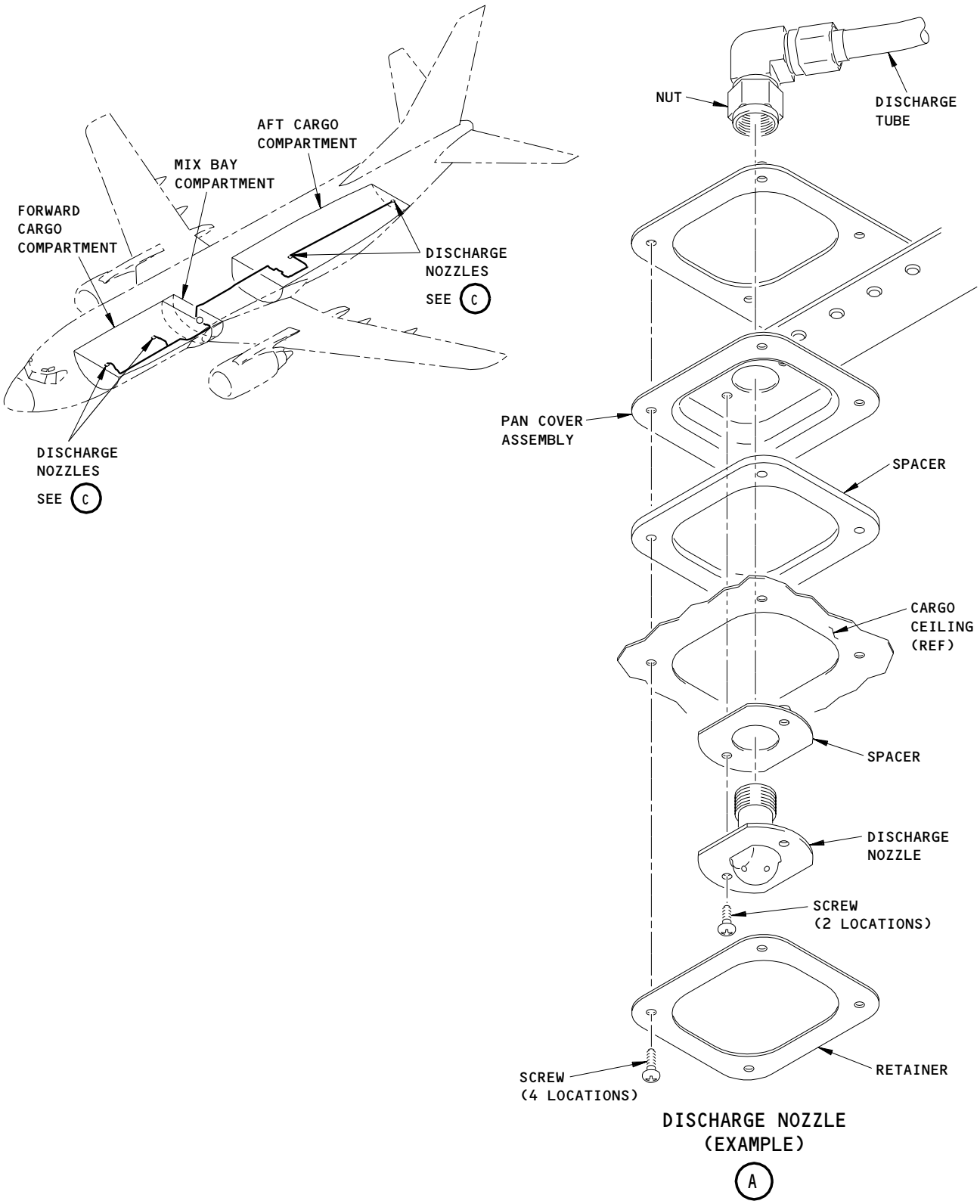
1. General
   A. This procedure has these tasks:
      (1) Removal of the Fwd/Aft cargo compartment discharge nozzle(s).
      (2) Installation of the Fwd/Aft cargo compartment discharge nozzle(s).
2. Cargo Compartment Discharge Nozzle(s) Removal (Fig. 401)
   A. Reference
      (1) AMM 25-52-131/401, Cargo Compartment Lining
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

   C. Prepare for Removal
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) Circuit Breaker Panel P6 or P18:
              1) CARGO FIRE EXT 1
      (2) Open 4404R, Forward Cargo Door or 4504R, Aft Cargo Door.
   D. Remove cargo compartment discharge nozzle.
      (1) Remove forward or aft cargo compartment ceiling lining as required (AMM 25-52-111/401).
      (2) Remove screws holding discharge nozzle to pan cover assembly and retain the spacer.
      (3) Disconnect discharge nozzle from discharge tube.
      (4) Install protective cover over discharge tube end.
3. Cargo Bay Smoke Detector Installation (Fig. 401)
   A. Reference
      (1) AMM 25-52-111/401, Cargo Compartment Ceiling Lining
   B. Access
      (1) Location Zones
          213 Forward Cargo Compartment
          215 Aft Cargo Compartment

      (2) Access Panels
          4404R Forward Cargo Door
          4504R Aft Cargo Door

   C. Prepare for Installation
      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) Circuit breaker Panel P6 or P18:
              1) CARGO FIRE EXT 1
      (2) Open the 4404R Forward Cargo Door or 4504R Aft Cargo Door.
   D. Install Cargo Compartment Discharge Nozzle
      (1) Remove protective cover installed on discharge tube.



Cargo Compartment Discharge Nozzle Removal/Installation
Figure 401

(2) Connect discharge nozzle to discharge tube, tighten to 45-55 pound-feet and install lockwire.
(3) Install discharge nozzle screws through spacer and attach to pan cover assembly.
(4) Install the forward or aft cargo compartment ceiling lining as required (AMM 28-52-111/401).
(5) Remove the DO-NOT-CLOSE tag and close this circuit breaker
(a) Circuit Breaker Panel P6 or P18:
1) CARGO FIRE EXT 1

E. Return the airplane to its normal condition
(1) Close 4404R, Forward Cargo Door or 4504R, Aft Cargo Door.