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3	DEC 01/04	18
4	DEC 01/04	16
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6	DEC 01/04	05
7	DEC 01/04	02
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203	DEC 01/04	01
204	DEC 01/04	01
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15	DEC 01/04	07
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21-41-0		
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105	DEC 01/04	02
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21-51-11		
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404	DEC 01/04	02

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104	DEC 01/04	01
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106	DEC 01/04	01
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503	DEC 01/04	06
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403	DEC 01/04	01
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403	DEC 01/04	01
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403	DEC 01/04	13
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402	DEC 01/04	02
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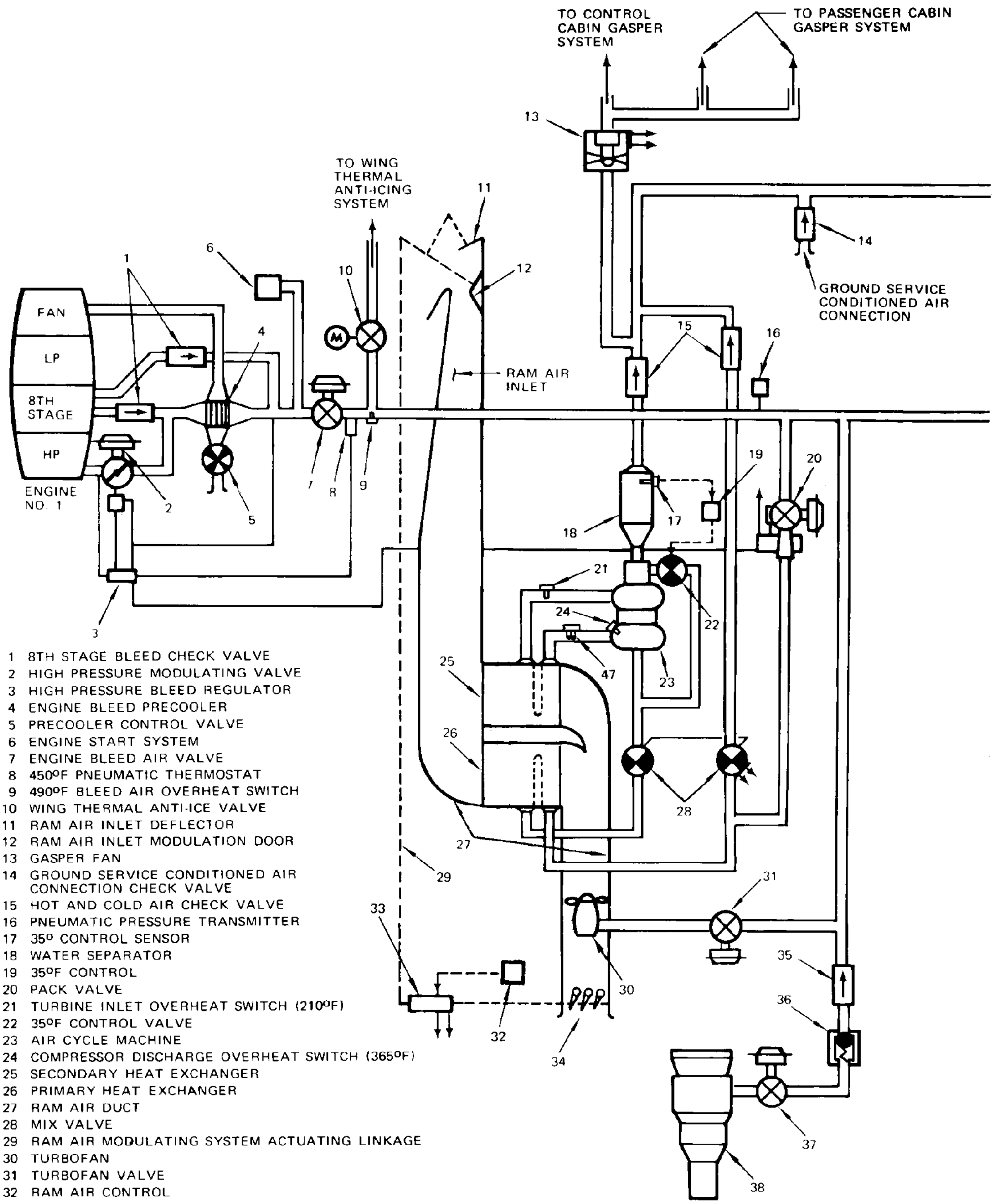
AIR CONDITIONING - DESCRIPTION AND OPERATION

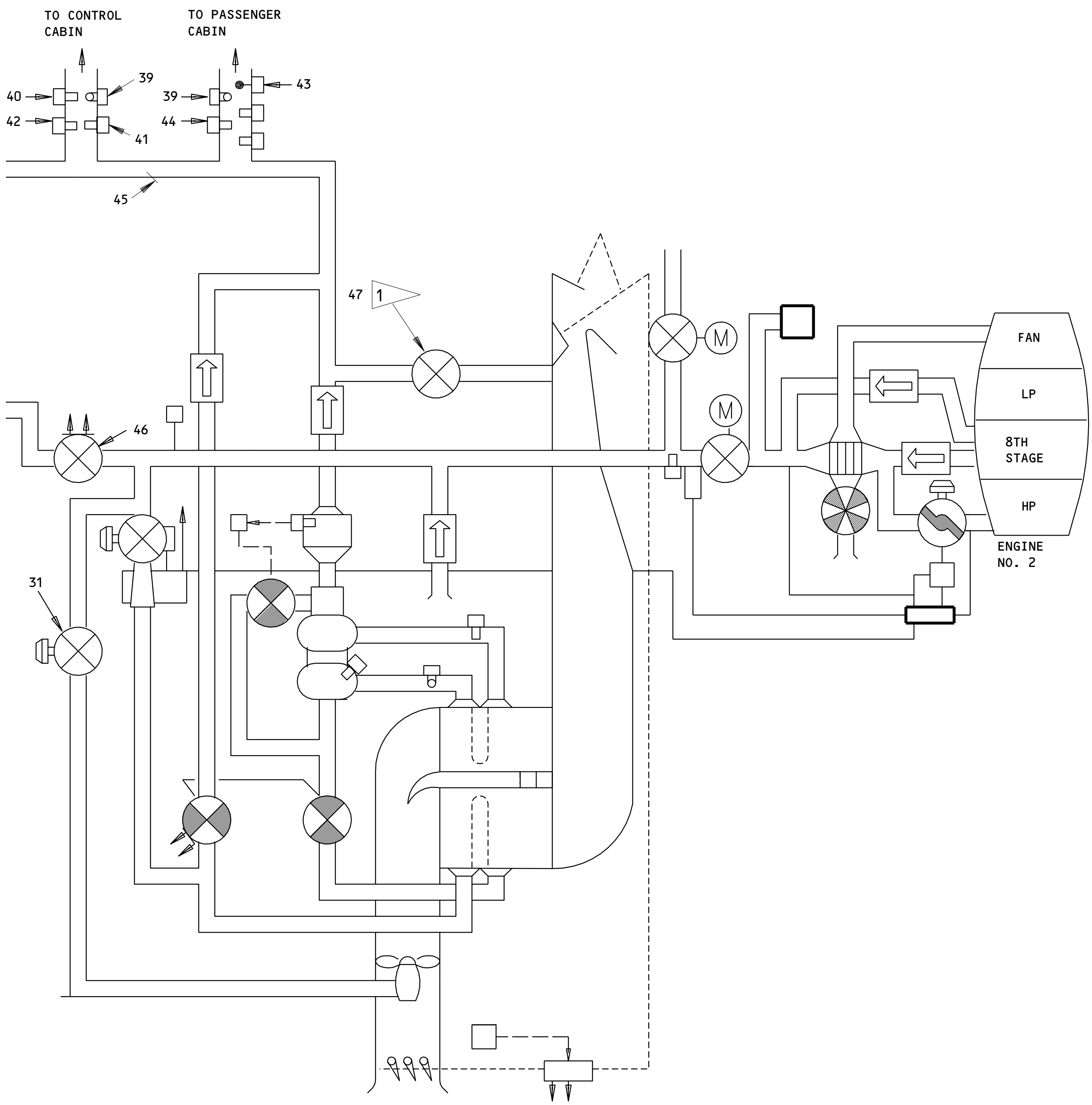
1. General
   A. The air conditioning systems provide conditioned air to the control cabin, passenger cabin, electronic equipment compartment, forward cargo compartment, air conditioning distribution bay and aft cargo compartment. Air supply to the air conditioning system is furnished by the pneumatic system from either engine bleed air or the auxiliary power unit (APU) in flight, and from engine bleed air, the auxiliary power unit, a ground pneumatic supply cart, or from a ground conditioned air supply cart during ground operation (Fig. 1). Chapter 36, Pneumatic, describes air supply to the pneumatic manifold. Part of the warm air supply from the engines or pneumatic cart is passed through the air cycle system to be cooled. The cold air is then mixed with the remainder of the warm air as required to obtain the conditioned air temperature called for by the temperature control system. This conditioned air then passes into the control and passenger cabins through the distribution system. Cabin air is exhausted a number of ways. Galley and toilet vents, the ground service air conditioning connection check valve, condensate drains, and the water separator drains, for example, exhaust cabin air without regard for cabin pressurization control requirements. The combined flow from all outlets other than the pressurization control outflow valves is limited to a value less than that which enters the cabin from the air conditioning system. The outflow valves are regulated to exhaust only that additional quantity of air required to maintain the desired pressure in the cabin. For a more detailed description of the electrical/electronic equipment cooling, refer to Equipment Cooling System - Description and Operation.
   B. This chapter considers the air conditioning system as including five subsystems: compression, distribution, pressurization control, cooling, and temperature control. Figure 2 shows the flow of air through the airplane for air conditioning and pressurization.
2. Compression
   A. This subsystem describes the equipment and methods used to regulate flow of air to the air conditioning system. Regulated flow is required to maintain adequate air supply and to prevent excessive flow. Undersupply may limit pressurization of the airplane, while over supply may cause the air cycle system to overheat.



1 8TH STAGE BLEED CHECK VALVE
2 HIGH PRESSURE MODULATING VALVE
3 HIGH PRESSURE BLEED REGULATOR
4 ENGINE BLEED PRECOOLER
5 PRECOOLER CONTROL VALVE
6 ENGINE START SYSTEM
7 ENGINE BLEED AIR VALVE
8 450°F PNEUMATIC THERMOSTAT
9 490°F BLEED AIR OVERHEAT SWITCH
10 WING THERMAL ANTI-ICE VALVE
11 RAM AIR INLET DEFLECTOR
12 RAM AIR INLET MODULATION DOOR
13 GASPER FAN
14 GROUND SERVICE CONDITIONED AIR CONNECTION CHECK VALVE
15 HOT AND COLD AIR CHECK VALVE
16 PNEUMATIC PRESSURE TRANSMITTER
17 35° CONTROL SENSOR
18 WATER SEPARATOR
19 35°F CONTROL
20 PACK VALVE
21 TURBINE INLET OVERHEAT SWITCH (210°F)
22 35°F CONTROL VALVE
23 AIR CYCLE MACHINE
24 COMPRESSOR DISCHARGE OVERHEAT SWITCH (365°F)
25 SECONDARY HEAT EXCHANGER
26 PRIMARY HEAT EXCHANGER
27 RAM AIR DUCT
28 MIX VALVE
29 RAM AIR MODULATING SYSTEM ACTUATING LINKAGE
30 TURBOFAN
31 TURBOFAN VALVE
32 RAM AIR CONTROL
33 RAM AIR ACTUATOR
34 RAM AIR EXIT LOUVERS
35 APU BLEED AIR CHECK VALVE
36 APU RELIEF VALVE
37 APU BLEED AIR VALVE
38 APU (AUXILIARY POWER UNIT)
39 DUCT TEMPERATURE ANTICIPATOR SENSOR
40 190°F DUCT OVERHEAT SWITCH
41 DUCT TEMPERATURE LIMIT SENSOR
42 250°F DUCT OVERHEAT SWITCH
43 SUPPLY DUCT TEMPERATURE BULB
44 DUCT TEMPERATURE LIMIT SENSOR
45 MAIN DISTRIBUTION MANIFOLD RELIEF VALVE
46 ISOLATION VALVE
47 RAM AIR SENSOR

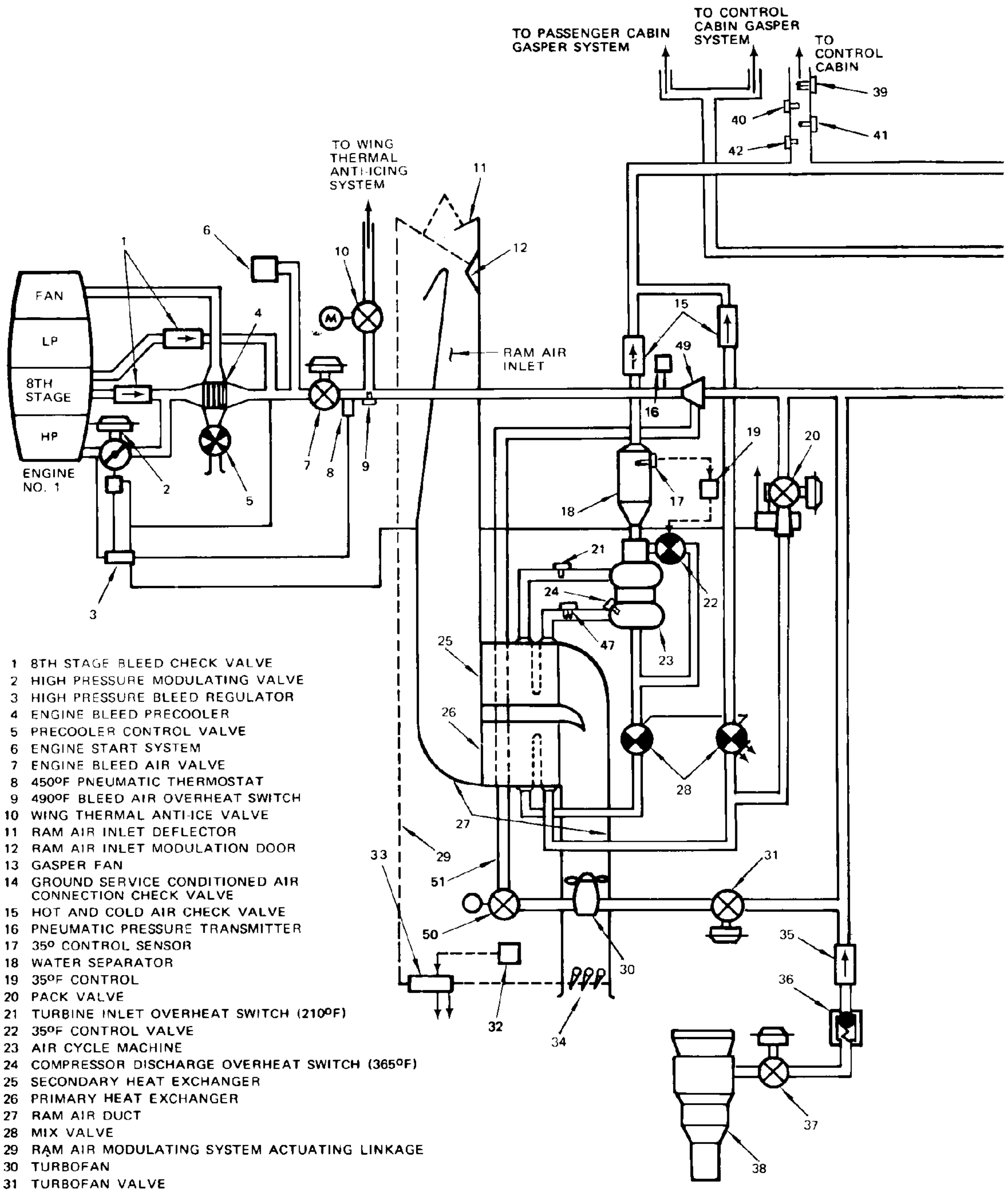
EFFECTIVITY
LV-JMW thru LV-JMY

Air Conditioning System Schematic
Figure 1 (Sheet 1)



EFFECTIVITY
LV-JMW thru LV-JMY

Air Conditioning System Schematic
Figure 1 (Sheet 2)



1 8TH STAGE BLEED CHECK VALVE
2 HIGH PRESSURE MODULATING VALVE
3 HIGH PRESSURE BLEED REGULATOR
4 ENGINE BLEED PRECOOLER
5 PRECOOLER CONTROL VALVE
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25 SECONDARY HEAT EXCHANGER
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28 MIX VALVE
29 RAM AIR MODULATING SYSTEM ACTUATING LINKAGE
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31 TURBOFAN VALVE
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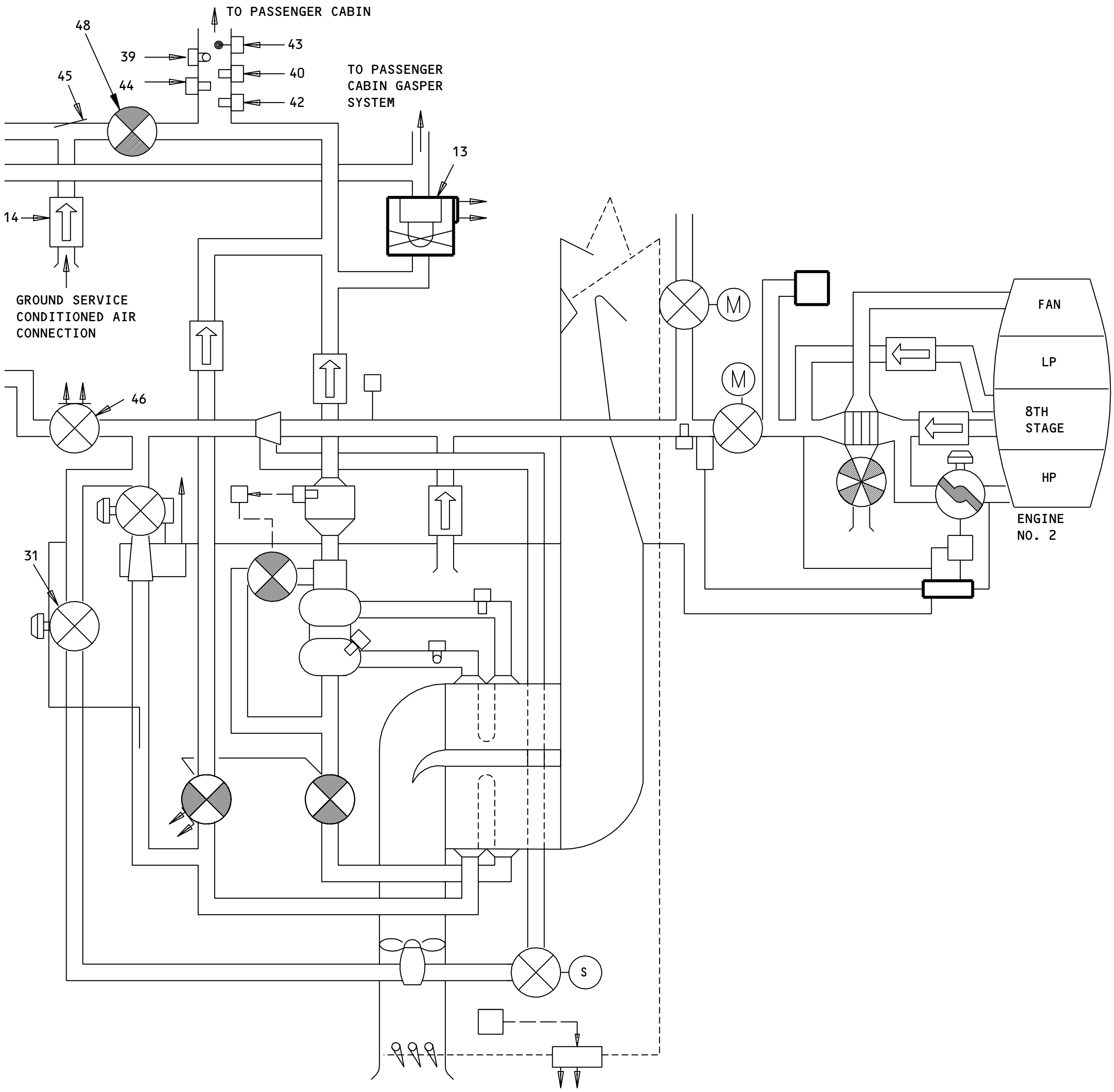
43 SUPPLY DUCT TEMPERATURE BULB
44 DUCT TEMPERATURE LIMIT SENSOR
45 MAIN DISTRIBUTION MANIFOLD RELIEF VALVE
46 ISOLATION VALVE
47 RAM AIR SENSOR
48 CABIN AIRFLOW SHUTOFF VALVE
49 ENGINE BLEED AIR CLEANER
50 AIR CLEANER PURGE VALVE
51 AIR CLEANER PURGE LINE

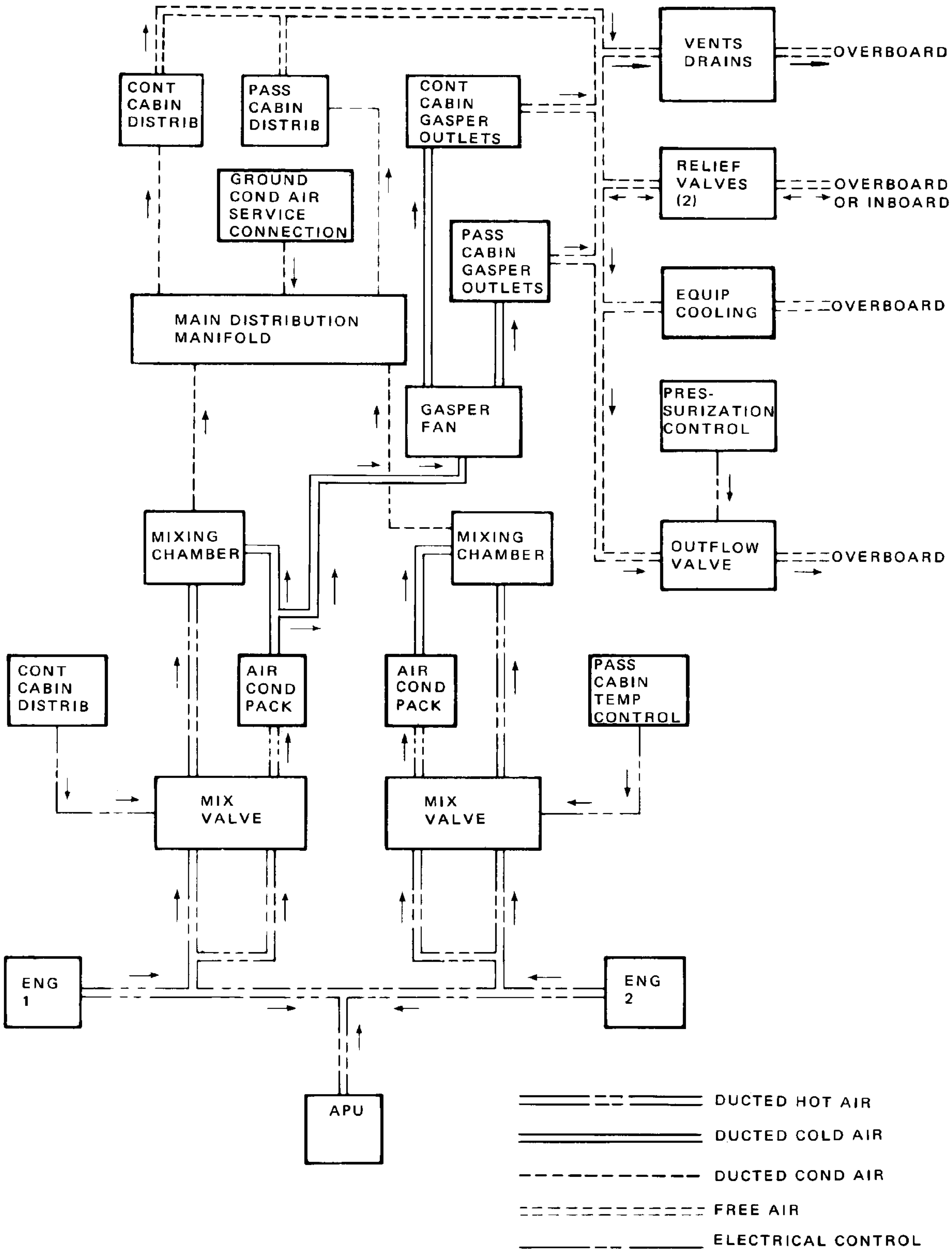
Air Conditioning System Schematic
Figure 1 (Sheet 3)



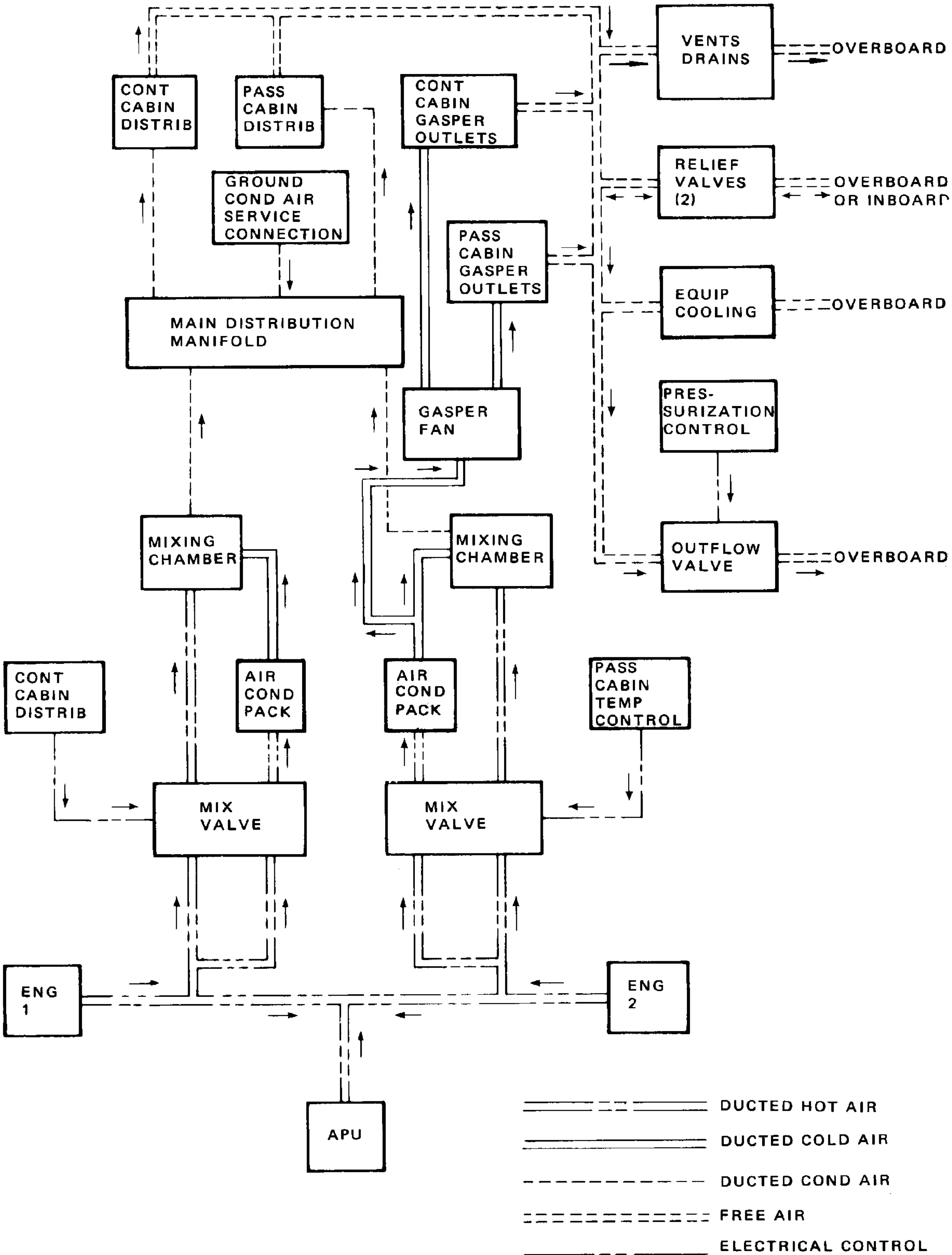
EFFECTIVITY

All except
LV-JMW thru LV-JMY

Air Conditioning System Schematic
Figure 1 (Sheet 4)



Air Conditioning Block Diagram
Figure 2 (Sheet 1)



Air Conditioning Block Diagram
Figure 2 (Sheet 2)

B. The engines furnish 8th- or 13th-stage air, depending on engine power setting and air conditioning demand, for air conditioning during normal operation. Bleed air from the engines enters the pneumatic system, where the temperature is normally regulated to approximately 370°F and limited to 450°F. A thermoswitch in the pneumatic system will prevent excessively hot air from entering the air conditioning system by closing the bleed air shutoff valve. Airflow to each air conditioning system is initiated by a pack valve, which includes features for regulating airflow. The compression subsystem explains how airflow is controlled.

C. An air cleaner system is provided to purge the engine bleed air of impurities. The system consists of two similar subsystems, which function automatically whenever engine bleed air is used for air conditioning and the airplane is on the ground or the flaps are extended. Each subsystem consists of an inertial type air cleaner and purge line; an electrically controlled pneumatically operated purge valve and an electrical control system. The impurities collected by the cleaner are vented overboard through the ram air exhaust louvers. For a more detailed description and effectivity of the air cleaner system, refer to Air Cleaner System - Description and Operation.

3. Distribution

A. Two separate and independent systems distribute air to the passenger and control cabins. The individual (gasper) air distribution system routes only the cold air from the air cycle system while the conditioned air distribution system routes a mixture of the cold and hot air to the cabins.

B. The gasper system provides each crewmember and passenger a method for cooling his local area to a value different from that provided by normal air conditioning automatic control. Air is received from the air cycle system and ducted to each individual station. An adjustable nozzle at each station allows the individual a choice anywhere between no supplementary cold air and full system capacity cold air. With all gasper outlets open approximately 20 percent (maximum) of the total cabin inflow air passes through the gasper system.

C. The conditioned air distribution system routes temperature controlled air to the passenger and control cabins. One duct system supplies the control cabin and another entirely separate duct system supplies the passenger cabin. Both systems originate at the main distribution manifold with ducts extending forward. Riser ducts near the forward end of the passenger cabin connect to an overhead duct extending fore and aft the full length of the passenger cabin. A nozzle at the bottom of the duct releases a balanced flow of air directly into the cabin.

4. Pressurization Control System

A. The pressurization control system includes pressurization control, pressurization relief valves, and pressurization indicating and warning.

B. Cabin pressure is controlled by positioning a cabin pressurization outflow valve to meter cabin air exhaust. The valve operates electrically from any of three different control systems. Two of these control systems, AUTO and STANDBY, are electronic and provide automatic pressure control, while the third, MANUAL, requires manual switch operation for adjustment. Normal control is from the AUTO system with the STANDBY system acting as a backup. The MANUAL system functions as an override over both automatic systems.

C. Pressurization relief valves include two safety relief valves, which prevent over-pressurizing the airplane, and a vacuum relief valve which prevents pressure inside the airplane becoming appreciably less than ambient. In addition to the relief valves, pressure equalization valves are installed in both cargo compartments to provide a quick method of allowing cargo compartment pressure to vary, within limits, with cabin pressure. Blowout panels are used in both cargo compartments to protect against a sudden differential in pressure between the cargo compartment interior and exterior.

D. Indicators are provided to allow monitoring cabin altitude, differential pressure, and rate of pressure change. A cabin altitude warning system sounds a horn if cabin altitude exceeds approximately 10,000 feet.

5. Cooling

A. All cold air required for air conditioning is provided by an air cycle system. Passing bleed air through a primary heat exchanger, an air cycle machine, and a secondary heat exchanger cools the air sufficiently to handle any cooling situation required. A ram air system provides coolant air for the heat exchangers. A ram air modulation control system automatically regulates the supply of coolant air during flight to obtain required cooling with minimum aerodynamic drag from the system. A turbofan draws air through the system for ground operation. A water separator removes excess moisture from the cooled air. Various thermal switches, thermostats, sensors, and valves are included with the system to provide automatic protection and warning of an air cycle system malfunction.

6. Temperature Control

A. Temperature of the air entering the distribution systems to the passenger and control cabins is regulated by positioning mix valves. The mix valves proportion hot bleed air with cold air from the air cycle system to provide air-conditioned comfort in the passenger and control cabin. There is one mix valve for each air cycle system. Two sets of controls on the forward overhead panel provide automatic or manual control and system monitoring for each system. The control cabin controls apply to the left air cycle system and the passenger cabin controls the right air cycle system. Each control system consists of a temperature regulator, temperature indicator, temperature sensors, overheat control and warning light, mix valve, and mix valve position indicator.

AIR CONDITIONING - MAINTENANCE PRACTICES

1. Pack Cooling System Performance Test

A. General

(1) The following procedure is developed for detection of system abnormalities using only airplane instrumentation. This procedure is intended to provide quick evaluation of system performance for scheduled maintenance checks and trouble shoot flight operation problems.

B. Reference Procedure

(1) 49-11-0, APU Power Plant Operating Procedure

C. Prepare for Air Conditioning Test

(1) Check that all air conditioning and pneumatic circuit breakers are closed (in).

(2) Check that the following circuit breakers on circuit breaker panel P6 are closed:

(a) MASTER CAUTION (all except FUEL, if installed)

(b) INDICATOR LIGHTS, MASTER DIM BUS (9 places)

(c) DIM & TEST (1 place)

(3) Check warning lights and annunciators.

(a) Place LIGHTS switch on lightshield panel (P2-l) to TEST. Check that both MASTER CAUTION lights, the AIR COND annunciator light and PACK TRIP OFF light come on.

(4) Open air conditioning equipment bay door.

(5) Operate both cabin temperature selectors on overhead panel to place mix valves in full cold position and leave both selectors in OFF MANUAL position. Check that both visual indicators on air mix valves in air conditioning bay, show full cold position. If not, repair temperature control system before proceeding (Ref 21-61-0, Conditioned Air Temperature Control Systems).

(6) Place engine 1 and 2 BLEED switches on overhead panel to OFF position and APU BLEED switch to ON position.

(7) Provide APU power (Ref 49-11-0).

NOTE: Electrical load to be less than 25 amperes.

(8) Place both air conditioning (A/C) PACK switches to OFF position.

(9) Place ISOLATION VALVE switch to OPEN position.

(10) Record ambient temperature which is used for calculation in flow and heat exchanger check.

(11) Record APU exhaust gas temperature (EGT).

NOTE: This is used for calculation in flow check. Allow time for EGT to stabilize and tap indicator to remove hysteresis. Ensure valve positions, remain as stated, to avoid effect of leakage variance.

D. Test air conditioning system.

(1) Turbofan Valve Test

(a) Remove both connectors from turbofan valve solenoids and manually override the valve opens. Check that the valve modulates to a position somewhere less than full open.

NOTE: Duct pressure should be higher than the valve maximum regulating pressure of 33 psi. A valve that is fully open is regulating too high.

(b) Replace the connectors and turn both packs ON. Observe that the valves are full open.

NOTE: Duct pressure will be lower than the valve minimum regulating pressure of 27 psi. A valve that is not fully open is regulating too low.

(2) Flow and Primary Heat Exchanger Test

(a) With both A/C packs ON, note APU EGT.

NOTE: EGT should be within established maximum limits to ensure adequate flow for these tests.

(b) Turn off right pack (not under test), and remove connector from the left pack water separator 35-degree sensor. Check that APU EGT drops and duct pressure rises to above 27 psi.

NOTE: This ensures pack flow is regulated by the flow control, not by the APU load limiter. In hot ambient, APU load limit may occur normally. In that case, a finding of low flow condition in step (2)(e), is not valid.

(c) Verify the 35-degree control valve has opened fully.

(d) Check that water separator bag condition indicator is below red band.

NOTE: Indicator is in the red band, the bag is dirty and is restricting flow.

(e) For airplanes with Garrett APU Models GTCP85-129B, C, D, E, or F, record stabilized APU EGT. The difference between this reading and pack off (step C (11)) should be within the limits shown on Fig. 201.

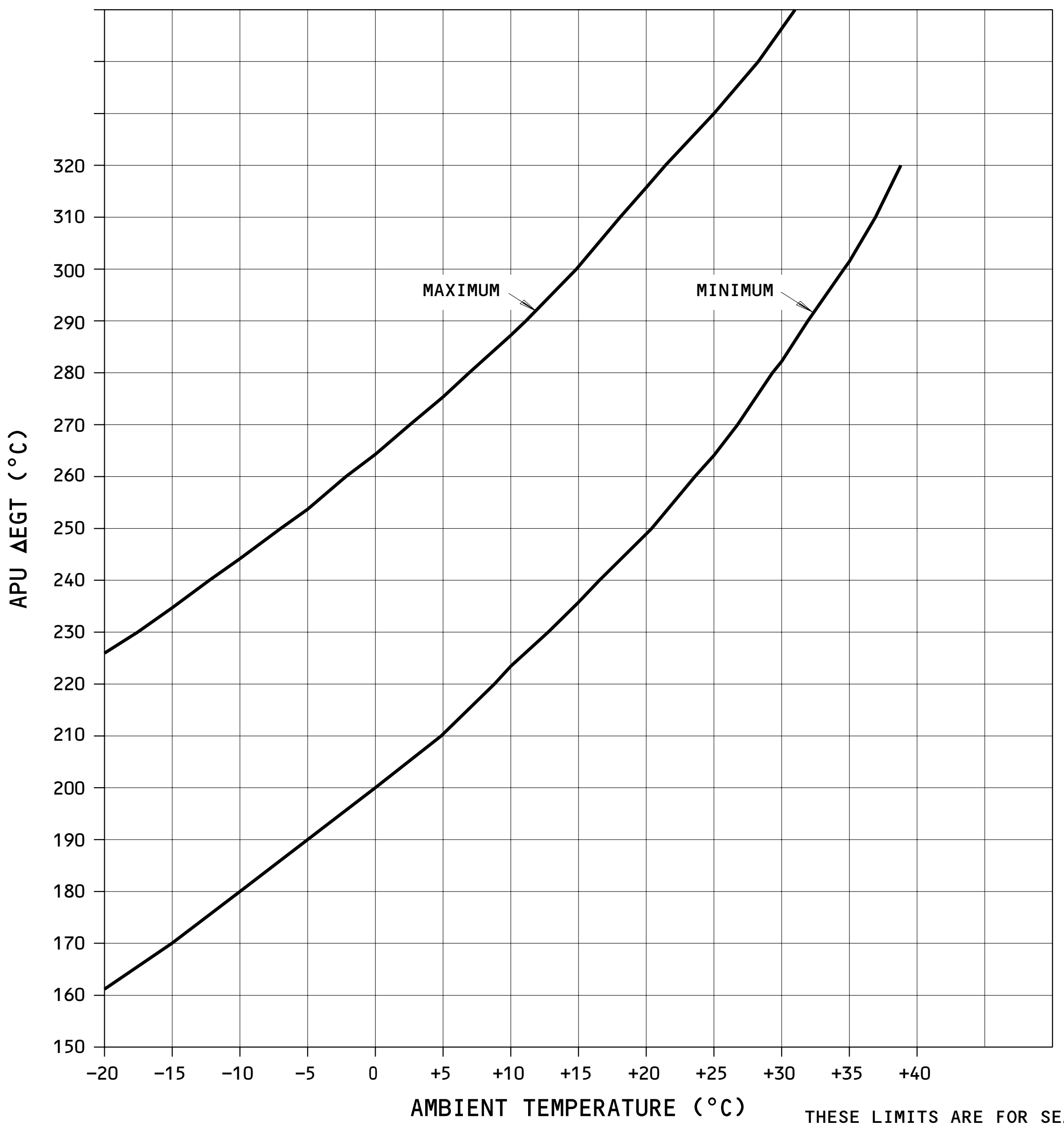
NOTE: EGT below the limits shown in Fig. 201 indicates the pack flow is low and an EGT above the limits shown in Fig. 201 indicates a high flow condition.

(f) For airplanes with Garrett APU Models GTCP85-129H, -129J, or -129K, record stabilized APU EGT. The difference between this reading and pack off (step C.(11)) should be within ±40°C of the APU delta EGT shown in Fig. 201 for the high flow curve.

(g) Record supply duct temperature. The supply duct temperature should not be higher than 40°F (22°C) above ambient temperature.

NOTE: If flow and turbofan operation are normal, a higher duct temperature is evidence of poor primary heat exchanger performance.

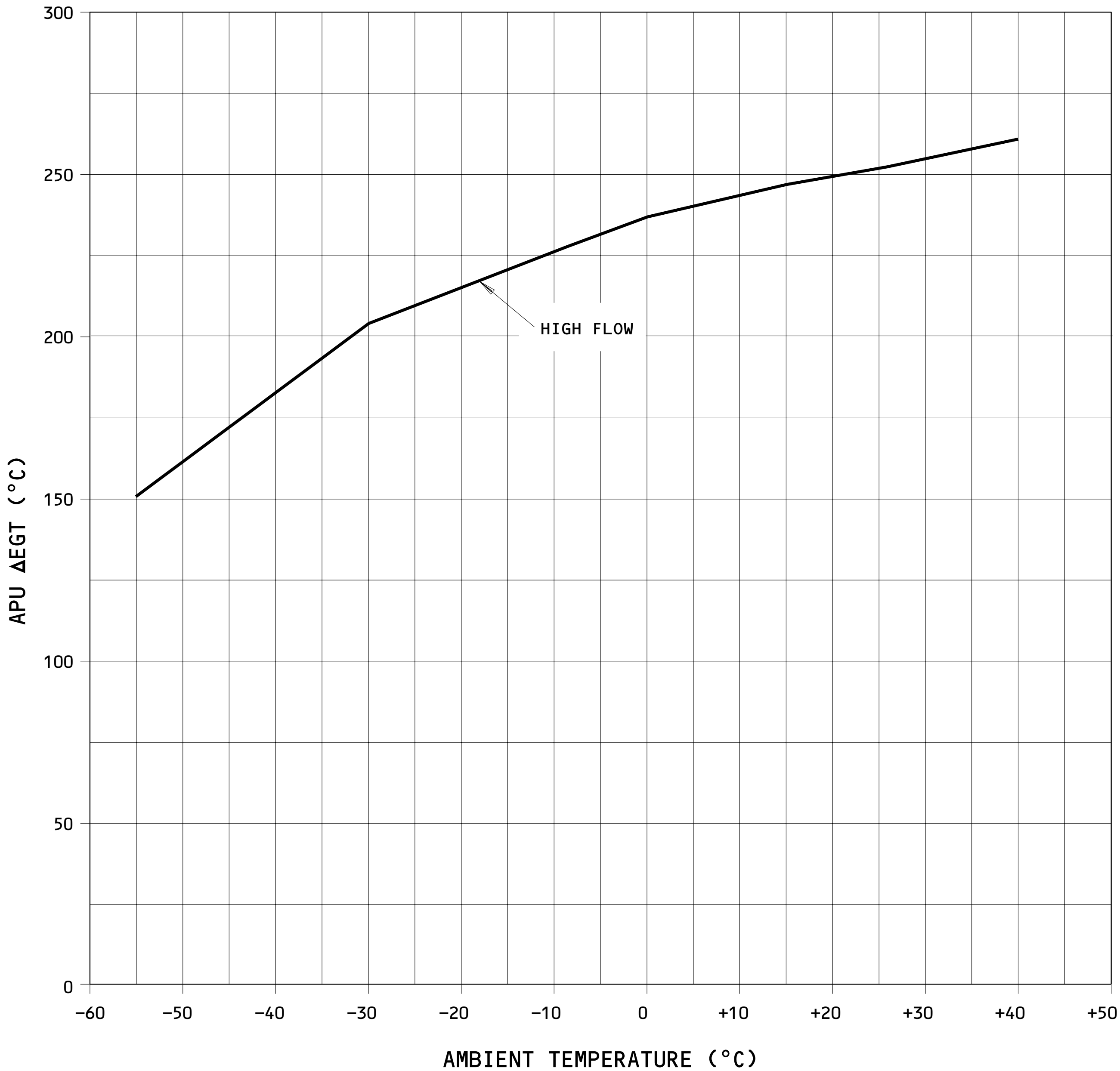
1) If it is not convenient to replace heat exchanger, continued satisfactory performance may be obtained on a temporary basis by cleaning the heat exchangers. Two methods of cleaning the heat exchangers are provided. The preferable method is to backflush the heat exchangers (Ref 21-51-21, Heat Exchanger - Cleaning). The heat exchangers may also be cleaned using shop air as described below in steps a) thru f).
   a) Position and safety both A/C pack switches to OFF.
   b) Open access panel outboard of air conditioning bay.
   c) Remove heat exchanger inspection panels to gain access to upstream side of heat exchanger cores.
   d) Using shop air, blow out cores of both heat exchangers.
   e) Install inspection and access panels.
   f) Position both A/C pack switches to ON, allow adequate time for temperature to stabilize and check that supply duct temperature is less than 40°F (22°C) above ambient.
2) If supply duct temperature has been adequately reduced, satisfactory heat exchanger operation may be realized. If not, the heat exchangers must be replaced.



THESE LIMITS ARE FOR SEA LEVEL STATIC OPERATION.
FOR HIGHER ELEVATIONS, RAISE EACH LINE BY 5°C PER 1,000 FEET.

AIRPLANES WITH GARRETT APU MODELS GTCP85-129B, C, D, E OR F

Changes in APU EGT (with One A/C Pack Flow) per Changes in Ambient Temperature
Figure 201 (Sheet 1)



AIRPLANES WITH GARRETT APU MODELS GTCP85−129H,−129J,−129K

NOTE: THESE LIMITS ARE FOR SEA LEVEL STATIC OPERATION.
FOR HIGHER ELEVATIONS, RAISE EACH LINE BY 5°C PER 1,000 FEET.

Changes in APU EGT (with One A/C Pack Flow) per Changes in Ambient Temperature
Figure 201 (Sheet 2)

(h) Reconnect the water separator 35-degree sensor.

NOTE: Normally, the 35 degree control valve will move to the fully closed position, ice for several seconds (bag condition indicator in the red band), then modulate as control is established.

(3) Cooling and 35° Control System Test
(a) Record the stabilized supply duct temperature. Check that temperature is between 32°F (0°C) and 40°F (4°C).
1) If the supply duct temperature is low, check that the 35° control valve is full open.

NOTE: The valve may normally be fully open in ambient below freezing.

2) If the supply duct temperature is high, check that the 35° control valve is fully closed.

NOTE: The valve may normally be full closed in hot ambients. If full closed, and flow and heat exchanger performance are normal, at less than very hot ambients (approximately 100°F or 38°C), a high duct temperature indicates a loss of cooling efficiency. See next step for further evidence.

(b) Record 35° control valve position. The valve opening should not be greatly less than that found for the opposite pack.

NOTE: Valve position is widely variable with ambient temperature and humidity conditions, but an opening of less than half that for the opposite side under the same conditions suggests loss of cooling efficiency (requiring less than normal ACM bypass flow), due either to the cooling turbine or secondary heat exchanger.

(4) APU Flow Mode Test
(a) Disconnect the APU mode solenoid connector on the flow control. Check that a slight drop in APU EGT occurs.

NOTE: This verifies the operation of the APU flow mode shift to main engine flow control.

(b) Reconnect the connector. A slight increase in APU EGT should occur.
(c) Turn left pack off.

(d) Turn right pack ON and repeat steps (2)(b) thru (4)(b).

E. If no longer required, turn APU off. Refer to 49-11-0.

REMOVING SMOKE OR FUMES FROM THE AIR CONDITIONING SYSTEM - MAINTENANCE PRACTICES

1. General
   A. The oil fumes and the smoke from an APU/engine failure can get into the airplane cabin and cause contamination of the conditioned air. This procedure gives instructions to remove the oil contamination from the air conditioning and pneumatic systems. You must first isolate the cause of the oil contamination and repair the problem before you do this procedure.
      (1) The APU is the most likely source of the smoke or odors. An APU failure can release oil into the air conditioning system. Oil, glycol, or hydraulic fluid ingested into the inlet of the APU is another possible source of the contamination.
      (2) Once oil has entered the pneumatic and/or air conditioning system, it tends to accumulate in the heat exchangers or precoolers. The oil, hydraulic fluid, or glycol vaporizes at higher temperatures and enters the cabin.
      (3) Do not do this procedure with the crew and passengers on board, since this procedure generates a high concentration of smoke.
2. Removal of Oil Contamination from the Air Conditioning and Pneumatic Systems
   A. References
      (1) 21-31-0, Pressurization Control Systems - Maintenance Practices
      (2) 21-51-41, Water Separator Coalescer (Bag) - Cleaning/Painting
      (3) 24-22-0, Manual Control
      (4) 36-11-41, Pneumatic Ground Service Connector
      (5) 49-11-0, APU Power Plant - Maintenance Practices
      (6) 71-09-100, Power Plant - Operating Procedure
   B. Access
      (1) Location Zone

101	Control Cabin - Left
102	Control Cabin - Right
212	Left Air Conditioning Equipment Bay
214	Right Air Conditioning Equipment Bay

      (2) Access Panels

3303L	A/C Access Panel
3403R	A/C Access Panel

   C. Procedure
      (1) Open the access doors to the air conditioning bays.
      (2) Remove the water separators (Ref 21-51-41).
      (3) Clean the coalescer bags for the water separators (Ref 21-51-41).
      (4) Install the water separators (Ref 21-51-41).
      (5) Clean the pneumatic ducts and the components where you can see the oil contamination.
      (6) Replace the components that have too much contamination.
      (7) Supply electrical power (Ref 24-22-00 MP).

(8) Make sure these switches are set to OFF at the P5-10 panel:
   (a) L and R PACK switches
   (b) APU BLEED switch
   (c) BLEED 1 and BLEED 2 switches
   (d) GASPER FAN switch

(9) Make sure the ISOLATION VALVE switch on the P5 overhead panel is set to OPEN.

(10) Remove the check valve at the pneumatic ground connector (AMM 36-11-41).

NOTE: This will permit the initial bleed air, which has more oil contamination, to go out through the check valve opening.

(11) Pressurize the APU pneumatic duct:

WARNING: DO NOT GO NEAR THE CHECK VALVE WHEN YOU PRESSURIZE THE APU PNEUMATIC DUCT. THE APU BLEED AIR CAN CAUSE INJURY TO PERSONS WHEN THE BLEED AIR GOES OUT THROUGH THE CHECK VALVE OPENING.

NOTE: This procedure will remove the oil contamination from the APU bleed air. The APU bleed air will go out through the check valve opening.

   (a) Start the APU and let the operation of the APU become stable (Ref 49-11-0).
   (b) Put the APU BLEED switch to ON.

   NOTE: The APU bleed air shutoff valve opens and the bleed air goes out through the check valve opening.

   (c) Let the APU operate until the APU bleed air has no smell of the oil contamination.
   (d) Put the APU BLEED switch to OFF.

   NOTE: The APU bleed air shutoff valve closes.

   (e) Stop the APU (Ref 49-11-0).

(12) Install the check valve which you removed from the pneumatic ground connector (Ref 36-11-41).

(13) Start the APU again (Ref 49-11-0).

(14) Set the APU BLEED switch to ON.

(15) Operate the air conditioning packs:

NOTE: This procedure uses the APU bleed air to remove the oil from the air conditioning system.

(a) Make sure the aft outflow valve is open (Ref 21-31-0) or at least one passenger entry door is open.

WARNING: MAKE SURE THERE IS AN EXIT FOR THE CONDITIONED AIR IN THE AIRPLANE. ACCIDENTAL CABIN PRESSURIZATION CAN CAUSE INJURY TO PERSONS.

(b) Set the position of these switches on the P5-10 panel as follows:
1) ISOLATION VALVE to OPEN
2) L PACK and R PACK switches to AUTO
3) GASPER FAN switch to ON
(c) Let the air conditioning packs operate until the conditioned air in the airplane has no smell of the oil contamination.
(d) Set the L and R PACK switches to OFF.
(e) Stop the APU (Ref 49-11-0).
(f) Set the APU BLEED switch to OFF.
(16) Start the engines and let the engines operate at ground idle speed (Ref 71-00-00).
(17) Operate the air conditioning packs:

NOTE: This procedure uses the engine bleed air to remove the oil contamination from the air conditioning system.

(a) Set the position of these switches on the P5-10 panel as follows:
1) L and R PACK switches to AUTO
2) BLEED 1 and 2 switches to ON
(b) Let the air conditioning packs operate until the conditioned air in the airplane has no smell of the oil contamination.
(c) Set the L and R PACK switches to OFF.
(18) Stop the engines (Ref 71-09-100).
(19) Set these switches to OFF at the P5-10 panel:
(a) L and R PACK switches
(b) GASPER FAN
(20) Examine these components for oil contamination:
(a) Heat exchangers
(b) Coalescer bags in the water separators
(c) Gasper air fan filters (on some airplanes only)
(21) Do the procedure again, if required, until the conditioned air in the airplane has no smell of the oil contamination.

(22) Close the access doors to the air conditioning bays.
(23) Remove the electrical power if it is not necessary (Ref 24-22-00 MP).

AIRPLANE ABILITY TO MAINTAIN CABIN PRESSURE IN-FLIGHT ON SINGLE PACK OPERATION - TROUBLESHOOTING

1. General
   A. Troubleshooting the airplane ability to maintain cabin pressure in-flight on a single pack operation involves the air cycle system, the pneumatic supply system, the pressurization control system, and various airplane openings that could possibly be a source of leakage. An understanding of how the different components are interrelated as well as the function of each is needed to locate and correct problems in either system.
2. Preparation for Troubleshooting
   A. Supply electrical power (AMM 24-22-00/201).
   B. Make sure that all air conditioning circuit breakers are on.
   C. Make sure that all pressurization control system circuit breakers are on.
3. Troubleshooting Chart (Table 101)

Airplane Ability to Maintain Cabin Pressure in Flight on Single Pack Operation
Table 101

SYSTEM	MINIMUM REQUIREMENT	REQUIREMENT SATISFIED	
		YES	NO

Airplane Ability to Maintain Cabin Pressure in Flight on Single Pack Operation
Table 101

SYSTEM	MINIMUM REQUIREMENT	REQUIREMENT SATISFIED	
		YES	NO
SINGLE PACK - GROUND IDLE	ABLE TO MAINTAIN CABIN DIFFERENTIAL PRESSURE OF 3.9 - 4.1 PSID AND CABIN RATE OF CHANGE IS NO MORE THAN -100 FEET/MINUTE	CONFIDENCE IS FAIR THAT AIRPLANE WILL MAINTAIN PRESSURE WITH SINGLE PACK WHILE AT CRUISE	CONFIDENCE IS LOW THAT AIRPLANE WILL MAINTAIN PRESSURE ON SINGLE PACK AT CRUISE. EMPHASIS NEEDS TO BE PLACED ON THE FOLLOWING <u>OUTFLOW</u> WAS AIRPLANE LEAK DOWN DURING PART III (REF 21-00-05 MP) LESS THAN 100 SECONDS? IF SO, FIRST CHECK FOR CABIN LEAKS THEN RUN PART III TEST AGAIN. <u>INFLOW</u> IF THE CABIN LEAK DOWN RATE WAS ACCEPTABLE, THEN THE PACK PERFORMANCE NEEDS TO BE INVESTIGATED. DO VARIOUS PACK SYSTEM HEALTH CHECKS (REF 21-11-0 A/T).
SINGLE PACK - 65% N2	CABIN RATE OF CHANGE IS -500 FEET/MINUTE OR GREATER	CONFIDENCE IS HIGH THAT AIRPLANE WILL MAINTAIN PRESSURE WITH SINGLE PACK WHILE AT CRUISE	

Airplane Ability to Maintain Cabin Pressure in Flight on Single Pack Operation Table 101			
		REQUIREMENT SATISFIED	
SYSTEM	MINIMUM REQUIREMENT	YES	NO
AIRPLANE/ STRUCTURE AIR LEAKAGE	LEAK DOWN RATE FROM 4.0 TO 2.5 PSID IS GREATER THAN OR EQUAL TO 100 SECONDS	CABIN LEAKAGE IS ACCEPTABLE OPERATORS MAY WISH TO CONSIDER CONDUCTING (REF 5-51-91 MD) LEAKAGE TEST ON C-CHECK BASIS AND MONITOR PERFORMANCE	INSPECT AND REPAIR ANY AIR LEAKAGE AS NOTED ON THE DATA SHEET SPECIFICALLY: DOORS AND HATCHES MISSING OR TORN SEALS, POOR CONTACT BETWEEN DOOR SEALS AND AIRPLANE DUE TO DIRT, ETC., INSPECT SEALING COMPOUND AREAS AND REPAIR DOOR SEALS (REF 21-43-11 R/I). FORWARD OUTFLOW VALVE DO A TEST OF THE VALVE (REF 52-09-100 AP)
AIRPLANE/ STRUCTURE AIR LEAKAGE	LEAK DOWN RATE FROM 4.0 TO 2.5 PSID IS GREATER THAN OR EQUAL TO 100 SECONDS		EE COOLING VALVE PIN 10-60701-1 THRU -6 SHOULD CLOSE AT 2.0 TO 2.8 PSID AND THE -7 VALVE SHOULD CLOSE AT 7 TO 1.1 PSID.

Airplane Ability to Maintain Cabin Pressure in Flight on Single Pack Operation
Table 101

SYSTEM	MINIMUM REQUIREMENT	REQUIREMENT SATISFIED	
		YES	NO
AIRPLANE/ STRUCTURE AIR LEAKAGE	LEAK DOWN RATE FROM 4.0 TO 2.5 PSID IS GREATER THAN OR EQUAL TO 100 SECONDS		<u>BILGE DRAINS</u> SHOULD CLOSE AT APPROXIMATELY 2.0 PSID - CABIN PRESSURE SAFETY RELIEF VALVE - OUTFLOW VALVE SEAL - NEGATIVE PRESSURE RELIEF VALVE SEAL - WATER SERVICE PANEL - FLIGHT DECK WINDOWS - PRESSURE BULKHEAD PENETRATIONS SHOULD ALL HAVE MINIMAL LEAKAGE - SIGNIFICANT LEAKS SHOULD BE RESOLVED AS REQUIRED
ENGINE BLEED DUCT GROUND IDLE	DUCT PRESSURE SHOULD BE 15 TO 20 PSI	CONTINUE TO MAINTAIN BLEED SYSTEM COMPONENTS ON 1C - CHECK INTERVALS AS SPECIFIED IN MPD 36-11-20 ITEMS.	CONSIDER ACCOMPLISHING THE ENGINE BLEED AIR DISTRIBUTION SYSTEM TEST (REF 36-11-0 A/T) TO HELP IMPROVE SYSTEM PERFORMANCE
ENGINE BLEED DUCT PRESSURE - 65% N2	DUCT PRESSURE SHOULD BE 26 TO 38 PSI		
CABIN PRESSURIZTION CONTROL SYSTEM	AFTER SUCCESSFUL COMPLETION OF CONFIDENCE CHECK CABIN PRESSURE CAN BE MAINTAINED	CONFIDENCE IS HIGH THAT CABIN PRESSURE CAN BE MAINTAINED.	CONSIDER ACCOMPLISHING CABIN PRESSURIZATION SYSTEM TEST (REF 21-31-00 A/T)

CONFIDENCE CHECK OF AIRPLANE ABILITY TO MAINTAIN CABIN PRESSURE IN FLIGHT ON SINGLE PACK OPERATION - MAINTENANCE/PRACTICES

1. General
   A. The function of this procedure is to do a ground check of the capability of the air conditioning packs to pressurize the airplane when it is in flight. This test can be accomplished prior to dispatch at an interval best determined by the operator
   B. This confidence check consists primarily of the three parts that follow:
      (1) Airplane pressurization to 4.0 psid with the right engine and the APU.
      (2) Comparison of the capability of the pack(s) to pressurize the airplane with engine bleed sources at ground idle and at 65% N2. The pack performance will be determined by the collection and comparison of the cabin pressure rate of change indications. The cabin rate of change indications during the test are to be recorded on the data sheet of Figure 201.
      (3) Determination if the airplane is unable to maintain pressure due to a leaky cabin or a pack performance problem.
   C. Figure 201 provides a graphical representation of the three parts of this confidence check.
2. Airplane Dispatch with Single Pack Operation - Confidence Check
   A. References
      (1) AMM 24-22-0/201, Manual Control - (Apply Power)
      (2) AMM 32-00-01/201, Ground Lock Assemblies - Maintenance Practices
      (3) AMM 49-11-0/201, APU Power Plant Maintenance Practices
   B. Airplane Pressurization
      (1) Prepare for airplane pressurization as follows:
         (a) Make sure that the nose and main landing gear are pinned (AMM 32-00-01/201).
         (b) Inspect the condition of all door seals for evidence of wear and tear.
            1) Record the condition of the door seals on the data sheet of Figure 201.
         (c) Lower the bay doors for the air conditioning equipment.
      (2) Make sure that there is audio communication between the flight compartment personnel and ground personnel.
      (3) Supply electrical power (AMM 24-22-00/201).
      (4) Set the ISOLATION VALVE switch on the air conditioning panel to OPEN.
      (5) Start the APU (AMM 49-11-0/201).
      (6) Set the APU BLEED switch on the air conditioning panel to ON.

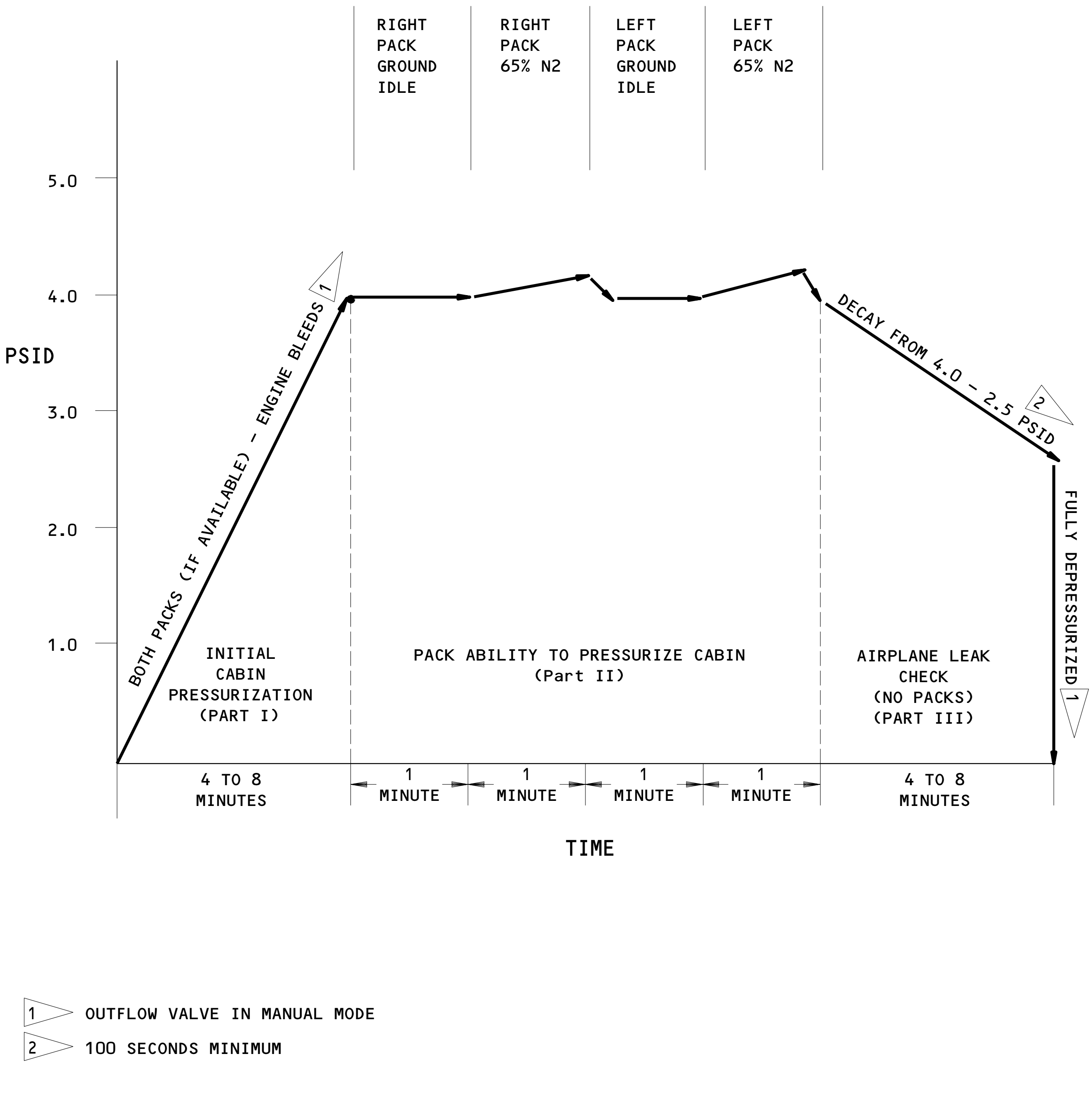
(7) Do all of these steps for the right pack valve, and then do them again for the left pack valve to make sure that the pack valves operate correctly:
   (a) Make sure the right (left) pack valve is fully closed.
   (b) Set the R (L) PACK switch on the air conditioning panel to ON.
   (c) Hold the PASS CABIN temperature selector knob (CONT CABIN temperature selector knob for the left pack valve) on the air conditioning temperature control panel in the manual COOL position until the AIR MIX VALVE indicator moves to full COLD.
   (d) Make sure the right (left) pack valve moves to a position between full open and partially closed.
   (e) Hold the temperature selector knob in the manual WARM position until the indicator moves to full HOT.
   (f) Make sure that the right (left) pack valve moves toward the closed position.
   (g) Hold the temperature selector knob in the manual COOL position until the indicator moves to full COLD.
   (h) Make sure that the right (left) pack valve returns to the same position between full open and partially closed.
   (i) Set the R (L) PACK switch to OFF.
   (j) Make sure that the right (left) pack valve moves to the fully closed position.

(8) Pressurize the airplane to 4.0 psid:
   (a) Set the ISOLATION VALVE switch to CLOSE.
   (b) Supply pneumatic pressure to the right pack with the right engine at ground idle.
      1) BLEED 2 switch is set to ON.
      2) BLEED 1 switch is set to OFF.
      3) R PACK switch is set to ON.
   (c) Supply pneumatic pressure to the left pack with the APU.
      1) APU BLEED switch is set to ON.
      2) L PACK switch is set to ON.
   (d) Manually operate the aft outflow valve to maintain the cabin pressure of 4.0 psid as follows:
      1) Make sure the pressurization mode selector is set at MAN AC or MAN DC.
      2) Position the CLOSED/OPEN toggle switch as necessary to maintain 4.0 psid on the DIFF PRESS gauge.

(9) Do these steps after the airplane has been pressurized to 4.0 psid:

   <u>WARNING</u>: OBEY THE SAFETY INSTRUCTIONS WHEN YOU WORK IN THE AREA OF AN ENGINE IN OPERATION. INSPECT THE AIRPLANE FUSELAGE AND DOORS ON THE SIDE OF THE AIRPLANE THAT DOES NOT HAVE AN ENGINE IN OPERATION. FAILURE TO COMPLY WITH ALL SAFETY INSTRUCTIONS COULD RESULT IN PERSONNEL INJURY OR DEATH.

   (a) Obey all safety instructions if you work around an engine that is in operation (AMM 71-09-100/201).
   (b) Inspect these components for any sign of leakage:
      1) Doors
      2) Hatches



Airplane Dispatch with Single Pack Operation - Confidence Check
Figure 201 (Sheet 1)

441484

AIRPLANE ______________ HOURS ______________ CYCLES ______________ DATE ______________

PART I - INITIAL CABIN PRESSURIZATION (0.0 TO 4.0 PSID)

CONDITION OF CARGO AND MAIN ENTRY DOOR SEALS ______________________________

FLOW CONTROL VALVE INDICATOR MODULATION LEFT VALVE ______________ RIGHT VALVE ______________

ANY OBVIOUS AIR LEAK NOISE FROM INSIDE CABIN ______________________________

ANY OBVIOUS LEAKS OUTSIDE AIRPLANE ______________________________

ESTIMATED TIME TO PRESSURIZE FROM 0.0 TO 4.0 PSID ______________________________

BLEED SOURCE(S) USED TO ACHIEVE 4.0 PSID LEFT ENGINE RIGHT ENGINE APU

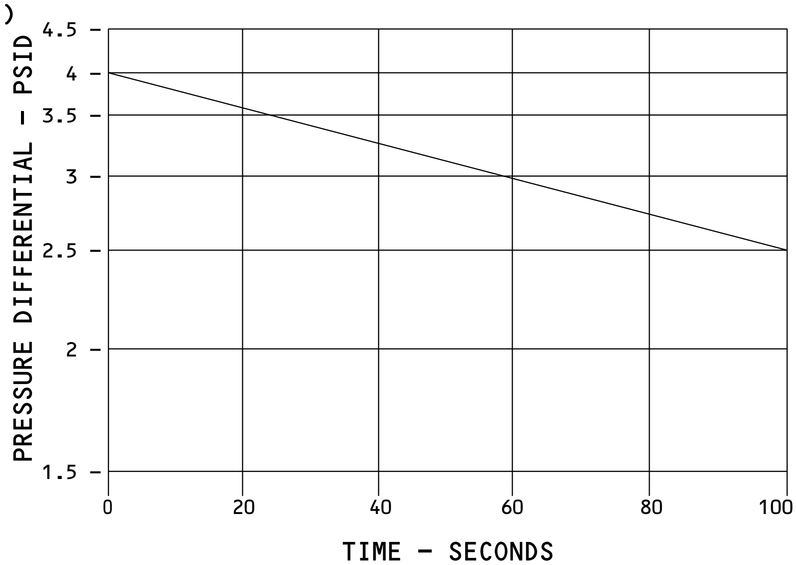
PART II - SINGLE PACK ABILITY TO PRESSURIZE THE CABIN (GROUND IDLE AND 65% N2)

	CABIN RATE OF CHANGE	BLEED SOURCE & DUCT PRESSURE	ENGINE N2 %
RIGHT PACK GROUND IDLE	________	________	________
RIGHT PACK 65% N2	________	________	________
LEFT PACK GROUND IDLE	________	________	________
LEFT PACK 65% N2	________	________	________

PART III - AIRPLANE LEAK DOWN (NO PACK OPERATION)

CABIN TEMPERATURE ______________________

TIME (SECONDS)	CABIN (PSID)	CABIN (RATE OF CHANGE)
10	________	________
20	________	________
30	________	________
40	________	________
50	________	________
60	________	________
70	________	________
80	________	________
90	________	________
100	________	________
110	________	________
120	________	________



Airplane Dispatch with Single Pack Operation - Confidence Check
Figure 201 (Sheet 2)

3) Forward outflow valve
4) Equipment cooling valve
5) Bilge drains
6) Flight deck windows
7) Safety relief valve
8) Air conditioning and APU duct seals at the pressure bulkhead penetrations in the air conditioning bays.
9) Outflow valve seal.

(c) Make a record of evidence of leakage on the Part 1 data fields of Fig. 201.

C. Test of Pack Ability of Pressurize the Passenger Cabin

(1) Do this check of the right pack capability to pressurize the passenger cabin with right engine at ground idle:
(a) Set the L PACK switch on the air conditioning panel to OFF.
(b) Set the APU BLEED switch on the air conditioning panel to OFF.
(c) Make sure the R PACK switch is set to ON.
(d) Adjust the aft outflow valve to stabilize the cabin pressure to 4.0 PSID.
(e) If a differential pressure of 4.0 psid cannot be maintained, either a pack supply or airplane leakage problem exists. Refer to the troubleshooting for additional information.
(f) Make a record of these parameters on the data sheet:
1) Cabin rate of change
2) Bleed source
3) Duct pressure
4) N2%
(g) Inspect the left side of the airplane for air leakage while the right engine is in operation.

(2) Do this check of the right pack capability to pressurize the passenger cabin with right engine at 65% N2:
(a) Advance the right engine throttle to 65% N2.
(b) Make a record of these parameters on the data sheet:
1) Cabin rate of change
2) Bleed source
3) Duct pressure
4) N2%
(c) Adjust the aft outflow valve to stabilize the cabin pressure to 4.0 PSID.
(d) If a differential pressure of 4.0 psid cannot be maintained, either a pack supply or airplane leakage problem exists. Refer to troubleshooting for additional information.

(3) Start the left engine with the APU bleed air.
(a) Allow left engine parameters to stabilize.

(4) Set BLEED 1 to ON.

(5) Set the L PACK switch to ON.

(6) Put the R PACK switch to OFF.

(7) Put the BLEED 2 switch to OFF.

(8) Shut down the right engine.

(9) Do this check of the left pack capability to pressurize the passenger cabin with left engine at ground idle:
   (a) Adjust the aft outflow valve to stabilize the cabin pressure to 4.0 PSID.
   (b) If 4.0 psid cannot be maintained, refer to the trouble shooting to determine if there is a pack (air inflow) problem and/or and air leakage problem.
   (c) Make a record of these parameters on the data sheet.
      1) Cabin rate of change
      2) Bleed source
      3) Duct pressure
      4) N2%
   (d) Inspect the right side of the airplane for air leakage while the left engine is in operation.

(10) Do this check of the left pack capability to pressurize the passenger cabin with left engine at 65% N2:
   (a) Advance the left engine throttle to 65% N2.
   (b) Make a record of these parameters on the data sheet.
      1) Cabin rate of change
      2) Bleed source
      3) Duct pressure
      4) N2%
   (c) Adjust the aft outflow valve to stabilize the cabin pressure to 4.0 PSID.
   (d) If 4.0 psid cannot be maintained, refer to the troubleshooting to determine if there is a pack (air inflow) problem and/or an air leakage problem.

D. Airplane Leak Down Check

(1) Do this check of the leakage of the cabin pressure:
   (a) Make a record of the cabin temperature.
   (b) Adjust the aft outflow valve to stabilize the cabin pressure to 4.5 PSID.
   (c) When 4.5 psid on the DIFF PRESS gauge has been achieved and stabilized, fully close (manually) the aft outflow valve.
      1) Make sure that the indication on the gauge above the CLOSED/OPEN switch on the pressurization control panel shows that the valve is fully closed.
   (d) Set the L PACK switch to OFF.
   (e) Set the BLEED 1 switch to OFF.
   (f) Shut down the left engine.

      <u>CAUTION</u>: THE APU MUST BE KEPT IN OPERATION IN THE EVENT A BLEED SOURCE IS NEEDED IF A VERY HIGH RAPID CABIN DEPRESSURIZATION OCCURS OR IF ELECTRICAL POWER IS NEEDED AND A GROUND SOURCE IS NOT USED. FAILURE TO KEEP THE APU IN OPERATION COULD POSSIBLY RESULT IN EQUIPMENT DAMAGE.

   (g) Continue to operate the APU

(h) Make a record of the pressure differential indications during the cabin pressure leak down:
   1) Start the check at 4.0 psid (time zero).
   2) Make a record of the pressure differential indications at 10 second intervals for 120 seconds of time.

(2) Depressurize the airplane and restore it to its unpressurized condition.

(3) Remove pneumatic pressure.

(4) Make sure the mode selector switch on the cabin pressurization control panel, P5-6, is returned to the AUTO position.

(5) Remove the nose and main landing gear safety locks (AMM 32-00-01/201).

E. Performance Summary

(1) Best performance of the air conditioning packs and airplane structure is as follows:

SYSTEM	BEST PERFORMANCE
Single Pack - Ground Idle	Able to maintain or increase cabin differential at 4.0 PSID and cabin rate of change of 0 or negative value (cabin pressurizing).
Single Pack - 65% N2	Able to maintain or increase cabin differential at 4.0 PSID and cabin rate of change of -500 feet/minute or greater (cabin pressurizing).
Cabin Leakage Rate (4.0 psid down to 2.5 psid)	Greater than 100 seconds required for cabin bleed down to occur.

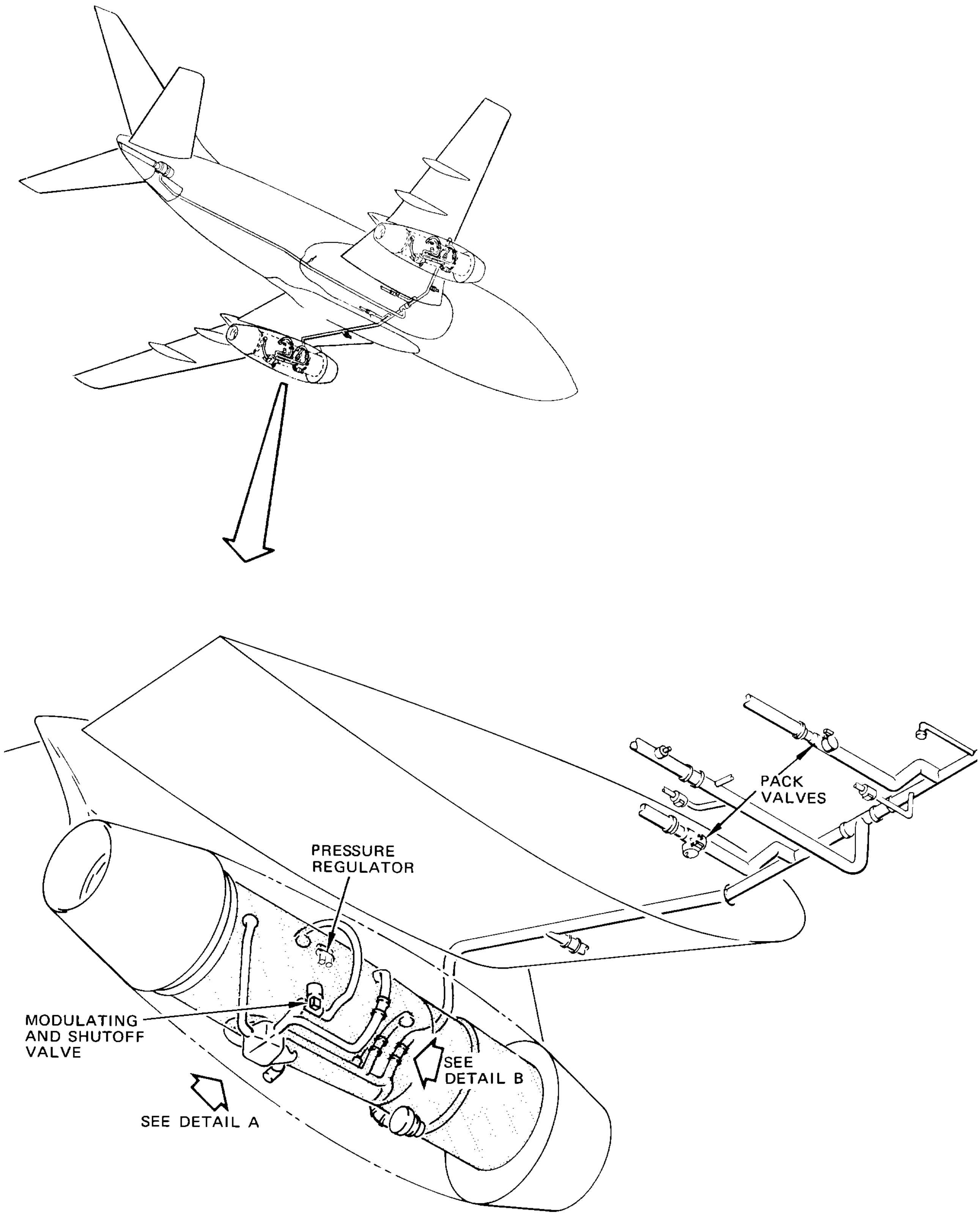
(2) If the test data agrees with the best performance data for the packs (inflow) and the airplane structure (outflow), you can be very sure that cabin pressure can be maintained at cruise (FL250) on a single pack.

(3) Compare the data that you recorded on Figure 202 with the listed best performance data to find the condition of the packs and the airplane.

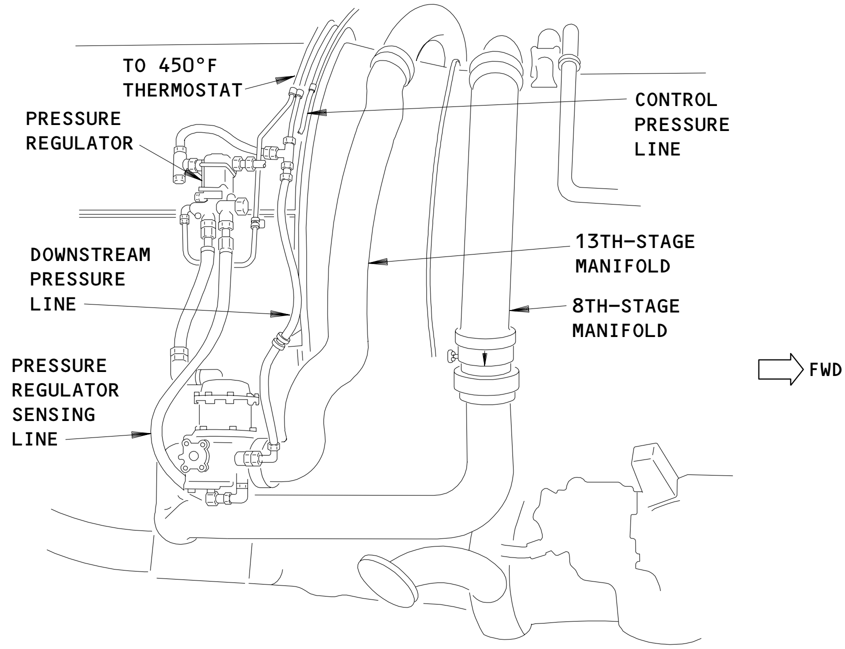
(4) If the test data does not agree with the best performance data for the packs and the airplane structure, refer to troubleshooting analysis and steps to correct the problems.

ENGINE BLEED AIR COMPRESSION CONTROL SYSTEM - DESCRIPTION AND OPERATION

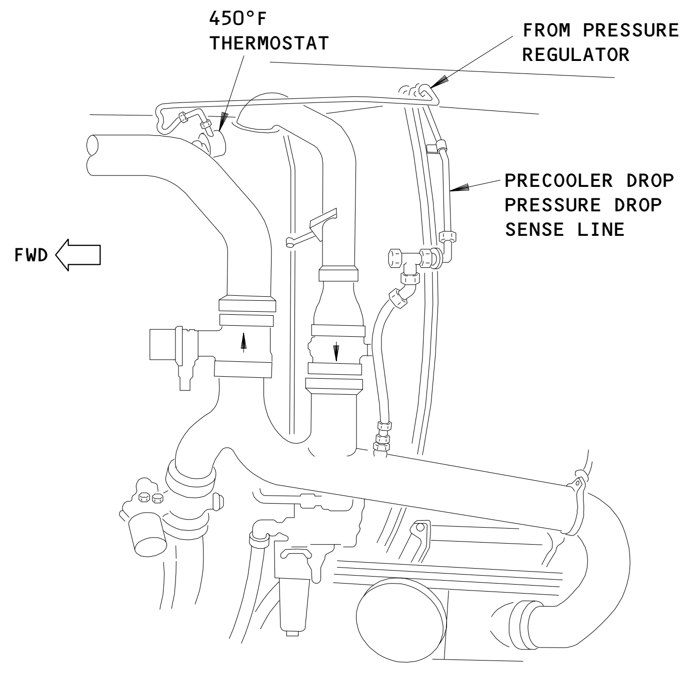
1. General
   A. The air source for the air condition system is the pneumatic manifold covered in Chapter 36, Pneumatic. The air compression control system meters air from the manifold to meet air conditioning airflow requirements. Whenever the output of eight stage pressure is insufficient to meet the air conditioning needs, the control system permits bleed air from the 13th stage to enter the manifold and supplement the airflow output of the 8th stage bleed.
   B. There are two identical and parallel engine bleed air compression control systems. Each bleed control system consists of a pack valve, a pressure regulator, and a modulating and shutoff valve, all interconnected with pressure sensing lines (Fig. 1). The modulating and shutoff valve is located on the 13th stage engine bleed duct, upstream of the precooler heat exchanger. The pack valves are located in the air conditioning pack bay. The engine bleed air compression control system is pneumatic in operation as shown by figure 2.
2. Pack Valves
   A. The pack valves have the purpose of metering the air into the air condition system. The pack valves are pneumatically driven and electrically controlled, with a solenoid override for APU operation (Fig. 2). The pack valves are located in the air condition pack bay and the control switches are located on the forward overhead panel and marked L PACK and R PACK. The units are normally closed flow control and shutoff valves.
   B. Butterfly shutoff operation is accomplished by energizing solenoid A to seat the solenoid ball on the inlet pressure port, thus closing off the actuator air supply and venting the actuator. The actuator spring will then move the butterfly to the closed position.
   C. When solenoid A is energized to seat the ball on the vent port and open the actuator supply pressure port, the control orifice and actuator will be supplied with air pressure for airflow control operation (Fig. 3). The pressure is supplied from an inlet upstream pressure tap and is regulated to a desired value by the pilot regulator. Air then passes through the control orifice and builds up pressure in the actuator chamber, moving the butterfly toward the open position. When the airflow increases to the scheduled value, the venturi control servo bleeds off air through its ball valve at the correct rate to maintain the actuator pressure at the proper level for the desired flow. If the cabin pressure decreases, the bellows will expand and change the venturi control servo spring balance which produces the desired lower airflow rate.
   D. For APU operation, solenoid B is energized to allow inlet pressure to act on the servo reset piston. As the piston moves the venturi control balance is reset to control to a high airflow rate as required for APU operation.



Engine Bleed Air Compression Control System Component Location
Figure 1 (Sheet 1)



RIGHT SIDE
DETAIL A



LEFT SIDE
DETAIL B

Engine Bleed Air Compression Control System Component Location
Figure 1 (Sheet 2)

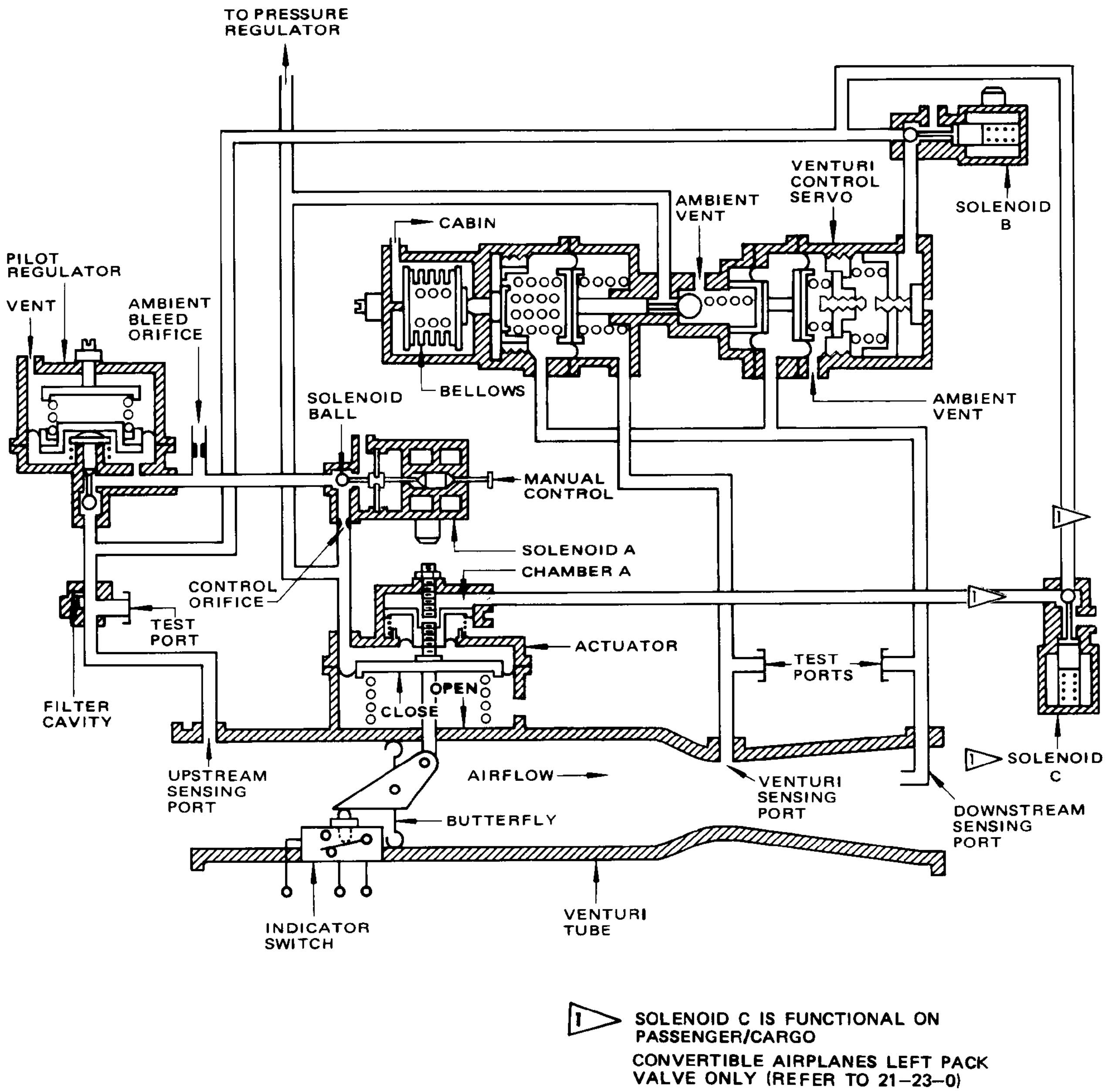
E. On Passenger/Cargo Convertible Airplanes the left pack valve has two modes of operation (normal and low flow). Electrical power to operate the pack valve comes from the air conditioning switch (L PACK) and goes to the SMOKE CLEARANCE switch which is a multiple contact switch. With the air conditioning switch ON and SMOKE CLEARANCE switch in NORMAL the pack valve drives open. (Refer to Passenger Cabin Conditioned Air Distribution System, 21-23-0, Fig. 4). When the SMOKE CLEARANCE switch is placed in the CARGO-P/C UNPRESS position, power is moved from the valve open contact to the valve closed contact and at the same time a circuit is set up to solenoid C (low flow mode). This causes pressure to be removed from the actuator chamber and pressurizes chamber A. As a result instead of the pack valve going full closed it remains slightly open (Fig. 2).

F. A pack valve closed limit switch provides a ground for the pack valve closed relay to drive mix valve full cold after the pack valve closes. The switch is actuated by the valve butterfly bell crank. The latch type solenoid A is provided with a manual control, such that the solenoid valve and latch can be operated manually.

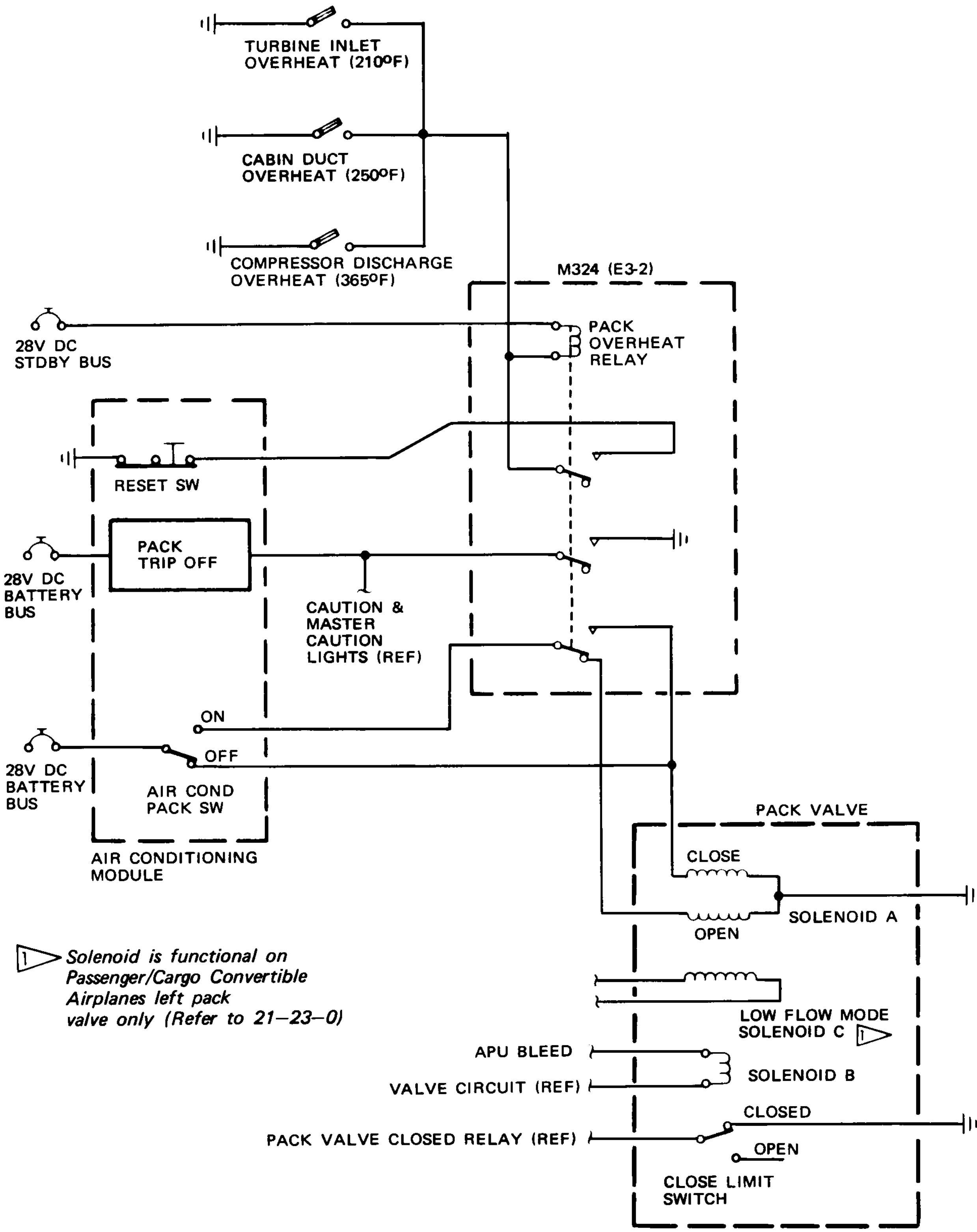
3. Modulating and Shutoff Valve

A. The modulating and shutoff valve adds 13th stage bleed air when 8th stage bleed is inadequate. The modulating and shutoff valve regulates the flow of 13th stage bleed air into the system and is controlled by a pneumatic signal received from the pressure regulator. The unit consists of a pneumatic actuator and butterfly valve. (See figure 4.) The actuator is divided into two pressure chambers, an opening chamber and a closing chamber, and by a diaphragm assembly. The opening chamber is connected by tubing to the pressure regulator, and the closing chamber is connected by tubing to the pneumatic manifold downstream of the heat exchanger. The diaphragm assembly operates the butterfly through a connecting rod and linkage. The butterfly valve consists of a butterfly disk located within the airflow duct of the valve body. A port on the valve body upstream of the butterfly supplies unregulated air to the pressure regulator.

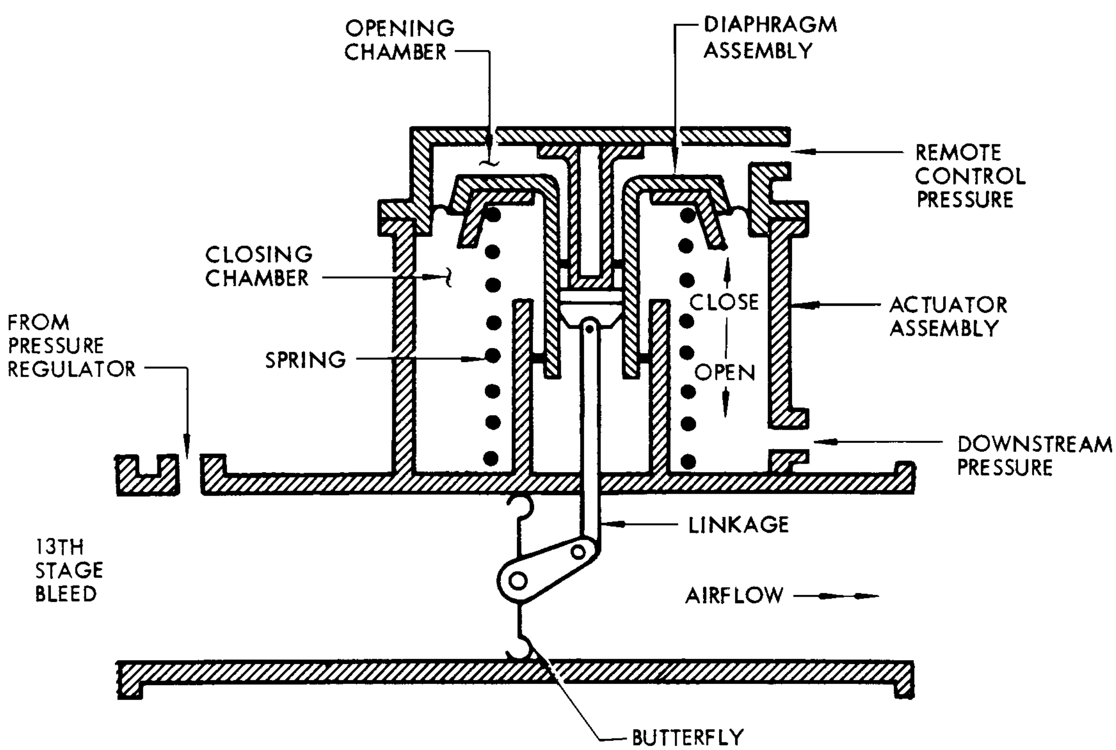
B. During operation, pressure from the pressure regulator is supplied into the opening chamber, where the pressure on the diaphragm overcomes the spring and moves the butterfly toward the open position. Simultaneously the downstream pressure sensed in the closing chamber will supplement the closing spring and tend to drive the valve toward the close position. As the bleed air manifold pressure approaches the differential between the control pressure and closing spring pressure the valve modulates.



Pack Valve Schematic
Figure 2

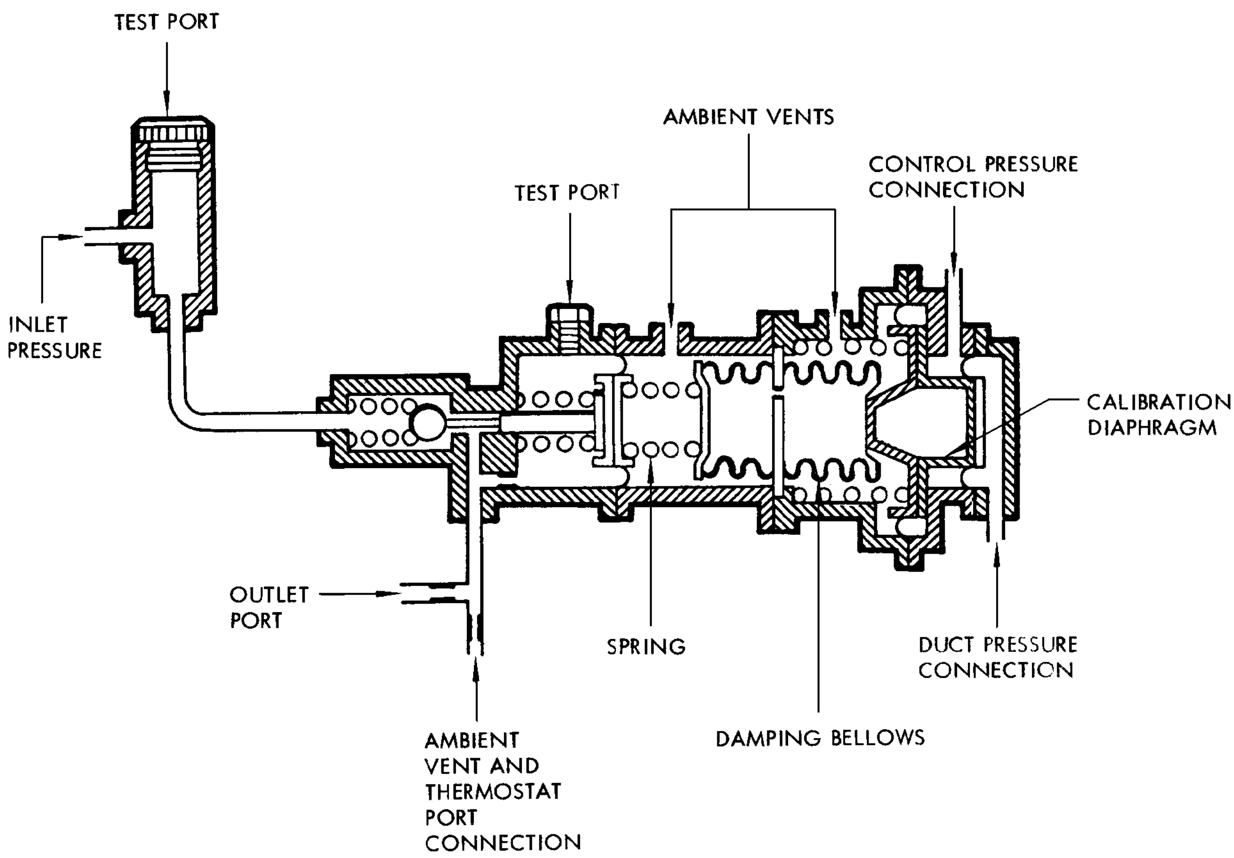


Pack Valve Control Circuit
Figure 3



Modulating and Shutoff Valve Schematic
Figure 4

4. Pressure Regulator
   A. This unit is a variable differential pressure regulator. It is spring-loaded in the open position and regulates outlet pressure to a constant differential above ambient when duct and control pressures are low. At this time the calibration diaphragm assembly rests against the stop in the actuator cover. When duct or control pressure is higher, the calibration diaphragm assembly moves the hydraulic damping bellows assembly and recalibrates the outlet pressure by compressing the regulation spring according to the levels of sensed duct and control pressures. Stroke of the calibration diaphragm assembly is limited by a stop in the actuator body to limit the level to which outlet pressure can be increased. (See figure 5.)
   B. A bleed orifice vents outlet air to ambient to provide a bleed flow for the control orifice. A test port is provided in the inlet port.
5. 450°F Thermostat
   A. A 450° thermostat is provided in the engine bleed air compression system. This thermostat is located in the bleed air duct downstream of the precooler. The thermostat is a direct acting bleedoff, bimetallic sensing probe.
   B. Under most operating conditions the precooler system keeps the air temperature below 450°F but when there is a high airflow demand from the thermal anti-ice and air conditioning systems, the precooler system limits may be exceeded and the air temperature may continue to rise when all systems are functioning properly. The 450°F thermostat operates between 450 and 490°F to prevent trips from the bleed overheat switch during these conditions.
   C. A tube from the thermostat connects to the control line for the modulating and shutoff valve (13th stage). At 450°F an ambient port in the thermostat begins to open reducing control pressure to the valve which causes it to move towards closed. This reduction in pressure causes the modulating and shutoff valve to modulate towards the closed position thereby reducing the total airflow through the precooler. When the thermostat is operating the vent opening to ambient may vary anywhere between full closed and full open depending on temperature of the air.
6. Operation
   A. With the exception of the solenoid valves, the flow control and bleed stage switchover functions are entirely pneumatic. (See figure 6.) When the system is operating on 8th-stage bleed, the actuator regulates the airflow in response to control signals generated by the flow-sensing venturi control servo. This valve controls the pressure in the head of the actuator and responds primarily to the pressure difference sensed by the venturi. If the regulated airflow tends to increase, the venturi airflow will also increase causing the control pressure to decrease and move the actuator toward the closed position.



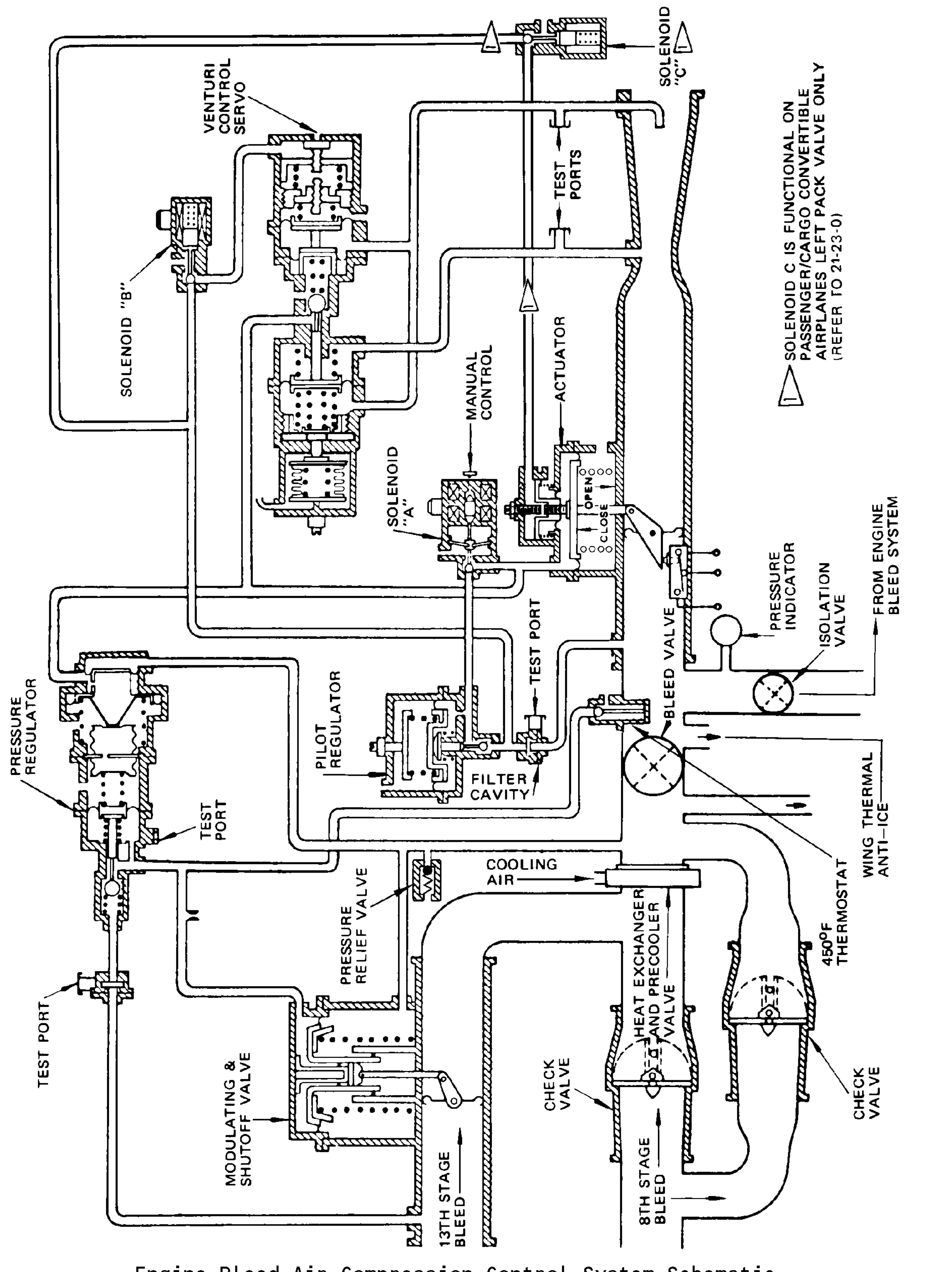
Pressure Regulator Schematic
Figure 5

B. The actuator also functions as the air conditioning pack shutoff valve. When the latching solenoid (A) is closed, the supply pressure from the regulator is cut off and the actuator closes under the action of the spring. When the system is operating from APU bleed air the solenoid (B) is opened allowing an additional pressure to reach the control servo.

C. As the 8th-stage pressure falls, or the system required pressure increases, the venturi pressure increases thereby stroking the actuator towards the open position to maintain essentially constant flow. The control servo pressure is also supplied to the 13th-stage pressure regulator. When the control pressure reaches 7 psi above ambient the modulating valve is wide open and any further increase in control pressure will not affect valve position. However, when the control pressure exceeds 7 psig the pressure regulator comes into action causing the 13th-stage modulating and shutoff valve to modulate.

D. The pressure regulator is a variable output regulator which controls the pressure of the 13th-stage modulating and shutoff valve. The pressure in the bleed air ducts, just downstream of the precooler, is used as a reference for the regulator and this same pressure is also applied to the underside of the 13th-stage modulating valve. As the output pressure of the regulator is increased, relative to its reference pressure, the differential pressure across the 13th-stage valve is increased and the valve modulates towards the open position. The output pressure of the regulator is a direct function of the control pressure magnitude. The overall effect is that the actuator and 13th-stage modulating and shutoff valve operate in sequence. As the 8th-stage bleed pressure decreases the actuator opens to compensate until it reaches the limit of its travel. At this point the 13th-stage modulating and shutoff valve starts to open and supplies progressively more of the required airflow until it takes over completely and the 8th-stage check valves close. The reverse sequence takes place with increasing engine bleed pressure or decreasing system demand pressure.

E. Regardless of the system demand, or the control pressure level, the maximum pressure which the 13th-stage valve can deliver to the system is limited to approximately 45 psig above ambient. If the system pressure, (measured downstream of the precooler) exceeds this value, the 13th-stage valve will start to close under the action of its spring load. At the other end of the pressure range, the pressure regulator, in the absence of any control pressure signal, acts as a fixed reference regulator and controls the 13th-stage valve head pressure to a nominal 11 psig above ambient. This holds the 13th-stage valve open at engine idle power, when the 8th-stage pressure is too low to provide the normal control signal to the 13th-stage valve pressure regulator.



Engine Bleed Air Compression Control System Schematic
Figure 6

ENGINE BLEED AIR COMPRESSION CONTROL SYSTEM - TROUBLESHOOTING

1. General
   A. The compression control system is designed to provide an adequate supply of engine bleed air for starting engines and operating air conditioning at variable engine speeds without over pressurizing pneumatic ducts.
   B. The regulating portion of this system consists of the 13-stage modulating and shutoff valve, a high pressure regulator and a pack valve. Other components which could cause trouble in the system are the 450°F thermostat and the engine bleed precooler. If all of the above units are functioning correctly but system pressure does not stay within limits of curves shown in Fig. 501 of Bleed Air Compression Control System - Adjustment/Test, the problem must exist in the interconnecting sense lines.
   C. The following troubleshooting charts are provided to isolate problems in the system and utilize a test set to provide a go/no-go check of the modulating and shutoff valve, high pressure regulator and the pack valve.
   D. We have eliminated the engine bleed air precooler as a possible fault since any leakage at the precooler massive enough to cause problems should be extremely obvious.
   E. Troubleshooting charts (Fig. 101), in part, utilize a test set and test set procedures for isolation of faults. The test set procedures follow troubleshooting charts.
2. Equipment and Materials
   A. Portable Valve Actuating Test Set - AiResearch Part No. 290121-3
   B. Electrical Cable, Special Purpose - AiResearch Part No. 290406-1-1

   NOTE: Cable is required for test set procedure No. 3 only.

3. TroubleShooting Chart
4. Test Set Procedures
   A. General
      (1) The following troubleshooting procedures are written to provide a maintenance level, go/no-go check of the modulating and shutoff valve, pressure regulator and pack valve without removing the component from the airplane.
   B. Test Set Procedure No. 1 (Modulating and Shutoff Valve)
      (1) Gain access to modulating and shutoff valve and pressure regulator by opening right engine cowl.
      (2) Remove cap from test set fitting No. 6 (Fig. 102).
      (3) Remove plug from pressure regulator filter cavity test port (Fig. 103, Detail A) and install 290224-1 adapter in filter cavity test port of pressure regulator.
      (4) Connect test hose to test set fitting No. 6 and to adapter at filter cavity test port.
      (5) Open test set cylinder shutoff valve.

Accomplish Engine Bleed Air Compression Control System Adjustment/Test with engine running and applicable air conditioning pack on.

Check bleed air pressure. IF -

BLEED AIR PRESSURE IS HIGH - Check for leakage in modulating and shutoff valve downstream sensing tubing. IF -

BLEED AIR PRESSURE IS LOW - Temporarily cap off 450°F thermostat sense line connection and check that pressure increases. IF -

LEAKAGE - Replace or repair leaking tubing.

NO LEAKAGE - Shut down engine, depressurize pneumatic system and check that modulating and shutoff valve closes. IF -

VALVE CLOSES - Replace high pressure regulator.

VALVE DOES NOT CLOSE - Replace modulating and shutoff valve.

PRESSURE INCREASES - Replace 450°F thermostat. (Ref 36-12-41/401)

PRESSURE DOES NOT CHANGE - Shut down air conditioning packs and engines and check high pressure regulator per test set procedure No. 2. IF -

PRESSURE REGULATOR DEFECTIVE - Replace high pressure regulator.

PRESSURE REGULATOR OK - Check modulating and shutoff valve per test set procedure No. 1. IF -

MODULATING AND SHUTOFF VALVE DEFECTIVE - Replace modulating and shutoff valve.

MODULATING AND SHUTOFF VALVE OK - Check pack valve per test set procedure No. 3. IF -

PACK VALVE DEFECTIVE - Replace pack valve.

PACK VALVE OK - Pressurize pneumatic system to locate leakage in control tubing and replace or repair leaking tubing (sense lines) as required.

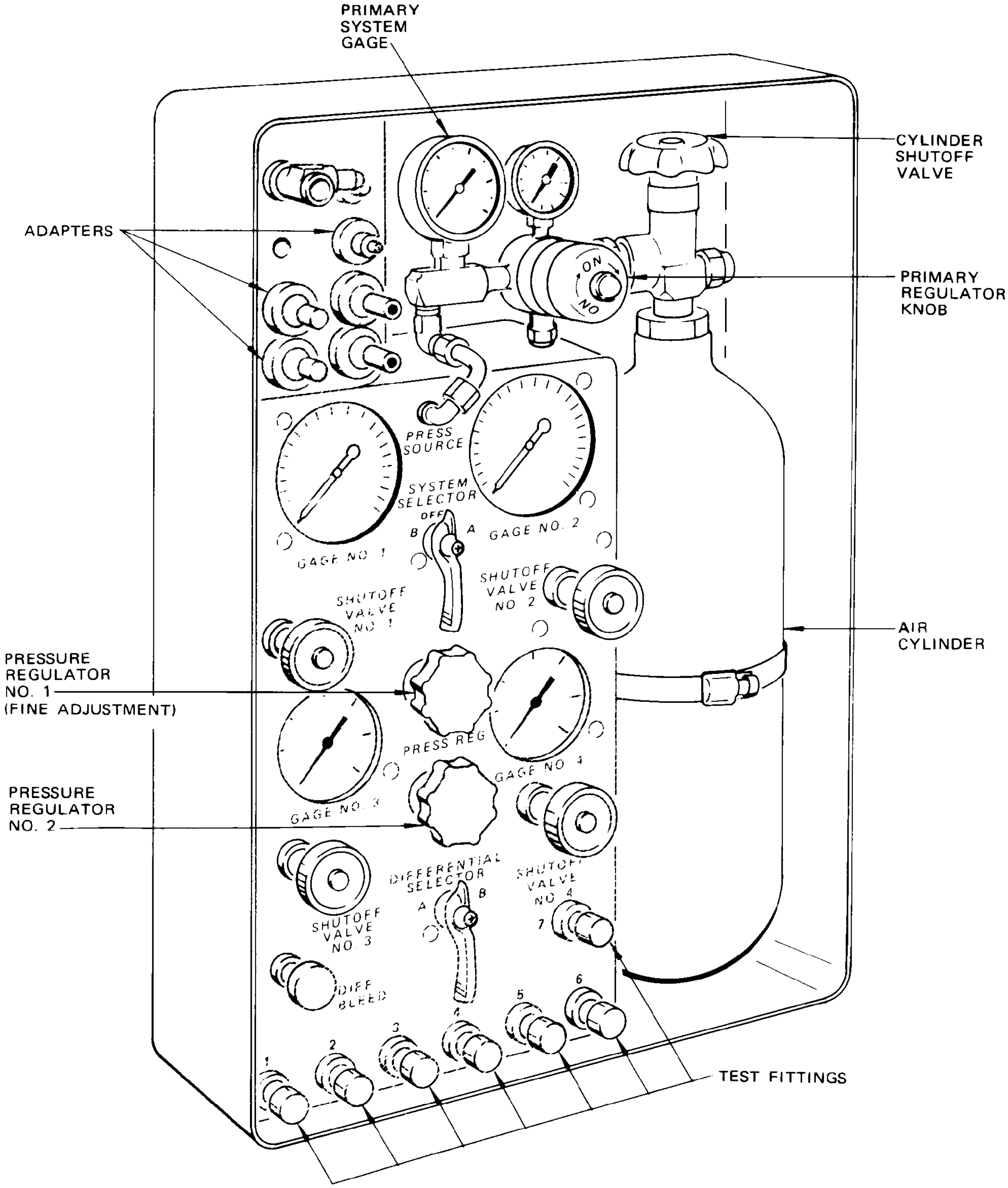
Engine Bleed Air Compression Control System
Figure 101

(6) Turn test set primary regulator knob clockwise until a reading of 50 ±5 psig is obtained on primary system gage.
(7) Place SYSTEM SELECTOR valve handle to A.
(8) Open SHUTOFF VALVE No. 2 and 3.
(9) Turn No. 1 PRESS REG clockwise until a reading of 4.0 inches of mercury is obtained on GAGE No. 2. Check that modulating and shutoff valve butterfly begins to open or is full open by observing the valve position indicator (Fig. 103, Detail B).
(10) Turn No. 1 PRESS REG clockwise until a reading of 8.0 inches of mercury is obtained on GAGE No. 2. Check that modulating and shutoff valve butterfly is full open by observing the visual indicator.

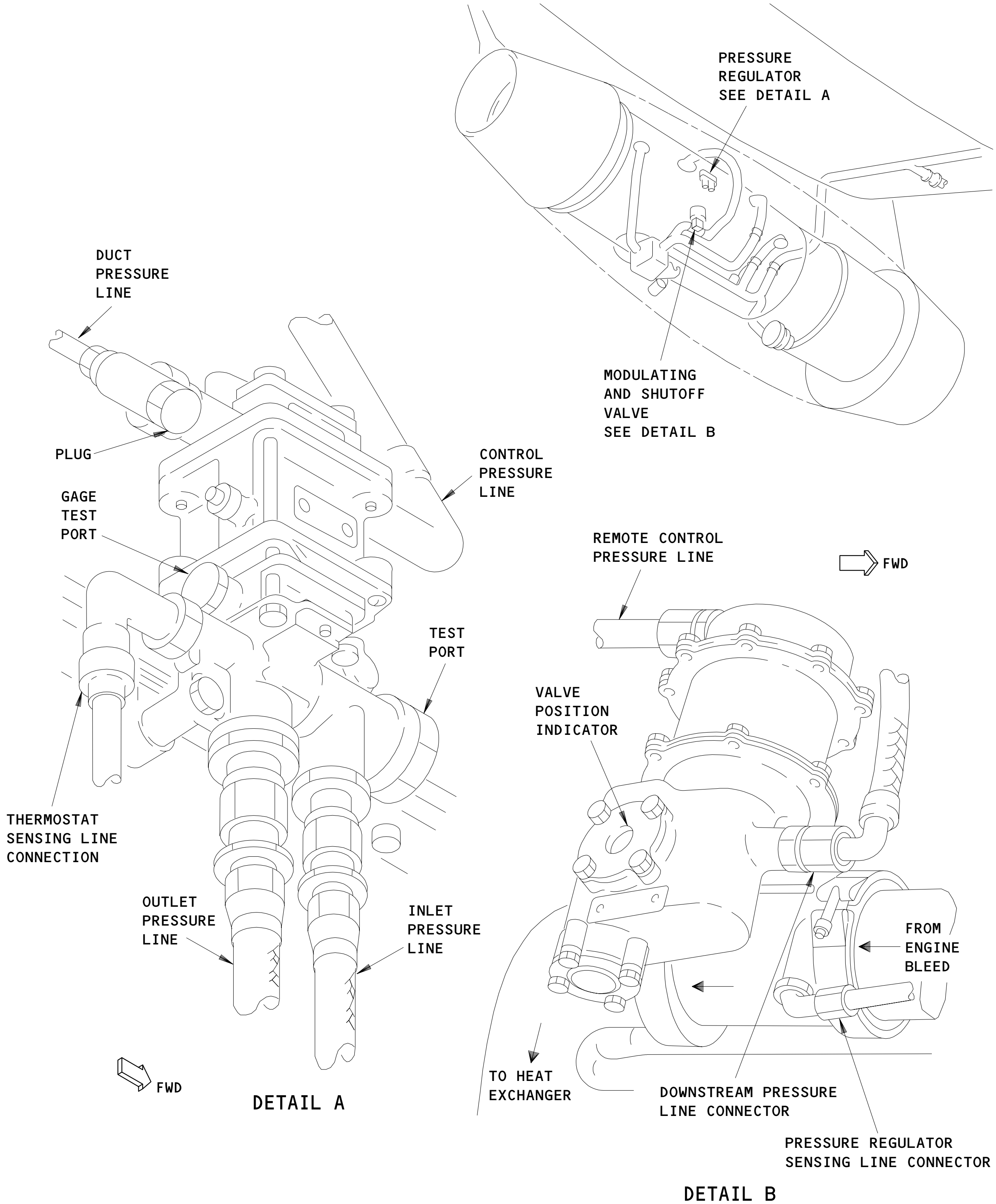
NOTE: If required limits in steps (9) and (10) have been obtained component is satisfactory. If these limits have not been obtained, replace modulating and shutoff valve.

(11) Turn primary regulator knob and No. 1 PRESS REG counterclockwise until a zero pressure indication is obtained on primary system gage.
(12) Close SHUTOFF VALVE No. 2 and 3.
(13) Disconnect test hose from test set fitting No. 6 and from adapter at filter cavity test port of pressure regulator and stow.
(14) Remove adapter from filter cavity test port of pressure regulator.
(15) Install cap on test set fitting No. 6.
(16) Close right engine cowl.

C. Test Set Procedure No. 2 (Pressure Regulator)
(1) Gain access to pressure regulator by opening right engine cowl.
(2) Open air conditioning equipment bay door to gain access to pack valve.
(3) Remove caps from test set fittings No. 2 and 4 (Fig. 102).
(4) Remove plug from pressure regulator filter cavity test port and install 290224-1 adapter in filter cavity test port of pressure regulator (Fig. 103, Detail A).
(5) Connect test hose to test set fitting No. 4 and to adapter at filter cavity test port.
(6) Remove plug from gage test port of pressure regulator and install AN815-4D union in gage test port.
(7) Connect test hose to test set fitting No. 2 and to union at gage test port.
(8) Open test set cylinder shutoff valve.
(9) Turn test set primary regulator knob clockwise until a reading of 65 ±5 psig is obtained on primary system gage.
(10) Place SYSTEM SELECTOR valve handle to A.
(11) Turn No. 1 PRESS REG clockwise until a reading of 59 ±1 psig is obtained on GAGE No. 3.
(12) Check that GAGE No. 4 has a regulated outlet pressure of 12 ±3 psig.



Portable Valve Actuating Test Set
Figure 102

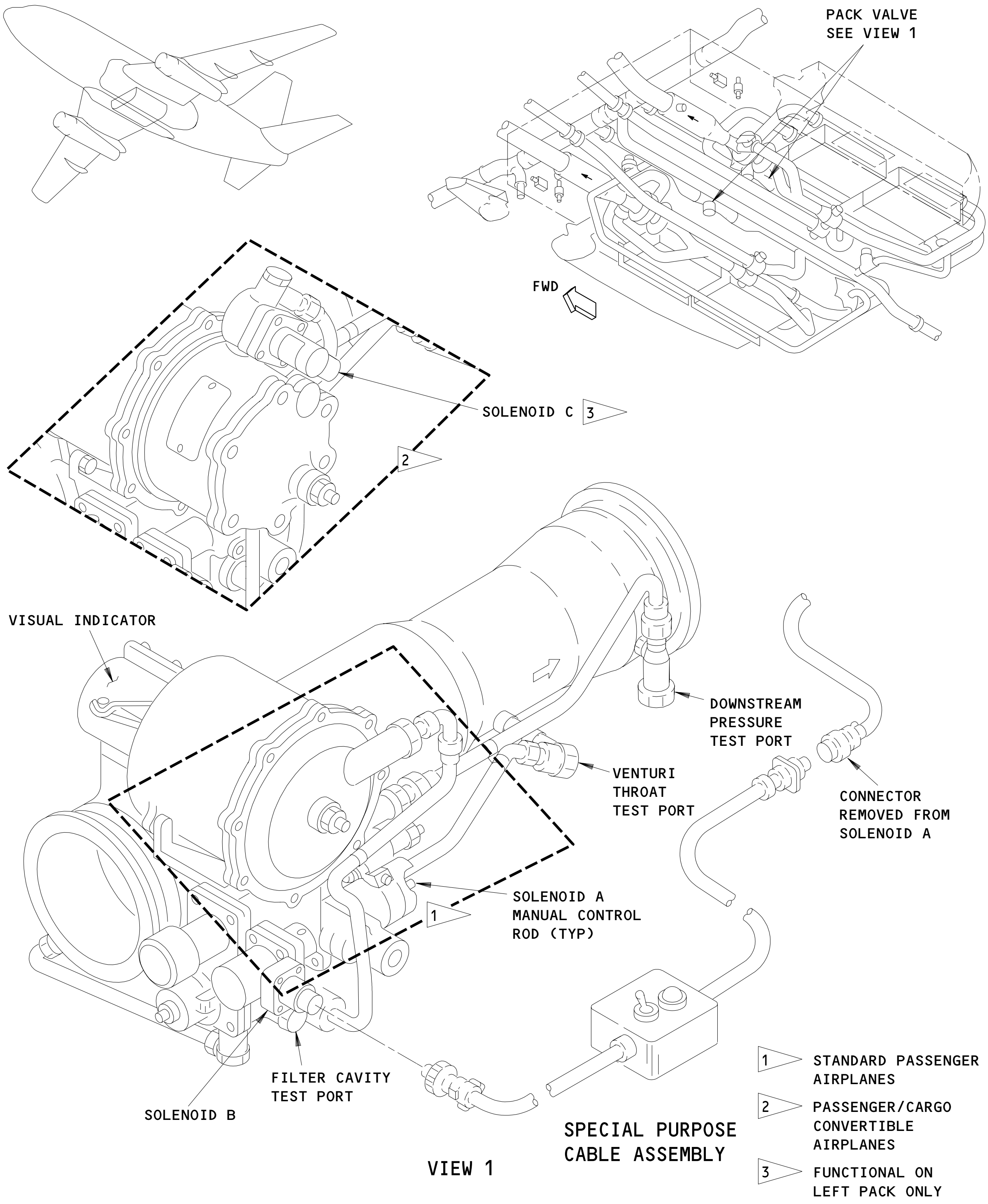


Pressure Regulator and Modulating and Shutoff Valve
Figure 103

(13) Turn primary regulator knob and No. 1 PRESS REG counterclockwise to obtain a zero pressure indication.
(14) Place SYSTEM SELECTOR valve handle to OFF.
(15) Remove caps from test set fittings No. 1 and 7.
(16) Disconnect test hose from test set fitting No. 4 and connect to test set fitting No. 1.
(17) Remove plug from pressure regulator duct pressure line fitting (Fig. 103) and install 290167 adapter. Tighten adapter 180-240 pound-inches. Connect hose from test set fitting No. 4 to adapter in duct pressure line port.
(18) Remove filter cavity test port plug from pack valve and install 290395-1 adapter (Fig. 104). Connect hose from test set fitting No. 7 to adapter in filter cavity test port.
(19) Place test set SYSTEM SELECTOR valve handle to B.
(20) Open SHUTOFF VALVE No. 1 and 2.
(21) Place DIFFERENTIAL SELECTOR valve handle to A.
(22) Turn primary regulator knob clockwise until a reading of 60 ±5 psig is obtained on primary system gage.
(23) Turn PRESS REG No. 1 clockwise until a reading of 20 ±1 psig is obtained on GAGE No. 3.
(24) Using the manual control rod, manually open solenoid A on pack valve.
(25) Turn PRESS REG No. 2 clockwise until a reading of 14.3 ±0.1 inches of mercury is obtained on GAGE No. 2.
(26) Check that GAGE No. 4 has a regulated outlet pressure of 21 ±3.0 psig.

NOTE: If required limits in steps (12) and (26) have been obtained, pressure regulator is satisfactory. If these limits have not been obtained, replace pressure regulator.

(27) Turn PRESS REG No. 1 and 2 counterclockwise until a zero pressure is obtained.
(28) Turn primary regulator knob counterclockwise until a zero pressure is obtained on primary system gage.



Pack Valve
Figure 104

(29) Place DIFFERENTIAL SELECTOR valve handle to off.
(30) Close SHUTOFF VALVE No. 1 and 2.
(31) Manually close solenoid A on pack valve.
(32) Disconnect all test set hoses and stow.
(33) Remove 290395-1 adapter from pack valve and install filter cavity test port plug.
(34) Remove 290167 adapter from pressure regulator and install duct pressure line connection.
(35) Remove 290224-1 adapter from regulator filter cavity test port and install filter cavity test port plug.
(36) Remove AN815-4D Union from gage test port and install gage test port plug.
(37) Install caps on test set fittings No. 1, 2, 4 and 7.
(38) Close test set cylinder shutoff valve.
(39) Close air conditioning equipment bay door.
(40) Close right engine cowl.

D. Test Set Procedure No. 3 (Pack Valve)

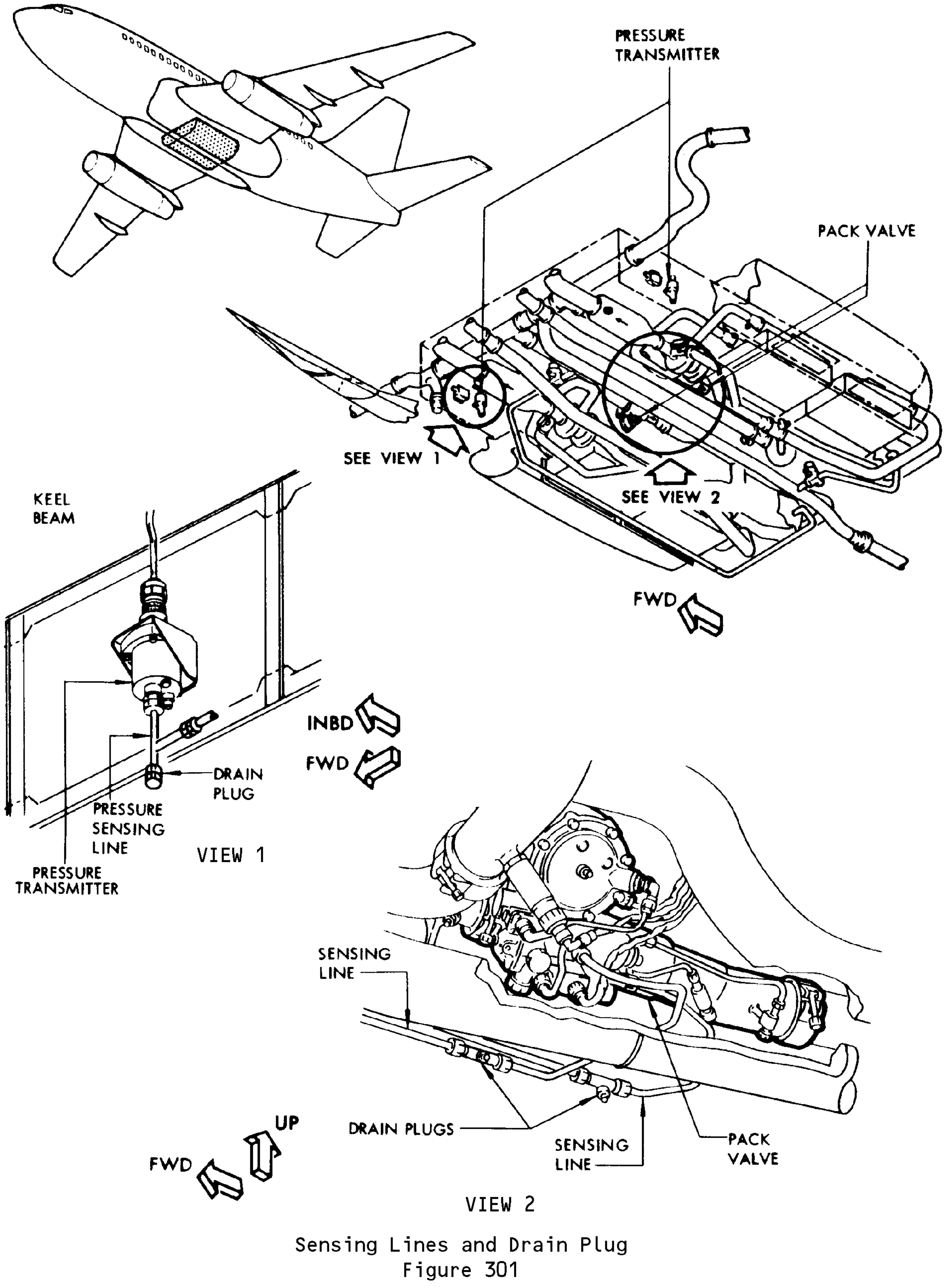
(1) Open air conditioning equipment bay door to gain access to pack valve.
(2) Install special purpose cable assembly (Fig. 104).
(3) Remove caps from test set fittings No. 5 and 6 (Fig. 102).
(4) Remove plug from pack valve filter cavity test port and install 290395-1 adapter in filter test port of pack valve (Fig. 104).
(5) Connect test hose to test set fitting No. 6 and to adapter at pack valve.
(6) Open test set cylinder shutoff valve.
(7) Turn test set primary regulator knob clockwise until a reading of 35 ±5 psig is obtained on primary system gage.
(8) Place test set SYSTEM SELECTOR valve handle to A.
(9) Using the manual control rod, manually open solenoid A on pack valve.
(10) Open SHUTOFF VALVE No. 2 and 3.
(11) Turn PRESS REG No. 1 clockwise until a reading of 17.0 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly is full open by observing visual indicator.
(12) Manually close solenoid A on pack valve.
(13) Turn PRESS REG No. 1 counterclockwise until a zero pressure is obtained on GAGE No. 2.
(14) Place test set SYSTEM SELECTOR valve handle to OFF.
(15) Turn primary regulator knob counterclockwise until a zero pressure is obtained on primary system gage.
(16) Disconnect test set hose from test set fitting No. 6.
(17) Remove cap from test set fitting No. 1 and connect test set hose.
(18) Remove plugs from pack valve venturi throat test port and downstream pressure test port and install 290166 adapters in both test ports (Fig. 104).
(19) Connect test hose to test set fitting No. 5 and to adapter in the venturi throat test port.
(20) Connect test hose to test set fitting No. 6 and to adapter in the downstream pressure test port.
(21) Place test set SYSTEM SELECTOR valve handle to B.

(22) Place test set DIFFERENTIAL SELECTOR valve handle to B.
(23) Turn test set primary regulator knob clockwise until a reading of 35 ±3 psig is obtained on primary system gage.
(24) Using the manual control rod, manually open solenoid A on pack valve.
(25) Check that pack valve butterfly is open by observing the visual indicator.
(26) Turn test set PRESS REG No. 1 clockwise until a reading of 8.0 ±0.1 psig is obtained on GAGE No. 3.
(27) Turn DIFF BLEED valve counterclockwise until a reading of 4.6 ±0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly remains open by observing visual indicator.
(28) Turn DIFF BLEED valve counterclockwise until a reading of 7.0 ± 0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly begins to close or is closed by observing visual indicator.
(29) Turn DIFF BLEED valve clockwise until a zero indication is obtained on GAGE No. 2.
(30) Turn PRESS REG No. 1 clockwise until a reading of 15 ±1 psig is obtained on GAGE No. 3.
(31) Turn DIFF BLEED valve counterclockwise until a reading of 3.6 ±0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly remains open by observing visual indicator.
(32) Turn DIFF BLEED valve counterclockwise until a reading of 5.6 ±0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly begins to close or is closed by observing visual indicator.
(33) Turn DIFF BLEED valve clockwise until a zero indication is obtained on GAGE No. 2.
(34) Turn PRESS REG No. 1 clockwise until a reading of 23 ±2 psig is obtained on GAGE No. 3.
(35) Turn DIFF BLEED valve counterclockwise until a reading of 3.0 ±0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly remains open by observing visual indicator.
(36) Turn DIFF BLEED valve counterclockwise until a reading of 4.4 ±0.2 inches of mercury is obtained on GAGE No. 2. Check that pack valve butterfly begins to close or is closed by observing visual indicator.
(37) Turn DIFF BLEED valve clockwise until a reading of 4.0 inches of mercury is obtained on GAGE No. 2. Note position of butterfly by observing visual indicator.
(38) Energize pack valve solenoid B (Fig. 104). Check that pack valve butterfly moves toward open or is opened.
(39) Turn test set DIFF BLEED valve clockwise until a zero indication is observed on GAGE No. 2.
(40) Turn PRESS REG No. 1 counterclockwise until a zero indication is observed on GAGE No. 3.
(41) Manually close pack valve solenoid A.
(42) Turn primary regulator knob counterclockwise until a zero indication is observed on primary system gage.
(43) Place DIFFERENTIAL SELECTOR valve handle to OFF.

(44) Close SHUTOFF VALVE No. 2 and 3.
(45) Disconnect all three test hoses and stow.
(46) Install caps on test set fittings No. 1, 5 and 6.
(47) Remove 290166 adapters from pack valve venturi test port and downstream pressure test port and install plugs.
(48) Remove 290395-1 adapter from pack valve filter test port and install plug.
(49) Close test set cylinder shutoff valve.
(50) Remove special purpose electrical cable and install solenoid A electrical connectors.
(51) Close air conditioning equipment bay door.

ENGINE BLEED AIR COMPRESSION CONTROL SYSTEM - SERVICING

1. General
   A. Sensing lines are required in the compression control system to interconnect and transmit pressures between components. Since a collection of moisture in any of these lines could cause inaccurate pressure transmittals or cause the tubing to split should the moisture freeze, drain plugs are provided.
   B. Two pressure sensing lines to each pack valve and one line to each pressure transmitter are provided with a drain plug (Fig. 301).
2. Moisture Removal
   A. Open air condition bay door to gain access to drain plugs.
   B. For pack valve sensing lines, remove drain plugs located adjacent to keel beam and inboard of the pack valve (View 2, Fig. 301).
   C. For pressure transmitter, remove drain plug from line beneath the transmitter. The transmitter is attached to the outboard side of the equipment bay near the forward end (View 1).
   D. After moisture has drained, install plug or caps removed in 2.B and/or 2.C.
   E. Close air conditioning bay doors.



Sensing Lines and Drain Plug
Figure 301

ENGINE BLEED AIR COMPRESSION CONTROL SYSTEM - ADJUSTMENT/TEST

1. Engine Bleed Air Compression Control System Test
   A. General
      (1) Bleed air from the engine to the air condition system is automatically adjusted by the modulating and shutoff valve, the pressure regulator and the pack valve. The control system permits bleed air from the 13th-stage to enter the manifold and supplement the airflow output of the 8th stage bleed.
      (2) A solenoid on the pack valve is energized by the A/C pack switch to open or close the pack valve when the engine bleed air distribution system is pressurized. After the valve is opened it modulates automatically to control flow of air to the air cycle system. The following tests provide an operational check of the pneumatic and air cycle systems with the pneumatic system pressurized. For testing the air cycle system without pressurizing the engine bleed air distribution system, refer to 21-51-0, Air Cycle System - Adjustment/Test. Refer to 36-11-0, Adjustment/Test for checking duct leakage.
      (3) The engine bleed air distribution system can be pressurized by a ground pneumatic cart, by the auxiliary power unit (APU) or by engines. The following tests assume that the system is being pressurized either by engine(s) or by APU.
      (4) The test with engines running confirms proper operation of all components in the bleed air compression control system and air cycle system while the test with APU leaves out much of bleed air compression control but checks air cycle system, dual bleed warning, and the pack valve.
      (5) The pressure curve shown in Fig. 502 is for a standard day but does show a typical pattern for all conditions. The curve should not be used as a reason for squawking the bleed air distribution or air cycle systems, but should be used as a comparison of test observations.
      (6) These tests, as written, describe the left bleed air compression control system. The right system is identical except engine 2 should be operated.
   B. Bleed Air Compression Control System Test With Engine Running
      (1) Test Bleed Air Compression Control System
         (a) Check that air conditioning systems turbofans oil level are not below the ADD line on dipsticks and that the ACM's oil level extend at least three fourths the distance to the top of their sight glasses.
         (b) Operate engine No. 1 (Ref Chapter 71, Power Plant).

(c) On forward overhead panel place ISOLATION VALVE switch to CLOSE position, the GASPER FAN and BLEED AIR switch on OFF, the PACK switch on ON, and the APU bleed switch on OFF, and check that bleed air pressure indicator reads 0 ±1.5 psi.
(d) Move PACK switch to OFF.
(e) With engine running at IDLE, place BLEED AIR switch to ON, allow pressure to stabilize, then check that the bleed air pressure indicator reads 11 ±3 psi.
(f) Slowly increase engine power to 1.5 EPR while observing pressure indicator. Check that pressure remains at 11 ±3 psi initially as power is increased then rises smoothly to a final value not exceeding 43 psi.
(g) Slowly decrease engine power to idle and check that pressure indication decreases smoothly to 11 ±3 psi.
(h) Position PACK switch to ON, and AIR TEMP selector to SUPPLY DUCT.
(i) Hold temperature selector to manual COOL until air mix valve moves to full COLD then move selector to OFF.
(j) Check that air is emerging from cabin air outlets.
(k) Slowly increase engine power to 1.5 EPR while observing pressure indicator and check that pressure rises smoothly as power is increased, stabilizes, then again rises smoothly. See Fig. 501 for approximate pressure at which stabilization will occur.

NOTE: Pressure stabilizing then starting to rise again is an indication that system has gone on 8th-stage bleed. The pressure at which stabilization occurs will depend on ambient conditions. The air supply duct indicated pressure curve, Fig. 501, illustrates the pattern at which duct pressure changes with respect to engine speed for different ambient conditions. Although curve does depict specific pressure for a specific condition, the importance of the curve is to show pattern expected when engine bleed air compression control system is operating normally.

(l) After system has gone on 8th-stage bleed, hold engine power setting until system stabilizes then check that duct temperature reads 36 ±4 °F (2 ±2°C).

(m) Slowly decrease engine power and check that pressure indication decreases in reverse to the increase that you saw before.
(n) Move PACK switch to OFF.
(o) Move BLEED AIR switch to ON.
(p) Shut engine off (Ref Chapter 71, Power Plant).

C. Bleed Air Compression Control System Test With APU Running

NOTE: Operate only one pack at a time when performing the following test.

(1) Test Bleed Air Compression Control System
(a) Open air conditioning equipment bay door.
(b) Start APU (Ref Chapter 49, APU Ignition and Starting System).
(c) On forward overhead panel, place ISOLATION VALVE switch to OPEN, ENGINE BLEED switches OFF, APU BLEED switch ON, and PACK switch ON.
(d) Verify that pack valve is on high airflow regulation.

NOTE: During accomplishment of 1) and 2) check that DUAL BLEED light does not come on.

1) Allow the APU exhaust gas temperature to stabilize for a minimum of 2 minutes.
2) Note the APU exhaust gas temperature.
3) Remove electrical connector from APU mode solenoid (solenoid B) on the pack valve (Fig. 502). Check that a slight drop APU exhaust gas temperature occurs.

NOTE: This verifies the operation of the APU flow mode shift to main engine flow control.

4) Reinstall electrical connector and look for slight increase in exhaust gas temperature.

NOTE: If the exhaust gas temperature does not decrease, the pack valve is to be rejected and replaced.

(e) Move PACK switch to OFF.
(f) Move No. 2 ENGINE BLEED switch to ON and check that DUAL BLEED light, MASTER CAUTION lights and AIR COND annunciator light come on.
(g) Move LIGHTS switch on panel P2 to DIM and check that DUAL BLEED light dims. Move switch back to BRT and check that light returns to full brightness.

(h) Depress either MASTER CAUTION light.
   1) Check that both MASTER CAUTION lights and all master caution annunciator lights come on but, when released, only MASTER CAUTION lights, the AIR COND annunciator light, and DUAL BLEED light remain on.

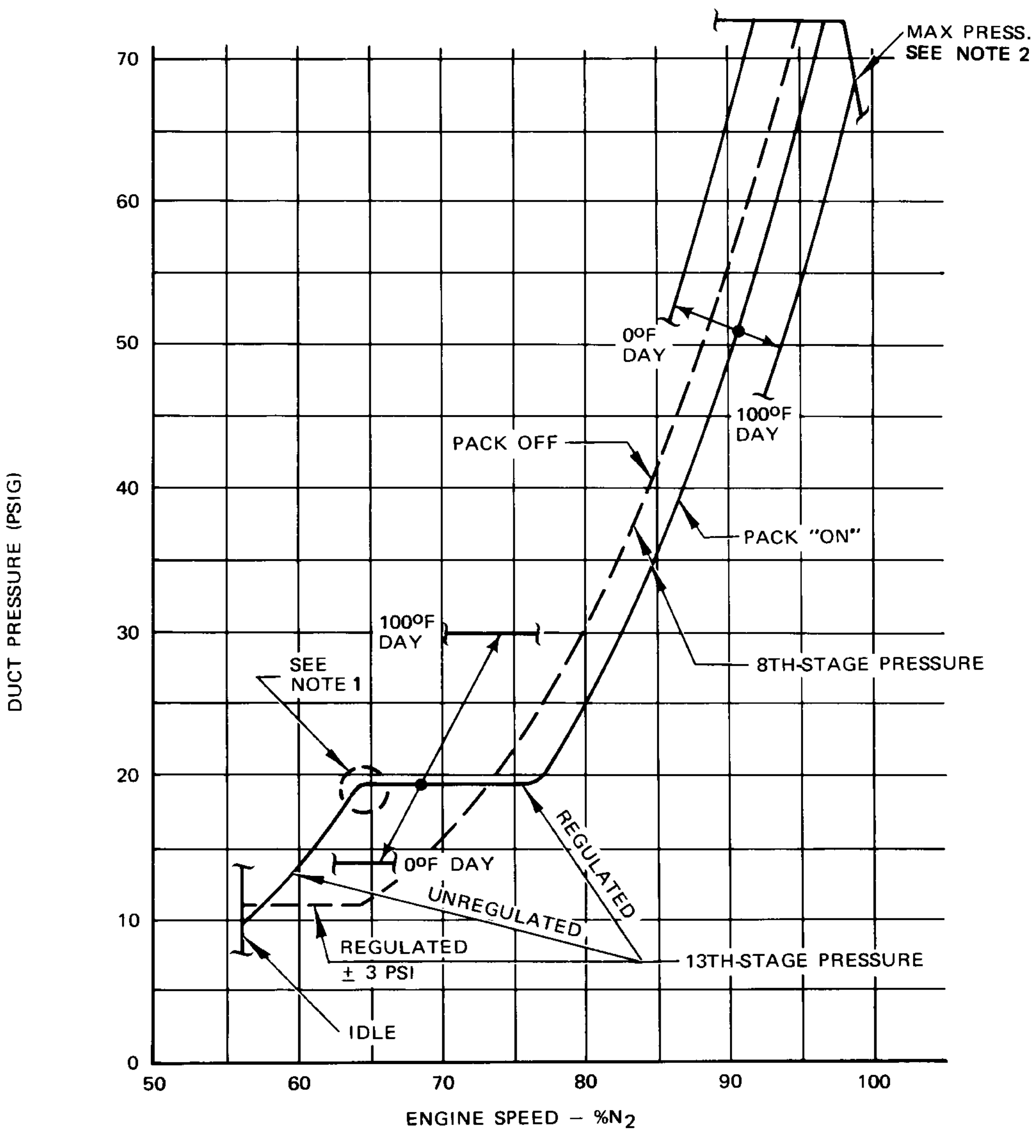
(i) Move ISOLATION VALVE switch to CLOSE and check that MASTER CAUTION lights, AIR COND annunciator light and DUAL BLEED light go out.

(j) Move No. 2 BLEED switch to OFF and No. 1 BLEED switch to ON and check that MASTER CAUTION lights, AIR COND annunciator light and DUAL BLEED light come on.

(k) Move ISOLATION VALVE switch to OPEN, No. 2 BLEED switch to ON and APU BLEED switch to OFF and check that MASTER CAUTION lights, AIR COND annunciator light and DUAL BLEED light go out.

(l) Move both engine BLEED Air switches to ON and ISOLATION VALVE switch to AUTO.

(m) Turn APU off (Ref Chapter 49, APU Ignition and Starting System).



CONDITIONS

SEA LEVEL - STATIC OPERATION
FOR HIGHER ELEVATIONS & FLIGHT OPERATION:
13TH-STAGE REGULATED VALUES AS SHOWN.
UNREGULATED VALUES WILL VARY.

STD DAY 59°F
TREND FOR OTHER DAYS NOTED

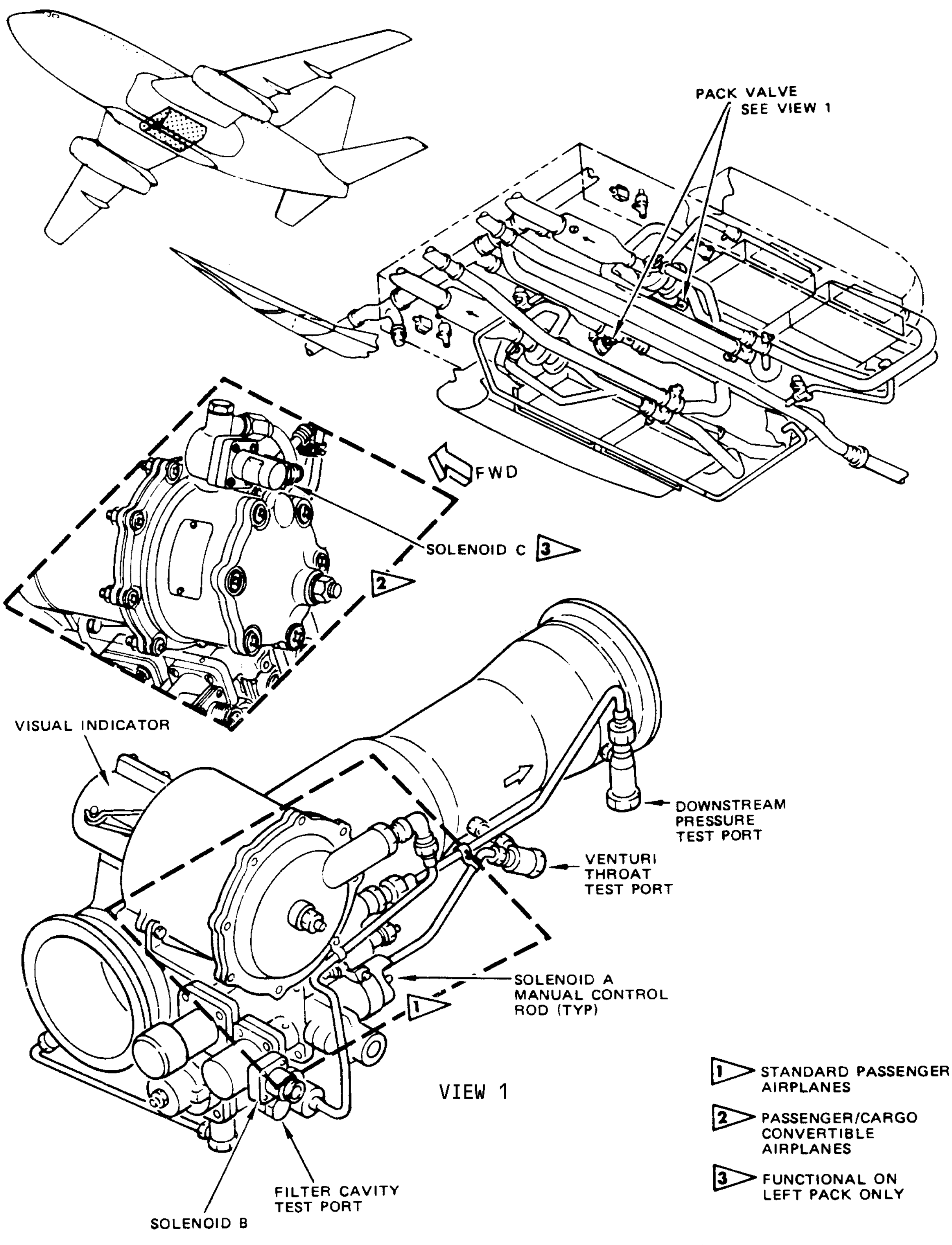
ENGINE BLEED VALVE "ON"

AIR MIX VALVE - FULL "COLD"
WARMER MIX VALVE POSITION TENDS TO LOWER 13TH-STAGE REGULATION LEVEL REQUIRED FOR FULL FLOW.

NOTE: 1 THIS 13-TH STAGE TRANSITION POINT DEFINES THE MINIMUM POWER SETTING REQUIRED FOR FULL PACK FLOW.

NOTE: 2 MAXIMUM PRESSURE AT FULL TAKEOFF. PRESSURE WILL NOT EXCEED 43 PSI DURING TEST AS ENGINE SPEED IS LIMITED TO 1.5 EPR.

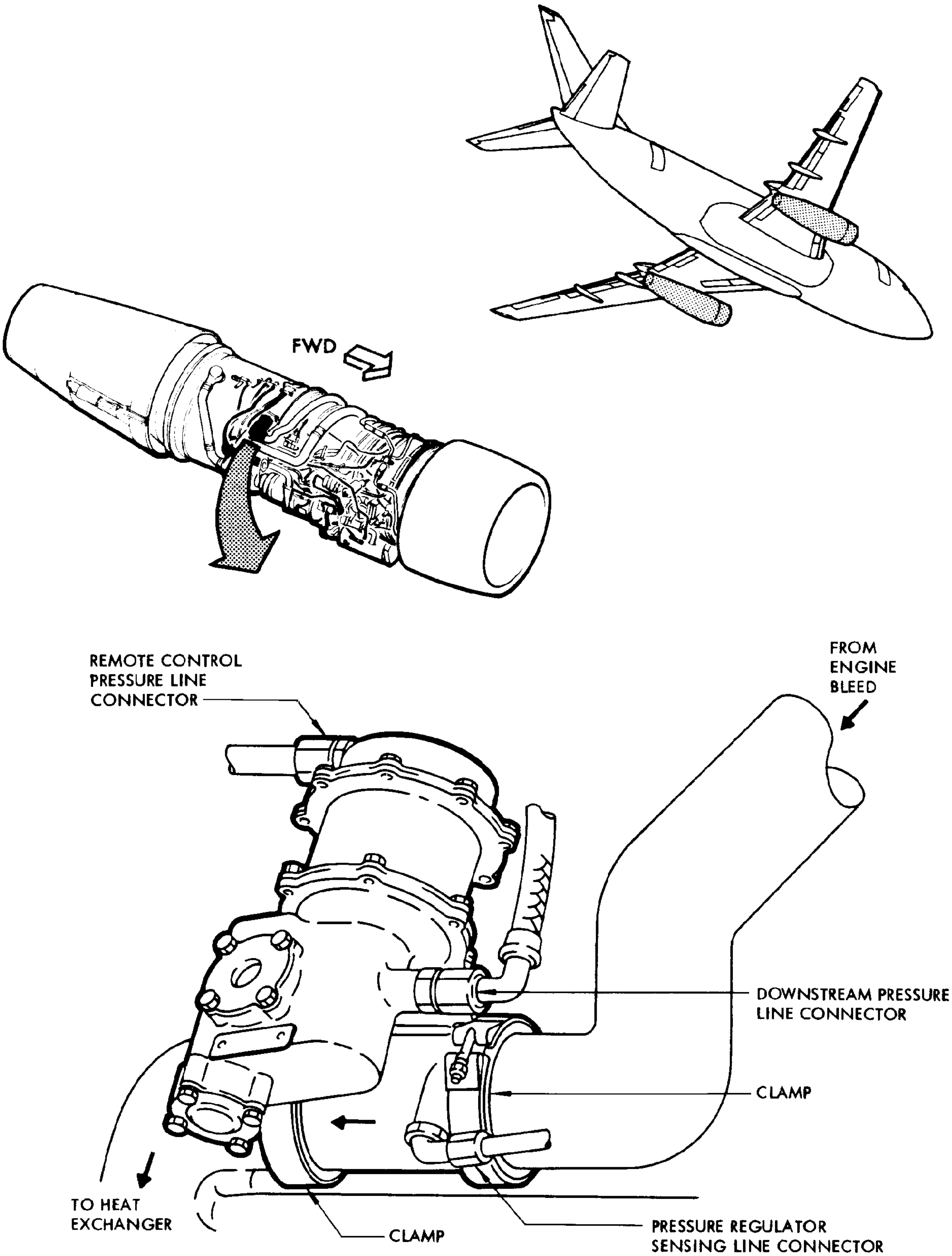
Air Supply Duct Indicated Pressure
Figure 501



Pack Valve Location
Figure 502

MODULATING AND SHUTOFF VALVE - REMOVAL/INSTALLATION

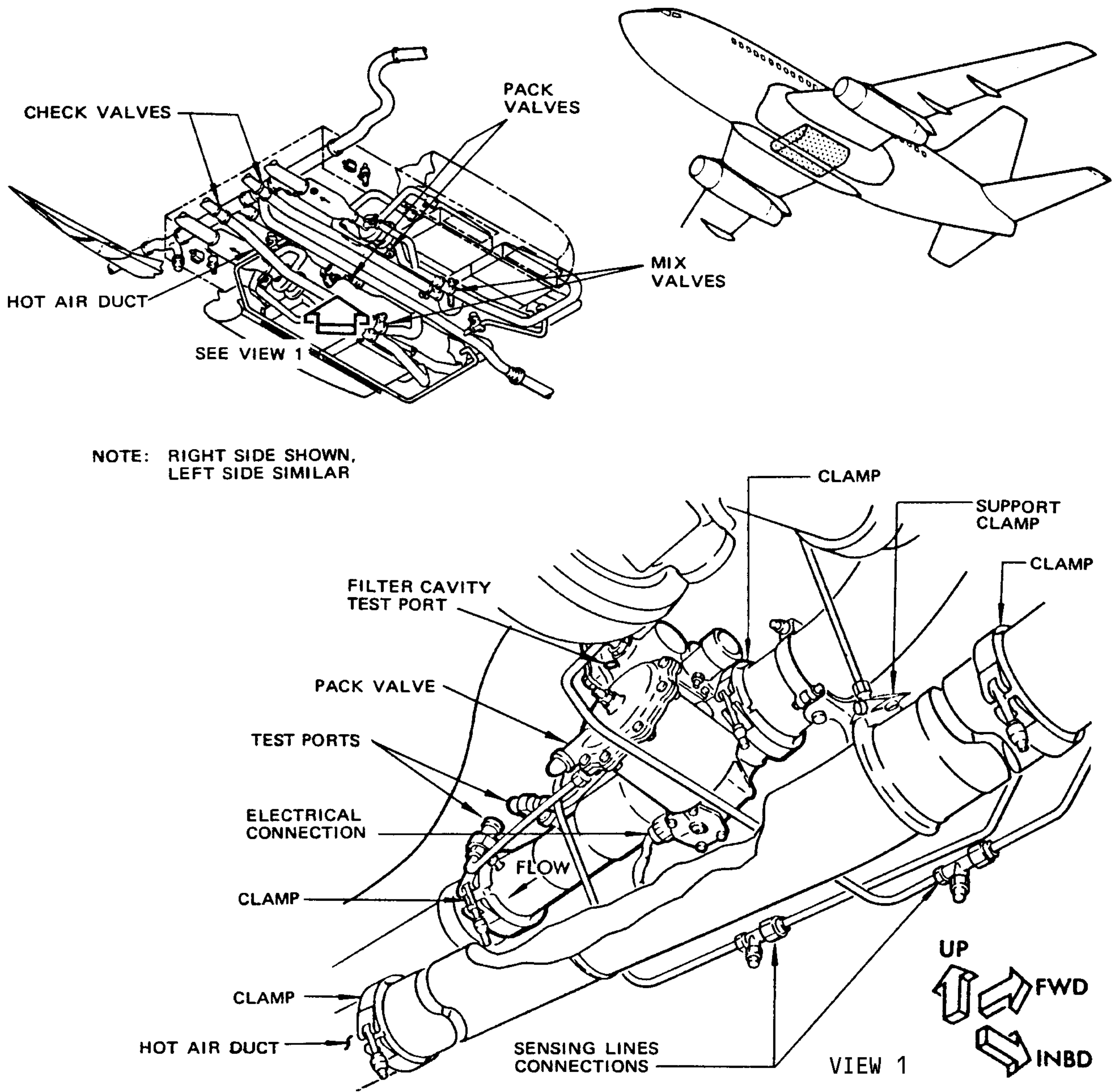
1. General
   A. The modulating and shutoff valve regulates 13th-stage bleed flow when 8th stage cannot meet system flow requirements.
   B. The modulating and shutoff valve is located on the lower right side of each engine.
2. Remove Modulating and Shutoff Valve (Fig. 401)
   A. Gain access to valve by opening right engine cowl.
   B. Disconnect sensing and pressure lines.
   C. Remove clamps on both sides of valve.
   D. Remove valve.
3. Install Modulating and Shutoff Valve (Fig. 401)
   A. Position valve in line with duct and flow arrow pointing aft.
   B. Install and fasten clamps on both sides of valve.
   C. Connect sensing and pressure lines.
   D. Test valve operation. Refer to Engine Bleed Air Compression Control System (AMM 21-11-0/501), or, if preferred, accomplish Test Set Procedure No. 1 (AMM 21-11-0/101).
   E. Close engine cowl.



Modulating and Shutoff Valve Installation
Figure 401

PACK VALVE - REMOVAL/INSTALLATION

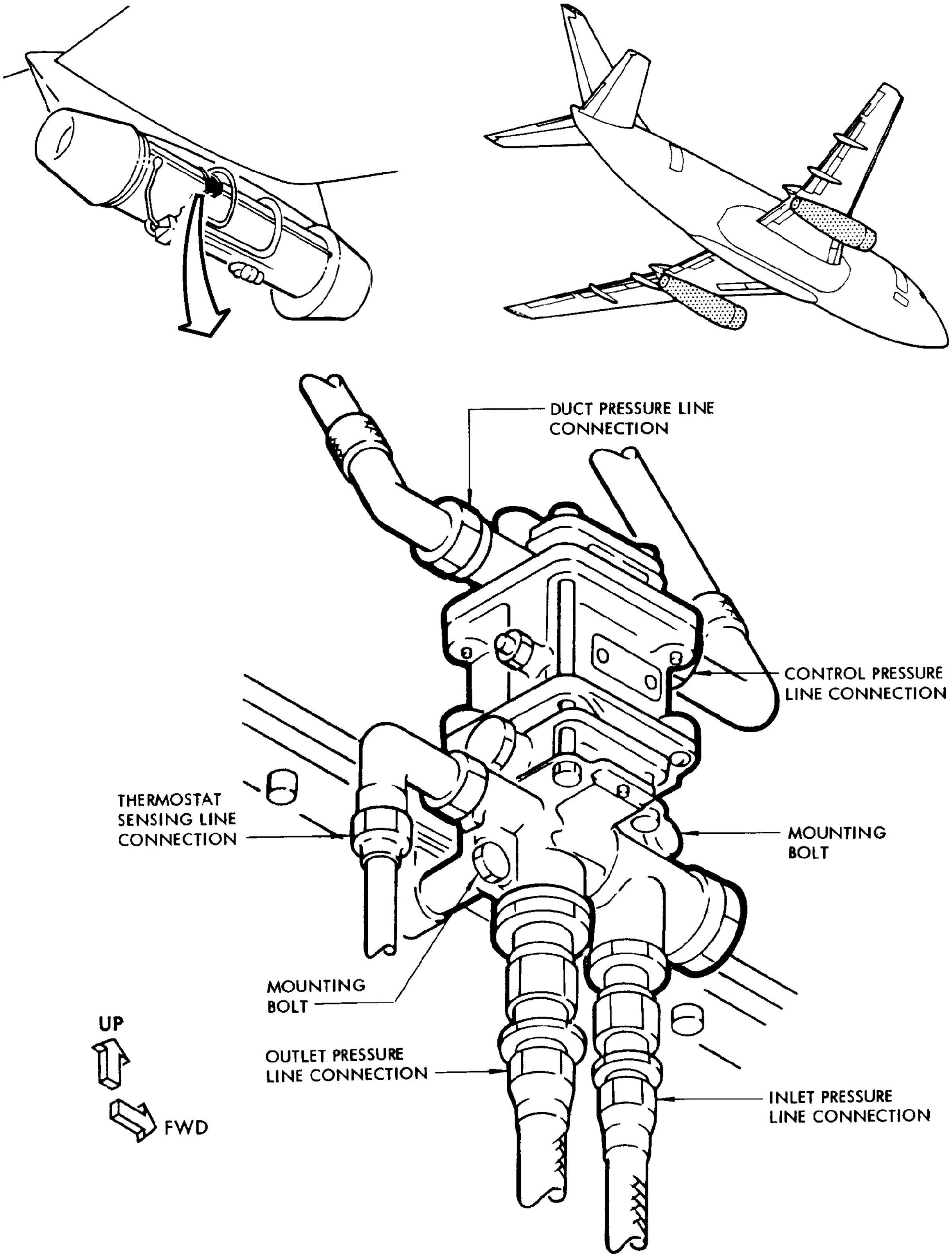
1. General
   A. The pack valves shut off or admit flow of air from the pneumatic manifold to the air conditioning system. The pack valves are located in the left and right air conditioning equipment bay.
2. Remove Pack Valve (Fig. 401)
   A. Open air conditioning equipment bay access door to gain access to valve.
   B. Remove duct clamps and disconnect support clamp of hot air duct forward of mixing valve.
   C. Remove hot air duct.
   D. Disconnect electrical connections and bonding jumper from valve.
   E. Disconnect sensing lines at pack valve.
   F. Remove aft and forward clamp from valve.
   G. Remove valve by sliding straight down.
3. Install Pack Valve (Fig. 401)
   A. Manipulate valve in position with arrow pointing aft.
   B. Install forward clamp on valve; do not tighten.
   C. Rotate valve as required to line up with pressure sensing lines and to permit clear access to the test ports. The heat detector wire may be locally moved or bent.
   D. Install aft clamp on valve; do not tighten.
   E. Rotate forward clamp as required so clamp nut can be tightened from outboard.
   F. Connect pressure sensing lines.
   G. Tighten forward and aft clamps.
   H. Connect electrical connection and bonding jumper.
   I. Locate hot air duct in support so duct ends align with mix valve and cold air check valve.
   J. Install forward and aft clamps of hot air duct.
   K. Tighten support clamp.
   L. Test pack valve operation (AMM 21-11-0/501).
   M. Close air conditioning equipment bay access doors.



Pack Valve Installation
Figure 401

PRESSURE REGULATOR - REMOVAL/INSTALLATION

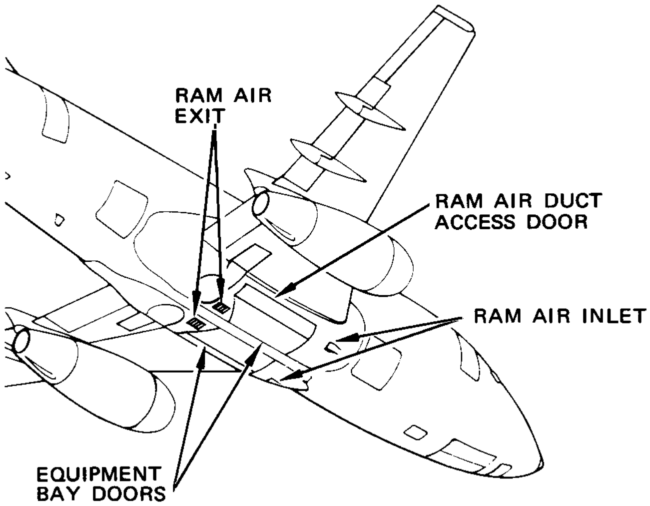
1. General
   A. The pressure regulator controls the modulation of 13th-stage bleed flow in conjunction with the flow through the pack valve.
   B. The pressure regulator is mounted on the right side of each engine above the 13th-stage valve.
2. Remove Pressure Regulator (Fig. 401)
   A. Gain access to regulator by opening right engine cowl.
   B. Disconnect sensing and pressure lines.
   C. Remove mounting bolts from mounting bracket.
   D. Remove regulator.
3. Install Pressure Regulator (Fig. 401)
   A. Position regulator on mounting bracket.
   B. Install mounting bolts.
   C. Connect sensing and pressure lines.
   D. Test pressure regulator. Engine Bleed Air Compression Control System - Adjustment/Test, or, if preferred, accomplish Test Set Procedure No. 2 of Engine Bleed Air Compression Control System - Trouble Shooting, 21-11-0.
   E. Close engine cowl.

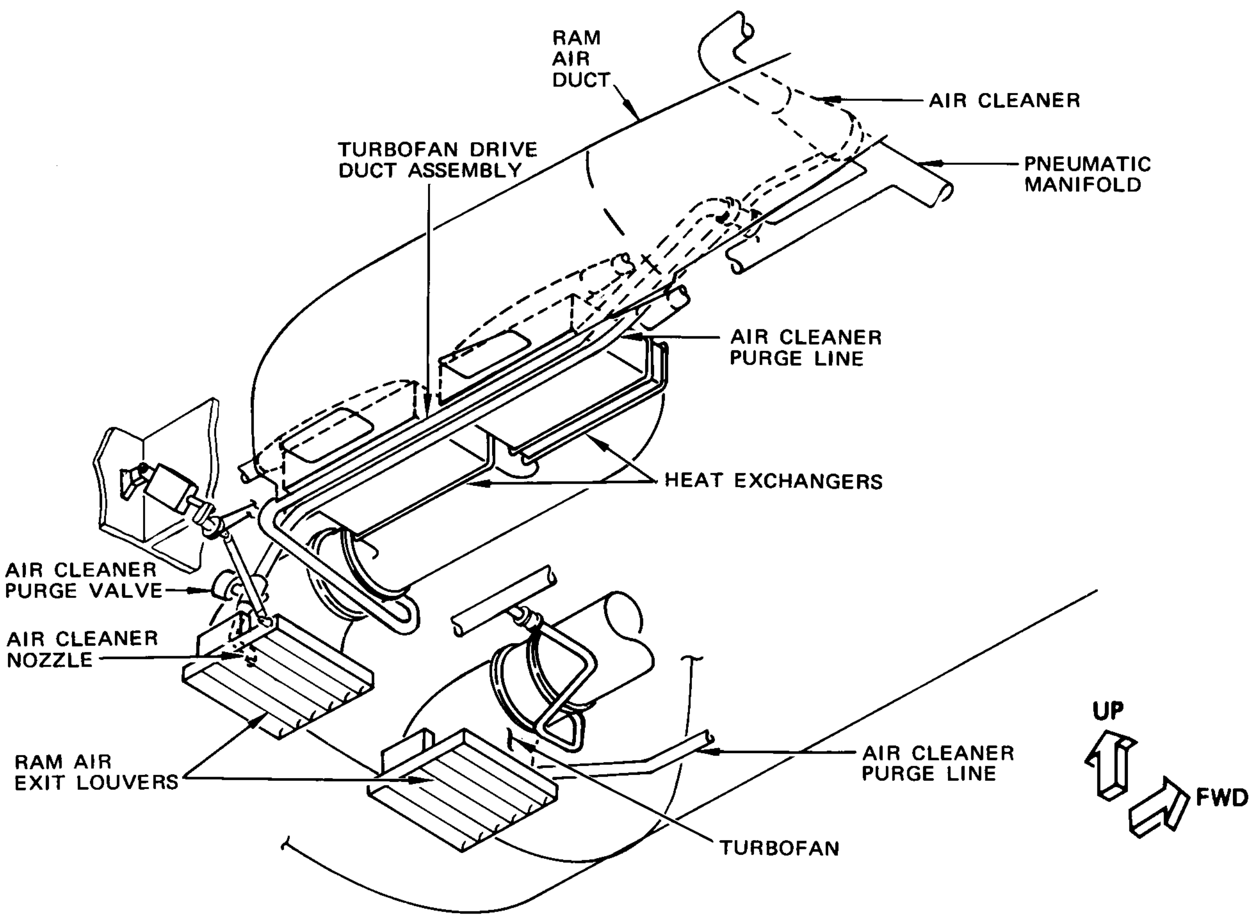


Pressure Regulator Installation
Figure 401

AIR CLEANER SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. An air cleaner system is provided to purge the engine bleed air from engines No. 1 and 2 of impurities. The system consists of two similar subsystems which function automatically whenever engine bleed air is used for air conditioning, and the airplane is on the ground or the flaps are extended. Each subsystem consists of an inertial type air cleaner and purge air ducting, an electrically controlled pneumatically operated purge valve and an electrical control system. The impurities collected by the cleaner are vented overboard through the ram air exit louvers. The air cleaners are located in the pneumatic manifold outboard of the duct to each air cycle system (Fig. 1).
2. Air Cleaner
   A. The air cleaner is an in-line inertial type. Air leaving the engine heat exchanger (precooler) is ducted into the center of the air cleaner, which is lined with louvered vanes around the perimeter. The air passing through the cleaner is forced to change direction abruptly, to pass through the louvers. This tends to force any heavy particles suspended in the air to continue on to the downstream end of the cleaner where they are collected in a collector ring. The collector ring is connected by the purge air duct through the purge valve to the ram air exhaust duct downstream of the turbofan valve. An air cleaner nozzle in the connection to the ram air exhaust duct limits the amount of air vented overboard for purging the air cleaner. When the purge valve is open air is bled through the collector ring, blowing the particles into the purge air duct and overboard. The clean air is ducted around the outside of the collector ring and into the pneumatic manifold (Fig. 2).
3. Purge Valve
   A. The purge valve is a pneumatically operated, electrically controlled, butterfly valve which controls the flow of bleed air from the air cleaner collector ring. The valve consists of an actuator and butterfly assembly and a solenoid operated pilot valve assembly.
   B. The actuator is divided into two pressure chambers, an opening chamber and a closing chamber, by a diaphragm assembly. The opening chamber is ported to the solenoid pilot valve, and the closing chamber is vented to ambient. The diaphragm actuates the butterfly through a connecting rod and linkage, and is spring loaded in the valve closed position. The butterfly valve consists of a butterfly disk which seats against a floating type seal located within the airflow duct of the valve body. The butterfly shaft has an external valve position indicator and the linkage has an adjustment screw for port leakage adjustment.





Air Cleaner System Components Location
Figure 1

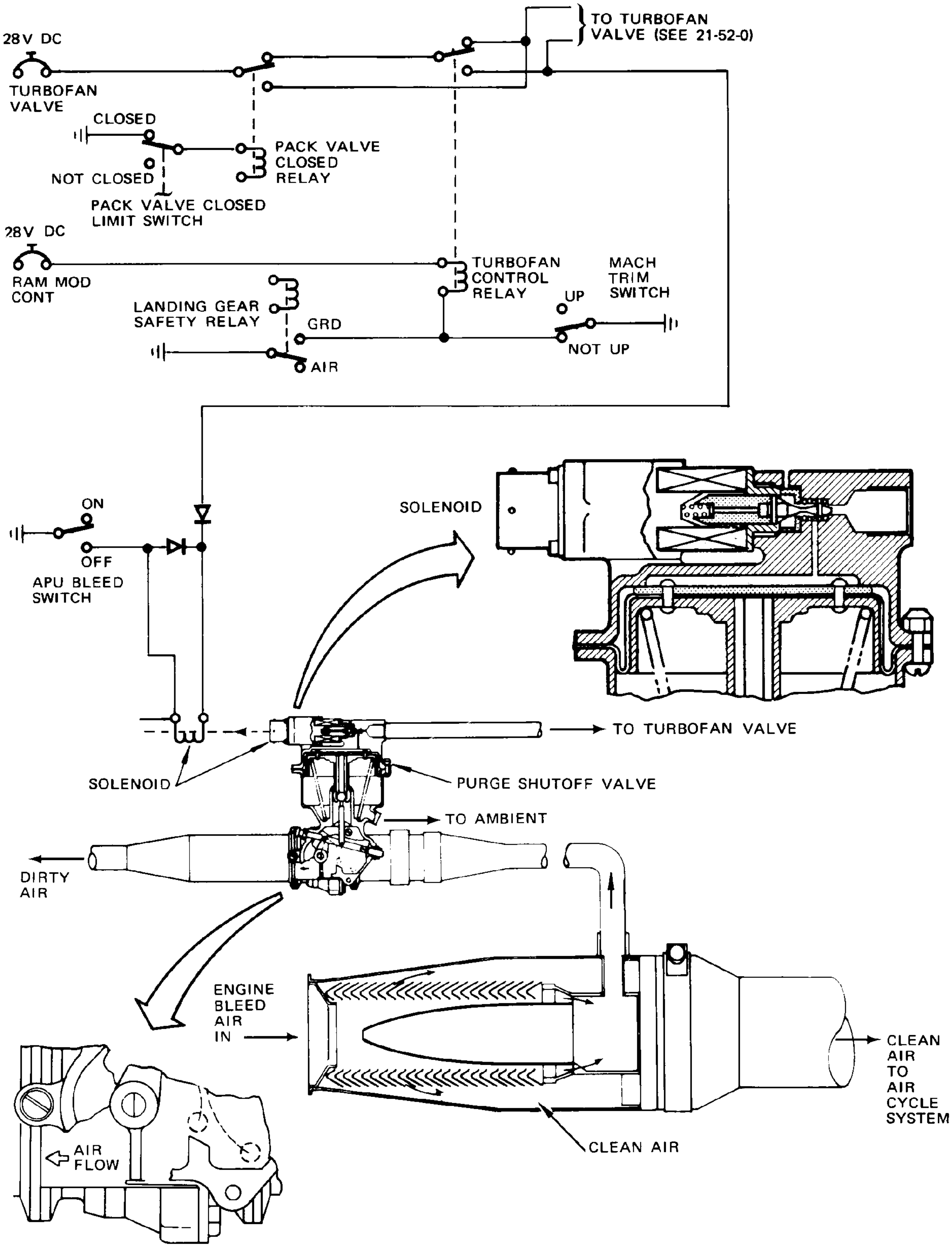
C. The solenoid operated pilot valve consists of a solenoid and a three port, two position poppet valve. One port is connected to the downstream side of the turbofan valve to sense pneumatic duct pressure. The second port is vented to ambient and the third port is connected to the actuator opening chamber. When the solenoid is de-energized the poppet connects the opening chamber to ambient, and closes off the port to duct pressure. When the solenoid is energized the poppet connects the opening chamber to duct pressure and closes off the ambient port. Energizing of the valve solenoid will actuate the valve to the open position as long as the pneumatic duct pressure exceeds ambient by more than the force of the valve closing spring (5 psi).

4. Electrical Control

A. Power to the purge valve solenoids is supplied from the 28-volt dc TURBOFAN VALVE circuit breaker on the P6 circuit breaker panel, through the pack valve closed relay and turbofan control relay. The circuit to the purge valve is completed through the APU BLEED switch contacts on P5 panel (Fig. 2).

5. Operation

A. The air cleaner system is completely automatic in operation. The air cleaner purge valve for engine No. 1 or No. 2 is opened whenever the air conditioning system is operating, the APU bleed switch is off, and the airplane is on the ground (landing gear safety relay energized) or the flaps are extended (mach trim switch closed). The air cleaner purge valve will automatically close whenever the air conditioning system is off, APU bleed switch is on, or during flight after flaps have been fully retracted.



Air Cleaner System Schematic
Figure 2

AIR CLEANER SYSTEM - ADJUSTMENT/TEST

1. General
   A. The air cleaner system does not require adjustment as the amount of bleed air required to purge the cleaner is predetermined by the air cleaner nozzle assembly in the ram air exit duct.
   B. Testing the air cleaner system consists of checking the proper functioning of the electrically controlled pneumatic purge valve. The test is effective in establishing the correct function of the electrical control circuit and the operation of the purge valve.
   C. The test is accomplished separately for each system with the respective air conditioning system operating, pneumatic system pressurized and electrical power provided to the airplane. The following test is applicable to either right or left air cleaner system.
2. Air Cleaner System Test
   A. Equipment and Materials
      (1) Electrical ground power supply - 115/200 volts ac, 400 Hz, 3 phase
   B. Prepare for Test
      (1) Open air conditioning equipment bay doors.
      (2) Check turbofan oil level and service if required (Ref Chapter 12, Ram Air System Turbofan Servicing).
      (3) Provide electrical power.
      (4) Check that the following circuit breakers on circuit breaker panel P6 are closed:
         (a) L and R TURBOFAN
         (b) L and R RAM MOD
         (c) RAM MOD CONT
         (d) MASTER CAUTION (all except FUEL, if installed)
         (e) INDICATOR LTS, MASTER DIM BUS (nine places)
         (f) DIM & TEST (one place)
      (5) Connect air source to pneumatic system ground service connection.

      NOTE: The isolation valve must be opened to provide air to the left ram air system turbofan valve (Ref Chapter 36, Engine Bleed Air Distribution System).

   C. Test Air Cleaner System
      (1) Lower wing flaps to any position other than full up (Ref Chapter 27, Trailing Edge Flap System).
      (2) Check that air conditioning PACK switch is OFF.
      (3) Check that turbofan valve is closed.
      (4) Pressurize pneumatic system.
      (5) Disconnect electrical connector which is located on the side of the pack valve visual indicator.
      (6) Check that turbofan valve opens and turbofan starts.

(7) Place APU BLEED switch to ON. Check that purge valve goes to CLOSED as noted by the valve position indicator.

(8) Place APU BLEED switch to OFF. Check that purge valve goes to OPEN as noted by valve position indicator.

(9) Connect electrical connector disconnected in step (5) to pack valve. Check that turbofan valve closes and turbofan stops.

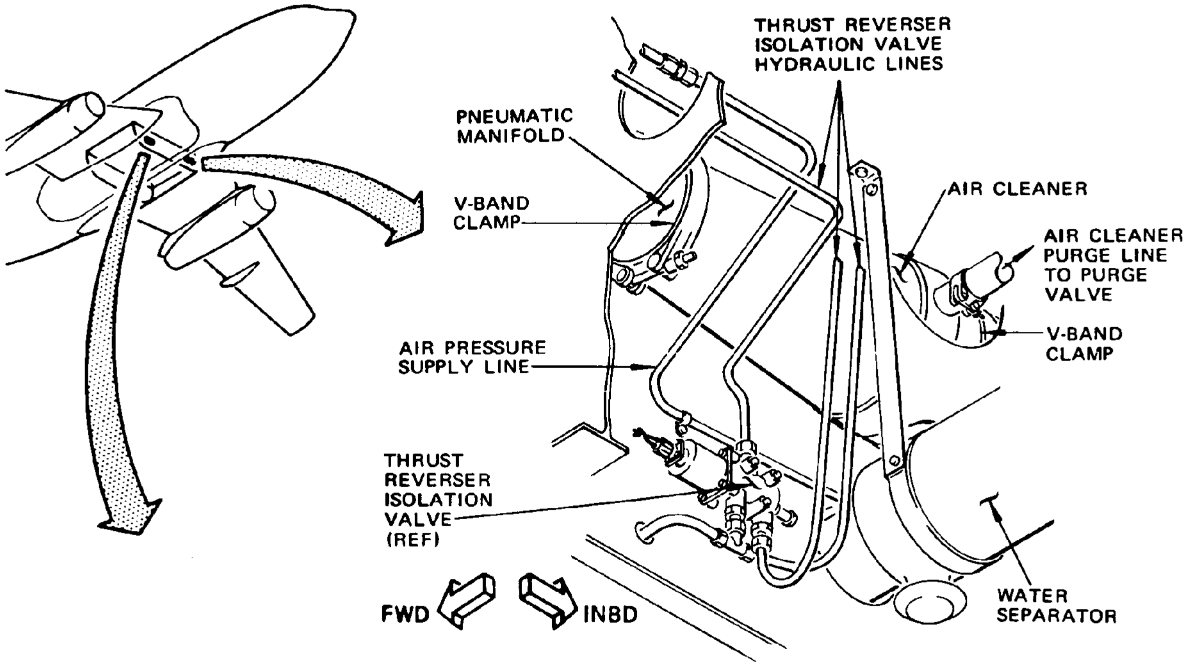
D. Restore Airplane to Normal Configuration

(1) Remove air source and close air conditioning equipment bay doors.

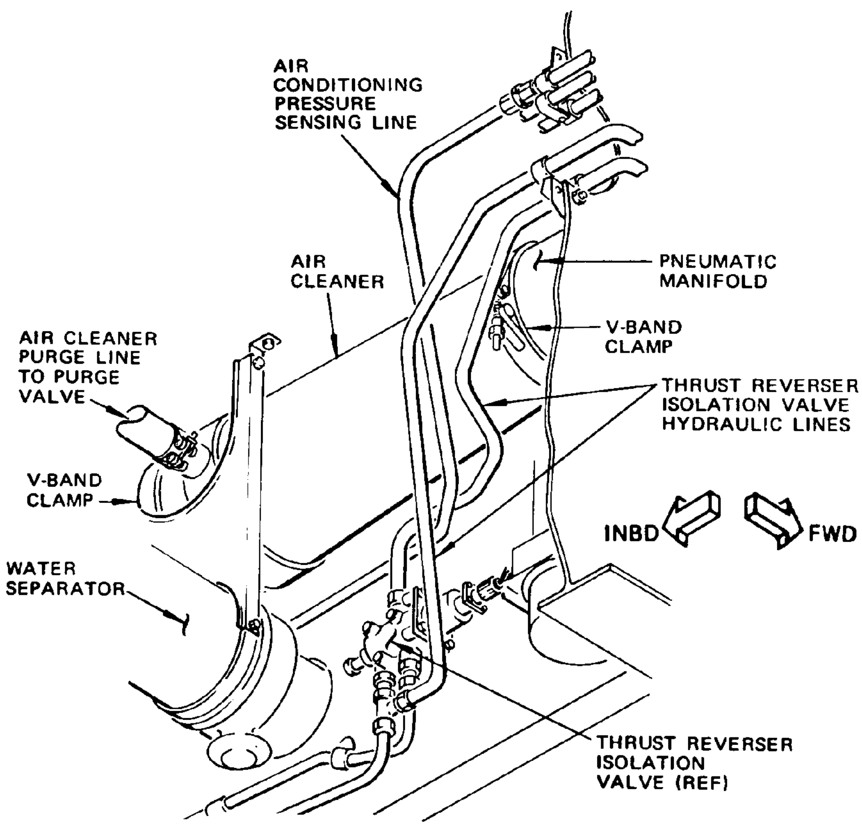
(2) If no longer required, remove electrical power from airplane.

ENGINE BLEED AIR CLEANER - REMOVAL/INSTALLATION

1. General
   A. EFFECTIVITY:
      (1) NH ALL EXCEPT JA-8401 THRU JA-8403, JA-8405 THRU JA-8408
          ML ALL EXCEPT 9M-AOU THRU 9M-AOW, 9V-BBC, 9V-BBE
          AR ALL EXCEPT LV-JMW THRU LV-JMY
          ND ALL EXCEPT CF-NAB, CF-NAH, CF-NAQ
          BU ALL EXCEPT LN-SUS, LN-SUP
          ZD ALL EXCEPT G-AVRL THRU G-AVRD, G-AWSY, G-AXNA THRU G-AXNC
   B. The engine bleed air cleaners are located in the pneumatic manifold outboard of the air conditioning duct for the respective engine. When removing or installing the air cleaner exercise care not to dent or damage beads on duct flanges as leaks may develop at joint.
   C. The removal/installation procedures for the air cleaners are similar. The tubing to be removed to provide clearance for removal of the air cleaner are slightly different. Any difference in procedure is noted in the step involved (Fig. 401).
2. Remove Air Cleaner
   A. Open air conditioning equipment bay doors.
   B. Remove hydraulic pressure from thrust reverser system (Ref Chapter 29, Hydraulic Power and Chapter 78, Thrust Reverser - MP).
   C. Remove hydraulic lines aft of air cleaner.
   D. For left side air cleaner removal, remove air pressure supply line at the fittings and remove line.
   E. For right side air cleaner removal, remove air conditioning pressure sensing line at fittings and remove line.
   F. Disconnect purge air duct from cleaner.
   G. Remove V-band clamp from each end of cleaner.
   H. Remove cleaner.
3. Install Air Cleaner
   A. Position air cleaner between duct flanges with large end downstream and rotate to align boss to purge bleed line.
   B. Install two V-band clamps. Do not tighten clamps completely.
   C. Connect purge air duct to boss on cleaner. Do not tighten clamp completely.
   D. For left side air cleaner installation, connect air pressure supply line.
   E. For right side air cleaner installation, connect air conditioning pressure sensing line.
   F. Connect lines to ports on thrust reverser isolation valve (Ref Chapter 29, Hydraulic Tubing and Flexible Hoses - MP).
   G. Check orientation of V-band clamps on each end of air cleaner and clamp connecting purge air duct to air cleaner to verify that they do not interfere with thrust reverser isolation valve hydraulic lines.
   H. Tighten clamps.
   I. Cycle thrust reverser several times to remove any air bubbles in hydraulic system.
   J. Functionally test system and check for air leaks at joints during test (Ref Air Cleaner System - A/T).
   K. Close air conditioning equipment bay doors.



LEFT SIDE AIR CLEANER INSTALLATION

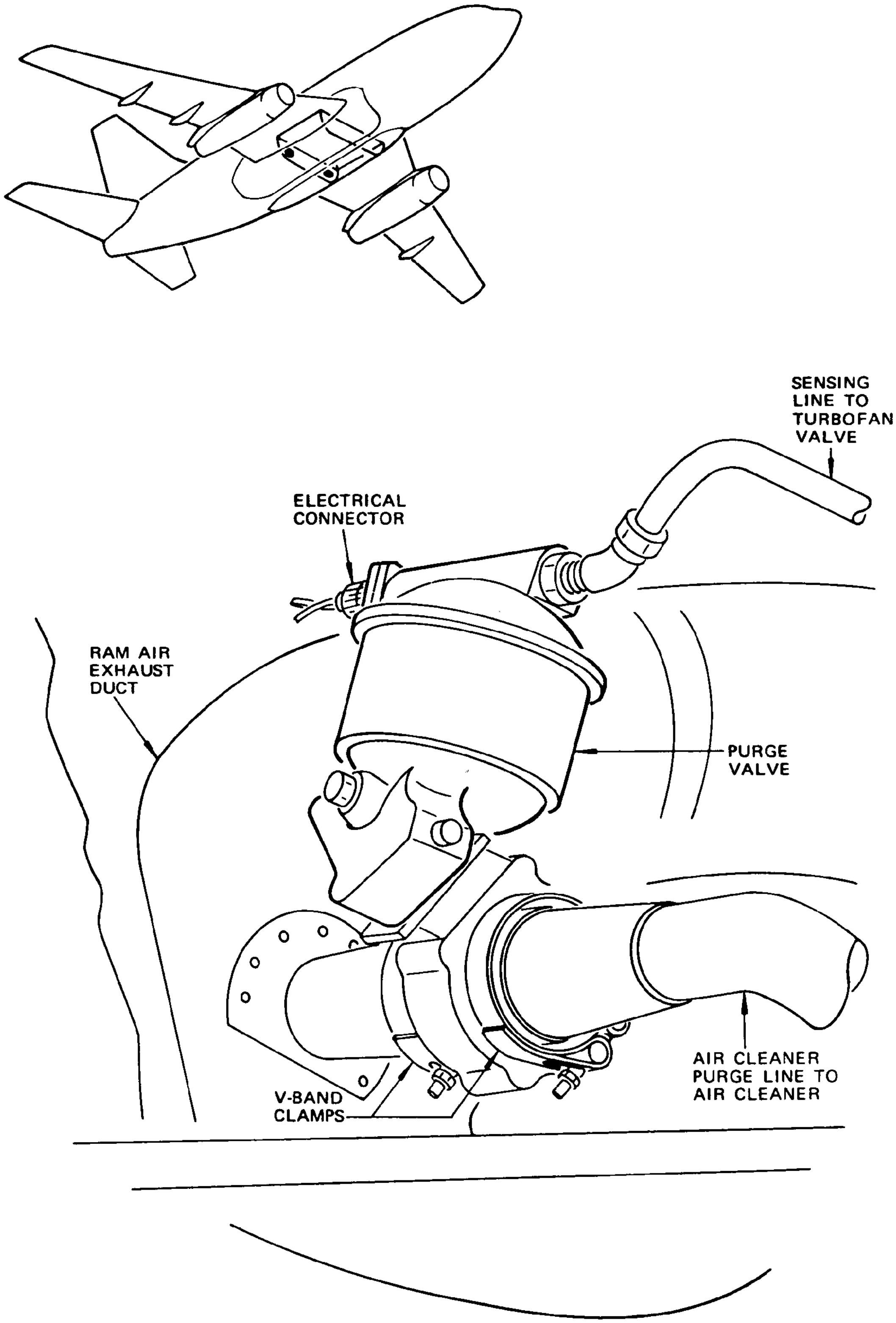


RIGHT SIDE AIR CLEANER INSTALLATION

Engine Bleed Air Cleaner Installation
Figure 401

AIR CLEANER PURGE VALVE - REMOVAL/INSTALLATION

1. General
   A. The air cleaner purge valve is located on the outboard side of the ram air exhaust duct downstream of the turbofan valve. The valve installations are similar for both sides. When removing or installing purge valve exercise care not to dent or damage beads on duct flanges as leaks may develop at joint (Fig. 401).
2. Remove Purge Valve
   A. Open TURBOFAN VALVE circuit breaker on P6 circuit breaker panel.
   B. Open air conditioning equipment bay doors.
   C. Disconnect electrical connector from valve solenoid.
   D. Disconnect sensing line from purge valve.
   E. Disconnect purge air duct from valve.
   F. Remove V-band clamps from each end of valve.
   G. Remove valve.
3. Install Purge Valve
   A. Position purge valve between duct flanges.
   B. Install and tighten two V-band clamps.
   C. Connect purge air duct to valve.
   D. Connect sensing line to purge valve.
   E. Connect electrical connector.
   F. Close TURBOFAN VALVE circuit breaker.
   G. Functionally test system and check for air leaks at joints during test (Ref Air Cleaner System - Adjustment/Test).
   H. Close air conditioning equipment bay doors.



Air Cleaner Purge Valve Installation
Figure 401

DISTRIBUTION - DESCRIPTION AND OPERATION

1. General
   A. The air conditioning distribution systems are responsible for moving all air into the passenger and control cabins. Two different types of air are sent to the cabins by completely unrelated distribution systems. The conditioned air distribution systems provide fully conditioned air to both cabins. The individual air (Gasper) distribution system supplies cold air to both cabins.
   B. Conditioned air distribution starts with the main distribution manifold. From the distribution manifold two separate systems, control cabin conditioned air and passenger cabin conditioned air, are responsible for getting air to the cabins.
   C. The control cabin air distribution system receives air from the left end of the main distribution duct and releases it into the control cabin from several outlets. The outlets are located to provide optimum flow patterns in the cabin.
   D. The passenger cabin conditioned air distribution system takes the remainder of air supplied to the main distribution manifold and delivers it to the passenger cabin. Air is released directly into the cabin from an overhead duct.
   E. The gasper distribution system handles only cold air and receives its air directly from the air cycle systems. The air is delivered to each passenger and crewmember and is adjustable for quantity at each outlet.

MAIN DISTRIBUTION MANIFOLD - DESCRIPTION AND OPERATION

1. General
   A. The primary function of the main distribution manifold is to provide a gathering place for all conditioned air required for the airplane. The manifold includes a pressure relief valve to protect distribution ducts against overpressure, a ground service connection to permit use of a service cart for supplying conditioned air, a main cabin airflow shutoff valve (Passenger/Cargo Convertible Airplanes), and most of the sensors, bulbs, and thermal switches required for operation and monitoring of the temperature control systems (Ref 21-61-0).
   B. Conditioned air supply ducts to the manifold, and distribution ducts from the manifold, are positioned to provide control cabin conditioned air from the left air cycle system and passenger cabin conditioned air from the right air cycle system during normal operation. Either system will provide conditioned air to both systems when the other system is off. Since the control cabin does not require all air provided by the left air cycle system during normal operation, part of its output will be mixed with the right system supply before going to the passenger cabin. A temperature bulb in the vicinity of the passenger cabin distribution outlet transmits duct temperature to an indicator in the control cabin. Although this temperature may be the same as control cabin air, it is not necessarily so, because of separate temperature control systems for the two cabins.
   C. The main distribution manifold is located aft of the forward cargo compartment aft bulkhead in a pressurized area (Fig. 1).
2. Main Distribution Manifold Relief Valve
   A. The main distribution manifold relief valve begins to open at approximately 17 inches of water and limits pressure in the manifold to approximately 27 inches of water. This relief valve protects the manifold and all the conditioned air ducts from excessive pressure surges.
   B. The relief valve is located in the duct section extending from the ground service conditioned air connector to the manifold (Fig. 1). An opening in the duct is covered by a flapper-type plate which is spring-loaded closed. Two adjustable springs hold the plate closed unless duct pressure exceeds 17 inches of water.

3. Ground Service Conditioned Air Connection

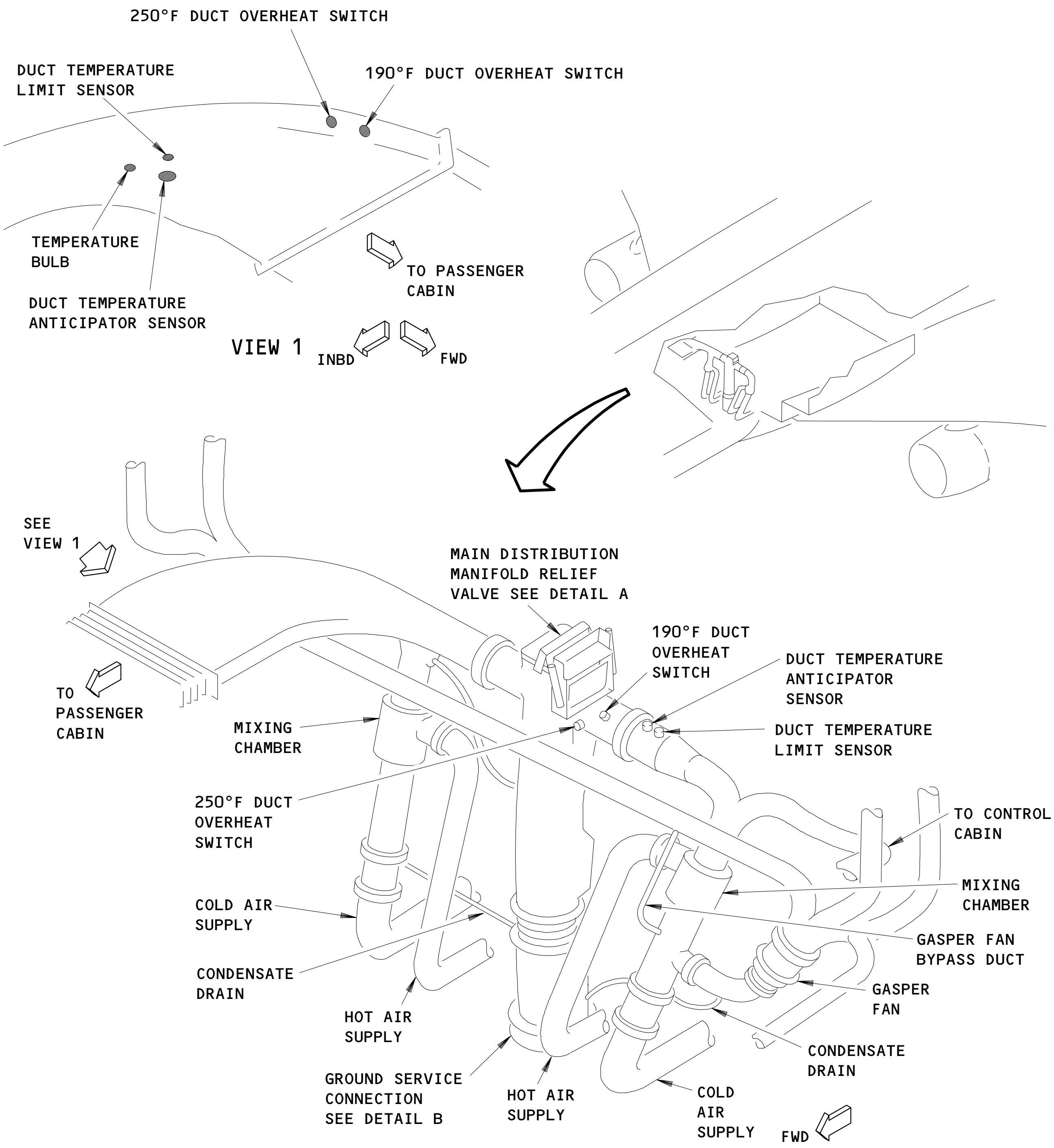
A. A ground service connection is provided to allow use of a ground service cart for conditioned air to the cabin when airplane air conditioning is off. A check valve in the duct prevents loss of air when airplane air conditioning is on.

B. The connection is a short duct section which is fastened to the pressure skin and the duct and check valve assembly at its upper flange and has three slotted holes in its lower flange to match fasteners on the ground service cart (Fig. 1). An access door must be opened to make the connection.

C. A swing check valve in the duct and check valve assembly opens with pressure from the ground service cart and closes when air is being supplied from the airplane air conditioning system. On some airplanes, a condensate drain tube from the gasper fan duct to the duct and check valve assembly and a drain hole are provided to allow any moisture, which may have condensed from the air, to be removed before it can get into the distribution systems.

4. Passenger Cabin Airflow Shutoff Valve (Passenger/Cargo Convertible Airplanes)

A. A passenger cabin airflow shutoff valve is installed in the main distribution manifold. The valve is for use in the all-cargo, and mixed passenger/cargo unpressurized configuration and provides a method for preventing airflow to the passenger cabin for a smothering effect without affecting control cabin distribution. Refer to Passenger Cabin Conditioned Air Distribution System for operation of the shutoff valve.



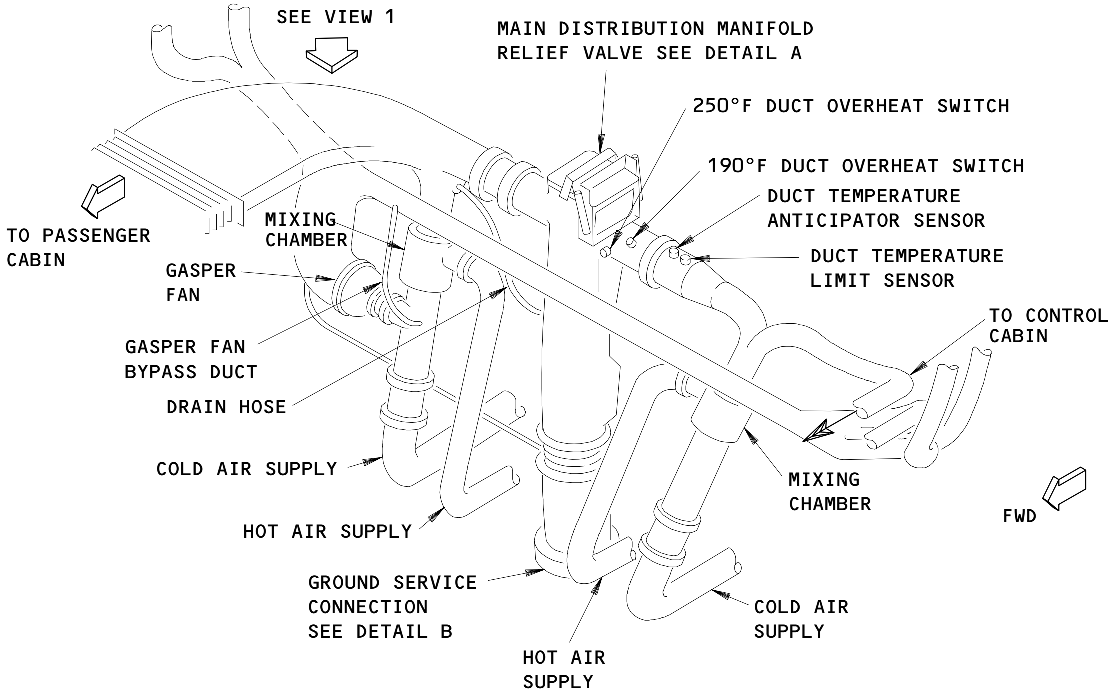
1 AR LV-JMW THRU LV-JMY

2 ALL EXCEPT AR LV-JMW THRU LV-JMY

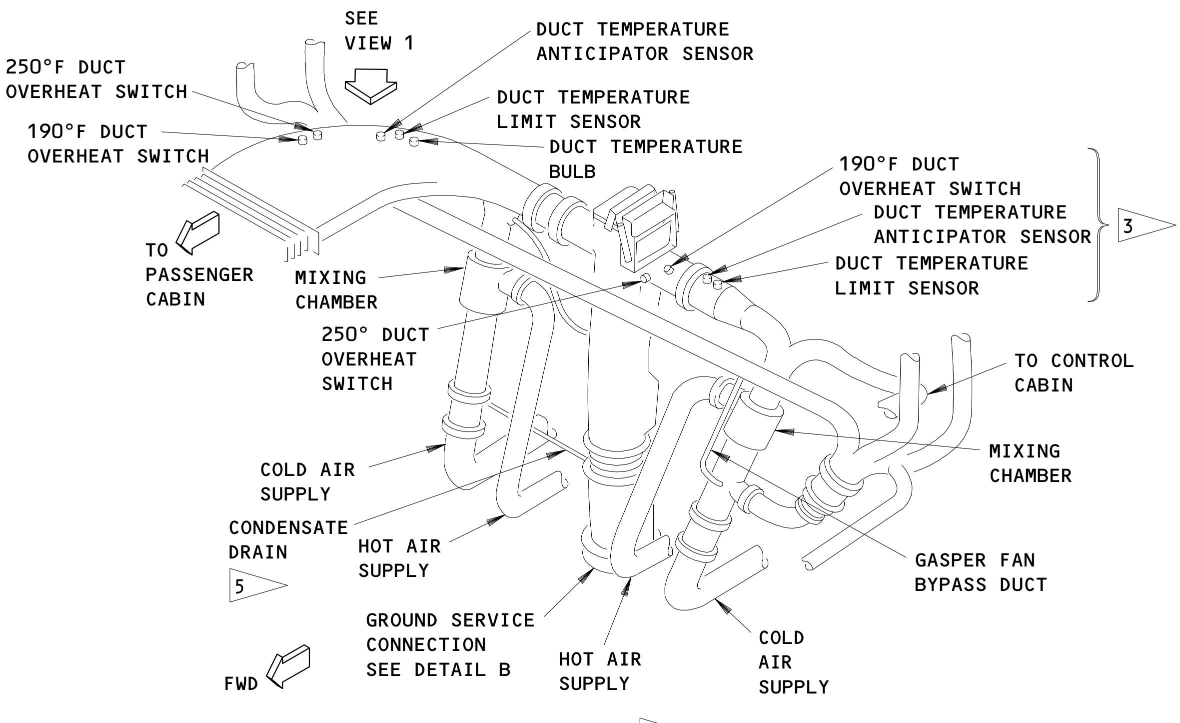
3 PASSENGER/CARGO CONVERTIBLE AIRPLANES

MANIFOLD 1

Main Distribution Manifold
Figure 1 (Sheet 1)

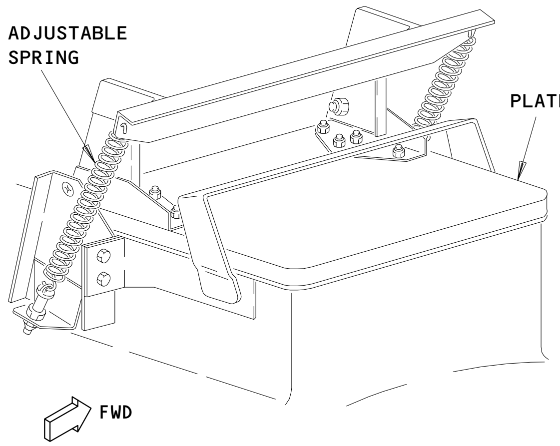


MANIFOLD 2

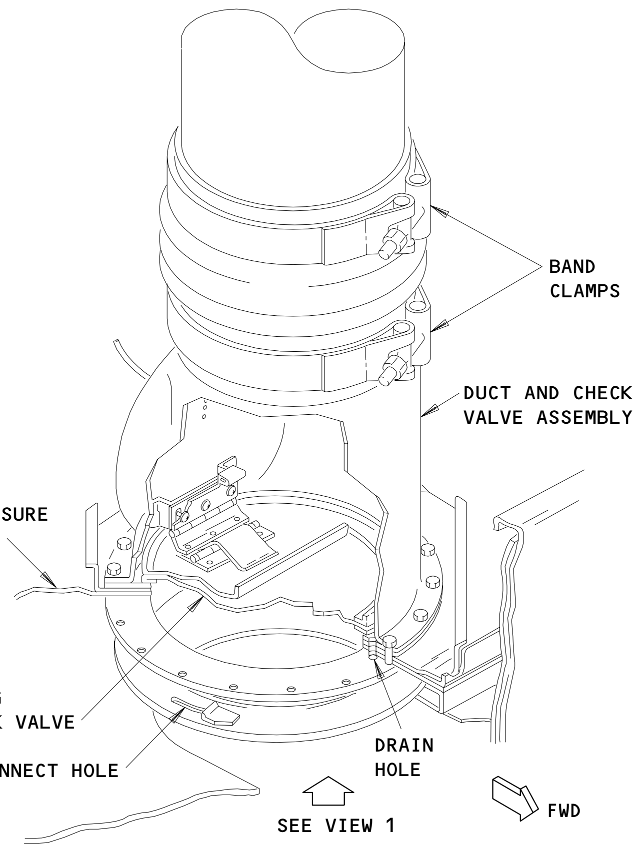


MANIFOLD 3

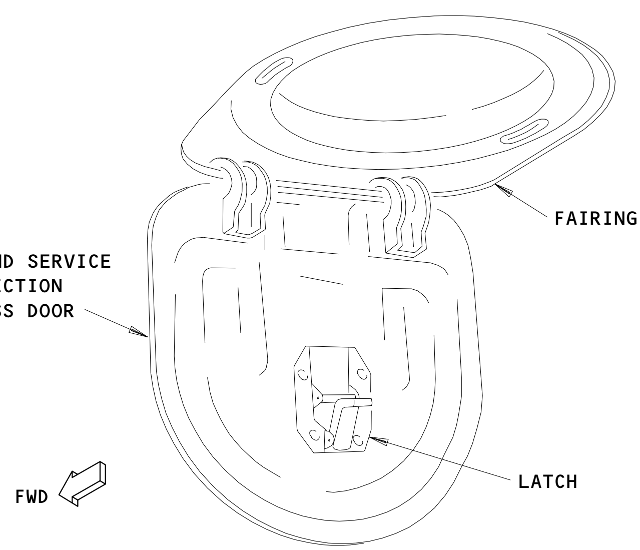
Main Distribution Manifold
Figure 1 (Sheet 2)



DETAIL A



DETAIL B



VIEW 1

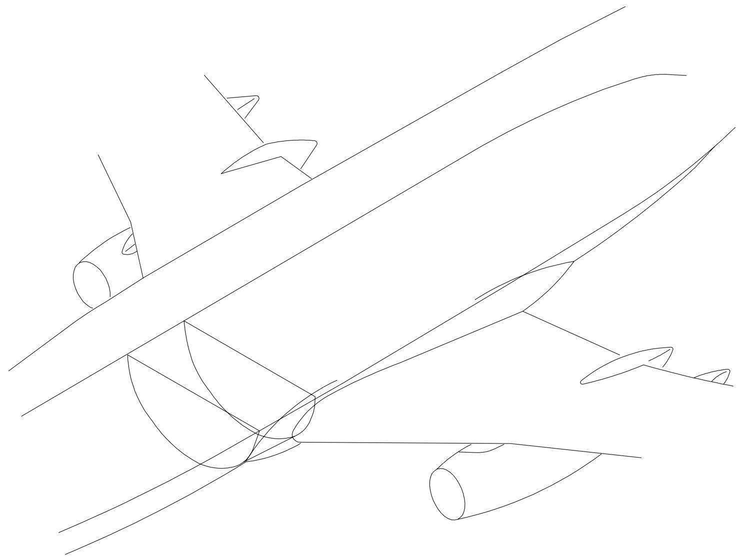
Main Distribution Manifold
Figure 1 (Sheet 3)

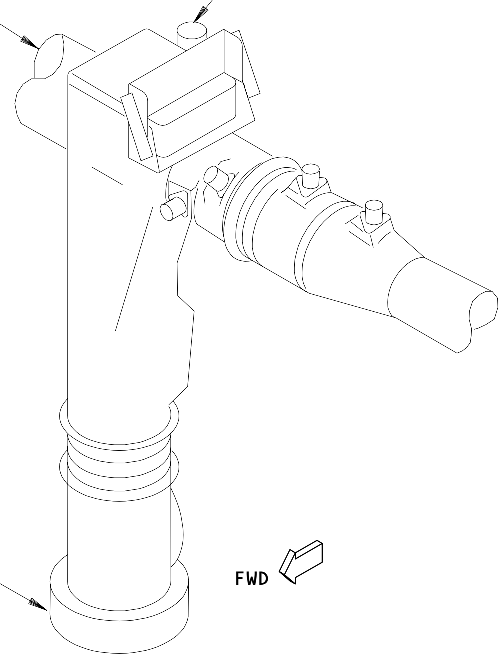
GROUND SERVICE CONDITIONED AIR CONNECTION DUCT AND CHECK VALVE ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. The duct and check valve assembly hinge is spring loaded to hold the swing check valve slightly open when air conditioning is off. When air conditioning is on the pressure in the distribution ducts is enough to overcome the spring load and cause the check valve to close. Before installation of a duct and check valve assembly the check valve should be checked and the hinge adjusted, if required, to obtain the open or closed position.
2. Equipment and Materials
   A. Primer - RTV 1200, Dow Corning, or equivalent
   B. Adhesive - 30-121, Dow Corning, or equivalent
   C. Solvent - Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) (Ref AMM/SOPM 20-30-88)
3. Remove Duct and Check Valve Assembly
   A. Remove center portion of forward cargo compartment aft bulkhead to gain access to air conditioning distribution bay.
   B. Remove band clamps and disconnect flexible duct from duct and check valve assembly (Fig. 401).
   C. On PW CF-PWD
      BT/TS N73714 and N73715
      NH JA8401 thru JA8403, JA8405 thru JA8407
      AR LV-JMW thru LV-JMY
      VP PP-SMA thru PP-SMF, PP-SMQ thru PP-SMT;
      Disconnect condensate drain from duct and check valve assembly.
   D. Remove bolts and washers from lower flange of duct and check valve assembly.
   E. Remove duct and check valve assembly.
4. Prepare Duct and Check Valve for Installation
   A. Check that gasket bonded to pan is not damaged. If damaged, replace.
      (1) Remove gasket.
         (a) Remove gasket and old adhesive with putty knife or similar tool with a medium sharp edge. Clean the remaining adhesive with solvent, Series 88 (Ref AMM/SOPM 20-30-88).
      (2) Install gasket.
         (a) Brush a coat of RTV 1200 primer on bonding surface except the silicone rubber gasket.

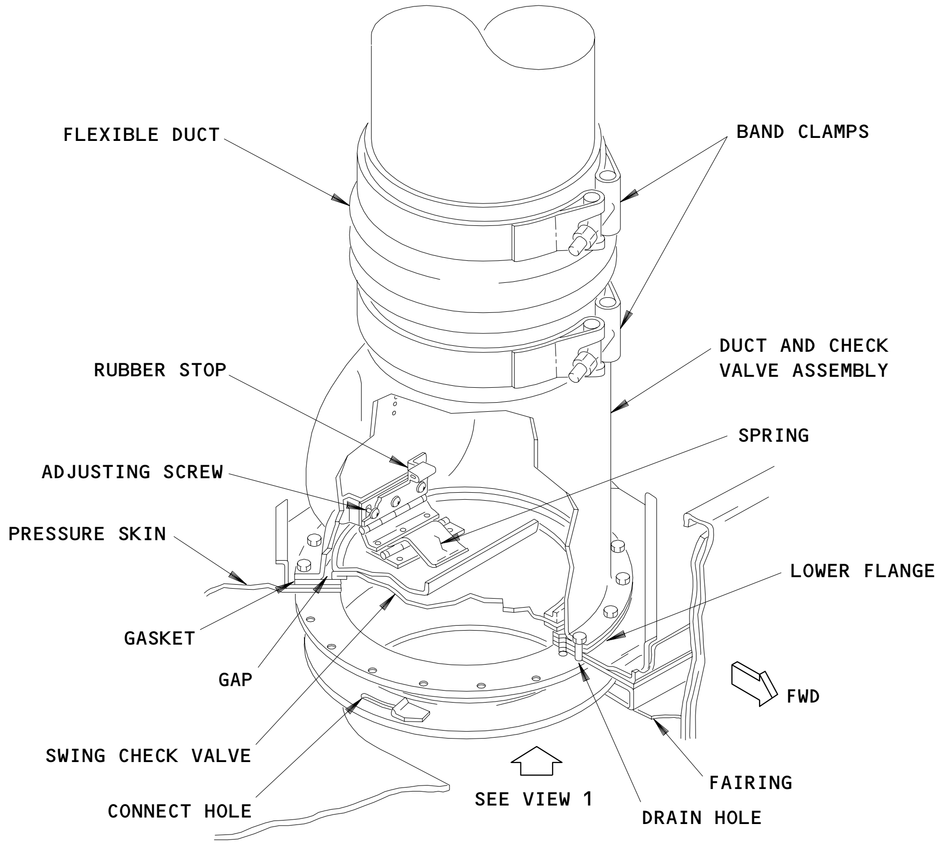
         CAUTION: DO NOT USE IF THE PRIMER TURNS CLOUDY OR MILKY.

         (b) Allow primer to air dry for a minimum of 30 minutes.

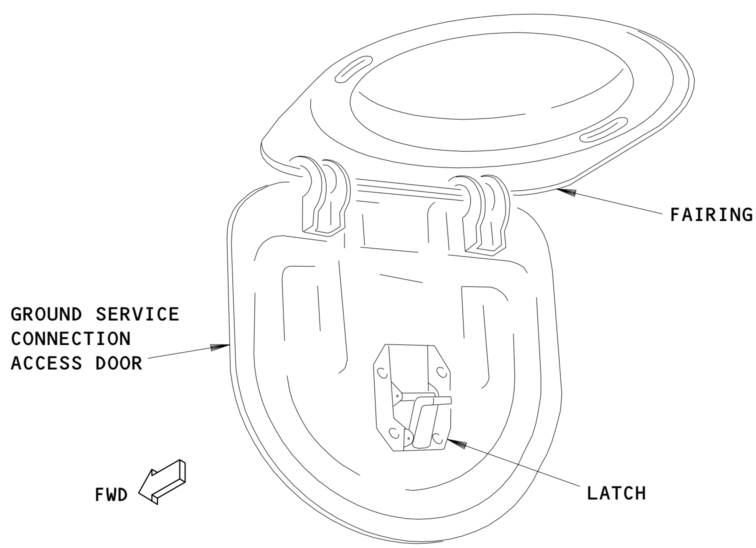




Duct and Check Valve Assembly
Figure 401 (Sheet 1)



DETAIL A



VIEW 1

Duct and Check Valve Assembly
Figure 401 (Sheet 2)

(c) Apply a uniform layer of 30-121 adhesive over surfaces to be bonded. Join surfaces as soon as possible after application of adhesive.

CAUTION: DO NOT WAIT LONGER THAN NECESSARY FOR JOINING SURFACES. WAITING MORE THAN A FEW MINUTES WILL CAUSE THE ADHESIVE TO FORM A SKIN, WHICH INTERFERES WITH ADHESION.

(d) Join surfaces and apply sufficient pressure to ensure complete contact without squeezing out excessive amount of adhesive.
(e) Allow the assembly to cure for 24 hours at 75 (±5)°F. (Optional cure 45 to 60 minutes at 200 to 250°F.)

CAUTION: DO NOT CONFINE BOND LINE. MOISTURE FROM THE AIR IS NEEDED FOR CURING.

NOTE: An odor of acetic acid will be present until cure is complete.

B. Check that check valve is slightly unseated. (See figure 401.)
   (1) Lay flange on a straight edge.
   (2) Allow edge of the swing check valve opposite hinge to be flush with straightedge.
   (3) Check that a slight gap exists between edge of the swing check valve and straightedge under the hinge.
   (4) Push down on the swing check valve at hinge and check that gap closes with little effort and opens when force is removed.
   (5) If gap does not exist or if force required seems excessive, loosen hinge adjusting screws and move hinge up or down as required.
   (6) Tighten adjusting screws.

5. Install Duct and Check Valve Assembly
   A. Position gasket and duct and check valve assembly. (See figure 401.)
   B. Install washers and bolts to lower flange of duct and check valve assembly.
      (1) Check for proper alignment of gasket to ensure drain vent is clear.
   C. Connect duct and check valve assembly to flexible duct with band clamps. (See figure 401.)
   D. On airplanes listed in paragraph 3.C. connect condensate drain to duct and check valve assembly.

E. Operate airplane air conditioning system and check that there is no leakage at duct joint and very little, if any, through the check valve.

NOTE: While air conditioning system is on, check for air leakage by feeling and listening. Diffused leakage is allowed, however, jet blasts are not permissible.

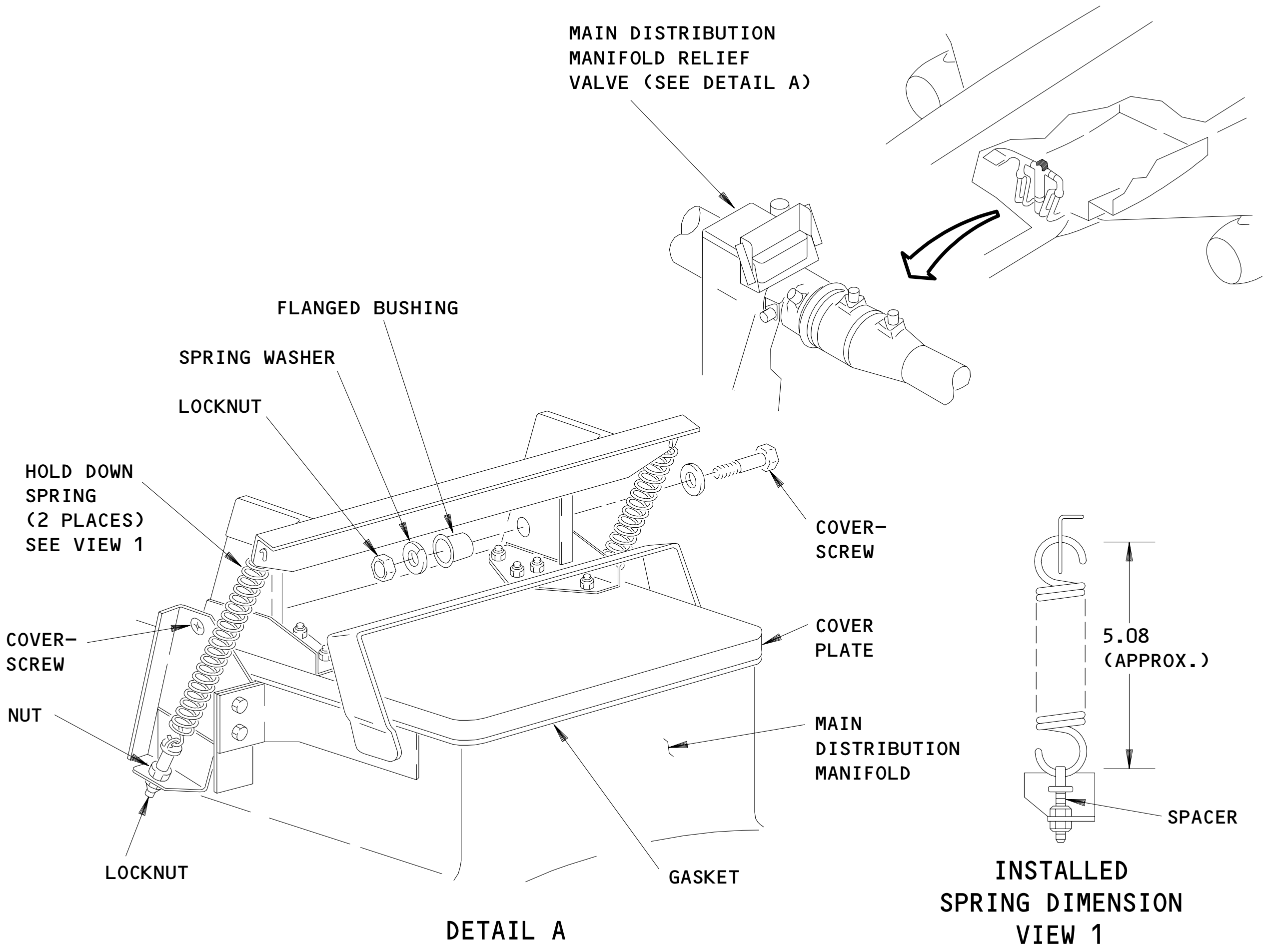
F. Check that air is coming through drain hole.
G. Turn off the air conditioning system.
H. Check that the swing check valve is slightly unseated.
I. Install aft bulkhead of forward cargo compartment.

MAIN DISTRIBUTION MANIFOLD RELIEF VALVE - REMOVAL/INSTALLATION

1. Remove Relief Valve (Fig. 401)
   A. Remove center portion of forward cargo compartment aft bulkhead to gain access to air conditioning distribution bay.
   B. Remove relief valve cover hold down springs on each side of valve.

      WARNING: LOAD ON INSTALLED SPRING IS 96 POUNDS. RELEASE OF TENSION COULD CAUSE PERSONNEL INJURY.

   C. Remove relief valve cover screws and remove cover assembly.
2. Install Relief Valve (Fig. 401)
   A. Check condition of gasket and install new gasket if necessary (Ref Approved Repairs).
   B. Position relief valve cover assembly and install screws.
   C. Install springs ensuring that installed spring length is approximately 5.08 inches with valve closed.
   D. Install center portion of forward cargo compartment aft bulkhead.



Main Distribution Manifold Relief Valve Installation
Figure 401

MAIN DISTRIBUTION MANIFOLD RELIEF VALVE - APPROVED REPAIRS

1. General
   A. The approved repairs for the main distribution manifold relief valve consists of removing and replacing the relief valve cover gasket.
2. References
   A. AMM 20-30-88/201 Airplane Structure Cleaning Solvents (Series 88)
   B. AMM 21-21-21/401 Main Distribution Manifold Relief Valve
3. Equipment and Materials
   A. Primer - RTV-1200, Dow Corning, or equivalent
   B. Adhesive - 30-121, Dow Corning, or equivalent
   C. Solvent - (Series 88)
4. Replace Relief Valve Cover Gasket
   A. Remove the relief valve cover (AMM 21-21-21/401).
   B. Remove old gasket from cover.
   C. Prepare cover to install new gasket.
      (1) Wipe off all foreign materials such as oils, waxes, or powders, using a dry, clean cloth.
      (2) Clean gasket surface with solvent to remove foreign materials and old adhesive completely (AMM 20-30-88/201).
      (3) Check that gasket surface has been sanded gloss-free.
   D. Prime new gasket and cover surfaces.
      (1) Brush a coat of primer to mating surfaces of gasket and cover.

      CAUTION: DO NOT USE IF THE PRIMER TURNS CLOUDY OR MILKY.

      (2) Allow a minimum of 30 minutes drying time.
   E. Apply a uniform layer of adhesive over surfaces to be banded. Join surfaces as soon as possible after application of adhesive.

   CAUTION: DO NOT WAIT LONGER THAN NECESSARY FOR JOINING SURFACES. WAITING MORE THAN A FEW MINUTES WILL CAUSE THE ADHESIVE TO FORM A SKIN WHICH INTERFERES WITH ADHESION.

   F. Join surfaces and apply sufficient pressure to ensure complete contact without squeezing out excessive amount of adhesive.
   G. Allow the assembly to cure for 24 hours at 75 ±5°F. (Optional cure, 45 to 60 minutes at 200 to 250°F.)

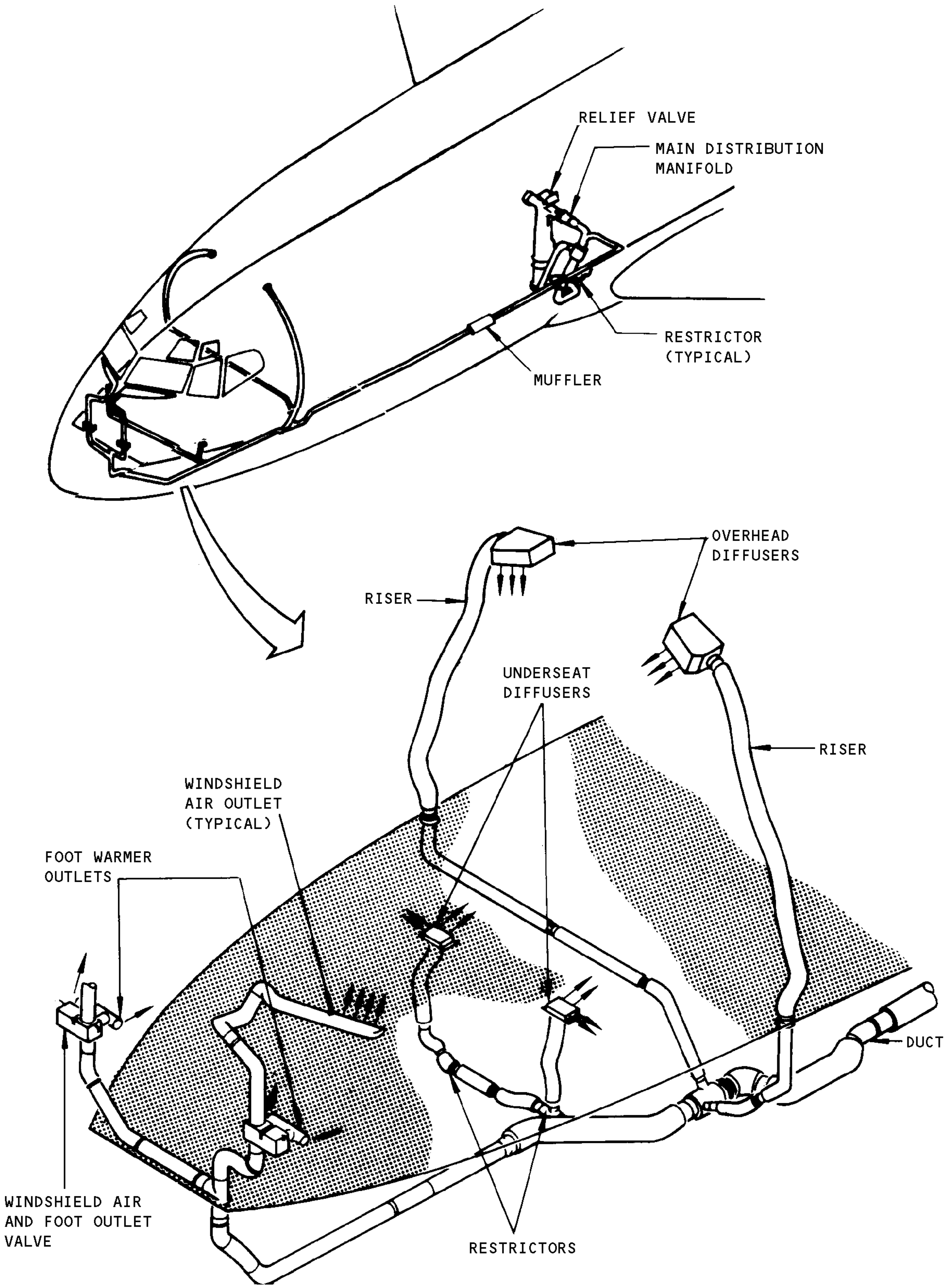
   CAUTION: DO NOT CONFINE BOND LINE. MOISTURE FROM THE AIR IS NEEDED FOR CURING.

   NOTE: An odor of acetic acid will be present until cure is complete.

   H. Install the relief valve cover (AMM 21-21-21/401).

CONTROL CABIN CONDITIONED AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The control cabin conditioned air distribution system consists of a series of ducts originating from the main distribution manifold and leading forward under the floor, on the left side of the airplane, to the control cabin, where it branches off into several risers which end at the ceiling, floor and foot level outlets (Fig. 1). Three orifice restrictors in the system balance the flow. An acoustical muffler is installed upstream of the distribution bay to reduce control cabin duct airflow noise.
2. General
   A. Air from the control cabin is exhausted through miscellaneous openings and grilles in the floor, and is drawn into the electronic equipment compartment to provide electrical/electronic equipment cooling and forward cargo compartment heating. For a more detailed description of the electrical/electronic equipment cooling, refer to Equipment Cooling System - Description and Operation.
3. Control Cabin Conditioned Air Outlets
   A. The control cabin conditioned air distribution duct branches into several risers which feed eight outlets in the control cabin. The outlets are located to provide optimum flow patterns in the cabin.
   B. The control cabin outlets consist of two overhead diffusers, two underseat diffusers, two foot air outlets, and two windshield outlets.
   C. The overhead diffusers are located on the cabin ceiling, just above and aft of window No. 3. Each of these outlets consists of an anemostat which can be opened or closed to any desired extent by turning a slotted adjusting screw. Directional control of airflow is provided by a movable external baffle.
   D. The captain's and first officer's diffusers are on the floor, directly under each seat. Two restrictors in the duct balance the flow. These outlets cannot be manually controlled and air flows continuously as long as the distribution system is pressurized.
   E. There is a dual purpose valve at the end of the distribution duct behind the rudder pedals for the captain and one for the first officer. Two cable controlled knobs marked FOOT AIR and WINDSHIELD AIR are fastened on a bracket below the captain's panel and the first officer's panel. Pulling either knob moves a baffle plate attached to a lever allowing a choice between no conditioned air and full capacity conditioned air to either the foot outlets, the windshield duct, or both. (See figure 2.)



Control Cabin Air Distribution Component Location
Figure 1

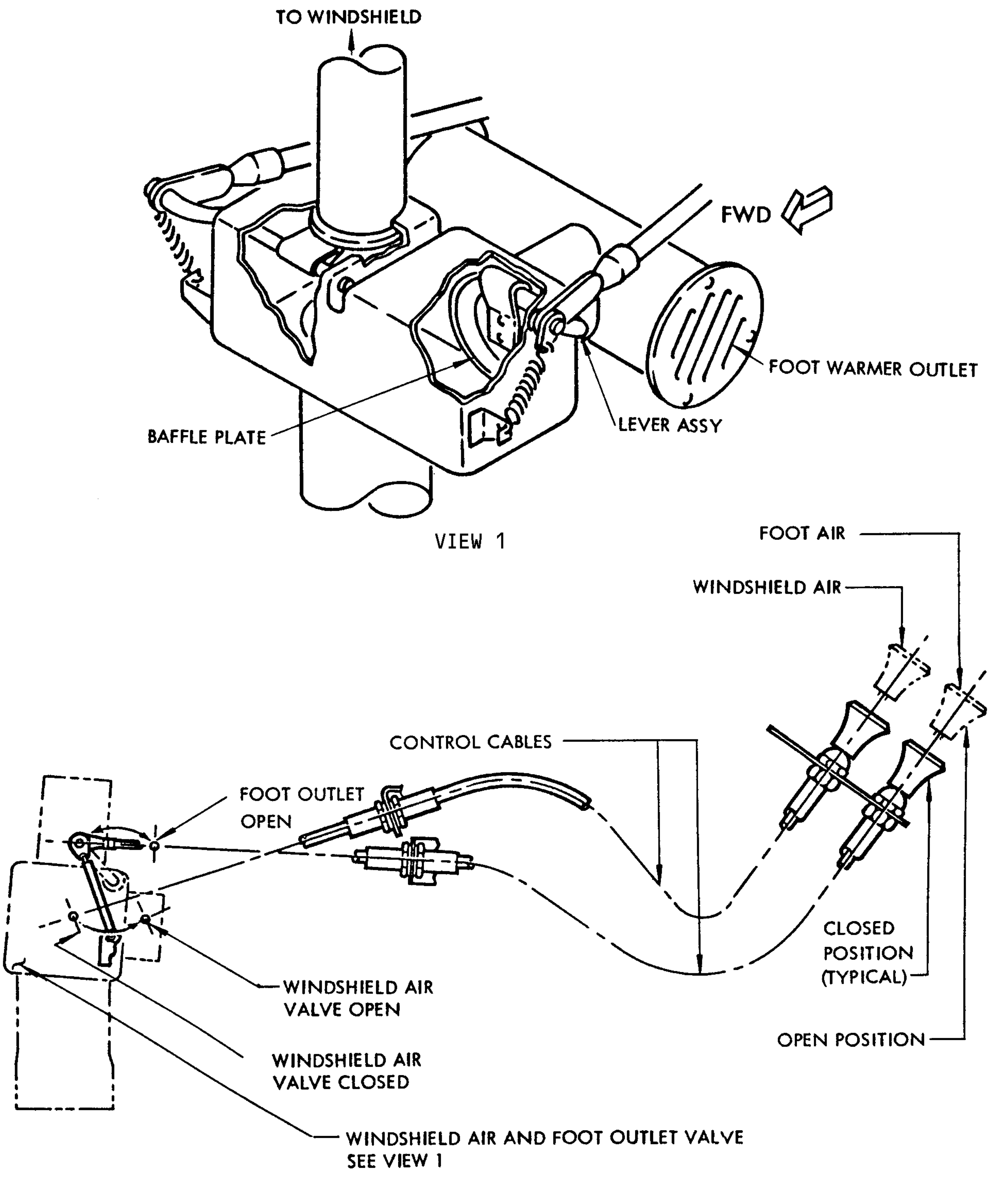
4. Forward Cargo Heat Distribution

A. The forward cargo compartment is heated by control cabin air and air exhaust from the electrical/electronic equipment area (Ref 21-41-0).

5. Muffler

A. A muffler is provided in the control cabin conditioned air distribution system to minimize airflow noise. A restrictor is located in ducting immediately upstream of the muffler. The restrictor ensures balanced airflow from the control cabin outlets, and should be retained if the muffler is replaced. The muffler is located in the duct which extends from the distribution bay to the control cabin, below the control cabin floor above the nose wheel well (Fig. 1). For access remove the left aft wall panel in nose wheel well (Ref 12-31-11).

6. Operation



Windshield Air and Foot Outlet Valve Control
Figure 2

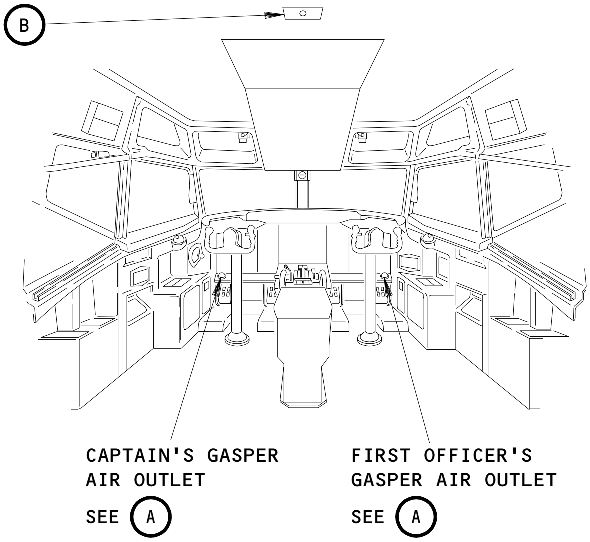
CONTROL CABIN GASPER AIR OUTLETS - REMOVAL/INSTALLATION

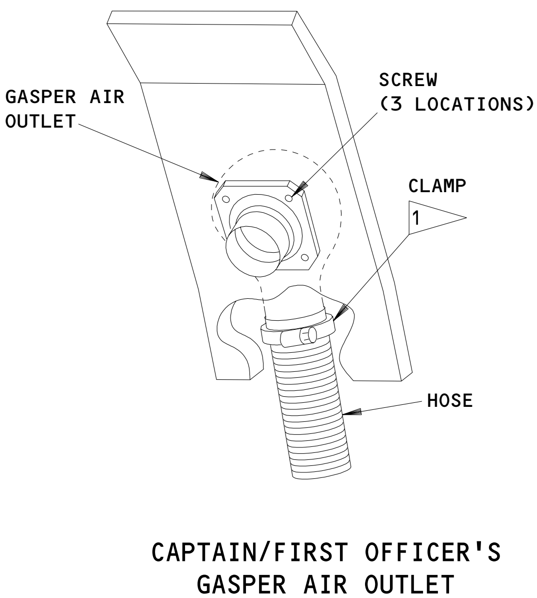
1. General
   A. This procedure has these tasks:
      (1) A removal of the gasper air outlets installed in the control cabin.
      (2) An installation of the gasper air outlets installed in the control cabin.
   B. The gasper air outlet is referred to as the gasper in this procedure.
2. Gasper Air Outlet Removal (Fig. 401)
   A. References
      (1) AMM 25-16-11/401, CONTROL CABIN LINING - REMOVAL/INSTALLATION
   B. Access
      (1) Location Zones
          101 Control Cabin (Left)
          102 Control Cabin (Right)

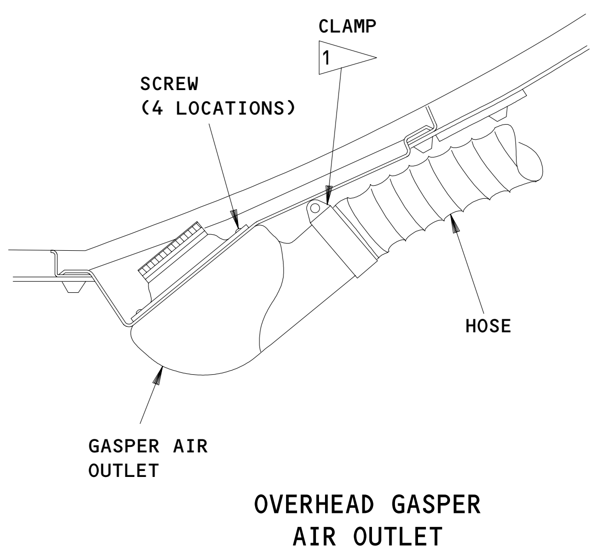
   C. Prepare for the Removal
      (1) Remove the flight compartment panel for the applicable gasper (AMM 25-16-11/401).
   D. Gasper Air Outlet Removal
      (1) Loosen the clamp that holds the hose to the gasper.
      (2) Remove the hose from the gasper.
      (3) Remove the screws that attach the gasper to the panel.
      (4) Remove the gasper.
3. Gasper Air Outlet Installation (Fig. 401)
   A. References
      (1) AMM 25-16-11/401, CONTROL CABIN LINING - REMOVAL/INSTALLATION
   B. Access
      (1) Location Zones
          101 Control Cabin (Left)
          102 Control Cabin (Right)

   C. Gasper Air Outlet Installation
      (1) Put the gasper in the panel.
      (2) Install the screws that attach the gasper to the panel.
      (3) Put the clamp on the hose and connect the hose to the gasper.
      (4) Tighten the hose clamp.

      WARNING: MAKE SURE THE HEAD OF THE GASPER AIR OUTLET HOSE CLAMP IS POSITIONED TOWARDS THE PANEL ASSEMBLY AND AWAY FROM ANY WIRING OR WIRE BUNDLES. CHAFING CAN OCCUR AND CAUSE AN ELECTRICAL SHORT IF THE CLAMP HEAD TOUCHES THE WIRING. AN ELECTRICAL SHORT CAN CAUSE A FIRE.

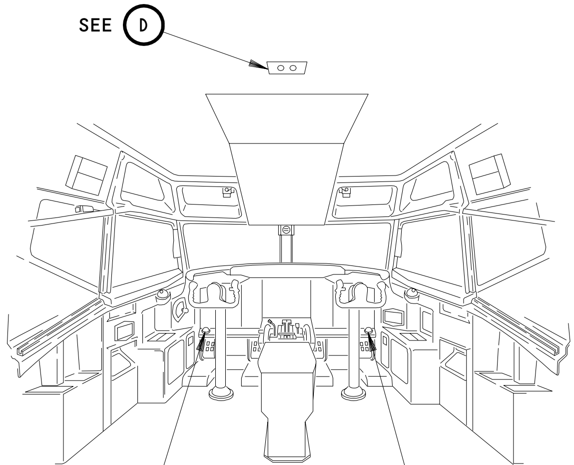




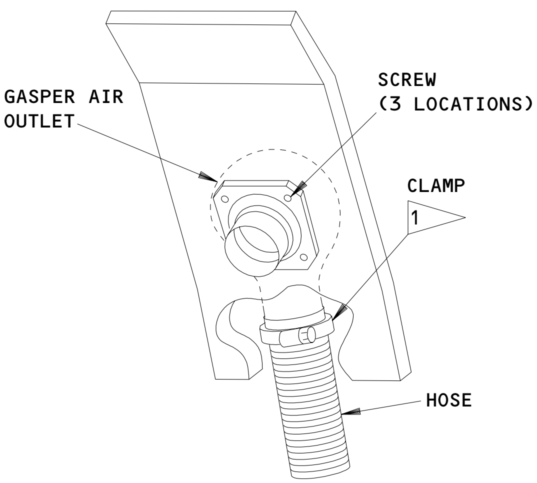


1 POSITION HEAD OF CLAMP TOWARDS THE PANEL

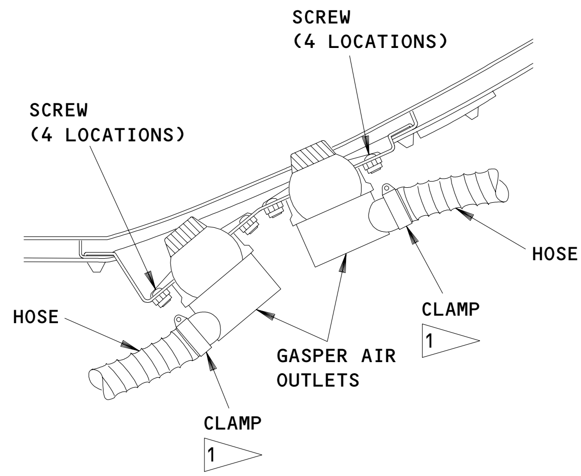
Gasper Air Outlet Installation
Figure 401 (Sheet 1)



FLIGHT COMPARTMENT



CAPTAIN/FIRST OFFICER'S
GASPER AIR OUTLET
C



OVERHEAD GASPER
AIR OUTLET
D

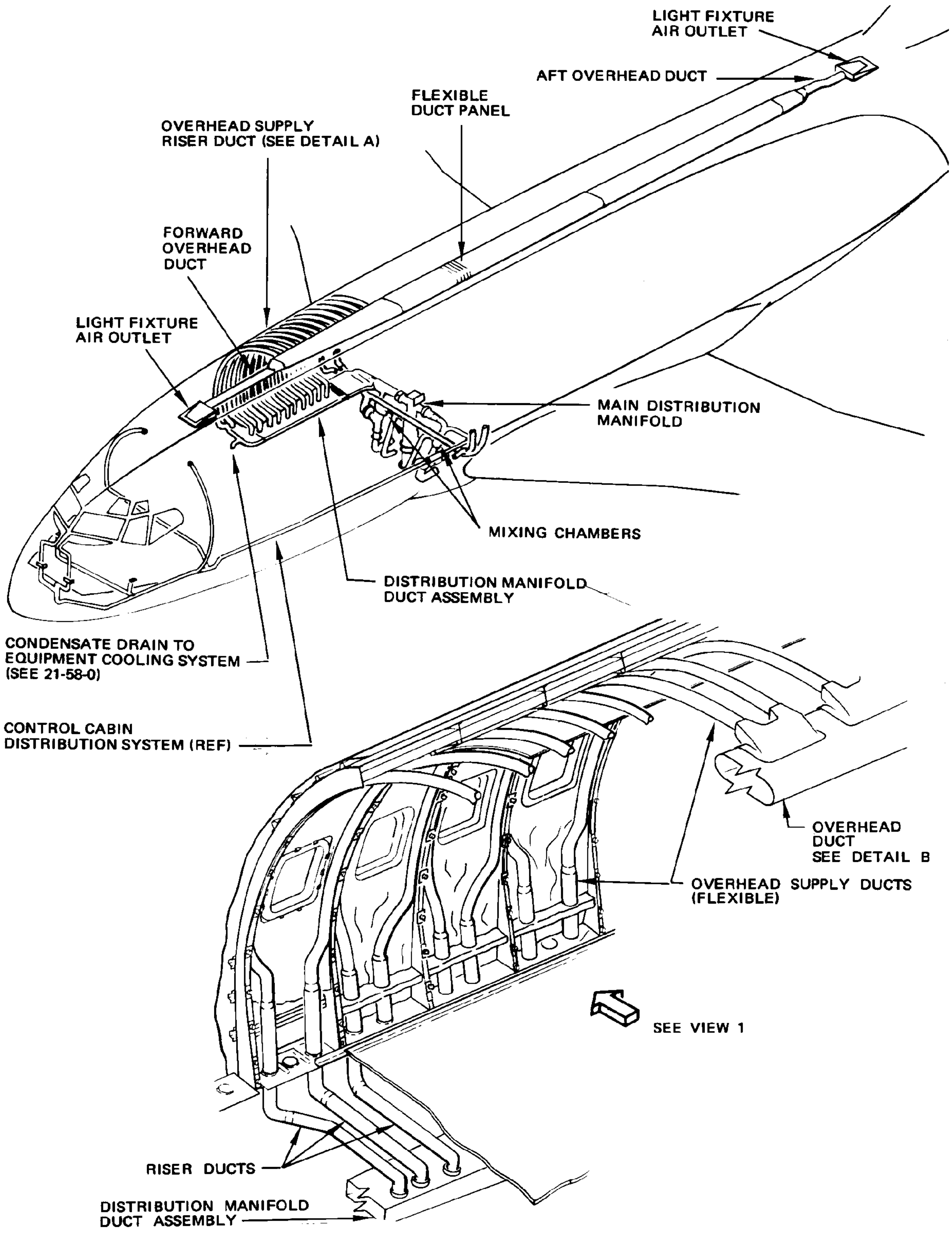
Gasper Air Outlet Installation
Figure 401 (Sheet 2)

D. Put the Airplane Back to Its Usual Condition

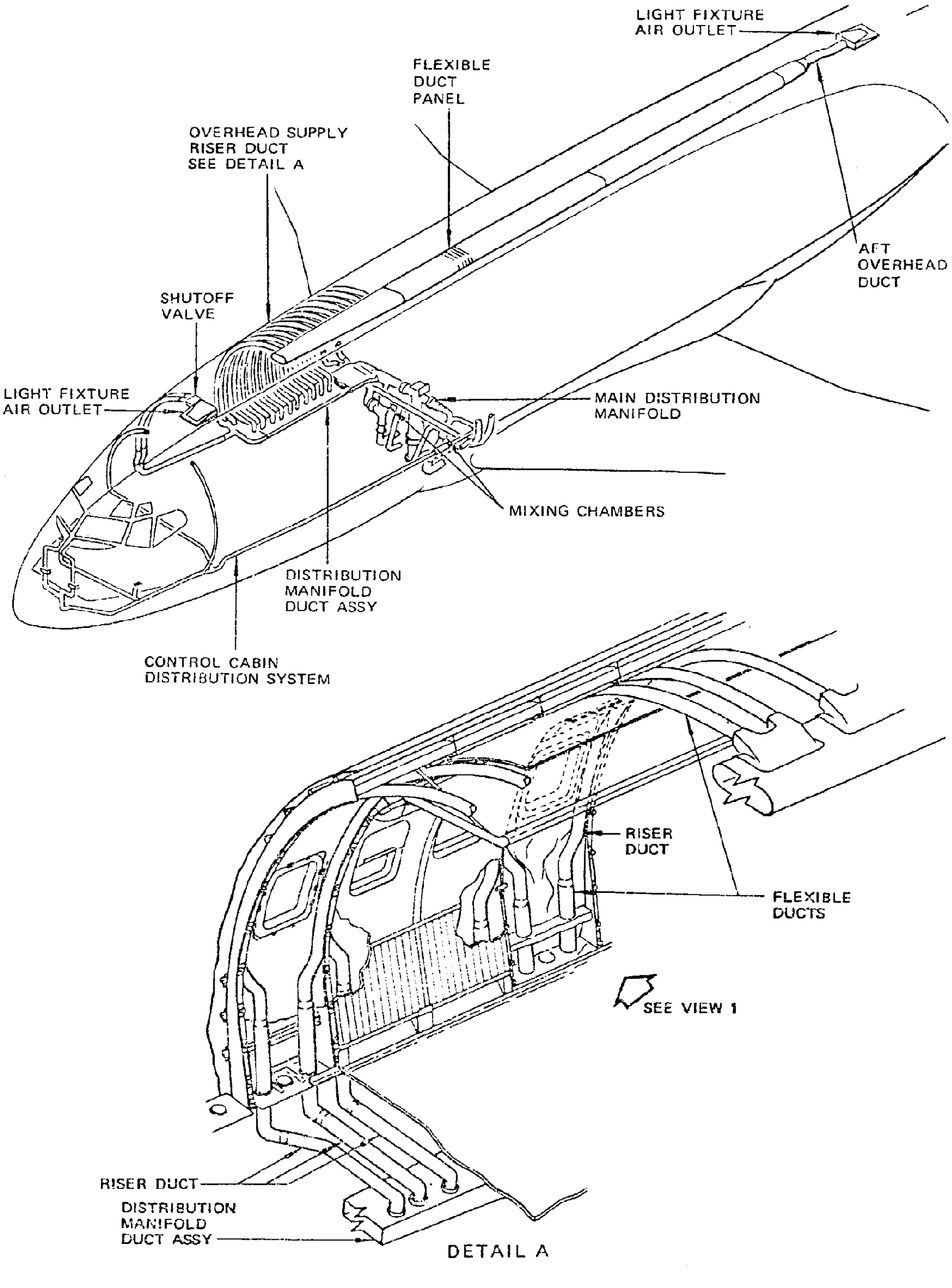
(1) Install the flight compartment panel for the applicable gasper (AMM 25-16-11/401).

PASSENGER CABIN CONDITIONED AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

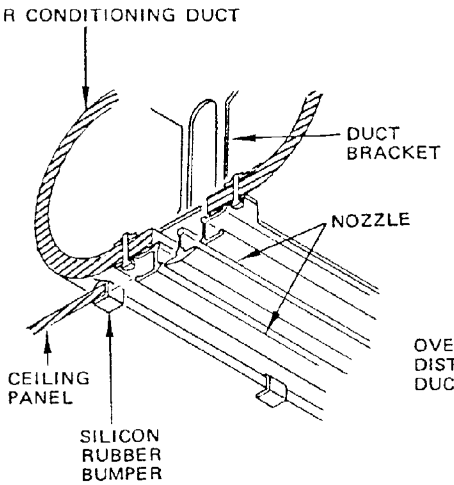
1. General
   A. The passenger cabin conditioned air distribution system consists of the main distribution manifold, distribution manifold duct assembly, riser ducts, and an overhead distribution duct (Fig. 1).
   B. Conditioned air for the passenger cabin originates in the main distribution manifold. From the mixing chambers, conditioned air is ducted forward through the distribution manifold duct assembly on the right side of the airplane to a series of riser ducts in the forward cabin wall. Riser ducts located in the right-hand wall supply conditioned air to the overhead distribution duct. A condensate drain tube on the forward end of the distribution duct manifold assembly minimizes the possibility of moisture entering the overhead duct (Fig. 1).
   C. The overhead distribution duct is mounted along the centerline of the airplane, extending forward and aft the full length of the passenger cabin. Air is directed into the passenger cabin through a continuous, slot-type nozzle, which extends for approximately 70% of the length of the overhead duct. At the forward and aft ends of the cabin, where the ceiling height is less, air enters the cabin through a grille on either side of a light fixture. Temperature of the conditioned air is automatically controlled (Ref 21-61-0).
   D. The major portion of the passenger cabin exhaust air flows around the walls of the aft cargo compartment and is discharged overboard through the pressurization control system outflow valves. A small amount of air is exhausted directly overboard from the galley and lavatory vents (Ref 21-30-0).
2. Overhead Supply Riser Ducts
   A. Attached to the distribution manifold duct assembly in the forward cargo compartment, riser ducts go up the right wall to supply conditioned air to the overhead distribution duct. Flexible ducts connect to the distribution manifold duct assembly and the overhead distribution duct. The flexible ducts are attached to the overhead supply riser ducts with tape (Detail B, Fig. 1).



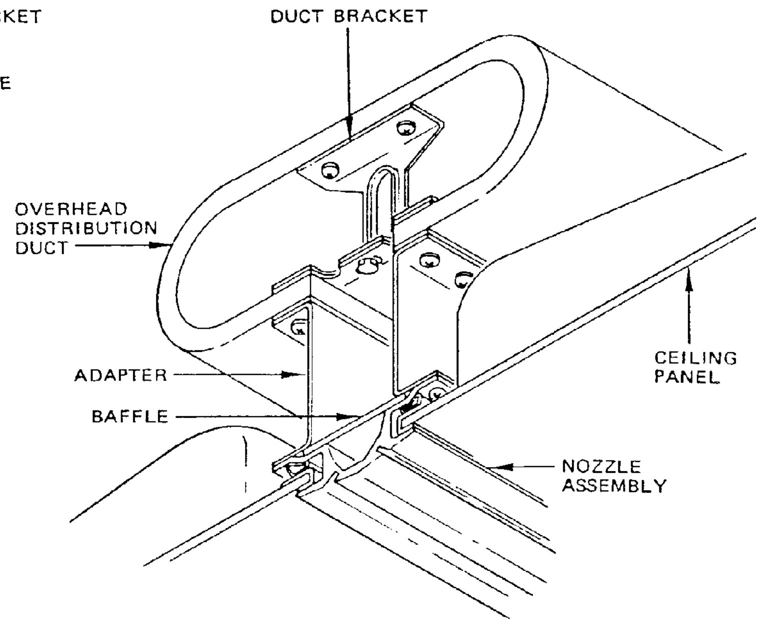
Passenger Cabin Conditioned Air Distribution
Figure 1 (Sheet 1)



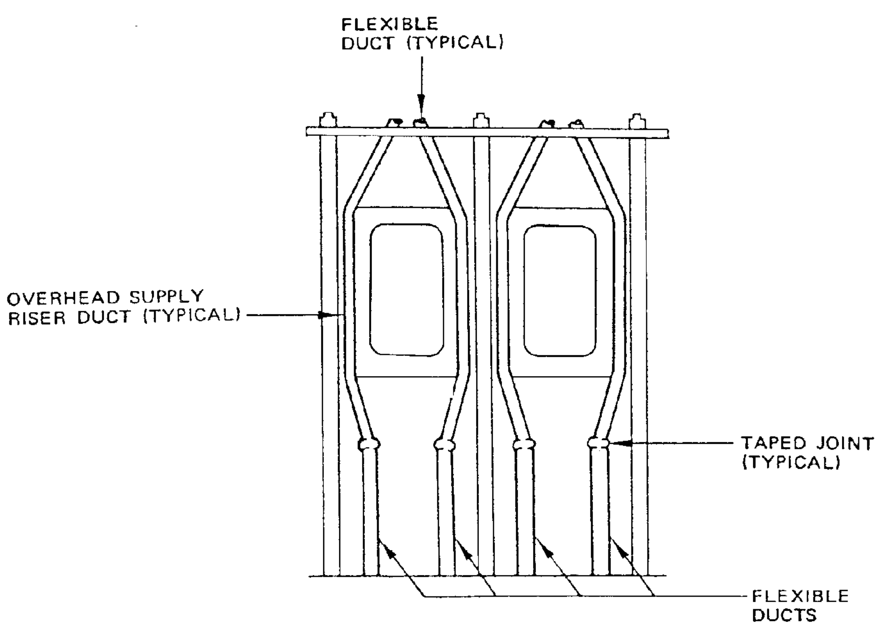
Passenger Cabin Conditioned Air Distribution Components Location
Figure 1 (Sheet 2)



DETAIL B
AIRPLANES WITHOUT NEW LOOK INTERIOR

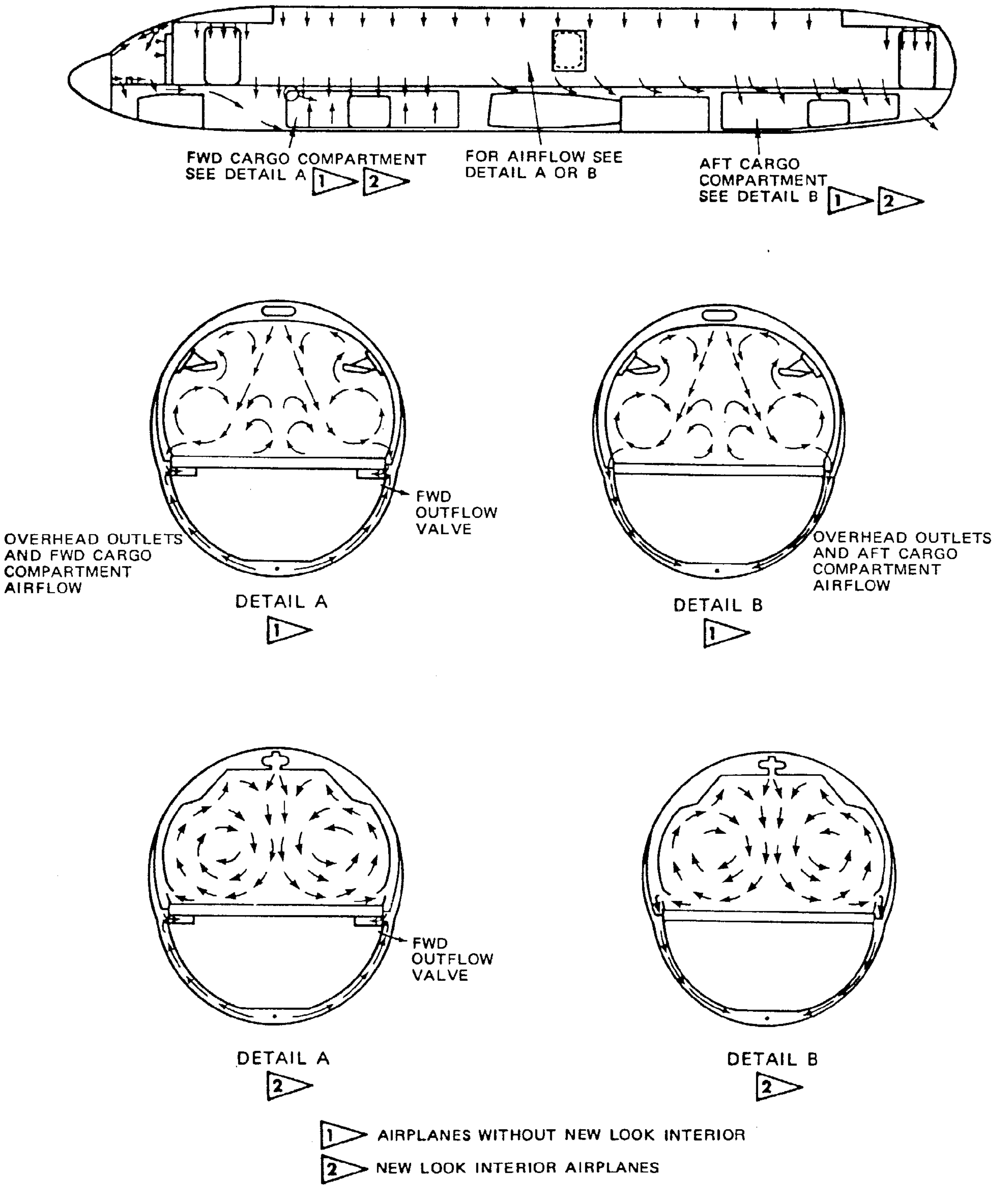


DETAIL B
AIRPLANES WITH NEW LOOK INTERIOR



VIEW 1

Passenger Cabin Conditioned Air Distribution Components Location
Figure 1 (Sheet 3)



Passenger Cabin Airflow Diagram
Figure 2

3. Passenger Cabin Overhead Distribution Duct

A. The overhead distribution duct extends from the forward to the aft end of the curved ceiling along the airplane centerline. Brackets on the upper surface of the duct attach it to the airplane structure. The overhead distribution duct is made of polyurethane. On Standard Passenger Airplanes the forward and aft overhead duct section that connects to the light fixture is made of glass fabric reinforced plastic. The Passenger/Cargo Convertible Airplanes have only the aft overhead duct section. On the upper surface of the overhead duct at approximately midcabin position is a flexible duct panel. This flexible panel provides easy access to the upper beacon light. Refer to Beacon Light, Chapter 33.

B. Conditioned air is directed into the passenger cabin through a continuous, slot-type nozzle which extends for approximately 70% of the length of the overhead duct. At the forward and aft ends of the cabin, where the ceiling height is less, air enters the cabin through a grille on either side of the light fixture. On Passenger/Cargo Convertible Airplanes the forward grille is supplied air from the distribution manifold duct assembly.

4. Passenger Cabin Air Exhaust

A. Air from the passenger cabin is exhausted through foot level grille in the main cabin sidewall. This air and control cabin air then flows around the walls of the aft cargo compartment and is eventually discharged overboard through the cabin pressurization outflow valve.

5. Galley Vent System

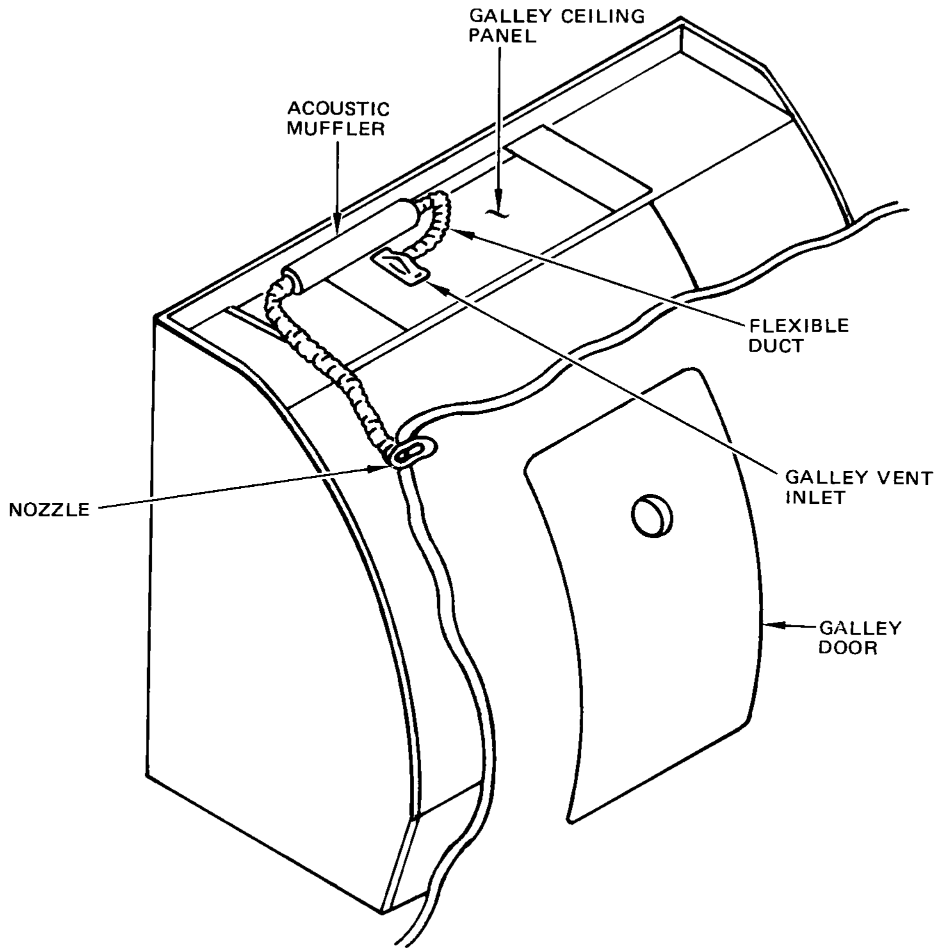
A. The galley is ventilated by a system consisting of flexible ducts which connects an inlet vent and filter at the galley ceiling to an exhaust nozzle in the airplane skin. The nozzle incorporates a flow limit-venturi. An acoustic muffler is incorporated in the ducts to lessen noise from the system. The muffler is attached to the ducts and to structure by clamps (Fig. 3).

6. Passenger Cabin Distribution Shutoff System (Passenger/Cargo Convertible Airplanes)

A. The passenger cabin distribution shutoff system consists of a passenger cabin airflow shutoff valve, cabin air shutoff relay, smoke clearance relay and a smoke clearance switch. The passenger cabin airflow shutoff valve is installed in the main distribution manifold and provides a means of shutting off airflow to the passenger cabin under certain configurations without affecting control cabin distribution. These configurations are the all-cargo, or passenger and cargo pressurized configurations.

B. The SMOKE CLEARANCE switch is a three position switch located on the forward overhead panel and is normally in a guarded NORMAL position. The other two positions of the switch are CARGO-P/C UNPRESS and P/C PRESS. In the all-cargo configuration whether pressurized or unpressurized the switch is placed in the CARGO-P/C UNPRESS position. When switched to CARGO-P/C UNPRESS the following functions occur:

(1) The forward outflow valve opens.
(2) The gasper fan shuts off.
(3) The right pack valve shuts off and left pack valve switches to a low flow mode by energizing solenoid C of the left pack valve.



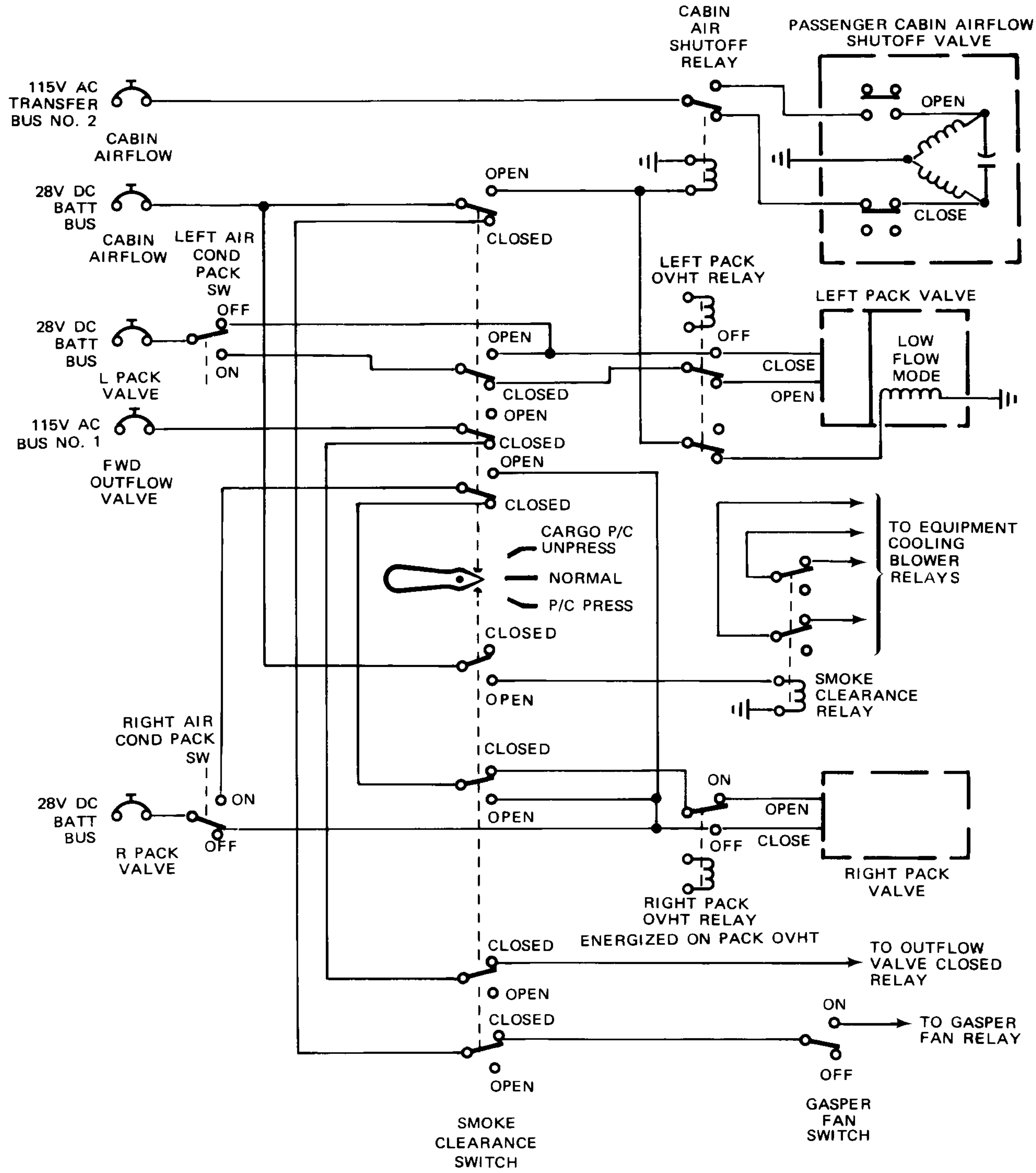
Galley Vent System Component Location
Figure 3

(4) The passenger cabin airflow shutoff valve closes.

C. When switched to P/C PRESS the following functions occur:

(1) The forward outflow valve opens.
(2) The gasper fan shuts off.
(3) The right pack valve shuts off.
(4) The passenger cabin airflow shutoff valve remains open.
(5) The equipment cooling blower shuts off.

D. The system returns to normal when the SMOKE CLEARANCE switch is returned to the guarded NORMAL position (Fig. 4).



Passenger Cabin Distribution Shutoff System Circuit
Figure 4

OVERHEAD DISTRIBUTION DUCT - REMOVAL/INSTALLATION

1. General
   A. Two procedures have been provided since only a silicone adhesive will stick to a duct prepared with a silicone adhesive. Procedure 1 will be effective for all ducts except those installed or repaired with GE RTV 133 black silicone adhesive. Ducts installed or repaired with GE RTV 133 adhesive must use Procedure 2.
2. Equipment and Materials
   A. Solvents (Ref 20-30-31)
      (1) Solvent - Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) (Ref AMM/SOPM 20-30-88)
      (2) Toluene TT-T-548 or JAN-T-171 Grade A
   B. Tapes (Ref 20-30-51)
      (1) HT1-4 Nomex tape, 4-inches wide
   C. Adhesives (Ref 20-30-11)
      (1) GE RTV 133 (Procedure 2)
      (2) BMS 5-7 Type II (EC2155) (Procedure 1)

      NOTE: EC2155 has been replaced by EC4419 adhesive, but may be used until existing stocks are depleted.

   D. Panduit Installation Tool - PN GS4H - Panduit Corporation, Tinley Park, Illinois
3. Remove Overhead Distribution Ducts (Fig. 401)
   A. Gain access to ducts by removing appropriate ceiling panels in passenger cabin (Ref Chapter 25, Equipment and Furnishings).
   B. Remove screws attaching the applicable sections of duct nozzle and adapter to ducts.

      NOTE: The baffle, nozzle, and adapter joints do not always align. It may be necessary to remove screws attaching the nozzle to the adapter on the adjacent ducts joints to obtain a removable unit.

   C. Remove nozzle assembly, baffle, and adapter.
   D. On overhead ducts having overhead supply duct connections, disconnect overhead supply ducts by removing strap clamps at overhead supply joints.
   E. Insert a protective sheet metal guard between top of duct and ceiling insulation in order to protect insulation when cutting duct joint.
   F. Cut through tape at joints between the edges of adjacent ducts.

      CAUTION: DO NOT REMOVE OLD TAPE OR DUCT JOINT MAY DISINTEGRATE.

   G. Remove screws from duct brackets securing ducts to structure.
   H. Remove duct(s).

4. Install Overhead Distribution Duct
   A. If duct has been previously installed, trim away any tape flush with the end of the duct.
   B. Secure duct to supports with screws.
   C. Prepare the tape for joining duct sections per one of the following procedures.

      NOTE: Retaping over old tape may be made four times at any one joint. If additional taping must be made, cut away taped portion of duct and replace with a short duct section of the same size.

      (1) Procedure 1 (Ducts installed without GE RTV 133 adhesive)

         WARNING: PREVENT SOLVENT TO SKIN CONTACT; AVOID INHALATION OF VAPORS; USE ONLY IN AREAS WITH ADEQUATE LOCAL EXHAUST VENTILATION.

         CAUTION: THIS PROCEDURE DOES NOT APPLY TO DUCTS REPAIRED OR INSTALLED WITH GE RTV 133 BLACK SILICONE ADHESIVE. USE PROCEDURE 2 FOR DUCTS WITH THIS TYPE ADHESIVE.

         (a) Clean faying surfaces of ducts with the solvent using dry clean cheesecloth or wipers. Blot dry excess solvent.
         (b) Thin BMS 5-7 Type II adhesive by adding one part of toluene to two parts of adhesive, by volume. Mix thoroughly.
         (c) Install tape joint using one, or a combination of the following three methods. For all three methods the following is applicable:
            1) Ensure that there is a minimum of 1.5 inch of tape on each duct end.
            2) Overlap the tape ends 1-2 inches at the tape joint except for ducts with nozzle openings, no overlap of the tape ends is required. Pull out wrinkles in the tape and smooth out any voids or air pockets between the tape and the ducts.
         (d) Method I: Apply a moderate to heavy coat of adhesive, approximately 0.020-0.030 inch thick to both the tape and to the end of the duct. While the adhesive is still wet, apply the tape to the duct. Apply a liberal topcoat of adhesive to ensure saturation of the tape.
         (e) Method II: Apply a 3-inch wide coat of thinned adhesive, approximately 0.040-0.060 inch thick to the outside surface of each duct end. While the adhesive is still wet, apply the tape to the adhesive coated surface of duct. Apply a liberal topcoat of adhesive to ensure saturation of the tape.

(f) Method III (For locations with limited access):

1) Place the tape on a suitable flexible installation aid.

2) Apply a coat of thinned adhesive approximately 0.040-0.060 inch thick to the tape. The adhesive will soak through and hold the tape temporarily to the installation aid.

3) While the adhesive is still wet, position the installation aid against the duct joint with the adhesive side toward the duct. Pull the tape away from the installation aid onto the duct surface. Smooth out any wrinkles and trapped air to ensure that the tape is contacting the duct. If possible, insulation blankets should be prevented from contacting the adhesive to allow air circulation until the adhesive is dry.

(g) Allow the adhesive to cure under contact pressure for a minimum of 4 hours at 65-100°F before pressurizing the air conditioning system.

(2) Procedure 2 (ducts using GE RTV 133 adhesive)

(a) Coat the tape on one side with adhesive. Open time is approximately 30 minutes before a surface skin will begin to form. The tack-free skin interferes with adhesion. Extreme caution must be exercised during application to ensure that no adhesive is applied outside the bond area if subsequent finishing is required.

(b) Wrap one layer of coated tape (with adhesive down) over the joint with a minimum of 1 inch on each duct. Overlap the tape ends 1-2 inches at the tape joint except that for ducts with nozzle openings, no overlap of the tape ends is required.

(c) Pull out wrinkles in the tape and smooth out any voids or air pockets between the tape and the ducts.

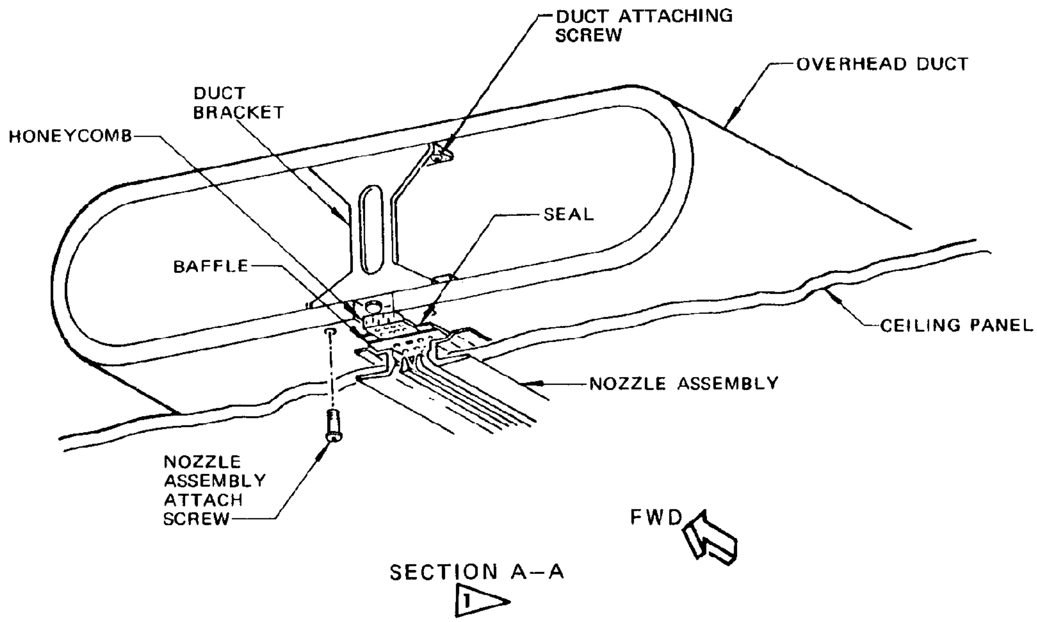
(d) Apply positive pressure to ensure contact of the adhesive to the duct. A bondline thickness of 0.04 to 0.08 inches is required. This is approximately 2.0 ounces of adhesive per foot of 4-inch wide tape.

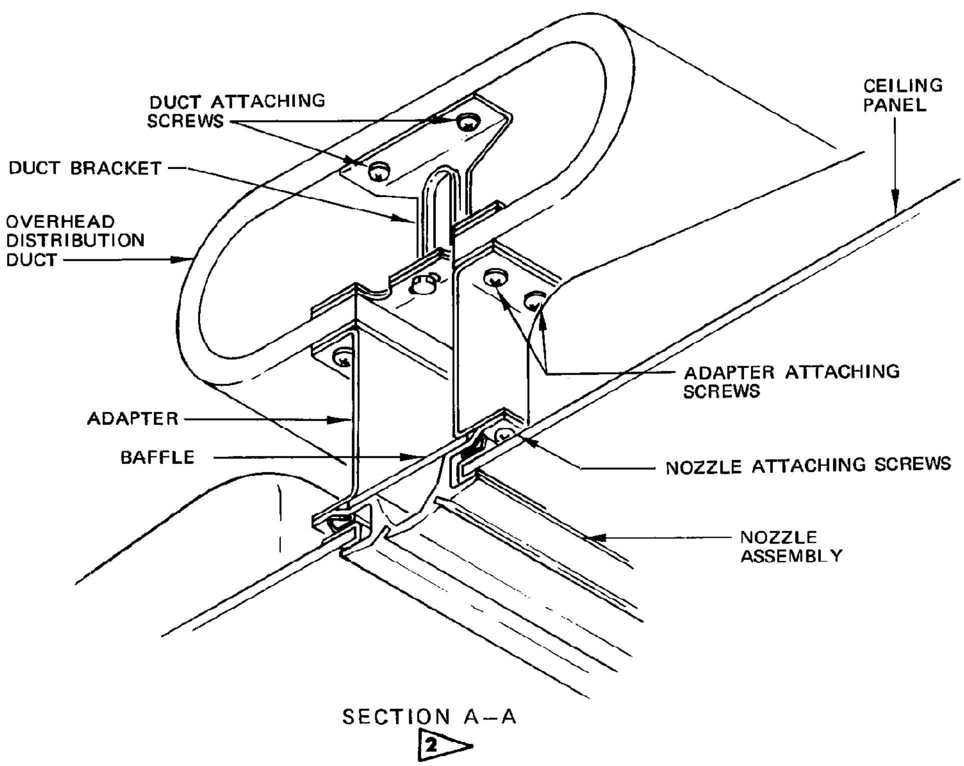
(e) Allow the adhesive to cure under contact pressure for a minimum of 24 hours at 65-100°F. A minimum of 20% relative humidity is required for adhesive cure.

D. Install seal, baffle and nozzle assembly.

E. Secure overhead duct nozzle to duct with screws.

F. Install ceiling panels.

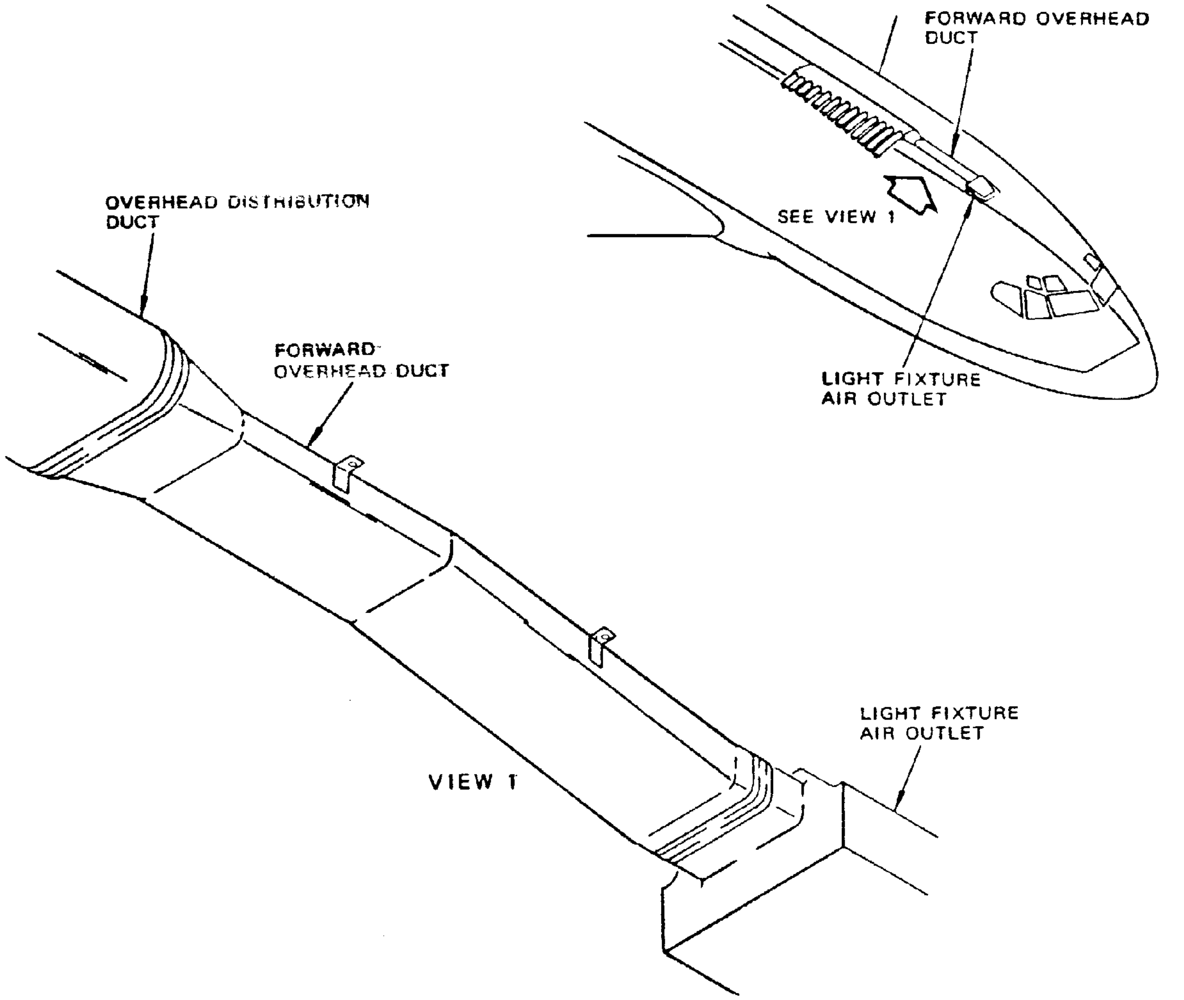




Overhead Duct Installation
Figure 401

FORWARD OVERHEAD DISTRIBUTION DUCT - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices for the forward duct are the same as for the aft duct. Refer to 21-23-42.



Forward Overhead Distribution Duct and Valve Assembly
Figure 201

AFT OVERHEAD DISTRIBUTION DUCT - REMOVAL/INSTALLATION

1. General
   A. The aft overhead distribution duct is a duct section, made of polyurethane, which connects the overhead distribution duct to the light fixture. The following procedure describes removal/installation of the aft duct. Removal/installation for the forward duct may be accomplished by using the same procedure.
   B. Two procedures have been provided, since only a silicone adhesive will stick to a duct prepared with a silicone adhesive. Procedure 1 will be effective for all ducts except those installed or repaired with GE RTV 133 black silicone adhesive. Ducts installed or repaired with GE RTV 133 adhesive must use Procedure 2.
2. Equipment and Materials
   A. Solvents (Ref 20-30-31)
      (1) Solvent - Final Cleaning of Metal Prior to Non-structural Bonding (Series 88) (Ref AMM/SOPM 20-30-88)
      (2) Toluene TT-T-548 or JAN-T-171 Grade A
   B. Tapes (Ref 20-30-51)
      (1) HT1-4 Nomex tape, 4 inches wide
   C. Adhesives (Ref 20-30-11)
      (1) GE RTV 133 or
      (2) GE PSA-529/SRC-18
3. Remove Aft Overhead Distribution Duct
   A. Remove ceiling panel.
   B. Remove screws holding duct to ceiling supports.
   C. Disconnect forward end of duct from overhead duct.
      (1) Insert a protective sheet metal guard between the top of the duct and the ceiling insulation to protect the insulation when cutting duct.
      (2) Cut through old tape at the joints between the edges of adjacent ducts.

      CAUTION: DO NOT REMOVE OLD TAPE. DUCT JOINT WILL DISINTEGRATE UPON REMOVAL OF THE TAPE.

   D. Remove tape connecting aft portion of duct to light fixture.
   E. Remove duct section.
4. Install Aft Overhead Distribution Duct
   A. Telescope end of duct to light fixture inlet as required to allow forward end of assembly to butt against overhead duct.
   B. Secure duct to ceiling support.

C. Prepare tape for joining duct sections per one of the following procedures.

NOTE: Retaping over old tape may be made four times at any one joint. If additional taping must be made, cut away taped portion of duct and replace with a short duct section of the same size.

(1) Use GE RTV 133 adhesive if the color of the adhesive on the initial installation is black.

CAUTION: MAKE SURE THAT YOU USE THE SAME TYPE OF ADHESIVE THAT WAS USED ON THE INITIAL INSTALLATION OF THE DUCT JOINT. THE ADHESIVE WILL NOT BOND TO THE DUCTS UNLESS THE SAME TYPE OF ADHESIVE IS USED.

(2) Use GE PSA-529/SRC-18 if the color of the adhesive on the initial installation is clear.

CAUTION: MAKE SURE THAT YOU USE THE SAME TYPE OF ADHESIVE THAT WAS USED ON THE INITIAL INSTALLATION OF THE DUCT JOINT. THE ADHESIVE WILL NOT BOND TO THE DUCTS UNLESS THE SAME TYPE OF ADHESIVE IS USED.

(3) Procedure 1 (Ducts without GE RTV 133 adhesive)

WARNING: PREVENT SOLVENT TO SKIN CONTACT; AVOID INHALATION OF VAPORS; USE ONLY IN AREAS WITH ADEQUATE LOCAL EXHAUST VENTILATION.

CAUTION: THIS PROCEDURE DOES NOT APPLY TO DUCTS REPAIRED OR INSTALLED WITH GE RTV 133 BLACK SILICONE ADHESIVE. USE PROCEDURE 2 FOR DUCTS WITH THIS TYPE ADHESIVE.

(a) Clean faying surfaces of ducts with solvent using dry clean cheesecloth or wipers. Blot dry excess solvent.
(b) Mix adhesive per the manufacturer's instructions.
(c) Install tape joint using one, or a combination of the following three methods. For all three methods the following is applicable:
1) Ensure that there is a minimum of 1.5 inch of fiberglass tape on each duct end.
2) Overlap the tape ends 1-2 inches at the tape joint. Pull out wrinkles in the tape and smooth out any voids or air pockets between the tape and the ducts.

(d) Method I: Apply a moderate to heavy coat of adhesive, approximately 0.020-0.030 inch thick to both the tape and to the end of the duct. While the adhesive is still wet, apply the tape to the duct. Apply a liberal topcoat of adhesive to ensure saturation of the tape.

(e) Method II: Apply a 3-inch wide coat of thinned adhesive, approximately 0.040-0.060 inch thick to the outside surface of each duct end. While the adhesive is still wet, apply tape to the adhesive coated surface of duct. Apply a liberal topcoat of adhesive to ensure saturation of the tape.

(f) Method III (For locations with limited access):

1) Place tape on a suitable flexible installation aid.

2) Apply a coat of thinned adhesive approximately 0.040-0.060 inch thick to the tape. The adhesive will soak through and hold the tape temporarily to the installation aid.

3) While the adhesive is still wet, position the installation aid against the duct joint with the adhesive side toward the duct. Pull the tape away from the installation aid onto the duct surface. Smooth out any wrinkles and trapped air to ensure that the tape is contacting the duct. If possible, insulation blankets should be prevented from contacting the adhesive to allow air circulation until the adhesive is dry.

(g) Allow the adhesive to cure under contact pressure for a minimum of 12 hours at 65-100°F before pressurizing the air conditioning system.

(4) Procedure 2 (ducts using GE RTV 133 adhesive)

(a) Coat tape on one side with adhesive. Open time is approximately 30 minutes before a surface skin will begin to form. The tack-free skin interferes with adhesion. Extreme caution must be exercised during application to ensure that no adhesive is applied outside the bond area if subsequent finishing is required.

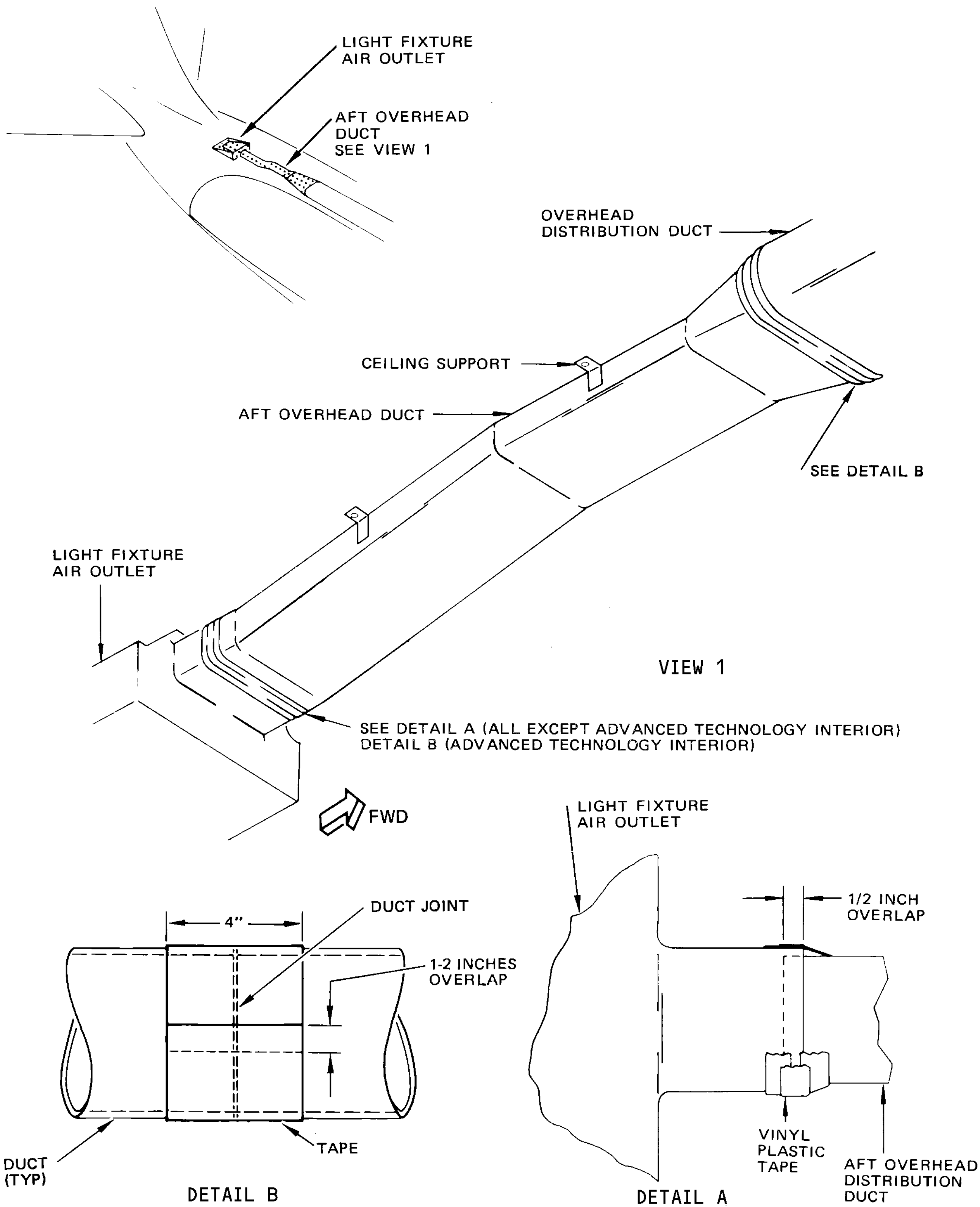
(b) Wrap one layer of coated tape (with adhesive down) over the joint with a minimum of 1.5 inch on each duct. Overlap the tape ends 1-2 inches at the tape joint.

(c) Pull out wrinkles in the tape and smooth out any voids or air pockets between the tape and the ducts.

(d) Apply positive pressure to ensure contact of the adhesive to the duct. A bondline thickness of 0.04 to 0.08 inch is required. This is approximately 2.0 ounces of adhesive per foot of 4-inch wide tape.

(e) Allow the adhesive to cure under contact pressure for a minimum of 24 hours at 65-100°F. A minimum of 20% relative humidity is required for adhesive cure.

D. Clean area to be taped at ceiling light end of duct with solvent.



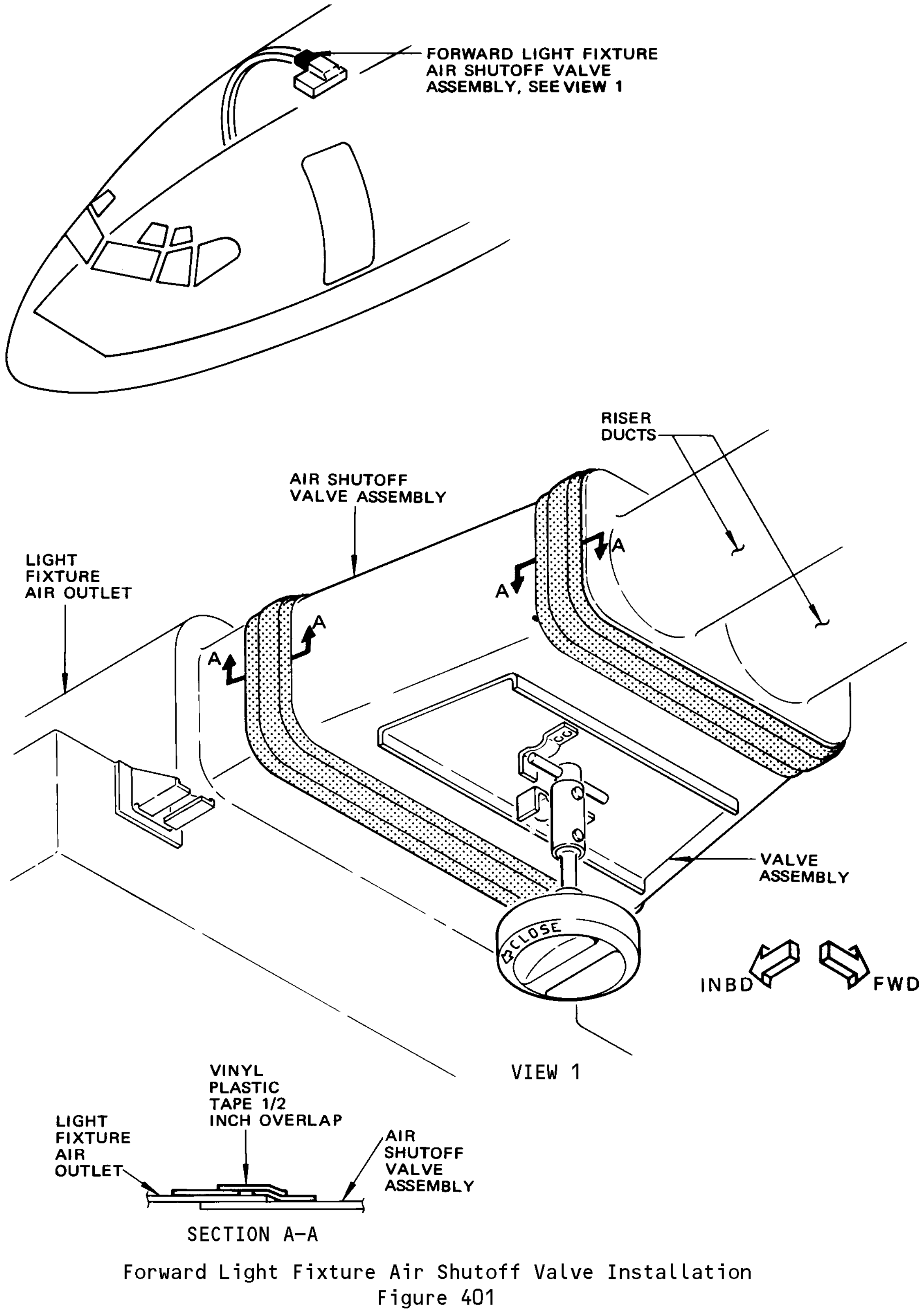
Overhead Distribution Duct Installation
Figure 401

E. Apply two laps of 2-inch vinyl plastic tape to the center of the joint. Pull taut and smooth while applying.

F. Install ceiling panel.

FORWARD LIGHT FIXTURE AIR SHUTOFF VALVE - REMOVAL/INSTALLATION

1. General
    A. The air shutoff valve connects the riser duct from the distribution manifold duct assembly to the light fixture. Removal/Installation of the shutoff valve riser ducts at the manifold duct assembly, and the aft overhead distribution duct and valve assembly may use the same procedure.
2. Equipment and Materials
    A. Cleaning Solvent, BMS 3-2
    B. Vinyl plastic tape, pressure sensitive adhesive, 2 inches wide
3. Remove Forward Light Fixture Air Shutoff Valve
    A. Remove ceiling panel.
    B. Remove screws holding riser duct and valve assembly to ceiling supports.
    C. Remove tape connecting valve to light fixture.
    D. Remove tape connecting valve to riser duct.
    E. Remove valve assembly.
4. Install Forward Light Fixture Air Shutoff Valve
    A. Telescope ends of duct to light fixture inlet as required (Fig. 401).
    B. Install screws to hold riser duct and valve assembly to ceiling support.
    C. Clean area to be taped with cleaning solvent.
    D. Apply two laps of 2-inch vinyl plastic tape to the center of the joint, pulling taut and smoothing while applying.
    E. Install ceiling panel.



Forward Light Fixture Air Shutoff Valve Installation
Figure 401

VENT MUFFLER - MAINTENANCE PRACTICES

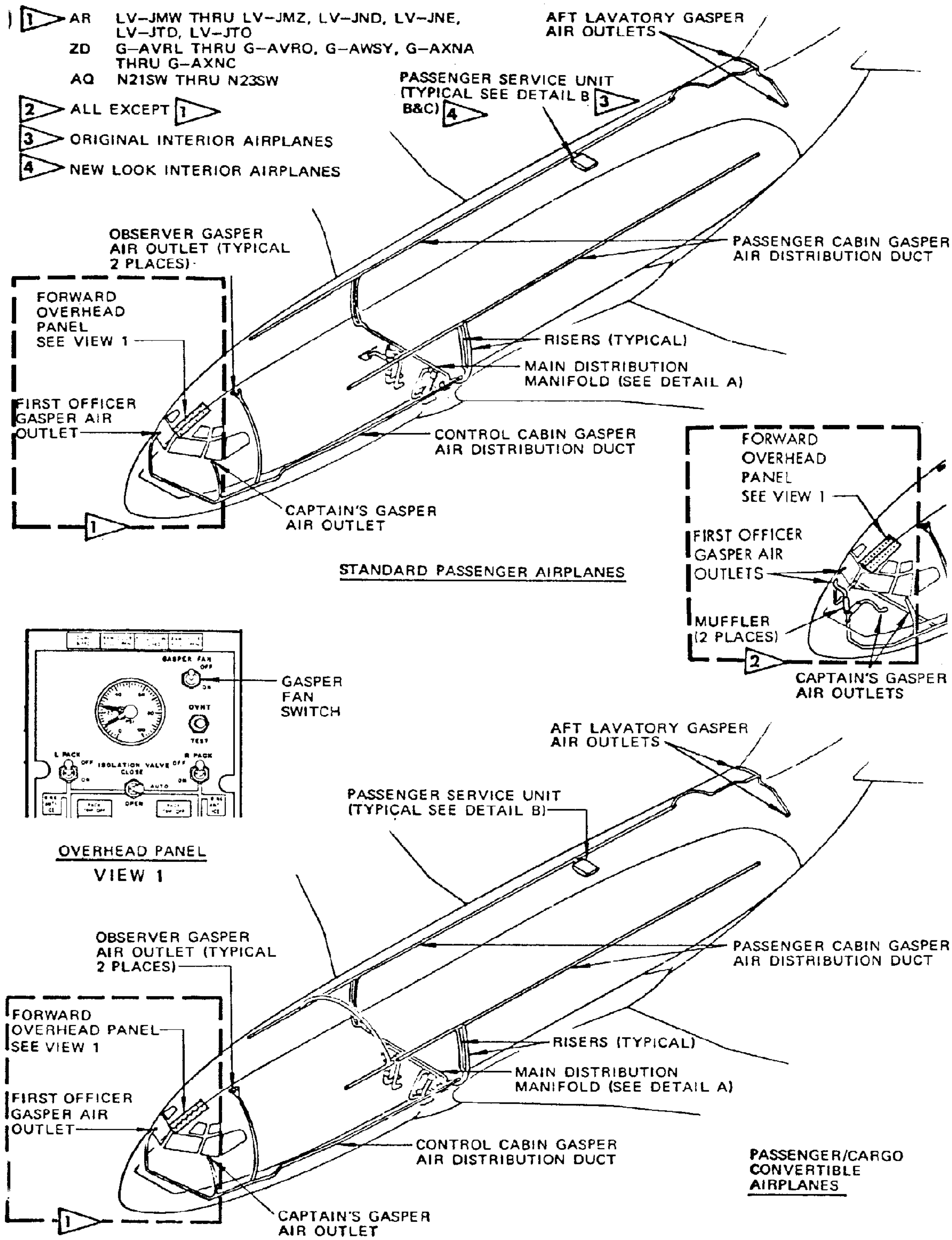
1. General
   A. Increased noise levels can be caused by increased air velocity through restrictions in the muffler due to contamination or cracks in the muffler shell.
2. Equipment and Materials
   A. Vinyl tape (AMM 20-30-51/201)
      (1) Permacel 29
   B. Cylindrical wooden plug
   C. Cleaning Solvent - BMS 3-2 (AMM 20-30-31/201)
3. Vent Muffler Cleaning
   A. Remove vent muffler.

      NOTE: Access to muffler, located on LH side opposite galley service door, is gained by removing ceiling panel.

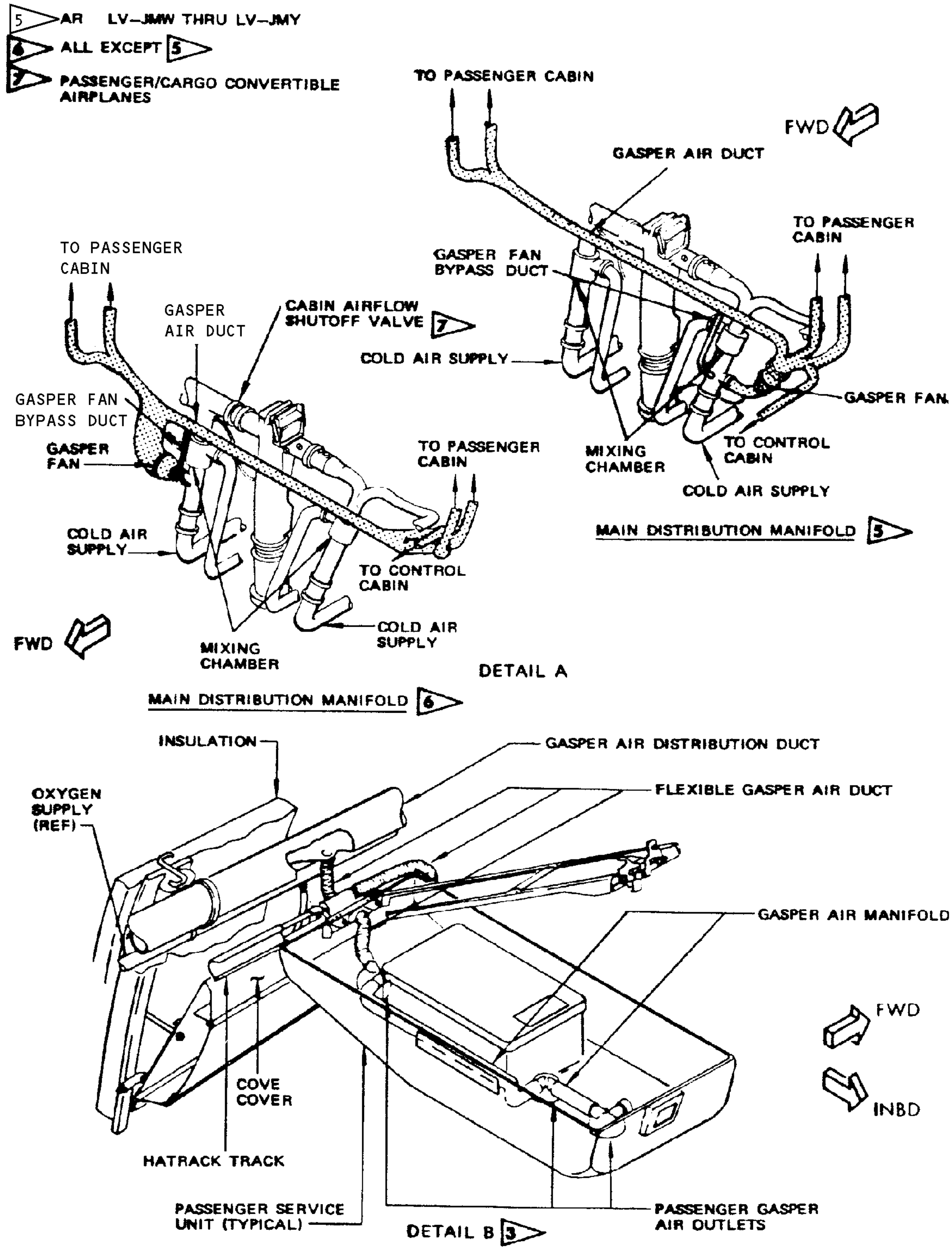
   B. Insert cylindrical wooden plug, slightly less in diameter than muffler flow diameter, through muffler.
   C. If required, repeat procedure through hoses/ducts adjoining muffler.
   D. Install vent muffler.
4. Vent Muffler Repair
   A. Remove vent muffler.
   B. Clean muffler crack area, if required, with BMS 3-2 solvent.
   C. Wrap cracked area with vinyl tape with minimum 2-inch overlap on all sides with no voids.
   D. Install vent muffler.

INDIVIDUAL (GASPER) AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

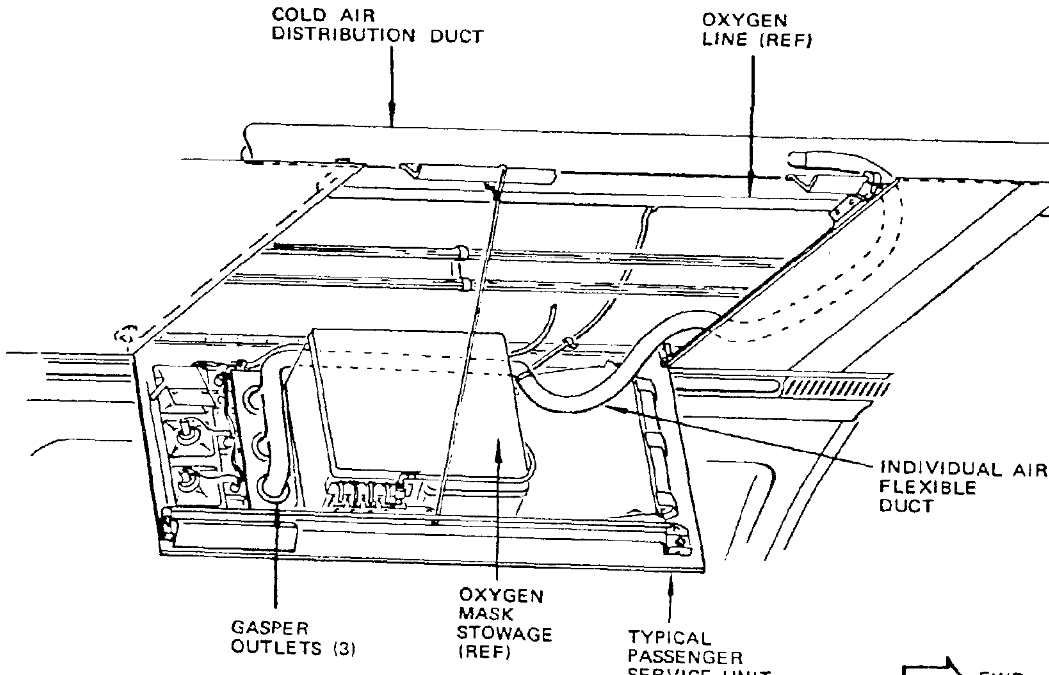
1. General
   A. The individual (gasper) air distribution system provides a supplementary source of cold air for each crewmember, each passenger, and each lavatory. Gasper air is provided to cool the individual area to a value different from that provided by the normal air distribution system. An outlet nozzle at each station allows the individual a choice anywhere between no cold air and full system capacity cold air. The outlet nozzle is adjustable to permit direction as well as quantity of cold air for each individual's comfort.
   B. The gasper system consists of a gasper fan, risers, distribution ducts, and individual adjustable outlets. Cold air is received from the cooling packs through the cold air supply duct leading to the mixing chamber and is routed through the gasper fan. For passenger cabin the air passes up risers to distribution ducts located either behind the hatracks or above the passenger service units. From the distribution ducts, cold air is taken to the individual outlets in the passenger service units and lavatories. Cold air for the crew is supplied by a separate duct on the left side going forward under the main cabin floor. (See figure 1.)
2. Gasper Fan
   A. The gasper fan is a 115-volt ac motor-operated fan intended to increase pressure available in the gasper system under conditions of low supply pressure or high cold air demand. The high demand condition would exist when one air conditioning pack is operating. The fan may be run continuously without damage.
   B. The gasper fan on some airplanes is contained in the right side and on others in the left side of the gasper air duct in the air conditioning distribution bay. The fan provides cold air to the control and passenger gasper systems from the right or left air cycle system. (See figure 1 for effectivity.)
   C. The gasper fan can be turned on or off by a switch located on the forward overhead panel. Circuit protection for the gasper fan is provided by a circuit breaker on P6 circuit breaker panel.
   D. On Passenger/Cargo Convertible Airplanes an electrical interlock circuit (figure 2) prevents gasper fan operation when the smoke clearance switch is moved to either the mixed passenger/cargo unpressurized or the mixed passenger/cargo pressurized configuration. Returning the smoke clearance switch to its guarded NORMAL position permits gasper fan operation.



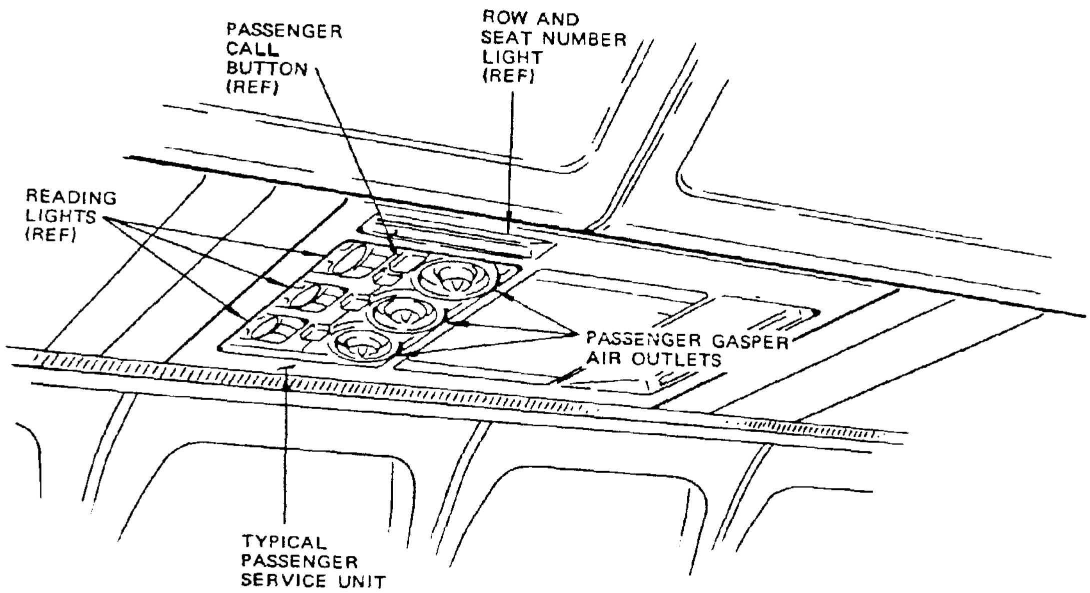
Individual (Gasper) Air Distribution System Component Location
Figure 1 (Sheet 1)



Individual (Gasper) Air Distribution System Component Location
Figure 1 (Sheet 2)



DETAIL B
4



DETAIL C
4

Individual (Gasper) Air Distribution System Component Location
Figure 1 (Sheet 3)

3. Control Cabin Gasper Air Distribution

A. The control cabin gasper air distribution consists of a duct on the left side of the airplane below the floor, originating just upstream of the gasper fan in the air conditioning distribution bay, and extending to the control cabin. In the control cabin the duct branches into three risers, feeding four outlets, each to a crew station air outlet. On some airplanes, supplemental gasper outlets are on the captain's and first officer's instrument panel. (See figure 1 for effectivity.)

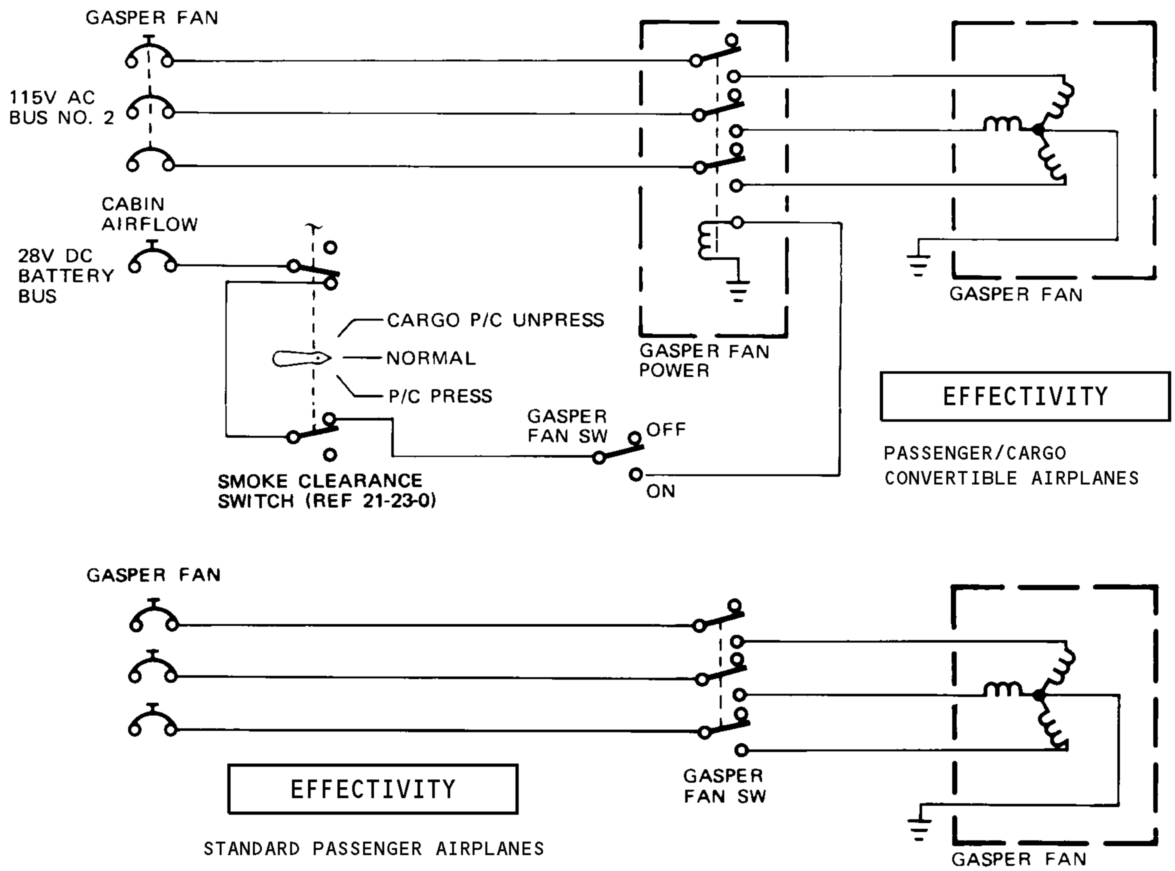
B. The captain's and first officer's gasper air outlets are located on the captain's and first officer's side panels just below the sliding window and, on some airplanes, the outer ends of the left of the airplane centerline, at the aft end of the control cabin. The outlets are adjustable for quantity of flow as well as direction of flow.

C. The gasper air ducts to the instrument panel outlets have mufflers to decrease duct noise. The mufflers are behind the forward electronic panel and are accessible by removing the electronic panel modules.

4. Passenger Cabin Gasper Air Distribution

A. The passenger cabin gasper air distribution consists of risers originating downstream from the gasper fan. The risers connect to a cold air distribution duct, installed either behind the hatrack or above the passenger service units. From outlets on the lower surface of the distribution duct, cold air is taken directly by flexible connections to gasper air outlets in the passenger service units.

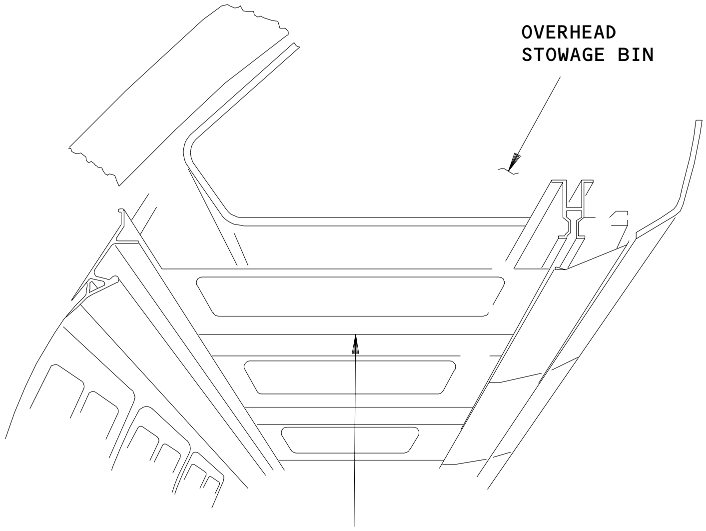
B. The lavatory gasper outlets are identical to the passenger and crew outlets. They are installed on the lavatory soffit panel and connected directly to the cold air distribution duct.



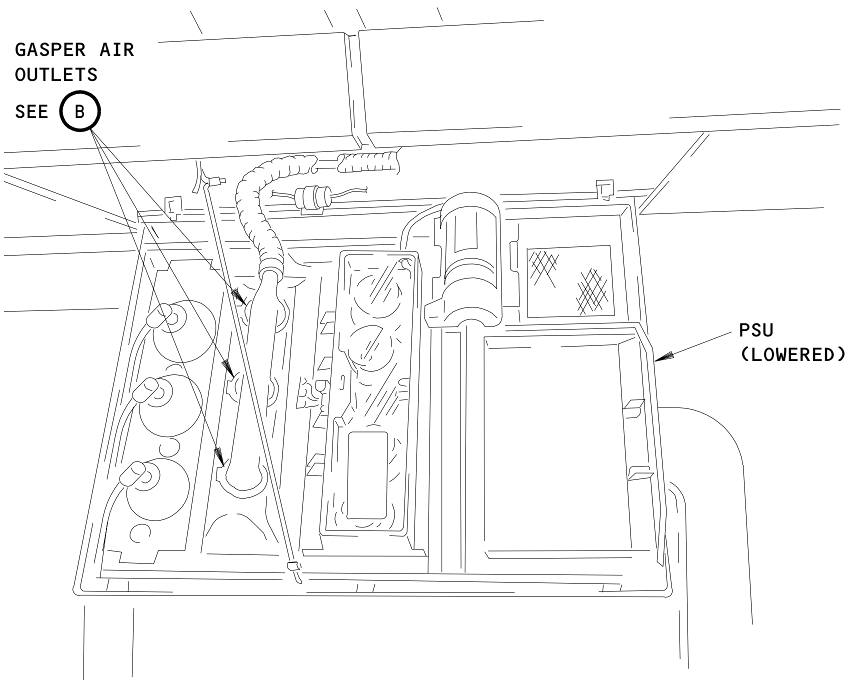
Gasper Fan Circuit Schematic
Figure 2

PASSENGER CABIN GASPER AIR OUTLETS - REMOVAL/INSTALLATION

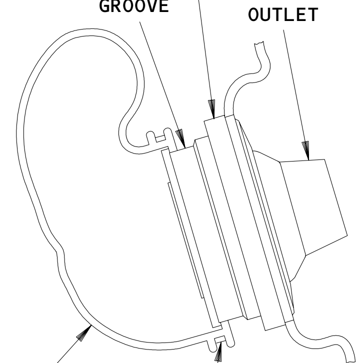
1. General
   A. This procedure has these tasks:
      (1) A removal of the gasper air outlets installed in the Passenger Service Units (PSU).
      (2) An installation of the gasper air outlets installed in the Passenger Service Units (PSU).
      (3) A removal of the gasper air outlets installed in the Lavatory Service Units (LSU).
      (4) An installation of the gasper air outlets installed in the Lavatory Service Units (LSU).
   B. The gasper air outlet is referred to as the gasper in this procedure.
2. Gasper Air Outlet (PSU) Removal (Fig. 401)
   A. References
      (1) AMM 25-23-311/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
      (2) AMM 25-23-511/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
      (3) AMM 25-23-611/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
   B. Access
      (1) Location Zone
          200 Upper Half of Fuselage
   C. Prepare for the Removal
      (1) Remove the applicable (PSU) gasper panel (AMM 25-23-311/201), (AMM 25-23-511/201), or (AMM 25-23-611/201).
   D. Gasper Air Outlet Removal
      (1) Remove and discard the strap from the air manifold.
      (2) Disconnect the air manifold from the gasper.
      (3) Hold the gasper while you remove the retainer nut.
      (4) Remove the gasper from the (PSU) gasper panel.
3. Gasper Air Outlet (PSU) Installation (Fig. 401)
   A. References
      (1) AMM 25-23-311/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
      (2) AMM 25-23-511/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
      (3) AMM 25-23-611/201, PASSENGER SERVICE UNIT - MAINTENANCE PRACTICES
   B. Access
      (1) Location Zone
          200 Upper Half of Fuselage
   C. Gasper Air Outlet Installation
      (1) Put the gasper into the (PSU) gasper panel.
      (2) Install the retainer nut on the gasper and tighten.
      (3) Connect the air manifold to the gasper.
          (a) Make sure the lip on the air manifold engages the groove in the gasper.
      (4) Install a new strap to the air manifold.



PASSENGER COMPARTMENT



PSU
(TYPICAL)
A



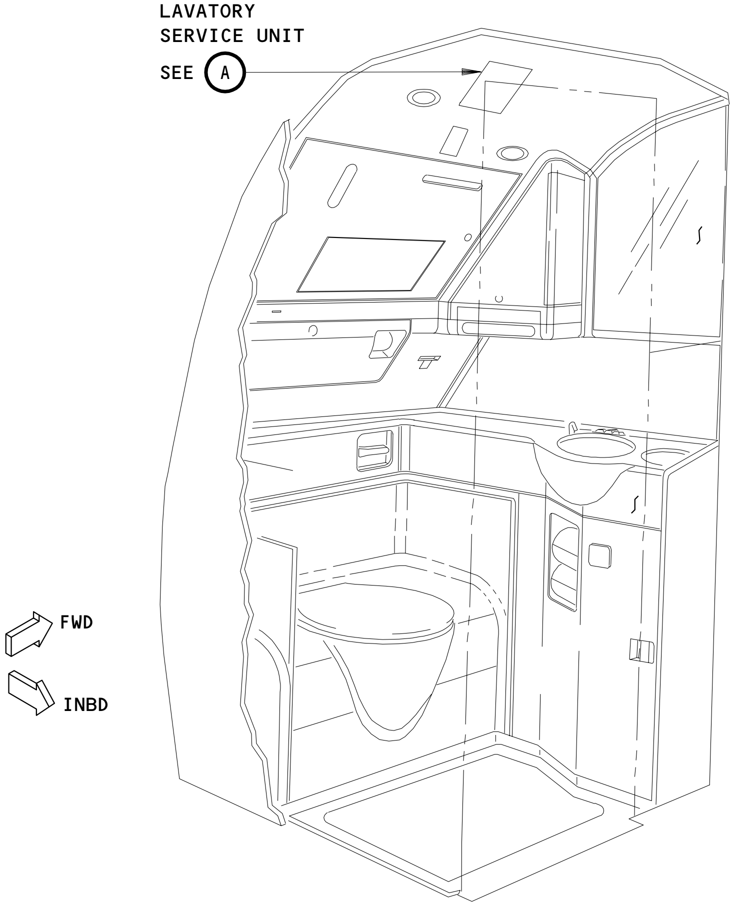
GASPER AIR OUTLET
(TYPICAL)
B

Gasper Air Outlets (PSU) Installation
Figure 401

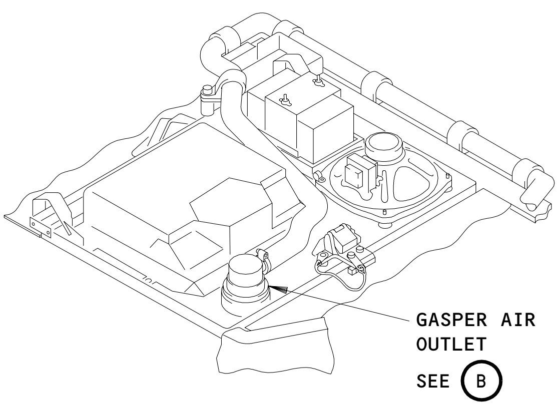
D. Put the Airplane Back to Its Usual Condition
  (1) Install the applicable (PSU) gasper panel (AMM 25-23-311/201), (AMM 25-23-511/201), or (AMM 25-23-611/201).

4. Gasper Air Outlet (LSU) Removal (Fig. 402)
  A. References
    (1) (AMM 25-23-131/401), ATTENDANT AND LAVATORY SERVICE UNITS (ASUs AND LSUs) - REMOVAL/INSTALLATION
    (2) (AMM 25-41-5/401), FORWARD LAVATORY CEILING PANEL - REMOVAL/INSTALLATION
    (3) (AMM 25-41-9/401), AFT LAVATORY CEILING PANEL - REMOVAL/INSTALLATION
  B. Access
    (1) Location Zone
      200 Upper Half of Fuselage
  C. Prepare for the Removal
    (1) AIRPLANES WITH GASPER MOUNTED IN THE (LSU) PANEL;
      Lower the applicable (LSU) gasper panel (AMM 25-23-131/401).
    (2) AIRPLANES WITH GASPER MOUNTED IN THE CEILING PANEL;
      Remove the applicable ceiling panel (AMM 25-41-5/401) or (AMM 25-41-9/401).
  D. Gasper Air Outlet Removal
    (1) AIRPLANES WITH GASPER MOUNTED IN THE (LSU) PANEL;
      Do these steps to remove the gasper from the panel.
      (a) Loosen the clamp that holds the hose to the gasper.
      (b) Remove the hose from the gasper.
      (c) Hold the gasper while you remove the retaining ring.
      (d) Remove the gasper from the (LSU) gasper panel.
    (2) AIRPLANES WITH GASPER MOUNTED IN THE CEILING PANEL;
      Do these steps to remove the gasper from the panel.
      (a) Loosen the clamp that holds the hose to the gasper.
      (b) Remove the hose from the gasper.
      (c) Hold the gasper while you remove the screws that attach the gasper to the panel.
      (d) Remove the gasper from the panel.

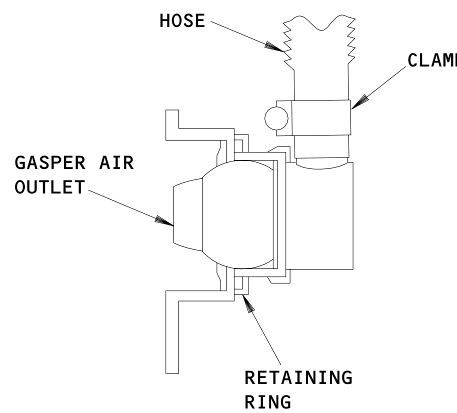
5. Gasper Air Outlet (LSU) Installation (Fig. 402)
  A. References
    (1) (AMM 25-23-131/401), ATTENDANT AND LAVATORY SERVICE UNITS (ASUs AND LSUs) - REMOVAL/INSTALLATION
    (2) (AMM 25-41-5/401), FORWARD LAVATORY CEILING PANEL - REMOVAL/INSTALLATION
    (3) (AMM 25-41-9/401), AFT LAVATORY CEILING PANEL - REMOVAL/INSTALLATION
  B. Access
    (1) Location Zone
      200 Upper Half of Fuselage



LAVATORY COMPARTMENT
(TYPICAL)

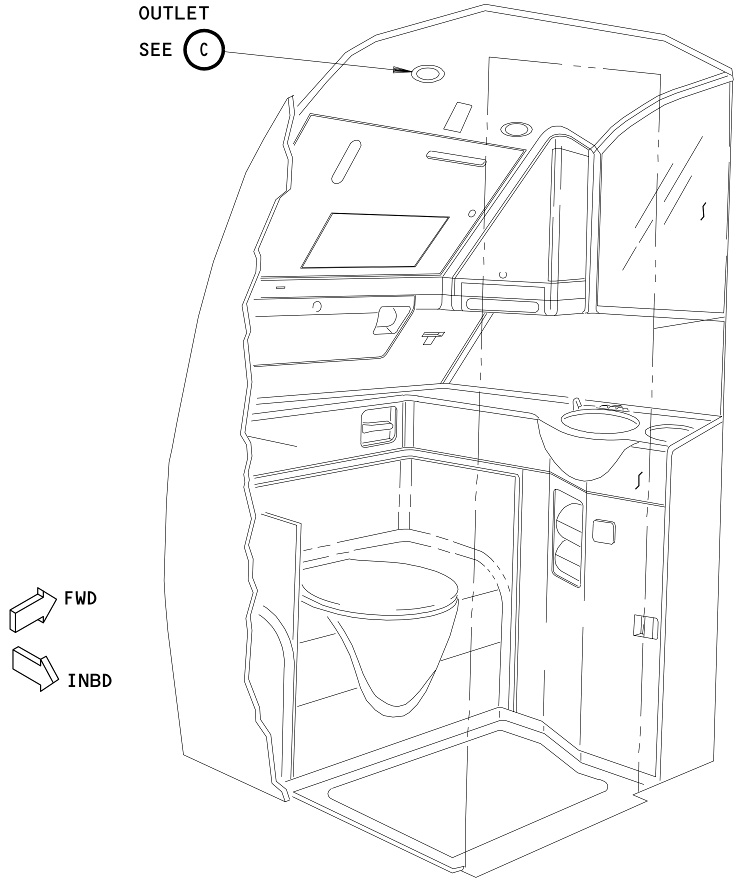


LAVATORY SERVICE UNIT
(TYPICAL)
A

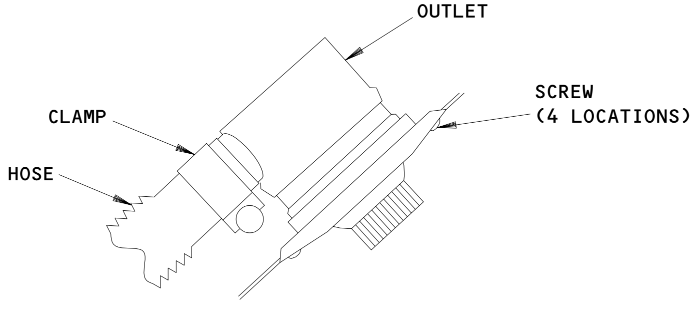


GASPER AIR OUTLET
(TYPICAL)
B

Gasper Air Outlet Installation
Figure 402 (Sheet 1)



LAVATORY COMPARTMENT
(TYPICAL)



GASPER AIR OUTLET
(TYPICAL)
C

Gasper Air Outlet Installation
Figure 402 (Sheet 2)

C. Gasper Air Outlet Installation

(1) AIRPLANES WITH GASPER MOUNTED IN THE (LSU) PANEL;
Do these steps to install the gasper to the panel.

(a) Put the gasper into the (LSU) gasper panel.
(b) Install the retaining ring on the gasper.
(c) Put the clamp on the hose and connect the hose to the gasper.
(d) Tighten the hose clamp.

(2) AIRPLANES WITH GASPER MOUNTED IN THE CEILING PANEL;
Do these steps to install the gasper to the panel.

(a) Put the gasper into the ceiling panel.
(b) Install the screws that attach the gasper to the panel.
(c) Put the clamp on the hose and connect the hose to the gasper.
(d) Tighten the hose clamp.

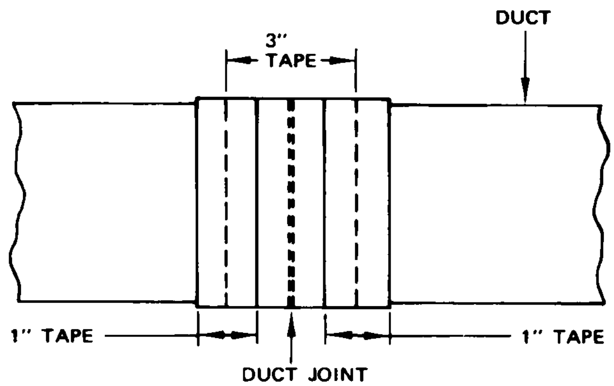
D. Put the Airplane Back to Its Usual Condition

(1) AIRPLANES WITH GASPER MOUNTED IN THE (LSU) PANEL;
Install the applicable (LSU) gasper panel (AMM 25-23-131/401).

(2) AIRPLANES WITH GASPER MOUNTED IN THE CEILING PANEL;
Install the applicable ceiling panel (AMM 25-41-5/401) or
(AMM 25-41-9/401).

GASPER AIR DUCT - APPROVED REPAIRS

1. General
   A. Cracked or broken polycarbonate (lexan) gasper air ducts are repairable. Two types of repair are used, cementing a patch over the defect, and wrapping tape around the defective area. When properly applied, the patch usually makes a more permanent repair, however, wrapping is usually the faster procedure. The degree of damage considered to be repairable is at the operator's discretion.
2. Repair by Patching
   A. Equipment and Materials
      (1) Sheet material for patch, allowing minimum of 1-inch overlap. Use either:
         (a) Polycarbonate-lexan, approximately 0.020 thickness.
         (b) Aluminum - any thickness and hardness that can readily be shaped to fit damaged area contour.
      (2) Adhesive. Use any adhesive applicable to the specifications listed below (Ref 20-30-11).
         (a) BMS 5-19, Class B
         (b) BMS 5-26, Class B (Proseal 890 only)
         (c) BMS 5-44, Class B (Proseal 890 only)
         (d) BMS 5-79, Class B
      (3) Solvent - Isopropyl alcohol, ethel alcohol or naphtha (Ref 20-30-31)
      (4) Sandpaper - medium grit (commercially available)
   B. Repair Duct
      (1) Gain access to damaged section of gasper duct.
      (2) Loosen or remove duct clamps as required, to make duct available for repair.
      (3) Determine area to be repaired and obtain sheet patching material. Trim the damaged area with a sharp knife to provide smooth rounded edges.
      (4) Clean area to be patched.
         (a) If insulation is on duct, remove insulation down to plastic duct.
         (b) Lightly sand areas to be coated with cement to eliminate gloss.
         (c) Clean areas with solvent. Wipe solvent with clean lintless cloth before solvent evaporates.
      (5) Mix adhesive thoroughly and apply uniform brush coat to each faying surface.
      (6) Assemble immediately, applying sufficient pressure to ensure complete contact of faying surfaces. A continuous bead of extruded adhesive usually indicates proper contact.
      (7) Temporarily secure patch with string or tape during initial cure period. Final cure is obtained in a week or more at normal room temperature.



Severed Duct Joint Repair
Figure 801

(8) If insulation was removed from duct in repair area, install section of insulation by using same adhesive.
(9) Install duct clamps removed above.
(10) Reinstall items removed to gain access to duct.

3. <u>Repair by Wrapping</u>

A. Equipment and Materials

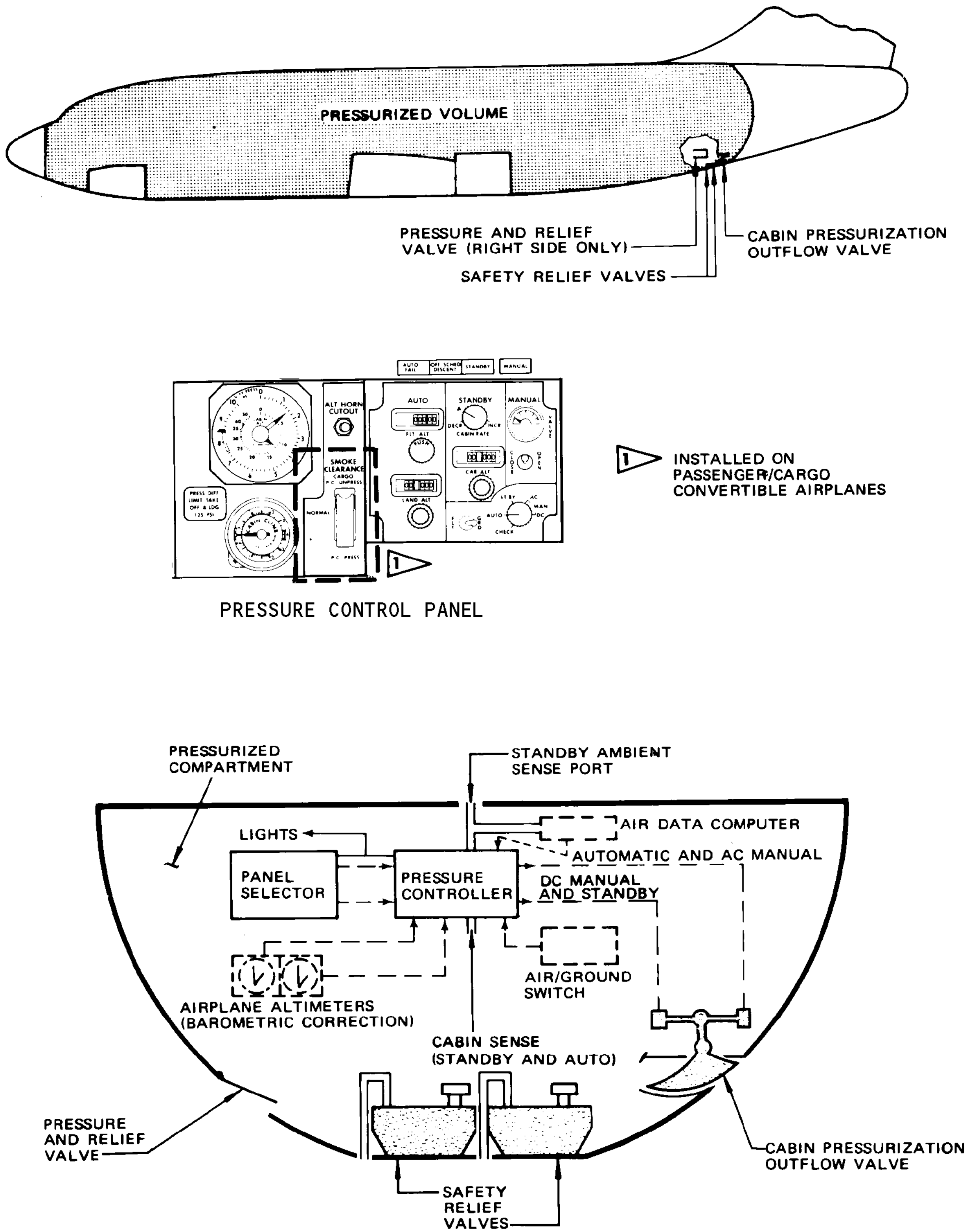
(1) Adhesive. Use any adhesive applicable to the specifications listed below (Ref 20-30-11).
 (a) BMS 5-19, Class B
 (b) BMS 5-26, Class B (Proseal 890 only)
 (c) BMS 5-44, Class B (Proseal 890 only)
 (d) BMS 5-79, Class B
(2) Tape - thermosetting, 1 and 3 inches wide. Fiberglass tape is preferred (Ref 20-30-51)
(3) Solvent - Isopropyl alcohol, ethel alcohol or naphtha (Ref 20-30-31)

B. Repair Duct

(1) Gain access to damaged section of gasper duct.
(2) Loosen or remove clamps as required, to make duct available for repair.
(3) If crack extends into duct area with insulation, remove insulation from the complete area.
(4) If duct is severed, remove sharp edges of duct with a file. Areas of cracks in which edges align, thus not exposing a raw edge, do not need filing. If damage is extensive, remove damaged section and install a short section of new duct.
(5) Clean area to be taped with solvent. Wipe solvent with clean lintless cloth before solvent evaporates.
(6) Align ducts, if severed, so that gap is 1/8 inch minimum to 3/8 inch maximum and apply tape, using either method:
 (a) Apply two wraps of 3-inch tape, centering tape on joint, smoothing tape to eliminate all wrinkles.
 (b) Apply one wrap of 3-inch tape, centering tape on joint, and overlap tape about 1 inch. Apply a wrap of 1-inch tape around each edge of the 3-inch tape, centering the 1-inch tape on tape edge (Fig. 801).
(7) On cracked ducts, in which the duct is not severed, apply 3-inch tape to overlap edges and ends of crack 1 inch minimum. Tape may be positioned and overlapped as required, to cover crack.
(8) If insulation was removed, use the adhesive to re-install the insulation.
(9) Install duct clamps removed above.
(10) Reinstall items removed to gain access.

PRESSURIZATION CONTROL - DESCRIPTION AND OPERATION

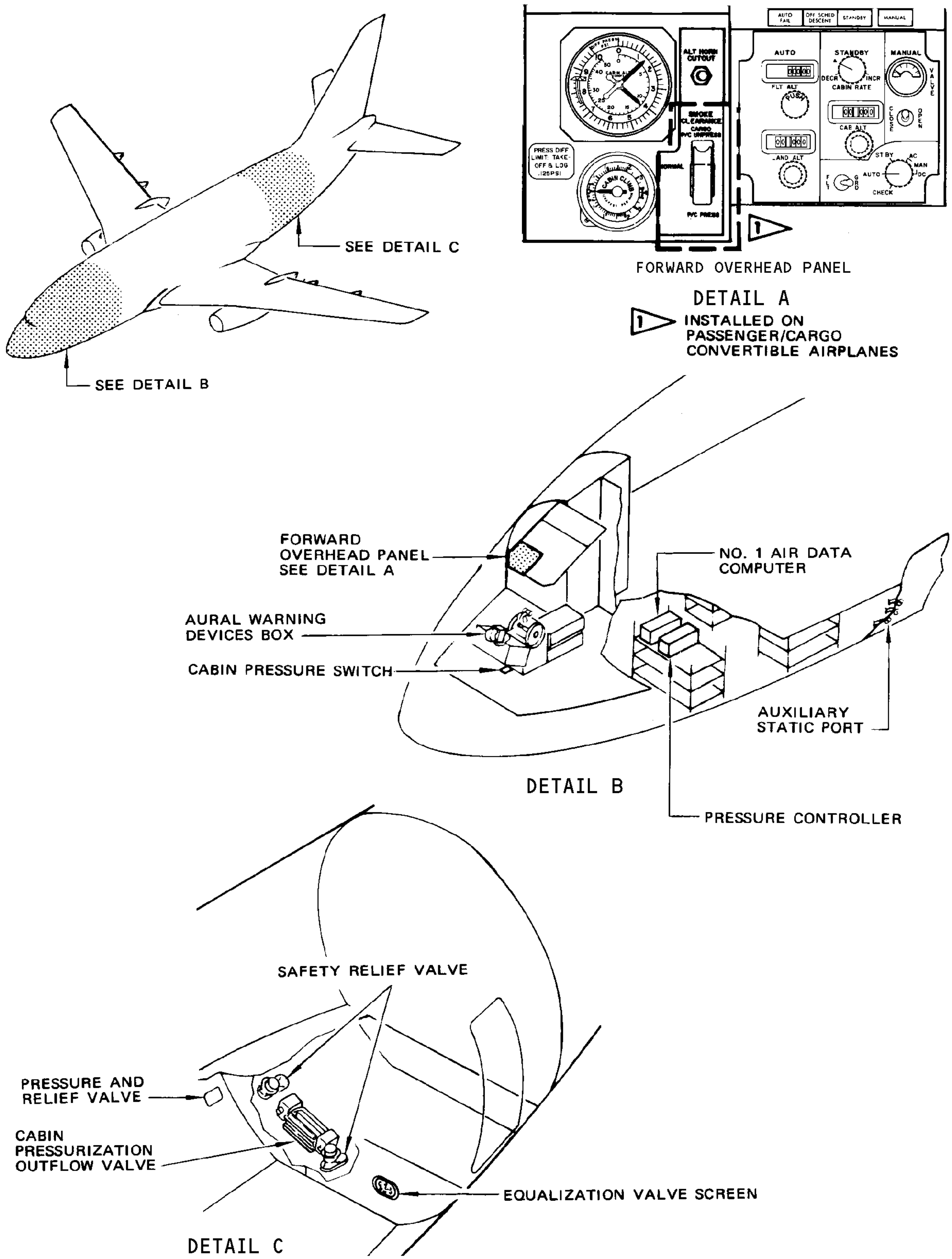
1. General
   A. Pressurization control includes the pressurization control system, pressurization relief valves, and pressurization indication and warning.
2. Pressurization Control System
   A. The pressurization control system describes only the parts of pressurization control which provide a regulated low altitude pressure in the cabin at all airplane altitudes.
   B. The system is electrically operated and electronically controlled. There are four operating modes, which may be selected on the pressure control panel. Automatic is the normal operating mode, standby is semi-automatic in operation and backs up the automatic system, and two manual modes provide direct electrical control. All modes position the cabin pressurization outflow valve to maintain desired cabin pressure.
      (1) The manual modes are identified as manual AC and manual DC. Each provides direct control to the outflow valve through separate electrical motors. The manual modes backup the automatic and standby systems.
   C. In each of the three systems, cabin pressure is maintained by positioning the outflow valve to regulate airflow from the cabin with respect to air from the air cycle system.
3. Pressurization Relief Valves
   A. Pressurization relief valves are valves or equipment installed for the purpose of relieving abnormal conditions which prevent normal operation of the airplane.
   B. Relief valves include safety relief valves, a pressure and relief valve, pressure equalization valves, and blowout panels.
4. Pressurization Indication and Warning
   A. Pressurization indication and warning describes the equipment provided for monitoring cabin pressure and cabin pressure rate of change and the equipment provided for cabin altitude warning.



Pressurization Control Schematic
Figure 1

PRESSURIZATION CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The pressurization control system is an electrically operated and electronically controlled system, which meters the exhaust of ventilating air to provide controlled pressurization of the passenger and control cabins, the electronic compartment, both cargo compartments, and the lower nose compartment. The pressurization control system consists of a pressure control panel, a pressure controller, and a cabin pressurization outflow valve (Fig. 1). The pressurization control system characteristics are as follows:
      (1) The system has four operating modes; automatic, standby, ac manual and dc manual. Automatic is the normal operating mode. Standby is a semiautomatic backup. The ac manual and dc manual modes are backups for automatic and standby modes. The system is completely automatic and under normal conditions requires no adjustment by the flight crew throughout the flight except for barometric correction.
      (2) Both the ac manual mode and the dc manual mode provide direct control to the outflow valve through separate electrical motors. The manual modes back up the automatic and standby systems.
      (3) In the automatic mode, the system accepts manual inputs of planned flight altitude and landing altitude before takeoff. It then determines the lowest possible cabin altitude that can be maintained during airplane high altitude flight and schedules any necessary change in cabin pressure during the flight without any action by the crew. The system can also be reset if a change in planned flight altitude or landing field altitude is made.
      (4) Cabin pressure rate of change is automatically controlled.
      (5) The system provides a cabin pressure differential with respect to ambient of approximately 7.45 psi at cruise altitude.
      (6) Barometric correction for automatic and standby pressure control assures that cabin pressure and landing field pressure are approximately the same at landing.
      (7) A selector switch permits overriding the automatic and standby systems to directly control the position of the outflow valve electrically. Alternate ac or dc control over the valve is provided.
      (8) The STANDBY system automatically takes over to control cabin pressure according to cabin altitude and rate of cabin pressure change settings if certain limits are exceeded in AUTO. In addition, a manual transfer can be made from AUTO to STBY, if desired, by use of the mode selector switch.



Pressurization Control System Component Location
Figure 1

B. Operation of the pressurization control system requires signals into the pressurization control system from direct ambient sense, the captains' altimeter, and the landing gear ground safety sensor in the automatic mode, and from the first officers' altimeter, the air data computer, and the landing gear ground safety sensor in the standby mode. Refer to AMM Chapter 34, Air Data Pressure Instruments, for description of the air data computer and the pilots' altimeters and to AMM Chapter 32, Landing Gear Safety Sensors, for description of the landing gear ground safety sensor. Electrical circuit protection for the pressurization control system is provided by circuit breakers on the P6 circuit breaker panel.

2. Pressure Control Panel

A. The pressure control panel includes four groupings of dials, switches, and indicators used in setting up or changing the operation of the pressurization control system. One grouping is for the automatic (AUTO) method of operation, another is for the semiautomatic or standby method, the third is for the manual method, and the fourth is to allow choosing the desired method of control and function available.

B. For the AUTO method there is an adjusting knob and indicator (LAND ALT) for setting destination landing field altitude and another knob and indicator (FLT ALT) for setting cruise altitude.

C. Instruments for STANDBY consist of a cabin altitude adjusting knob (CAB ALT) and indicator and a cabin rate of pressure change (CAB RATE) knob. There is a pip mark on the panel for the CAB RATE knob which marks the setting for approximately 300 feet per minute rate of change. CAB RATE range is from 50 to 2000 sea level ft/min.

D. The manual method utilizes a two-position self-centering toggle switch for controlling the position of the outflow valve. The switch has momentary contacts closed in the OPEN and CLOSE positions for driving the outflow valve open or closed respectively. Releasing the switch breaks the contacts. A position indicator is provided for monitoring outflow valve position.

E. The fourth section of the panel includes a five-position mode selector switch, CHECK, AUTO, STDBY, AC and DC MAN; and a two-position FLT-GRD toggle switch. The FLT-GRD switch is used in conjunction with the selector switch and landing gear sensor switch to control minimum cabin differential pressure when the selector is in AUTO, cabin pressurization on the ground when the selector is in AUTO or STDBY, outflow valve positioning rate when the selector is in MAN and to check the auto fault detector circuit when the selector is in the CHECK position. When the selector is in either MAN position the cabin pressurization is controlled directly by the use of the manual OPEN-CLOSE switch to actuate the outflow valve under either ac or dc control, depending on the position of the selector switch.

3. Pressure Controller

A. The pressure controller is an electronic unit which accepts preset cabin pressure requests from the control panel, interprets the signal, compares that signal to other existing conditions such as airplane ambient pressure, and cabin pressure, then positions the outflow valve to obtain and maintain proper differential pressure (Fig. 2).

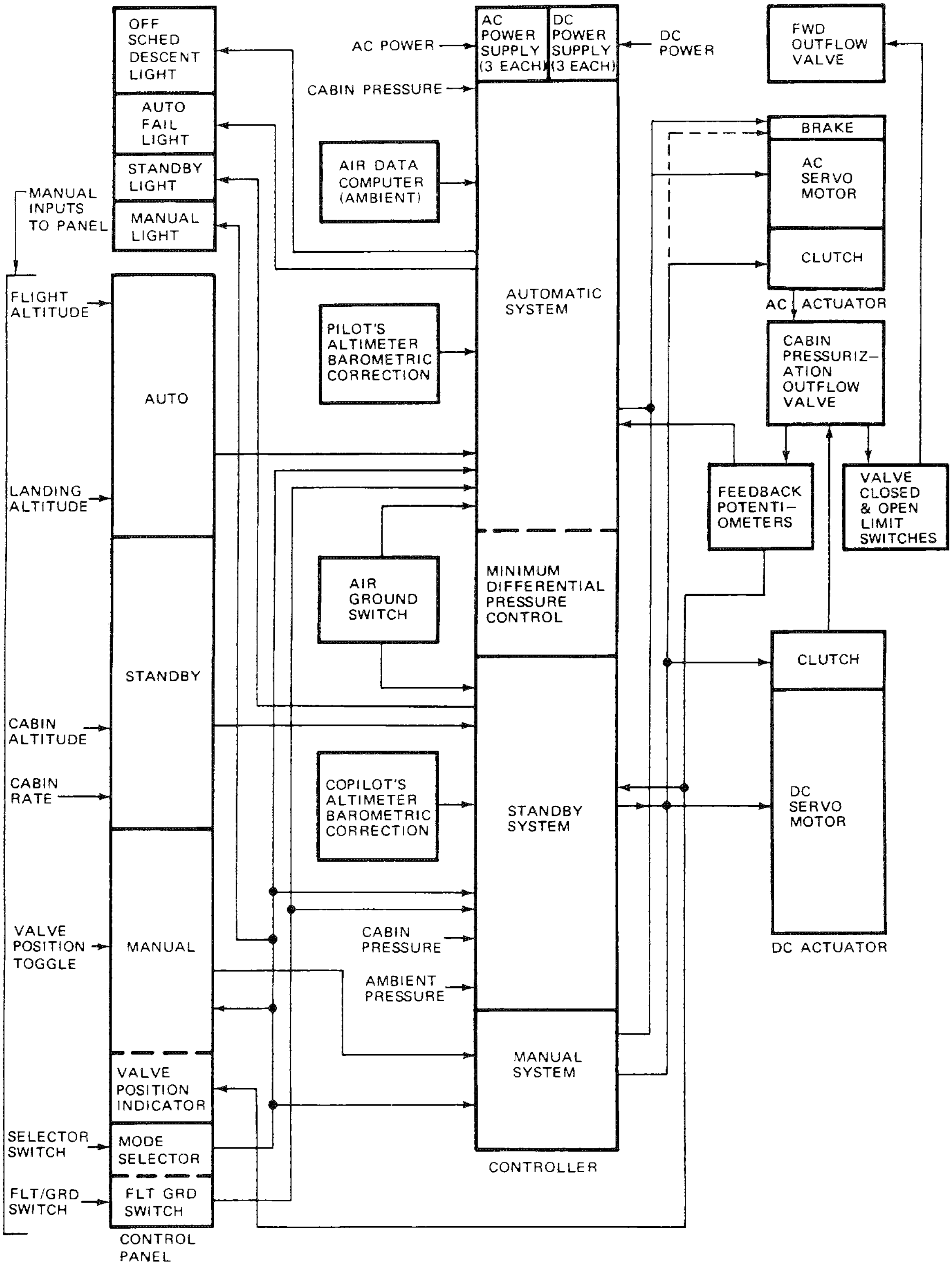
B. Two completely independent pressure control system networks are contained within the pressure controller. The automatic system operates as a function of destination landing field altitude and cruise altitude while the standby system operates according to the selected cabin altitude and selected rate.

C. Inputs to the pressure controller for the automatic system include ac and dc electrical power to the controller power supply, an ambient pressure signal from the air data computer, cabin pressure, barometric correction from the captain's altimeter, and the selected signals from the landing gear safety switch and the AUTO control panel. Inputs for the standby system include cabin pressure, ambient pressure from the auxiliary static system, barometric correction from the first officer's altimeter, and the selected signals from the landing gear safety switch and the STANDBY control panel.

D. All outputs from the pressure controller operate the cabin pressurization outflow valve. The controller will operate either under the automatic system or the standby system, but never both systems simultaneously. The FLT-GRD switch is used to modify both outputs for cabin prepressurization on the ground. When the switch is moved to FLT position with the selector in AUTO the valve will move to a position which will cause cabin pressure to rise slightly (0.1 psi) above that at the takeoff field. With the selector in STBY the valve will be positioned to control the pressure to the selected standby cabin altitude. Whether in AUTO or STANDBY, if switch is moved to GRD and airplane is on the ground, the outflow valve will move to full open at the rate required to completely depressurize the airplane at rate limit.

E. On the front of the pressure controller there are covered test jacks, a handle, two pressure fittings, an identification plate, and two angle brackets used to secure the controller in the airplane (Fig. 3). The 15 test jacks, located under the cover, are female jack-type electrical connections used primarily for troubleshooting the pressurization system aboard the airplane.

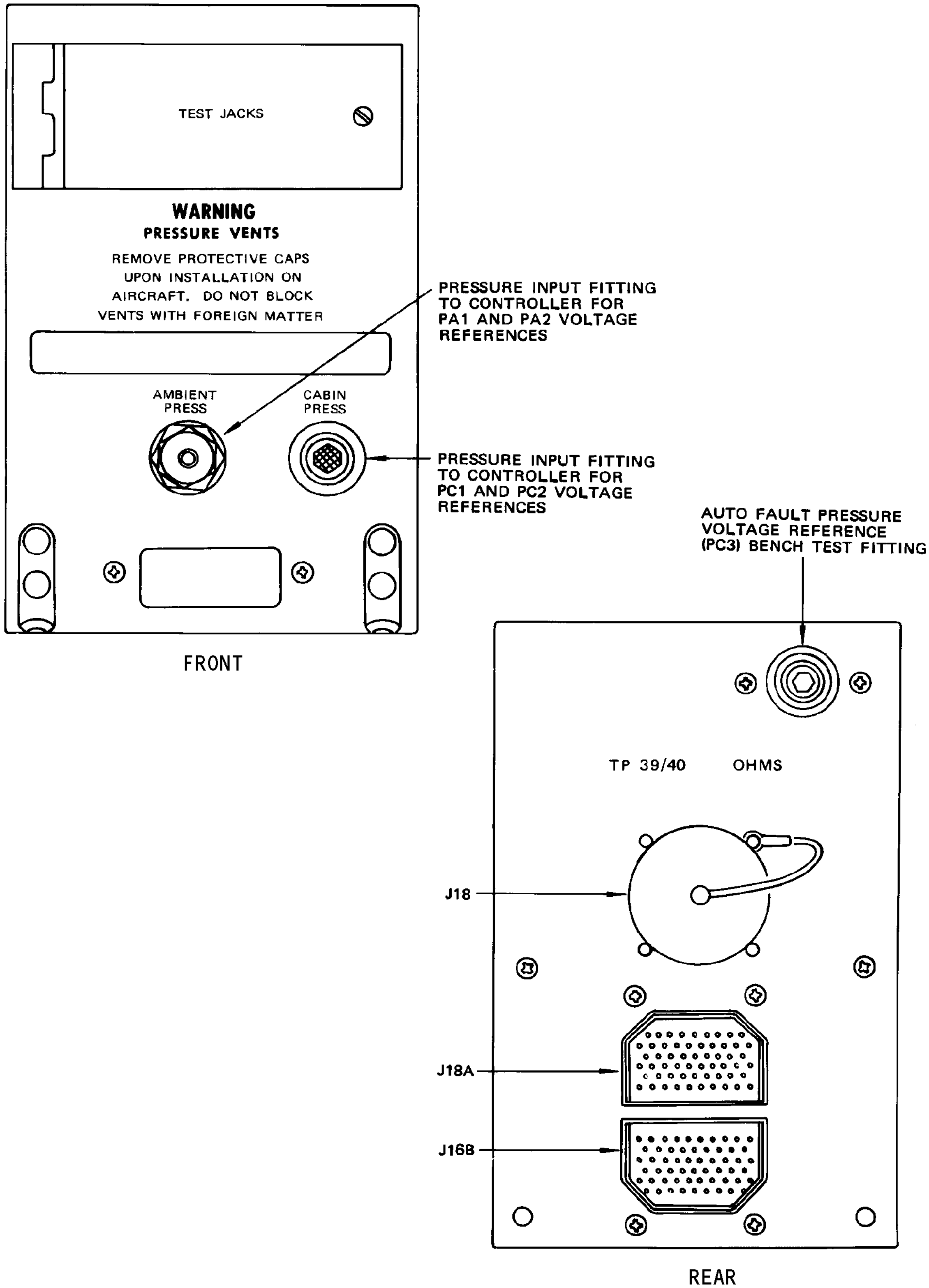
F. The following list defines the mode of operation associated with each test jack on the pressure controller:



Pressurization Control System Block Diagram
Figure 2

441955

Test Jack No.	Description	Functional Mode Being Tested AUTO	STBY	Manual AC	Manual DC
1	Standby rate potentiometer wiper		X		
2	Flight altitude potentiometer wiper	X			
3	Land altitude potentiometer wiper	X			
4	Auto barometric correction potentiometer wiper	X			
5	Cabin altitude potentiometer wiper		X		
6	Standby barometric correction potentiometer wiper		X		
7	FLT/GRD switch, landing gear switch	X	X		
8	ADC potentiometer wiper	X			
9	AC actuator motor brake voltage	X		X	X
10	AC actuator clutch voltage		X		X
11	DC actuator clutch voltage		X		X
12	AC actuator motor winding	X		X	
13	Ground	X	X	X	X
14	Standby rate limiter output		X		
15	Auto rate limiter output	X			



Front and Rear View of Pressure Controller
Figure 3

G. The rear of the pressure controller has two electrical connectors (Fig. 3) The connector with the protective cover is used for a bench test of the controller and has no function in the airplane. The other connector is a single receptacle with polarizing keyways between the two sets of contacts. This connector provides connection to the airplane wiring.

H. The pressure controller is located on the top shelf of the forward equipment rack in the electronic equipment compartment.

4. Cabin Pressurization Outflow Valve

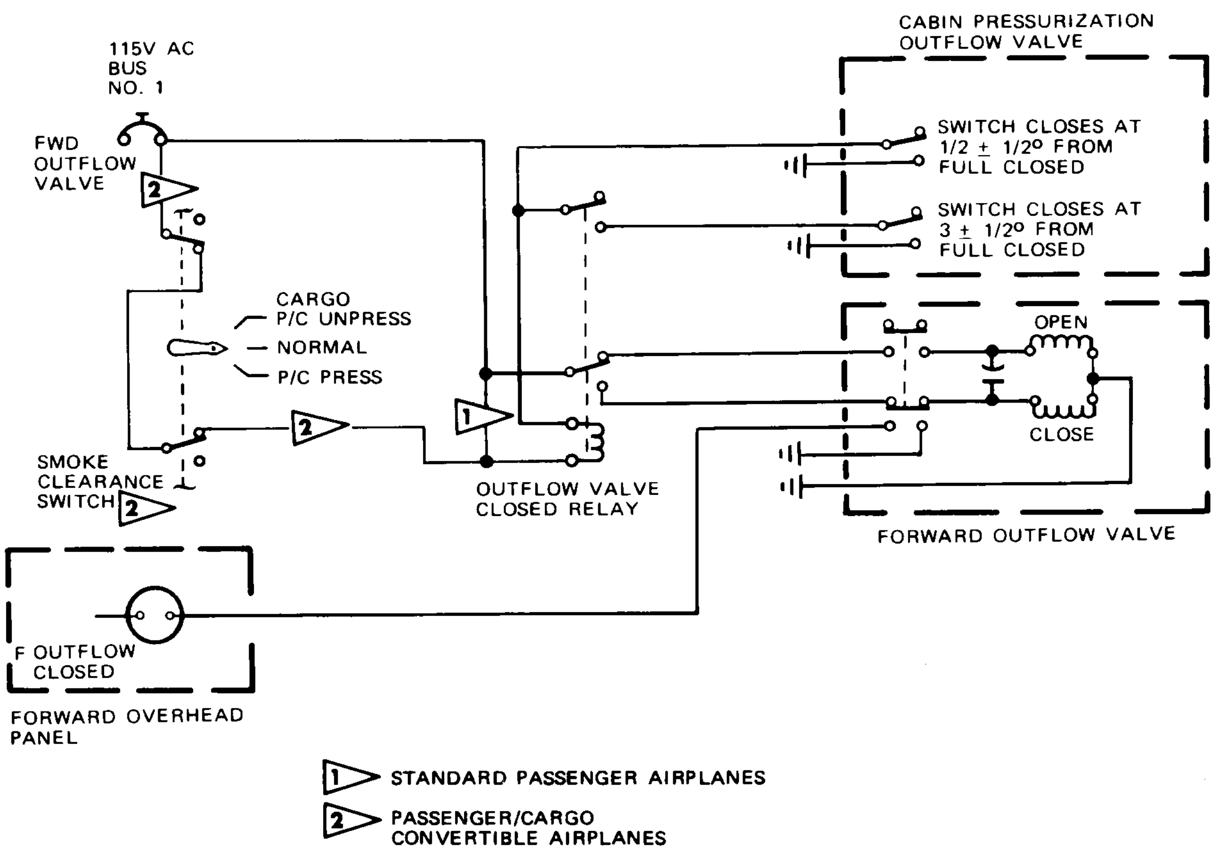
A. The outflow valve is a thrust recovery, rotating gate-type valve. The rotating gate is driven by either a rotary dc electrical actuator or a rotary ac electrical actuator. Each actuator is mechanically connected to the gate shaft. Between each actuator and the gate shaft an electrically operated spring-loaded clutch makes or breaks the connection. AUTO and AC MANUAL modes operate the ac actuator. STANDBY and DC MANUAL modes operate the dc actuator. When either actuator is in operation the clutch to the other actuator is disengaged (Fig. 4).

B. The clutch for the dc actuator is spring loaded disengaged with the ac actuator clutch spring-loaded engaged. With electrical power to the clutches, the dc actuator clutch is engaged and the ac actuator clutch becomes disengaged. The clutches are energized when operating from the standby system or the manual dc system.

C. An outflow valve closed limit switch and an outflow valve open position switch are included in the cabin pressurization outflow valve. Both switches close near the closed position of the valve. The open position switch closes at a more open position than the closed limit switch, but has no effect on pressure control until after the closed limit has closed. When the closed limit switch closes, a circuit is completed to close the forward outflow valve. After the valve closes, a circuit is completed through the open position switch to hold the forward outflow valve closed until the pressurization outflow valve opens enough, 3.5 degrees open, to assure adequate air supply to cabins for desirable pressure control.

D. The outflow valve is installed so its outlet is flush with the body skin. The valve is located to the right of the airplane centerline, at the underside of the airplane, approximately opposite the aft entry door.

WARNING: OUTFLOW VALVE IS MOTOR-OPERATED. DO NOT INSERT HAND OR TOOLS IN OUTLET DURING ANY GROUND OPERATION OR INJURY TO PERSONNEL MAY OCCUR.



Forward Outflow Valve Control Schematic
Figure 4

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5. Forward Outflow Valve

   A. The forward outflow valve is located near the forward left side of the forward cargo compartment. The outflow valve discharges air that has been circulated between the cargo compartment insulation and lining to heat the cargo compartment. Refer to HEATING for a more detailed description of the forward outflow valve. Under certain conditions the valve being opened could work against the pressurization control system. A pair of limit switches prevent the forward outflow valve from affecting the pressurization system during those operating conditions. The forward outflow valve will close when the cabin pressurization outflow valve is within 0.5 degree of closed and will open when the pressurization outflow valve opens approximately 3.5 degrees. A position switch in the forward outflow valve actuator controls a F OUTFLOW CLOSED warning indicator on the overhead air conditioning panel (Fig. 4).

6. Operation

   A. Normal operation of the pressurization control system is the automatic method. The destination landing field altitude and desired cruise altitude are set on the control panel. The manual input settings of airplane cruise and landing field altitudes are changed to voltage signals and are directed to the cabin pressure controller unit. The cabin pressure controller unit accepts these inputs along with electrical signals from the air data computer, captain's barometric correction potentiometer, power from airplane ac and dc busses, outflow valve position feedback, and from the landing gear ground safety sensor. The cabin pressure controller unit also detects cabin pressure levels and converts these to voltage signals. The cabin pressure controller utilizes these inputs to program a cabin pressure which will be proportional to airplane altitude. This will in turn provide the necessary voltage signals to the outflow valve causing the valve to modulate flow of cabin air to the atmosphere such as to maintain cabin pressure at the desired level.

B. Should the cabin altitude or pressure rate of change limits be exceeded while the controller is functioning in AUTO, or in the event of a power failure to the automatic system, control will automatically be transferred to the standby system provided that power is available to that system. The pressurization control system also has the capability of limiting the cabin altitude from exceeding 15,000 feet. The limit control is an integral part of the cabin pressure controller unit, is utilized in both automatic and standby systems, and functions as follows: In the event that cabin pressure drops below the level corresponding to the maximum cabin altitude, and the system is on automatic control, the automatic fault detector and transfer circuit will cause the standby control to be energized at 13,895 feet. A transfer will also occur if the rate of cabin pressure change exceeds 1.0 psi per minute. Prior to fault detection and transfer, the standby system will have been tracking the existing cabin pressure within 50 sea level feet. Upon transfer, the cabin pressure will change to the selected standby cabin altitude at the selected standby rate of change. When cabin pressure is controlled by the standby system, the cabin pressure is limited to 14,625 feet by another pressure switch incorporated in the controller unit. This will initiate a signal to the dc servo motor and will cause the outflow valve to modulate airflow so that a cabin altitude of 14,625 feet is not exceeded. The AUTO FAIL and STANDBY lights will come on to signify that the automatic system of pressure control has been superseded by the standby system. After a trip to standby, the automatic mode may be reselected. If a fault still remains, the system will again trip to standby.

C. The standby system may also be utilized, if desirable, although the automatic change to standby has not occurred. By moving the selector switch to STBY after setting the cabin altitude and pressure rate of change to the desirable conditions, the standby system in the pressure controller will function as above. When operating in this method the STANDBY light will come on even though there is no AUTO FAIL. The different light conditions for the standby mode are:
   (1) When standby mode is selected, only the standby light will be on.
   (2) When an automatic transfer to standby has taken place and the selected mode is still automatic the STANDBY and AUTO FAIL lights will be on. The AUTO FAIL light will go out when standby is manually selected.
   (3) If an automatic fault occurs and the standby mode is inoperative, only the AUTO FAIL light will be on.

D. Manual operation of the outflow valve occurs when the selector switch is moved to either MAN AC or MAN DC. In either case electrical power is switched to the outflow valve toggle switch and the valve can be opened or closed as desired. On PS N378PS thru N382PS, N983PS thru N987PS; BU LN-SUS and LN-SUP; NH JA8401 thru JA8403, JA8405 thru JA8408; AR LV-JMW thru LV-JMY; ZD G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC; ND CF-NAB, CF-NAH, CF-NAQ, when the FLT-GRD switch is in FLT the manual control of the valve is a pulse control, so that the actuator movement is limited for each time the switch is actuated to the open or closed positions. The toggle switch must be released and operated again if more valve movement is desired. Several toggles are required to observe a change in valve position, however, a single toggle will change cabin pressure in flight. On ALL EXCEPT PS N378PS thru N382PS, N983PS thru N987PS; BU LN-SUS and LN-SUP; NH JA8401 thru JA8403, JA8405 thru JA8408; AR LV-JMW thru LV-JMY; ZD G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC; ND CF-NAB, CF-NAH, CF-NAQ, manual control of valve is obtained by holding the outflow valve toggle switch in OPEN or CLOSE until the desired opening is achieved. When the FLT-GRD switch is in GRD the valve will move continuously within the valve travel limits as long as the switch is actuated. When the switch is released, the valve will hold the position obtained. During manual control the cabin altimeter and differential pressure indicator must be monitored for obtaining the desired cabin condition. The MANUAL light above the control panel comes on during manual control.

E. The FLT-GRD switch is used to control cabin pressurization during takeoff and after landing in order to minimize the pressure fluctuations as the controller transfers from the ground to flight modes of operation. When the controller is functioning in AUTO and the FLT-GRD switch is placed in FLT, the minimum differential pressure control circuit will provide an overriding signal to pressurize the cabin to approximately 0.1 psi above ambient (altitude approximately 200 sea level feet below field elevation). When the airplane leaves the ground and the auto control signal is transferred from the depressurized ground signal to the climb schedule by the landing gear safety switch, the minimum differential control will maintain the cabin pressure at 0.1 psi above ambient until the climb schedule cabin pressure exceeds the 0.1-psi pressure differential. During descent, FLT-GRD switch in FLT, the automatic system schedules cabin descent pressure to maintain a slightly higher pressure on landing (approximately 0.15-psi differential). After landing when FLT-GRD switch is moved to GRD, the outflow valve will move to the full open position at the rate required to completely depressurize the airplane at rate limit.

F. When the controller is functioning in STDBY and the FLT-GRD switch is placed in FLT, the controller will try to maintain the cabin pressure at the cabin altitude control setting. When the FLT-GRD switch is placed in GRD and the controller is in the ground mode of operation while functioning in either AUTO or STDBY, the controller output signal will open the outflow valve at the rate required to depressurize the airplane at rate limit.

G. The operational modes are as follows:

MODE SELECTOR POSITION	FLT-GRD SW POSITION	RESULTS
AC MAN	GRD	AC actuator drives outflow valve. Valve will maintain position unless toggled open or closed from pressure control panel. Valve movement will be continuous for as long as toggle is applied.
	FLT	AC actuator drives outflow valve. Valve will maintain position unless toggled open or closed. Valve movement will be a small increment for each toggle. *[1] Valve movement will be continuous for as long as toggle is applied. *[2]
DC MAN	GRD	DC actuator drives valve. Valve will maintain position unless toggled open or closed. Valve movement will be continuous for as long as toggle is applied.
	FLT	DC actuator drives valve. Valve will maintain position unless toggled open or closed. Valve movement will be a small increment for each toggle. *[1] Valve movement will be continuous for as long as toggle is applied. *[2]

*[1] PS N378PS thru N382PS, N983PS thru N987PS
BU LN-SUS and LN-SUPPORT
NH JA8401 thru JA8403, JA8405 thru JA8408
AR LV-JMW thru LV-JMY
ZD G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC
ND CF-NAB, CF-NAH, CF-NAQ
*[2] ALL EXCEPT *[1]

MODE SELECTOR POSITION	FLT-GRD SW POSITION	RESULTS
STBY	GRD (Airplane on ground)	DC actuator drives valve. Pressure controller signals actuator to drive valve full open.
	FLT	DC actuator drives valve. Pressure controller modulates valve through dc actuator to maintain selected cabin pressure. Cabin pressure changes at selected rate settings.
AUTO	GRD (Airplane on ground)	AC actuator drives valve. Pressure controller signals ac actuator to drive valve full open.
	FLT (Airplane on ground)	AC actuator drives valves. Pressure controller signals ac actuator to modulate valve for 0.1-psi pressurization.
	FLT (Airplane airborne)	AC actuator drives valve. Pressure controller signals ac actuator to modulate valve to achieve cabin pressure computed and scheduled by the pressure controller.

H. Since the pressurization control system is completely automatic, in the event of a power loss in any mode certain events will automatically take place. The characteristics of the system in the event of a power loss are as follows:

POWER LOSS	EFFECT ON OUTFLOW VALVE	SYSTEM INDICATION	SYSTEM AVAILABLE	POWER RESTORED
AUTO MODE				
AUTO AC for up to 12.0 seconds	Valve locked in last position by AC actuator *[1]	AUTO FAIL, AIR COND and MASTER CAUTION lights come on	STBY, MAN AC, MAN DC	3 seconds after power is restored system returns to AUTO. Lights go out.
AUTO AC for 14.9 ±3.0 seconds *[2]	None *[3]	AUTO FAIL, STANDBY AIR COND and MASTER CAUTION lights come on	STBY, MAN AC, MAN DC	System still in STANDBY. Place mode selector switch to STBY then to AUTO. AUTO FAIL and STANDBY lights will go out.
AUTO DC	Outflow valve response is sluggish and valve may go to closed.	AUTO FAIL, STANDBY AIR COND and MASTER CAUTION lights may come on	STBY, MAN AC, MAN DC	System returns to normal.

POWER LOSS	EFFECT ON OUTFLOW VALVE	SYSTEM INDICATION	SYSTEM AVAILABLE	POWER RESTORED
Total power loss	Valve locked in last position by ac actuator *[1]	AUTO FAIL, STANDBY, AIR COND and MASTER CAUTION lights come on	None	3 seconds after power is restored system returns to AUTO. AUTO FAIL and STANDBY lights go out.
Total power loss except MAN DC	Valve locked in last position by dc actuator *[1]	AUTO FAIL, STANDBY, AIR COND and MASTER CAUTION lights come on	MAN DC	3 seconds after power is restored system returns to AUTO. AUTO FAIL and STANDBY lights go out.
STBY MODE				
MAN DC	Valve locked in last position by ac actuator	Cabin pressure may drift from altitude selected	AUTO, MAN AC	System returns to STBY
STANDBY AC	Valve locked in last position by dc actuator *[1]	Cabin pressure may drift from altitude selected	AUTO, MAN AC, MAN DC	System returns to STBY
STANDBY DC	None	None	AUTO, MAN AC, MAN DC	No effect on STBY
AUTO AC	None	None	MAN AC, MAN DC	No effect on STBY

POWER LOSS	EFFECT ON OUTFLOW VALVE	SYSTEM INDICATION	SYSTEM AVAILABLE	POWER RESTORED
AUTO DC	None	None	MAN AC, MAN DC	No effect on STBY
Total power loss in last	Valve locked position by ac actuator	AUTO FAIL, AIR COND and MASTER CAUTION lights come on	None	System returns to STBY. AUTO FAIL light goes out.
Total power loss except MAN DC	Valve locked in last position by dc actuator	AUTO FAIL, AIR COND and MASTER CAUTION lights come on	MAN DC	System returns to STBY. AUTO FAIL light goes out.
MAN AC MODE				
MAN AC	Valve locked in last position by ac actuator	Cabin pressure will not change when valve is toggled	AUTO, STBY MAN DC	System returns to MAN AC
MAN DC	None	None	AUTO	No effect on MAN AC
STANDBY AC	None	None	AUTO, MAN DC	No effect on MAN AC
STANDBY DC	None	None	AUTO, STBY MAN DC	No effect on MAN AC
AUTO AC	None *[1]	None	STBY, MAN DC	No effect on MAN AC
AUTO DC	None	None	AUTO, STBY, MAN DC	No effect on MAN AC

POWER LOSS	EFFECT ON OUTFLOW VALVE	SYSTEM INDICATION	SYSTEM AVAILABLE	POWER RESTORED
MAN DC MODE				
MAN AC	None	None	AUTO, STBY	No effect on MAN DC
MAN DC	Valve locked in last position by AC actuator	Cabin pressure will not change when valve is toggled	AUTO, MAN AC	System returns to MAN DC
STANDBY AC	None *[1]	None	AUTO, MAN AC	No effect on MAN DC
STANDBY DC	None	None	AUTO, STBY MAN AC	No effect on MAN DC
AUTO AC	None	None	STBY, MAN AC	No effect on MAN DC
AUTO DC	None	None	AUTO, STBY MAN AC	No effect on MAN DC

*[1] Valve position indicator will indicate valve in closed position
*[2] System automatically transfers to standby
*[3] No effect on outflow valve until transfer standby occurs

PRESSURIZATION CONTROL SYSTEM - TROUBLESHOOTING

1. General

A. Troubleshooting of the pressurization control system is broken down to correspond to the four operational modes. Refer to Adjustment/Test to verify that any mode is malfunctioning. The troubleshooting chart isolates the trouble to a particular system component, i.e., pressure controller, pressure control panel, or cabin pressurization outflow valve, or to an input which is not part of the system, i.e., air data computer or landing gear ground safety sensor. If adjustment/test shows pressurization control system is operable and a flight complaint is received, check the airplane ambient pressure sensing lines for leakage.

B. Outflow valve operation may be observed from outside the airplane by looking into the valve outlet. Check the outflow valve for movement if the VALVE position indicator does not move. This would indicate a possible malfunction in the valve position indication system.

WARNING: OUTFLOW VALVE IS MOTOR OPERATED. DO NOT INSERT HAND OR TOOLS IN OUTLET DURING ANY GROUND OPERATION OR INJURY TO PERSONNEL MAY OCCUR.

C. To simulate a flight condition with the airplane on the ground, the landing gear lights circuit breaker must be opened to de-energize the airplane landing gear ground safety sensor relay. The AUTO FAIL and STANDBY lights will remain on continuously if the circuit breakers for the 28-volt dc bus No. 1 and 2 are both open. This is normal for power input conditions. To remedy the situation, close all circuit breakers and place FLT-GRD switch to GRD.

D. The rate of cabin altitude change is shown on the CLIMB indicator in feet per minute.

E. If cabin pressurization schedule cannot be maintained during descent with engines at idle and the forward and aft outflow valves are closed, check the entire airplane for cracks and door seals for leakage. Such leaks or cracks will be well defined with nicotine (brown) stain. If no obvious leaks are present, perform cabin depressurization and excessive leak checks per Chapter 5.

SA 2. Equipment and Materials

A. Voltohmmeter - Simpson Model 260 Series 4M

B. Breakout Box - F80206-1 (use with Model CPC-22 Cabin Pressure Control Unit)

3. Troubleshooting Charts

3. Trouble Shooting Charts

A. Automatic Mode

OFF SCHED DESCENT light does not illuminate during altitude slew of the air data computer (ADC). Check bulb and power to bulb. IF -

- BULB IS DEFECTIVE AND/OR NO POWER TO BULB - Replace bulb or repair wiring.
- BULB AND POWER TO BULB OK - Perform ADC altitude slew again and monitor slew again and monitor voltage at test jack 8 or test pin H (Ref Adjustment/Test). IF -
  - VOLTAGE DROPS ABOUT 0.35 VOLTS/SEC WHEN BUTTON IS PRESSED AND RETURNS TO ORIGINAL VALUE AT SAME RATE WHEN BUTTON IS RELEASED - Replace pressure controller.
  - NO VOLTAGE SLEW IS OBSERVED - Replace ADC.

OFF SCHED DESCENT light comes on but does not go out after a short time (approximately 3 minutes) in automatic mode.

Check pressure controller - Turn off power to light and remove pressure controller. Check for continuity from OFF SCHED DESCENT light to pin D948B-38 on pressure controller. IF -

- NO CONTINUITY - Repair wiring between pressure controller and OFF SCHED DESCENT light.
- CONTINUITY - Replace pressure controller.

Cabin Pressure Control System AUTO Mode Troubleshooting
Figure 101 (Sheet 1)

CONTINUED ON
FOLLOWING PAGE

Ground pressurized or ground unpressurized circuits not functional.

Test AC Manual Mode. Refer to Pressurization Control System - Adjustment/Test. IF -

AC MANUAL MODE IS NOT FUNCTIONAL - Trouble shoot per par. D.

AC MANUAL MODE IS FUNCTIONAL - Place FLT-GRD switch to GRD. Check for minimum of 28V DC between test jack 7 and test jack 13 or test pin G and test pin N. Place FLT-GRD switch to FLT. Voltage should go below 2V DC. IF -

VOLTAGE IS 28 VOLTS OR MORE WITH FLT-GRD SWITCH IN GRD AND OUTFLOW VALVE DOES NOT OPEN - Replace pressure controller.

VOLTAGE IS BELOW 2 VOLTS WITH FLT-GRD SWITCH IN FLT AND OUTFLOW VALVE DOES NOT CLOSE - Replace pressure controller.

VOLTAGE STAYS AT 28 VOLTS OR MORE REGARDLESS OF FLT-GRD SWITCH POSITION - Replace pressure control panel.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 2)

CONTINUED ON
FOLLOWING PAGE

VOLTAGE STAYS BELOW 2 VOLTS REGARDLESS OF FLT-GRD SWITCH POSITION - Disconnect pressure control panel and check for voltage from pressure controller to FLT-GRD switch pin 22. IF -

- VOLTAGE IS PRESENT - Check for continuity through FLT-GRD switch. IF -
  - NO CONTINUITY - Replace pressure control panel.
- VOLTAGE IS NOT PRESENT - Remove pressure controller and check for ground from landing gear safety sensor at pressure controller pin D948B-56. IF -
  - GROUND IS PRESENT - Replace pressure controller.
  - GROUND NOT PRESENT - Refer to Chapter 32 - Landing Gear Safety Sensor.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 3)

If check is completely correct, check output from air data computer. Measure voltage at test jack 8 to test jack 13 (gnd) or test pin H to test pin N (gnd). Refer to Pressurization Control System - Adjustment/Test. IF -

Voltage is zero or out of range, remove pressure controller and check for continuity into air data computer from wiper to both sides of potentiometer across pins D948B-12 to D948B-55 and pin D948B-2. Check for resistance across pins D948B-2 to D948B-55. IF -

- NO CONTINUITY OR RESISTANCE - Replace air data computer or repair wiring.
- CONTINUITY AND RESISTANCE - Replace pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 4)

AUTO FAIL AND STBY lights do not come on with all power applied with mode selector switch in CHECK.

Make certain FLT-GRD switch is in FLT.

Check bulb and power to bulb. IF -

BULBS ARE DEFECTIVE - Replace bulbs.

BULB AND POWER OK - Remove pressure control panel. Check for continuity from panel pin 25 to 29 and from pin 8 to 7 with mode selector switch in CHECK. IF -

NO CONTINUITY - Replace pressure control panel.

CONTINUITY - Replace pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 5)

STBY light comes on when fault is checked with standby mode inoperative.

Replace pressure controller.

AUTO FAIL light fails to reset or STBY light continually on regardless of control panel settings for AUTO or STBY. AC and DC MAN normal.

Replace pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 6)

Outflow valve does not respond to barometric correction. Ground unpressurized and ground pressurized checks are normal.

Check barometric correction input. Voltage at test jack 4 to test jack 13 or test pin D to test pin N (Ref Adjustment/Test) should vary from 1V DC to 0V DC as barometric correction is varied from 31.0 to 28.1 in. Hg (1050 to 951 mbs). IF -

VOLTAGE DOES NOT VARY (fluctuates) - Replace captain's altimeter.

VOLTAGE IS NOT IN CORRECT RANGE - Remove pressure controller and check that resistance into captain's altimeter across pressure contoller pins D948B-29 to D948B-13 varies 0 to 1000 ohms as setting is varied from 31.0 to 28.1 in. Hg. IF -

- RESISTANCE VARIES CORRECTLY - Replace pressure controller.
- NO RESISTANCE, VARIES INCORRECTLY OR DOES NOT CHANGE SMOOTHLY - Replace captain's altimeter.

VOLTAGE IS GOOD - Remove pressure controller, open LANDING GEAR LIGHTS circuit breaker and check that there is no ground input from landing gear ground safety sensor at controller pin D948B-56. IF -

- NO GROUND - Replace pressure controller.
- GROUND - Refer to Chapter 32 - Landing Gear Safety Sensors.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 7)

Outflow valve does not respond properly to isobaric schedule check. Barometric correction check is good and ground unpressurized and ground pressurized checks are good.

Check inputs from FLT ALT and LAND ALT controls. FLT ALT control input is measured from test jack 2 to test jack 13 (gnd) or test pin B to test pin N (gnd). LAND ALT control input is measured from test jack 3 to test jack 13 (gnd) or test pin C to test pin N (gnd)(Ref Adjustment/Test). IF -

BOTH READINGS ARE ZERO OR INCORRECT - Remove pressure control panel. Check for voltage of 19 to 21V DC at control panel pin 6. IF -

VOLTAGE IS GOOD - Replace pressure control panel.

VOLTAGE IS ZERO - Remove pressure controller. Check continuity from control panel pin 6 to controller pin D948B-49. IF -

CONTINUITY - Replace pressure controller.

NO CONTINUITY - Repair wiring between pressure control panel and pressure controller.

ONE READING IS GOOD AND THE OTHER IS NOT - Remove pressure control panel and pressure controller. Check continuity from control panel pin 5 to controller pin D948B-5 and from control panel pin 36 to controller pin D948B-20. IF -

NO CONTINUITY - Repair wiring between pressure control panel and pressure controller.

CONTINUITY - Replace pressure control panel.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 8)

B. Standby Mode

STANDBY Light not illuminated. Check bulb. IF -

BULB DEFECTIVE - Replace bulb.

BULB OK - Remove pressure control panel. Check continuity between control panel pins 16 and 15 with mode selector switch to STBY. IF -

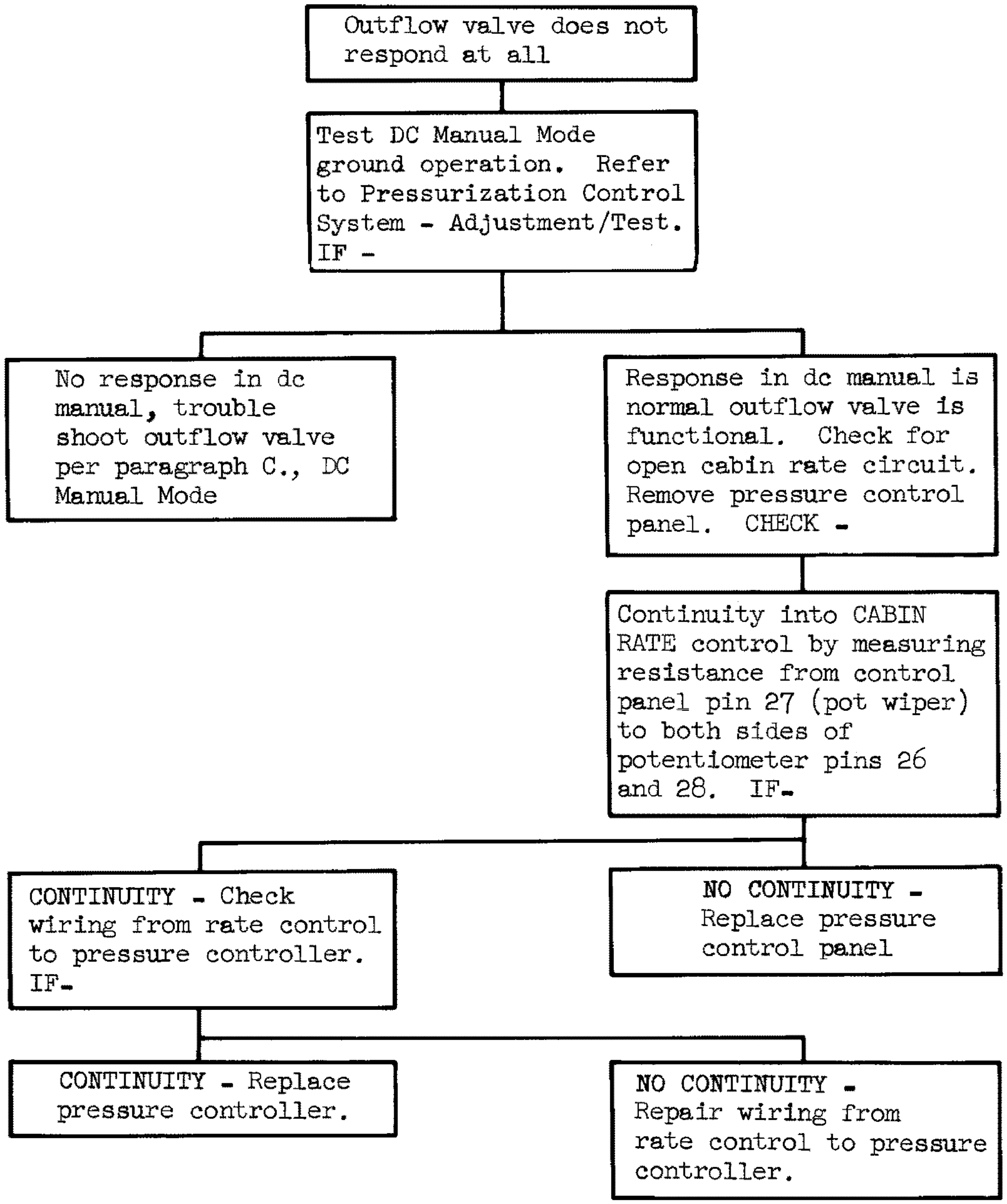
NO CONTINUITY - Replace pressure control panel.

CONTINUITY - Remove pressure controller and check continuity between controller pins D948A-37 and D948A-47. IF -

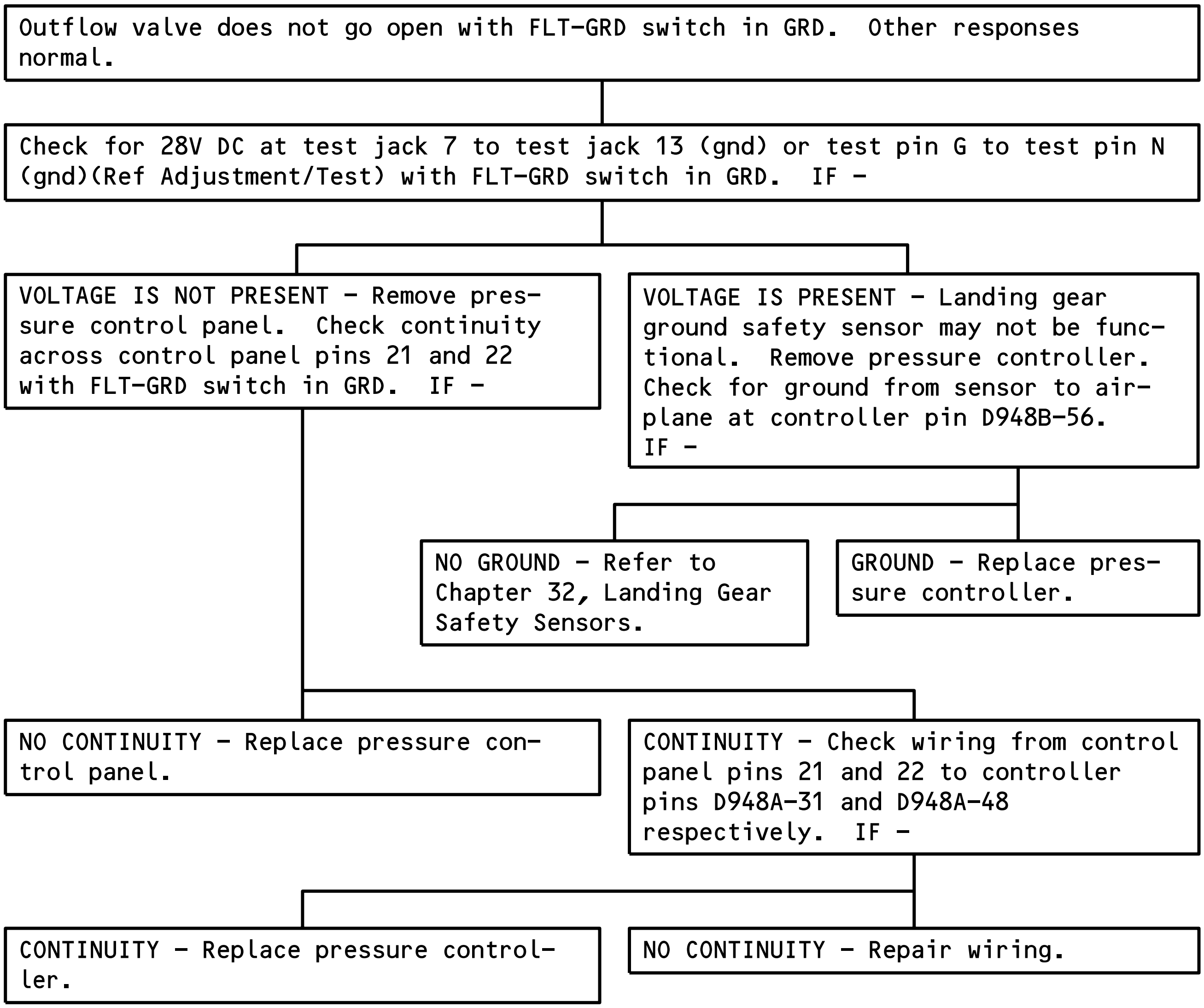
NO CONTINUITY - Replace pressure controller.

CONTINUITY - Repair airplane wiring.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 9)



Pressurization Control System - Troubleshooting
Figure 101 (Sheet 10)



Outflow Valve does not Go Open with FLT-GRD Switch in GRD. Other Responses Normal.
Figure 101 (Sheet 11)

Outflow valve does not respond to barometric correction input. Ground operation normal.

Check that barometric correction input voltage at test jack 6 to test jack 13 (gnd) or test pin F to test pin N (gnd)(Ref Adjustment/Test) varies continuously as barometric correction varies from 31.0 to 28.1 in. Hg (1050 to 951 mbs) with FLT-GRD switch in FLT. IF -

CONTINUED ON FOLLOWING PAGE

- VOLTAGE IS FIXED AT 3 TO 7V DC - Replace pressure controller.
- VOLTAGE DOES NOT VARY CONTINUOUSLY - Replace first officer's altimeter.
- VOLTAGE IS NOT IN CORRECT RANGE - Remove pressure controller and check that resistance into first officer's altimeter across controller pins D948A-22 to D948A-2 varies 0 to 1000 ohms as setting is varied from 31.0 to 28.1 in. Hg (1050 to 951 mbs). IF -
  - RESISTANCE VARIES CORRECTLY - Replace pressure controller.
  - NO RESISTANCE OR VARIES INCORRECTLY - Replace first officer's altimeter.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 12)

Outflow valve does not respond properly to CAB ALT control.

Check input voltage from CAB ALT control at test jack 5 to test jack 13 (gnd) or test pin E to test pin N (gnd)(Ref Adjustment/Test). IF -

VOLTAGE VARIES CORRECTLY - Check input voltage from CAB ALT control at test jack 5 to test jack 13 (gnd) or test pin E to test pin N (gnd) (Ref Adjustment/Test).

VOLTAGES CORRECT - Replace pressure controller.

VOLTAGES INCORRECT - Remove pressure control panel. Check for -19 to -21 vdc input from controller at control panel pin 4. IF -

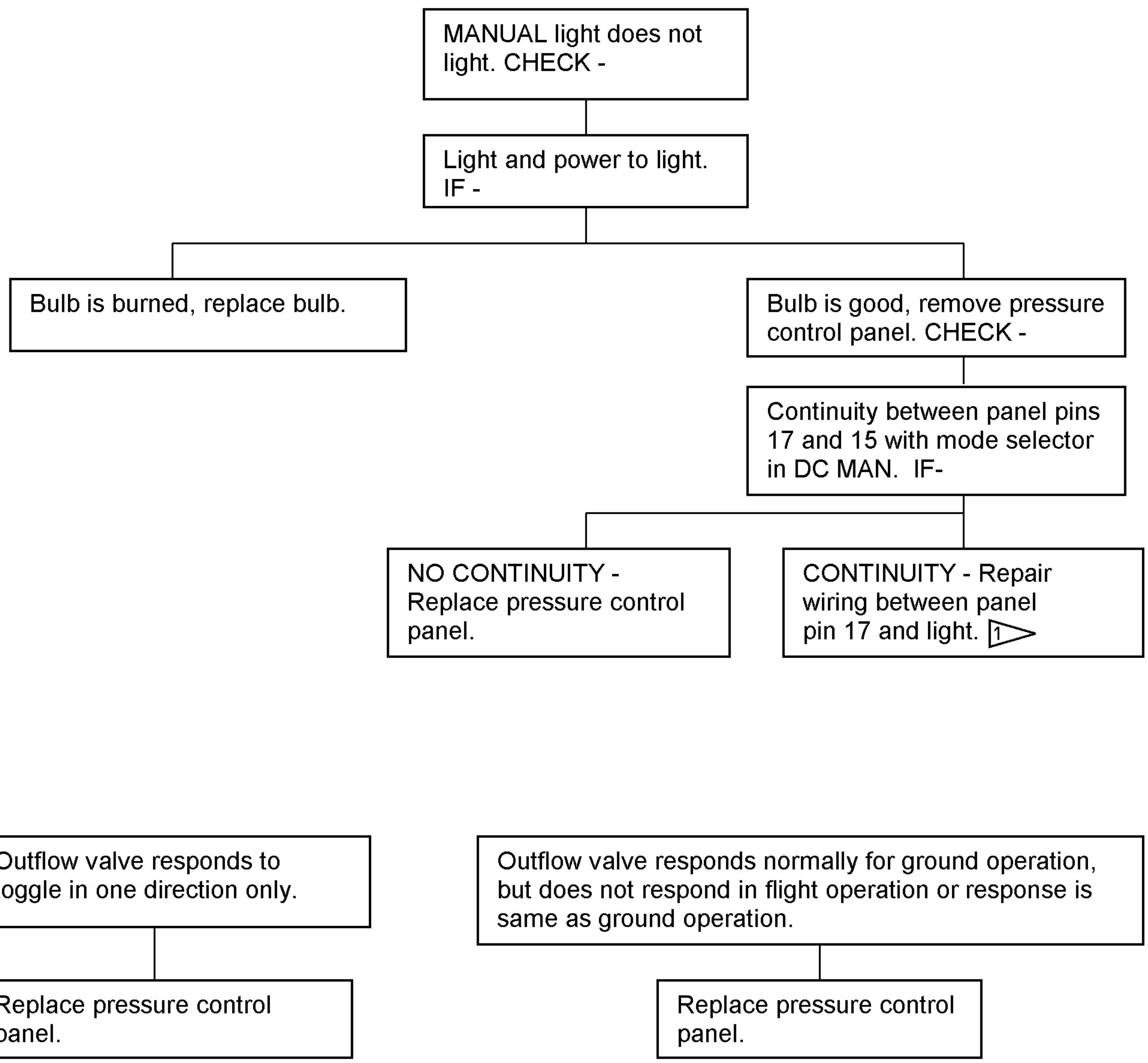
VOLTAGE ZERO - Replace pressure controller.

VOLTAGE OK - Replace pressure control panel.

VOLTAGE OUT OF RANGE - Replace pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 13)

C. DC Manual Mode



1 Make sure the mode selector switch is returned to AUTO when troubleshooting is completed.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 14)

C. DC Manual Mode

Outflow valve does not respond in ground or flight operation.

Test Standby Mode. Refer to Pressurization Control System - Adjustment/Test. IF -

OUTFLOW VALVE OPERATION NORMAL - Perform AC Manual test to check toggle circuits in control panel (Ref Pressurization Control System - Adjustment/Test). IF -

OUTFLOW VALVE DOES NOT RESPOND PROPERLY TO STANDBY MODE TEST - Place mode selector switch to DC MAN. CHECK -

For 28V DC (clutch energizing voltage) at test jack 11 to test jack 13 (gnd) or test pin L to test pin N (gnd) (Ref Adjustment/Test). IF -

AC MANUAL IS FUNCTIONAL - Remove pressure control panel. CHECK -

AC MANUAL IS NOT FUNCTIONAL - Remove pressure control panel. CHECK -

Continuity between panel pins 29 and 11 with mode selector in DC MAN. IF -

CONTINUITY - Remove pressure controller. CHECK -

NO CONTINUITY - Replace pressure control panel.

Continuity between panel pin 1 and D948A-25 and between pin 2 and D948A-44. IF -

For 12V DC at panel pin 18 and for 28V DC at pin 29. IF -

NO CONTINUITY - Repair wiring. [1]

CONTINUITY - Replace pressure control panel. IF -

EITHER VOLTAGE IS ZERO - Check wiring from pressure controller. IF -

BOTH VOLTAGES ARE PRESENT - Replace pressure control panel.

PANEL REPLACEMENT DOES NOT CORRECT PROBLEM - Replace pressure controller.

CONTINUITY - Replace pressure controller.

NO CONTINUITY - Repair wiring from pressure controller. [1]

[1] Make sure the mode selector switch is returned to AUTO when troubleshooting is completed.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 15)

D37639

NO VOLTAGE - Replace pressure controller.

VOLTAGE - Remove pressure controller. CHECK -

Continuity to dc actuator from pressure controllers airplane connector. CHECK -

Resistance across controller pins D948A-20 and D948A-36 is 10 ohms and across D948A-16 and ground is 21 ohms. IF -

RESISTANCE - Replace outflow valve.

RESISTANCE OPEN - Check wiring. IF -

NO CONTINUITY - Repair wiring. [1]

CONTINUITY - Replace outflow valve.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 16)

D. AC Manual Mode

Outflow valve responds to toggle in one direction only.
Replace pressure control panel.

Outflow valve responds normally for ground operation, but no response in flight operation or response same as ground operation.
Replace pressure control panel.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 17)

Outflow valve does not respond in ground or flight operation.

Perform automatic mode test to check functioning of outflow valve (Ref Adjustment/Test). IF -

OUTFLOW VALVE DOES NOT RESPOND PROPERLY TO AUTOMATIC MODE TESTS - Place mode selector switch to AC Man and FLT-GRD to GRD. Hold toggle switch in OPEN or CLOSE position. CHECK -

OUTFLOW VALVE RESPONDS PROPERLY - Perform dc manual mode test to check toggle circuit function (Ref Adjustment/Test). IF -

DC MANUAL IS NOT FUNCTIONAL - Trouble shoot per par. C.

DC MANUAL IS FUNCTIONAL - Remove pressure control panel.

Check for 20V AC at panel pin 19 and 24V DC at pin 8. IF -

EITHER VOLTAGE PRESENT - Replace pressure control panel.

EITHER VOLTAGE ZERO - Check wiring from pressure controller. IF -

NO CONTINUITY - Repair wire from pressure controller. [1]

CONTINUITY - Replace pressure controller.

VOLTAGE at test jack 9 to test jack 13 (gnd) or test pin J to test pin N (gnd) and at test jack 12 to test jack 13 (gnd) or test pin M to test pin N (gnd)(Ref Adjustment/Test). IF -

NOTE: Hold toggle switch in OPEN or CLOSE while making measurements.

EITHER VOLTAGE ZERO - Replace pressure controller.

EITHER VOLTAGE GOOD - Check continuity into outflow valve from pressure controller. [2] IF -

NO CONTINUITY - Repair wiring. [1]

CONTINUITY - Replace outflow valve.

[2]

Controller Pin		AC Actuator Pin
D948B-25	to	12
D948B-34	to	13
D948B-6	to	1
D948B-15	to	2
D948B-16	to	5
D948B-47	to	15
D948B-35	to	4

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 18)

4. Cabin Pressure Controller Internal Fuse Tests

A. General

(1) Overcurrent protection is designed into Hamilton Standard CPC 21 and CPC 22 cabin pressure controllers. Three fuses are installed internal to the controller on the output drive signals to the outflow valve clutch coils and AC motor control windings. The purpose for the fuses is to prevent thermal damage caused by excessive current draw. Should resistance drop too low, as a result of aircraft wiring shorts or shorts in clutch coil or AC motor windings, the associated fuse will open. Corrective action requires not only isolation of the overcurrent failure, but removal and replacement of faulty controller. Should the controller be replaced prior to correcting the electrical short, the newly replaced controller will experience the same open fuse failure.

(2) Protective fuses are identified in controller electrical schematics as F1, F2 and F3. Theses fuses are associated with the AC clutch coil, DC clutch coil and AC motor windings, respectively.

(3) The outflow valve is driven either by an AC electrical actuator or a DC electrical actuator. Each actuator may be connected to the valve drive shaft by an electrically operated spring-loaded clutch. AUTO and AC MANUAL modes operate the AC actuator. STANDBY and DC MANUAL modes operate the DC actuator. When either actuator is in operation, the clutch to the other actuator is disengaged. With no electrical power to the clutches, the DC actuator clutch is spring-loaded disengaged and the AC actuator clutch is spring-loaded engaged. With electrical power to the clutches, the DC actuator clutch is engaged and the AC actuator clutch is disengaged.

(4) As described above, supply of DC voltage to the clutch coils is a function of mode selection. Current travels from the controller through the clutch coils to ground.

(5) Current flow through the AC motor control windings is also dependent on switch position, however, direction of current flow and source of electrical power will vary depending on the controller mode of operation. Starting at the controller, current flows through aircraft wiring to the AC motor then back through aircraft wiring and terminates at a ground provided in the controller. When operating in AUTO, voltage is supplied to the AC motor center tap. This electrical supply is protected by fuse F3. Current flow through the center tap and appropriate (open or closed) AC motor control winding is the result of a ground provided by switching logic within the controller. Thus, flow of current follows a loop path starting and ending within the controller.

(6) AC MANUAL operation also follows a loop path starting and ending within the controller. However, internal controller logic will cause switching to an alternate source of electrical power. As a result of this switching, current no longer flows through fuse F3. In addition, during AC MANUAL operation, electrical power is not provided to the motor center tap. Current flow in series through both control windings and direction of motor rotation is accomplished by toggling power and ground signals within the controller. Therefore, AC MANUAL will operate with an open F3 fuse.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 19)

B. AC and DC Clutch Coil Fuse Test, Fuse F1 and F2

Place MODE SELECTOR switch in STANDBY. Measure voltage on test jacks 10 and 11 (CPC 21) or test pins K and L (CPC 22). Voltage shall read 20-31 VDC. If -

VOLTAGE BELOW LIMIT ON EITHER AC OR DC CLUTCH COILS - Remove the cabin pressure controller installed in the electronic shelf. Check resistance to ground on aircraft connector D948 pin A45 for the AC clutch coil or pin A16 for the DC clutch coil. Resistance shall be 21 OHM minimum. IF -

RESISTANCE IS BELOW MINIMUM - Disconnect D950 (AC clutch coil) or D952 (DC clutch coil) and verify connector pins are not bent or shorted. Measure resistance to ground on aircraft connector D948 pin A45 (AC clutch coil) or pin A16 (DC clutch coil). Verify open on volt/ohm meter. IF -

METER DOES NOT READ OPEN - Correct short in aircraft wiring. Replace cabin pressure controller.

METER READS OPEN - Measure resistance at connector D950 pin 6 (AC clutch coil) or D952 pin 6 (DC clutch coil) at outflow valve. Resistance shall be 18 ohms minimum. IF -

RESISTANCE IS BELOW MINIMUM - Replace outflow valve and pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 20)

C. AC Motor Winding Fuse Test, Fuse F3

Place MODE SELECTOR switch in AUTO. Place the FLT/GRD switch to GRD position. Verify outflow valve is in full OPEN position. Place the FLT/GRD switch to FLT position. NOTE: The outflow valve will close after approximately 15 seconds. Measure the AC voltage at test pin -12 (CPC 21) or test jack -M (CPC 22) as outflow valve moves from OPEN to CLOSED. Voltage shall read 10 VAC miminum. IF -

VOLTAGE IS BELOW MINIMUM - Remove the cabin pressure controller installed in the electronic shelf. Check resistance across aircraft connector D948 for pins B35 to B26, and pin B47 to B16. Resistance shall be 4.0 ohms minimum. IF -

RESISTANCE IS NOT WITHIN LIMITS - Disconnect connector D950 at outflow valve. Examine connector pins (bent, shorted, damaged). IF -

CONNECTOR PINS ARE BENT, SHORTED, OR DAMAGED - Repair bent pins, replace shorted/damaged pins. Replace cabin pressure controller.

CONNECTOR PINS ARE NOT BENT, SHORTED OR DAMAGED - Check resistance across aircraft connector D948 on pins B35 and B26 and pins B47 and B16. Verify open on volt/ohmmeter. IF -

METER SHOWS AN OPEN - Measure resistance across connector D950 pins 3 and 4 and across pins 5 and 15 at outflow valve. Add the two resistance values to get the series resistance for the motor.
The series resistance shall be as follows:

Servo motor P/N	Resistance (ohms)
718420-2	4.2 (±10%)
769860-1, -2	3.2 (±10%)
769860-3	3.8 (±10%)
769860-4	1.9 (±20%)

IF -

SERIES RESISTANCE IS NOT WITHIN RANGE, replace both the outflow valve and the pressure controller.

METER DOES NOT SHOW AN OPEN - Correct short in aircraft wiring and replace cabin pressure controller.

Pressurization Control System - Troubleshooting
Figure 101 (Sheet 21)

PRESSURIZATION CONTROL SYSTEM - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices for the pressurization control system consists of an operational test. The pressurization control system operational test provides a method for making periodic quick checks of the pressurization control system ability to switch modes of operation. Although the test does not provide a complete check of the pressurization control system, it does assure that system will switch from automatic to standby and that standby and manual control are available if needed during flight. Refer to Adjustment/Test for a complete functional test of the system.
   B. To prevent inadvertent cabin pressurization, an airplane door must be open if air is being supplied to air conditioning packs from a ground cart or APU/ENGINE.
2. Prepare to Operationally Test Pressurization Control System
   A. Provide electrical power.
   B. Check that following circuit breakers are closed:
      (1) MAN DC (P6)
      (2) STBY DC (P6)
      (3) AUTOMATIC DC (P6)
      (4) AUTOMATIC AC (P6)
      (5) MAN AC (P6)
      (6) STBY AC (P6)
      (7) All CONTROL CABIN LIGHTS module circuit breakers (P6)
      (8) LANDING GEAR LIGHTS (P6)
      (9) No. 1 AIR DATA COMPUTER (P18)
   C. Move pressurization control system controls as follows:
      (1) Mode selector to AUTO
      (2) FLT/GRD switch to GRD
      (3) CAB ALT counter to 500 feet above field altitude
      (4) Captain and First Officer altimeter to field barometric pressure.
      (5) CABIN RATE selector to pip
   D. Press-to-test following lights:
      (1) AUTO FAIL
      (2) OFF SCHED DESCENT
      (3) STANDBY
      (4) MANUAL
      (5) F OUTFLOW CLOSED
3. Operationally Test Pressurization Control System

   NOTE: On airplanes with the CPC 21 controller installed, a 15-minute warm-up time is required. On airplanes with the CPC 22 controller installed, a 5-minute warm-up time is required.

A. Check that lights noted in 2.D. are out.

<u>CAUTION</u>: KEEP HANDS AND TOOLS AWAY FROM THE OUTFLOW VALVE DURING THE TEST. THE OUTFLOW VALVE WILL MOVE, AND CAN CAUSE INJURY TO PERSONS.

B. Attach a KEEP CLEAR tag on or near the outflow valve.
C. Check that VALVE position indicator shows outflow valve to be in open position.
D. Move FLT/GRD switch to FLT and check that outflow valve moves toward close.

<u>NOTE</u>: VALVE position indicator should be monitored to detect outflow valve movement. There will be a delay of approximately 10 seconds before indicator shows movement.

E. Move mode selector to CHECK and observe that following events take place:
   (1) AUTO FAIL light comes on
   (2) STANDBY light comes on
   (3) Outflow valve moves toward open
   (4) F OUTFLOW CLOSED light goes out
F. Move CAB ALT counter to 500 feet below field level and check that outflow valve moves toward close.
G. Move FLT/GRD switch to GRD and check for the following:
   (1) AUTO FAIL light goes out
   (2) STANDBY light goes out
   (3) Outflow valve moves toward open
H. Allow at least 20 seconds from time mode selector was moved to CHECK, step 3.E., then move FLT/GRD switch to FLT and check for the following:
   (1) AUTO FAIL light stays out
   (2) STANDBY light stays out
   (3) Outflow valve moves toward close
I. Move mode selector to AUTO and check for the following:
   (1) AUTO FAIL light comes on
   (2) STANDBY light comes on
   (3) Outflow valve stays closed
J. Move mode selector to MAN AC and check for the following:
   (1) AUTO FAIL light goes out
   (2) STANDBY light goes out
   (3) MANUAL light comes on
K. Move FLT/GRD switch to GRD.
L. Hold MANUAL switch in OPEN position and check that outflow valve moves toward open.
M. Hold MANUAL switch in CLOSE position and check that outflow valve moves toward close.

N. Move mode selector to MAN DC and check for the following:
   (1) AUTO FAIL light stays out
   (2) STANDBY light stays out
   (3) MANUAL light stays on
O. Hold MANUAL switch in OPEN position and check that outflow valve moves toward open.
P. Hold MANUAL switch in CLOSE position and check that outflow valve moves toward close.
Q. Allow at least 20 seconds from time mode selector was moved to AUTO (step 3.I.) then move mode selector to AUTO and check for the following:
   (1) AUTO FAIL light stays out
   (2) STANDBY light stays out
   (3) OFF SCHED DESCENT light stays out
   (4) MANUAL light goes out
   (5) Outflow valves moves to open
R. Remove electrical power if no longer required.

PRESSURIZATION CONTROL SYSTEM - ADJUSTMENT/TEST

1. Pressurization Control System Test
   A. General
      (1) The pressurization control system test consists of four tests. Two tests are required to verify the manual control features of pressurization control, and two other tests verify the automatic control and standby control features respectively. All tests must be accomplished to verify the pressurization control system, although there may be occasions during maintenance where only one of the tests is needed to prove the integrity of a part being replaced or repaired. The requirement for testing will be listed in applicable maintenance procedure when only a part of the system test is needed.
      (2) The four tests described are as follows: DC Manual Mode Test, AC Manual Mode Test, Standby Mode Test, and Automatic Mode Test. For a quick check of operational characteristics of pressurization control system, refer to Maintenance Practices.
      (3) Preparations listed in DC Manual Mode are applicable to all of the tests. Where additional preparation is required for any of the tests it will be listed as a step in the applicable test procedure. Special test equipment, if required, will be included in the test requiring the equipment.

WARNING: OUTFLOW VALVE IS MOTOR-OPERATED. DO NOT INSERT HAND OR TOOLS IN OUTLET DURING ANY GROUND OPERATION OR INJURY TO PERSONNEL MAY OCCUR.

NOTE: During ground operation, outflow valve gate drop when switching between AUTO and STBY, AUTO and DC MAN, STBY and AC MAN or AC MAN and DC MAN is considered normal.

      (4) To prevent inadvertent cabin pressurization, an airplane door must be open if air is being supplied to air conditioning packs from a ground cart or APU/ENGINE unless performing tests.
   B. DC Manual Mode Test
      (1) Prepare to test DC Manual Mode.
         (a) Provide electrical power.
         (b) Check that the following circuit breakers on panel P6 are closed:
            1) AUTOMATIC AC and DC
            2) STBY AC and DC
            3) MAN AC and DC
         (c) Place FLT-GRD switch on pressurization control panel to GRD.

(d) Place mode selector switch to DC MAN.
(e) Close LANDING GEAR - LIGHTS circuit breaker on panel P6.

NOTE: Allow approximately 15-minute warmup of electronic components before proceeding with tests on automatic or standby modes. AC manual and dc manual modes may be tested with no warmup.

(2) Test DC Manual Mode.
(a) Place mode selector switch to DC MAN and check that MANUAL light comes on.
(b) Check cabin pressurization outflow valve ground operation.
1) Move and hold the manual outflow valve toggle switch to CLOSED and verify the outflow valve moves toward the fully closed position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light comes on. Visually check that the forward and aft outflow valves are fully closed.
2) Move and hold the manual outflow valve toggle switch to OPEN and verify the outflow valve moves toward the fully open position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light goes out. Visually check that the forward and aft outflow valves are fully open.
3) Operate outflow valve toggle switch until VALVE position indicator is at about the center mark.
4) Place FLT-GRD switch to FLT.
(c) Check cabin pressurization outflow valve flight operation.

NOTE: LH D-ABEA thru D-ABED, D-ABEF thru D-ABEI, D-ABEK thru D-ABEW, D-ABEY, D-ABBE thru D-ABDE and D-ABFE;
AP N461GB thru N465GB, N467GB, N468AC;
BU LN-SUS and LN-SUP;
NH JA8401 thru JA8403, JA8405 thru JA8408;
AR LV-JMW thru LV-JMY;
ZD G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC;
20 or more actuations of the outflow valve toggle switch will be required to see movement of the VALVE position indicator.

On ALL airplanes EXCEPT those listed above;
When switch is held toward CLOSED or OPEN, the valve will move accordingly.

1) Move and hold the manual outflow valve toggle switch to CLOSED and verify the outflow valve moves toward the fully closed position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light comes on. Visually check that the forward and aft outflow valves are fully closed.
2) Move and hold the manual outflow valve toggle switch to OPEN and verify the outflow valve moves toward the fully open position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light goes out. Visually check that the forward and aft outflow valves are fully open.

NOTE: If a 10-61209-10 cabin pressure selector panel is installed, the outflow valve will move incrementally in the FLT mode with each toggle switch actuation. The toggle switch must be cycled in order to fully close or open the outflow valve.

3) Place FLT-GRD switch to GRD.
4) Select AC MAN OPEN and ensure that outflow valve is open.

NOTE: During ground operation, outflow valve gate drop when switching from DC MAN to AC MAN is considered normal.

5) If no longer required, remove electrical power from airplane.
6) Set the mode selector switch on the cabin pressurization control panel to the AUTO position.
7) If the outflow valve moves in an erratic manner, as observed on the valve position indicator, replace the outflow valve (AMM 21-31-11/401).

C. AC Manual Mode Test
(1) Prepare to test AC Manual Mode.
(a) Refer to Prepare to Test DC Mode.
(2) Test AC Manual Mode.
(a) Place mode selector switch to AC MAN and check that MANUAL light comes on.
(b) Check cabin pressurization outflow valve ground operation.
1) Move and hold the manual outflow valve toggle switch to CLOSED and verify the outflow valve moves toward the fully closed position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light comes on. Visually check that the forward and aft outflow valves are fully closed.

2) Move and hold the manual outflow valve toggle switch to OPEN and verify the outflow valve moves toward the fully open position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light goes out. Visually check that the forward and aft outflow valves are fully open.
3) Operate outflow valve toggle switch until VALVE position indicator is at about the center mark.
4) Place FLT-GRD switch to FLT.

(c) Check cabin pressurization outflow valve flight operation.

<u>NOTE</u>: LH D-ABEA thru D-ABED, D-ABEF thru D-ABEI, D-ABEK thru D-ABEW, D-ABEY, D-ABBE thru D-ABDE and D-ABFE;
AP 461GB thru N465GB, N467GB, N468AC;
BU LN-SUS and LN-SUP;
NH JA8401 thru JA8403, JA8405 thru JA8408;
AR LV-JMW thru LV-JMY;
ZD G-AVRL thru G-AVRO, G-AWSY, G-AXNA thru G-AXNC;
20 or more actuations of the outflow valve toggle switch will be required to see movement of the VALVE position indicator.

On ALL airplanes EXCEPT those listed above;
When switch is held toward CLOSED or OPEN, the valve will move accordingly.

1) Move and hold the manual outflow valve toggle switch to CLOSED and verify the outflow valve moves toward the fully closed position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light comes on. Visually check that the forward and aft outflow valves are fully closed.
2) Move and hold the manual outflow valve toggle switch to OPEN and verify the outflow valve moves toward the fully open position in a smooth continuous manner by observing the valve position indicator. Check that the forward outflow valve light goes out. Visually check that the forward and aft outflow valves are fully open.

<u>NOTE</u>: If a 10-61209-10 cabin pressure selector panel is installed, the outflow valve will move incrementally in the FLT mode with each toggle switch actuation. The toggle switch must be cycled in order to fully close or open the outflow valve.

3) Place FLT-GRD switch to GRD.
4) Select AC MANUAL OPEN and ensure that outflow valve is open.

5) If no longer required, remove electrical power from airplane.
6) Set the mode selector switch on the cabin pressurization control panel to the AUTO position.
7) If the outflow valve moves in an erratic manner, as observed on the valve position indicator, replace the outflow valve (AMM 21-31-11/401).

D. Standby Mode Test

(1) Prepare to test Standby Mode.
  (a) Refer to Prepare to test DC Manual Mode.

(2) Test Standby Mode
  (a) On control panel set CAB ALT to field altitude and CABIN RATE at pip mark.
  (b) Set field barometric correction (QFE), or corrected sea level pressure (QNH) on first officer's altimeter.
  (c) Set CAB ALT to 200 feet below field altitude (QNH), or to a minus 200 feet (QFE).
  (d) Switch selector to STBY and check that STANDBY light comes on.
  (e) Place FLT-GRD switch to GRD and check that outflow valve is open, or opens.
  (f) Check standby mode flight operation.
    1) Open landing gear lights circuit breaker and check that outflow valve goes to the full closed position in 10 to 40 seconds as observed on the VALVE position indicator.
    2) Place FLT-GRD switch to FLT.
    3) Close landing gear lights circuit breaker and check that outflow valve remains closed.
    4) Increase CAB ALT control setting to 200 feet above field altitude and check that outflow valve goes to full open.
  (g) Check airplane barometric correction.
    1) Set CAB ALT control setting to field elevation.

CAUTION: DO NOT EXCEED NORMAL BAROMETER OPERATING RANGE OF 28.10-31.00 IN. HG (952-1049 MB). EXCEEDING RANGE MAY CAUSE MALFUNCTION OF PRESSURIZATION SYSTEM.

    2) Set first officer's altimeter to 0.3 inch Hg (10 mb) barometric correction above the corrected value and check that the outflow valve goes to the closed position.
    3) Set first officer's altimeter to 0.6 inch Hg (20 mb) barometric correction below the last setting and check that the outflow valve goes to the open position.
    4) Set barometric correction to the corrected pressure.

5) Select AC MAN OPEN. Ensure that outflow valve is open.

NOTE: During ground operation, outflow valve gate drop when switching from STBY to AC MAN is considered normal.

6) Remove electrical power if no longer required.

E. Automatic Mode Test
(1) Prepare to test Automatic Mode.
(a) Refer to Prepare to test DC Manual Mode
(2) Test Automatic Mode
(a) Place mode selector switch to AUTO and check that AUTO FAIL, STANDBY, OFF SCHED DESCENT and MANUAL lights are off.
(b) Check ground pressurized and ground unpressurized circuits.
1) Place FLT-GRD switch to FLT and check that outflow valve goes to the full closed position in approximately 30 seconds as observed on the VALVE position indicator.
2) Place FLT-GRD switch to GRD and check that outflow valve goes to full open within 30 seconds as observed on the VALVE position indicator.
(c) Check automatic fault detector operation.
1) Place FLT-GRD switch to FLT.
2) Place mode selector switch to CHECK and check that AUTO FAIL and STANDBY lights come on.
3) Place FLT-GRD switch to GRD and check that AUTO FAIL and STANDBY lights go out.
4) Wait at least 30 seconds and then place FLT-GRD switch to FLT.

NOTE: Elapsed time periods are required for initial fault conditions to clear.

5) Place mode selector switch to AUTO and check that AUTO FAIL and STANDBY lights come on.
6) Place mode selector switch to STBY and check that AUTO FAIL light goes out.
7) Wait at least 30 seconds and then place mode selector switch to AUTO and check that STANDBY light goes out.
8) Open AUTO AC circuit breaker and check that AUTO FAIL light comes on immediately and that STANDBY light comes on in 11 to 19 seconds.
9) Close AUTO AC circuit breaker.
10) AIRPLANES WITH THREE CABIN PRESSURE FITTINGS ON FRONT OF CONTROLLER;
Check that AUTO FAIL and STBY lights go out.

11) AIRPLANES WITH ONE CABIN PRESSURE FITTING ON FRONT OF CONTROLLER;
    a) Place mode selector switch to STBY and check that AUTO FAIL light goes out.

       NOTE: At this time a delay of 20 to 30 seconds is necessary to allow induced voltage to bleed off.

    b) Place mode selector switch to AUTO and check that STANDBY light goes out.

(d) Check automatic fault detector operation with standby mode inoperative.
    1) Place FLT-GRD switch to FLT.
    2) Open STANDBY AC circuit breaker.
    3) Open AUTO AC circuit breaker and check that the AUTO FAIL light comes on, but STANDBY light does not.
    4) Place FLT-GRD switch to GRD and check that AUTO FAIL light goes out.
    5) Close STANDBY AC circuit breaker.
    6) Close AUTO AC circuit breaker.

(e) Check automatic mode barometric correction circuits.
    1) Set FLT ALT control to 35,000 feet.
    2) Set LAND ALT control to field altitude.
    3) Place FLT-GRD switch to FLT and wait for outflow valve to close.
    4) Set captain's altimeter to field pressure.

       CAUTION: DO NOT EXCEED NORMAL BAROMETER OPERATING RANGE OF 28.10-31.00 IN. HG (952-1049 MB). EXCEEDING RANGE MAY CAUSE MALFUNCTION OF PRESSURIZATION SYSTEM.

    5) Open landing gear lights circuit breaker and check that outflow valve goes to full open within 1 minute as observed on the VALVE position indicator.
    6) Set captain's altimeter to 0.3 inch Hg (10 mb) above field pressure and check that outflow valve goes to full close within 1 minute as observed on VALVE position indicator.
    7) Set captain's altimeter to 0.3 inch Hg (10 mb) below field pressure and check that outflow valve goes to full open within 1 minute as observed on VALVE position indicator.

(f) Check isobaric pressure reference.
    1) Set FLT ALT control to 28,000 feet.
    2) Set LAND ALT control to 5000 feet.
    3) Check that captain's altimeter is set at 29.00 inches of mercury and that outflow valve is open.

4) Assure that at least 2 minutes have passed since the LANDING GEAR LIGHTS circuit breaker was opened then press and hold the ALT slew button on the No. 1 air data computer for at least 5 seconds.
5) Release the button and check that OFF SCHED DESCENT light comes on within 5 seconds, then goes off after the pressure signal has returned to ambient.
6) Slowly increase the barometric correction at a rate not exceeding 0.30 inch of mercury/minute while observing the VALVE position indicator. When outflow valve starts to close, stop changing barometric setting unless a small additional increase is required to completely close the outflow valve.

   NOTE: This step is a setup step to just close the valve. When completed, a slight decrease in the correction will start the outflow valve toward open.

7) Increase LAND ALT setting to 5100 feet and check that outflow valve remains closed.
8) Increase LAND ALT setting to 5700 feet and check that outflow valve goes to open.
9) Close landing gear lights circuit breaker.
10) Press the altitude slew button on the No. 1 air data computer and hold for at least 5 seconds. Release button and check that OFF SCHED DESCENT light does not come on.
11) Select AC MANUAL OPEN and ensure that outflow valve is open.
12) Determine if there is any further need for electrical power on airplane, if not, remove external electrical power.
13) Set the mode selector switch on the cabin pressurization control panel to the AUTO position.

2. Pressure Controller Test Jack Function Test

A. General

(1) In addition to testing the pressurization system modes of operation, a clear understanding of the test jack functions (Fig. 501) on the pressure controller will aid in trouble shooting and testing of certain components.

(2) The tests described in the following paragraphs will isolate problems to the pressure controller, pressure control panel outflow valve and barometric correction potentiometers landing gear module, air data computer including the airplane wiring.

B. Equipment and Materials

(1) A specific voltage and tolerance range is provided for the tests. All tests shall be conducted using the most accurate meter available. A Simpson meter 260, model 4M (or equivalent) is acceptable for all readings with the exception of voltage readings in the millivolt level. For outputs in the millivolt level, a portable vacuum tube voltmeter or digital voltmeter should be used.

(2) When checking TJ12, the use of an instrument other than a Simpson meter 260 4M or equivalent, may result in ac voltage readings significantly lower than the specified tolerance due to the filtering characteristics of the instrument.

(3) A breakout box (P/N F80206-1) may be used on Model CPC-22 Cabin Pressure Control Unit with the above meters.

C. Standby Rate Potentiometer Wiper (Test Jack 1 or Test Pin A)

(1) Place CABIN RATE control on pressurization control panel at the pip mark. Check that voltage between test jack 1 and test jack 13 is 0.056 ±0.010 volt dc or between test pins A and N is 0.024 ±0.010 volt dc.

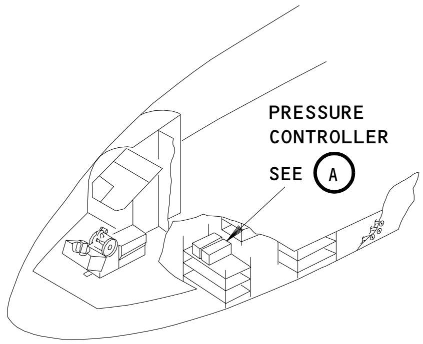
(2) Place CABIN RATE control to DECR. Slowly move control knob from DECR to INCR and back to DECR. Check that there is a smooth change in voltage between test jack 1 and test jack 13 ranging from approximately 0.008 ±0.005 volt dc (DECR) to 0.350 ±0.050 volt dc (INCR). Between test pins A and N the range is from 0.005 ±0.005 volt dc (DECR) to 0.165 ±0.050 volt dc (INCR).

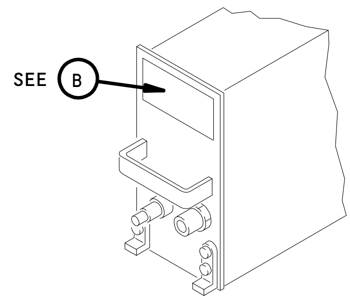
D. Flight Altitude Potentiometer Wiper (Test Jack 2 or Test Pin B)

(1) Set FLT ALT control on pressurization control panel to the following settings and check for the corresponding voltages.

Altitude (feet)	Volts dc (± 0.1)
+4,000	+16.65
+12,000	+12.26
+20,000	+8.86
+36,000	+4.33

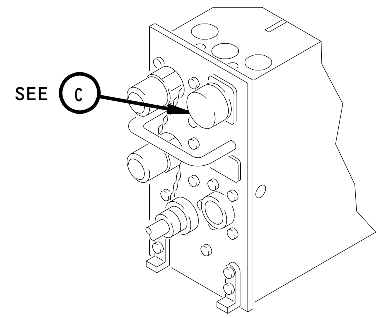
NOTE: Check that FLT ALT control knob releases after it is pushed in to make a new setting. It should rotate freely without changing the counter numbers.





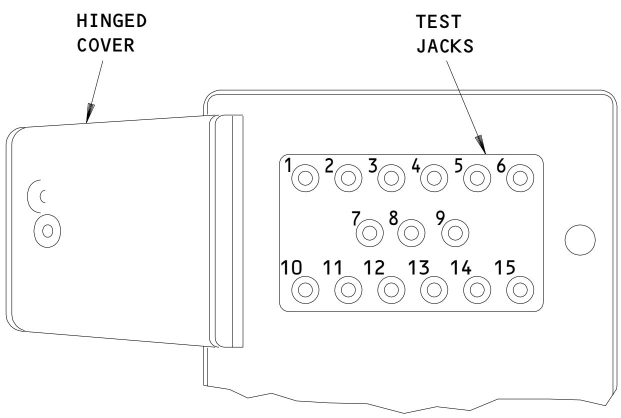
PRESSURE CONTROLLER CPC21

A

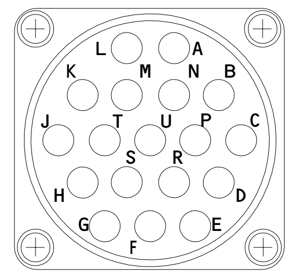


PRESSURE CONTROLLER CPC22

A



B



C

TEST JACK NO.		FUNCTION EXAMINED (COMPONENT)	MODE			
CPC22	CPC21		AUTO	STANDBY	MAN AC	MAN DC
A	1	CABIN RATE (SELECTOR PANEL)		X		
B	2	FLT ALT (SELECTOR PANEL)	X			
C	3	LAND ALT (SELECTOR PANEL)	X			
D	4	BARO CORRECT - AUTO MODE (AIRCRAFT COMP)	X			
E	5	CAB ALT (SELECTOR PANEL)		X		
F	6	BARO CORRECT - STBY MODE (AIRCRAFT COMP)		X		
G	7	FLT - GRD SWITCH (SELECTOR PANEL)+				
		AIR - GRD SAFETY SWITCH (AIRCRAFT COMPONENT)	X	X	X	X
H	8	AIR DATA COMPUTER ALTITUDE REF (AIRCRAFT COMPONENT)				
		(MERCURE USES SERVO ALTIMETER)	*X	*X		
J	9	AC ACTUATOR (OFV) BRAKE VOLTAGE (CONTROL/OFV)	X		X	
K	10	AC ACTUATOR (OFV) CLUTCH VOLTAGE (CONTROL/OFV)	X	X	X	X
L	11	DC ACTUATOR (OFV) CLUTCH VOLTAGE (CONTROL/OFV)	X		X	
M	12	AC ACTUATOR (OFV) MOTOR VOLTAGE (CONTROL/OFV)	X		X	
N	13	GROUND	X	X	X	X
P	14	STANDBY RATE LIMITER				
R	15	AUTO RATE LIMITER	X			
S	--	UNUSED				
T	--	UNUSED				
U	--	UNUSED				

* CAN BE AUTO OR STANDBY

Pressure Controller Test Pin Function Chart
Figure 501

E. Land Altitude Potentiometer Wiper (Test Jack 3 or Test Pin C)
   (1) Rotate LAND ALT control on pressurization control panel from -990 through 000 feet and check for a smooth linear change in voltage.
   (2) Set LAND ALT control on pressurization control panel to the following settings and check for the corresponding voltages.

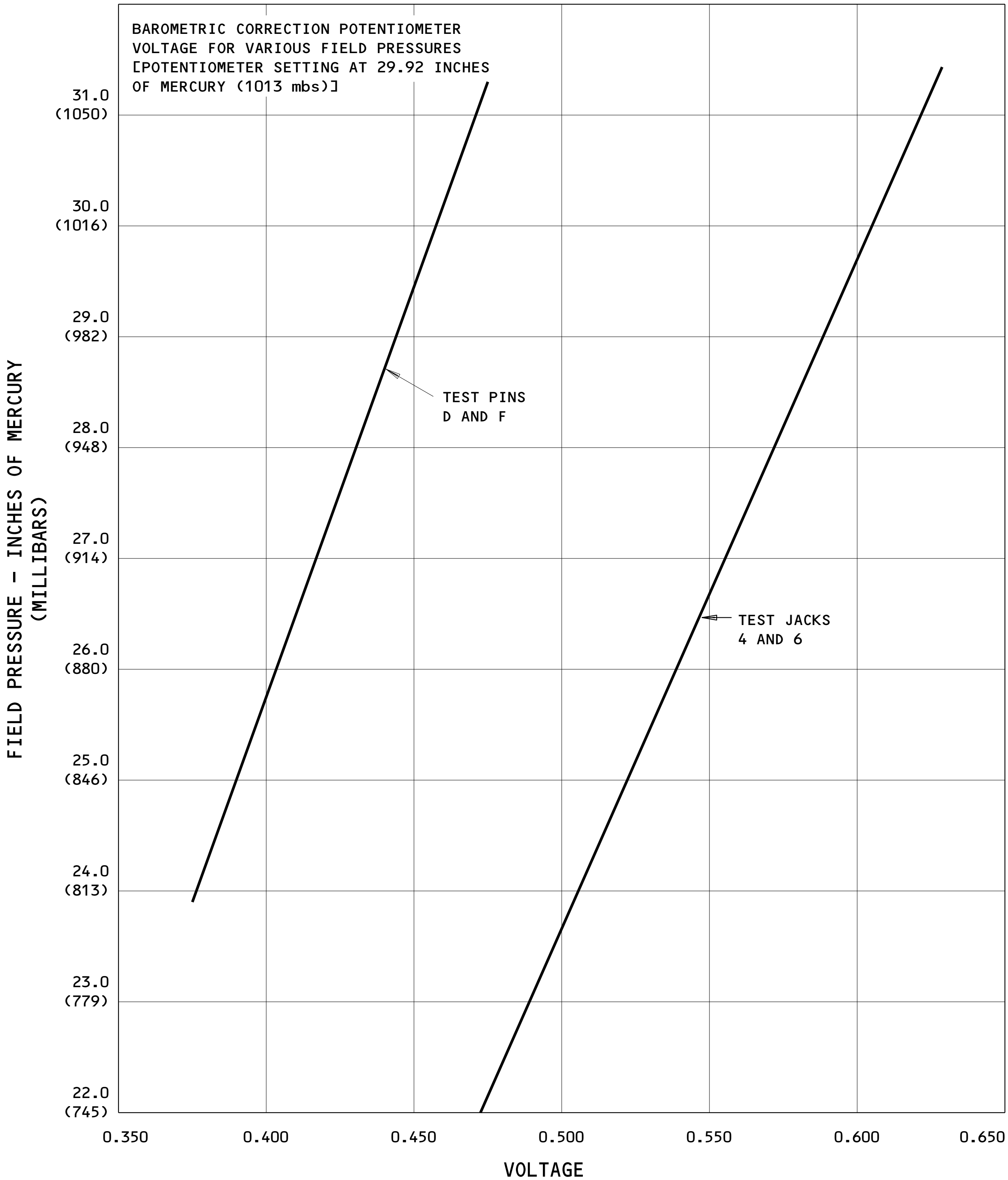
Altitude (feet)	Volts dc (± 0.1)
-500	+8.30
+400	+7.68
+1,400	+7.00
+2,400	+6.34
+3,400	+5.70
+4,400	+5.08
+5,400	+4.48

F. Auto Mode Barometric Correction Potentiometer Wiper (Test Jack 4 or Test Pin D)
   (1) Rotate auto mode barometric correction potentiometer wiper through its range and check for a smooth and continuous voltage change.
   (2) Set captain's altimeter to 29.92 inches of mercury.
   (3) Measure and record the voltage at test pin D or test jack 4.
   (4) Obtain and record the current field pressure for the day.
   (5) Refer to Fig. 502 and read the barometric correction potentiometer voltage for the field pressure.
   (6) Check that voltage at test jack 4 or test pin D is within ± 0.01 volt of the voltage that you read from Fig. 502.

G. Cabin Altitude Potentiometer Wiper (Test Jack 5 or Test Pin E)
  (1) Rotate CAB ALT control on pressurization control panel from -990 feet through 000 feet and check for a smooth and continuous voltage change.
  (2) Set CAB ALT control on pressurization control panel to the following settings and check for the corresponding voltages.

Altitude (feet)	Volts dc (± 0.05)	
	Test Jack 5	Test Pin E
+400	-7.68	-5.76
+1,400	-7.00	-5.25
+2,400	-6.34	-4.76
+3,400	-5.70	-4.28
+4,400	-5.08	-3.81
+5,400	-4.48	-3.36
+6,400	-3.89	-2.92
+7,400	-3.33	-2.50

H. Standby Mode Barometric Correction Potentiometer Wiper (Test Jack 6 or Test Pin F)
  (1) Place FLT-GRD switch to FLT. Rotate standby mode potentiometer through its range and check for a smooth and continuous voltage change.
  (2) Set first officer's altimeter to 29.92 inches of mercury. Record field pressure and determine from chart (Fig. 502) the corresponding voltage.



Barometric Correction Potentiometer Voltage Chart
Figure 502

(3) Check that voltage at test jack 6 or test pin F is within ± 0.01 volt of the chart value for test jack 4 or test pin D step F.(3).

I. FLT-GRD Switch (Test Jack 7 or Test Pin G)

(1) Place FLT-GRD switch to GRD.

(2) Check that LANDING GEAR - LIGHTS circuit breaker on panel P6 is closed (in). Check that voltage at test jack 7 or test pin G is 20 to 31 volts dc.

NOTE: If no voltage is present at test jack 7 or test pin G, check for an open ground on the ground sensor in the landing gear strut switch.

(3) Open LANDING GEAR-LIGHTS circuit breaker and check that voltage at test jack 7 or test pin G is less than 2 volts dc.

(4) Close LANDING GEAR-LIGHTS circuit breaker and check that voltage at test jack 7 or test pin G is 20 to 31 volts dc.

(5) Plate FLT-GRD switch to FLT and check that voltage at test jack 7 or test pin G is less than 2 volts dc.

J. Air Data Computer Potentiometer Wiper (Test Jack 8 or Test Pin H)

CAUTION: TO AVOID DAMAGE TO AIR DATA COMPUTER, ASSURE THAT VOLTMETER IS SET AT THAT PROPER VOLTAGE SCALE BEFORE MAKING CONTACT BETWEEN TEST JACK 8 AND 13 OR TEST PINS H AND N. DO NOT CHANGE VOLTAGE SCALES AFTER CONTACT IS MADE BETWEEN TEST JACKS 8 AND 13 OR TEST PINS H AND N. IF A MULTIMETER IS USED, DO NOT USE THE OHMS SCALE OF THE METER AT TEST JACK 8 OR TEST PIN H.

(1) Record field pressure in inches of mercury to two decimal places. Voltage between jacks 8 and 13 - multiply field pressure by 0.6448 volt/in. Hg. Voltage between pins H and N - multiply field pressure by 0.4836 volt/in. Hg. Using a voltmeter scale with an accuracy and readability combined of ± 0.020 volt dc, measure voltage at test jack 8 or test pin H. Voltage should read within ± 0.1 volt dc of the calculated voltage value.

NOTE: The tolerances provided are necessary to determine if a ground discrepancy in the automatic mode is caused by the air data computer or pressure controller.

K. AC Actuator Motor Brake Voltage (Test Jack 9 or Test Pin J)
    (1) Place mode selector switch to AUTO and check that voltage at test jack 9 or test pin J is 19 to 33 volts dc.
    (2) Place mode selector switch to STBY and check that voltage at test jack 9 or test pin J is less than 2 volts dc.
    (3) Place mode selector switch to AC MAN and FLT-GRD switch to GRD.
    (4) Move outflow valve toggle switch to CLOSE and then to OPEN and check that voltage at test jack 9 or test pin J is 19 to 33 volts dc.

L. AC Actuator Clutch Voltage (Test Jack 10 or Test Pin K)
    (1) Place mode selector switch to AUTO and check that voltage at test jack 10 or test pin K is less than 2 volts dc.
    (2) Place mode selector switch to AC MAN and move outflow valve toggle switch to CLOSE and then to OPEN. Check that voltage at test jack 10 or test pin K is less than 2 volts dc.
    (3) Place mode selector switch to STBY and check that voltage at test jack 10 or test pin K is 20 to 31 volts dc.
    (4) Place mode selector switch to DC MAN and check that voltage at test jack 10 or test pin K is 20 to 31 volts dc.

M. DC Actuator Clutch Voltage (Test Jack 11 or Test Pin L)
    (1) Place mode selector switch to AUTO and then to AC MAN. Check that voltage at test jack 11 or test pin L is less than 2 volts dc.
    (2) Place mode selector switch to STBY and then to DC MAN. Check that voltage at test jack 11 or test pin L is 20 to 31 volts dc.

N. AC Actuator Motor Winding (Test Jack 12 or Test Pin M)
    (1) Place mode selector switch to AUTO and FLT-GRD switch to FLT. As the outflow valve moves from the open to closed position, check that voltage at test jack 12 or test pin M is 18 to 40 volts ac. With the outflow valve at the stop the voltage at test jack 12 or test pin M is 16 to 38 volts ac.
    (2) Place mode selector switch to AC MAN and place outflow valve toggle switch to OPEN. Check that voltage at test jack 12 is less than 2 volts ac or at test pin M is 16 to 32 volts ac.
    (3) Move outflow valve toggle switch to CLOSE. Check that voltage at test jack 12 is 16 to 32 volts ac or at test pin M is less than 2 volts ac.

O. Standby System Scheduling Voltage (Test Jack 14 or Test Pin P) Auto System Scheduling Voltage (Test Jack 15 or Test Pin R)

CAUTION: ASSURE THAT VOLTMETER IS IN THE DC VOLTS POSITION BEFORE CHECKING TEST JACKS 14 AND 15 OR TEST PINS P AND R TO PREVENT DAMAGE TO PRESSURE CONTROLLER.

(1) Record voltage at test jack 14 or test pin P.
(2) Record voltage at test jack 15 or test pin R.

NOTE: The difference between the voltages recorded at test jack 14 and 15 or test pins P and R should be no more than 0.5 volt dc.

(3) Set the mode selector switch on the cabin pressurization control panel to the AUTO position.

3. Standby Rate Check
A. Check that all cabin doors and sliding windows are closed.
B. Start and operate air cycle packs in MANUAL-COLD (AMM 21-00/201).
C. Set CAB ALT to -500 feet.
D. Set CABIN RATE selector to vertical position.
E. Set mode selector to STBY.
F. Set FLT/GRD toggle switch to FLT. Check that CABIN CLIMB stabilizes at 1000 ±300 SL FEET PER MIN down before moving near zero.
G. Set FLT/GRD toggle switch to GRD. Check that CABIN CLIMB stabilizes at 1000 ±300 SL FEET PER MIN up before moving near zero.
H. Set CABIN RATE selector to pip mark.
I. Set FLT/GRD switch to FLT. When CABIN CLIMB stabilizes at 300 +100 SL FEET PER MIN down, set CABIN RATE selector to full DECR position. Check that CABIN CLIMB stabilizes at 50 ±50 SL FEET PER MIN down before moving near zero.
J. Set FLT/GRD switch to GRD. When CABIN CLIMB stabilizes at 50 ±50 SL FEET PER MIN up, set CABIN RATE selector to pip mark. Check that CABIN CLIMB stabilizes at 300 ±100 SL FEET PER MIN up before moving near zero.

4. Standby Altitude Check
A. Open sliding window in flight compartment.

B. Make sure the auxiliary fuel tank access panels (tank or equipment bay) are completely installed.

C. Start and operate air cycle packs in MANUAL-COLD (AMM 21-00/201).

CAUTION: DO NOT START OR OPERATE AIR CYCLE PACKS BEFORE AUXILIARY FUEL ACCESS PANELS (TANK OR EQUIPMENT BAY) ARE COMPLETELY INSTALLED. WHEN OPERATING THE PACKS, THERE IS A CHANCE THE AIRPLANE MIGHT BE PRESSURIZED. THIS COULD RESULT IN SERIOUS DAMAGE AND/OR RUPTURE OF FUEL CELLS.

D. Set CAB ALT to 200 feet above field elevation.

E. Set FLT/GRD switch to FLT and reset CAB ALT down slowly until outflow valve starts to close.

F. Set CAB ALT in position at which outflow valve movement is minimized. Check that CAB ALT reads field elevation ± 120 feet.

G. Set FLT/GRD switch to GRD.

H. Close sliding window in flight compartment.

5. Auto Rate Check

A. Start and operate air cycle packs in MANUAL-COLD (AMM 21-00/201).

B. Set mode selector to AUTO.

C. Set FLT/GRD switch to FLT. Check that CABIN CLIMB stabilizes at 250 to 450 SL FEET PER MIN down before moving near zero.

D. Set FLT/GRD switch to GRD. Check that CABIN CLIMB stabilizes at 300 to 600 SL FEET PER MIN up before moving near zero.

E. Restore airplane to normal.

6. Pressurization Outflow Valve Resistance Tests

A. Remove outflow valve (AMM 21-31-11/401).

B. At connectors D950 (AC clutch) and D952 (DC clutch), check that resistance between pins 6 and 7 is 21 ±3 ohms and resistance between pins 8 and 11 is 10 ±1.5k.

C. Replace the outflow valve if any resistance measurements are out of tolerance.

D. Install the outflow valve (AMM 21-31-11/401).

(1) Set the mode selector switch on the cabin pressurization control panel to the AUTO position.

CABIN PRESSURIZATION OUTFLOW VALVE - REMOVAL/INSTALLATION

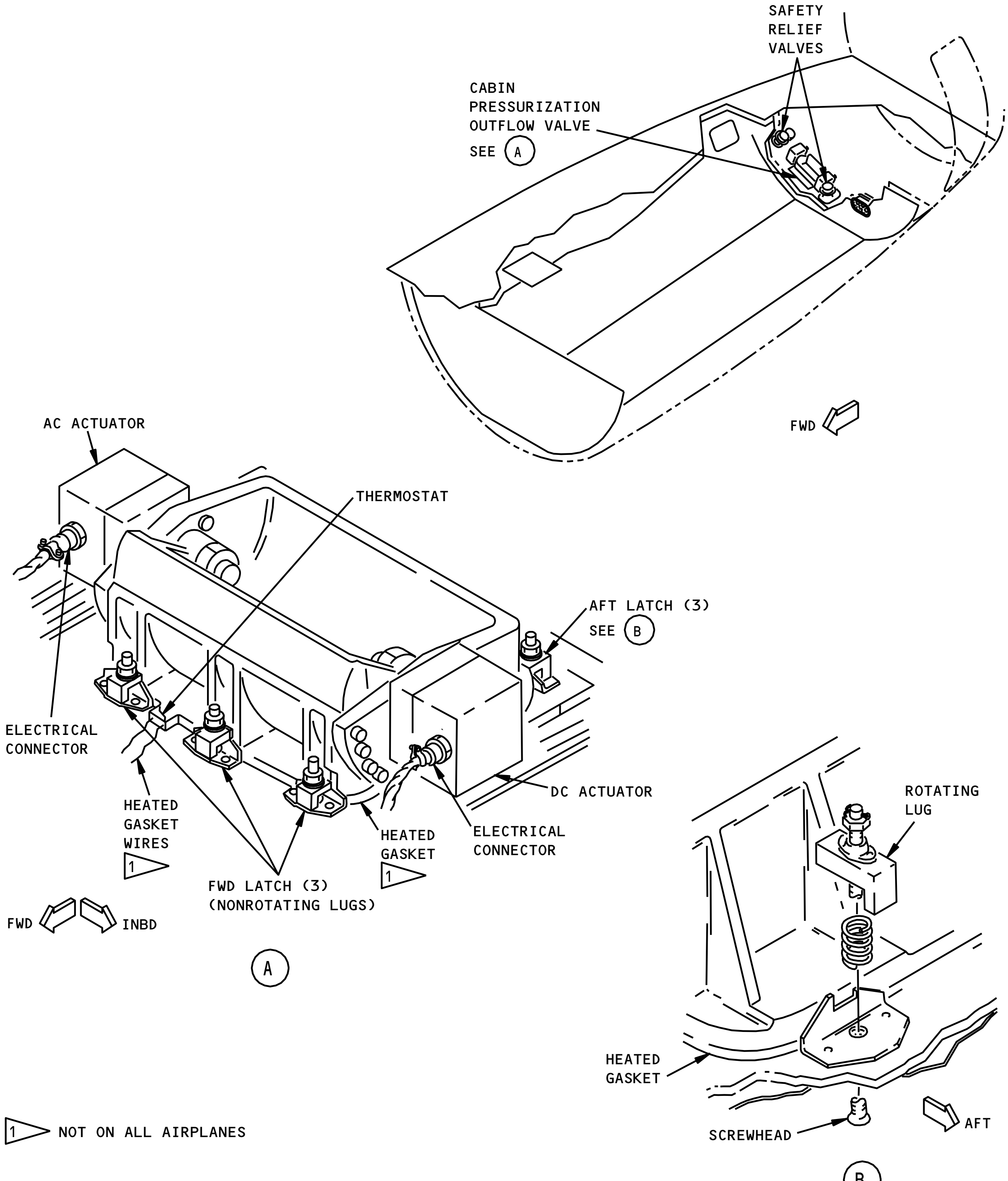
1. General
   A. The cabin pressurization outflow valve is removed and installed from outside the airplane. It is located under the fuselage approximately opposite the aft entry door.
2. Equipment and Materials
   A. Bit - Apex 212-5/16 inch
   B. Methyl Ethyl Ketone (20-30-31) or
   C. Isopropyl Alcohol (20-30-31)
   D. PROSEAL 898 (B-1/2 or B-2) (20-30-11, BMS 5-79)
   E. Spatula or flow gun
3. Remove Cabin Pressurization Outflow Valve
   A. Open the six PRESSURIZATION CONTROL and one OUTFLOW VALVE HEATER, if installed circuit breakers on P6-4.

      WARNING: ACTUATION OF OUTFLOW VALVE DURING REMOVAL/INSTALLATION COULD CAUSE INJURY TO PERSONNEL.

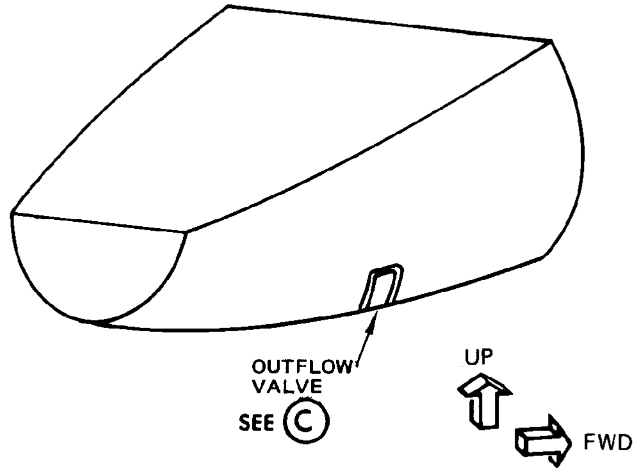
   B. Locate three screwheads forward of outflow valve and three screwheads aft of outflow valve.
   C. Insert bit in each screwhead and rotate counterclockwise until stop point is reached.
   D. Press upward and aft against aft end of outflow valve, rotating it about l/4-turn.
   E. Reach through opening and disconnect electrical connectors on forward side of each actuator.
   F. Remove heated gasket from outflow valve body, if installed. Do not break wire leads. If necessary to replace heated gasket refer to 21-31-12, MP.
   G. Bring outflow valve down through opening and out of airplane.
4. Install Cabin Pressurization Outflow Valve
   A. Lift outflow valve through opening in airplane and position valve with actuator electrical receptacles facing forward.
   B. Install heated gasket on outflow valve body.
   C. Connect electrical connectors to actuators.
   D. Slide forward end of outflow valve under latches and lower aft end of valve into place.
   E. Insert bit in each screwhead and rotate clockwise until stop has been contacted. Tighten opposite latches until each latch has been tightened.
   F. Apply a fillet seal around outflow valve opening (AMM 51-31-0/201). Fillet seal should extend 0.60 inch on to outflow valve body on the forward and aft edges and 0.30 inch on to the outflow valve body around the rest of the opening.

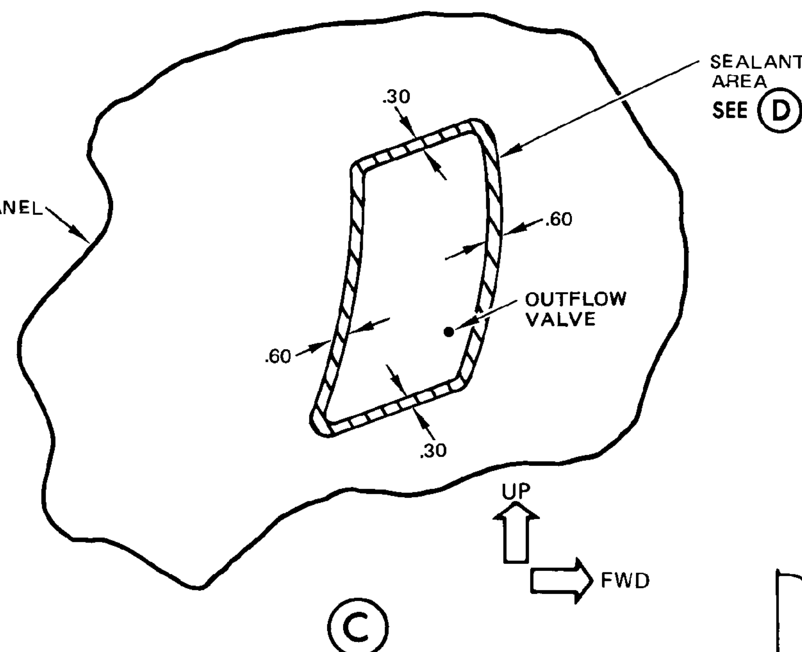
CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY THE FILLET SEAL. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

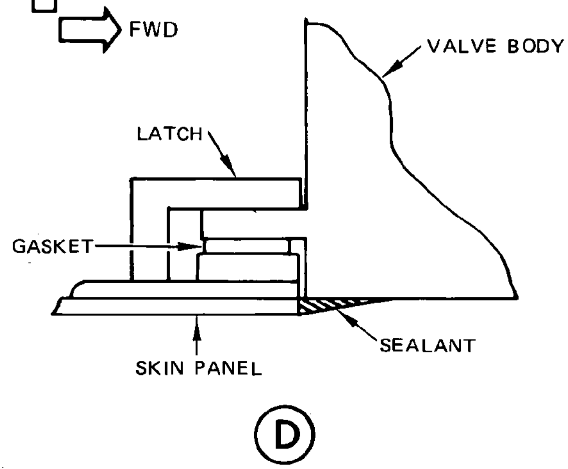
G. Close circuit breakers opened in 3.A
H. Provide electrical power.
I. Place L and R PACK switches to OFF.
J. Move pressurization control system mode selector to MAN-DC.
K. Move FLT/GRD switch to GRD.
L. Position MANUAL toggle switch to CLOSE and observe that VALVE position indicator shows valve closing.
M. Close aft outflow valve with MANUAL toggle switch and check that forward outflow valve is closed and forward outflow valve light illuminates.
N. Position mode selector switch to AUTO and observe that VALVE position indicator shows valve moves to full open. Check that forward outflow valve is open and forward outflow valve light extinguished.
O. Remove electrical power if no longer required.



Cabin Pressurization Outflow Valve
Figure 401 (Sheet 1)







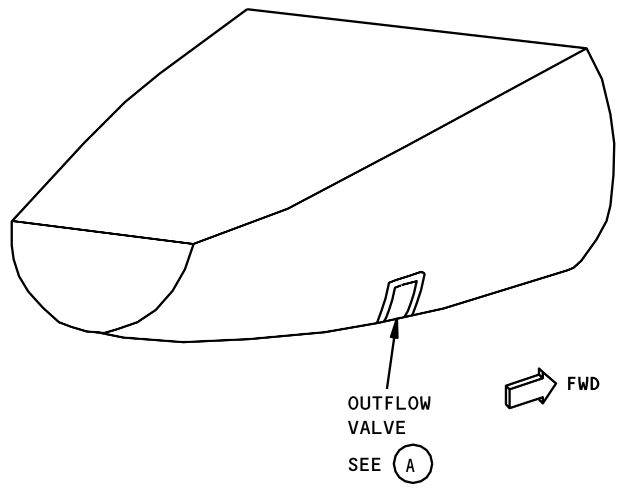
Cabin Pressurization Outflow Valve
Figure 401 (Sheet 2)

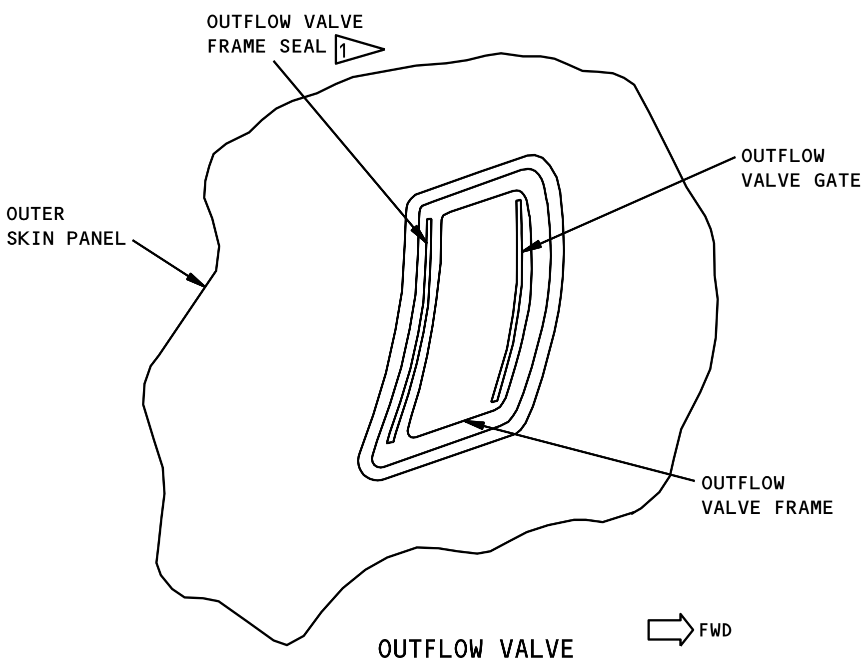
CABIN PRESSURIZATION OUTFLOW VALVE - APPROVED REPAIRS

1. General
   A. This repair procedure replaces the outflow valve frame seals while the outflow valve is installed on the airplane.
2. Equipment and Materials
   A. Cleaning Solvent (Ref 20-30-31)
      (1) Methyl Ethyl Ketone - TT-M-261
      (2) Isopropyl Alcohol - TT-I-735
   B. Adhesive - BAC5010 Type 71 (Furane 8543, Ciba-Geigy)
   C. Weight Tool - 715853-1-T4 (Hamilton Standard)
3. Repair Outflow Valve Frame Seals (Fig. 801)
   A. Operate the outflow valve until it is fully open:
      (1) Supply electrical power.
      (2) Make sure these circuit breakers on the P6 panel are closed:
         (a) AUTOMATIC AC and DC
         (b) STBY AC and DC
         (c) MAN AC and DC
      (3) Put the FLT-GRD switch on the pressurization control panel to GRD.
      (4) Put the mode selector switch to DC MAN.
      (5) Close the LANDING GEAR - LIGHTS circuit breaker on the P6 panel.
      (6) Move and hold the manual outflow valve toggle switch to OPEN until the outflow valve is completely open.
   B. Open these circuit breakers on the P6 panel and install collars:
      (1) AUTOMATIC AC and DC
      (2) STBY AC and DC
      (3) MAN AC and DC
   C. Use a sharp edged plastic or wood tool to remove the remaining outflow valve frame seal from the frame seal groove.
   D. Clean the frame seal groove with methyl ethyl ketone or isopropyl alcohol to remove all traces of the adhesive. Use a clean, lint-free cloth to remove the solvent residue before it dries.
   E. Use the manufacturers instructions to prepare the adhesive.

      NOTE: The pot life of the adhesive at temperatures below 100°F is 3 to 4 minutes. The adhesive must be applied and the seal installed into the frame seal groove quickly after the adhesive is mixed.

   F. Apply a thin, uniform coat of the adhesive to the faying surfaces in the frame seal groove.
   G. Install the valve frame seal into the groove immediately after you apply the adhesive.
   H. Use the weight tool 715853-1-T4 and two C-clamps to hold the seal in the groove.
   I. Let the adhesive cure for a minimum of 120 minutes at a temperature greater than 45°F.





OUTFLOW VALVE
(OUTFLOW VALVE
SHOWN FULLY OPEN)

A

1 OUTLINE OF FRAME SEAL GROOVE NOT SHOWN FOR CLARITY

Cabin Pressurization Outflow Valve
Figure 801

J. Remove the weight tool and C-clamps after the adhesive has cured.

K. Remove the collars and close these circuit breakers on the P6 panel:
   (1) AUTOMATIC AC and DC
   (2) STBY AC and DC
   (3) MAN AC and DC
   (4) Make sure that the mode selector switch on the cabin pressurization control panel is returned to the AUTO position.

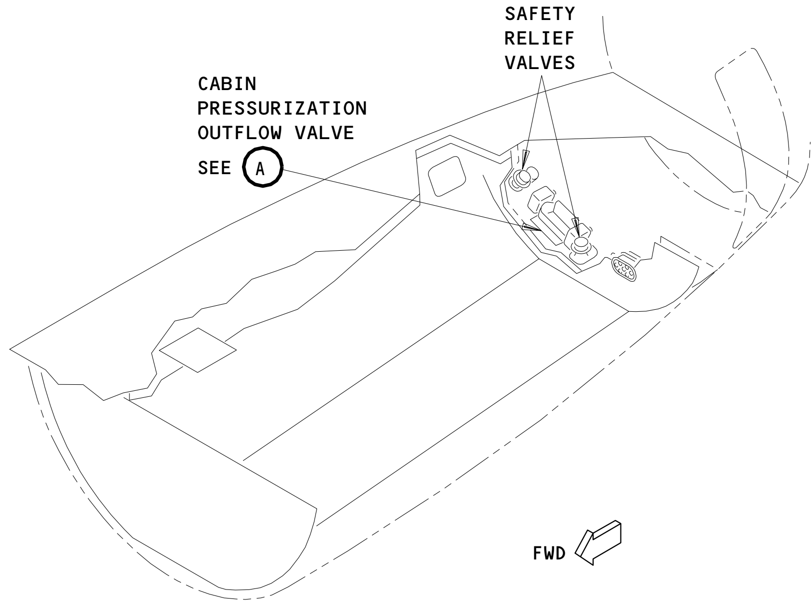
OUTFLOW VALVE HEATED GASKET - MAINTENANCE PRACTICES

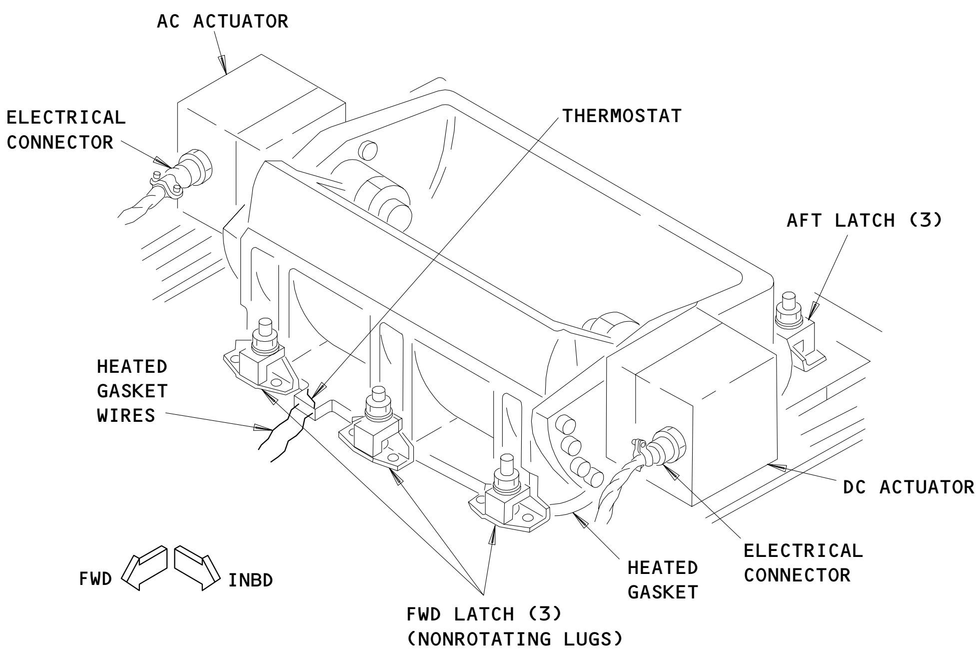
1. General
   A. The gasket sealing the aft outflow valve to the airplane structure contains a heating element, thermostat and overheat fuse to provide heat in this area for cold high altitude flight to prevent the outflow valve freezing closed.
   B. These procedures cover an adjustment test to assure operation of the heated gasket and removal/installation procedure should the heating element fail.
2. Heated Gasket Operation
   A. The outflow valve heated gasket is powered by 115v ac from the P6 circuit breaker panel. Area temperature will be maintained between 40 ±5°F (4.4 ±2.7°C) and 70 ±5°F (21.1 ±2.7°C) by an integral thermostat. An integral fuse will open if the gasket temperature reaches approximately 160°F (71.1°C).
3. Heated Gasket Adjustment/Test
   A. Equipment and Materials
      (1) Means to cool gasket thermostat to approximately 35°F (1.7°C). Ice bag or ground air conditioning unit.
   B. Prepare to test heated gasket
      (1) Pull six PRESSURIZATION CONTROL circuit breakers (P6).

      WARNING: INADVERTENT OPERATION OF THE OUTFLOW VALVE MAY CAUSE SEVERE INJURY TO PERSONNEL.

      (2) Check OUTFLOW VALVE HEATER circuit breaker (P6) is open.
      (3) Provide electrical power (Ref 24-22-00 MP).
   C. Test heated gasket.
      (1) Gain access to AFT OUTFLOW HEATER circuit breaker terminals located on P6-4 panel.
      (2) Check for resistance of 25-45 OHMS at breaker terminal 2.
      (3) If 25-45 OHM resistance exists at circuit breaker terminal 2 perform steps 5 and 6.
      (4) If the 25-45 OHM resistance does not exist at circuit breaker terminal 2, apply cold air or a heat sink (approx 32°F) to the outflow valve gasket thermostat until the resistance reading is obtained. Gasket thermostat location: within rectangular protrusion, where electrical lead wires originate on the outflow valve heater gasket.
      (5) Close AFT OUTFLOW HEATER circuit breaker and allow sufficient time (approx 10 minutes or less) for gasket thermostat to open.
      (6) Open AFT OUTFLOW HEATER circuit breaker and verify that resistance at circuit breaker terminal 2 indicates an open circuit.
      (7) CLOSE AFT OUTFLOW HEATER circuit breaker (P6).

4. Heated Gasket Removal/Installation
   A. Remove cabin pressurization outflow valve (Ref 21-31-11 R/I).
   B. Cut wires securing heated gasket to ship wiring and remove gasket.
   C. Splice lead wires from new heated gasket to ship wiring. Maintain same wire length as original installation.
   D. Install cabin pressurization outflow valve (Ref 21-31-11 R/I).
   E. Perform heated gasket Adjustment/Test.





OUTFLOW VALVE
A

Outflow Valve Heated Gasket
Figure 201

PRESSURE CONTROLLER - REMOVAL/INSTALLATION

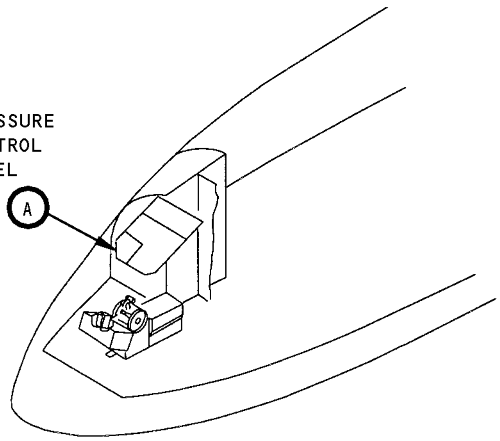
1. General
   A. The pressure controller located on the top shelf of the forward equipment rack in the electronic equipment compartment is no problem to install. However, to properly engage the pressure controller electrically, an extractor-inserter tool is used. Refer to Chapter 20, Electrical/Electronic Black Box - Removal/Installation for proper use of the special tool.
   B. After installation of new controller, check pressurization control system operation per 21-31-0, Pressurization Control System - Maintenance Practices.

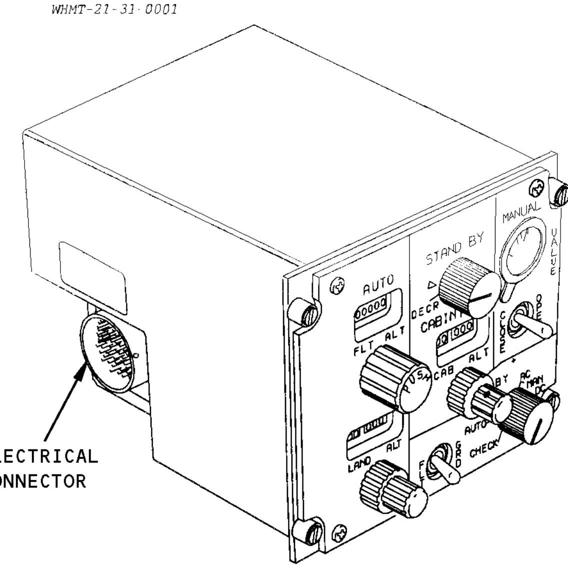
PRESSURE CONTROL PANEL - REMOVAL/INSTALLATION

1. General
   A. The pressure control panel is located on the lower right part of the P5 forward overhead panel in the flight deck.
2. Remove Pressure Control Panel (Fig. 401)
   A. Open these circuit breakers on the P6 panel.
      (1) AUTOMATIC AC and DC
      (2) STBY AC and DC
      (3) MAN AC and DC
   B. Lower the P5 panel to get access to the pressure control panel on the forward overhead panel in the flight deck.
   C. Disconnect the electrical connector.
   D. Loosen the quarter-turn fasteners at the corners of the pressure control panel.

      WARNING: HOLD THE PRESSURE CONTROL PANEL WHEN YOU RELEASE THE FASTENERS. IF THE PANEL FALLS, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN POSSIBLY OCCUR.

   E. Remove the pressure control panel.
3. Install Pressure Control Panel
   A. Lower the P5 panel.
   B. Install the pressure control panel completely into the forward overhead panel.
      (1) Turn the four quarter-turn fasteners to hold the panel.
   C. Connect the electrical connector.
   D. Do the pressurization control system operational test (Ref 21-31-0, MP).



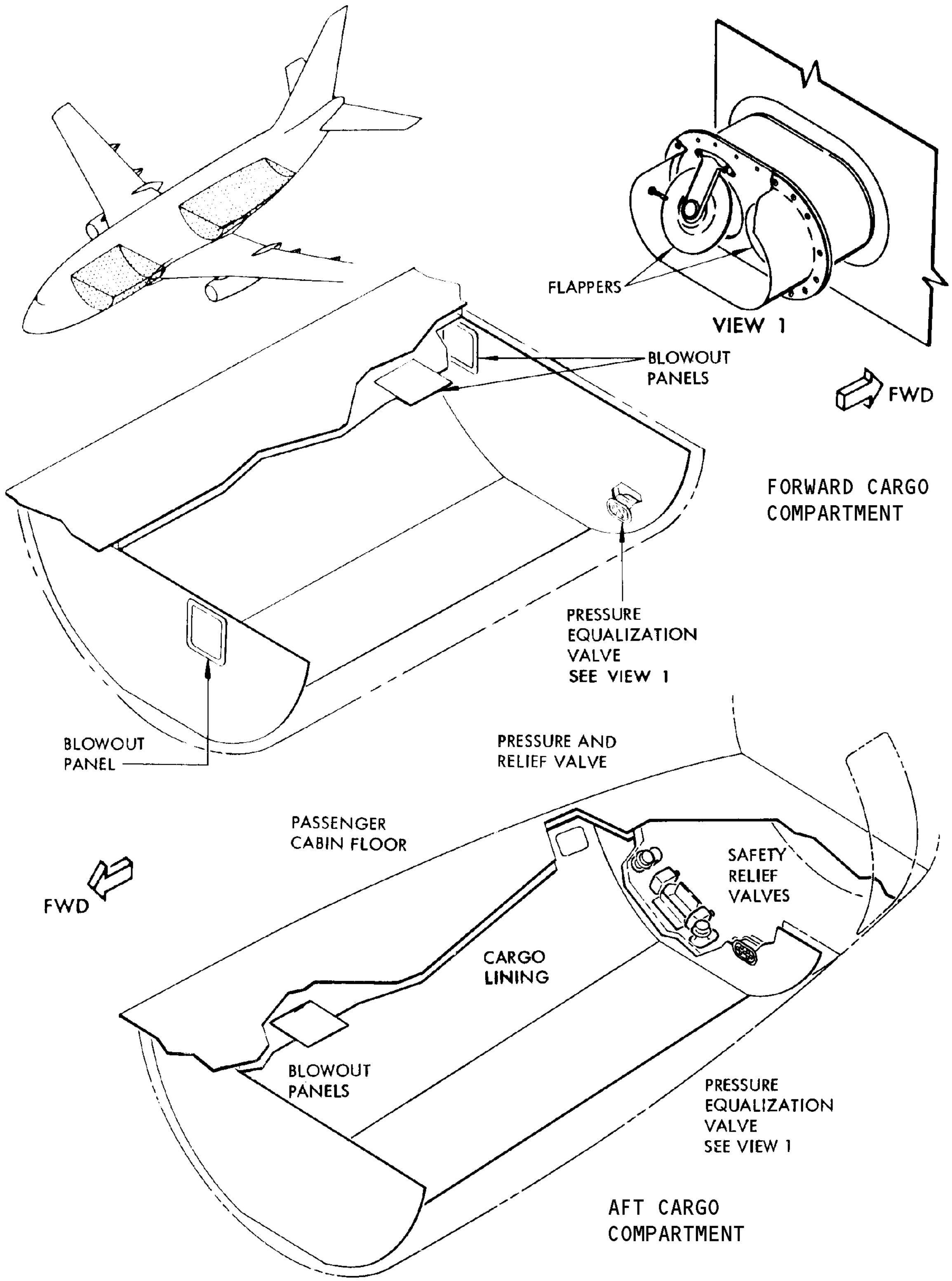


PRESSURE CONTROL PANEL
A

Pressure Control Panel Installation
Figure 401

PRESSURIZATION RELIEF VALVES - DESCRIPTION AND OPERATION

1. General
   A. Pressurization relief valves are installed in the airplane to prevent excessive positive and negative cabin-to-ambient pressure differentials.
   B. Relief valves in the airplane include two safety relief valves, a pressure and relief valve, two pressure equalization valves, and four blowout panels. (See figure 1.)
   C. During normal pressurization, control cabin pressure is maintained for passenger comfort throughout the cabin and cargo compartments. A failed pressure control, rapid changes in pressure of the cabin or cargo compartments, or a requirement for rapidly dropping the airplane altitude could cause damage to airplane components unless there are methods for relieving pressure differential.
   D. The safety relief valves protect against ambient to cabin pressure differential when cabin pressure is above ambient. The pressure and relief valve provides protection from ambient being higher than cabin as might be experienced in a high airplane rate of descent with no air input to the cabin.
   E. A pressure equalization valve in each of the cargo compartments allows pressure in the cargo compartments to vary with changes in cabin pressure although the compartments are isolated from the normal conditioned air ventilation of the cabin.
   F. Blowout panels in the forward bulkhead, aft bulkhead and ceiling of the forward cargo compartment and ceiling of the aft cargo compartment protect the respective structure from extremely fast pressure changes.
2. Safety Relief Valves (Fig. 2)
   A. Two safety relief valves acting independently of each other and all other systems prevent the cabin-to-ambient pressure differential from exceeding 8.5 psi.
   B. Each valve consists of a poppet valve, control chamber, and a spring-loaded diaphragm operated sensor control for controlling the valve opening. The control chamber is vented to the cabin, but has a restrictor in the vent for limiting cabin air inflow. A filter is also installed to prevent contamination in the control chamber. Another passage vents to ambient through the diaphragm operated sensor control poppet.
   C. The sensor control is separated by a diaphragm. One side of the diaphragm senses cabin pressure while the other side senses ambient pressure. A differential pressure of 8.5 psi will cause the poppet to unseat opening a vent from the control chamber to ambient. This venting of the control chamber reduces the pressure within the chamber.



Pressurization Relief Valves Location
Figure 1

D. The valve gate, with control chamber pressure on one side will cause the gate to unseat at approximately 8.5-psi differential pressure as a result of cabin pressure on the other side of the valve gate. The diaphragm operated sensor control ensures that cabin-to-ambient differential pressure does not exceed 8.50 psi.

E. The safety relief valves are installed under the fuselage approximately opposite the aft entry door. One safety relief valve is installed on each side of the outflow valve.

3. <u>Pressure and Relief Valve</u>

A. The pressure and relief valve prevents a negative pressure differential from becoming great enough to damage the airplane during emergency descent with no airplane air input from the air conditioning system. The valve consists of a spring-loaded door which relieves automatically. The valve is located forward and above the upper safety relief valve (Fig. 1).

4. <u>Pressure Equalization Valves</u>

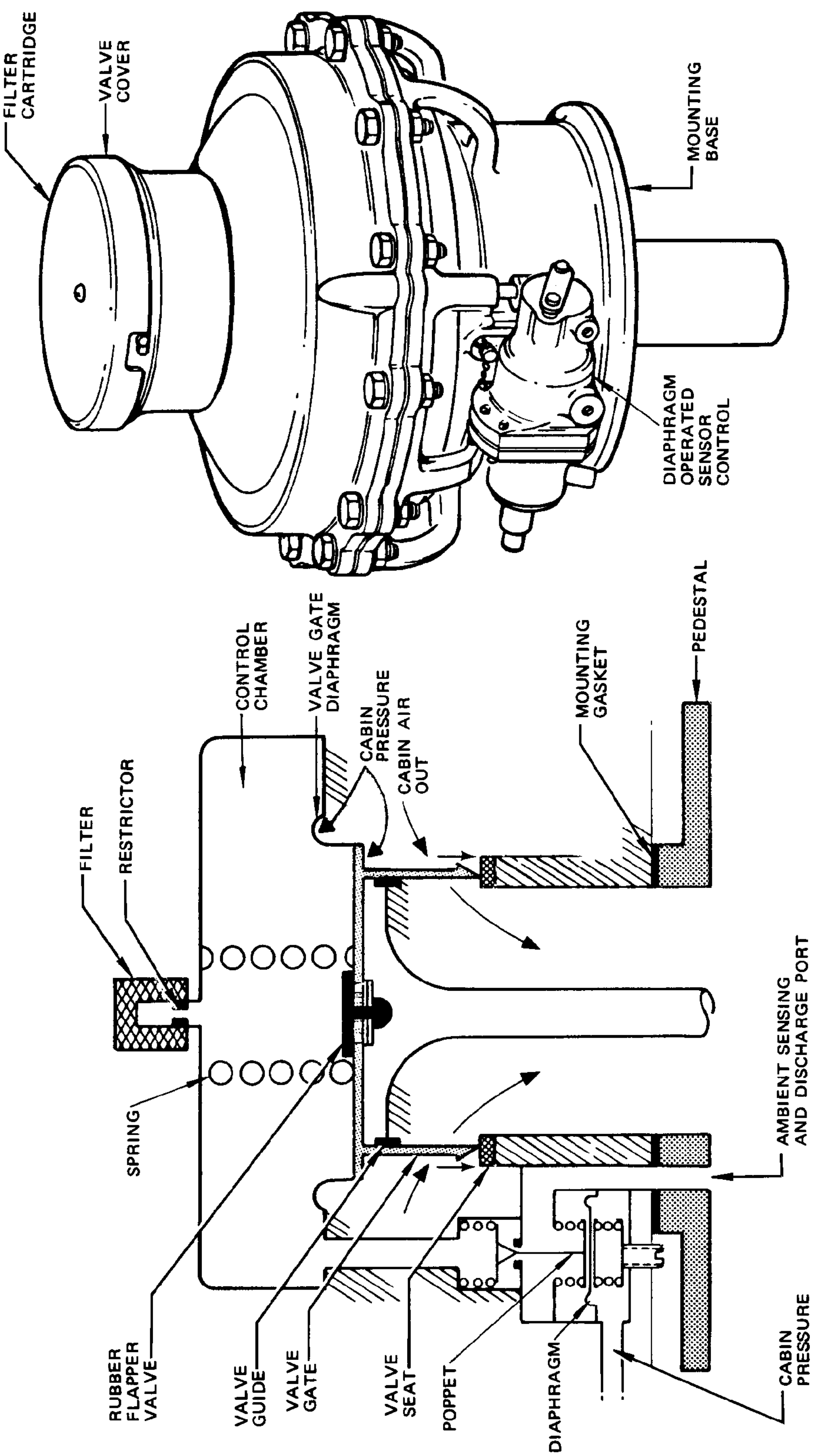
A. An equalization valve is provided at the aft bulkhead of each cargo compartment. (See figure 1.) These valves keep the pressure in the cargo compartments and the cavities surrounding them at approximately the same pressure should the cabin pressure vary.

B. Each equalization valve contains two valve flappers. One flapper hinges away from the cargo compartment and the other hinges toward the cargo compartment. Each valve is accessible from within the cargo compartment where it is installed.

5. <u>Blowout Panels</u>

A. Three blowout panels are located in the forward cargo compartment and one is located in the aft cargo compartment. These panels are designed to maintain isolation of the cargo compartments during normal service but will blow out to protect structure at a differential pressure of approximately 1 psi.

B. In the forward cargo compartment one blowout panel is located in the forward bulkhead, another is in the aft bulkhead, and the third is located in the ceiling lining. The blowout panel in the aft cargo compartment is located in the ceiling lining. (See figure 1.)



Safety Relief Valve Schematic
Figure 2

PRESSURE AND RELIEF VALVE - REMOVAL/INSTALLATION

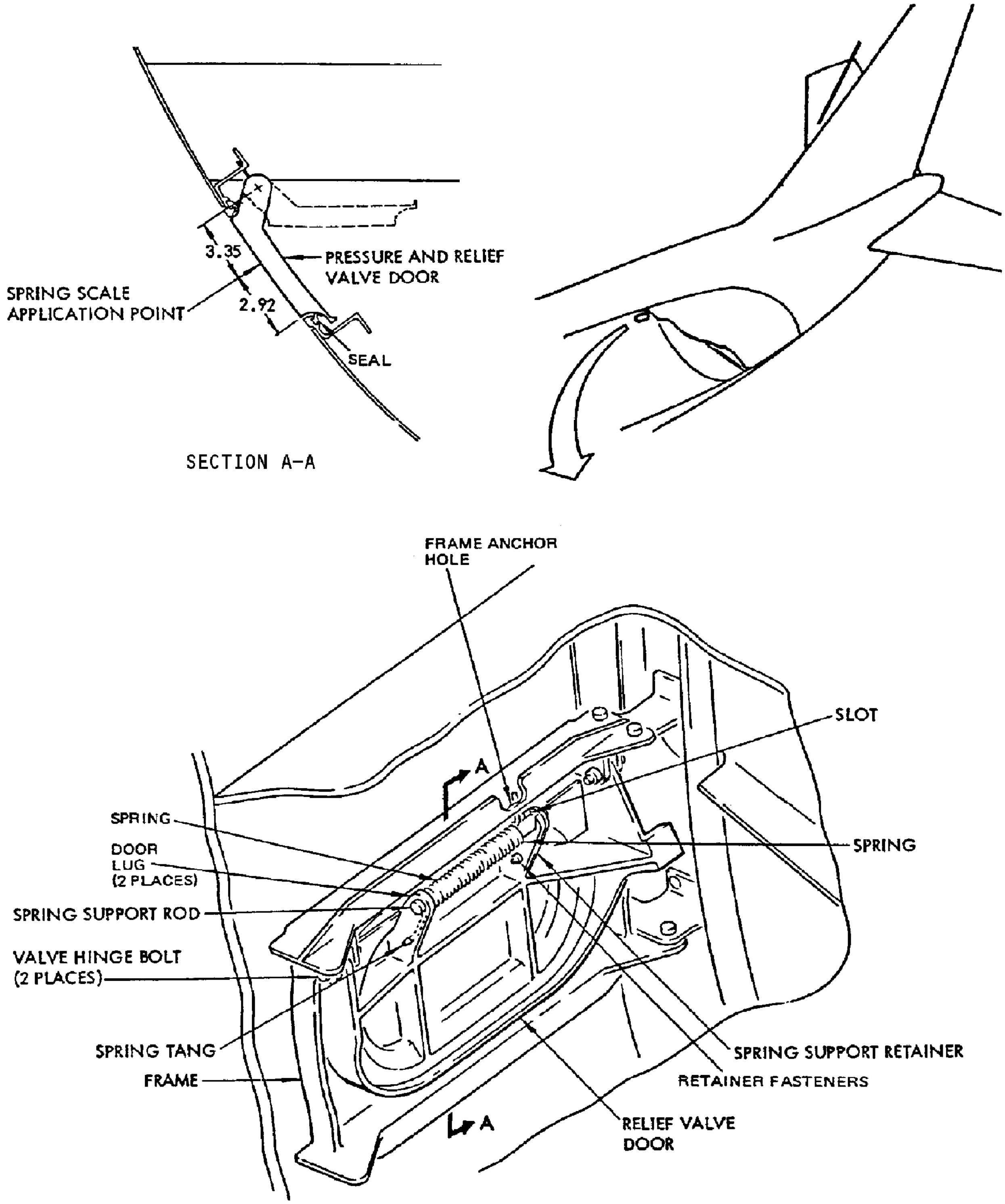
1. General
   A. The pressure and relief valve is a spring-loaded flapper valve which opens when ambient pressure exceeds cabin pressure.
2. Equipment and Materials
   A. Spring scale - push type
   B. Deleted
3. Remove Valve (Fig. 401)
   A. Remove right panel from aft cargo compartment aft bulkhead.
   B. Remove valve hinge bolts.
   C. Disengage spring from frame anchor hole and remove valve door from frame.

      NOTE: Spring should not be allowed to snap out of frame anchor hole. Restrain spring and lower to rest against valve door.

   D. Remove fasteners holding spring support retainer and remove retainer.
   E. Hold spring securely, remove spring support rod, disengage spring from valve door anchor hole, and allow spring to unwind.

      NOTE: Spring will unwind approximately 360 degrees.

4. Install Valve (Fig. 401)
   A. Slide spring on spring support rod.
   B. Insert spring tang through small hole in door lug and insert end of support rod in large hole of same door lug.
   C. Wind spring approximately 360 degrees, insert free end of support rod in slot, and allow other end of spring to rest against valve door edge.
   D. Place spring support retainer in position and secure fasteners.
   E. Check condition of seal in frame and replace if damaged.
   F. Install relief valve door in valve frame.
      (1) Position valve door in valve frame and engage end of spring in frame anchor hole.
      (2) Install hinge bolts.
      (3) Deleted.
   G. Test Valve
      (1) Position spring scale against outside of valve door.
      (2) Check that 4 to 8 pounds is required to crack door open.
      (3) Open door to full open. Door must open smoothly.
      (4) Check that 8 to 10.5 pounds is required to hold door full open (80 degrees).
   H. Install cargo compartment aft bulkhead panel.



Pressure and Relief Valve Installation
Figure 401

SAFETY RELIEF VALVE - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Parting Agent - Fluorocarbon MS122 (Ref 20-30-51)
2. Remove Safety Relief Valve (Fig. 401)
   A. Gain access to safety relief valves by removing right panel of aft cargo compartment aft bulkhead.
   B. Loosen clamp around base of valve being removed and slip clamp down onto pedestal.
   C. Remove safety relief valve and gasket.
3. Install Safety Relief Valve (Fig. 401)
   A. Apply parting agent to both sides of gasket and position gasket on pedestal.

      CAUTION: MAKE SURE AMBIENT SENSE PASSAGE IS NOT BLOCKED BY GASKET. BLOCKING THE PASSAGE WILL PREVENT VALVE OPERATION.

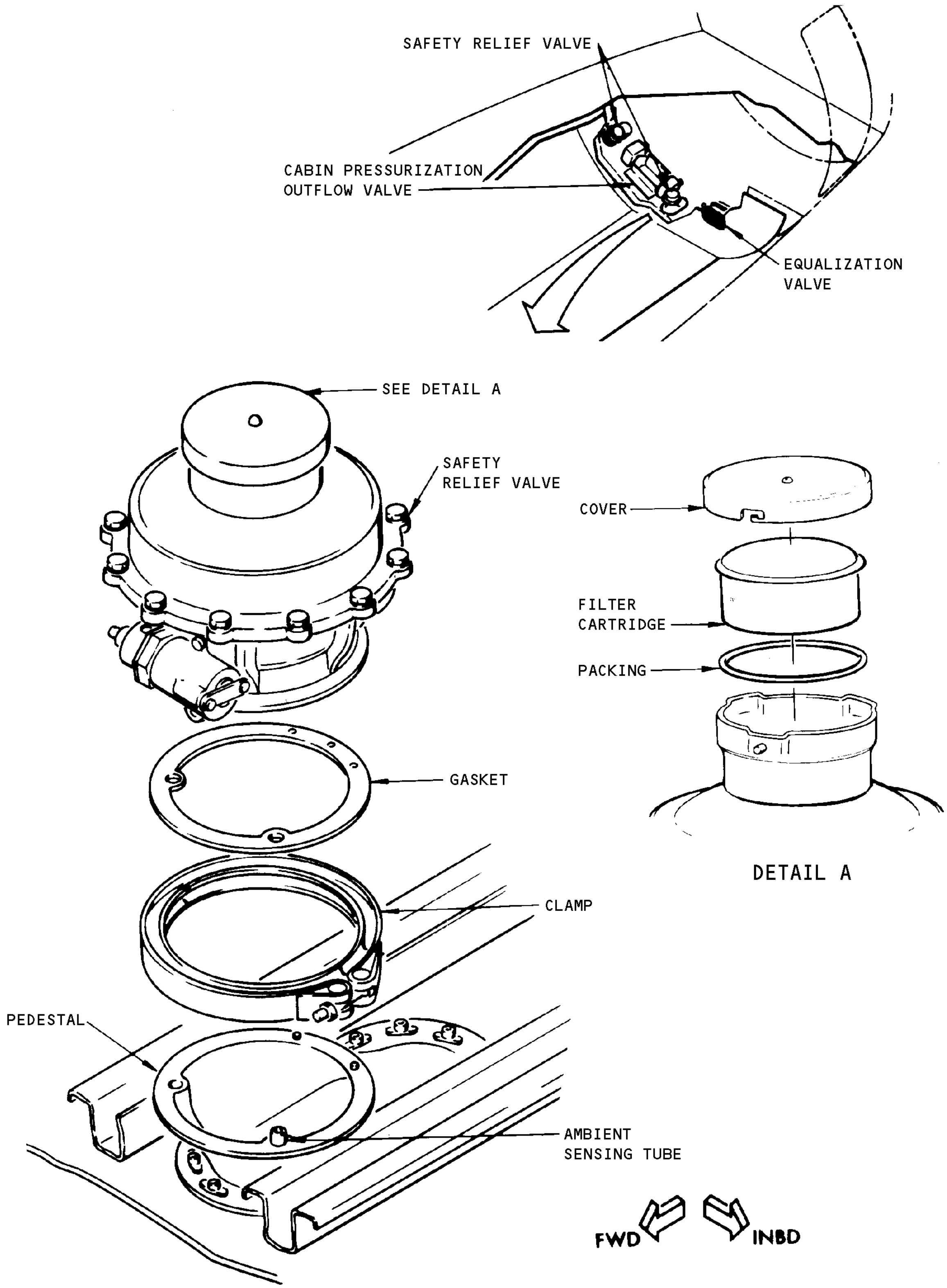
   B. Check sensing passage through pedestal and into relief valve for any loose dirt or other obstruction and position valve on pedestal.

      CAUTION: USE CARE IN POSITIONING VALVE ON PEDESTAL TO AVOID DAMAGE TO SENSING TUBE.

   C. Position clamp around top of pedestal and base of valve and tighten clamp bolt.
   D. Test safety relief valve (Ref Adjustment/Test).

      NOTE: The Adjustment/Test procedure may be omitted if a new or overhauled valve is installed.

   E. Install panel in rear wall of aft cargo compartment.



Safety Relief Valve Installation
Figure 401

SAFETY RELIEF VALVE - ADJUSTMENT/TEST

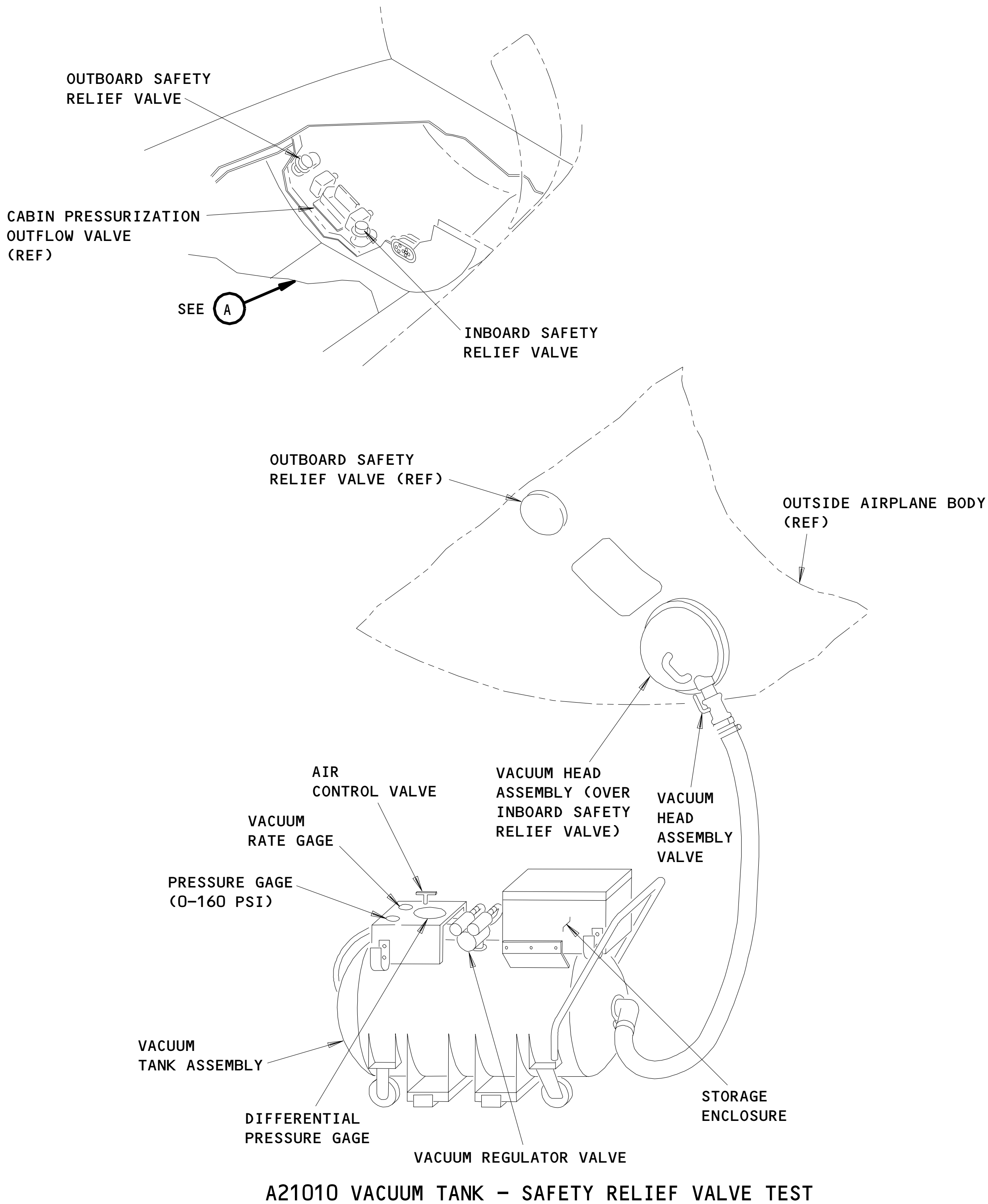
1. Safety Relief Valve Test
   A. General
      (1) Ground testing of the safety relief valve consists of reducing pressure at the valve sensing port to simulate low ambient pressure.
      (2) The test may be performed using either of two test fixtures. Both methods are covered in this procedure.
2. Test Safety Relief Valve Using Hamilton Standard Test Fixture
   A. Equipment and Materials
      (1) Valve Test Fixture - GS15047, Hamilton Standard
      (2) Air source
   B. Test Safety Relief Valve
      (1) Set pressure regulator on valve test fixture so that pressure regulator valve is closed.
      (2) Connect air source to pressure regulator on valve test fixture.
      (3) Position valve test fixture over safety relief valve on fuselage with test fixture locating crossbar forward of safety relief valve deflector tube. Hold fixture in position until vacuum is initiated.

         NOTE: Valve test fixture is positioned as far forward as possible to ensure that safety relief valve ambient sense port is clear of test fixture gasket.

      (4) Turn air pressure regulator on valve test fixture to start flow of air.
      (5) Monitor vacuum gage on valve test fixture and adjust air pressure regulator so that vacuum increases 4.5 in. Hg/min near relief point. Support valve test fixture to prevent it from dropping when safety relief valve opens (between 16.8 and 17.8 in. Hg).

         CAUTION: FAILURE TO SUPPORT FIXTURE WILL ALLOW FIXTURE TO DROP FROM FUSELAGE AT VALVE OPENING POINT AND CAUSE DAMAGE.

      (6) Note vacuum gage reading when safety relief valve opens. Valve should open between 16.8 and 17.8 in. Hg.
      (7) Set pressure regulator on valve test fixture so that regulator valve is closed.
      (8) Remove valve test fixture from airplane and disconnect air source.
      (9) Repeat test for other safety relief valve.
3. Test Safety Relief Valve Using Boeing Test Equipment (Fig. 501)
   A. Equipment and Materials
      (1) A21010-( ), Vacuum Tank - Safety Relief Valve Test
      (2) Shop Air Source (capable of 60-80 psi)



Safety Relief Valve Test
Figure 501

B. Test Safety Relief Valve

(1) Connect the air source to the quick-disconnect air connection on the vacuum tank assembly.

(2) Make sure the vacuum regulator valve is turned fully clockwise.

(3) Adjust the air control valve until the indication on the pressure gage is 70 ±10 psi.

(4) Make sure that the vacuum head assembly valve is closed.

(5) Adjust the vacuum regulator valve until the differential pressure is approximately 2.0 psi.

NOTE: Turn the vacuum regulator valve counterclockwise to increase the vacuum (differential pressure). The arrow on the vacuum regulator valve indicates an increase of pressure, not vacuum.

(6) Put the vacuum head assembly over the safety relief valve and open the vacuum head assembly valve.

CAUTION: HOLD THE VACUUM HEAD ASSEMBLY AGAINST THE AIRPLANE BODY DURING THE TEST. WHEN A VACUUM IS NOT PRESENT, THE VACUUM HEAD ASSEMBLY CAN FALL TO THE GROUND AND DAMAGE CAN OCCUR.

(7) Adjust the vacuum regulator valve until the safety relief valve opens such that the indication on the vacuum rate gage is not more than 2.4 psi/minute.

NOTE: When the indication on the differential pressure gage stops to increase and then starts to decrease, the safety relief valve has opened.

(8) Make sure that the safety relief valve opens at a differential pressure of 8.25 to 8.74 psi.

NOTE: After the safety relief valve opens, the differential pressure decreases below 8.25 psi and then starts to increase.

(9) If the safety relief valve opens at a differential pressure that is too high, make sure that there are no leaks at the tubing connections on the vacuum tank assembly.

(10) Adjust the vacuum regulator valve to decrease the indication on the differential pressure gage to 2.0 psi.

<u>CAUTION</u>: DO NOT DECREASE THE DIFFERENTIAL PRESSURE AT A RATE GREATER THAN 4.0 PSI/MINUTE AS SHOWN ON THE VACUUM RATE GAGE. DAMAGE TO THE SAFETY RELIEF VALVE CAN OCCUR IF THE DIFFERENTIAL PRESSURE IS DECREASED TOO QUICKLY.

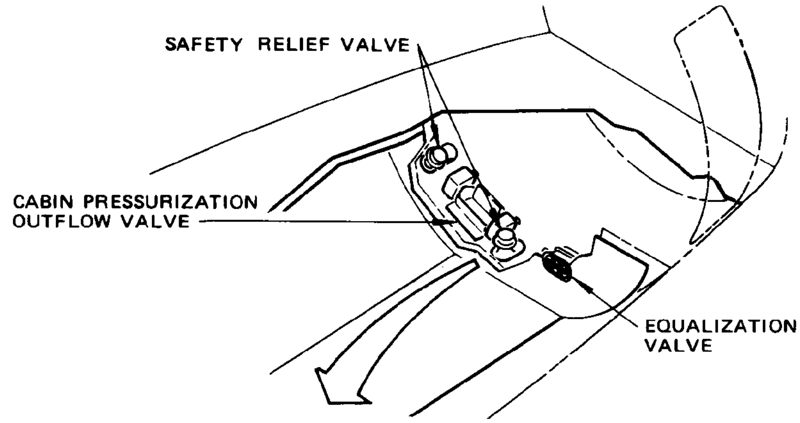
(11) Close the vacuum head assembly valve.
(12) Turn the vacuum regulator valve fully clockwise to decrease the differential pressure to zero psi.
(13) Close the air control valve.
(14) Remove the test equipment from the airplane.
(15) Do the test again for the other safety relief valve.

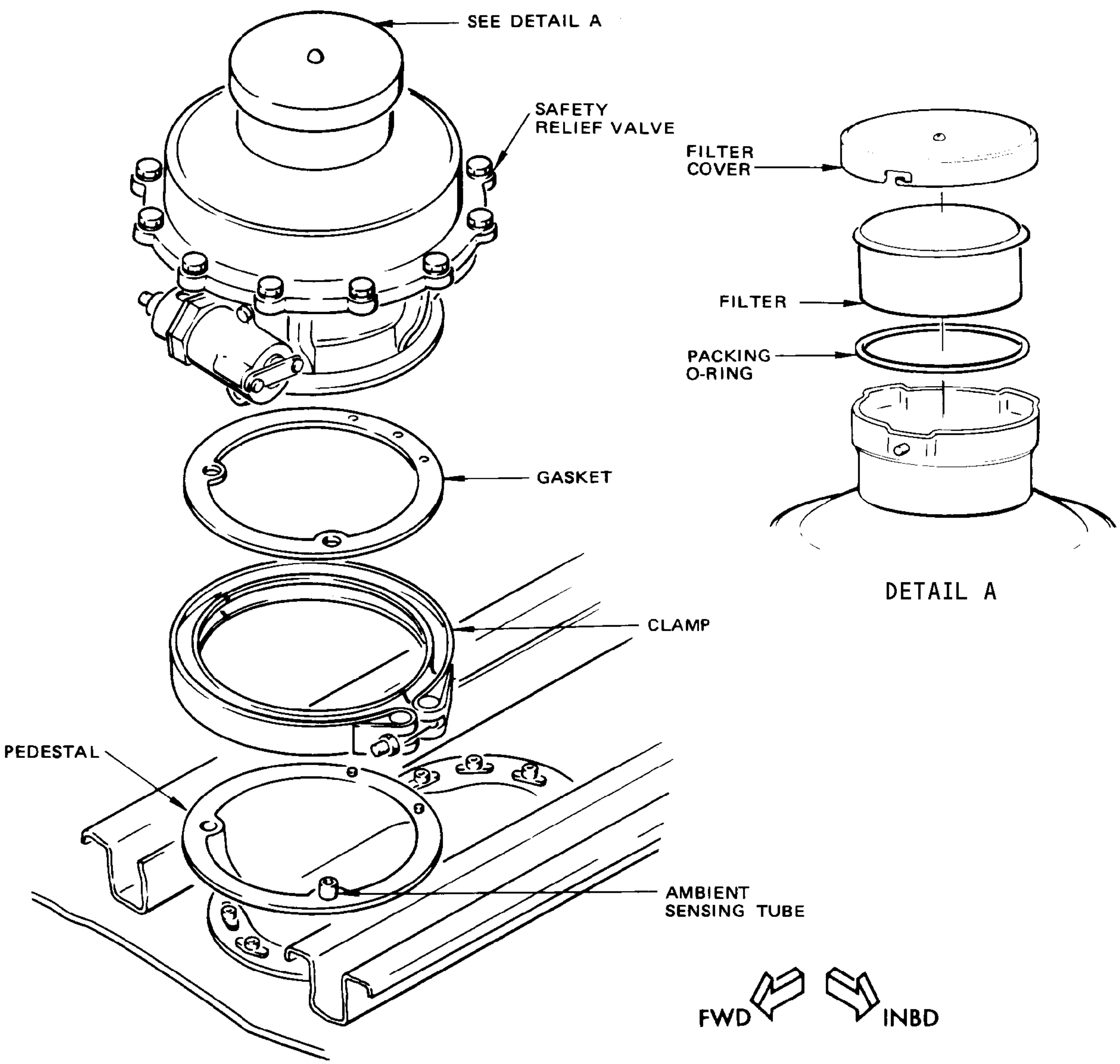
SAFETY RELIEF VALVE FILTER - REMOVAL/INSTALLATION

1. General
   A. The safety relief valve filter is a throw-away type filter which prevents contamination of relief valve control chamber from passenger cabin exhaust air.
2. Remove Safety Relief Valve Filter (Fig. 401)
   A. Remove right panel of aft cargo compartment aft bulkhead.
   B. Press down on filter cover, rotate cover counterclockwise and remove cover.
   C. Remove filter and packing.
3. Install Safety Relief Valve Filter
   A. Check condition of filter cavity and clean if necessary.
      (1) If necessary, clean filter cavity with soft, lint-free cloth moistened with trichloroethylene then wipe dry with clean lint-free cloth.

      CAUTION: DO NOT PLUG ORIFICE IN CENTER OF FILTER CAVITY.

   B. Install packing on filter and insert filter into filter cavity.
   C. Position cover, then install by pressing cover down and rotating it clockwise.
   D. Test safety relief valve (Ref Safety Relief Valve - Adjustment/Test).
   E. Install aft cargo compartment aft bulkhead lower center panel.





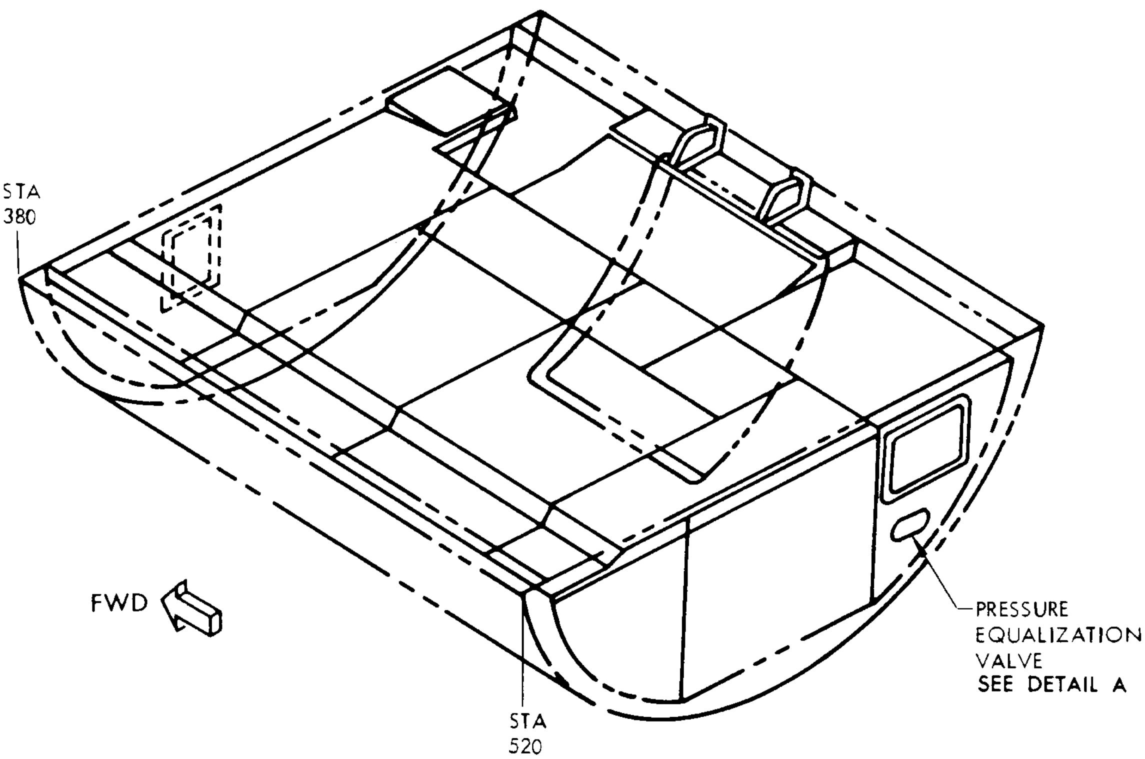
Safety Relief Valve Installation
Figure 401

PRESSURE EQUALIZATION VALVES - REMOVAL/INSTALLATION

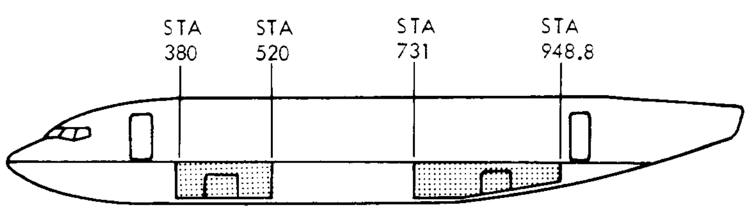
1. General
   A. A pressure equalization valve is installed in the aft bulkhead of each cargo compartment. The valves are identical and the following removal and installation procedures are written to apply to both valves, taking into account the relevant differences in the procedures for each.
   B. In the forward cargo compartment the pressure equalization valve is installed on the right-hand aft bulkhead panel and is removed from this panel after the panel is removed. In the aft cargo compartment, removal of the aft bulkhead center access panel gives access to attachment hardware of the pressure equalization valve which is mounted on left-hand bulkhead panel.
2. Remove Cargo Compartment Pressure Equalization Valve (Fig. 401)
   A. Remove bulkhead panels as follows:
      (1) In forward cargo compartment, disengage quick-release fasteners around periphery of right-hand aft bulkhead panel and remove panel complete with pressure equalization valve.
      (2) In aft cargo compartment, remove aft bulkhead center access panel by disengaging quick-release fasteners around periphery of panel.
   B. Remove screws attaching bulkhead grille and remove grille.
   C. Remove screws retaining valve to bulkhead panel.
   D. Remove valve from bulkhead panel.
3. Install Cargo Compartment Pressure Equalization Valves (See figure 401.)
   A. Check that seals are bonded to panel assembly. Replace if necessary. (Seals are bonded to panel assembly only.)
   B. Position valve on aft side of bulkhead panel and spacer ring on the forward side and install screws, washers and nuts (11 places).
   C. Position bulkhead grille on forward side of bulkhead panel and install screws (11 places).

      NOTE: Check that gasket is bonded to grille.

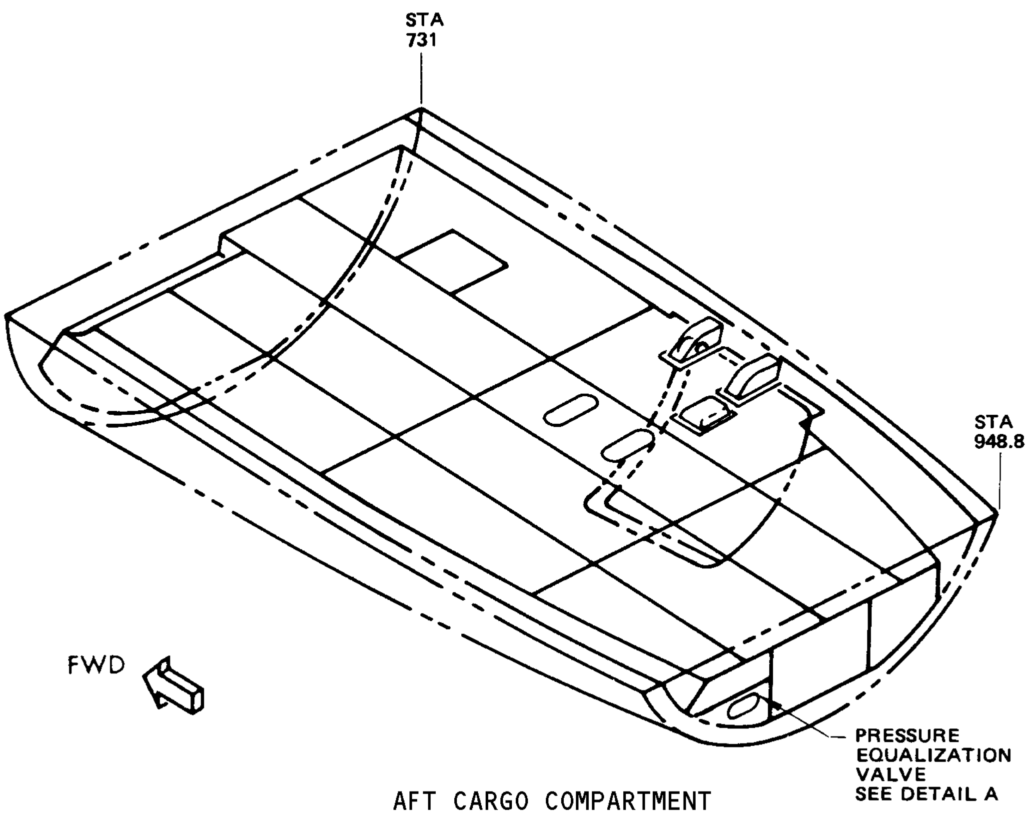
   D. Install bulkhead panels as follows:
      (1) In forward cargo compartment position right-hand aft bulkhead panel, complete with pressure equalization valve, and engage quick-release fasteners around periphery of panel.
      (2) In aft cargo compartment position center bulkhead access panel and engage quick-release fasteners around periphery of panel.

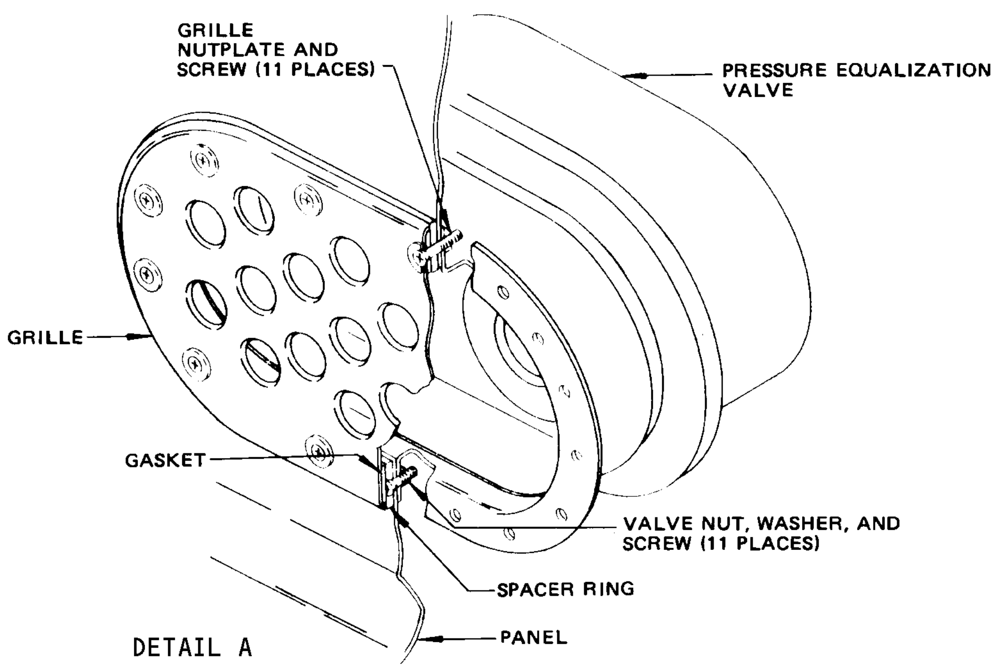


FORWARD CARGO COMPARTMENT



Pressure Equalization Valves Installation
Figure 401 (Sheet 1)





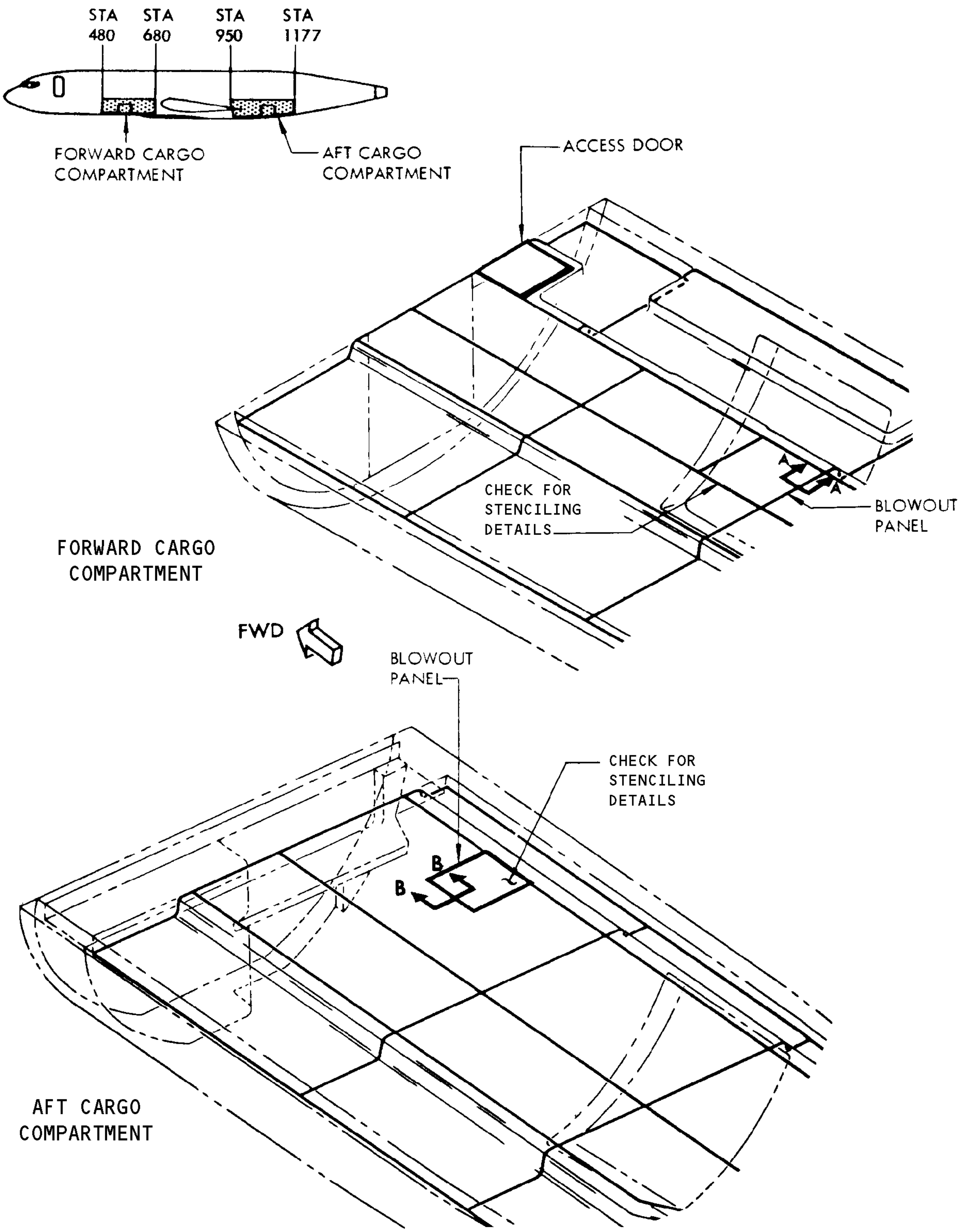
Pressure Equalization Valves Installation
Figure 401 (Sheet 2)

CEILING BLOWOUT PANELS - REMOVAL/INSTALLATION

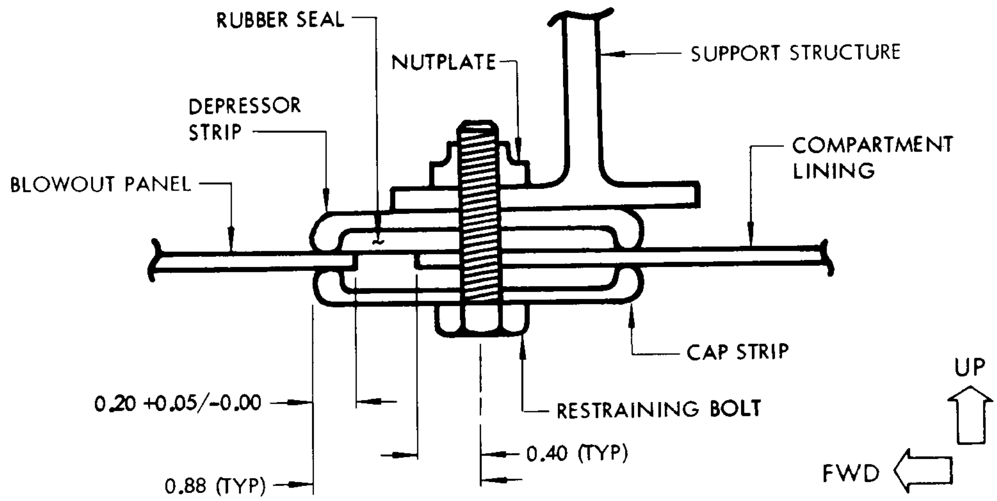
1. General
   A. One blowout panel is provided in the ceiling of each cargo compartment. Each blowout panel has the words, "Controlled Pressure Relief Panel," stenciled on the surface facing into the cargo compartment.
   B. The removal/installation of each blowout panel is similar; therefore both blowout panels will be covered by the same procedure. Access for maintenance is from inside the cargo compartment.
2. Remove Cargo Compartment Ceiling Blowout Panel
   A. Remove cap strips where length of cap strip approximates the matching blowout panel dimension. It is not necessary to completely remove cap strips when they are long. The long cap strips may be loosened in the area of the blowout panel to allow panel removal. (See figure 401.)

      NOTE: To facilitate reinstalling blowout panel, mark edge of the cap strip on blowout panel on all sides. When installing blowout panel these lines will aid positioning blowout panel at correct edge engagement with the cap strip.

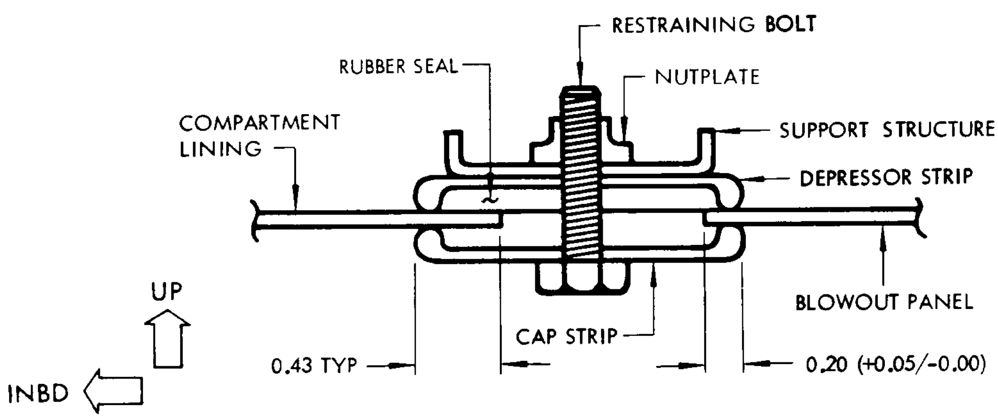
   B. Remove blowout panel from ceiling.
3. Install Cargo Compartment Ceiling Blowout Panel
   A. If a blowout panel is damaged and must be replaced and a new blowout panel is not available, a new blowout panel may be fabricated as follows:
      (1) Use same material or equivalent as existing panel.
      (2) Cut material to approximate size; leave blowout panel slightly oversized.
      (3) Position blowout panel in opening. Install cap strip and tighten bolts only enough to engage cap strips.
      (4) Mark the edge of the cap strips on the blowout panel. Remove cap strips.
      (5) Draw a line between 0.20 and 0.25 inch out from the original line. Trim off excess material.
   B. Check that the following is stenciled on the blowout panels:
      (1) On the upper side of the aft compartment blowout panel only: "PUSH DOWN FOR EMERGENCY ACCESS TO CARGO COMPARTMENT."



Cargo Compartment Ceiling Blowout Panel Installation
Figure 401 (Sheet 1)



SECTION A-A



SECTION B-B

Cargo Compartment Ceiling Blowout Panel Installation
Figure 401 (Sheet 2)

(2) On the lower side:
"CONTROLLED PRESSURE RELIEF PANEL"
"ENGAGE EDGES BETWEEN 0.20 AND 0.25 INCHES AND TIGHTEN RESTRAINING BOLTS 20 TO 25 POUND-INCHES TORQUE"

C. Place blowout panel in mounting position against depressor strip. Check that blowout panel is correctly positioned so stenciling is on the correct side. (See figure 401.)

D. Install cap strips, but do not tighten.

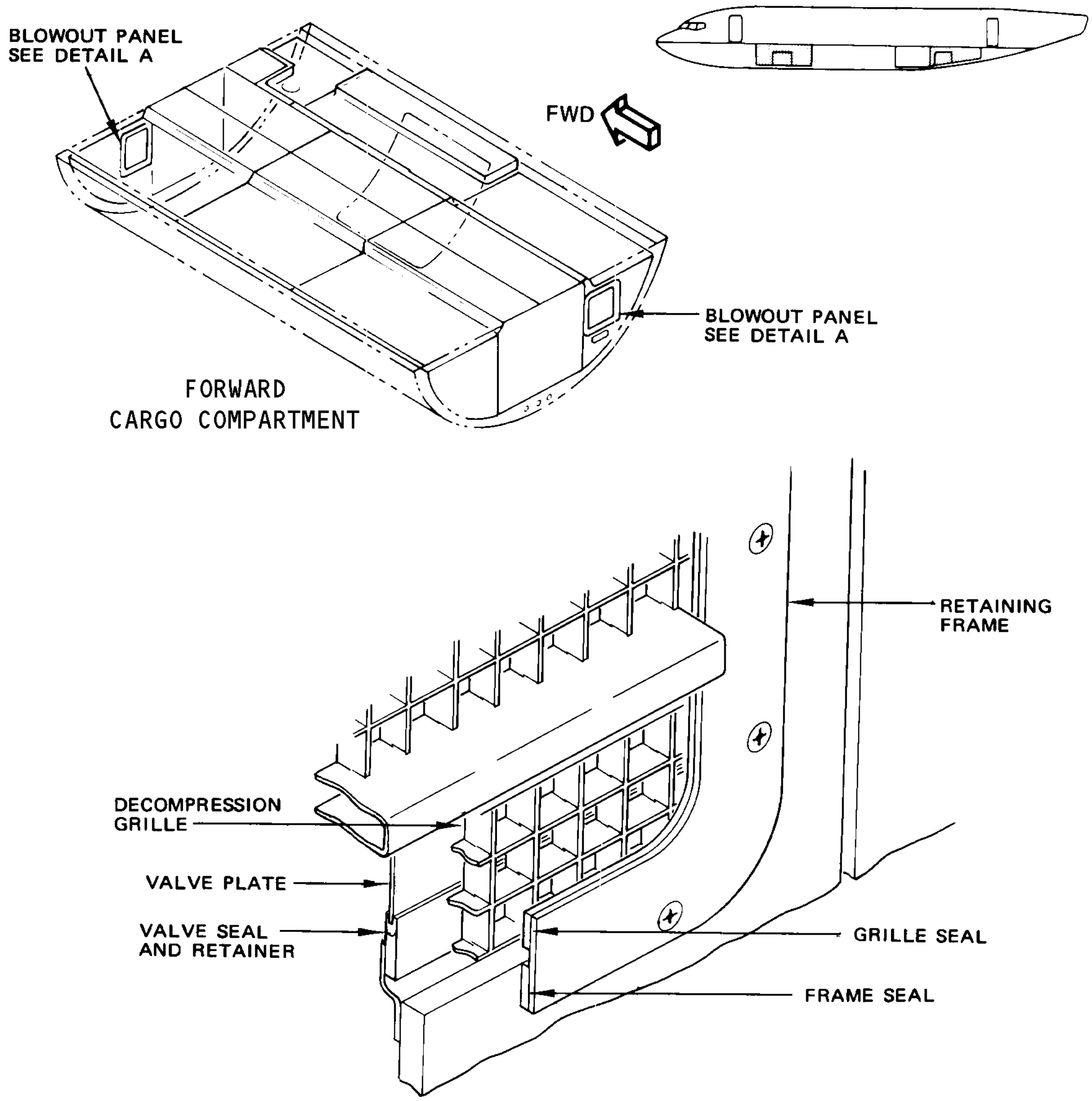
E. If blowout panel was marked during removal, position blowout panel so that lines previously drawn, line up with the edge of the cap strips.

F. Check that blowout panel edge engagement with cap strip is between 0.20 and 0.25 inch. Tighten restraining bolts to 20 to 25 pound-inches torque.

CAUTION: TO ENSURE CORRECT BLOWOUT FUNCTION OF PANEL, CORRECT EDGE ENGAGEMENT AND TIGHTENING OF RESTRAINING BOLTS ARE MOST IMPORTANT.

BULKHEAD BLOWOUT PANELS - REMOVAL/INSTALLATION

1. Remove Panel (Fig. 401)
   A. Remove screws from retaining frame and remove frame.
   B. Remove decompression grille.
   C. Remove valve plate, seal and retainer.
2. Install Panel (Fig. 401)
   A. Position valve plate and seal in opening. Check that valve plate is properly seated in the seal.
   B. Position decompression grille in front of the valve plate.
   C. Position retaining frame over grille and valve plate and install screws.



Bulkhead Blowout Panel Installation
Figure 401

PRESSURIZATION INDICATION AND WARNING - DESCRIPTION AND OPERATION

1. General
   A. The pressurization indication and warning system, which consists of lights, indicators and a cabin altitude warning system, permits monitoring of the cabin pressurization control system during its operation and provides aural and visual warning in case of pressurization system malfunction (Ref 21-31-0, Description and Operation).
   B. The following indicator lights are installed on the forward overhead panel and obtain power through 28 v dc Bus No. 1.
      (1) The AUTO FAIL light indicates an automatic transfer from the automatic pressurization control mode.
      (2) The OFF SCHED DESCENT indicates the airplane is descending prior to obtaining the flight altitude as selected by the FLT ALT selector when operating in the AUTO mode.
      (3) The STANDBY light indicates that the pressurization control system is operating in the standby mode.
      (4) The MANUAL light indicates that the pressurization control system is operating in the manual mode.
   C. The outflow valve position indicator is installed on the forward overhead panel and is powered from the precision 20-volt supply in the pressure controller.
   D. The cabin altimeter and differential pressure indicator are combined in one instrument on the forward overhead panel, and powered directly by differential pressure. The altimeter and differential pressure indicator registers cabin altitude and pressure difference between cabin and ambient.
   E. The cabin rate of climb indicator is installed on the forward overhead panel and powered directly by differential pressure. The indicator registers rate of pressure change in the cabin.
   F. The cabin altitude warning system is activated by a pressure switch which is connected to the aural warning devices box (Ref 31-26-0). The system provides an intermittent sound signal when cabin altitude exceeds approximately 10,000 feet.
2. Operation
   A. The pressurization control system is normally operated in the automatic mode. Any change in the operating mode causes illumination of one or more lights on the forward overhead panel. The operating mode may be selected by positioning the selector switch. The STANDBY or MANUAL lights will illuminate as applicable. A loss of power during operation in the AUTO or STANDBY mode may cause illumination of the AUTO FAIL light. An automatic transfer from automatic to standby mode causes illumination of the AUTO FAIL and STANDBY lights. The AUTO FAIL light will go out if the selector is switched to STBY.

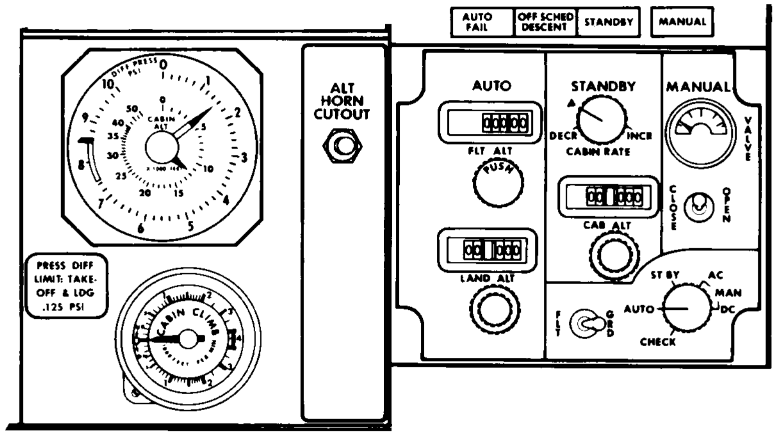
B. With the pressurization control in AUTO, the flight altitude selected corresponds to the cruising altitude of the airplane. The OFF SCHED DESCENT light will illuminate if the airplane starts to descend prior to coming within .25 PSI of the pressure selected by the FLT ALT selector.

C. There is an outflow VALVE position indicator below the MANUAL light on the pressurization control panel. During manual mode operation the outflow valve is positioned manually with the toggle switch.

D. The cabin altimeter and differential pressure indicator are combined in one instrument on the pressurization control panel. The cabin altimeter senses cabin pressure and displays equivalent altitude in FEET. The other scale indicates pressure differential from cabin to ambient in PSI.

E. The rate of cabin altitude change is indicated on the CLIMB indicator, and is applicable to airplane ascent or descent. The CLIMB indicator senses rate of cabin pressure change and therefore reads differently at different cabin altitudes for the same pressure change. For example, a change of 500 sea level feet per minute would read approximately 725 ft/min at a cabin altitude of 10,000 feet.

F. The aural warning system provides an intermittent horn signal if cabin altitude exceeds approximately 10,000 feet during flight (Ref 31-26-0, Aural Warning and Call Devices). The ALTITUDE HORN CUTOUT switch may be used to stop the sound signal.



Pressurization Panel
Figure 1

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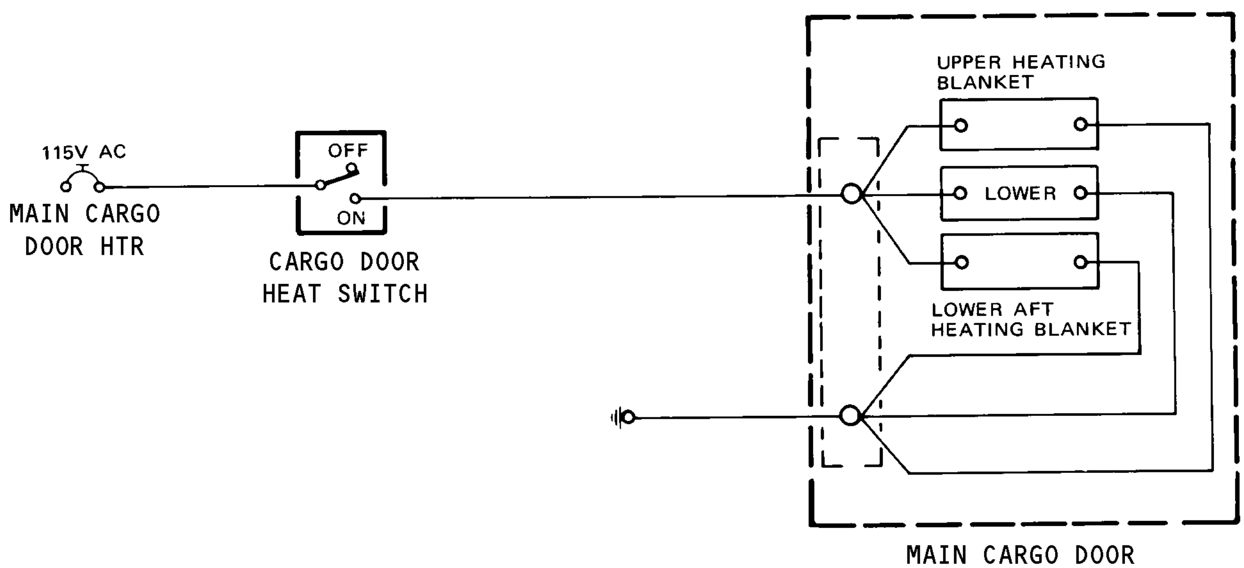
HEATING - DESCRIPTION AND OPERATION

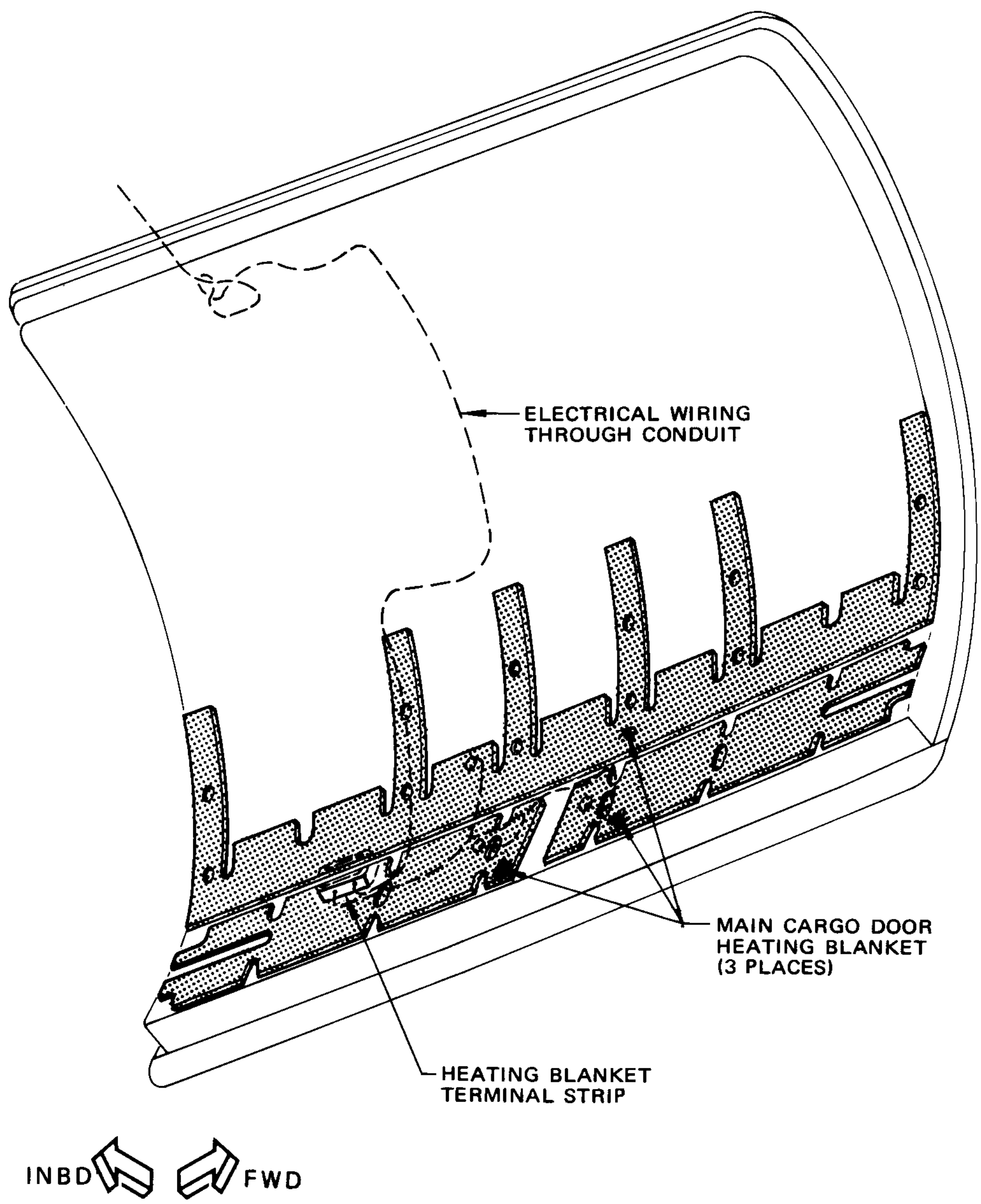
1. General
   A. Heating includes that portion of the air conditioning system which supplies heated air to the passenger cabin and cargo compartments. Heating is accomplished by use of conditioned airflow and distribution ducting, and on Passenger/Cargo Convertible Airplanes, heating blankets.
   B. Cabin heating is accomplished by conditioned air distribution. The overhead distribution duct provides heat to the cabin. On Passenger/Cargo Convertible Airplanes, electric heating blankets are installed in the main cargo door to provide heating in the door area (Ref 21-41-0, Passenger Cabin Heating).
   C. Cargo compartment heating is accomplished by exhausting passenger cabin air around the compartment walls (Ref 21-43-0, Cargo Compartment Heating).

PASSENGER CABIN HEATING - DESCRIPTION AND OPERATION

1. General
   A. Heating of the passenger cabin does not exist as a specific heating system. Whether heating or cooling is required is determined by the temperature control system, 21-61-0, which either lowers or raises the temperature of the cabin by mixing air from the air cycle system with hot air bypassing the air cycle system. Refer to Cooling, 21-50-0.
   B. Maintaining a relatively consistent temperature throughout the passenger cabin is accomplished through the passenger cabin air distribution system. Conditioned air enters the passenger cabin from a slotted spaced nozzle in the overhead distribution duct, which gives proper air circulation throughout the cabin. Refer to Conditioned Air Distribution System, 21-23-0.
   C. On Passenger/Cargo Convertible Airplanes, electric heating blankets are installed in main cargo door area to provide warmth in the door area.
2. Main Cargo Door Heating Blankets
   A. On Passenger/Cargo Convertible Airplanes, three electric heating blankets are installed in the main cargo door behind the lining to maintain warm the in the cargo door area. The cargo door is lined and insulated so that it appears similar to the rest of the passenger cabin interior sidewall. Refer to Main Cargo Door Lining and Insulation, Chapter 52.
   B. The main cargo door heating blankets consist of an upper main door heater blanket, lower door heater blanket, and lower aft door heater blanket. (Fig. 2) The heating blankets receive power from the MAIN CARGO DOOR HTR circuit breaker on panel P6 through the CARGO DOOR HEAT switch located on the aft attendant's panel. (Fig. 1)



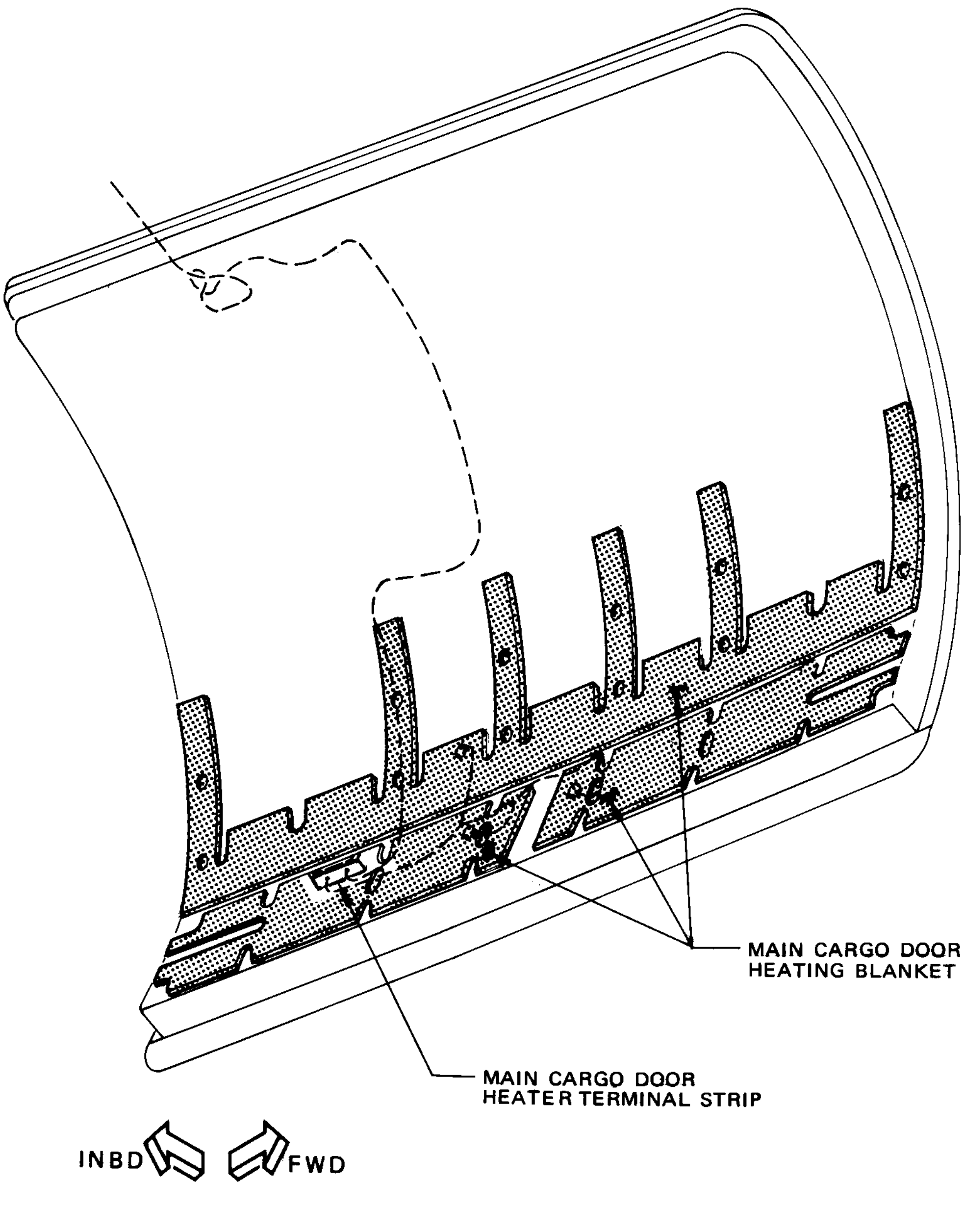
Main Cargo Door Heating Blanket Control Circuit
Figure 1



Main Cargo Door Heating Blankets
Figure 2

MAIN CARGO DOOR HEATING BLANKET - REMOVAL/INSTALLATION

1. Remove Main Cargo Door Heating Blanket
   A. Open MAIN CARGO DOOR HEATER circuit breaker on 115 volt ac bus No. 2 circuit breaker panel P6.
   B. Remove main cargo door lining. (See Main Cargo Door Lining - Removal/Installation, Chapter 52.)
   C. Remove fasteners that attach heating blanket to door frame. (See figure 401.)
   D. Remove two fiberglass insulation panels from the lower aft portion of the door. (See Main Cargo Door Insulation - Removal/Installation, Chapter 52.)
   E. Disconnect and mark electrical wires in main cargo door heater terminal strip located on the aft portion of stringer No. 14 of the cargo door.
   F. Disengage electrical wire fasteners and pull wires through holes on door frame.
2. Install Main Cargo Door Heating Blanket
   A. Insert electrical wires into holes on door frame and engage wire fasteners.
   B. Connect electrical wires in main cargo door heater terminal strip.
   C. Perform functional test of heating blankets as described in Main Cargo Door Heating Blanket - Adjustment/Test.
   D. Install the two fiberglass insulation panels that were removed to facilitate door heating blanket removal. (See Main Cargo Door Insulation - Removal/Installation, Chapter 52.)
   E. Position heating blanket in place and install fasteners that attach heating blankets to door frame.



Main Cargo Door Heating Blanket Installation
Figure 401

MAIN CARGO DOOR HEATING BLANKET - ADJUSTMENT/TEST

1. Functional Test of Main Cargo Door Heating Blankets
   A. Equipment and Materials
      (1) Electrical ground power supply, 115/200 volts ac, 400 cps, 3 phase
      (2) Volt-Ohm-Milliameter, Triplet 625NA or equivalent
      (3) Multimeter, Simpson 260 or equivalent
   B. Test Main Cargo Door Heating Blankets
      (1) Provide electrical power.
      (2) Open MAIN CARGO DOOR HTR circuit breaker on panel P6.
      (3) Check that CARGO DOOR HEAT switch on aft attendant's panel (P14) is OFF.
      (4) Disconnect wire from terminal No. 8 of terminal strip T259 above cargo door.
      (5) Measure resistance of heating blankets by connecting ohmmeter from wire disconnected in step B.(4) and to ground. Check that the resistance for the blankets is between 45 and 65 ohms.

         NOTE: To check resistance of individual heating blankets, disconnect ground wire for heating blanket being checked from main cargo door heater terminal strip located on the aft portion of stringer No. 14 of the cargo door. Measure resistance between terminal 1 on main cargo door heater terminal strip and terminal 2 (ground wire removed from terminal strip) for heating blanket being checked. Check that resistance for the upper heating blanket measures 128 to 157 ohms or that of the lower heating blankets measures as follows: 163 to 200 ohms for a blanket with dimensions of 166 x 17.5 inches, 286 to 349 ohms for a blanket with dimensions of 167.4 x 10 inches.

      (6) Reconnect the wire to terminal No. 8 of terminal strip T259.
      (7) Close MAIN CARGO DOOR HTR circuit breakers on panel P6.
      (8) Place CARGO DOOR HEAT switch on aft attendant's panel (P14) to ON.
      (9) Measure voltage between terminal No. 8 of terminal strip T259 and ground. Check that voltage is 115 ±3 volts ac.
      (10) By hand, feel that heating blankets commence heating with power applied.

         CAUTION: DO NOT APPLY POWER FOR MORE TIME THAN NECESSARY TO VERIFY BLANKETS ARE OPERATIONAL BECAUSE OF THE POSSIBILITY OF GROUND OVERHEAT.

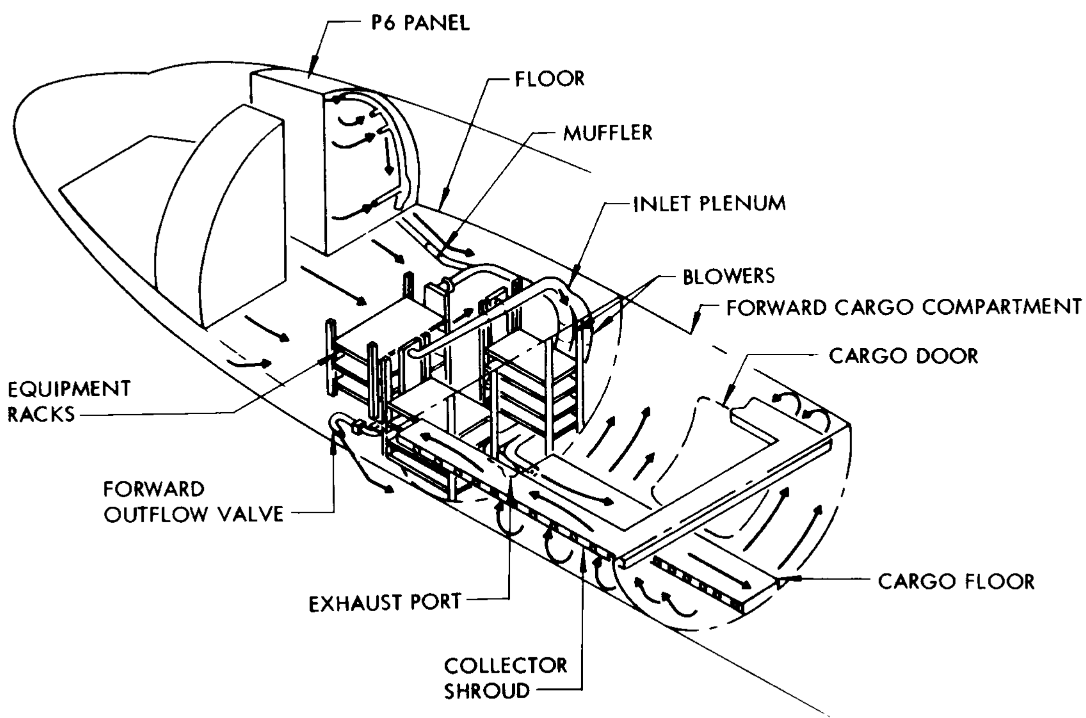
      (11) Place CARGO DOOR HEAT switch on aft attendant's panel (P14) to OFF. Check that there is no voltage between terminal No. 8 and ground.
      (12) If no longer required, remove electrical power from airplane.

CONTROL CABIN HEATING - DESCRIPTION AND OPERATION

1. General
   A. Heating of the control cabin does not exist as a specific heating system. Whether heating or cooling is required is determined by the temperature control system, 21-61-0, which either lowers or raises the temperature of the cabin by mixing air from the air cycle system with hot air bypassing the air cycle system. Refer to Cooling, 21-50-0.
   B. Maintaining a desirable temperature in the control cabin is accomplished through the control cabin air distribution system. Conditioned air enters the control cabin from several outlets located to give proper air circulation throughout the cabin. Refer to Control Cabin Conditioned Air Distribution System, 21-22-0.

CARGO COMPARTMENT HEATING - DESCRIPTION AND OPERATION

1. General
   A. Cargo compartment heating is accomplished by exhausting passenger cabin air around the compartment walls.
   B. Air from the passenger cabin, after picking up heat from the passenger cabin, is exhausted through foot level grilles in the passenger cabin sidewall. This air then flows around the walls to keep the cargo compartment from becoming cold as a result of outside air temperature. Air is induced through the walls of the aft cargo compartment by exhausting the air through the cabin pressurization outflow valve located to the right of the airplane centerline, at the underside of the airplane, approximately opposite the aft entry door.
2. Forward Cargo Compartment Heat Distribution
   A. Control cabin air is drawn through a duct located in the P6 circuit breaker panel and is utilized for equipment cooling. This duct, on the right side of the airplane connects into a system of ducts and manifolds that lead to an inlet plenum. Blowers are installed in the inlet plenum to act as air movers. During ground operation or when the control cabin is unpressurized, air is drawn through the ducts past a flow control valve, and is discharged overboard through the exhaust port. (See figure 1.)
   B. In flight, normal operation of the equipment cooling system will cause the automatic flow control valve of the equipment cooling system to go closed. As a result all air passing through and around the equipment will be discharged under the cargo compartment floor. From under the floor the air, heated from passing through and around the equipment, travels up the sidewalls and circulates between the cargo compartment insulation and lining heating the cargo compartment. This air is then collected in collector shrouds and is exhausted overboard through the forward outflow valve. The forward outflow valve works with the cabin pressurization outflow valve so that its performance is in conjunction with the pressurization system.
3. Forward Outflow Valve
   A. The forward outflow valve is normally in the open position. During flight, air from the equipment cooling system circulates between the cargo compartment insulation and lining to heat the cargo compartment before it is discharged overboard through the forward outflow valve. Upon demand from the cabin pressurization outflow valve to close, in order to conserve cabin pressure, the forward outflow valve will close. The forward outflow valve position is controlled by a pair of limit switches located in the cabin pressurization outflow valve actuator. (Refer to Pressurization Control System.)
   B. The forward outflow valve is located under the passenger cabin floor, next to the skin in the forward cargo compartment at approximately body station 370.



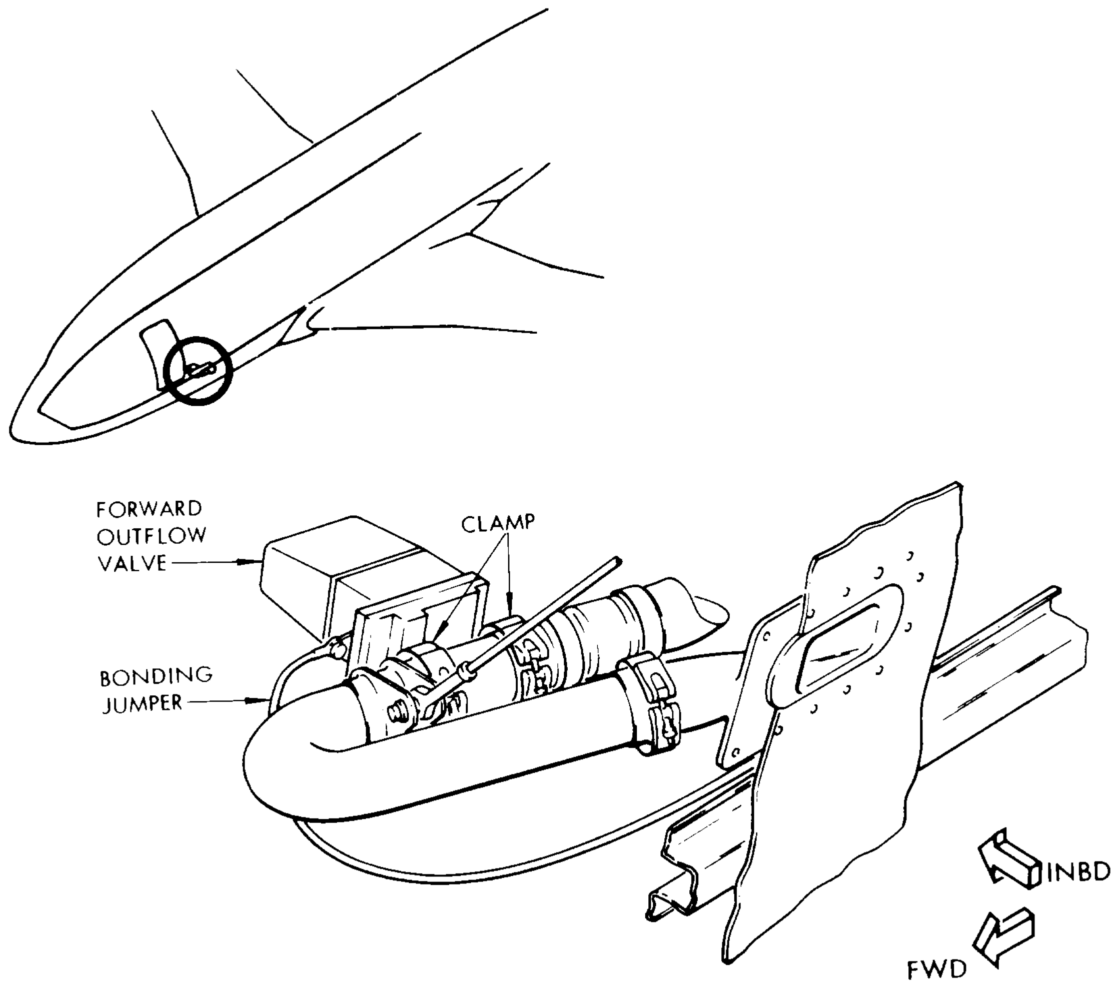
Forward Cargo Compartment Heating Airflow Diagram
Figure 1

FORWARD OUTFLOW VALVE - REMOVAL/INSTALLATION

1. Remove Forward Outflow Valve
   A. Check that FORWARD OUTFLOW VALVE circuit breaker on circuit breaker panel P6-4 is open.
   B. Remove the left portion of the forward bulkhead panel in the forward cargo compartment (Fig. 401).
   C. Remove electrical connector from valve.
   D. Remove bonding jumper from valve body.
   E. Support valve and remove clamp from each end of valve.
   F. Remove valve.
2. Install Forward Outflow Valve
   A. Position valve in place and install clamps (Fig. 401).

      NOTE: Ensure that arrow on valve body points forward.

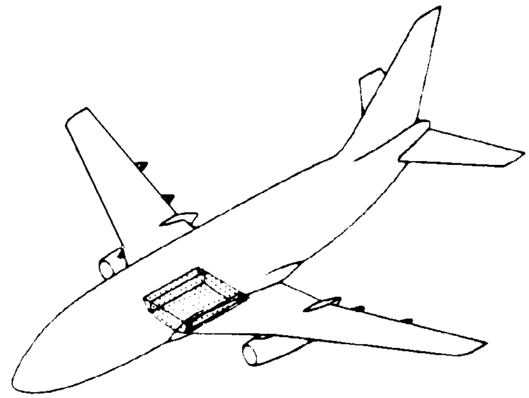
   B. Make sure that bonding lug is free of dirt, oil, and finish, and install bonding jumper.
   C. Install electrical connector.
   D. Close FORWARD OUTFLOW VALVE circuit breaker on P6-4 circuit breaker panel.
   E. Test forward outflow valve. Refer to Pressurization Control System - Adjustment/Test, AC or DC Manual Mode Test.
   F. Install cargo compartment lining.



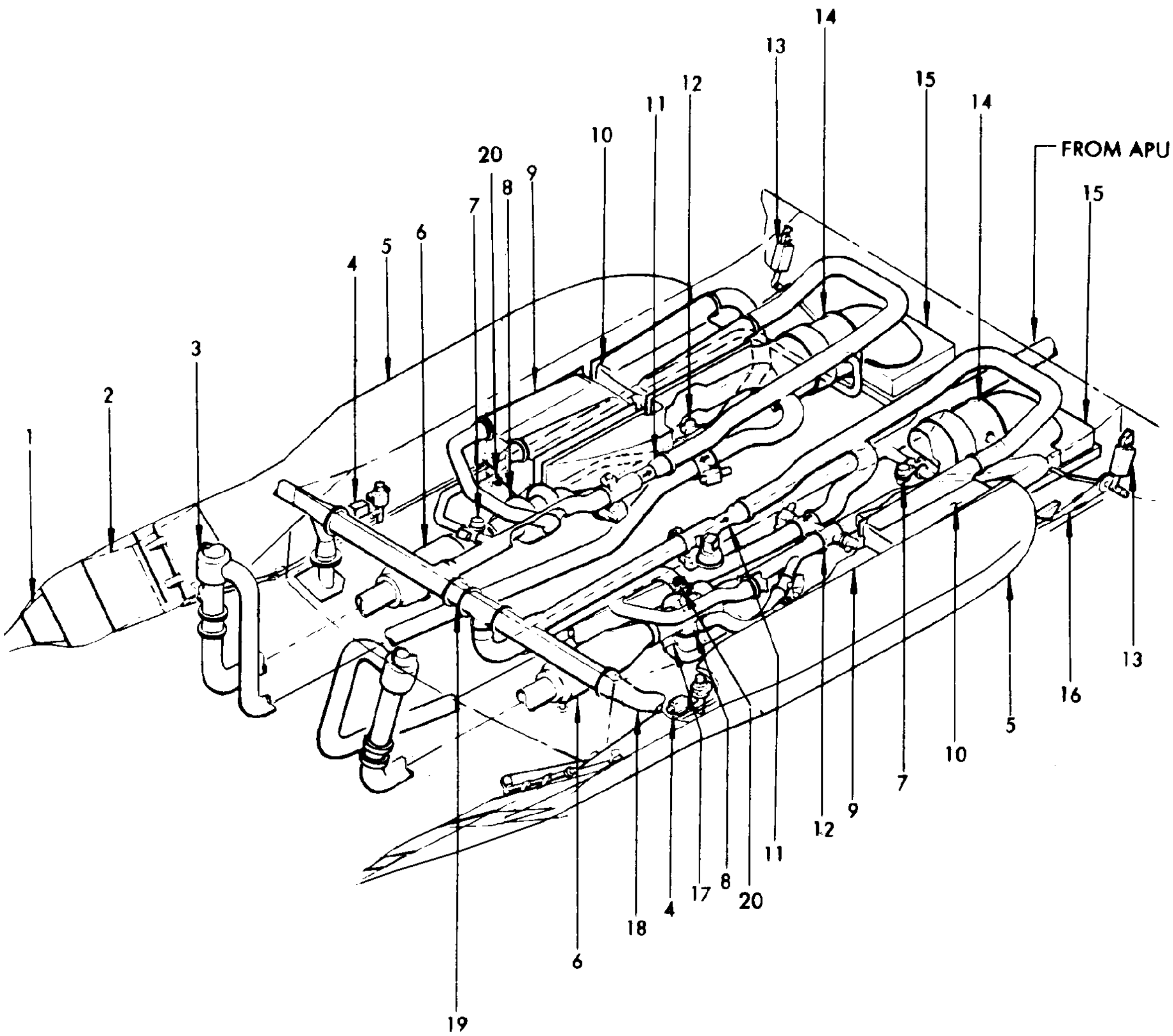
Forward Outflow Valve Installation
Figure 401

COOLING - DESCRIPTION AND OPERATION

1. General
   A. Cooling includes that portion of the air conditioning system which reduces the temperature of air received from the pneumatic system enough to meet any cooling requirement of the air conditioning system. The method of cooling this air consists of air-to-air type heat exchangers and an expansion turbine air cycle machine.
   B. Air from the pneumatic system is divided such that part of the air is passed through the cooling system with the remainder passing on to the mixing chamber. The cooled air is then mixed with the bypassed air to supply properly conditioned air to the distribution system. Two mix valves, one for each air cycle system, proportion the air.
   C. The cooling system is divided into two subsystems. Section 21-51-0, Air Cycle System, discusses the path of the air being cooled and the equipment used for cooling it. Section 21-52-0, Ram Air System, describes the system and its control which employs outside air as a cooling medium for the air cycle system. See figure 1 for location of cooling air and ram air equipment.
   D. The air cycle system supplies the cold air needed for mixture with the hot compressed engine bleed air to provide a selected temperature in the control and passenger cabins. Air from the Pneumatic System, Chapter 36, as regulated by the Engine Bleed Air Compression Control System, 21-11-0, is received into the air conditioning system. This air must be cooled a variable amount depending upon environmental conditions of the cabin. The temperature of air entering the cabins is regulated by the two mix valves. These valves send part of the air through the air cycle system to be cooled and bypass the remainder to be mixed with the cold air in the mixing chamber. See Temperature Control, 21-61-0.
   E. Since airflow through the air cycle system and hot air bypassing the system are supplied by the same duct, and airflow to the cabin is relatively constant, the mix valves not only regulate the quantity of cold air being supplied, but in regulating quantity, also influence temperature drop across the air cycle system. A water separator 35°F control system bypasses warm air around the turbine to mix with cold air from the turbine to prevent freezing in the water separator. As a result cold air at the water separator is never below freezing.
   F. Another system which has an influence on the cooling ability of the air cycle system is the ram air system. Although this system is not actually a part of the air cycle system, it supplies a cooling medium for the heat exchangers and must necessarily be considered in a discussion of the air cycle system. The ram air system automatically reduces ram air flow when maximum cooling is not required.



1 RAM AIR INLET DEFLECTOR DOOR
2 RAM AIR INLET MODULATION PANEL
3 MIXING CHAMBER
4 WATER SEPARATOR 35°F CONTROL
5 RAM AIR DUCT
6 WATER SEPARATOR
7 TURBOFAN VALVE
8 AIR CYCLE MACHINE
9 SECONDARY HEAT EXCHANGER
10 PRIMARY HEAT EXCHANGER
11 PACK VALVE
12 MIX VALVE
13 RAM AIR ACTUATOR
14 TURBOFAN
15 RAM AIR EXHAUST DUCT
16 RAM AIR MODULATION SYSTEM CONTROL CABLES
17 WATER SEPARATOR 35°F CONTROL VALVE
18 PNEUMATIC SUPPLY DUCT
19 ISOLATION VALVE
20 RAM AIR TEMPERATURE SENSOR



Cooling Air and Ram Air Equipment Location
Figure 1

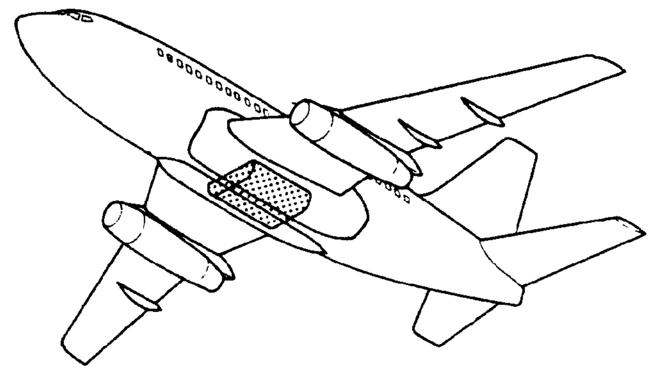
G. The mix valves may vary from full cold to hot depending on cabin requirements and the ram air system may be set at considerably less than maximum airflow. In describing how the air cycle system operates however, it is convenient to consider the mix valves in the full cold Position, hot valve closed-cold valve open, and the ram air doors full open.

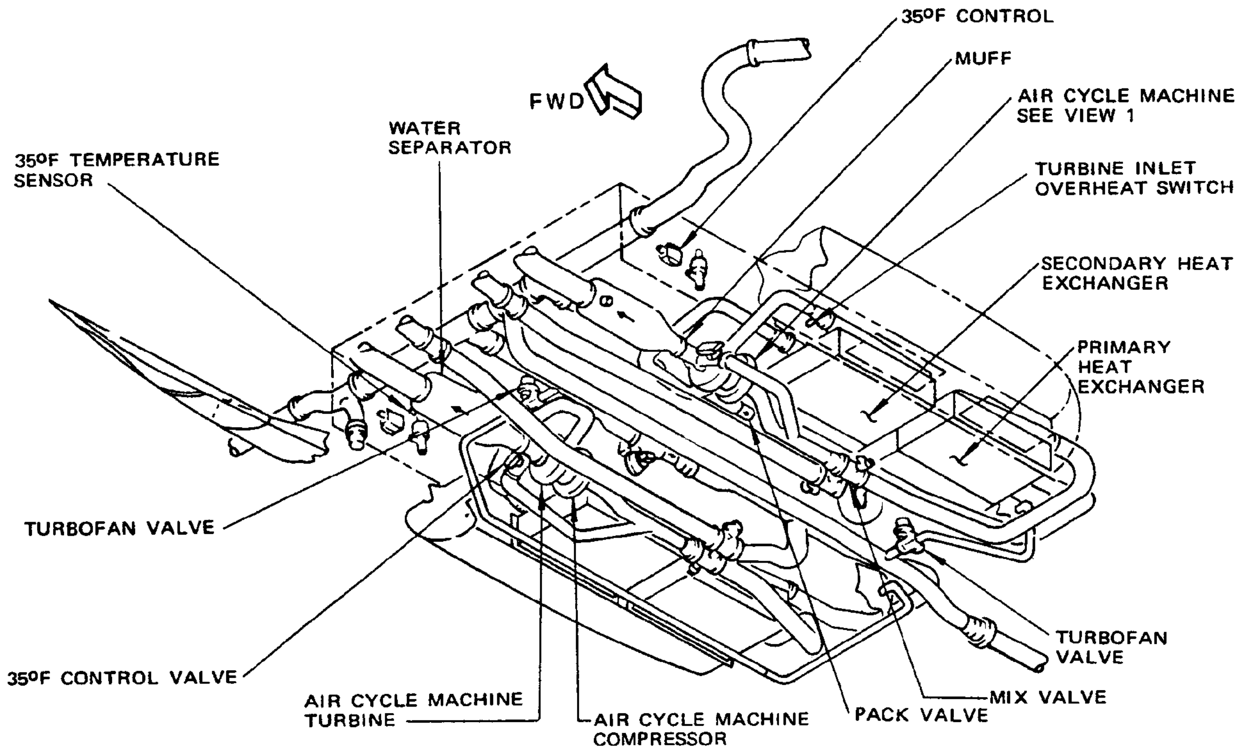
H. There are two air cycle systems on each airplane. The systems are virtually identical and are located on either side of the airplane centerline in a fairing beneath the center fuselage. The left system is considered to supply the control cabin and the right system the passenger cabin. The systems operate in parallel however and feed to a common manifold. During normal operation the control cabin utilizes only approximately twenty percent of the left system supply with the balance going to the passenger cabin. Either system operating alone is capable of maintaining acceptable temperatures when necessary.

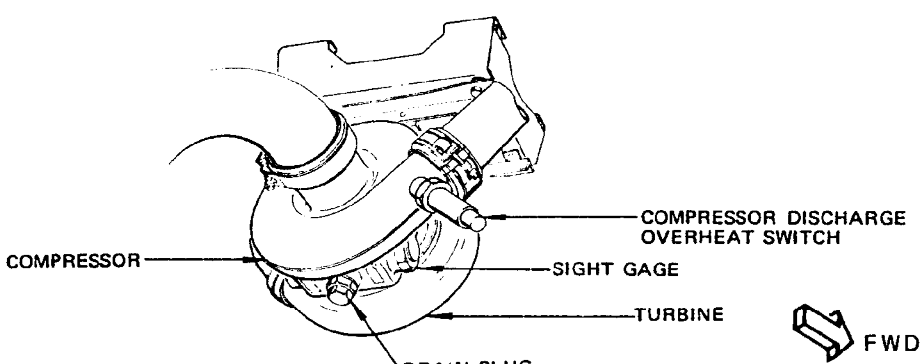
AIR CYCLE SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. Air conditioning cooling is provided by two air cycle systems. The systems also remove excess moisture from the air.
   B. Air cycle system equipment is contained in equipment bays located on either side of the airplane centerline at the underside of the center fuselage (Fig. 1).
   C. The cooling devices used in the air cycle system consist of a primary heat exchanger, a secondary heat exchanger, and an air cycle machine. The heat exchangers are of the air-to-air type with heat being transferred from the air going through the air cycle system to air going through the ram air system. The air cycle machine consists of a turbine and a compressor. Air passing through the secondary heat exchanger and expanding through the turbine drops in temperature as the energy is extracted. The expanding air releases energy to drive the compressor. The compressed air increases the temperature to the secondary heat exchanger, thus improving the heat transfer efficiency of the secondary heat exchanger.
   D. Protection of the air cycle machine is provided by two thermal switches. One thermal switch senses compressor discharge temperature. The other thermal switch senses turbine inlet temperature. Actuation of either thermal switch will cause the pack value to close.
   E. As the air cools its moisture content condenses. The moisture is atomized so finely however, that it will stay in suspension without a moisture removing device. The water separator collects this atomized moisture and removes it from the air cycle system air after it has left the air cycle machine.
   F. Moisture entering the water separator is kept from freezing by a 35°F control system. A 35°F sensor in the water separator and a 35°F control regulate a control valve in a duct between the primary heat exchanger exit and the water separator inlet. The valve opens to add warm air if the turbine discharge temperature approaches the freezing temperature of water.
2. Primary Heat Exchanger
   A. The primary heat exchanger is the first unit of the air cycle system through which engine bleed air passes to be cooled. The unit is rectangular in shape and is located between two sections of the ram air duct. The heat exchangers are of the true counterflow plate-fin type.
   B. Hot air enters one plenum chamber from the pneumatic duct at the aft inboard side of the exchanger. It is cooled as it passes between the sandwiched plates and fins to the other plenum chamber, then leaves by way of the air cycle machine duct connected to the aft outboard side of the heat exchanger. There is one primary heat exchanger for each air cycle system.

3. Air Cycle Machine
   A. The air cycle machine is a cooling unit consisting of an expansion turbine on a common shaft with a compressor. The shaft is bearing mounted in a housing to support the rotating turbine and compressor. A wick extends from the shaft to the bottom of the oil sump formed by the housing for lubrication of the moving parts. A filler plug and sight gage are provided on each side of the housing, with a magnetic oil drain plug on the bottom.
   B. The air cycle machine is located in the equipment bay between the duct leading from the primary heat exchanger and the duct to the water separator. (See figure 1.) A duct from the compressor and another to the turbine connect to the secondary heat exchanger. The turbine mounts are connected to airplane structure through serrated plates and washers to provide location adjustment. There is one air cycle machine for each air cycle system.
4. Secondary Heat Exchanger
   A. The secondary heat exchanger is identical to the primary heat exchanger. It is located in the equipment bay forward of the primary heat exchanger. Air from the air cycle machine compressor outlet enters the forward inboard connection of the secondary heat exchanger, passes between the sandwiched plates and fins, then returns to the air cycle machine turbine inlet from the forward outboard exchanger connection. There is one secondary heat exchanger for each air cycle system.
5. Thermal Sensing Units
   A. Two thermal switches are in the cooling system, and directly affect the air cycle system operation. One thermal switch senses compressor discharge temperature. The other thermal switch senses turbine inlet temperature. When an overheat condition exists in either position the affected thermal switch will cause the pack valve to close. Other thermal sensing switches located in the air cycle system are covered under ram air system and temperature control system.
   B. The turbine inlet overheat switch is located in the transition at the secondary heat exchanger and senses the temperature of air passing from the heat exchanger to the turbine of the air cycle machine.
   C. The compressor discharge overheat switch senses temperature of air being discharged from the compressor to the secondary heat exchanger. The switch is installed on the compressor scroll. (See view 1, figure 1.)
6. Check Valves
   A. Two check valves are provided for each air cycle system. One valve is in the cold air supply duct from the water separator to the mixing chamber and another is in the hot air supply duct to the mixing chamber. The two check valves prevent loss of air from the distribution system should a failure occur in the air cycle system area.







VIEW 1

Air Cycle System Component Locaton
Figure 1

7. Water Separator

A. Cold air leaving the air cycle machine passes through a muff to the water separator. (See figure 2.) Moisture in the air at this reduced temperature begins to condense. The condensate is so finely atomized however, that it will follow along in the air stream unless a suitable method is used to collect it. The water separator is used to collect and remove the excess moisture from the air before it enters the distribution system.

B. The water separator is a cylindrical chamber consisting of an inlet and outlet shell assembly which houses a polyester coalescer (bag), a conical-shaped metal coalescer support, a bypass valve assembly, and a valve support guide. A coupling joins the inlet and outlet shell assemblies and secures the coalescer support. The outlet shell assembly contains a collection chamber, a baffle, and an overboard water drain. Bosses are also provided for the installation of temperature sensing probes. A bag condition indicator is also included which consists of a spring loaded piston and disk enclosed in a housing and a color coded cap.

C. The coalescer bag and its support are conically shaped with the small diameter at the upstream end. The support fits inside the bag and has louvers shaped to impart a whirling motion to air as it passes through. Air enters the separator around the outside of the bag, passes through the bag, then through the louvers. As the damp air passes through the bag, the bag is wetted and larger droplets of water are formed. These droplets along with the air are caused to whirl by the louvers of the support. As the air and moisture pass through the separator the centrifugal force keeps the heavier moisture close to the inside of the support until it reaches the collection chamber. A cylindrical baffle approximately the diameter of the outlet duct extends inside the separator at the downstream end. The water and air whirling in a greater diameter than the baffle find it necessary to make a double reverse turn in order to leave the separator. The turning does not appreciable affect airflow but the water being much heavier cannot make the turn and remains in the collection chamber. An overboard drain mates to an outlet in the equipment bay doors. (See figure 3.)

D. The bypass valve allows air to pass through the water separator to the distribution system without first passing through the coalescer bag. The valve has two functions; (1) the valve opens as a result of increased pressure differential should the coalescer bag become clogged or frozen, and (2) on some airplanes the valve opens in response to an aneroid (bellows) at altitudes of 20,000 feet and above. (See figure 3.) At a low altitude, it is desirable to remove moisture from the air, but at approximately 20,000 feet the air moisture content is negligible. The bypass valve opens at lower altitudes only when the coalescer bag becomes excessively clogged to allow passage of sufficient air for proper ventilation and cabin pressure. At altitude moisture removal is not required and the valve opens to reduce pressure drop across the water separator. The bypass valve assembly is secured to a mounting ring within the inlet shell assembly and consists of a spring-loaded poppet and piston, an altitude sensing bellows, seat, and poppet arrangement.

E. If the coalescer bag is clogged, airflow through the water separator is retarded and causes an increase in pressure across the bypass valve. When the pressure differential exceeds the force of the valve loading spring, the valve opens and a portion of the air passes through the valve without first passing through the bag.

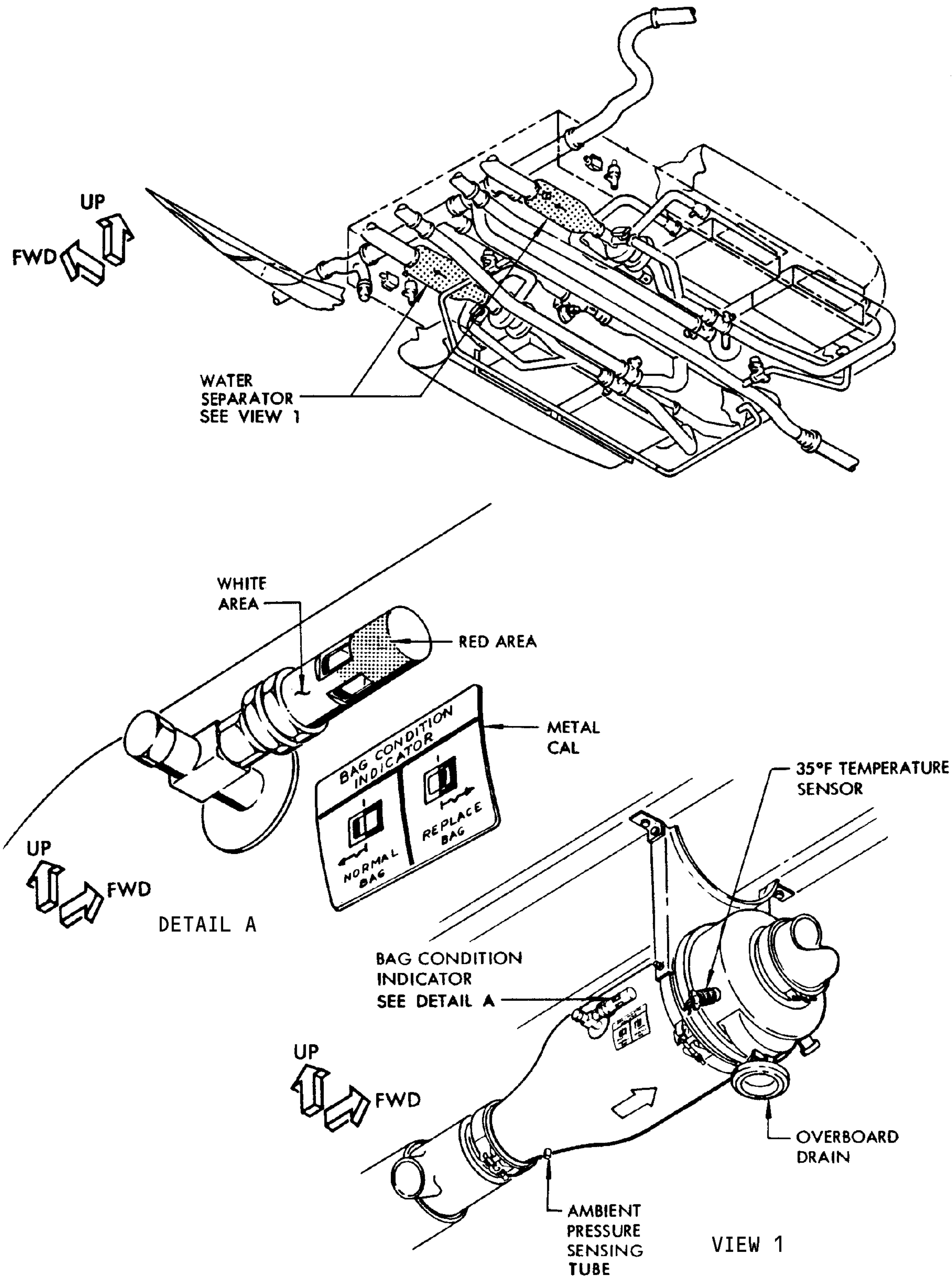
F. On airplanes with an aneroid bellows at a predetermined altitude of approximately 20,000 feet, the bellows expand in response to the reduced pressure sensed by the ambient pressure sensing tube. The pressure differential across the piston actuates the piston and opens the poppet.

G. The water separator also has a bag condition indicator. As the bag becomes clogged, the pressure applied to the bag condition indicator piston is increased, forcing the disk on the piston shaft toward the red colored window section of the indicator cap. When the disk is positioned within the red colored portion of the cap, it indicates a dirty bag and the bag should be replaced. (See figure 2, detail A.)

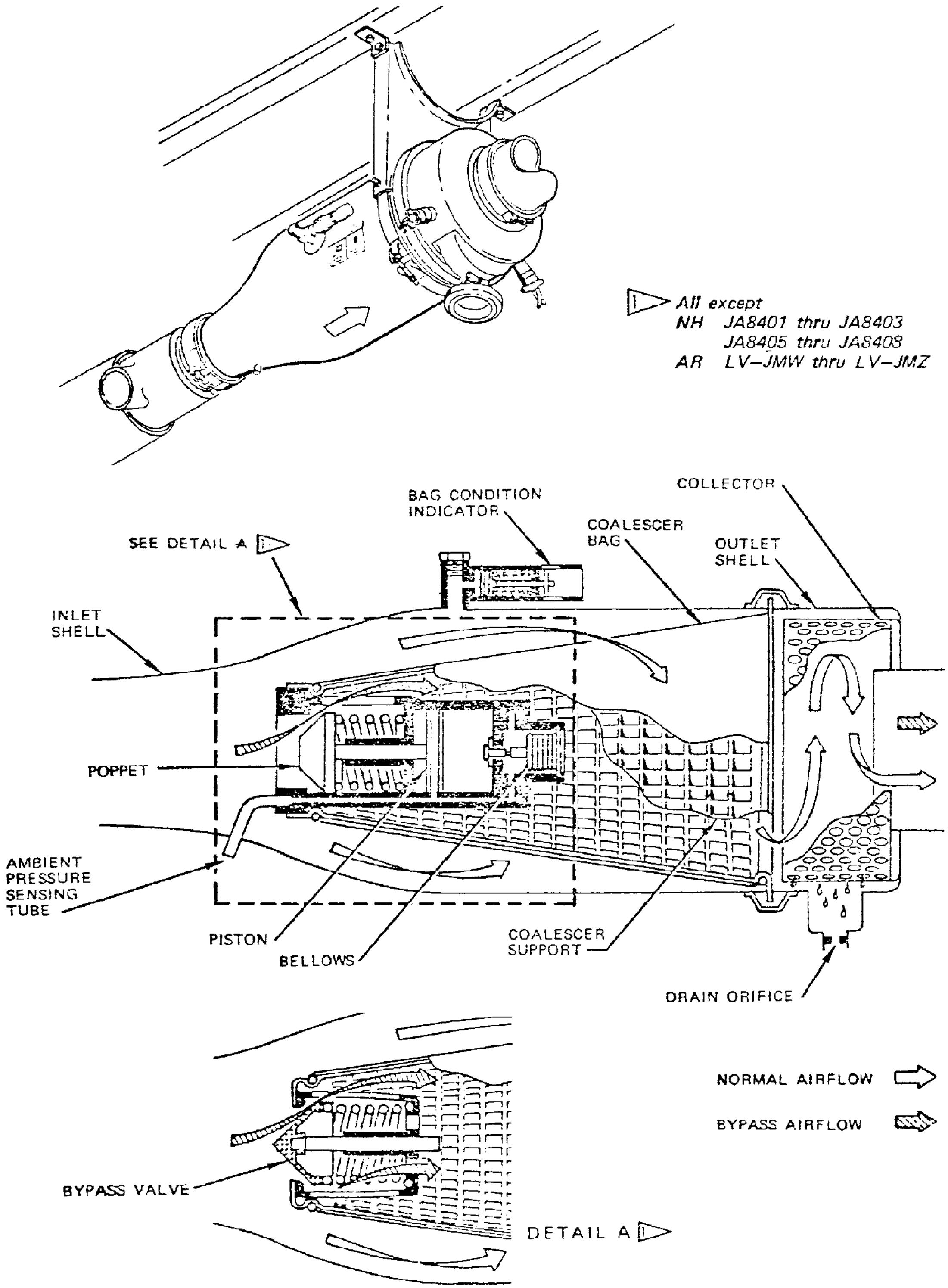
8. <u>Water Separator 35°F Control System</u>

A. When cooling requirements are high, the temperature of the air as it leaves the air cycle machine may drop below the freezing point of water. The water separator 35°F control system regulates air temperature into the separator to keep moisture from freezing on the water separator coalescer bag. (See figure 4.)

B. Keeping water separator temperature above freezing is accomplished by taking hot air from upstream of the air cycle machine compressor and routing it back into the system at the muff at the air cycle machine turbine discharge. The water separator 35°F control system regulates the quantity of air being bypassed.



Water Separator
Figure 2



Water Separator Airflow Schematic
Figure 3

C. The water separator 35°F control system consists of a water separator 35°F sensor, control, and valve. The sensor is located on the right forward underside of the water separator, the control is mounted to the outboard side of the equipment bay near the forward end of the bay, and the valve is located forward of the air cycle machine in the duct taking off from the air cycle machine compressor inlet duct.

D. The 35°F sensor is one element of the 35°F control. The control contains a bridge circuit, an amplifier, and a silicon-controlled rectifier actuator control. The sensor is utilized as a remotely located variable resistance for one leg of the bridge circuit. As temperature at the sensor changes, its resistance changes, unbalancing the bridge. The bridge circuit is connected to the amplifier. The amplifier interprets the signal received and then signals the actuator control to move the valve open or closed. When the bridge is balanced current is shut off to the valve and it maintains the position held. The bridge balances with temperature in the separator at approximately 35°F.

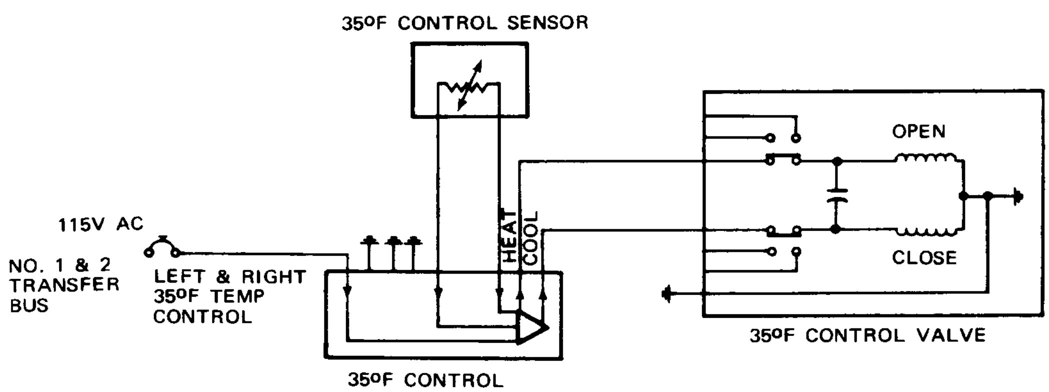
E. Some 35°F controls have built-in test circuits which provide a quick check of the 35° F control system. A test switch, two indicator lights and a test instruction placard have been added to these units. The test switch is a rotary type with five test positions and one flight position. When control system is not being tested, the switch must be returned to the flight position.

9. Operation

A. When air conditioning is turned on, the pack valves open and hot air from the pneumatic system enters the air conditioning system. Depending on cabin temperature requirements, the mix valves adjust to send the required portion of this air through the air cycle system. The remainder passes unchanged through a duct to the mixing chamber (Fig. 5).

B. The air entering the system first passes through the primary heat exchanger where some heat is removed. This air, still at an elevated temperature, moves on to the air cycle machine where it passes through the compressor and the secondary heat exchanger before it reaches the turbine. The turbine then drives the compressor. As the air is compressed, its temperature and pressure rise. The secondary heat exchanger then lowers the temperature to approximately the value it was as it entered the compressor but at a higher pressure. The air expands as it drives the turbine and leaves the turbine at the coolest temperature of the cycle.

C. Should the temperature of the air leaving the compressor reach 365 ±10°F (185 ±6°C), the compressor discharge overheat switch will close to energize the pack overheat relay. Energizing the relay completes circuits to close the pack valve, illuminate the PACK TRIP OFF and AIR COND master caution annunciators. Pushing the TRIP RESET switch will return the system to normal operation after the overheat condition has been corrected.



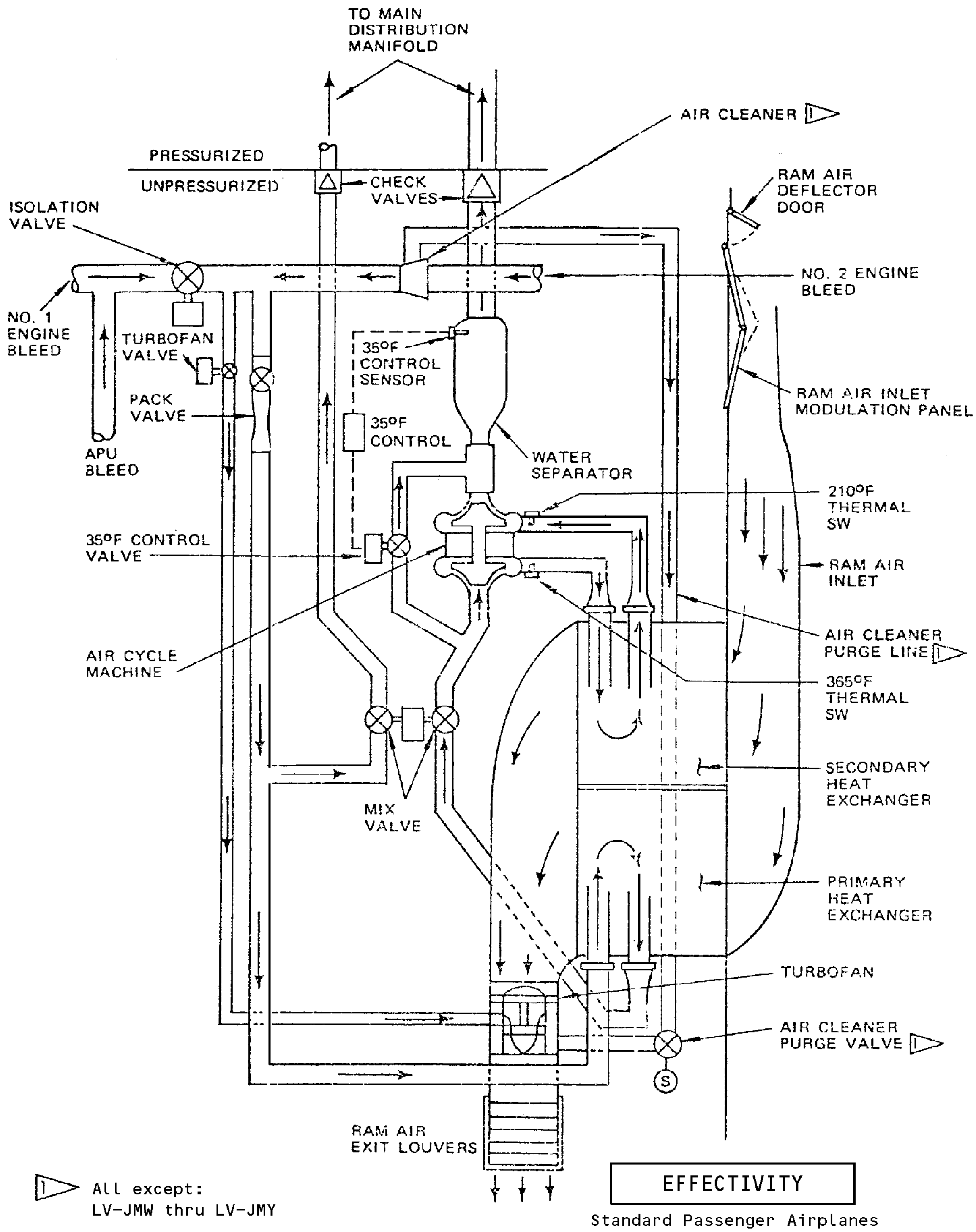
Water Separator 35°F Control System Circuit
Figure 4

D. Unless the secondary heat exchanger reduces the temperature of the air sufficiently, overheat of the turbine may occur. At a turbine inlet temperature of 210 ±10°F (93 to 104°C), the turbine inlet overheat switch will close. Closing of this switch will also energize the pack trip relay to close the pack valve, illuminate the PACK TRIP OFF light and AIR COND master caution annunciators. Pushing the TRIP RESET switch will return the system to normal operation after the overheat condition has been corrected.

E. From the air cycle machine the air is ducted forward to the water separator. Excess moisture condenses from the air at the reduced temperature and is separated from the air and drained overboard. The water separator 35°F control system bypasses primary heat exchanger air around the air cycle machine, if needed, to prevent water freezing in the separator.

F. Cold air leaving the water separator then travels to the mixing chamber.

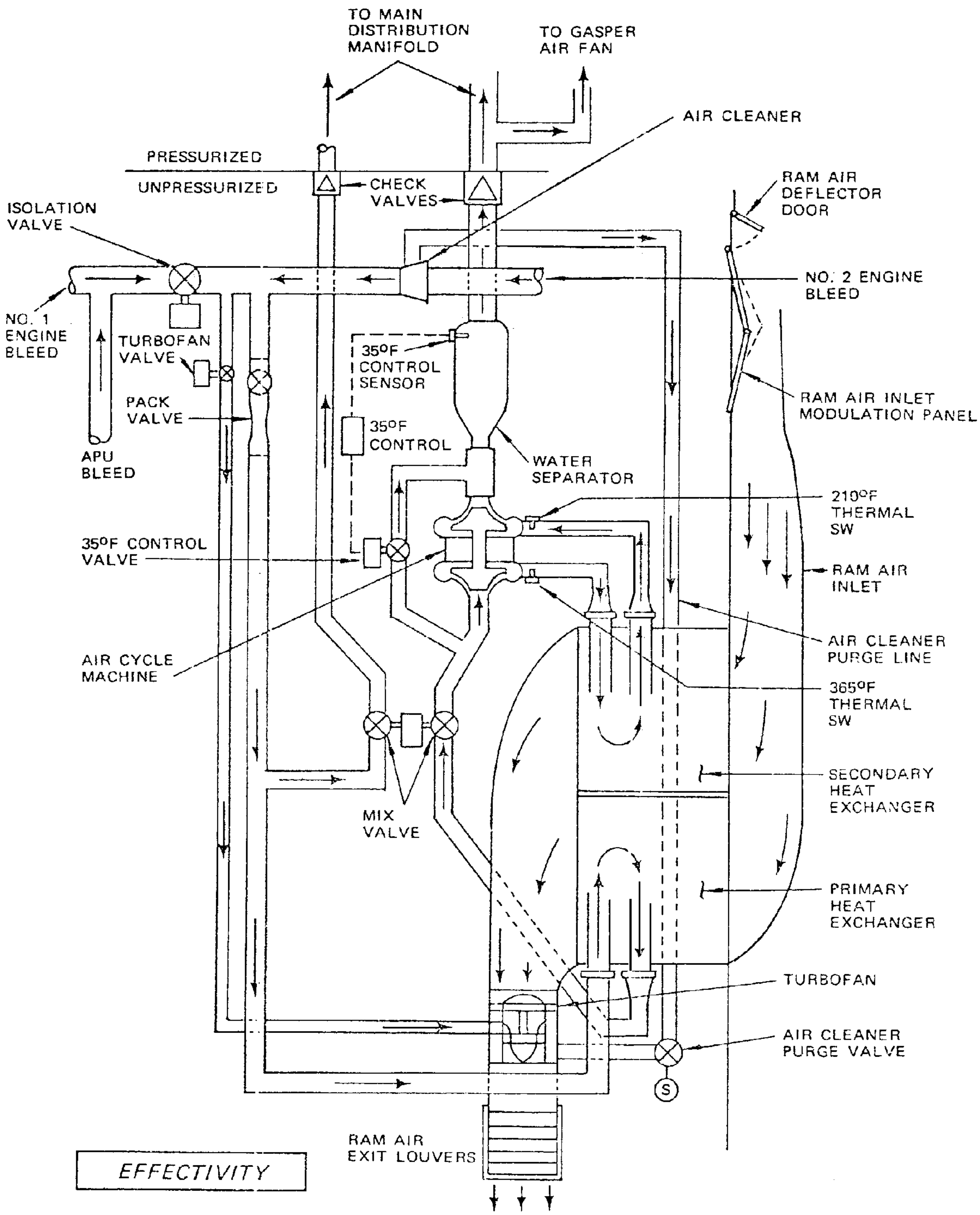
G. When the air conditioning switches are turned off the pack valve closes and the mix valve drives to full cold.



[1] All except:
LV-JMW thru LV-JMY

EFFECTIVITY
Standard Passenger Airplanes

Right Air Cycle System Airflow Diagram
Figure 5 (Sheet 1)



EFFECTIVITY

Passenger/Cargo
Convertible Airplanes

Right Air Cycle System Airflow Diagram
Figure 5 (Sheet 2)

COOLING - TROUBLESHOOTING

1. General
   A. Troubleshooting the cooling portion of the air conditioning system involves both the air cycle system and the ram air system. An understanding of how the different components are interrelated as well as the function of each is needed to locate and correct problems in either system.
   B. Grouping individual components according to function aids in locating a defective component. The water separator, 35° control sensor, 35° control valve and 35° control are functionally related. Another grouping includes the heat exchangers; air cycle machine, ram air system, and the compressor discharge and turbine inlet overheat thermal switches.
2. Water Separator - 35° Control
   A. Trouble in the water separator, 35° control system may be recognized by moisture or fog in the cabin, a pounding noise from the 35° control valve opening and closing, or by the lack of water emerging from the water separator drain during air conditioning operation when on the ground. Water separator problems may be caused by water freezing on the condenser bag as a result of a faulty 35° sensor or 35° control valve, or 35° control, or a dirty condenser bag.
   B. Built-in test equipment on some 35° controls provide a method for checking electrical operation of 35° control system and if there are problems will isolate the faulty component. Test instructions are printed on the control unit.
3. Cooling Equipment
   A. Thermal switches are located in the system to prevent overheat damage to other cooling system equipment. Sensors, trouble lights, and indicators are provided to indicate abnormal conditions. When trouble shooting, it is helpful to consider the indicator reading at time of malfunction to locate faulty component. For example, either the air cycle machine (ACM) compressor discharge overheat switch or the ACM turbine inlet overheat switch actuation will cause pack shutdown.
   B. When either overheat switch closes a circuit is completed to close the respective pack valve. Should a system trip off it may be that proper cooling is not being accomplished by the secondary heat exchanger and trip-off results from the turbine inlet overheat switch.
   C. For turbine inlet overheat trip-off, remove inspection door on underside of ram air duct forward of secondary heat exchanger and examine for any obstruction to flow at end of the secondary heat exchanger. If no obstruction, check turbine inlet overheat switch.

D. System trip-off from overheat may result from any one of several failures. In each case indicator readings may give a clue as to where the malfunction exists. System overheat will result either from restriction of airflow through the ram air system, an over abundance of air supply from the pneumatic system, or an inoperative mix valve which permits passage of hot engine bleed air only. Should air supply to the ACM be greater than normal, system temperature will rise although not necessarily enough to cause the system to trip off. The increase in flow will cause a corresponding increase through air conditioning ducts which may be reported as abnormal duct noise and/or low engine pressure ratio indicator reading. If the 13th-stage high pressure modulating valve fails in the full open position, system may trip off due to overheat. At such time the increase in airflow to the cabin will be so great that it cannot escape notice. For trouble shooting the modulating valve and engine bleed air compression control system, refer to 21-11-0.

4. Wing and Lower Aft Body Overheat Detection

A. When operating air cycle system on auxiliary power unit (APU) air during hot weather the air cycle system and/or pneumatic hot air ducts could cause nuisance trips of the Wing and Lower Aft Body Overheat Detection System, 26-18-0. Should overheat detection system trip without excessive duct leakage, check cleanliness of ducts (Ref 36-19-11, Maintenance Practices).

5. Troubleshooting Charts

Fog or high humidity in cabin and/or pounding noise heard through distribution system. CHECK -

WATER SEPARATOR - Pressurize pneumatic system and with APU on operate each system separately on full cold to determine faulty system. After faulty system is identified, examine pressure indicator assembly. If disk is in red portion of cap, it indicates that the coalescer is clogged and requires replacement. During replacement check that bypass valve is not open or binding. Recheck system for continuance of malfunction. If system still malfunctions, move mix valve to full cold and check duct temperature after it has stabilized. Duct temperature of faulty system will read 36°F (2°C) or less (refer to note). Shut down system. Check for clogged drain boss. THEN -

CHECK 35° CONTROL SYSTEM. With airplane power switch ON remove electrical plug from 35° control valve and check for 115V AC close signal at pin 2. (If airplane is cold soaked, 35°F or below, check for 115V AC open signal at pin 1.) IF -

NO VOLTAGE - Check for open circuit breaker on No. 1 transfer bus)LH 35°F control) or on No. 2 transfer bus (RH 35°F control). IF -

Voltage is present through circuit breaker check for continuity between transfer bus and pin 4 of faulty system 35°F control plug. IF -

VOLTAGE OK - Control valve is not in position as called for by input signal, replace 35° control valve.

CONTINUED ON FOLLOWING PAGE

NOTE: Normally when water separator icing occurs with only one system operating the duct temperature will be 33°F (0°C) or below. Due to accumulation of indicator and temperature bulb tolerances, coupled with variations in temperature of the duct environment between the water separator and the temperature bulb, icing may occur at a duct temperature reading of up to 36°F (2°C).

Cooling - Troubleshooting
Figure 101 (Sheet 1)

CONTINUED FROM PRECEDING PAGE

CONTINUITY - Check for continuity between pin 2 of 35° control plug and pin 1 of 35° control valve plug and between pins 3 of 35° control plug and 2 of 35° control valve plug.
IF -

NO CONTINUITY - Repair wiring between transfer bus and plug of 35° control.

CONTINUITY - Reinstall 35° control plug.
THEN -

NO CONTINUITY - Repair wiring between 35° control plug and 35° control valve.

Remove plug from 35° sensor, remove sensor and reinstall plug on sensor. THEN -

Dependent upon ambient temperature apply heat or ice to sensor. IF -

Heat is applied check for close signal at pin 2 of control valve plug. IF -

Ice is applied check for open signal at pin 1 of control valve plug.
IF -

NO SIGNAL. Replace sensor and rerun ice or heat test. IF -

Voltage is still missing from pins 1 or 2 replace 35° control.

Cooling - Troubleshooting
Figure 101 (Sheet 2)

Cabin will not cool sufficiently by either the manual or automatic temperature control system.

CHECK AIR MIX VALVE - Connect ground electrical power and energize panel P6-1. Open OVERHEAT circuit breaker. Check that all other air conditioning circuit breakers are closed (in). Verify APU and engine bleed switches are OFF. Place PACK switch to ON. Move temperature control knob to manual WARM, then manual COOL and check that mix valve position indicator pointer moves to full HOT, then to full COLD. The extreme positions are reached when the pointer aligns with the second index mark from either end of the scale. Place PACK switches to OFF.
IF -

RAM AIR INLET MODULATION PANEL OR RAM AIR EXHAUST LOUVERS WILL NOT GO TO FULL OPEN - Check ram air system per trouble shooting procedure, 21-52-0.

MIX VALVE MOVES TO FULL COLD - Close OVERHEAT circuit breaker. Pressurize pneumatic manifold to a minimum of 25 psig. Operate only one system at a time. Place PACK switch to ON. Allow temperature to stabilize, then check SUPPLY DUCT temperature to isolate pack causing trouble. A reading of 43°F (6°C) or above indicates a faulty system. (See Note.) Lower air conditioning equipment bay doors and check position indicator on 35°F control valve.
IF -

MIX VALVE DOES NOT MOVE TO FULL COLD - Check temperature control system per trouble shooting procedure. See temperature control trouble shooting, 21-61-0.

CONTINUED ON FOLLOWING PAGE

Cooling - Troubleshooting
Figure 101 (Sheet 3)

CONTINUED FROM PRECEDING PAGE

35° CONTROL VALVE IS CLOSED - Check operation of turbofan and ram air inlet modulation panel. Check that ram air exhaust louvers are full open. Remove ram air duct inspection doors and inspect for obstructions inside ducts.
IF -

35° CONTROL VALVE IS NOT FULL CLOSED, OR DOES NOT CLOSE - Place PACK switch to OFF and replace 35°F control valve.
IF -

Problem still exists check sensor and 35° control as outlined in 35° control system trouble shooting procedure.

COOLING SYSTEM DEFECTIVE - Replace or repair faulty duct temperature recheck duct temperature to verify that condition has been corrected.

COOLING SYSTEM OK - Check engine bleed air compression control system per trouble shooting procedure. Refer to 21-11-0.

Cooling - Troubleshooting
Figure 101 (Sheet 4)

AIR CYCLE SYSTEM - ADJUSTMENT/TEST

1. General
    A. This procedure has these tasks:
        (1) Air Cycle System Test
        (2) Pack Protective Circuit Test
    B. These tasks are presented to check air cycle system components which require only electrical power for their operation. The remaining air cycle system components which require air flow, or pressure, for their operation must be checked with the engine bleed air distribution system components (Ref 21-11-0, Adjustment/Test). Duck leakage is checked in 36-11-0, Adjustment/Test.
    C. The following tasks utilize pack valve position with respect to several steps in the procedure. Since the ducts are not pressurized the pack valve will not be repositioned in response to electrical control. In order to accomplish this test, therefore, it is necessary to remove the electrical connector form the pack valve limit switch and to keep a person stationed at the pack valve to determine simulated operation of the valve. A click will be felt, or heard, at solenoid A of the pack valve during the step in which pack valve is supposed to open or close.
2. Air Cycle System Test
    A. General
        (1) This test checks the operation of the pack valve and makes sure the overheat switches close when an overheat condition occurs.
    B. Equipment and Materials
        (1) Temp-Cal Probe Heater BH-3884-40 (Attachment to Jet Cal engine analyzer) or H294 Temp-Cal Thermal Switch Tester or H394 Temp-Cal Tester with adapter cable BH405. BH24944 Heater Probe Kit (basic P/N).

            NOTE: This kit is necessary to use the testers listed above. Consult with the supplier for the appropriate dash number for a specific airplane model and tester combination.
            HOWELL INSTRUMENTS, 3479 WEST VICKERY BLV., FORT WORTH TEXAS 76107

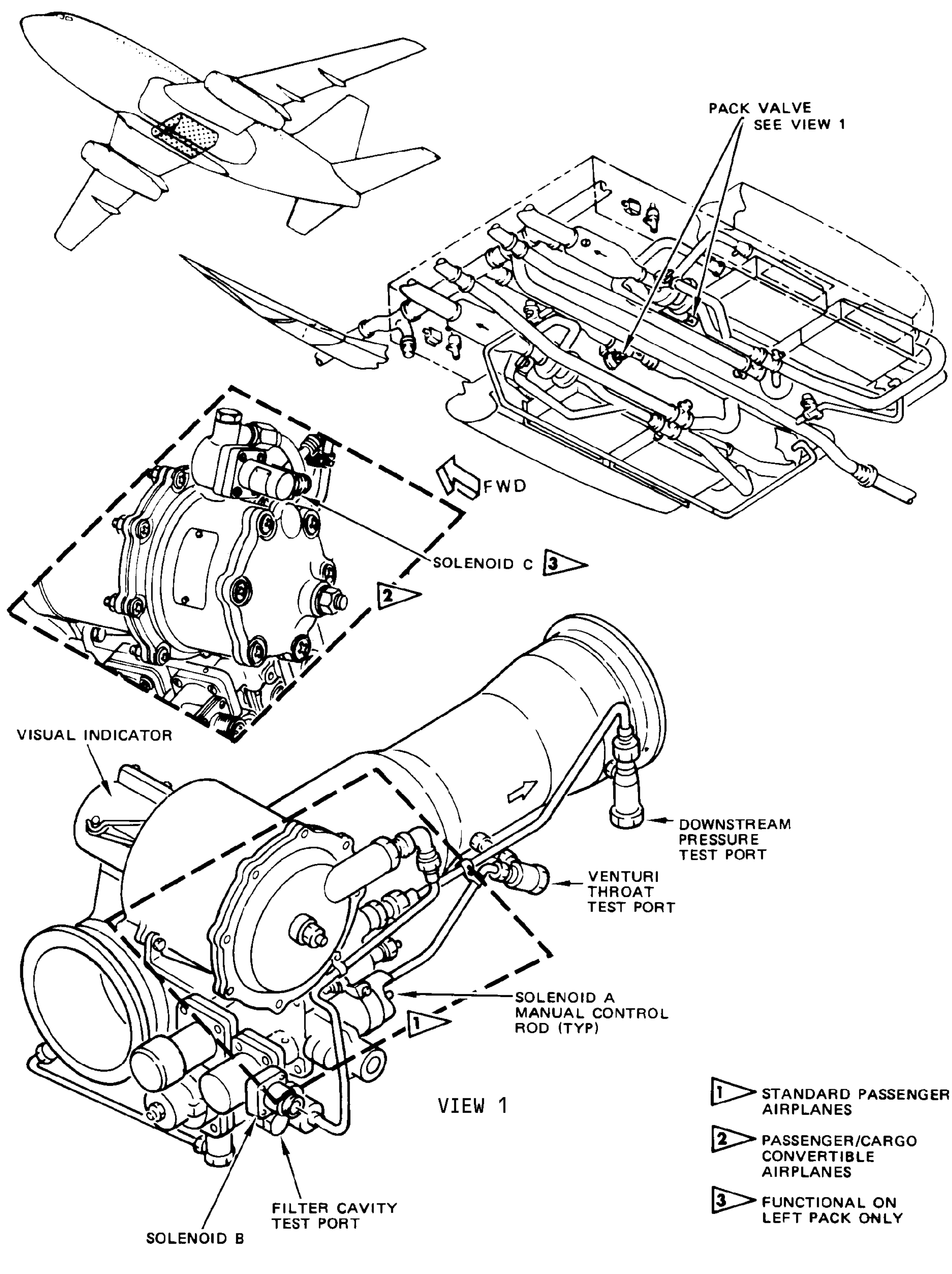
    C. Prepare Air Cycle System for Test
        (1) Provide electrical power.
        (2) Check that all air conditioning circuit breakers are closed (in).
        (3) Check that the following circuit breakers on circuit breakers panel P6 are closed:
            (a) MASTER CAUTION (all except FUEL, if installed)
            (b) INDICATOR LIGHTS, MASTER DIM BUS (9 places)
            (c) DIM & TEST (1 place)

(4) Check warning lights and annunciators.
   (a) Place LIGHTS switch on lightshield panel (P2-l) to TEST. Check that both MASTER CAUTION lights, the AIR COND annunciator light and PACK TRIP OFF light come on.
   (b) Move LIGHTS switch to BRT.
   (c) Press to test PACK TRIP OFF light.
   (d) While pressing PACK TRIP OFF light, move LIGHTS switch to DIM and check that light dims.
   (e) Continue to press PACK TRIP OFF light, move LIGHTS switch to BRT and check that light brightens.
(5) Check that air conditioning PACK switch is in OFF position.
(6) Open air conditioning equipment bay door.
(7) Simulate open position of pack valve.
   (a) Open OVERHEAT circuit breaker.
   (b) Remove connector from pack valve limit switch. (See figure 501.)
   (c) Close OVERHEAT circuit breaker.

D. Test Air Cycle System
(1) Move air conditioning PACK switch to ON and check for a click at solenoid A of the pack valve.
(2) Move temperature selector knob toward MANUAL WARM to drive mix valve away from the full cold position.
(3) Check compressor discharge overheat switch operation.
   (a) Remove compressor discharge overheat switch from air cycle machine compressor scroll.
   (b) Apply controlled heat to overheat switch probe while observing MASTER CAUTION light and AIR COND annunciator light on P2-1 panel and PACK TRIP OFF light on forward overhead panel.

      CAUTION: DO NOT APPLY HEAT ABOVE 375°F (191°C) TO SWITCH PROBE OR THE SWITCH MAY BE DAMAGED.

      1) Check that both MASTER CAUTION lights, the AIR COND annunciator light, and the PACK TRIP OFF light come on at approximately 365 ±10°F (185 ±6°C) and that after lights come on a click is felt at solenoid A of the pack valve.
      2) After click is felt open OVERHEAT circuit breaker, reconnect electrical connector removed in step B.(7)(b), close OVERHEAT circuit breaker and check that mix valve drives to full cold position by observing AIR MIX VALVE position indicator.
   (c) Depress either MASTER CAUTION light. Check that AIR COND annunciator light and both MASTER CAUTION lights go off, but PACK TRIP OFF light remains on.



Pack Valve Location
Figure 501

(d) Depress any system MASTER CAUTION annunciator light. Check that both MASTER CAUTION lights and all master caution annunciator lights come on but, when released, only both MASTER CAUTION lights, AIR COND annunciator light, and PACK TRIP OFF light remain on.
(e) Remove heat source.
(f) Open OVERHEAT circuit breaker, remove pack valve limit switch connector from pack valve, then close OVERHEAT circuit breaker.
(g) Allow sufficient time for compressor discharge overheat switch to cool then push TRIP RESET switch and check that PACK TRIP OFF light, AIR COND annunciator light and both MASTER CAUTION lights go off, and check for click at solenoid A of the pack valve.
(h) Install compressor discharge overheat switch in air cycle machine compressor scroll.

(4) Check turbine inlet overheat switch operation.
(a) Move temperature selector knob to MANUAL WARM to drive valve away from full cold position.
(b) Remove turbine inlet overheat switch from air cycle machine turbine inlet duct.
(c) Apply controlled heat to overheat switch probe while observing MASTER CAUTION light and AIR COND annunciator light on P2 panel and PACK TRIP OFF light on forward overhead panel.
1) Check that both MASTER CAUTION lights, AIR COND annunciator light, and PACK TRIP OFF light come on at approximately 210 (±10)°F (92 to 104°C). When lights come on check for click at solenoid A of pack valve.
2) After click is felt, open OVERHEAT circuit breaker, reconnect pack valve limit switch electrical connector removed in step 2.C.(3)(f), close OVERHEAT circuit breaker and check that mix valve drives to full cold position by observing AIR MIX VALVE position indicator.
(d) Remove heat source.
(e) Open OVERHEAT circuit breaker, remove pack valve limit switch electrical connector from pack valve, then close OVERHEAT circuit breaker.
(f) Allow sufficient time for turbine inlet overheat switch to cool, then push TRIP RESET switch and check that PACK TRIP OFF light, AIR COND annunciator light and both MASTER CAUTION lights go off and check for click at solenoid A of pack valve.
(g) Install turbine inlet overheat switch in air cycle machine turbine inlet duct.
(h) Open OVERHEAT circuit breaker, install pack valve limit switch electrical connector, then close OVERHEAT circuit breaker.

(5) Move air conditioning PACK switch to OFF.
(6) Close applicable air conditioning equipment bay door.

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

3. Pack Protective Circuit Test

A. General

(1) This procedure makes sure the pack valve closes when an overheat condition occurs.

B. Equipment and Materials

(1) Jumper Wire

C. Prepare for Pack Protective Circuit Test

(1) Provide electrical power.

(2) Check that all air conditioning circuit breakers are closed (in).

(3) Check that the following circuit breakers on circuit breaker panel P6 are closed:

(a) MASTER CAUTION (all except FUEL, if installed)

(b) INDICATOR LIGHTS, MASTER DIM BUS (9 places)

(c) DIM & TEST (1 place)

(4) Check warning lights and annunciators.

(a) Place LIGHTS switch on lightshield panel (P2-l) to TEST. Check that both MASTER CAUTION lights, the AIR COND annunciator light and PACK TRIP OFF light come on.

(b) Move LIGHTS switch to BRT.

(c) Press to test PACK TRIP OFF light.

(d) While pressing PACK TRIP OFF light, move LIGHTS switch to DIM and check that light dims.

(e) Continue to press PACK TRIP OFF light, move LIGHTS switch to BRT and check that light brightens.

(5) Check that air conditioning PACK switch is in OFF position.

(6) Open air conditioning equipment bay door.

(7) Simulate open position of pack valve.

(a) Open OVERHEAT circuit breaker.

(b) Remove connector from pack valve limit switch (Fig. 501).

(c) Close OVERHEAT circuit breaker.

D. Test Pack Protective Circuit

(1) Move air conditioning PACK switch to ON and check for a click at solenoid A of the pack valve.

(2) Move temperature selector knob toward MANUAL WARM to drive mix valve away from the full cold position.

(3) Check compressor discharge overheat circuit.

(a) Disconnect electrical connector from compressor discharge overheat switch in air cycle machine compressor scroll.

(b) Install a jumper wire between two pins of electrical connector.

1) Check that both MASTER CAUTION lights, the AIR COND annunciator light, and the PACK TRIP OFF light come on and that after lights come on a click is felt at solenoid A of the pack valve.

2) After click is felt, open OVERHEAT circuit breaker, reconnect electrical connector removed in step 3.C.(7)(b), close OVERHEAT circuit breaker and check that mix valve drives to full cold position by observing AIR MIX VALVE position indicator.

(c) Depress either MASTER CAUTION light. Check that AIR COND annunciator light and both MASTER CAUTION lights go off, but PACK TRIP OFF light remains on.

(d) Depress any system MASTER CAUTION annunciator light. Check that both MASTER CAUTION lights and all master caution annunicator lights come on but, when released, only both MASTER CAUTION lights, AIR COND annunciator light, and PACK TRIP OFF light remain on.

(e) Remove jumper wire.

(f) Open OVERHEAT circuit breaker, remove pack valve limit switch connector from pack valve, then close OVERHEAT circuit breaker.

(g) Push TRIP RESET switch and check that PACK TRIP OFF light, AIR COND annunciator light and both MASTER CAUTION lights go off, and check for click at solenoid A of the pack valve.

(h) Connect electrical connector to compressor discharge overheat switch in air cycle machine compressor scroll.

(4) Check turbine inlet overheat switch circuit.

(a) Move temperature selector knob to MANUAL WARM to drive valve away from full cold position.

(b) Disconnect electrical connector from turbine inlet overheat switch in air cycle machine turbine inlet duct.

(c) Install jumper wire between two pins of electrical connector.

1) Check that both MASTER CAUTION lights, AIR COND annunciator light, and PACK TRIP OFF light come on. When lights come on, check for click at solenoid A of pack valve.

2) After click is felt, open OVERHEAT circuit breaker, reconnect pack valve limit switch electrical connector removed in step 3.D.(3)(f), close OVERHEAT circuit breaker and check that mix valve drives to full cold position by observing AIR MIX VALVE position indicator.

(d) Remove jumper wire.

(e) Open OVERHEAT circuit breaker, remove pack valve limit switch electrical connector from pack valve, then close OVERHEAT circuit breaker.

(f) Push TRIP RESET switch and check that PACK TRIP OFF light, AIR COND annunciator light and both MASTER CAUTION lights go off and check for click at solenoid A of pack valve.

(g) Connect electrical connector to turbine inlet overheat switch in air cycle machine turbine inlet duct.

(h) Open OVERHEAT circuit breaker, install pack valve limit switch electrical connector, then close OVERHEAT circuit breaker.

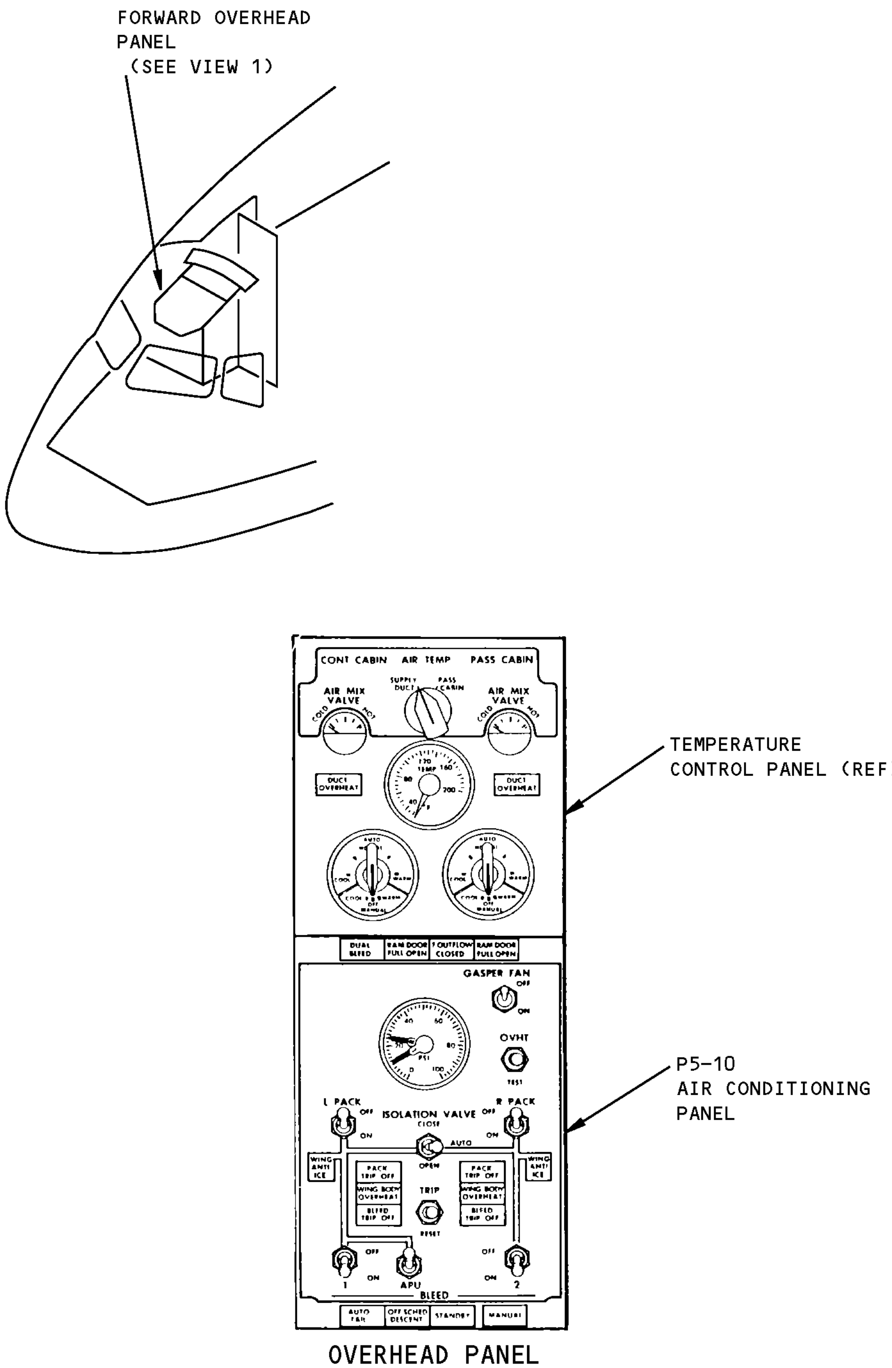
(5) Move air conditioning PACK switch to OFF.
(6) Close applicable air conditioning equipment bay door.
(7) If no longer required, remove electrical power from airplane.

AIR CONDITIONING MODULE - REMOVAL/INSTALLATION

1. General
   A. This procedure provides instructions to remove, install, and test the P5-10 air conditioning module, located on the P5 forward overhead panel. The test of the air conditioning module checks the integrity of the circuits into and out of the module.
2. Air Conditioning Module Removal (Fig. 401)
   A. Open all circuit breakers on the P6-4 circuit breaker panel that are associated with the air conditioning system.
   B. Lower the P5 forward overhead panel to get access to the back of the P5-10 air conditioning module.
   C. Disconnect electrical connectors D646 and D680 from the back of the air conditioning module.
   D. Loosen the fasteners on the sides of the air conditioning module that attach the module to the P5 forward overhead panel.
   E. Remove the air conditioning module.
3. Air Conditioning Module Installation (Fig. 401)
   A. Put the air conditioning module in its place in the P5 forward overhead panel.
   B. Tighten the fasteners on the sides of the air conditioning module that attach the module to the P5 forward overhead panel.
   C. Connect electrical connectors D646 and D680 to the air conditioning module.
   D. Raise the P5 forward overhead panel into position and tighten the retaining fasteners.
4. Air Conditioning Module Test
   A. Supply electrical power to the airplane.
   B. Close all air conditioning circuit breakers on the P6-4 circuit breaker panel.
   C. Check that all the following circuit breakers on circuit breaker panel P6-3 are closed:
      (1) MASTER CAUTION (all except FUEL, if installed)
      (2) INDICATOR LIGHTS, MASTER DIM BUS (9 places)
      (3) DIM & TEST
   D. Make sure the RAM DOOR FULL OPEN lights on the P5-10 air conditioning module are on.
   E. Make sure the L and R PACK switches on the air conditioning module are set to OFF.
   F. Set the LIGHTS switch on the P2 center instrument panel momentarily to TEST and make sure these lights come on and then go off.
      (1) AUTO FAIL
      (2) OFF SCHED DESCENT
      (3) STANDBY
      (4) MANUAL
      (5) L and R PACK TRIP OFF

(6) L and R BLEED TRIP OFF
(7) DUAL BLEED
(8) F OUTFLOW CLOSED

G. Push the OVHT TEST switch and make sure the WING-BODY OVERHEAT lights come on.
H. Open right cowl on both engines.
I. Position engine 1 BLEED switch to ON.
J. Check that bleed air valve for engine 1 opens as shown by valve position indicator.
K. Position engine 1 BLEED switch to OFF and check that valve closes.
L. Repeat steps H thru K for engine 2 BLEED switch.
M. Position GASPER AIR switch to ON.
N. Check that gasper fan operates and air is discharged from PSU gasper outlets in control and passenger cabins.
O. Position GASPER AIR switch to OFF.
P. Open an airplane door.
Q. Test the air conditioning module APU, PACK, ISOLATION VALVE and BLEED switches as follows:
   (1) Supply pneumatic air from the APU.
   (2) Put the ISOLATION VALVE switch to close.
   (3) Put the APU BLEED switch to ON.
   (4) Make sure pressure is indicated on the left pressure gage.
   (5) Put the L PACK switch to the AUTO position.
   (6) Make sure the indication on the left pressure gage decreases.
   (7) Put the L PACK switch to the OFF position.
   (8) Put the ISOLATION VALVE switch to the OPEN position.
   (9) Make sure pressure is indicated on the right pressure gage.
   (10) Put the R PACK switch to AUTO.
   (11) Make sure the indication on the right pressure gage decreases.
   (12) Put the R PACK switch to OFF.
R. Return the Airplane Back To Its Usual Condition:
   (1) Remove pneumatic power.
   (2) Put the APU BLEED switch to OFF.
   (3) Remove electrical power if it is not necessary.
   (4) Close airplane door opened for this test.
   (5) Close engine cowls.



Air Conditioning Module Installation
Figure 401

AIR CYCLE MACHINE - UNIT SERVICING

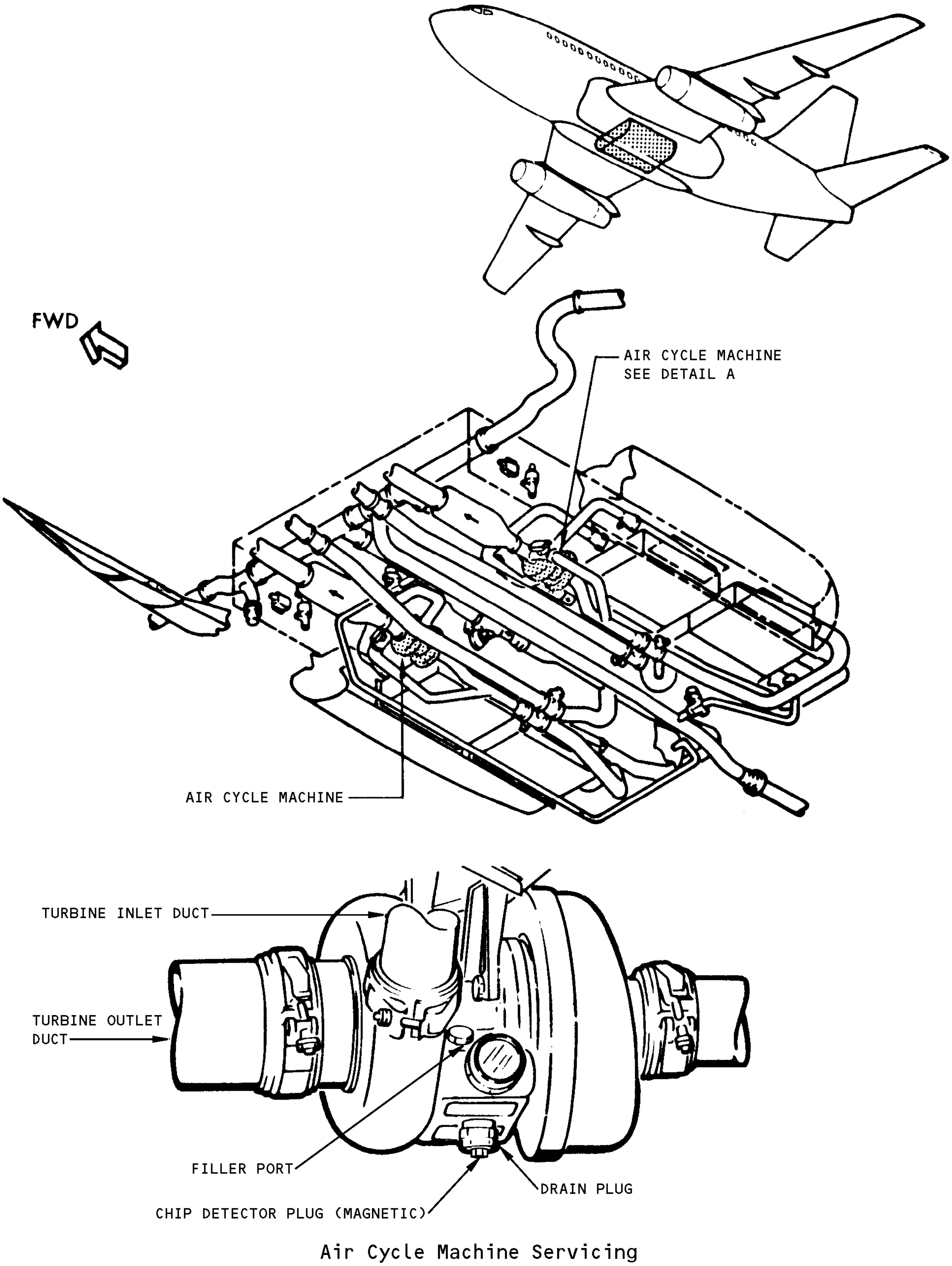
1. General
   A. The procedure outlined in this section is for replacing oil in the air cycle machine. For topping of oil refer to Chapter 12, Air Cycle Machine - Servicing.
2. Equipment and Materials
   A. Lubricant: Oil as approved by AiResearch Manufacturing Company, 9851-9951 Sepulveda Boulevard, Los Angeles, California 90009
3. Replace Air Cycle Machine Oil
   A. Open air conditioning equipment bay doors.
   B. Remove the chip detector plug from the drain plug in the bottom of the oil sump (Fig. 301).

      CAUTION: THE CHIP DETECTOR PLUG SHOULD NOT HAVE ANY METAL PARTICLES ON IT. THE PRESENCE OF METAL PARTICLES IS A SIGN OF WEAR IN THE AIR CYCLE MACHINE AND OF POSSIBLE ACM FAILURE.

   C. Inspect the chip detector plug for metal particles and clean plug if required.
   D. Remove filler plug from top of oil sump.
   E. Hold container below the drain plug.
   F. Remove drain plug and allow oil to drain completely.
   G. After oil has drained, install the drain plug with a new O-ring.
   H. Install chip detector plug with new O-ring into drain plug.
   I. Fill air cycle machine until oil starts to flow from filler port.

      NOTE: Oil sump should hold approximately 300 cc of oil.

   J. Install the filler plug with a new O-ring in the filler port.
   K. Close air conditioning equipment bay doors.



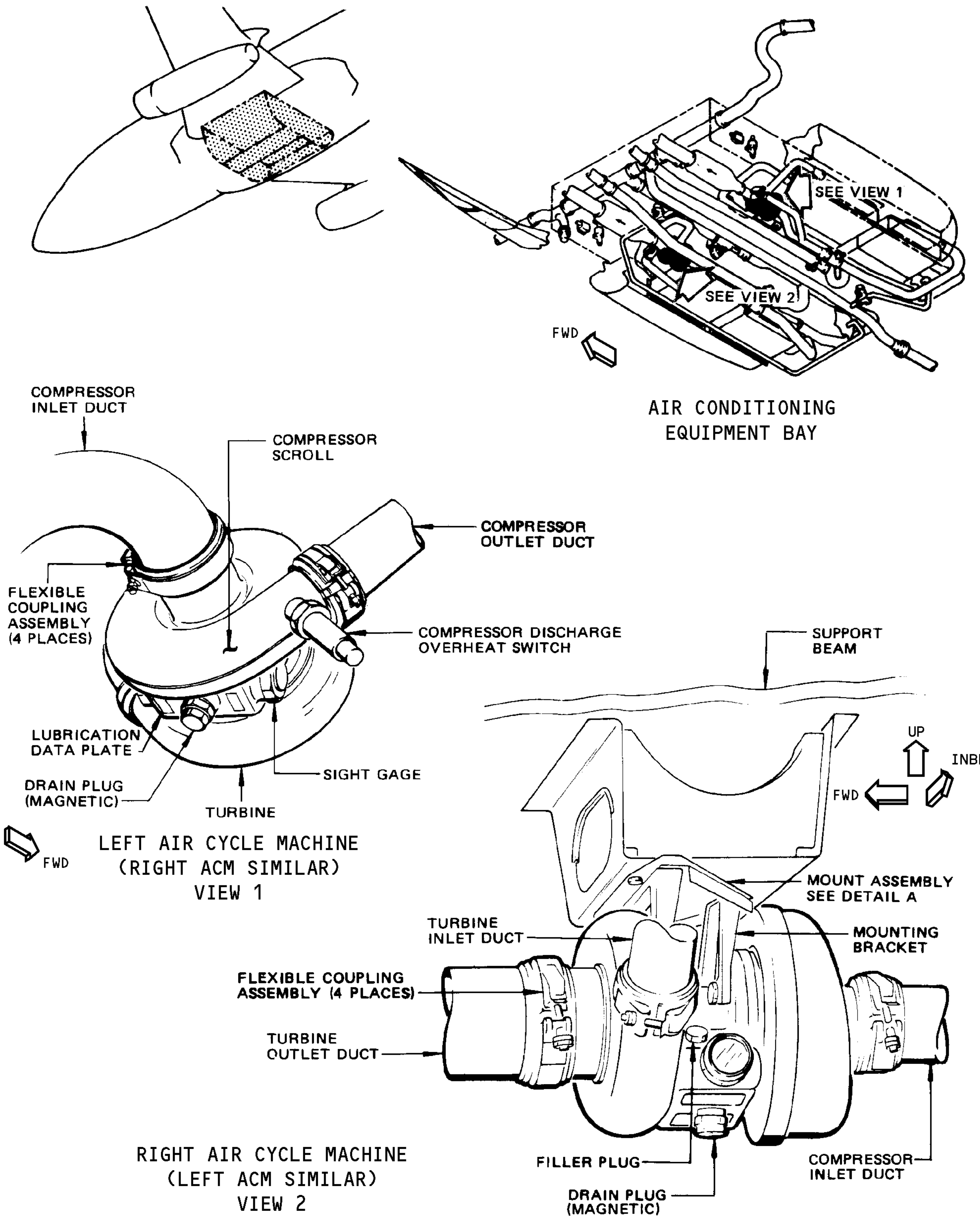
Air Cycle Machine Servicing
Figure 301

AIR CYCLE MACHINE (ACM) - REMOVAL/INSTALLATION

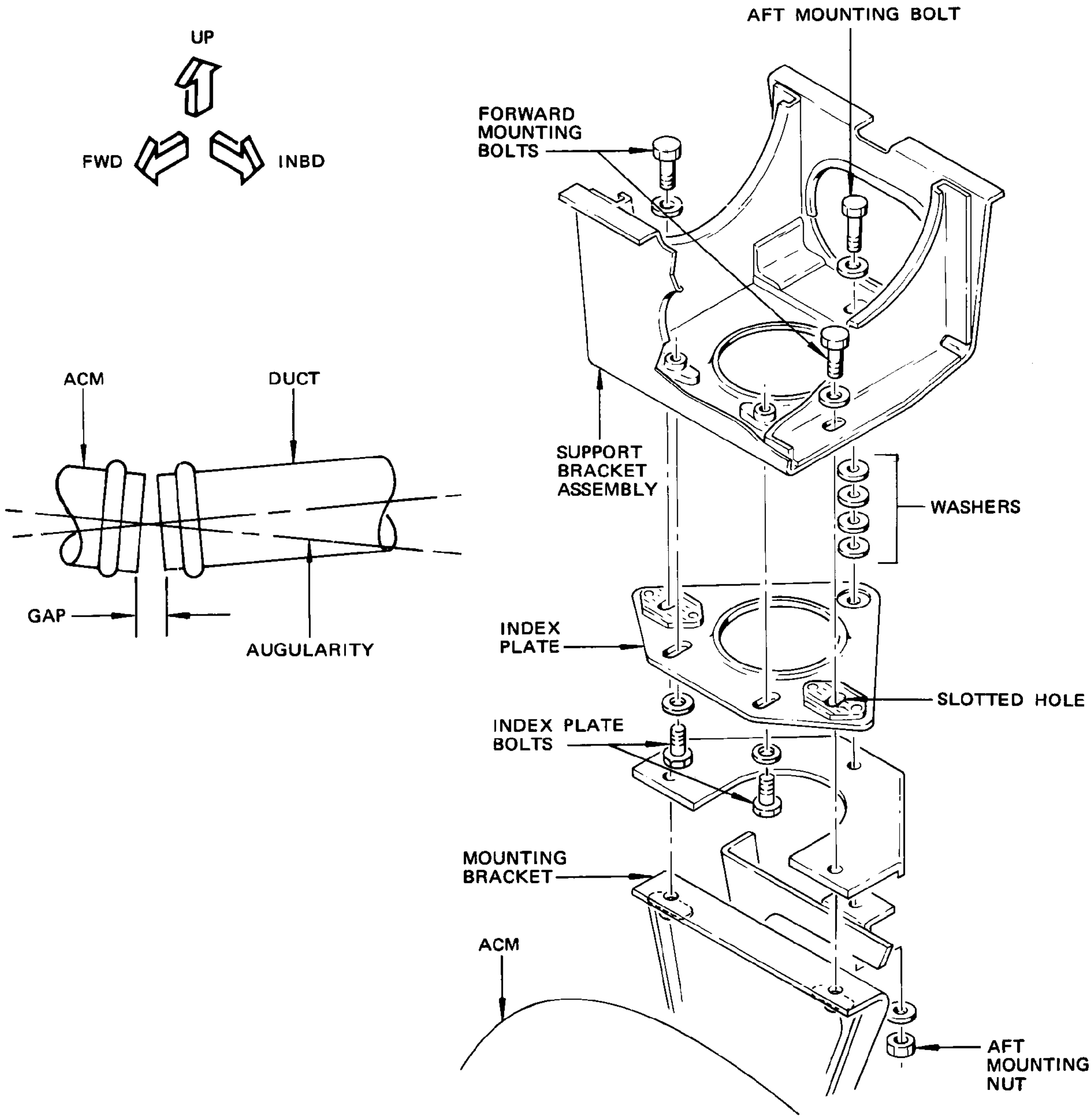
1. General
   A. Two air cycle machines (ACM) are provided for the air cycle air conditioning systems. Since the left and right ACM installations are alike, the following procedure will apply to either.
2. Prepare ACM for Removal
   A. Lower air conditioning equipment bay doors.
   B. Drain oil from air cycle machine.
3. Remove ACM
   A. Remove compressor and turbine inlet and outlet flexible couplings. Ref 21-51-61, Flexible Coupling Assembly - Removal/Installation.
   B. Remove compressor discharge overheat switch from ACM compressor scroll.
   C. Remove ACM from mount assembly.
      (1) Remove two forward mounting bolts, loosen aft mounting nut and slide ACM forward. (Detail A, Fig. 401) Do not remove two index plate bolts securing index plate to support bracket assembly.
   D. Remove ACM.
4. Install ACM
   A. Check that flexible coupling sleeve and ring are in place on ACM connecting ducts.

      NOTE: Procedure for installation of flexible couplings depends on whether a new coupling or old coupling is being used to connect ducts to ACM. Ref 21-51-61, Flexible Coupling Assembly - Removal/Installation, for recommended coupling installation procedure.

   B. Lift ACM into place and secure with three mounting bolts (Detail A, Fig. 401).
   C. Move compressor inlet and turbine outlet ducts into place.
   D. Move compressor outlet and turbine inlet ducts into place.
   E. Check ACM for alignment with ducts. If alignment is necessary, adjust ACM per step F. If alignment of ACM is not required, proceed with step G.
   F. Adjust ACM to align with mating ducts.
      (1) Loosen two index plate bolts securing index plate to support bracket assembly to allow movement of ACM forward or aft. Add or remove one washer to aft mounting bolt between index plate and support bracket to tilt ACM as required. Retighten two index plate bolts and aft mounting nut.
   G. Install flexible coupling assembly at turbine and compressor inlets and outlets (Ref 21-51-61, Removal/ Installation.
   H. Install compressor discharge overheat switch in ACM compressor scroll.
   I. Service ACM (Ref Chapter 21, Unit Servicing.
   J. Provide electrical power.



Air Cycle Machine Installation
Figure 401 (Sheet 1)



CLAMP	GAP		AUGULARITY MAXIMUM	OFFSET
	MAX	MIN		
COUPLING 3 IN. OD OR LESS	0.18	0.03	3°	NOT ALLOWED
COUPLING OVER 3 IN. OD	0.18	0.03	2°	

FLEXIBLE COUPLING TOLERANCE CHART

Air Cycle Machine Installation
Figure 401 (Sheet 2)

K. Pressurize pneumatic system to approximately 25 psi.
L. Operate air conditioning air cycle system.
M. Hold temperature selector to manual COOL until air mix valve moves to full COLD then move selector to OFF.
N. Wait for system to stabilize then check that SUPPLY DUCT temperature reads between 32 and 44°F (0 and 6°C).
O. Check for leakage at ACM duct clamps by listening and feeling. Diffused leakage is allowed at any connection but jet blasts are not.
P. Turn air cycle system off.
Q. Remove pneumatic power if no longer required.
R. Remove electrical power if no longer required.
S. Close air conditioning equipment bay doors.

HEAT EXCHANGERS - REMOVAL/INSTALLATION

1. General
   A. Each pack has a primary and secondary heat exchanger located between two sections of the ram air duct in the air conditioning equipment bay (Fig. 401). Removal/Installation procedures for the heat exchanger are similar. The following procedure is for either with any difference noted in the applicable step.
2. Equipment and Materials
   A. Primer, RTV 1200 (20-30-11)
   B. Adhesive, RTV 174 (20-30-11)
   C. Solvent - Final cleaning of All Organic Coatings Prior to Non-structural Bonding (Series 89) (Ref AMM/SOPM 20-30-89).
3. Remove Heat Exchanger
   A. Open ram air duct access door and air conditioning equipment bay doors.
   B. Remove ram air inlet duct inspection doors.
   C. Remove V-band clamps connecting heat exchanger to air conditioning ducts.
   D. For right heat exchanger, remove section of turbofan duct assembly under heat exchanger to provide clearance for removal (Fig. 401).
   E. On airplanes with an air cleaner system, remove section of air cleaner purge line from under heat exchangers to provide clearance for removal of heat exchanger (Detail B, Fig. 401).
   F. Remove V-band clamp outboard of 35°F control valve, and clamp downstream of valve at V-joint. Remove section of duct.
   G. Remove screws securing heat exchanger inlet lip and remove inlet lip.
   H. Remove screws securing heat exchanger to lower wing beam.
   I. Disconnect heat exchanger from duct (Fig. 401).
      (1) For secondary heat exchanger remove nuts, bolts, washers and lower spacer connecting the heat exchanger to flexible duct except two bolts which connect the heat exchanger to the support rod clip assembly. Remove stiffening flanges from either side of flexible duct if installed.
      (2) For primary heat exchanger remove all nuts, bolts and washers connecting heat exchanger to ram air outlet duct except those attached to the support rod clip assembly. Remove stiffening flange from between heat exchanger and ram air exhaust duct if installed.
   J. Support heat exchanger and remove fasteners connecting clip assembly to heat exchanger.
   K. Remove heat exchanger.
4. Prepare Heat Exchanger for Installation
   A. Check that gasket bonded to lower wing beam is not damaged. If damaged, replace.
   B. Remove gasket.
      (1) Remove gasket and adhesive with putty knife or similar tool with a medium sharp edge. Clean the remaining adhesive with solvent, Series 89 (Ref AMM/SOPM 20-30-89).

C. Install gasket.
   (1) Brush a liberal coat of RTV 1200 primer on bonding surfaces.
   (2) Allow a minimum of 30-minute drying time.
   (3) Apply a uniform layer of RTV 174 adhesive.
   (4) Join surfaces as soon as possible after application of adhesive to prevent formation of skin on adhesive.

      NOTE: Apply sufficient pressure to ensure complete contact but not enough to squeeze out an excessive amount of adhesive.

   (5) Allow 24 hours drying at 70 to 80°F. Optional cure time is 45 to 60 minutes at 200 to 250°F.

5. Install Heat Exchanger
   A. Support heat exchanger in position and secure clip assembly to heat exchanger per Fig. 401.
   B. Connect heat exchanger to duct.
      (1) For primary heat exchanger install all nuts, bolts, washers and stiffening flange (if applicable) connecting heat exchanger to ram air outlet duct. (See Fig. 401 for effectivity.)
      (2) For secondary heat exchanger install nuts, bolts, washers, stiffening flanges (if applicable) and lower spacer connecting heat exchanger to flexible duct as shown in view 1, Fig. 401.
   C. Install bolts securing heat exchanger to lower wing beam.
   D. Align heat exchanger with duct connections.

      NOTE: Adjust length of support rods as required to have heat exchanger duct connections match with duct runs. After final adjustment, lockwire support rods.

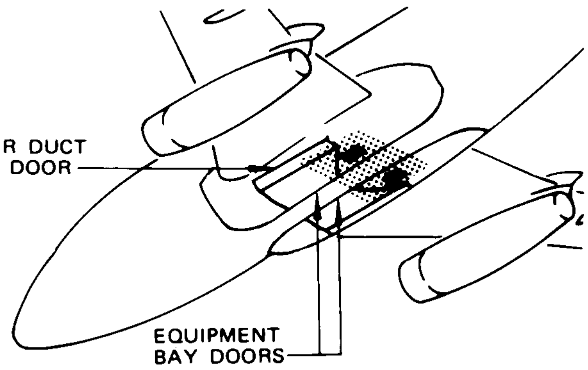
   E. Install duct section and V-band clamp outboard of 35°F control valve.
   F. Align duct section and install clamp downstream of valve at Y-joint.
   G. Install V-band clamps connecting heat exchanger to air conditioning ducts.

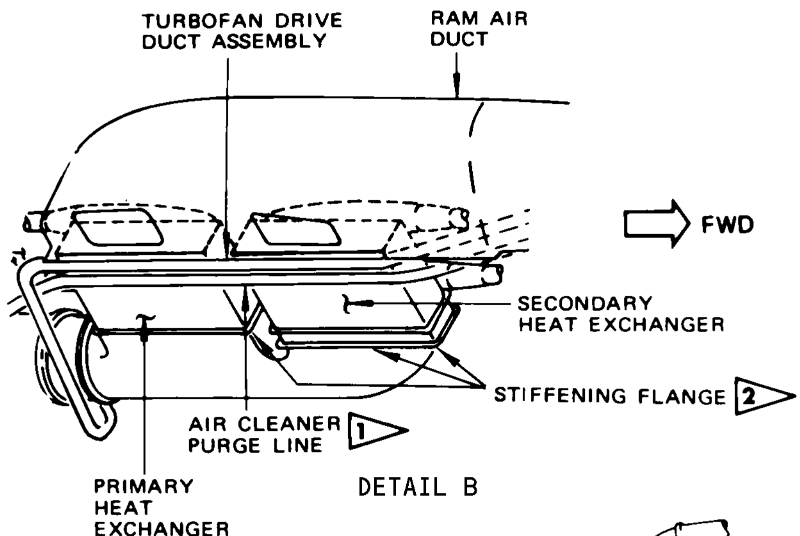
      CAUTION: MAINTAIN 1/2-INCH CLEARANCE BETWEEN AIR CONDITIONING DUCT AND HEAT EXCHANGER TO PREVENT DUCT FROM RUBBING ON THE LOWER EDGE OF THE FORWARD HEAT EXCHANGER.

   H. For right heat exchanger, install turbofan duct section.
   I. If applicable, install air cleaner purge line.
   J. Install heat exchanger inlet lip.
   K. Install ram air inlet duct inspection doors.
   L. Provide electrical power.
   M. Pressurize pneumatic system to approximately 25 psi.
   N. Operate air conditioning air cycle system.

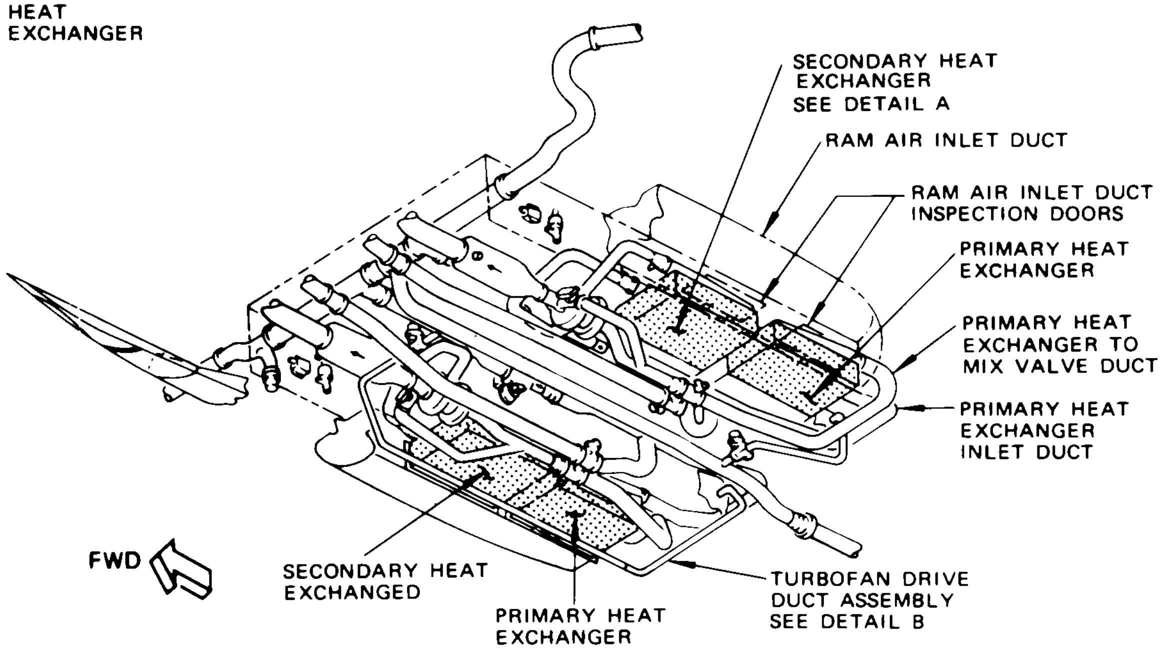
[1] AIRPLANES WITH BLEED AIR CLEANER

[2] AR ALL EXCEPT LV-JMW THRU LV-JMY, LV-JND AND LV-JNE
PV ALL EXCEPT CF-EPL, CF-EPO, CF-EPR
TZ ALL EXCEPT CR-TAN, CF-TAO
PW ALL EXCEPT CF-PWC THRU CF-PWE
WE ALL EXCEPT N2711R, N4906, N4907 AND N4902W
CP ALL EXCEPT CF-CPB THRU CF-CPE, CF-CPU, CF-CPV, CF-CPZ





DETAIL B



Heat Exchanger Installation
Figure 401 (Sheet 1)

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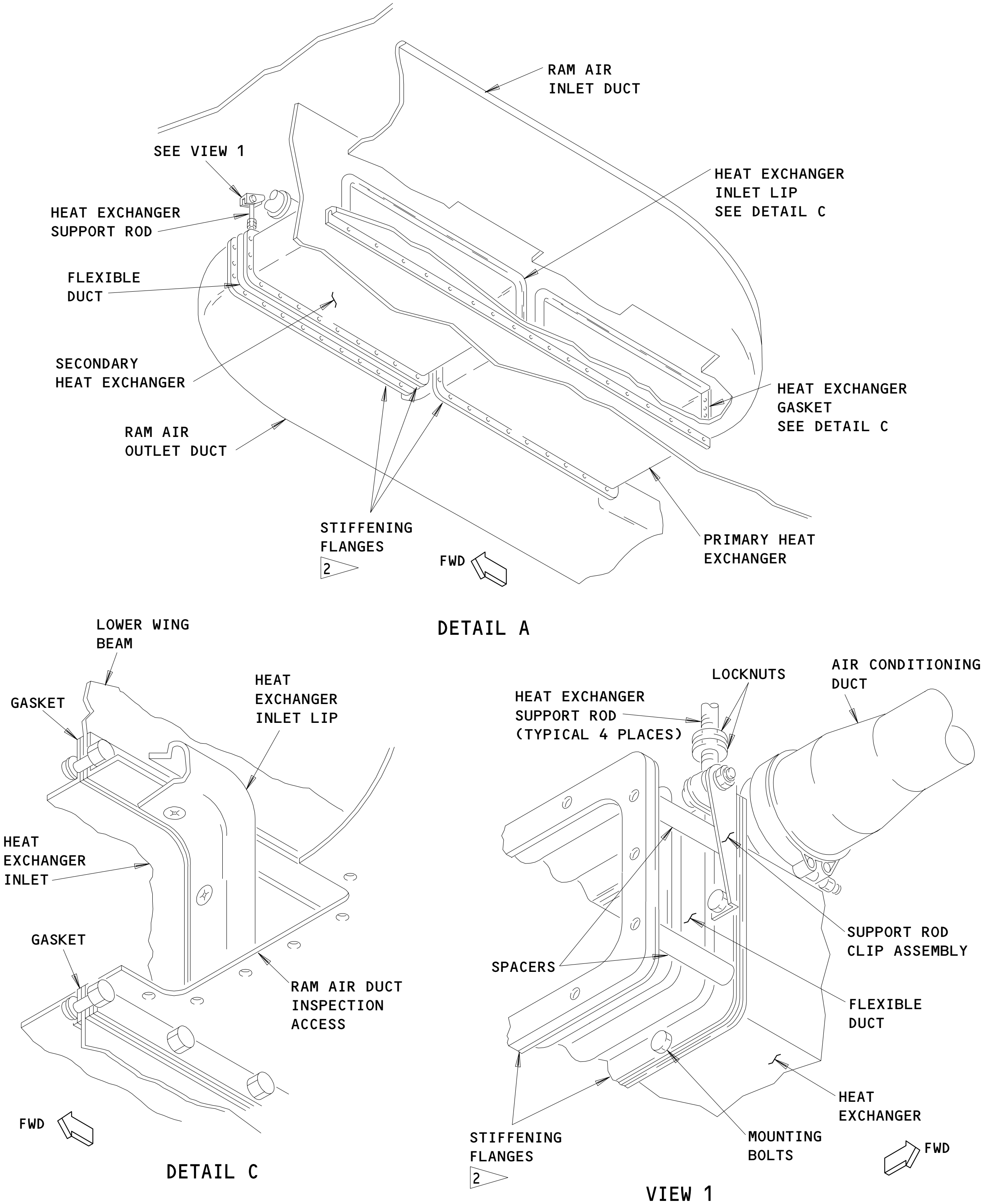


Heat Exchanger Installation
Figure 401 (Sheet 2)

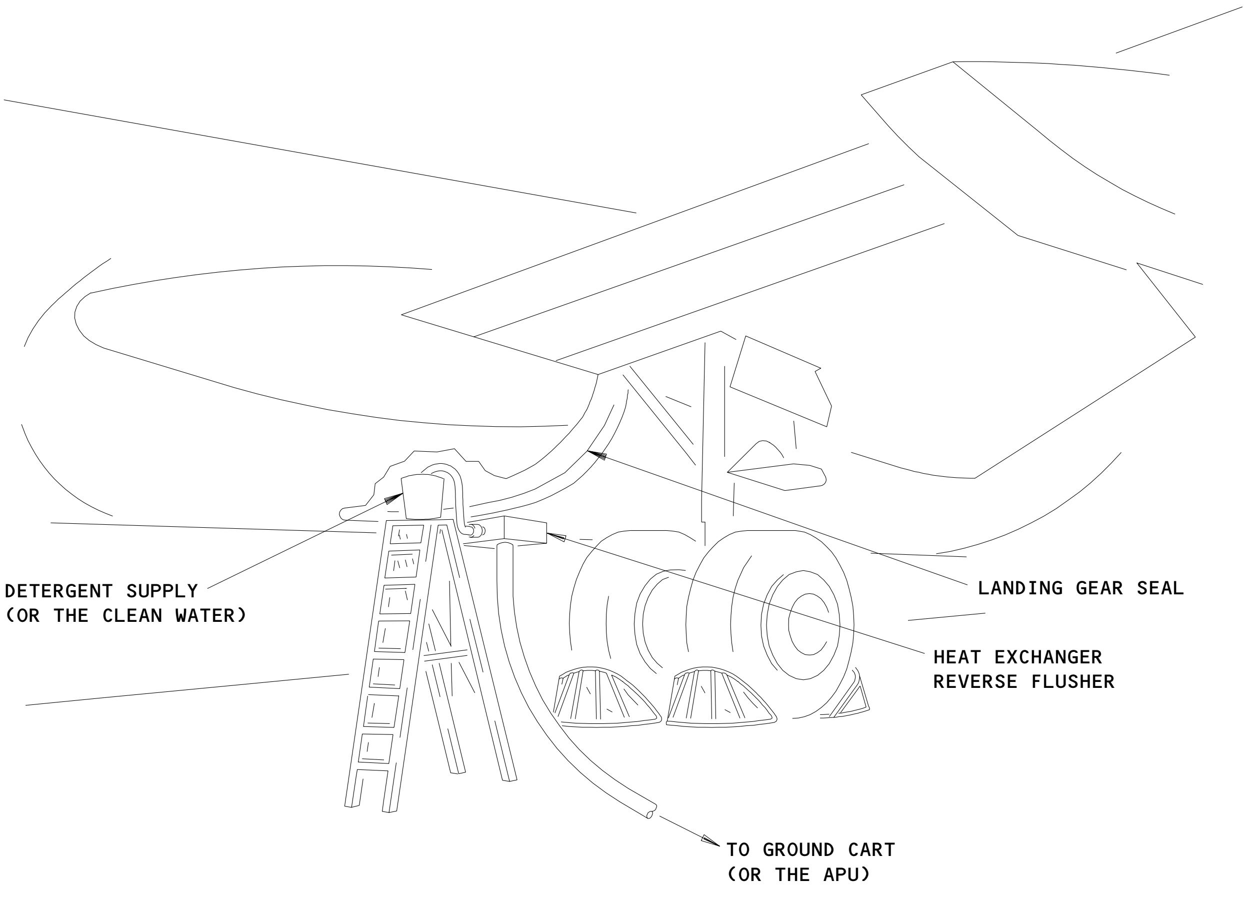
O. Hold temperature selector to manual COOL until air mix valve moves to full COLD then move selector to OFF.
P. Check for leakage at all duct joints that were separated by listening and feeling. Diffused leakage is allowed at any connection but jet blasts are not.
Q. Turn air cycle system off.
R. Remove pneumatic power if no longer required.
S. Remove electrical power if no longer required.
T. Close air conditioning equipment bay and ram air duct access doors.

HEAT EXCHANGER - ADJUSTMENT/TEST

1. General
   A. Dirty or clogged heat exchangers may cause A/C pack overheat trip. Should problems occur, accomplish heat exchanger tests included in 21-00, Air Conditioning - Maintenance Practices.

HEAT EXCHANGERS - CLEANING

1. General
    A. This procedure has one task. The task is to clean the primary and secondary heat exchangers of the air cycle system.
    B. The heat exchangers are cleaned with a detergent that flows through the heat exchangers in the opposite direction of the ram air. Air from the APU or from a high pressure ground cart can be used to move the detergent through the heat exchangers.
2. Primary and Secondary Heat Exchangers Cleaning
    A. Equipment and Materials
        (1) C21002-20 - Reverse Flusher - Heat Exchanger
        (2) PF80-012 - Deactivator - Check Valve, PF Industries Inc.
        (3) High Pressure Ground Cart
        (4) Detergent, general purpose liquid household, diluted with water as suggested by the manufacturer.
    B. Prepare to Clean the Heat Exchangers
        (1) Set the position of these switches on the forward overhead panel as follows:
            (a) Set the APU BLEED switch to OFF.
            (b) Set the L PACK and R PACK switches to OFF.
            (c) Set the ISOLATION VALVE switch to OPEN.
        (2) Make sure that the inlet doors and the exit louvers for the ram air are fully open.
        (3) Open the bay doors to the air conditioning equipment.
        (4) Open the access doors for the ram air duct.
        (5) Remove the two access panels to the heat exchangers.
        (6) Examine the exchangers to see if dirt or other unwanted material is on the inlet of the heat exchangers.
            (a) Remove all unwanted material from the inlet of the heat exchangers.
        (7) Install the heat exchanger reverse flusher below the ram air exhaust louvers and against the airplane (Fig. 701).
        (8) Put a container of diluted detergent on the work stand, and make sure that the container is above the reverse flusher.
        (9) Install the quick-disconnect end of a hose to the fitting on the side of the reverse flusher.
        (10) Put the other end of the hose into the container with the detergent.
    C. Clean the Heat Exchangers with the APU as the Pneumatic Source
        (1) Use the APU as the pneumatic source to clean the heat exchangers as follows:
            (a) Look at the pressure gage on the forward overhead panel and make sure the bleed air pressure is 0 psig.
            (b) Open the access door to the ground air connector for the pneumatic system.



Heat Exchanger Reverse Flusher Installation
Figure 701

(c) Install the check valve deactivator tool in the ground air connector.

WARNING: WEAR GLOVES THAT WILL GIVE YOU PROTECTION FROM HOT SURFACES WHEN YOU CONNECT OR DISCONNECT PNEUMATIC FITTINGS. THE GROUND AIR CONNECTOR CAN BE VERY HOT IF THE PACKS HAVE BEEN OPERATED IMMEDIATELY BEFORE THIS PROCEDURE. YOU CAN BADLY BURN YOUR HANDS IF YOU TOUCH A HOT GROUND AIR CONNECTOR.

(d) Install a pneumatic hose from the ground air connector to the fitting on the bottom of the reverse flusher.
(e) Start the APU (Ref 49-11-0/201).

CAUTION: DO NOT LET THE PRESSURE IN THE REVERSE FLUSHER BE MORE THAN 2.5 PSIG. THE RAM AIR DUCT COULD BE DAMAGED FROM PRESSURES MORE THAN 2.5 PSIG.

(f) Set the APU BLEED switch to ON.
(g) Set the APU BLEED switch to OFF when the container of the detergent is empty.

CAUTION: DO NOT PERMIT APU BLEED AIR WITHOUT THE SOAP SOLUTION TO GO THROUGH THE RAM AIR DUCTS. WITHOUT THE SOAP SOLUTION TO DECREASE THE TEMPERATURE OF THE APU BLEED AIR, DAMAGE TO THE RAM AIR DUCTS CAN OCCUR.

(h) Let the detergent stay on the heat exchangers for a minimum of 5 minutes.
(i) Flush the heat exchangers as follows:
   1) Fill the container with water.
   2) Set the APU BLEED switch to ON to flush the detergent and the contamination from the heat exchangers.
   3) Set the APU BLEED switch to OFF when the container of water is empty.

   CAUTION: DO NOT PERMIT APU BLEED AIR WITHOUT WATER TO GO THROUGH THE RAM AIR DUCTS. WITHOUT THE WATER TO DECREASE THE TEMPERATURE OF THE APU BLEED AIR, DAMAGE TO THE RAM AIR DUCTS CAN OCCUR.

   4) Do the steps above again until all of the detergent is flushed from the heat exchangers.
(j) Stop the APU (Ref 49-11-0/201).
(k) Look at the gage on the reverse flusher and make sure the pressure is 0 psig.

(l) Remove the pneumatic hose from the ground air connector and the reverse flusher.

WARNING: WEAR GLOVES THAT WILL GIVE YOU PROTECTION FROM HOT SURFACES WHEN YOU CONNECT OR DISCONNECT PNEUMATIC FITTINGS. THE GROUND AIR CONNECTOR CAN BE VERY HOT IF THE PACKS HAVE BEEN OPERATED IMMEDIATELY BEFORE THIS PROCEDURE. YOU CAN BADLY BURN YOUR HANDS IF YOU TOUCH A HOT GROUND AIR CONNECTOR.

(m) Remove the check valve deactivator tool from the ground air connector.

(n) Close the access door to the ground air connector.

D. Clean the Heat Exchangers with a High Pressure Ground Cart as the Pneumatic Source

(1) Use a high-pressure ground cart as the pneumatic source to clean the heat exchangers as follows:

(a) Install a pneumatic hose from the ground cart to the fitting on the bottom of the reverse flusher.

WARNING: WEAR GLOVES THAT WILL GIVE YOU PROTECTION FROM HOT SURFACES WHEN YOU CONNECT OR DISCONNECT PNEUMATIC FITTINGS. THE BLEED AIR FITTING ON THE GROUND CART CAN BE VERY HOT IF THE GROUND CART HAS BEEN OPERATED IMMEDIATELY BEFORE THIS PROCEDURE. YOU CAN BADLY BURN YOUR HANDS IF YOU TOUCH A HOT FITTING ON THE GROUND CART.

(b) Set the bleed switch on the ground cart to on.

(c) Open the bleed air valve on the ground cart.

CAUTION: DO NOT LET THE PRESSURE IN THE REVERSE FLUSHER BE MORE THAN 2.5 PSIG. THE RAM AIR DUCT COULD BE DAMAGED FROM PRESSURES MORE THAN 2.5 PSIG.

(d) Set the bleed switch on the ground cart to off when the container of detergent is empty.

CAUTION: DO NOT PERMIT HOT AIR FROM THE GROUND CART WITHOUT THE DETERGENT TO GO THROUGH THE RAM AIR DUCTS. WITHOUT THE DETERGENT TO DECREASE THE TEMPERATURE OF THE HOT AIR, DAMAGE TO THE RAM AIR DUCTS CAN OCCUR.

(e) Let the detergent stay on the heat exchangers for a minimum of 5 minutes.

(f) Flush the heat exchangers as follows:
1) Fill the container with water.
2) Set the bleed switch on the ground cart to on to flush the detergent and the contamination from the heat exchangers.
3) Set the bleed switch on the ground cart to off when the container of water is empty.

<u>CAUTION</u>: DO NOT PERMIT HOT BLEED AIR WITHOUT WATER TO GO THROUGH THE RAM AIR DUCTS. WITHOUT THE WATER TO DECREASE THE TEMPERATURE OF THE HOT BLEED AIR, DAMAGE TO THE RAM AIR DUCTS CAN OCCUR.

4) Do the steps above again until all of the detergent is removed from the heat exchangers.

(g) Close bleed air valve on the ground cart.
(h) Look at the gage on the reverse flusher and make sure the pressure is 0 psig.
(i) Remove the pneumatic hose from the ground cart and the reverse flusher.

<u>WARNING</u>: WEAR GLOVES THAT WILL GIVE YOU PROTECTION FROM HOT SURFACES WHEN YOU CONNECT OR DISCONNECT PNEUMATIC FITTINGS. THE BLEED AIR FITTING ON THE GROUND CART CAN BE VERY HOT IF THE GROUND CART HAS BEEN OPERATED IMMEDIATELY BEFORE THIS PROCEDURE. YOU CAN BADLY BURN YOUR HANDS IF YOU TOUCH A HOT FITTING ON THE GROUND CART.

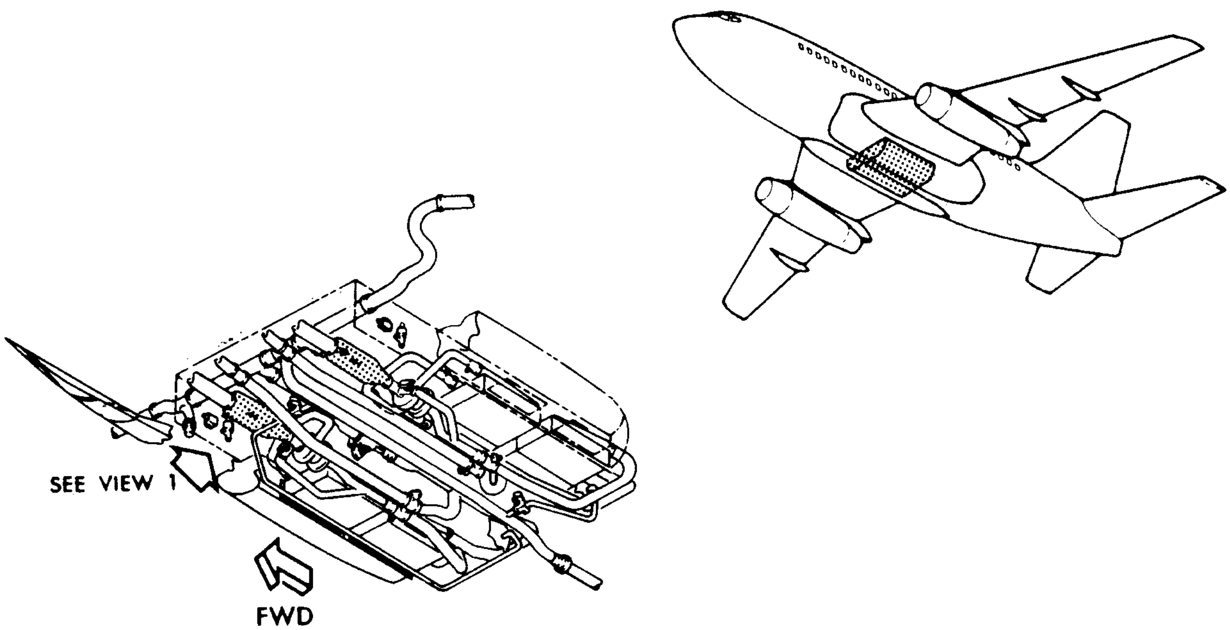
E. Put the Airplane Back to Its Usual Condition
(1) Remove the hose with the quick-disconnect fitting from the reverse flusher.
(2) Remove the reverse flusher from the exhaust louvers for the ram air.
(3) Install the access panels to the heat exchangers.
(4) Close the access door for the ram air ducts.
(5) Close the bay doors to the air conditioning equipment.

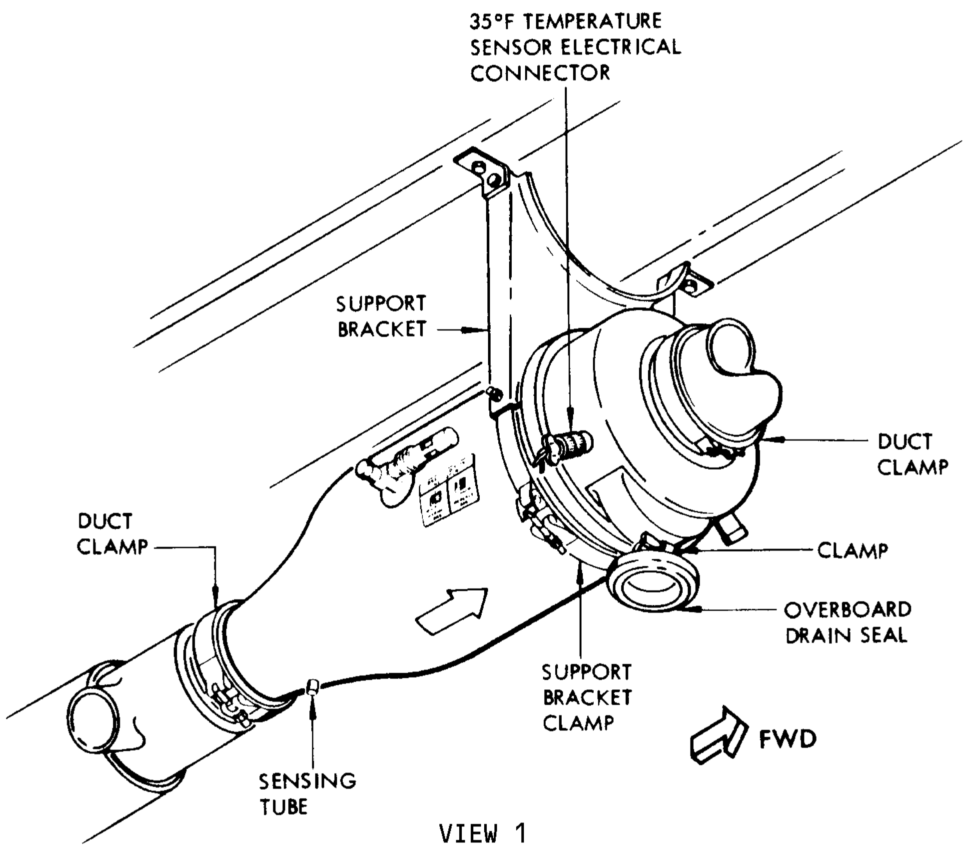
WATER SEPARATOR - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Antiseize - EASE-OFF 990 (Ref 20-30-21)
2. Remove Water Separator
   A. Lower air conditioning equipment bay door.
   B. Remove electrical connector from 35°F temperature sensor.
   C. Remove clamp holding overboard drain seal to water separator drain boss and retain seal for use on new water separator (Fig. 401).
   D. Disconnect duct clamps from forward and aft ends of water separator.
   E. Support water separator and remove support bracket clamp.
   F. Remove water separator.
   G. Remove 35°F temperature sensor and retain for use on new water separator.
3. Install Water Separator
   A. Apply light coating of antiseize to 35°F temperature sensor threads, then install in water separator and lockwire.
   B. Install 35°F temperature sensor in water separator and lockwire.
   C. Position water separator to support bracket with flow arrow pointing forward and install but do not tighten support clamp.
   D. Turn water separator as required to align electrical connector and water separator drain boss and install duct clamps loosely.
   E. Tighten water separator support bracket clamp.
   F. Tighten duct clamps.
   G. Install overboard drain seal and clamp to drain boss.
   H. Provide electrical power.
   I. Pressurize pneumatic system.
   J. Operate air conditioning system with mix valve at full cold position and check for air leakage at clamps.

      NOTE: With air conditioning system operating, check at clamps by feeling and listening. Diffused leakage is allowed at any clamp, however, jet blasts are not permissible.

   K. Check that 35°F control valve position indicator is at full open.
   L. Install temperature sensor electrical connector and check that 35°F valve moves toward closed then modulates.
   M. Remove pneumatic power if no longer required.
   N. Position pack switches to OFF.
   O. Close air conditioning equipment bay door.
   P. Remove electrical power if no longer required.





VIEW 1

Water Separator Installation
Figure 401

WATER SEPARATOR COALESCER (BAG) - REMOVAL/INSTALLATION

1. General
   A. The water separator coalescer (bag) is positioned around the bag support and secured at each end by a bead chain assembly and two springs. (See figure 401.)
2. Equipment and Materials
   A. Grease - Dow Corning High Vacuum, -40° to 400°F or equivalent
3. Remove Water Separator Bag
   A. Lower air conditioning equipment bay doors.
   B. Remove duct clamp at aft end of water separator.
   C. Remove clamp holding water separator shell assembly to collector chamber (See figure 401.)
   D. Remove water separator support bracket clamp.
   E. Remove shell assembly including bag support and bag by lowering assembly until collector chamber is cleared, then remove assembly from equipment bay.

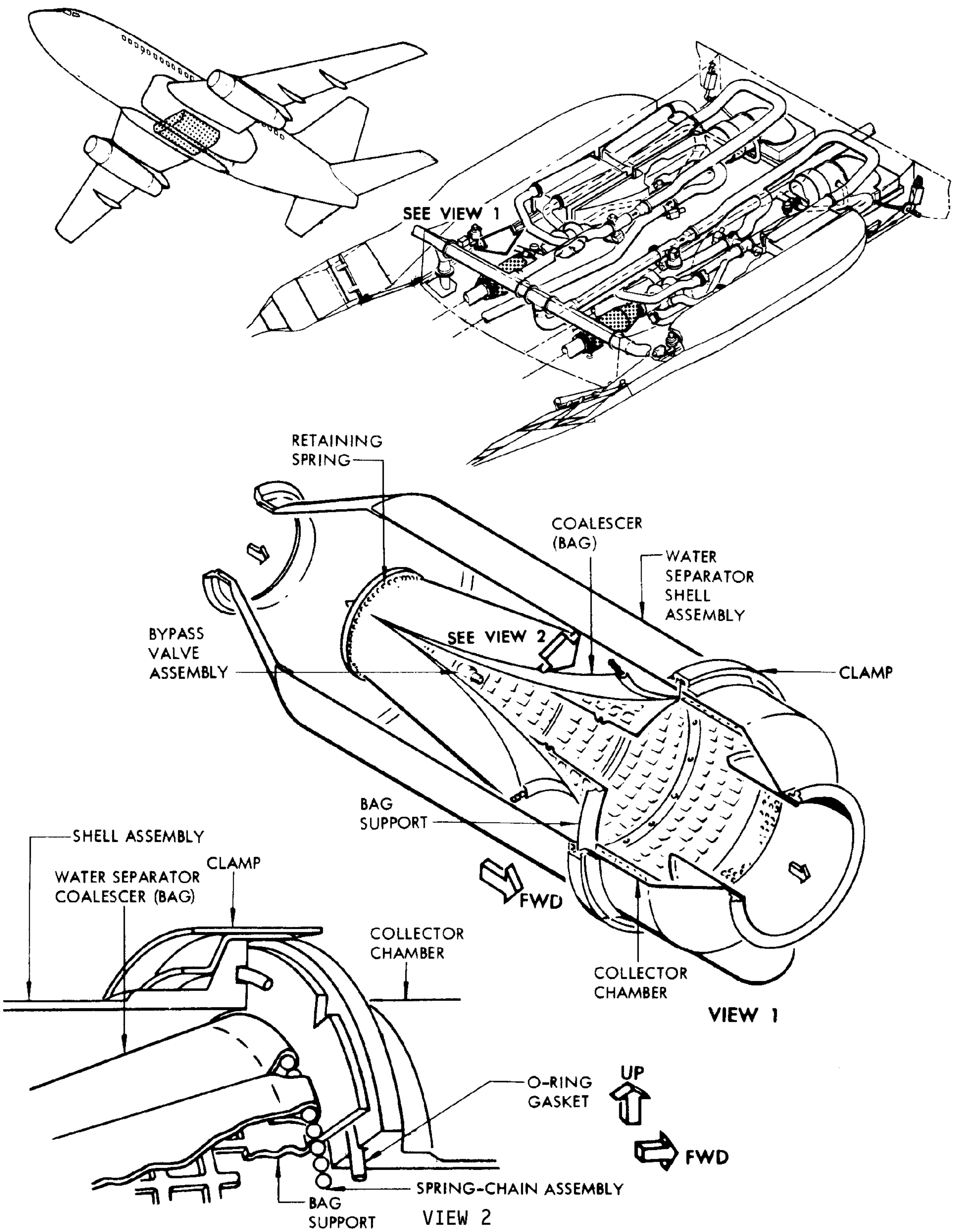
      NOTE: When performing step E, use care when lowering assembly so that O-ring gasket is not damaged.

   F. Remove spring-loaded chain retaining ring from aft end of bag.
   G. Slide bag from bag support.
4. Prepare Bag for Installation
   A. If bag is new; retaining spring-chain may not be installed through hem at large diameter end of bag. On bags without spring-chain installed, a string is provided for installation of spring-chain. Tie one end of chain to string and pull chain through hem.
   B. Attach ends of chain together with spring and remove string.
5. Install Water Separator Bag
   A. Check that louvers of bag support are clean, then slide new bag over support and install retaining ring.

      NOTE: If bag has napped side, install with napped side out.

   B. Visually check both O-ring gaskets for damage and indication of permanent set. Replace gaskets as necessary.
   C. Check inlet shell assembly and collector chamber for cleanliness. Remove any material that may plug drain.
   D. Locate O-ring gasket in shell assembly groove (View 2, Fig. 401).
   E. Install bag assembly into shell.
   F. Install O-ring gasket in collector chamber groove.

      NOTE: It may be necessary to lightly grease O-ring gasket to keep gasket in groove during installation. Wipe off excess grease.



Water Separator Coalescer Installation
Figure 401

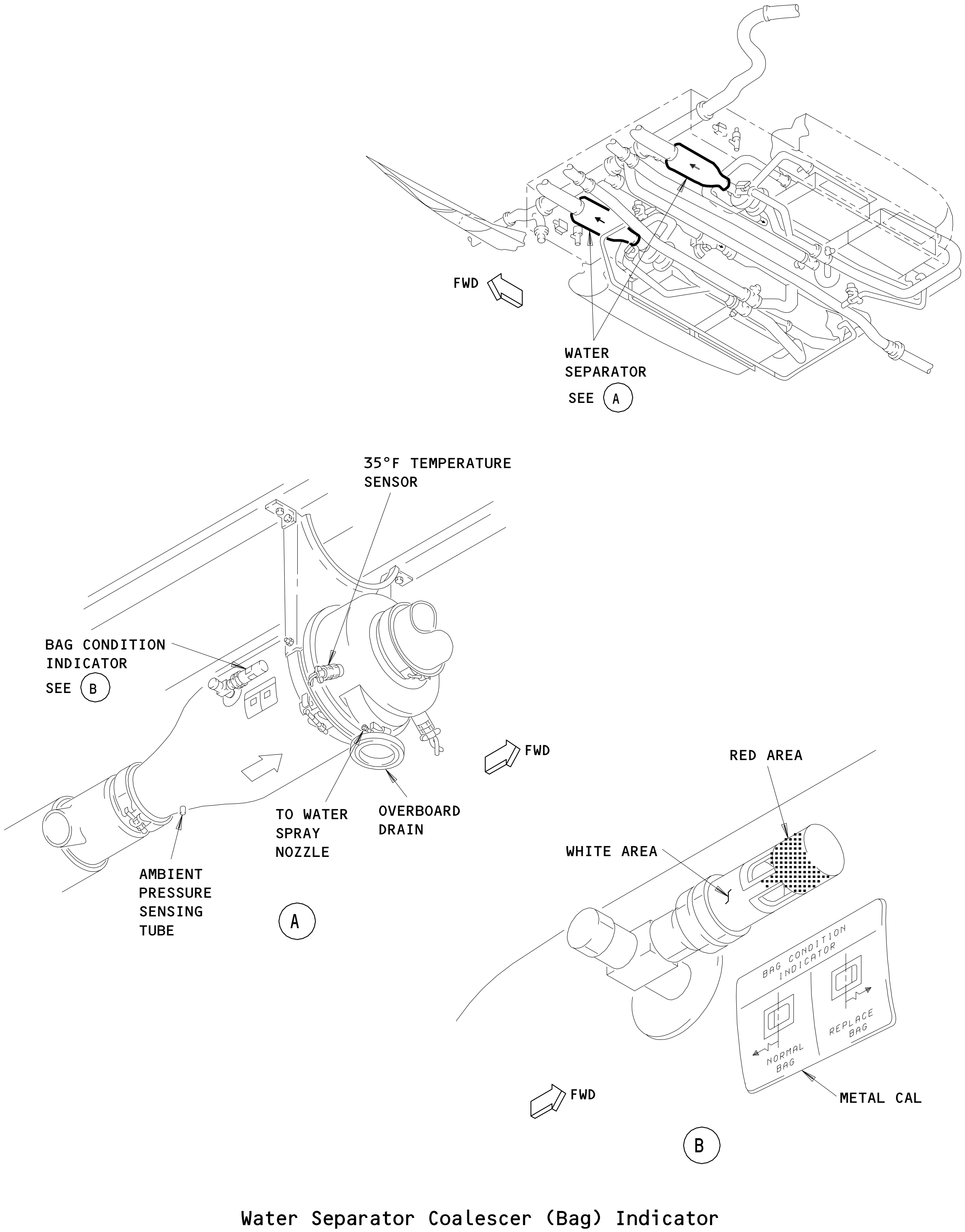
G. Slide shell assembly with bag between air duct and collector chamber.

NOTE: Be careful not to disturb O-ring gasket and keep bag support centered as much as possible in shell.

H. Install clamp holding shell to collector assembly.
I. Install duct clamp at aft end of water separator.
J. Install water separator support bracket clamp.
K. Provide electrical power.
L. Pressurize pneumatic system to approximately 25 psi.
M. Operate air conditioning air cycle system.
N. Hold temperature selector to manual COOL until air mix valve moves to full COLD then move selector to OFF.
O. Check for leakage at water separator duct clamps by listening and feeling. Diffused leakage is allowed at any connection but jet blasts are not.
P. Turn air cycle system off.
Q. Remove pneumatic power if no longer required.
R. Remove electrical power if no longer required.
S. Close air conditioning equipment bay doors.

WATER SEPARATOR COALESCER (BAG) - INSPECTION/CHECK

1. General
   A. Fog or high humidity in cabin and/or pounding noise heard through air conditioning distribution system is an indication of water separator coalescer bag clogging. As the bag becomes clogged, the pressure applied to the bag condition indicator piston is increased, forcing the disk on the piston shaft toward the red colored window section of the indicator cap. When the disk is positioned within the red colored portion of the cap, it indicates a dirty bag and the bag should be replaced (Fig. 601).
2. Preparation For Check
   A. Pressurize pneumatic system with APU, turn one air conditioning pack on (Ref 21-11-0, A/T).
   B. Using manual controls on overhead panel (Ref 21-61-0, DO) to operate air conditioning system at full cold.
3. Check Coalescer
   A. Examine bag condition indicator (Fig. 601).
   B. If disk is within red colored portion replace bag (R/I).
   C. Repeat Preparation For Check and Check Coalescer for other pack.
4. Return Airplane to Normal
   A. Shut off applicable air conditioning pack.
   B. Shut off pneumatic system (Ref 21-11-0, A/T).



Water Separator Coalescer (Bag) Indicator
Figure 601

WATER SEPARATOR COALESCER (BAG) - CLEANING/PAINTING

1. General
   A. Water separator coalescers (bags) may be cleaned for re-use if dirtiness is only cause for removal from the water separator.
   B. Two cleaning steps are provided. The first step need not be used unless the removed bag is contaminated with oil or grease.
2. Water Separator Bag Cleaning
   A. Equipment and Materials
      (1) Dry cleaning solvent - Stoddard Solvent, or equivalent

         NOTE: Dry cleaning solvent should be used only when bag is oily or greasy.

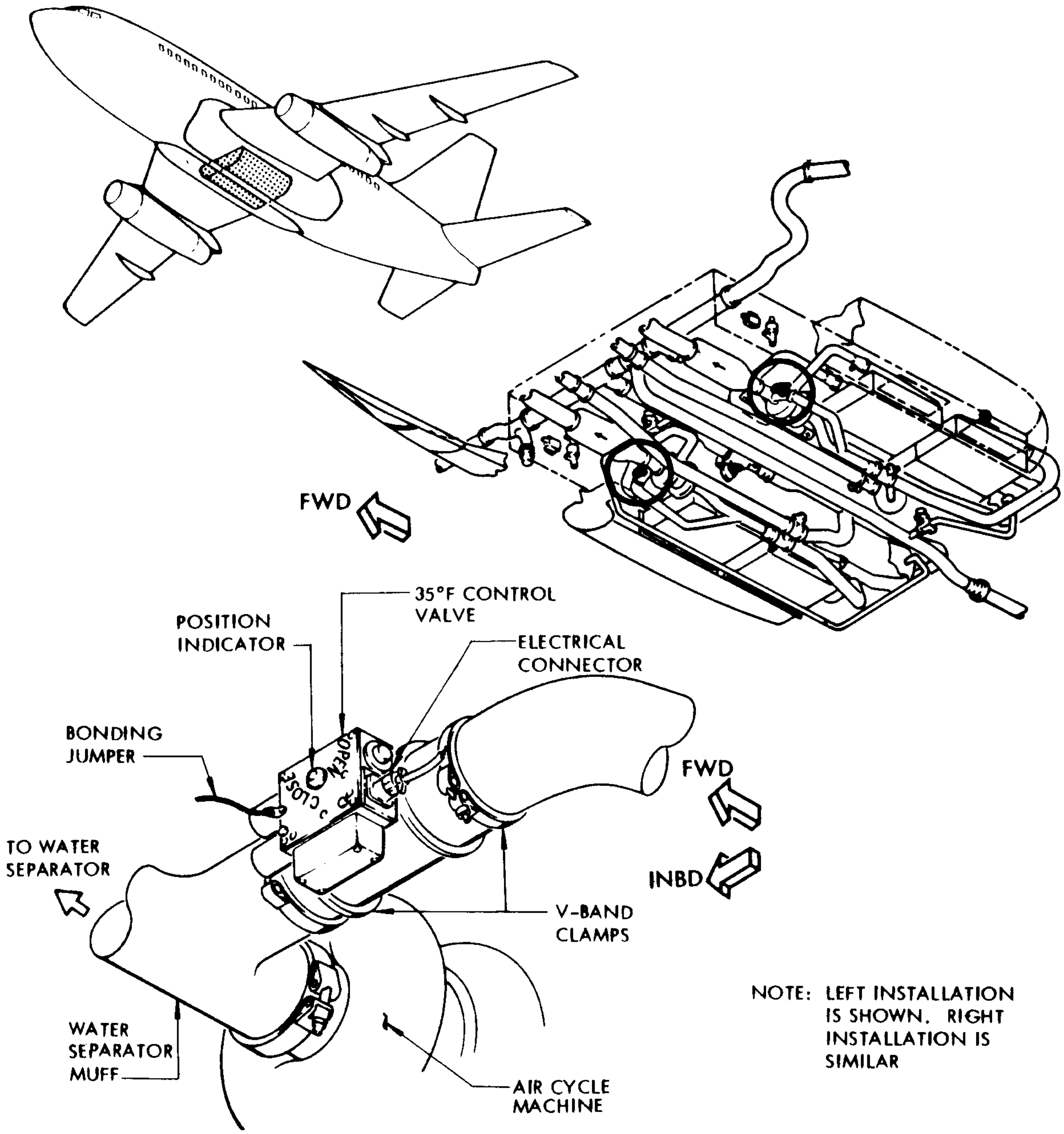
      (2) Any regular fabric detergent and a washing machine
      (3) Cleaner, Emulsion alkaline - GMC 528B
   B. Prepare Water Separator Bag for Cleaning
MH   (1) Remove separator bag from water separator (Ref Water Separator
MH   Coalescer (Bag) - Removal/Installation).
   C. Clean Water Separator Bag
      (1) Visually examine bag for oil or grease contamination. If the bag appears oily or greasy, do these steps:
         (a) Immerse bag in cleaning solvent and gently rub greasy spots, then remove from solvent.
      (2) Place bag in washer loaded with water and fabric detergent and wash for one normal cycle.
      (3) Check that no dry cleaning solvent odor exists. If objectionable odor exists, wash for another cycle.
   D. Install water separator bag. Refer to Water Separator Coalescer (Bag) - Removal/Installation.

35-Degree F CONTROL VALVE - REMOVAL/INSTALLATION

1. General
   A. A 35°F control valve is provided for each air cycle system. The right or left 35°F control valve removal/installation is the same. The position of the valve at installation is slightly different. Any difference in procedure is noted in the step involved.
2. Remove 35°F Control Valve
   A. Lower applicable air conditioning equipment bay door.
   B. Disconnect electrical connector from valve (Fig. 401).
   C. Disconnect bonding jumper from valve.
   D. Remove V-band clamps which hold valve in place.
   E. Remove valve.
3. Install 35°F Control Valve
   A. Check that new valve's position indicator shows closed and that valve is closed.
   B. Locate valve between duct ends and install V-band clamps. Do not tighten clamps.

      NOTE: For left 35°F control valve installation, install valve with motor actuator side of valve rotated up 20 ±10 degrees. For right side, install valve with motor actuator side of valve rotated down 20 ±10 degrees.

   C. Tighten clamps installed in step 3.B.
   D. Connect bonding jumper to valve (Fig. 401).
   E. Connect electrical connector to valve.
   F. Provide electrical power.
   G. Check that applicable (LEFT or RIGHT) 35°F TEMP CONTROL circuit breaker on panel P6 is closed.
   H. Check that 35°F control valve is closed.
   I. Open applicable TEMP CONTROL circuit breaker, remove electrical connector from 35°F control sensor then close circuit breaker and check that 35°F control valve opens.
   J. Open TEMP CONTROL circuit breaker install 35°F control sensor electrical connector then close circuit breaker and check that 35 degrees control valve closes.
   K. Remove electrical power if no longer required.
   L. Close applicable air conditioning equipment bay door.



NOTE: LEFT INSTALLATION IS SHOWN. RIGHT INSTALLATION IS SIMILAR

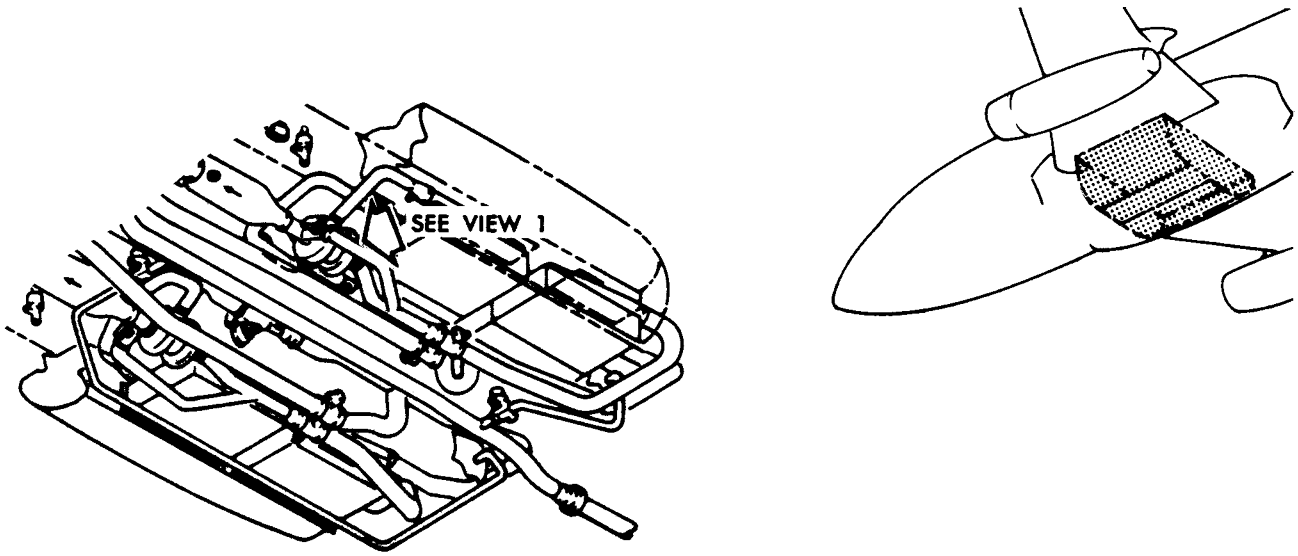
Control Valve Installation
Figure 401

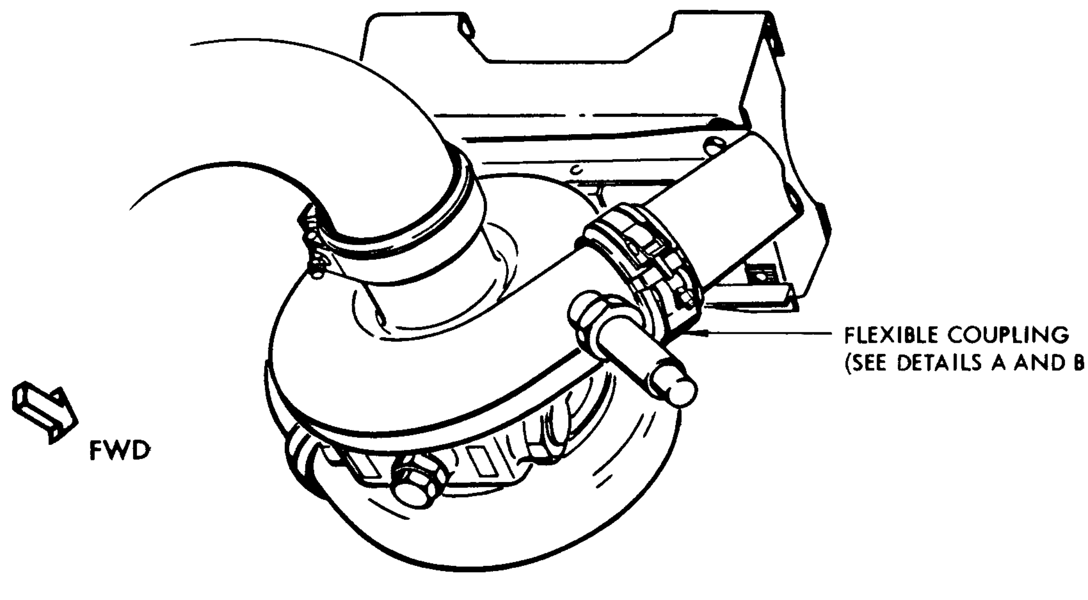
FLEXIBLE COUPLING ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. Flexible coupling assemblies, which connect the four ducts to the ACM, contain four different parts. (See detail B, figure 401.) Joining the ducts to the ACM may be difficult unless the proper method is used for assembling the coupling. This procedure describes the suggested method for disassembly or assembly of the couplings.
2. Remove Flexible Coupling Assembly
   A. Remove clamp. (See detail B, figure 401.)
   B. Raise edge of sleeve adjacent to component being removed and push sleeve over until its edge rides on outer surface of ring. (See detail A, figure 401.)
   C. Slide sleeve and ring on component not being removed until retainer is revealed.
   D. Remove retainer.
3. Prepare to Install Flexible Coupling Assembly

   NOTE: This preparation is applicable only when a new coupling or sleeve is being installed.

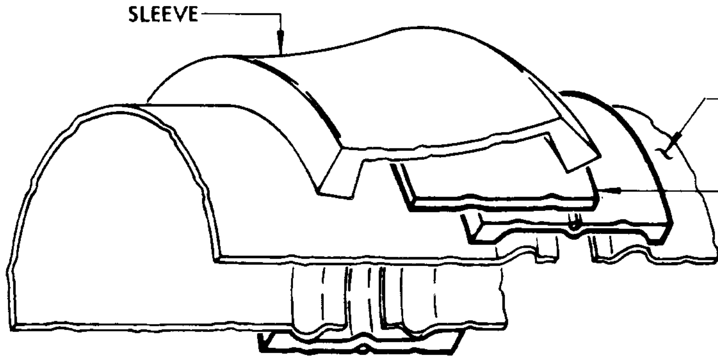
   A. Insert ring into sleeve at right angle, then rotate ring into alignment with sleeve. Do not insert ring completely into sleeve but keep one edge of sleeve riding on outside surface of ring.
   B. With exposed edge of ring toward joint, slide ring and sleeve onto duct until duct bead is exposed.
4. Install Flexible Coupling Assembly
   A. Align duct per tolerances in figure 401.
   B. Install retainer.
   C. Slide sleeve and ring over retainer.
   D. Position sleeve to encircle both ring and retainer.
   E. Install clamp and tighten nut to 90 to 95 pound-inches.



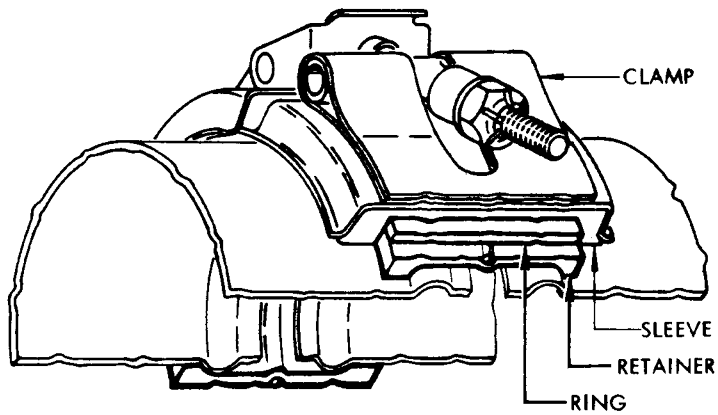


VIEW 1

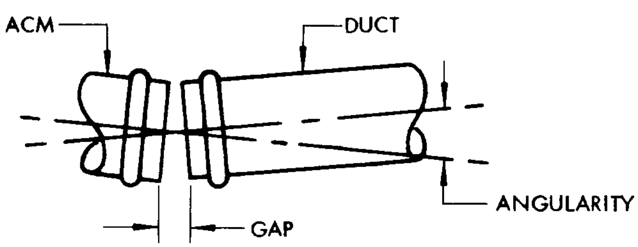
Flexible Coupling Assembly
Figure 401 (Sheet 1)



RING AND SLEEVE REMOVAL
DETAIL A



ACM FLEXIBLE COUPLING ASSEMBLED
(TYPICAL 4 PLACES)
DETAIL B



CLAMP	GAP		ANGULARITY MAXIMUM	OFFSET
	MAX	MIN		
ACM COUPLING 3 IN. OD OR LESS	0.18	0.03	3°	NOT ALLOWED
ACM COUPLING OVER 3 IN. OD	0.18	0.03	2°	

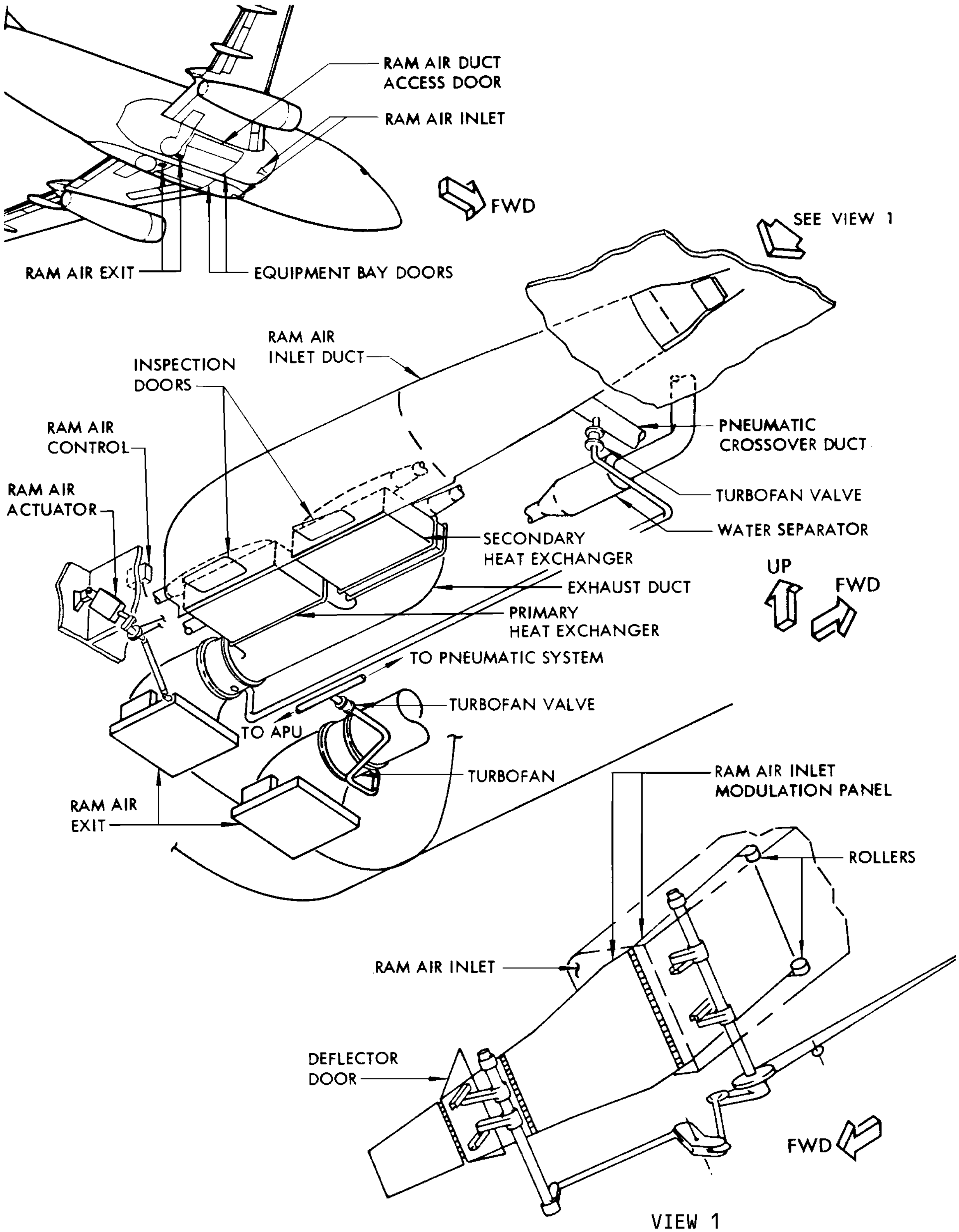
FLEXIBLE COUPLING TOLERANCE CHART

Flexible Coupling Assembly
Figure 401 (Sheet 2)

RAM AIR SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The ram air system provides for two different methods of operation. During pressurized flight, ram air is used as a cooling medium for the air cycle system heat exchangers. An air cycle system utilizes a turbofan to induce airflow through the same ducts for ground operation and during flight when flaps are in any position other than retracted. A ram air system is included for each air cycle system. (See figure 1)
   B. The ram air system provides a cooling medium for the air-to-air primary and secondary heat exchangers. The heat exchangers are located so that air passing through the ram air ducts must pass through the heat exchangers. A turbofan is installed between duct sections near the aft end of the ram air system.
   C. A ram air modulation system automatically regulates airflow through the ram air system during flight to minimize drag. The system also moves to provide maximum flow for ground operation and extends a deflector door to prevent slush injection when the airplane is moving on the ground.
   D. The ram air modulation system equipment includes the ram air inlet modulation panel, a deflector door, ram air exhaust louvers and their operation mechanism, a ram air actuator, a cable system for the ram air inlet modulation panel, a ram air control, and a ram air temperature sensor. (See figure 2). Air cycle system equipment includes a turbofan, a turbofan valve, and the related ducting for routing pressurized air to run the turbofan.
2. Ram Air Inlet
   A. The ram air inlet consists of a scoop, a modulation panel, and a deflector door. A scoop is located on each side of the airplane at the forward end of the wing to body fairing. The scoop forms the entry for the ram air ducts.
   B. The ram air inlet modulation panel is made up of two panel sections. The forward end of the forward panel is hinged to structure and its aft end is hinged to the forward end of the aft panel section. The aft end of the aft panel section is equipped with rollers, which allow movement forward and aft. Two cranks with rollers attached move the forward end of the aft panel inboard or outboard to open or close the inlet. The cranks are attached to a shaft, which is operated by the ram air actuator through a cable system.
   C. The deflector door is hinged at its forward edge to airplane structure and is shaped to fit in the scoop when retracted to prevent interference with ram airflow into the ram air ducts. A mechanism connected to the modulation panel cable system causes the deflector door to be extended when the airplane is on the ground and then to fair on takeoff. The deflector door minimizes the possibility of foreign material entering the ram air system when the airplane is moving on the ground.

3. Ram Air Ducts
   A. The ram air ducts are contained in the ram air duct cavity and the equipment bay. A web between the two compartments helps support the heat exchangers and the inlet ducts. The ram air exits ducts connect to the inboard side of the heat exchangers then extend to an outlet just aft of the equipment bay doors. A turbofan is included between duct sections immediately forward of the outlet. Access to the entire ram air duct system is obtained by opening the ram air duct access door and the air conditioning equipment bay doors.
4. Ram Air Actuator
   A. The ram air actuator is a 115-volt ac motor-operated linear actuator. It operates in either direction and may be stopped at any position between full extend and full retract. The actuator is used to modulate the ram air inlet modulation panel and the ram air exhaust louvers, and moves the deflector door.
   B. The ram air actuator is controlled by the ram air control. The control is automatic and depends on whether airplane is on the ground, in-flight with flaps positioned other that full up or in-flight with flaps positioned full up. When airplane is in-flight with flaps full up, temperature of the air in ram air system is sensed by the ram air control to govern actuator position. There are four position switches in the actuator, which work with the control system to obtain proper positioning of the inlet panel and the exhaust louvers. The ram air actuator is mounted on the aft bulkhead of the ram air duct cavity.
5. Ram Air Inlet Modulation Panel Cable and Linkage System
   A. The ram air inlet modulation panel and the deflector door are mechanically linked together and are operated by the ram air actuator through a cable system. The ram air actuator rod connects to a crank on the ram air modulation torque shaft quadrant assembly to drive the cable system.
   B. Two cables extend forward from the torque shaft quadrant along the inboard side of the ram air duct cavity to the forward end of the cavity. The cables then pass through the forward end of the cavity and are secured to the ram air inlet modulation panel quadrant. The ram air inlet modulation panel quadrant drives the inlet modulation panel shaft, which moves the inlet panels.
   C. The deflector door is also driven by the ram air inlet modulation panel quadrant. An arm assembly, which drives the deflector linkage, is mounted beside the inlet modulating panel quadrant on the inlet modulating panel shaft. A lug on the shoulder of the arm assembly fits into a cutout in the shoulder of the quadrant. A cam link and torsion spring allows additional movement of the quadrant for modulating the inlet panel after the deflector has retracted. An extension link assembly in the deflector linkage permits continued movement of the quadrant to the full extend position should the deflector fail to extend.



Ram Air System Component Location
Figure 1

D. The ram air modulation torque shaft quadrant assembly and control cables may be reached by opening the ram air duct access door. Access to the deflector linkage and the ram air inlet modulation panel quadrant requires removing the air conditioning fairing panel below the ram air inlet. On some airplanes a grease fitting and bushing are located on the arm assembly, which drives the ram air inlet deflector (Ref Chapter 12, Air Conditioning Ram Air Inlet Modulation Shaft Assembly Lubrication).

6. Ram Air Control

A. The ram air control electrically controls the ram air actuator to position the inlet modulation panel and the exhaust louvers during flight when flaps are up. The control unit is installed on the inboard side of the keel beam downstream of the turbofan. A ram air temperature sensor is installed in the air cycle machine compressor discharge duct. See cooling air and ram air equipment location illustration, 21-50-0.

7. Turbofan

A. The turbofan is a turbine-powered fan located between sections of the ram air exhaust ducts. Air from the pneumatic system is directed through the turbofan case to a small two-stage turbine centrally located inside the case. A larger diameter fan is located forward of the turbine and is shaft-connected to the turbine. As the fan turns, air is blown from the exhaust ducts creating a low-pressure upstream of the turbofan. As a result outside air is drawn through the ram air ducts. The turbofan normally operates only during ground air conditioning operation or in flight when the flaps are not up. Operation is controlled by a turbofan valve. During flight when flaps are up the turbofan windmills as ram air passes through the ducts.

8. Turbofan Valve

A. The turbofan valve is a solenoid-actuated shutoff and regulation valve requiring 28-volt dc current and is spring-loaded to the closed position. The valve remains closed after current is applied to the opening coil of the solenoid until the upstream pressure reaches approximately 8 psi. At any upstream pressure above 30 psi the valve will move toward close enough to hold downstream pressure to approximately 30 psi. The valve closes when current is applied to the solenoid-closing coil. A closed limit switch in the valve completes a circuit to the ram air control when the valve is closed. Refer to Ram Air Modulation Control paragraph 12.A. A manual control rod permits opening or closing the valve manually. Two test ports are provided for checking valve operation under pressure. The left turbofan valve is located in the left equipment bay inboard of the turbofan. The right turbofan valve is located in the right equipment bay at the forward end where the valve duct connects to the right pack cold air supply duct.

9. Ram Air Exhaust Louvers

A. Louvers are installed at the ram air outlet to restrict airflow through the ram air system during flight. The louvers are installed parallel to each other and are supported at either end by a support angle. Individual arms are splined to mate with the outboard end of each louver and are linked together at the other end of the arm to obtain simultaneous movement of each. The forward arm mates with a torque shaft that extends from the arm to the ram air actuator located in the ram air duct cavity. As the actuator moves, the louvers rotate to reduce or increase the exhaust area. Since the torque shaft is connected to the crank that operates the ram air inlet modulation panel control cables, movement of the exhaust louvers and the inlet modulation panel is obtained at the same time. The exhaust louvers are the primary restrictions to ram airflow while the inlet panel reduces the possibility of aerodynamic resonance in the ram air ducts.

10. Inspection Doors

A. Two inspection doors in each ram air system permit visually checking for foreign material in the ram air ducts or heat exchangers. One inspection door is located on the bottom of the ram air duct just outboard of the secondary heat exchanger. The other door is located on the bottom of the duct outboard of the primary heat exchanger. Open the ram air duct access door to gain access to either inspection door.

11. Operation

A. Ram Air Modulation Control (See figure 2).

(1) General

(a) Ram air modulation provides maximum airflow through the ram air system during ground operation. During flight, however, maximum airflow is seldom required. Ram sir modulation permits a reduction in airflow at this time which, in turn, results in substantial drag reduction. The modulation system automatically adjusts airflow according to air conditioning requirements.

(b) The ram air modulation system consists of adjustable inlet and exhaust opening, a ram air actuator, a cable system with mechanical linkage to the modulation panel, exhaust louvers, and deflector, a ram air control, a ram air temperature sensor, and the interrelated circuitry.

(c) There are three different steps of ram air modulation as determined by three airplane positions. Fixed positions are obtained when the airplane is on the ground and on the takeoff. During flight the openings vary according to airplane requirements.

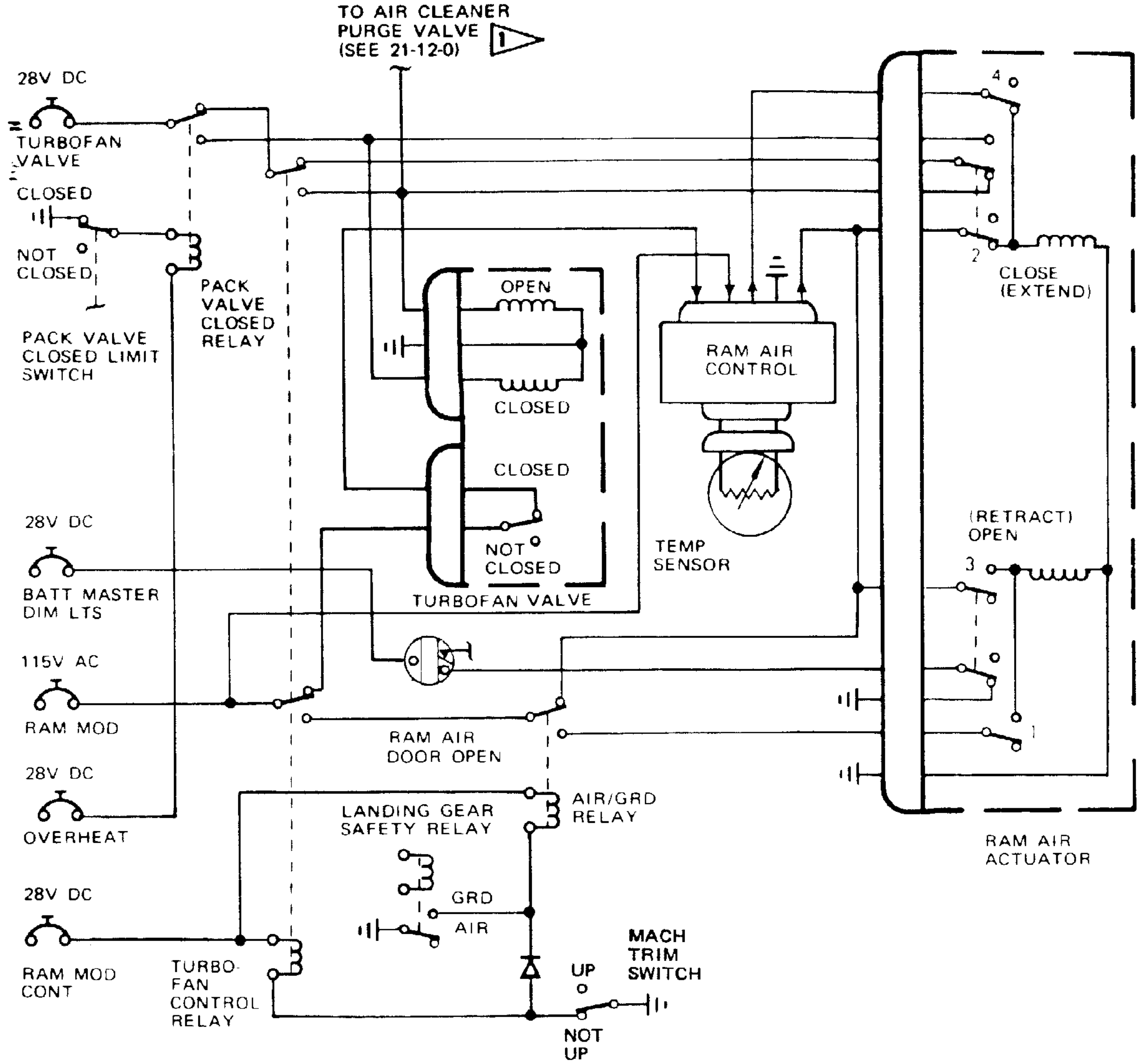
(2) Ground Operation

(a) When the airplane is on the ground the landing gear safety relay and the air-ground relay complete a circuit to the open side of the actuator and open all circuits to the close side. If the modulation panel and exhaust louvers are not already full open they will drive full open and the actuator position switches will move to the positions shown in Fig. 2. The deflector is mechanically linked to the inlet modulation panel and will be fully extended at this time. At the same time another position switch (switch 3) in the actuator completes a circuit for the RAM DOOR FULL OPEN light.

(3) Flight Operation

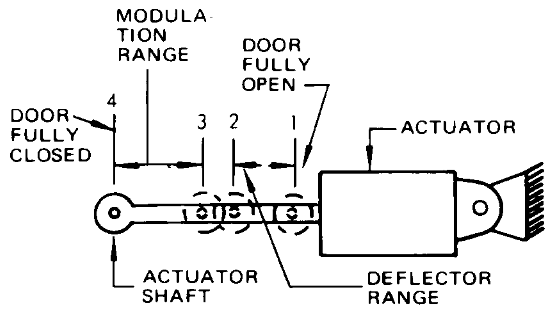
(a) When the airplane breaks ground on takeoff the air-ground relay becomes de-energized but the turbofan control relay stays energized because the flaps are down. This completes a circuit to the close side of the actuator through another position switch (switch 2) and the actuator moves to position 2. At actuator position 2 the inlet modulation panel and exhaust louvers have moved to a slightly closed position, but not one which will appreciably affect ram airflow. Refer to Fig. 2. At this position, however, the deflector door will have moved to the faired position. Any additional movement of the inlet panel will not affect the position of the deflector because the mechanism is against its stop. A cam link and torsion spring permits further movement of the panel.

(b) After takeoff, when the flaps are raised, the turbofan control relay becomes de-energized, the turbofan valve drives closed, and a circuit is completed to the ram air control. This circuit continues to drive the actuator toward close until actuator 3 is reached. At position 3 the actuator position switch (switch 3) closes. From this point on, as long as the flaps are up the ram air control will position the actuator somewhere between position 3 and 4. The positioning of the actuator depends on the temperature of the air at the air cycle machine compressor discharge. A ram air control sensor, located in the air cycle machine compressor discharge duct, provides a signal to the ram air control which positions the ram air exhaust louvers and inlet modulation panel. The ram air control sends either an extend or retract signal to ram air actuator as required to control air flow through ram air ducts and hold air cycle machine compressor discharge temperature to as near 230°F as possible. On cold days it may not be possible to attain the 230°F temperature. If this be the case, the actuator will drive to position 4, (full extend) and remain there until the temperature rises or flaps are lowered for landing. During approach and landing the ram air modulation system reverses the sequence noted for on-the-ground and takeoff conditions.



1 AIRPLANES WITH ENGINE BLEED AIR CLEANER

Ram Air Modulation System Schematic
Figure 2 (Sheet 1)

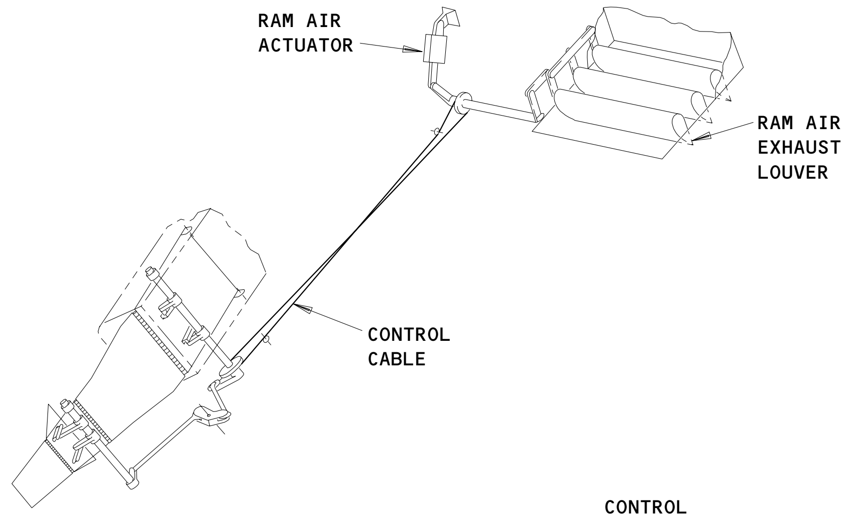


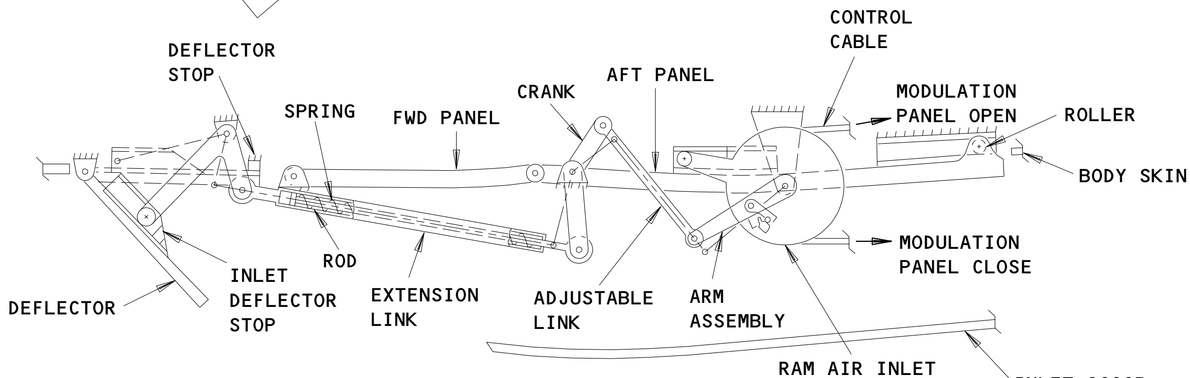
AIRPLANE POSITION	FLAP POSITION	RAM AIR ACTUATOR SWITCH POSITION *				ACTUATOR POSITION	TURBOFAN VALVE POSITION	MODULATION PANEL POSITION	DEFLECTOR POSITION
		1	2	3	4				
ON GROUND	UP OR DOWN					1	OPEN	FULL OPEN	EXTENDED
TAKEOFF	DOWN					MOVES TO 2	STAYS OPEN	MOVES TOWARD NORMAL OPEN	RETRACTED
AFTER TAKEOFF	UP					MOVES TO 3 [1A]	CLOSES	MOVES TO NORMAL OPEN [1A]	RETRACTED
CRUISE	UP					MODULATES BETWEEN 3 AND 4 [1A]	STAYS CLOSED	MODULATES BETWEEN NORMAL OPEN AND CLOSED [1A]	RETRACTED
LANDING APPROACH	DOWN					MOVES TO 3	OPENS	MOVES TO NORMAL OPEN	RETRACTED
TOUCH-DOWN	DOWN					MOVES 1	STAYS OPEN	DRIVES TO FULL OPEN	DRIVES TO FULL EXTEND

* SWITCH POSITION IS SHOWN FOR AIRPLANE ATTITUDE AFTER THE ATTITUDE HAS BEEN ATTAINED

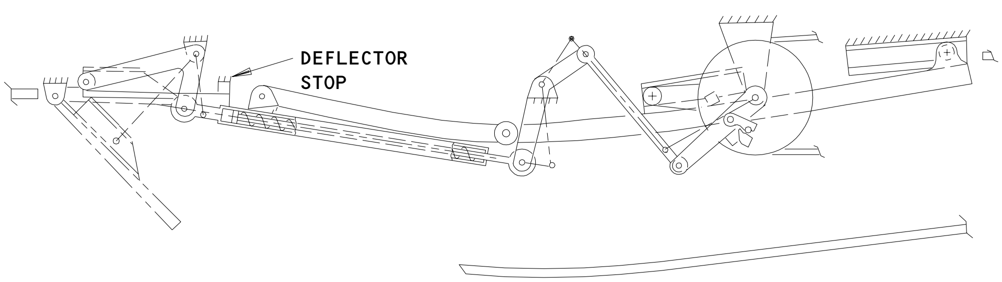
[1A] ACTUATOR POSITION REMAINS AT 2 IF AMBIENT CONDITIONS AND/OR HARDWARE CONDITION ARE SUCH THAT REQUIRE MAXIMUM RAM COOLING. THIS PREVENTS MODULATION PANEL MOVING FARTHER TOWARD CLOSED.

Ram Air Modulation System Schematic
Figure 2 (Sheet 2)

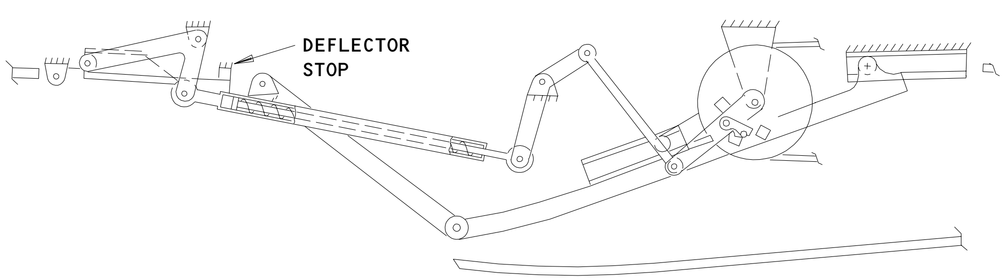




GROUND POSITION



AFTER TAKEOFF TO FLAPS UP POSITION



CRUISE FULL CLOSED POSITION

Ram Air Modulation Schematic
Figure 2 (Sheet 3)

RAM AIR SYSTEM - TROUBLESHOOTING

1. General
   A. If a system trips off from overheat but without excess air supply, the ram air system should be suspected. Check that ram air inlet and exhaust doors are open. Should foreign objects such as paper or cloth be ingested into the ram air system they could restrict airflow through the system. Inspection doors are provided in the ram air ducts forward of each heat exchanger for duct inspection. If difficulty occurred during flight while flaps were in any position other than fully retracted check-cooling system per adjustment/test procedure. If system has tripped off without excessive temperature being recorded, the thermal switches may be defective and should be checked per adjustment/test procedure.
2. Equipment and Materials
   A. Controlled Heat Source - Temp Cal Probe Heater (Attachment to Jet Cal Engine Analyzer)
3. Troubleshooting Charts

NOTE: When an actuator has to be replaced because of an actuator motor failure the ram air control must be removed and bench checked per vendor requirements to prevent reoccurrence of actuator failure.

Ram air inlet modulation panel or ram air exhaust louvers will not go to full open when airplane is on ground.

Check that wing flaps are full up and that air conditioning PACK switch is in the OFF position. Apply external power to airplane, remove ram air actuator plug of faulty system and check for 115V AC retract signal at pin 1 of plug. IF -

VOLTAGE IS PRESENT - Disconnect actuator shaft from bellcrank arm, reinstall plug on actuator and check that actuator moves to full retracted position. IF -

Actuator moves to full retracted position check for binding quadrants, cranks, or improper cable rigging.

Actuator does not move to retracted position replace actuator. (See note.)

NO VOLTAGE-Check air/grd relay for 115V AC at B1 (LH) or AI (RH). IF -

VOLTAGE IS PRESENT - Check for continuity between B1 (or A1) and pin 1 of faulty system ram air actuator plug. Repair or replace wiring.

NO VOLTAGE - Check for 115V AC at B2 (LH) of air/grd relay (A2, RH). IF -

Continued to top of next page

Ram Air System - Troubleshooting
Figure 101 (Sheet 1)

VOLTAGE IS PRESENT - Air/grd relay is not energized to ground position. Replace M324 air conditioning relay unit module.

NO VOLTAGE - Check for 115V AC at C1 (LH) of turbofan control relay (B1, RH). IF -

VOLTAGE IS PRESENT - Check for continuity between C1 (LH) of turbofan control relay and B2 (LH) of air/grd relay. (B1 of turbofan control relay and A2 of air/grd relay for RH side.) Repair or replace wiring.

NO VOLTAGE - Check for 115V AC at C2 (LH), or B2 (RH), of turbofan control relay. IF -

VOLTAGE IS PRESENT - This indicates that the turbofan control and the air/grd relays may not be grounded through the landing gear safety relay. To isolate problem to possible faulty landing gear safety relay lower flaps until the trailing edge mach trim switch actuates. This switch provides a second ground path for the turbofan control relay and this relay should actuate. IF -

NO VOLTAGE - Check continuity between C2 of turbofan control relay and left ram air actuator circuit breaker on ac transfer bus No. 1. (B2 and right ram air actuator circuit breaker on ac transfer bus No. 2.) Repair or replace wiring.

Turbofan relay does not actuate, replace M324 air conditioning relay unit module.

Turbofan relay does actuate, check out landing gear safety relay.

Ram Air System - Troubleshooting
Figure 101 (Sheet 2)

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RAM AIR DOOR STAYS OPEN IN CRUISE (RAM DOOR FULL OPEN LIGHT ON CONTINUOUSLY) - Check that applicable AIR COND PACK switch is OFF. Provide electrical power. Pressurize pneumatic system. Lower wing flaps enough to move mach trim switch away from its up position. Open applicable PACK VALVE circuit breaker. Remove limit switch connector from pack valve (Fig. 101). If operating flaps hydraulically, open and safety to open, GD INTERCONNECT VALVE circuit breaker (P6-2). Push and hold ground sensing test switch on the landing gear module [1]. While holding test switch, raise wing flaps to full up [2]. Check that ram air inlet modulation panel drives toward closed and RAM DOOR FULL OPEN light goes out. IF -

RAM AIR INLET MODULATION PANEL DRIVES TOWARD CLOSED AND LIGHT STAYS ON - Replace ram air actuator.

RAM AIR INLET MODULATION PANEL DRIVES TOWARD CLOSED, RAM DOOR FULL OPEN LIGHT GOES OUT - Check ram air ducts for foreign material restricting airflow. IF -

FOREIGN MATERIAL FOUND - Remove material.

NO FOREIGN MATERIAL FOUND - Remove temperature sensor from ACM compressor discharge and apply controlled heat source of up to 240°F to sensor. IF -

LIGHT ILLUMINATES AT TEMPERATURE BELOW 230°F - Replace temperature sensor.

LIGHT ILLUMINATES AT 230°F OR ABOVE - Problem is either faulty air cycle pack or bleed air compression control. Check pack performance first (Ref 21-00, Maintenance Practices) and/or bleed air compression control (21-11-0, Trouble Shooting).

RAM AIR INLET MODULATION PANEL DOES NOT DRIVE CLOSED, LIGHT STAYS ON - Remove connector from ram air control sensor and check that modulation panel drives closed and light goes out. IF -

[1] GROUND SENSING TEST SWITCH MUST BE HELD IN UNTIL TROUBLE SHOOTING IS COMPLETED OR PROCEDURE WILL NOT BE VALID. IF DURING A CHECK, THE TEST SWITCH IS RELEASED, THE AIR/GRD AND TURBOFAN CONTROL RELAYS WILL BE ENERGIZED AND CAUSE THE RAM AIR DOORS TO RETURN TO GROUND FULL OPEN POSITION.

[2]

Ram Air System - Troubleshooting
Figure 101 (Sheet 3)

MODULATION PANEL DRIVES CLOSED BUT LIGHT STAYS ON - Replace actuator.

MODULATION PANEL DRIVES CLOSED, LIGHT GOES OUT - Replace ram air control sensor.

MODULATION PANEL DOES NOT DRIVE CLOSED, LIGHT STAYS ON - Reconnect ram air control sensor, open RAM MOD circuit breaker. Remove limit switch electrical connector from turbofan valve and check for continuity between pins 1 and 3 of valve receptacle. IF -

NO CONTINUITY - Replace turbofan valve.

CONTINUITY - Close RAM MOD circuit breaker and check for 115V AC at pin 1 of connector. IF -

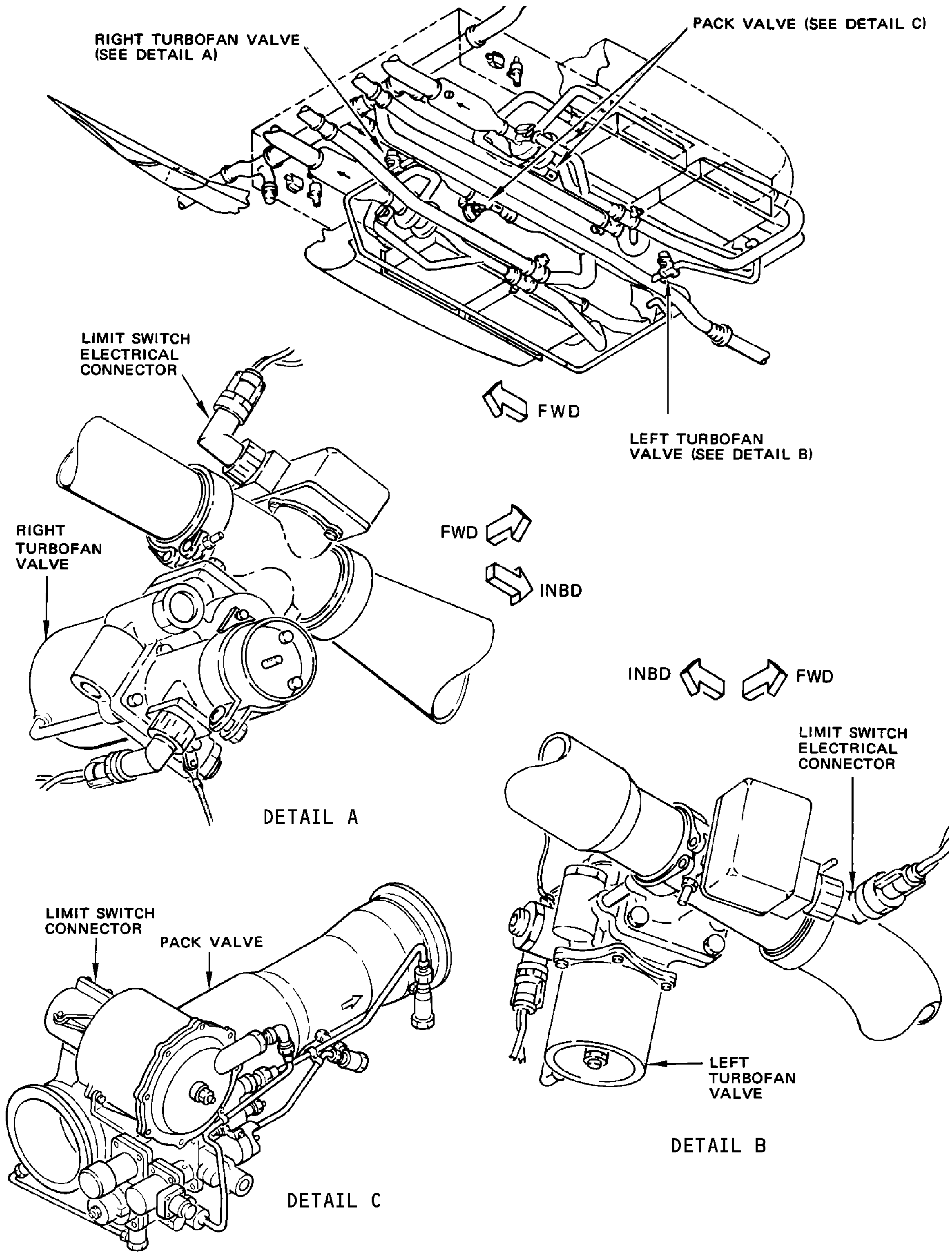
VOLTAGE - Replace ram air control then check that modulation panel drives closed and light goes out. IF -

NO VOLTAGE - Replace turbofan control relay.

PANEL DRIVES CLOSED AND LIGHT GOES OUT - System is now operable.

PANEL STAYS OPEN AND LIGHT STAYS ON - Replace ram air actuator.

Ram Air System - Troubleshooting
Figure 101 (Sheet 4)



Pack Valve and Turbofan Valves Connectors Location
Figure 102

RAM AIR SYSTEM - ADJUSTMENT/TEST

1. Ram Air System Test
   A. General
      (1) Three tests are presented for checking the ram air system. The Ram Air System Leakage Test provides a method for determining that the amount of leakage into the air conditioning equipment bay does not exceed the prescribed limits. The Ram Air System Operation Test provides a method for determining that ram air system will function correctly whether airplane is in flight or on the ground. During the test it is preferred that flaps are raised electrically. However, optional procedure to raise flaps hydraulically is also provided. The Ram Air System Drag Test provides a method for determining if mechanical friction of system is within limits. Each test is applicable to either right or left ram air system.
   B. Ram Air System Leakage Test
      (1) Equipment and Materials
         (a) Air source capable of delivering 15 pounds per minute at 2.5 psig.
         (b) Flow meter capable of measuring airflow from 15 pounds per minute at 2.5 psig to 5 pounds per minute at 0.5 psig.
         (c) Static pressure gage -0 to 2.5 psig.
         (d) Ram Air Exhaust Plug
            1) Preferred: F80233-( )
            2) Optional: TE65-51575-( )
         (e) Ram Air Inlet Plug
            1) Preferred: F80155-( )
            2) Optional: TE65-51201-( )
      (2) Prepare Ram Air System for Test
         (a) Lower air conditioning equipment bay doors.
         (b) Install ram air exhaust plug to outside of exhaust louver frame with bolts.
         (c) Remove ram air inlet modulation panel (Ref. 21-52-41).
         (d) Remove ram air inlet deflector (Ref. 21-52-21).
         (e) Insert ram air inlet plug into inlet, aft of the step off to the duct, and expand rubber periphery of plug by tightening the two adjusting screws.
         (f) Check that all duct tie bolts are connected.
         (g) Connect air source to ram air inlet plug.
      (3) Test Ram Air System Leakage
         (a) Apply pressure of 2.5 psi. Check that leakage rate does not exceed 15 pounds per minute.

(b) Check that there are no concentrated leaks at any duct joints.

NOTE: A concentrated leak is defined as a leak which can be felt by hand 12 inches from joint.

(c) Reduce pressure to 0.5 psi. Check that leakage rate does not exceed 5 pounds per minute.

(4) Restore Airplane to Normal Configuration
(a) Disconnect air source from ram air inlet plug.
(b) Remove ram air inlet plug.
(c) Remove duct plug from exhaust louver frame.
(d) Remove test equipment from airplane.
(e) Install ram air inlet modulation panel (Ref 21-52-41).
(f) Install ram air inlet deflector (Ref 21-52-21).
(g) Close air conditioning equipment bay doors.

C. Ram Air System Operation Test
(1) General
(a) Testing the ram air modulation system operation describes method for checking that the system will function correctly to provide modulation during flight, proper positioning of doors and panels on the ground, and adequate airflow for air conditioning operation on the ground or during flight.
(2) Equipment and Materials
(a) Controlled Heat Source - Temp Cal probe heater (attachment to Jet Cal engine analyzer) or equivalent
(b) Air source capable of delivering 15 pounds per minute at 8 to 30 psig
(3) Prepare to Test Ram Air System
(a) Open air conditioning equipment bay doors
(b) Check turbofan oil level (Ref Chapter 12, Ram Air System Turbofan Servicing).
(c) Provide electrical power.
(d) Check that the following circuit breakers on circuit breaker panel P6 are closed.
1) L and R TURBOFAN
2) L and R RAM MOD
3) RAM MOD CONT
4) MASTER CAUTION (all except FUEL, if installed)
5) INDICATOR LTS, MASTER DIM BUS (9 places)
6) DIM & TEST (1 place)

(e) Connect air source to pneumatic system ground service connection.

NOTE: The isolation valve must be opened to provide air to the left ram air system turbofan valve (Ref Chapter 36, Engine Bleed Air Distribution System).

(4) Test Ram Air Modulation System
(a) Lower wing flaps to any position other than full up (Ref Chapter 27, Trailing Edge Flap System).
(b) Check that air conditioning PACK switch is in the OFF position.
(c) Check that turbofan valve is closed.
(d) Pressurize pneumatic system.
(e) Disconnect electrical connector which is located on the side of the pack valve visual indicator.
(f) Check that turbofan valve opens and turbofan starts.
(g) Check that RAM DOOR FULL OPEN light is on.
(h) Open RAM MOD CONT circuit breaker.
(i) Check that ram air inlet deflector doors stay open.
1) Check that deflector door track rollers are within 0.10 inch of stops.

NOTE: Full open is with rig pin holes aligned. A rap on the inlet modulation panels by hand may be used to overcome friction for pin hole alignment.

(j) Close RAM MOD CONT circuit breakers.
(k) Push and hold ground sensing test switch on landing gear module.
(l) Check that ram air deflector door retracts to a streamlined position with the airplane body and that RAM DOOR FULL OPEN light stays on.
(m) Raise wing flaps either electrically or hydraulically.
1) Electrical flap operation.
a) Drive wing flaps fully up electrically and check that inlet modulation panel and exhaust louvers travel toward closed position.

NOTE: Flap actuation is complete when electric actuator motor stops driving.

1. If air inlet modulation panel does not move toward closed position, check that mach trim switch opened.

NOTE: Flaps must be fully up in order to open mach trim switch.

2. If mach trim switch did not open, trailing edge flap system is malfunctioning (Ref Chapter 27).

b) Check that turbofan stops and RAM DOOR FULL OPEN light goes out.

2) Hydraulic flap operation.

a) Open L and R RAM MOD circuit breakers.

b) Release ground sensing test switch and drive flaps fully up hydraulically.

c) Push and hold ground sensing test switch and check that turbofan stops.

d) Close L and R RAM MOD circuit breakers.

e) Check that RAM DOOR FULL OPEN light goes out.

f) Check that inlet modulation panel and exhaust louvers travel toward closed position.

1. If air inlet modulation panel does not move toward closed position, check that mach trim switch opened.

NOTE: Flaps must be fully up in order to open mach trim switch.

2. If mach trim switch did not open, trailing edge flap system is malfunctioning (Ref Chapter 27).

(n) After exhaust louvers have ceased moving, open RAM MOD CONT circuit breaker.

(o) Release ground sensing test switch.

(p) On AP N473AC, N4501W; SQ-9V-BBE, 9V-BBF; TM CR-BAA, CR-BAB; TZ CF-TAN, CR-TAO; AR LV-JMW thru LV-JMY; BU LN-SUG; TS N3713, check that clearance between trailing edge of louver and nearest adjacent louver is 1.00 to 1.26 inches. On ALL EXCEPT airplanes listed above, check that clearance is 0.65 to 1.00 inch.

(q) Remove ram air control sensor from the air cycle machine compressor discharge duct.

(r) Apply heat to ram air control sensor probe to a temperature of 230 +15/-0°F (110 to 118°C). Check that inlet modulation panel and exhaust louvers travel toward open, RAM DOOR FULL OPEN light comes on and deflector door remains in streamlined position.

(s) Remove heat source.

(t) After allowing time for sensor to cool, check that inlet modulation panel and exhaust louvers return to closed position and RAM DOOR FULL OPEN light goes out.
(u) Reinstall ram air sensor in the air cycle machine compressor discharge duct.
(v) Press and hold ground sensing test switch.
(w) Close RAM MOD CONT circuit breaker.
(x) Lower wing flaps either electrically or hydraulically.
1) Electrical flap operation.
a) Drive wing flaps down and check that as flaps leave the zero position the inlet modulation panel and
b) exhaust louvers move toward open, RAM DOOR FULL OPEN light comes on, turbofan starts and deflector stays in streamline position.
2) Hydraulic flap operation.
a) Open L and R RAM MOD circuit breakers.
b) Release ground sensing test switch and drive flaps down hydraulically.
c) Push and hold ground sensing test switch and check that turbofan starts.
d) Close L and R RAM MOD circuit breakers, then check that inlet modulation panel and exhaust louvers move toward open, RAM DOOR FULL OPEN light comes on and deflector stays in streamline position.
(y) Release ground sensing test switch and check that ram air inlet deflector door moves smoothly to open without contacting adjacent structure.
1) Check that deflector door track rollers are within 0.60 inch of stops.

NOTE: Difference between cycled dimension and rigged dimension represents allowable system tolerance.

(z) Connect disconnected electrical connector to pack valve. Check that turbofan valve closes and turbofan stops.
(5) Restore Airplane to Normal Configuration
(a) Remove air source and close air conditioning equipment bay doors.
(b) If no longer required, remove electrical power.
D. Ram Air System Drag Test
(1) General
(a) The ram air system drag test provides a method for checking the integrity of the working mechanical components of the ram air system during operation. The test is accomplished with ram air actuator disconnected from remainder of system therefore does not test actuator operation. For checking the integrity of the actuator accomplish ram air system operation test.
(2) Equipment and Materials
(a) Spring scale - 0-100-pound capacity

(3) Prepare to Test Ram Air System Drag
 (a) Check that ram air system is in full open position (deflector fully extended).
 (b) Open RAM MOD circuit breaker.
 (c) Open ram air duct access door.
 (d) Remove ram air actuator electrical connector.
 (e) Disconnect ram air actuator end fitting from torque shaft quadrant arm and secure actuator so end fitting is outside arm clevis.

(4) Test Ram Air System Drag
 (a) Connect spring scale to quadrant arm actuator bolt hole.
 (b) Exert force on torque shaft quadrant arm (downward and normal to the arm) as required to move ram air system from full open to full closed and check that load on spring scale does not exceed 75 pounds
 (c) Exert force on torque shaft quadrant arm in opposite direction as required to move ram air system from full closed to full open and check that load on spring scale does not exceed 60 pounds.
 (d) Remove spring scale.
 (e) Connect ram air actuator end fitting to torque shaft quadrant.
 (f) Install ram air actuator electrical connector.
 (g) Close RAM MOD circuit breaker.
 (h) Provide electrical power.
 (i) Push ground sensing test switch and check that deflector moves to streamline position.
 (j) Release ground sensing test switch and check that deflector moves to fully extended position.
 (k) Remove electrical power if no longer required.
 (l) Close ram air duct access door.

RAM AIR ACTUATOR - REMOVAL/INSTALLATION

1. General
   A. Prior to actuator attachment to the torque shaft quadrant arm, the actuator must be in the fully retracted position, and the ram air system must be in the full open position.
   B. When an actuator has to be replaced because of an actuator motor failure the ram air control must be removed and bench checked per vendor requirements to prevent reoccurrence of actuator failure.

      NOTE: You must bench check the ram air control only if you install an actuator with the part number 541674-3 or -5. Actuators with these part numbers do not have motors that can operate with continuous power. A ram air control that is defective and supplies constant power could cause the failure of an actuator.

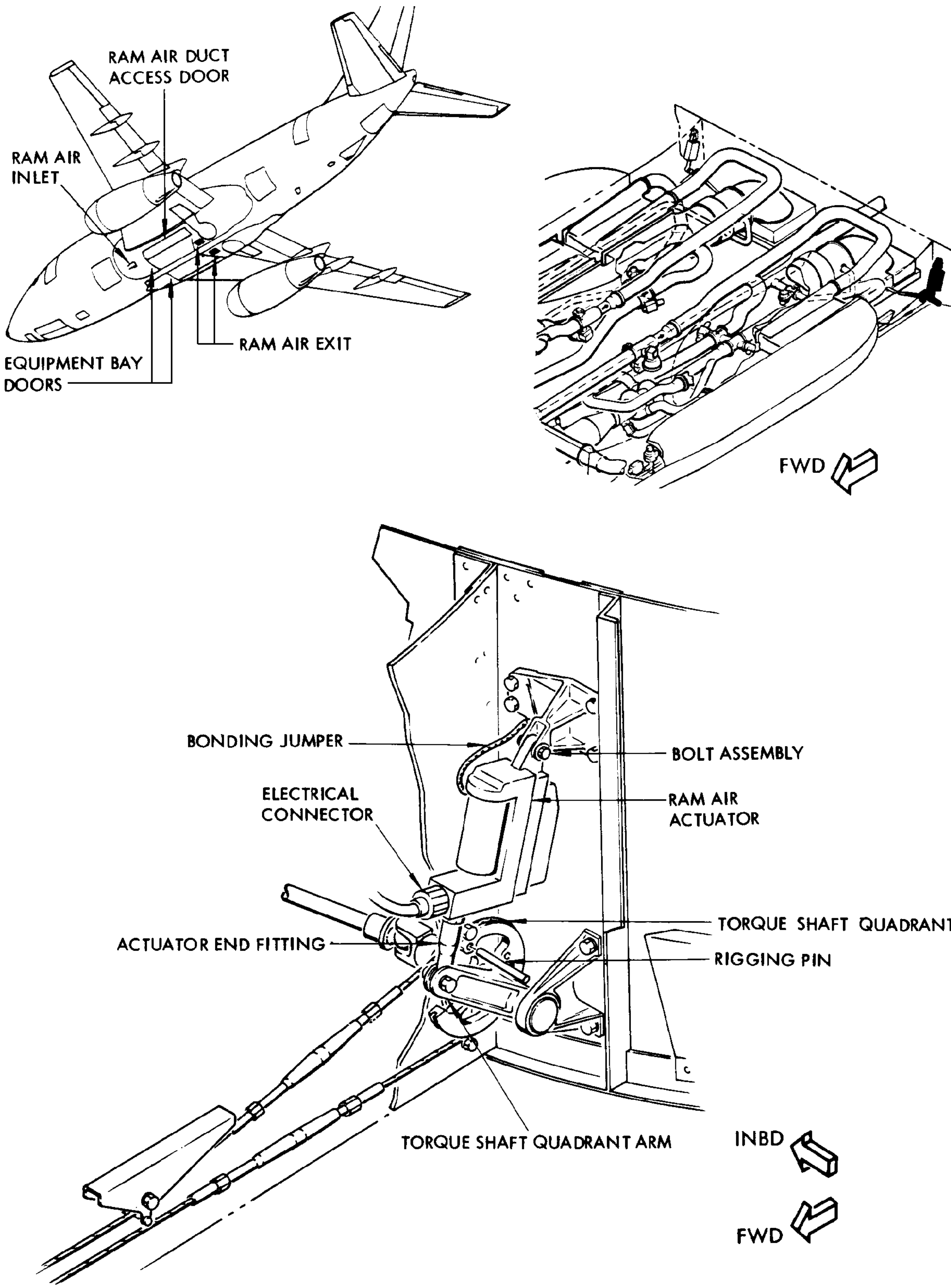
   C. To test the ram air actuator installation, it is necessary to lower the flaps.
2. Equipment and Materials
   A. Rigging Pin - 5/16-inch diameter, approximately 6 inches long
3. Remove Ram Air Actuator
   A. Open ram air duct access door.
   B. Remove electrical connector from actuator (Fig. 401).
   C. Remove bonding jumper from actuator.
   D. Remove attaching bolt assemblies at upper and lower end of actuator and remove actuator from airplane.
   E. Remove the ram air control:

      NOTE: You must remove the ram air control only if the actuator that you will install has a part number of 541674-3 or -5.

      (1) Open the L or R RAM MOD circuit breaker on the P6-4 circuit breaker panel.
      (2) Install a DO-NOT-CLOSE tag on the circuit breaker.
      (3) Disconnect the electrical connector from the ram air control.

         NOTE: The ram air control is installed on the inboard side of the keel beam downstream of the turbofan.

      (4) Remove the ram air control.
4. Install Ram Air Actuator
   A. Install the ram air control if it was removed:
      (1) Make sure that a check has been performed on the ram air control if you install an actuator with a part number of 541674-3 or -5.
      (2) Install the ram air control.
      (3) Connect the electrical connector to the ram air control.



Ram Air Actuator Installation
Figure 401

B. Rotate torque shaft quadrant by hand and install rigging pin (Fig. 401).
C. Insert actuator in place and install attaching bolt assembly at upper end only.
D. Install bonding jumper and electrical connector.
E. Actuate actuator to fully retracted position.

CAUTION: HANDHOLD ACTUATOR AWAY FROM THE TORQUE SHAFT QUADRANT ARM DURING THE FOLLOWING TEST TO PREVENT DAMAGE TO THE ACTUATOR OR QUADRANT ASSEMBLY.

(1) Provide electrical power.
(2) Check that the following circuit breakers on circuit breaker panel P6 are closed:
(a) L RAM MOD
(b) R RAM MOD
(c) RAM MOD CONT
(3) Determine that effect of pushing the ground sensing test switch located in the electronics compartment will not adversely affect any of the other systems that utilize the switch. Refer to 32-09-100 for exact location of switch and other systems involved.
(4) Depress and hold ground sensing test switch and check that actuator extends a short distance.
(5) Release ground sensing test switch and check that actuator retracts.

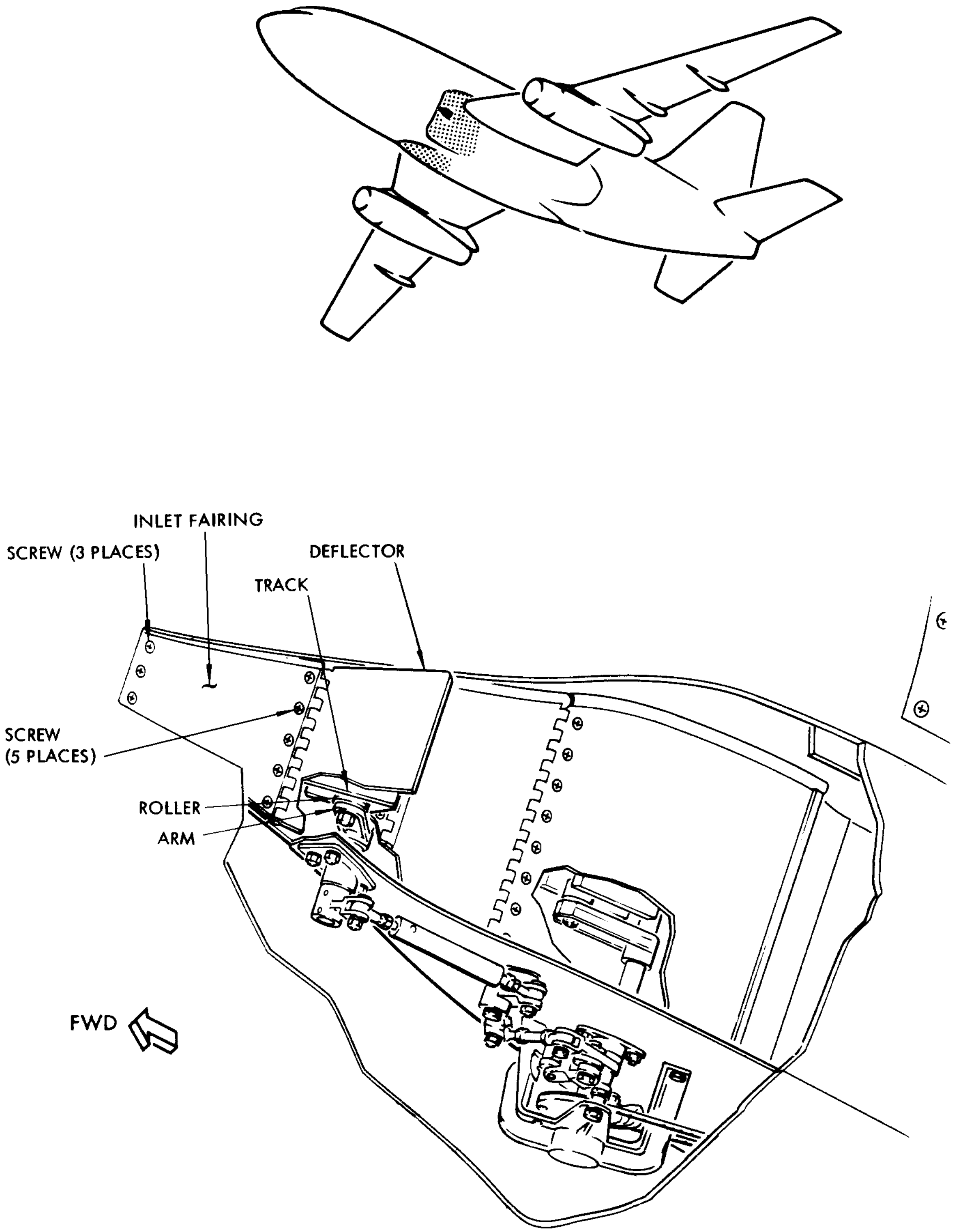
F. Adjust actuator end fitting, in or out, until bolt can be inserted through torque shaft quadrant arm and fitting, and install bolt.

NOTE: If adjustment is necessary actuator end fitting can be adjusted + 0.25 inches. Rewire after adjustment is made.

G. Remove rigging pin.
H. Close ram air duct access door.
I. Remove electrical power if no longer required.

RAM AIR INLET DEFLECTOR - REMOVAL/INSTALLATION

1. General
   A. When the airplane is on the ground the deflector is normally in the open position. To replace the deflector the operating mechanism must remain in this position.
2. Prepare for Removal of Ram Air Inlet Deflector
   A. Open ram air duct access door.
   B. Remove electrical plug from ram air actuator.
   C. Loosen, but do not remove, three screws at forward end of inlet fairing. (See figure 401.)
3. Remove Ram Air Inlet Deflector
   A. Remove five screws holding deflector hinge to structure at forward end of deflector.
   B. Slide deflector aft to disengage deflector tracks from rollers and remove from airplane.
4. Prepare Ram Air Inlet Deflector for Installation
   A. Check that arms on shaft assembly are extended. (Deflector open position.)
   B. Check that rollers on arms rotate freely.
5. Install Ram Air Inlet Deflector
   A. Slide deflector tracks over rollers and insert hinge half of deflector in position under inlet fairing. (See figure 401.)
   B. Install the five screws through inlet fairing and hinge.
   C. Tighten the three screws at forward end of inlet fairing.
   D. Reinstall electrical plug on ram air actuator and close ram air duct access door.



Ram Air Inlet Deflector Installation
Figure 401

RAM AIR INLET DEFLECTOR SHAFT ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. Prior to deflector shaft removal it is necessary to remove the deflector.
2. Equipment and Materials
   A. 5/16 inch rigging pins
   B. Shop Aid (Fig. 401)
3. Prepare for Removal of Ram Air Inlet Deflector Shaft Assembly
   A. Remove ram air inlet deflector. Refer to Ram Air Inlet Deflector-Removal, 21-52-21.
   B. Remove fairing panel covering ram air inlet.
4. Remove Ram Air Inlet Deflector Shaft Assembly (Fig. 401)
   A. Disconnect extension link from drive arm.
   B. Cut lockwire, drive both spring pins out of drive arm and shaft and remove drive arm from shaft.
   C. Remove lower support.

      NOTE: As lower support separates from structure shaft will drop with it, separating itself from upper support.

   D. Tilt shaft assembly and remove from cavity.
5. Prepare for Ram Air Inlet Deflector Shaft Assembly Installation
   A. Note position of drive arm and mark on new shaft assembly so that same shaft to arm relationship will exist as existed on removed shaft. Drive out both spring pins holding drive arms on shaft.
   B. Remove drive arm from shaft assembly.
6. Install Ram Air Inlet Deflector Shaft Assembly (Fig. 401)
   A. Place seal over upper end of shaft assembly.
   B. From within inlet cavity insert lower end of shaft assembly, from which drive arm has been removed, through one-inch hole in lower portion of structure.
   C. Raise shaft assembly and guide upper end into upper support.
   D. Install lower support and snug up nuts of both upper and lower supports. Rotate shaft and check for binding. Reposition supports, if necessary, and tighten nuts.
   E. Slip drive arm on shaft in position noted in 4.A.
   F. Dip spring pins in primer and drive pins into holes, securing drive arm to shaft, and lockwire pins.
   G. Connect extension link to drive arm.

      CAUTION: EXTENSION LINK IS A SPRING LOADED CARTRIDGE WHICH HAS A FIXED LENGTH OF 10.75 INCHES. IT IS NOT FIELD ADJUSTED.

H. Check that track rollers on shaft assembly are within 0.10 inches of inlet deflector stops.

NOTE: Inlet must be in rigged position. If required, rotate mod panel quadrant and install rigging pins. If required, install shop aid in the inboard end of the main inlet modulation shaft. Shop aid shall engage quadrant attach pin. Attach wrench to shop aid to rotate inlet.

I. If not, adjust link without extending extension link so that track rollers are within 0.10 inch of inlet deflector stops.

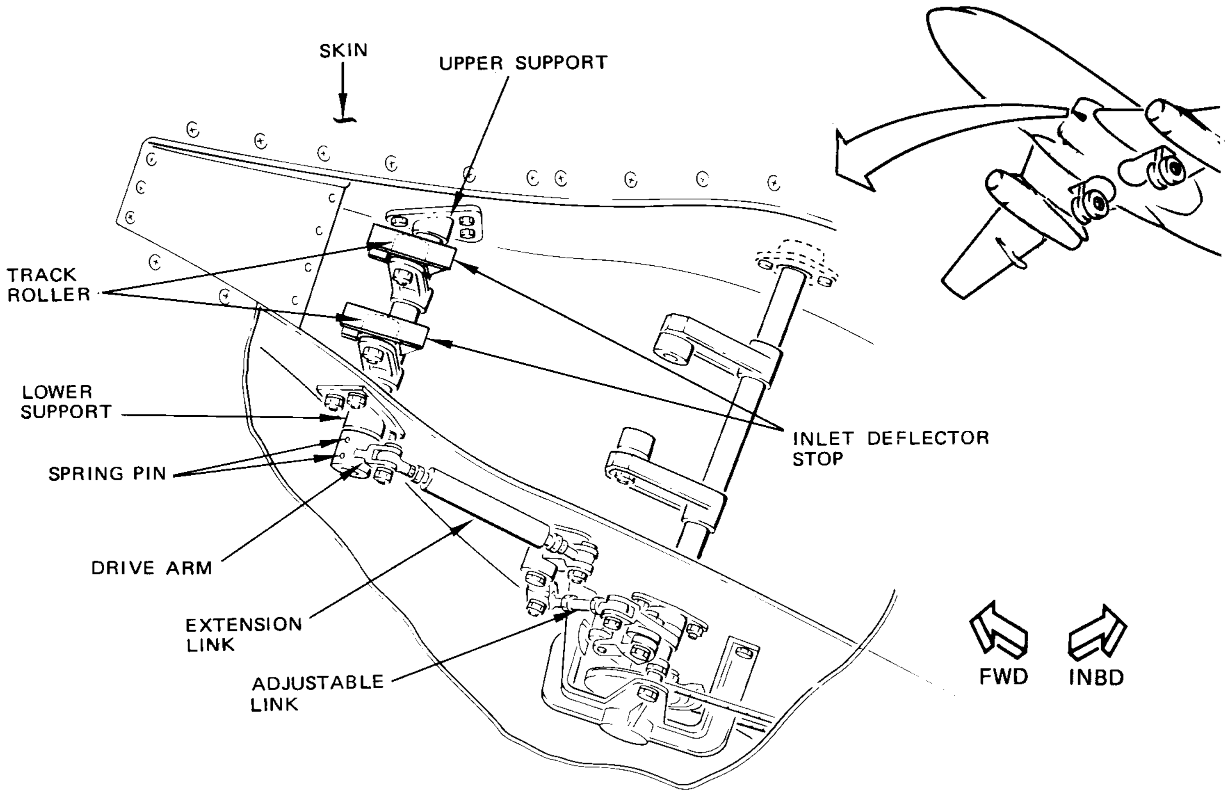
7. Restore Airplane to Normal Configuration

A. Remove rigging pins.

B. Reinstall bolts through skin and ram air inlet frame.

C. Reinstall fairing panel.

D. Install ram air inlet deflector (Ref 21-52-21).



Ram Air Inlet Deflector Shaft Assembly
Figure 401 (Sheet 1)

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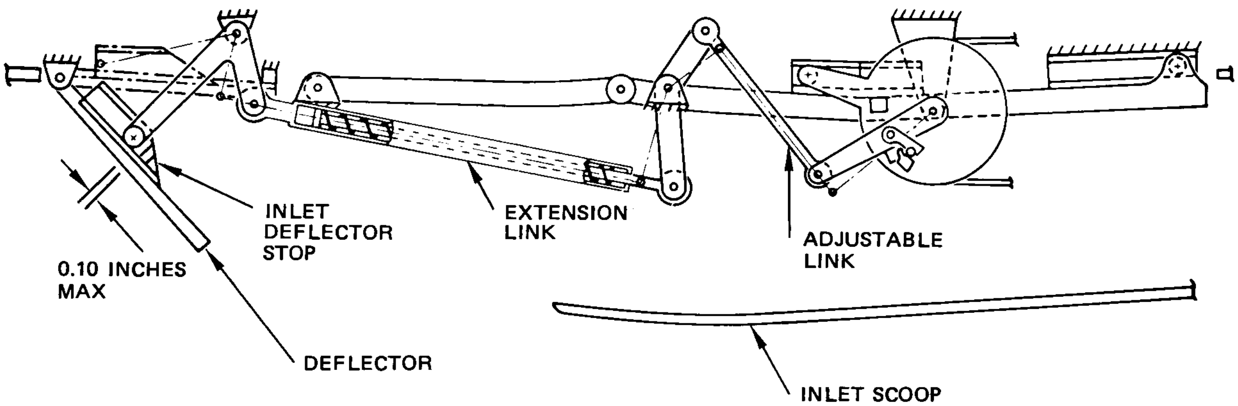
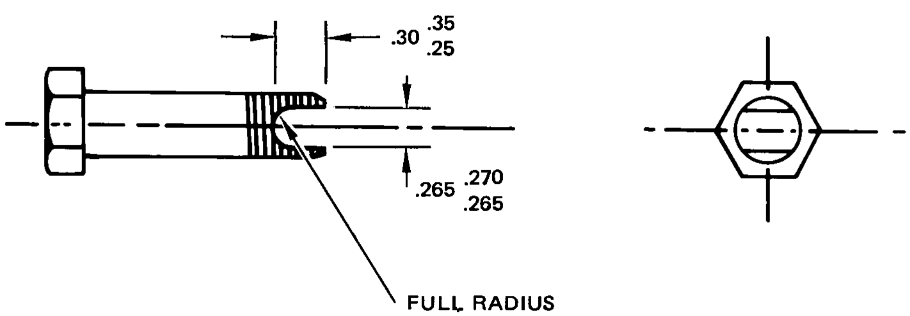


DEFLECTOR GROUND POSITION



SHOP AID: MAKE FROM BACB30NF 7-17

Ram Air Inlet Deflector Shaft Assembly
Figure 401 (Sheet 2)

RAM AIR INLET MODULATION PANEL - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. 5/16 inch rigging pin, approximately 6 inches long
   B. Shop Aid (Fig. 401).
2. Prepare for Removal of Ram Air Inlet Modulation Panel
   A. Disconnect ram air actuator from torque shaft quadrant.
   B. Remove fairing panel covering ram air inlet.
3. Remove Ram Air Inlet Modulation Panel (Fig. 401)
   A. Remove seven screws from hinge at forward end of modulation panel assembly.
   B. Rotate inlet modulation panel quadrant, and the connected mechanism, and install rigging pin.

      NOTE: Shop aid may be used to assist in rotating inlet. Install shop aid in the inboard end of the main inlet modulation shaft. Shop aid shall engage quadrant attach pin. Attach wrench to shop aid to rotate inlet.

   C. Tilt forward panel section of modulation panel assembly out, remove eight bolts, nuts, and washers from panel assembly hinge and remove forward panel section.
   D. Slide aft panel section forward until tracks disengage from their respective rollers.
   E. Remove inlet modulation panel section from inlet opening.
4. Prepare Ram Air Inlet Modulation Panel for Installation (Fig. 401)
   A. Rotate inlet modulation panel quadrant and install rigging pin if not already installed (Ref Step 3.B.).
   B. Check that rollers on arms and rollers on panel rotate freely.
   C. Remove forward section of modulation panel from aft section by removing eight bolts, nuts and washers from hinge.
5. Install Ram Air Inlet Modulation Panel
   A. Insert aft section of modulation panel into inlet opening, engage all rollers in their respective tracks and slide panel aft.
   B. Reinstall forward section of modulation panel assembly on aft section with the eight bolts, washers, and nuts removed in step 4.C.
   C. Remove rigging pin and rotate quadrant to close modulation panel.

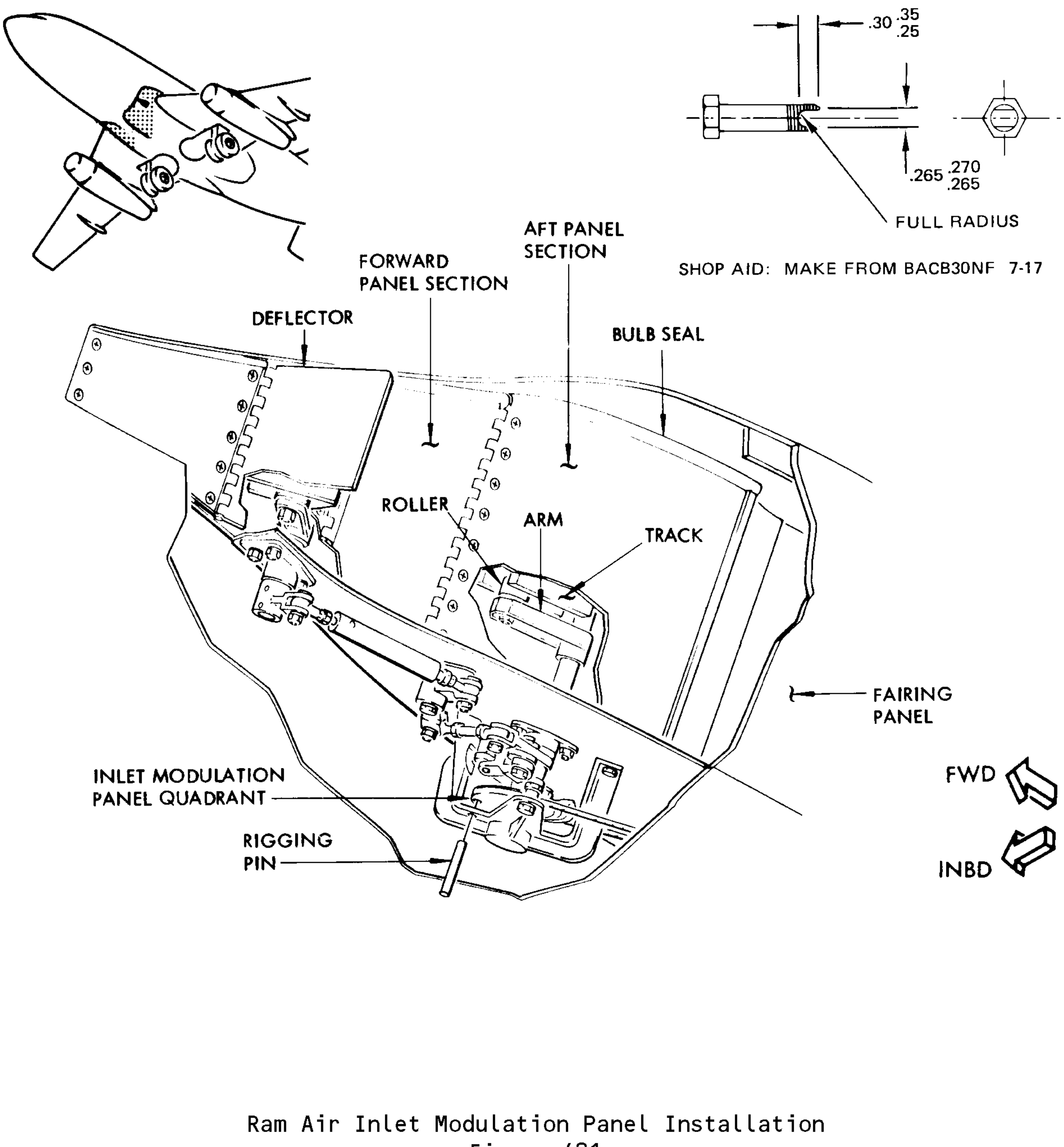
      NOTE: Shop aid may be used to rotate inlet.

   D. Attach forward end of panel assembly to structure with seven bolts.

E. Hand operate quadrant to open and close modulation panel and check that panel modulation does not bind except for friction of bulb seals to structure.

NOTE: Shop aid may be used to rotate inlet.

6. Restore Airplane to Normal Configuration
   A. Reinstall fairing panel.
   B. Reconnect ram air actuator to torque shaft quadrant.



Ram Air Inlet Modulation Panel Installation
Figure 401

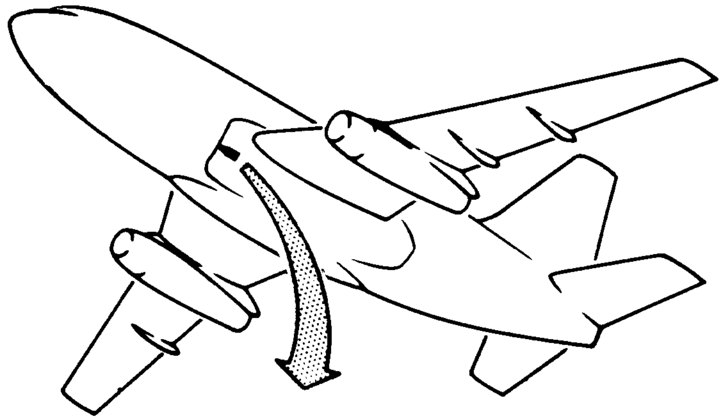
RAM AIR INLET MODULATION PANEL SHAFT ASSEMBLY - REMOVAL/INSTALLATION

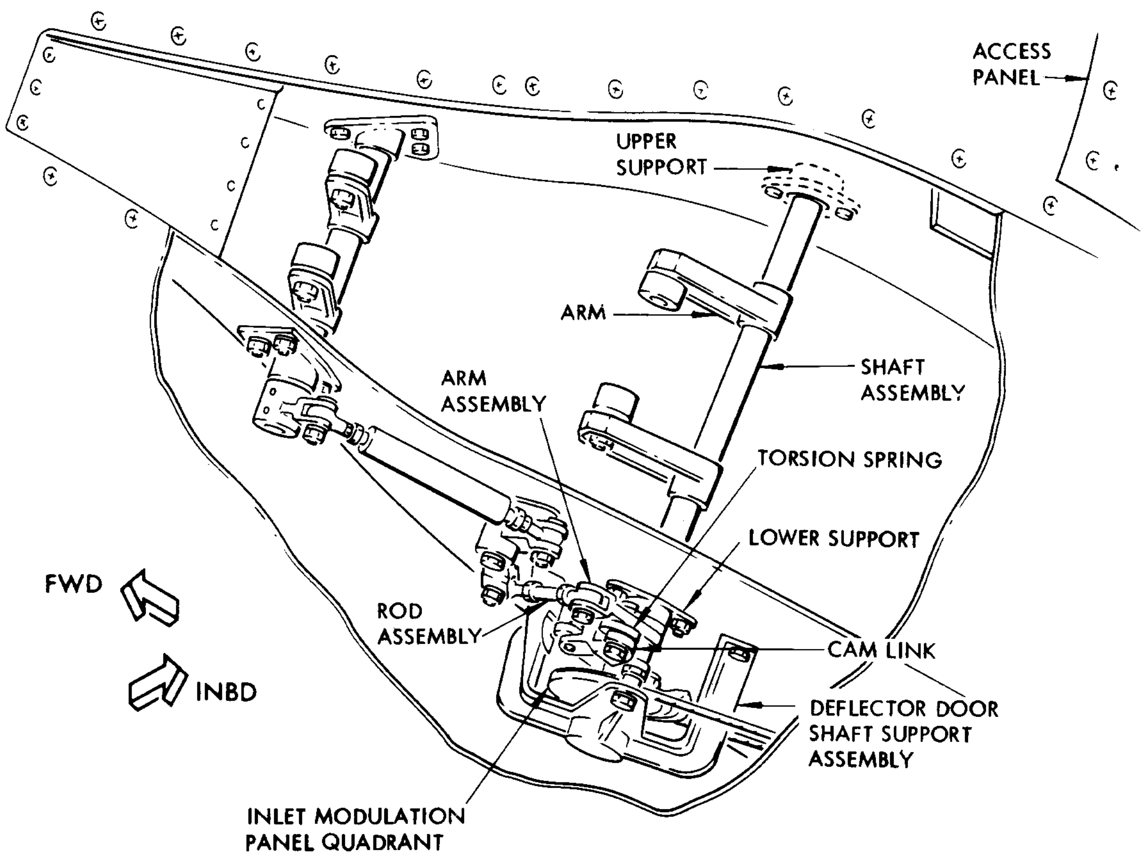
1. General
   A. Prior to shaft assembly removal it is necessary to remove the Ram Air Inlet Modulation Panel.
2. Prepare for Removal of Ram Air Inlet Modulation Panel Shaft Assembly
   A. Remove ram air modulation panel. Refer to Ram Air Inlet Modulation Panel - Removal, 21-52-41.
   B. Disconnect rod assembly from arm assembly (Fig. 401).
   C. Loosen cable turnbuckles until all tension has been removed from cables.
3. Remove Ram Air Inlet Modulation Panel Shaft Assembly
   A. Remove three bolts attaching deflector door shaft support assembly to structure and slide support from end of shaft.
   B. Remove cables from inlet modulation panel quadrant.
   C. Cut lockwire, drive out spring pins holding quadrant on shaft and slide quadrant from shaft.
   D. Remove cam link, torsion spring and arm assembly from shaft as one assembly.
   E. Remove lower support.

      NOTE: As lower support separates from structure shaft will drop with it, separating itself from upper support.

   F. Tilt shaft assembly and remove from cavity.
4. Install Ram Air Modulation Panel Shaft Assembly
   A. Remove inlet modulation panel quadrant from shaft assembly. Note position of quadrant on shaft.
   B. From within modulation cavity insert quadrant end of shaft assembly into hole in lower portion of structure.
   C. Raise shaft assembly and guide upper end into upper support.
   D. Install lower support, leaving nuts and bolts loose.
   E. On arm assemblies without grease fitting, prior to placing arm assembly on shaft, lubricate total length of arm to shaft bearing surface with synthetic oil grease, MIL-G-21164.
   F. Slip cam link, torsion spring and arm assembly on shaft (Fig. 401).
   G. Slip quadrant on shaft pins.
   H. Install cables on quadrant and install cotter pins.
   I. Place deflector door shaft support assembly in position on structure and install bolts and nuts finger tight.
   J. Tighten all bolts and nuts in lower support and deflector door shaft support assembly.
   K. Lubricate cam surface and apply grease at fitting, if installed (Ref 12-23-41).
   L. Rotate shaft and check for binding. Reposition supports or deflector door shaft support assembly by gently tapping in direction to eliminate binding and tighten all support nuts. Recheck shaft for binding.

M. Rig ram air inlet control cables (Ref 21-52-81, Adjustment/Test).
N. Install ram air inlet modulation panel (Ref 21-52-41, Installation).





Ram Air Inlet Modulation Shaft Assembly Installation
Figure 401

TURBOFAN - UNIT SERVICING

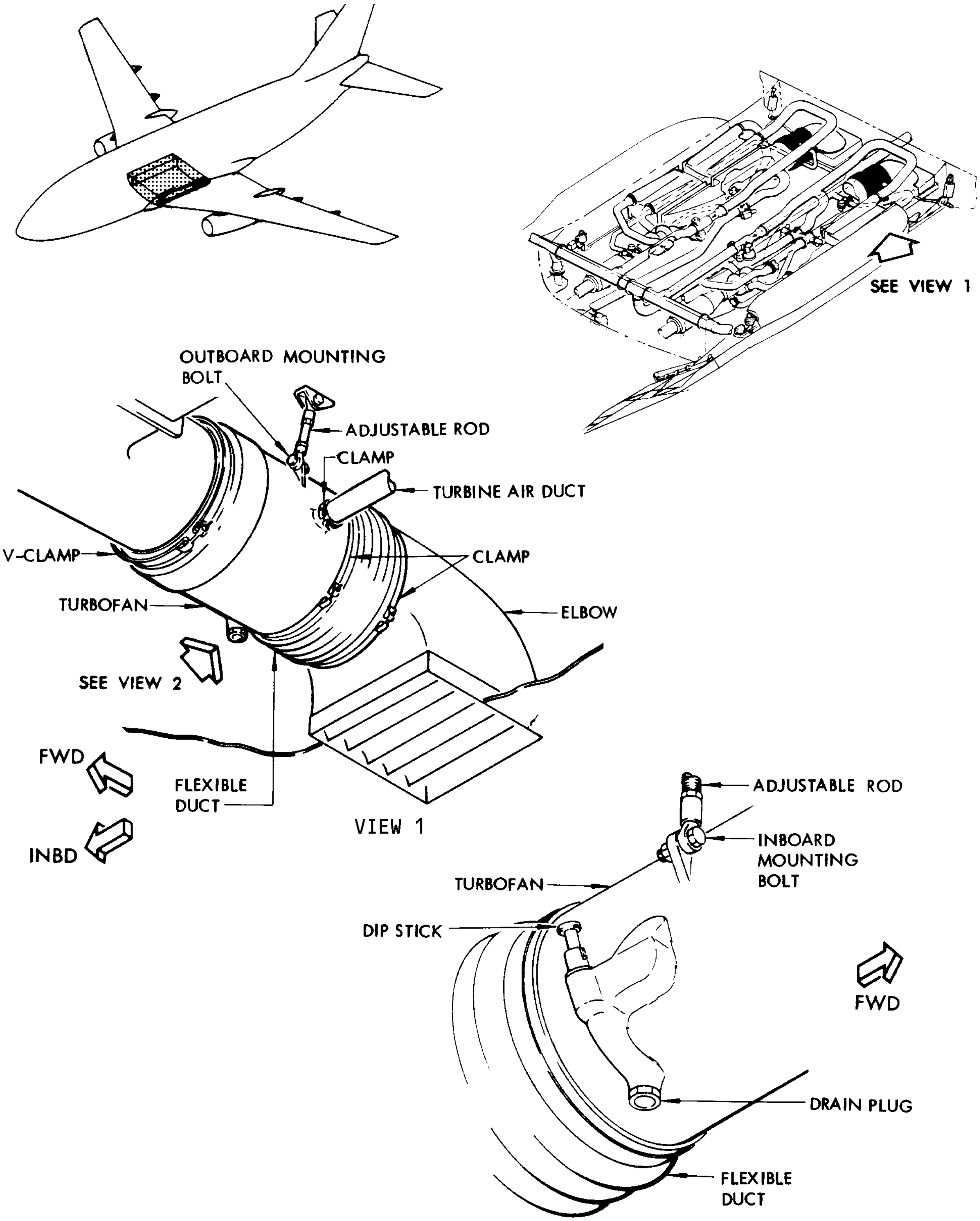
1. General
   A. The procedure outlined in this section is for draining and refilling the turbofan oil sump. For replenishing the sump refer to Ram Air System Turbofan - Servicing, Chapter 12.
2. Equipment and Materials
   A. Turbofan lubricant. Mobil Jet Oil II, MIL-L-23699.
   B. G01048 Lockwire - Corrosion Resistant Steel (0.032 In. Dia.) (NASM20995C32)
3. Replace Turbofan Oil
   A. Open air conditioning equipment bay doors.
   B. Remove turbofan drain plug and drain oil into suitable container.

      NOTE: Two electrical wires are stowed in the turbofan oil drain plug boss and are used during functional test of the turbofan to monitor bearing temperatures. Do not handle or pull wires loose from carrier.

   C. Install drain plug with new O-ring and safety wire using lockwire in accordance with Military Standard MS33540.
   D. Remove dipstick and add oil to overflow holes in dipstick fitting.
   E. Install dipstick with new O-ring.
   F. Close air conditioning equipment bay doors.

TURBOFAN - REMOVAL/INSTALLATION

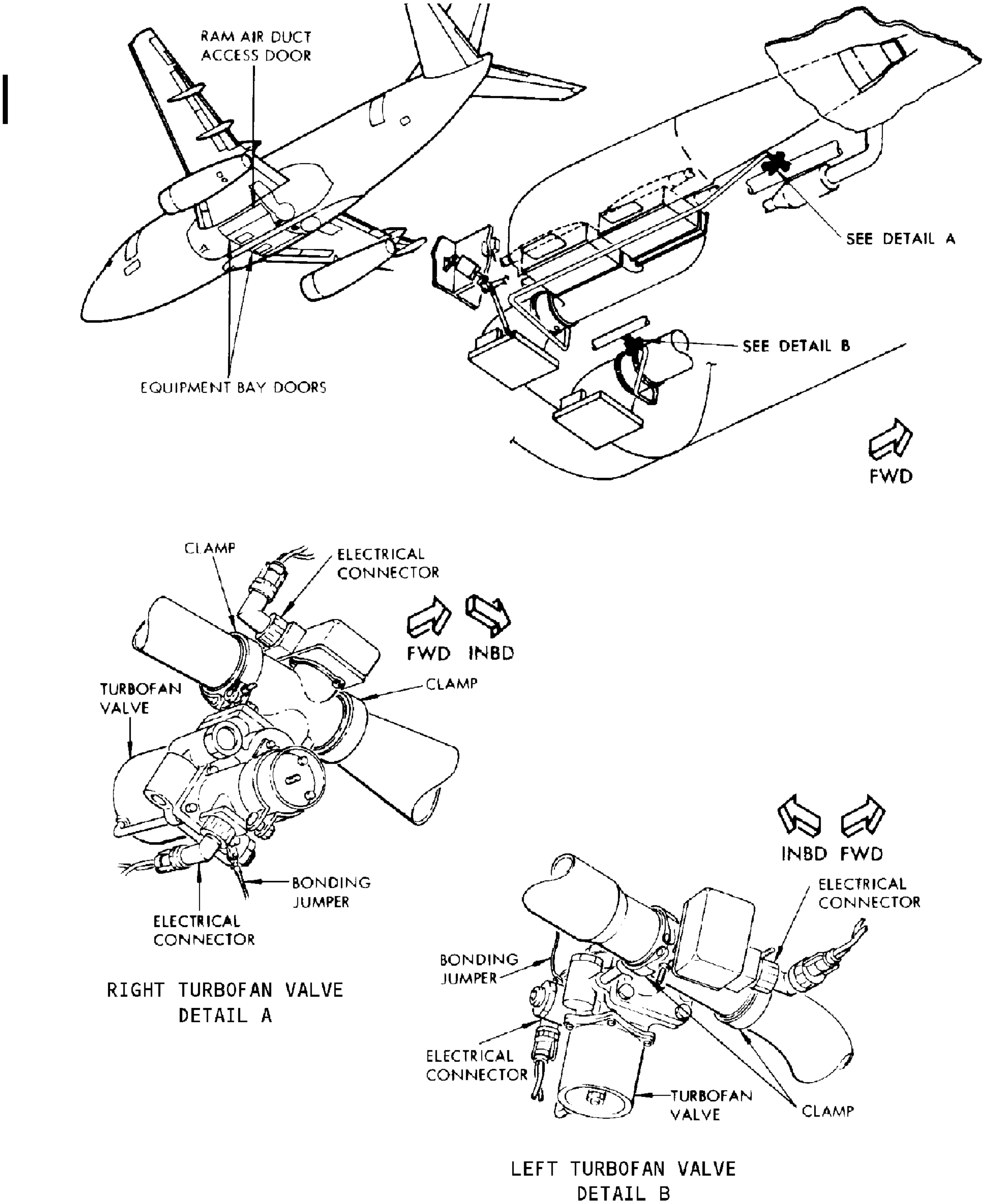
1. General
   A. Two turbofans, one for each ram air system, are located in the air conditioning equipment bay forward of their respective ram air exhaust louvers.
2. Prepare Turbofan for Removal
   A. Lower air conditioning equipment bay door.
   B. Drain oil from turbofan.
3. Remove Turbofan
   A. Remove turbine air duct section below turbofan. (See figure 401.)
   B. Remove flexible duct.
      (1) Loosen clamps at each end of flexible duct.
      (2) Slide clamps off flexible duct.
      (3) Work ends of flexible duct off beads of turbofan and exhaust louver elbow and remove duct.
   C. Loosen clamp at forward end of turbofan and slide clamp onto ram air duct.
   D. Remove outboard mounting bolt and allow turbofan to slowly rotate down on inboard mounting bolt.
   E. Remove inboard mounting bolt and remove turbofan from airplane.
4. Install Turbofan
   A. Check that forward V-clamp is on ram air duct.
   B. Raise turbofan into position in airplane and install inboard mounting bolt.
   C. Rotate turbofan up and install outboard mounting bolt.
   D. Assure proper alignment of turbofan lip with duct lip and install V-clamp.
      NOTE: Adjust rods as necessary for alignment.
   E. Check that clamps are loosely placed on turbofan outlet and elbow inlet and install flexible duct.
   F. Slide clamps in position over flexible duct and tighten.
   G. Install turbine air duct.
   H. Service the turbofan. Refer to Turbofan - Unit Servicing.
   I. Start air conditioning system and check for leaks at all joints and clamps.
   J. Stop air conditioning system and close air conditioning equipment bay doors.



Turbofan Installation
Figure 401

TURBOFAN VALVE - REMOVAL/INSTALLATION

1. Remove Turbofan Valve (Fig. 401)
   A. Check that LEFT or RIGHT turbofan valve circuit breaker on P6-4 load control center is open.
   B. Open air conditioning bay access door.
   C. Remove electrical connectors.
   D. Remove bonding jumper.
   E. Disconnect line leading to purge valve from turbofan valve.
   F. Remove clamps.
   G. Remove valve.
2. Install Turbofan Valve
   A. Install valve body with clamps.
   B. Connect line from purge valve to turbofan valve.
   C. Install bonding jumper.
   D. Install electrical connectors.
   E. Check that air conditioning PACK switch is at OFF and turbofan valve is closed.
   F. Close LEFT or RIGHT turbofan valve circuit breaker.
   G. Provide electrical power.
   H. Pressurize pneumatic system by a ground pneumatic cart.
   I. Move Isolation Valve switch to OPEN to provide air to left turbofan valve.
   J. Place air conditioning PACK switch to ON, and check that turbofan valve opens.
   K. Place air conditioning PACK switch to OFF, and check that turbofan valve closes.
   L. Move ISOLATION VALVE switch to CLOSE.
   M. Remove pneumatic system pressure if no longer required.
   N. Remove electrical power if no longer required.
   O. Close air conditioning bay access door.



Turbofan Valve Installation
Figure 401

RAM AIR INLET CONTROL CABLES - ADJUSTMENT/TEST

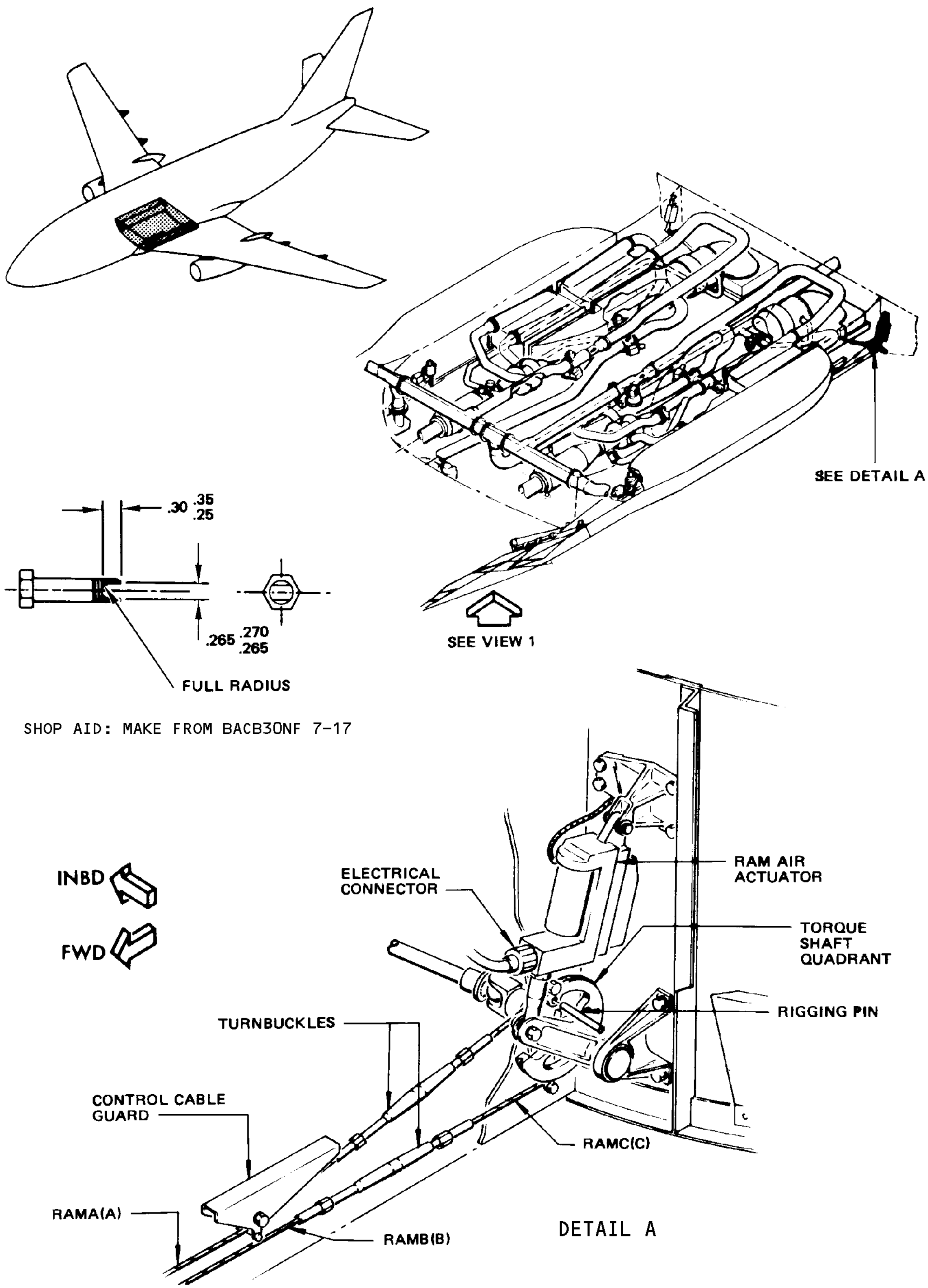
1. Ram Air Inlet Control Cable Adjustment
   A. General
      (1) Ram air inlet control cable adjustment is applicable to either the right or left ram air inlet control cables. If desirable both cable assemblies may be adjusted at the same time.
   B. Equipment and Materials
      (1) Tensiometer - 0 to 100 pound capacity
      (2) Rigging Pins - (2) 5/16 diameter, approximately 6 inches long

         NOTE: If right and left systems are adjusted at the same time, four rigging pins will be required.

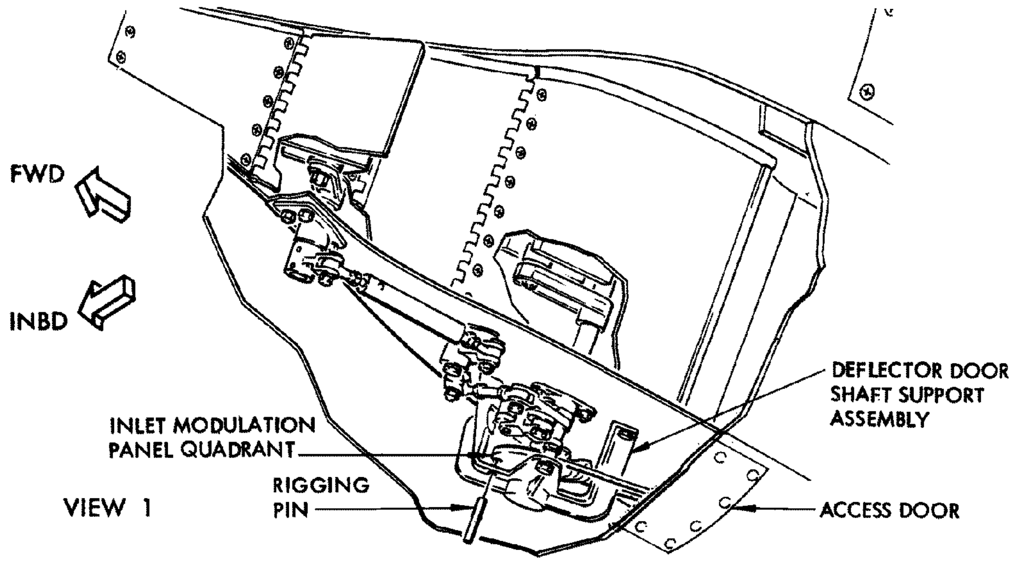
      (3) Shop Aid (Fig. 501)
   C. Prepare Ram Air Inlet Control Cables for Adjustment (Fig. 501)
      (1) Open ram air duct access door.
      (2) Remove access door from fairing panel.
      (3) Ensure actuator is in full retract position.
      (4) Disconnect electrical connector from ram air actuator.
   D. Adjust Ram Air Inlet Control Cables (Fig. 501)
      (1) Install rigging pin in torque shaft quadrant.
      (2) With inlet modulation panel in full open position, install rigging pin in inlet modulation panel quadrant.

         NOTE: Shop aid may be used to rotate inlet. If required, install shop aid in the inboard end of the main inlet modulation shaft. Shop aid shall engage quadrant attach pin. Attach wrench to shop aid to rotate inlet.

      (3) Adjust cables per tension chart. After adjusting cables, check that rigging pins can be removed easily. If not, balance tension accordingly.
   E. Restore Airplane to Normal Configuration (Fig. 501)
      (1) Remove rigging pins and operate actuator to confirm installation.
      (2) Connect electrical connector to ram air actuator.
      (3) Install air conditioning fairing panel below ram air inlet.
      (4) Close ram air duct access door.



Ram Air Inlet Control Cable Adjustment
Figure 501 (Sheet 1)

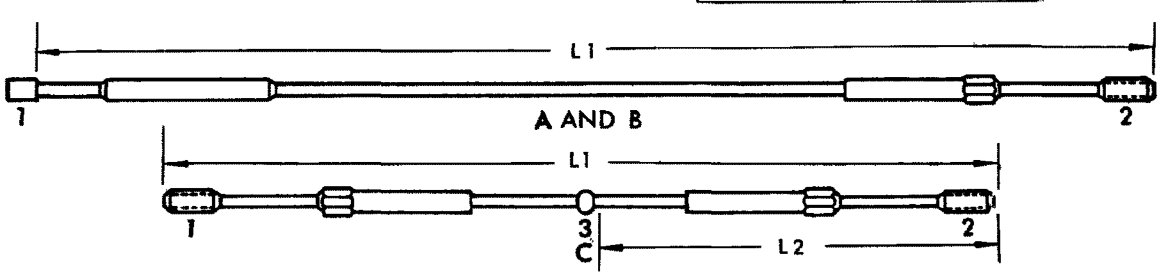


CABLE REF	FUNCTION MA - OPEN MB - CLOSED	DRAWING NO.	NO. REQ	LENGTH (INCHES) L1	L2	CABLE SIZE	FITTINGS 1.	2.	3.
A	RAMA	69-41215-1	2	137.90		3/32 7x7	BACT14A3	MS21260-L3LH	--
B	RAMB	69-41215-1	2	137.90		3/32 7x7	BACT14A3	MS21260-L3LH	--
C	RAMC	BACC13ACK.9.7-19.5	1	19.5	9.7	3/32 7x7	MS21260-L3RH	MS21260-L3RH	BACT14B3

CABLE CODE	FUNCTION
RAMA	ACTUATOR RETRACTED QUADRANT CLOCKWISE INLET OPEN
RAMB	ACTUATOR EXTENDED QUADRANT COUNTER-CLOCKWISE INLET CLOSED

RAM AIR INLET MODULATION PANEL CONTROL CABLE TENSION CHART

AMBIENT TEMP °F	CABLE RIGGING LOAD ± 5 LBS
110	88
90	79
70	70
50	61
30	52
10	42
-10	33
-30	24
-40	19



Ram Air Inlet Control Cables Adjustment
Figure 501 (Sheet 2)

EXHAUST MODULATION LOUVER ASSEMBLY - REMOVAL/INSTALLATION

1. Equipment and Materials
   A. Rigging Pins - (l) 1/4-inch diameter, and (l) 5/16 -inch diameter, both approximately 6 inches long
   B. Drill - 0.190 (+0.002/-0.005) inch diameter
2. Remove Modulation Louver Assembly
   A. Open air conditioning bay access door, and ram air duct access door.
   B. Cut lockwire and drive out the two spring pins which hold the torque shaft universal to the arm shaft (Detail A, Fig. 401).
   C. Loosen clamp and slide back over flexible duct.
   D. Remove cover.
   E. Remove screws (20 places) that attach louver assembly to airframe.
   F. Remove bolts which hold sections of torque shaft together.

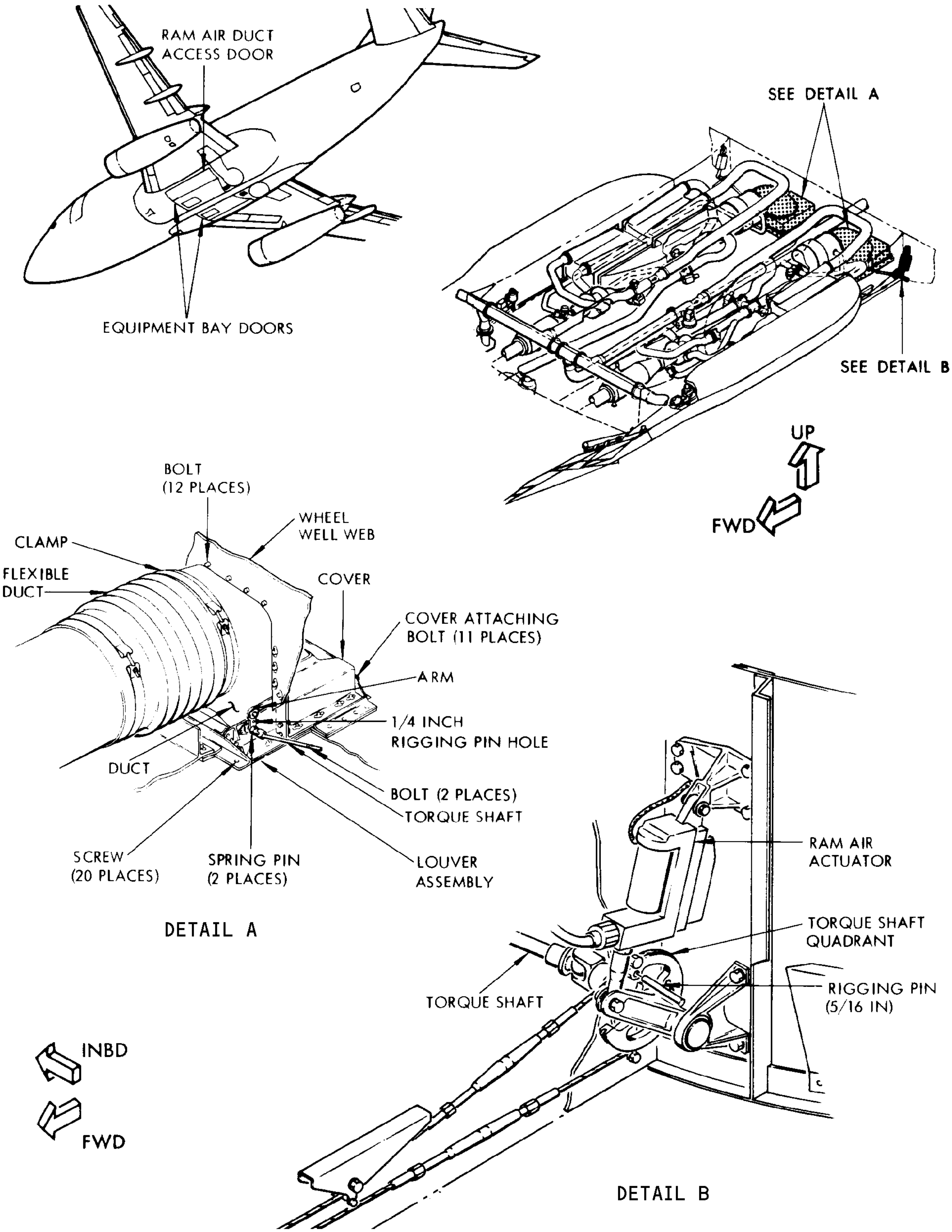
      NOTE: Mark shaft for proper realignment of bolt holes.

   G. Slide one section of torque shaft into other withdrawing universal from arm. Tape shafts together.
   H. Remove all but two of the twelve bolts that attach the duct collar to the web.

      NOTE: The two bolts left in to support the louver assembly should be opposite each other along the side.

   I. Support the louver assembly, remove the last two bolts, and lower the louver assembly from the airplane.
3. Install Modulation Louver Assembly
   A. Raise louver assembly into place and loosely install bolts through duct collar and into web (12 places) (Fig. 401).
   B. Install screws (20 places) that attach louver assembly to airframe.
   C. Install cover.
   D. Tighten bolts installed in step A.
   E. Slip flexible duct over duct lip and install clamp.
   F. Rotate arm until louvers are full open and install 1/4-inch-rigging pin.
   G. Ensure that ram air actuator is retracted (door open position) and install 5/16-inch rigging pin through torque shaft quadrant. (See detail B.)
   H. Remove tape holding torque shaft sections together and install universal on arm.
   I. Align bolt holes of torque shaft and install bolts.
   J. Using existing pin holes in universal as a guide drill through arm shaft (2 places).

      NOTE: Use 0.190 (+0.002/-0.005) inch drill.



Ram Air Exhaust Modulation Louver Assembly Installation
Figure 401

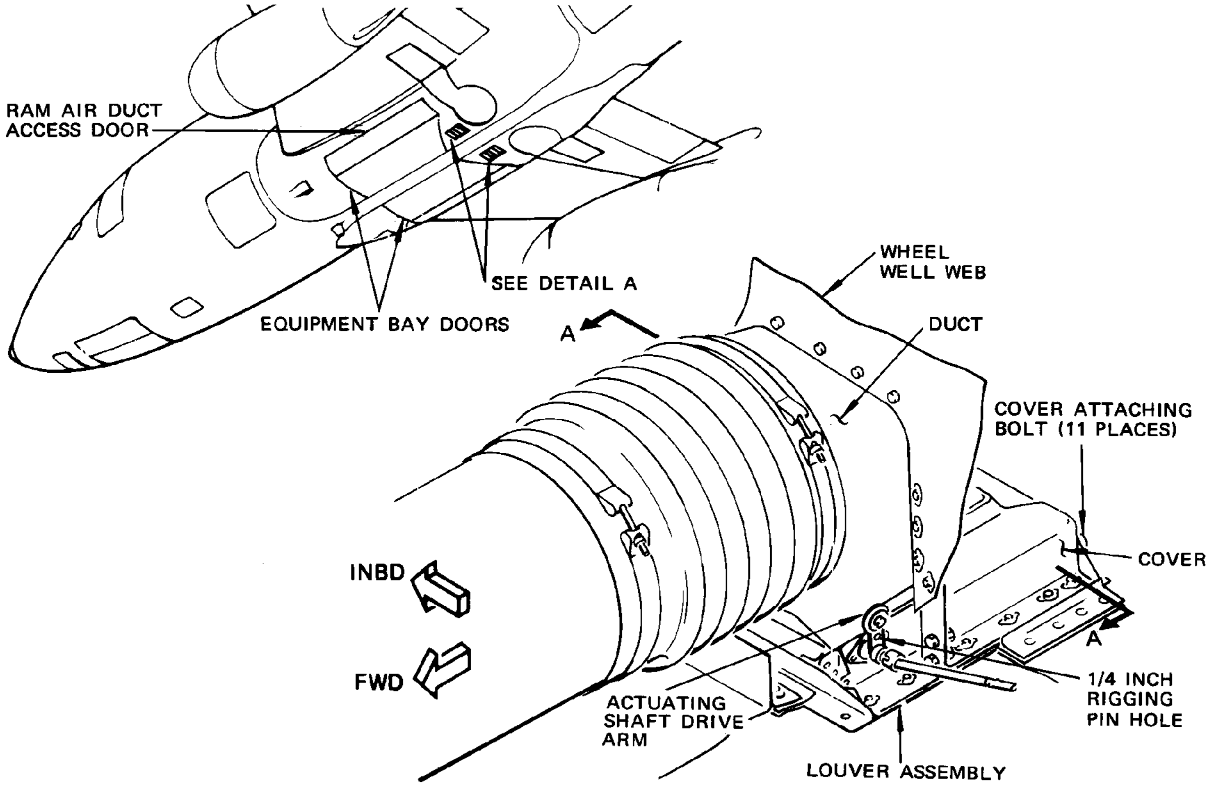
K. Dip spring pins in primer and drive pins into holes, securing universal to arm shaft, and lockwire pins.
L. Remove both rigging pins.
M. Test system for operation. Refer to Ram Air Modulation System Test, 21-52-0.
N. Close air conditioning bay access door, and ram air duct access door.

EXHAUST MODULATION LOUVER ASSEMBLY - APPROVED REPAIRS

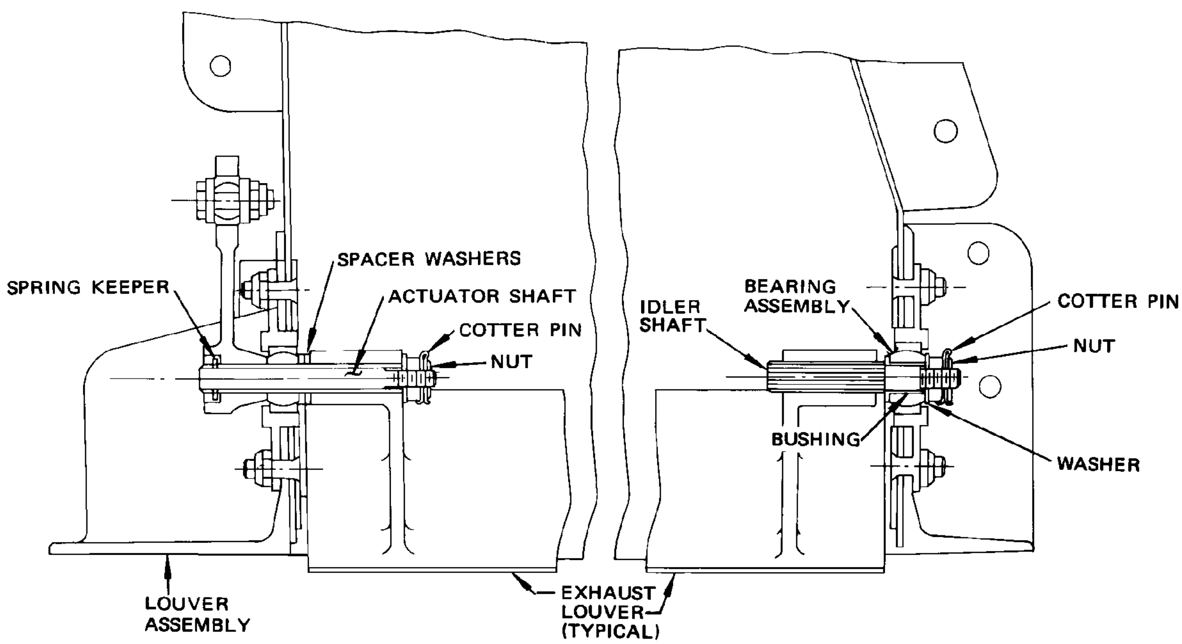
1. General
    A. Repairing the ram air exhaust modulation louver assembly entails replacing defective components, such as louvers, louver bearings and shafts, while the assembly is in the airplane.
2. Equipment and Materials
    A. Dow Corning RTV Sealant, or equivalent
3. Prepare for Repair
    A. If closed, open ram air exhaust louvers.
        (1) Provide electrical power.
        (2) Check that RAM MOD and RAM MOD CONT circuit breakers are closed.
    B. With louvers full open, open RAM MOD and RAM MOD CONT circuit breakers and apply warning tags.
    C. Open applicable air conditioning bay access door.
    D. Remove applicable modulation louver assembly access cover, accessible from wheel well.
4. Repair Exhaust Modulation Louver Assembly
    A. Remove louver (Fig. 801).
        (1) Reaching through open louver, remove cotter pin, nut, and washer from actuating shaft. Remove shaft by moving shaft outward.
        (2) Remove idler shaft by removing cotter pin, nut, and washer, and moving shaft inward.
        (3) Remove louver, checking spacer washers between actuator shaft bearing and louver.
        (4) If required, remove bearing assemblies by pushing bearing inward.
    B. Install louver (Fig. 801).
        (1) Install bearing, if removed.

            NOTE: Bearings are dry-film lubricated. Do not apply oil or grease on moving surfaces.

        (2) If a new louver is being installed, temporarily position louver between bearings to determine spacer washers required at actuator end to provide equal louver clearance within louver opening.
        (3) Check that bushing is in idler shaft bearing.
        (4) Position spacer washers and louver, align blind splines and install louver shafts.
        (5) Install washer and nut on each shaft. Tighten nuts to 30 pound-inches of torque. Align cotter pin holes by tightening nut as required and install cotter pins.
        (6) Remove bolt at actuator shaft drive arm and check that all louvers move without binding. Install bolt and cotter pin.



DETAIL A



SECTION A-A

Ram Air Exhaust Modulation Louver Assembly
Figure 801

5. Restore Airplane to Normal
   A. Apply sealant to cover mating surfaces and install modulation louver access cover.
   B. Close air conditioning bay access door.
   C. Remove warning tags and close applicable circuit breakers.
   D. If no longer required, remove electrical power from airplane.

RAM AIR DUCTS - APPROVED REPAIRS

1. General
   A. Access to the entire ram air duct system is obtained by opening the ram air duct access door and the air conditioning equipment bay doors.
2. Equipment and Materials
   A. Solvent - Final Cleaning of All Organic Coatings Prior to Non-structural Bonding (Ref AMM/SOPM 20-30-89)
   B. Adhesive tape, 1 inch wide, No. 474 Vinyl Plastic Tape, Minnesota Mining & Mfg. Co.
   C. Fiberglass cloth, style 181, Uniglass Industries, Division of United Merchants' and Manufactures, Inc.
   D. Adhesive, BMS 8-301, Class 3
   E. Abrasive Cloth, 400 grit
   F. Polyvinyl Chloride (PVC) Parting Film, Reynolds Metal Co.
   G. Cheesecloth or other lint-free wiping material containing not more than 0.75 percent (dry weight) oil or grease content.
3. Repair Ram Air Ducts
   A. Remove ram air duct within area of failure.
   B. Drill ends of cracks to prevent further crack propagation.
   C. Clean damaged and adjacent area.
      (1) Apply solvent, Series 89 (Ref AMM-SOPM 20-30-89) with clean, absorbent material.
      (2) Wipe off solvent before it has evaporated with a clean, oil and lint-free, absorbent, disposable material.
      (3) Sand the surface lightly to prepare surface. The sanding should extend one inch beyond repair area. Make a final solvent application and wipe clean as in (2) above.

         NOTE: Use clean rubber or cotton gloves and cheesecloth when cleaning the surfaces.

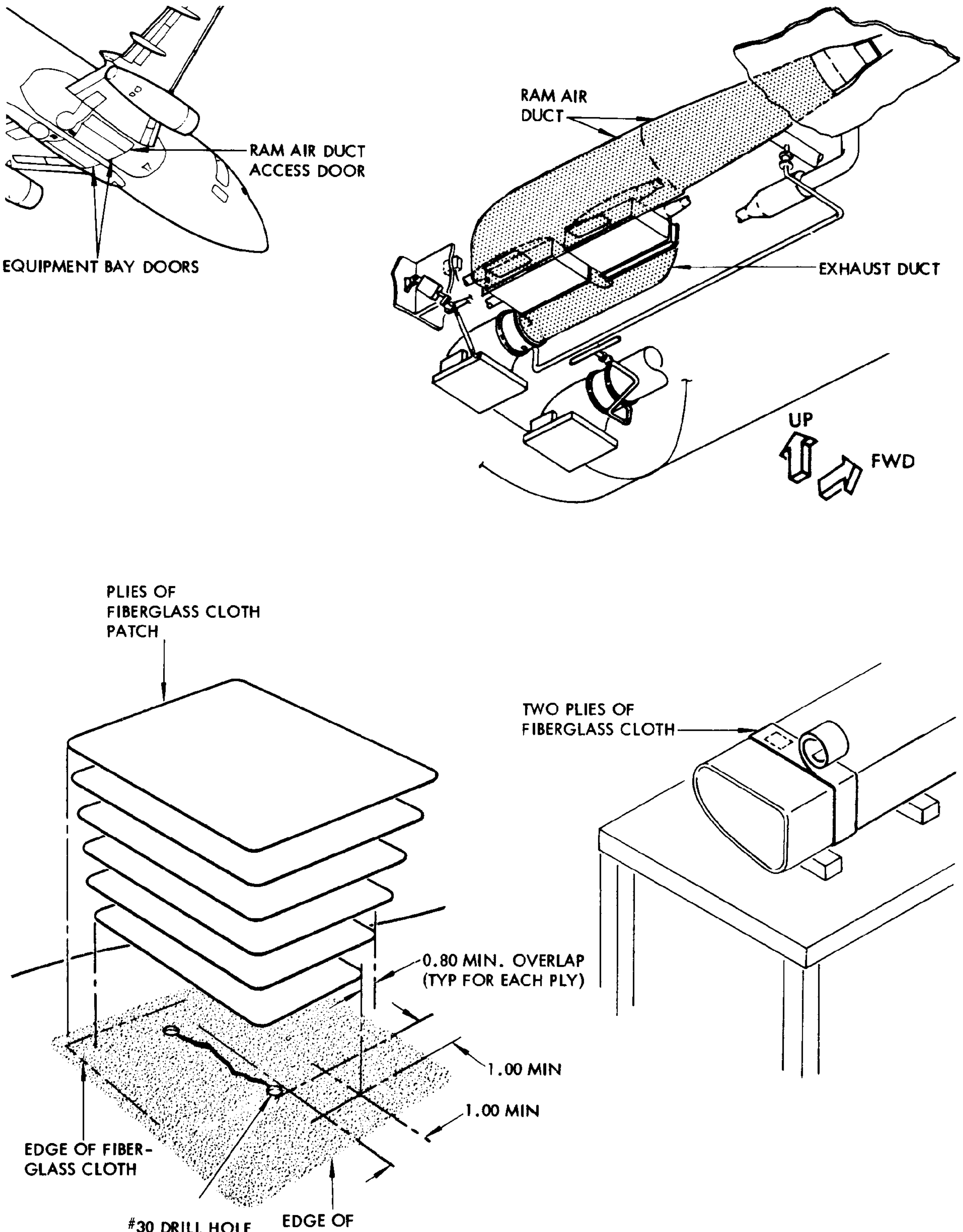
   D. Prepare fiberglass cloth.
      (1) Cut six plies of fiberglass cloth, the smallest covering an area 1.0 inches from defect (Fig. 801). Cut each succeeding ply so that it is at least 0.80 inches larger all around than preceding ply. Two additional plies are required and should be wrapped completely around duct, overlapping by 0.80 inch for each ply.
      (2) Impregnate each cloth patch with BMS 8-301, Class 3 prepared per BAC 5010, Type 113, or per manufacturer's instructions, and place between two pieces of PVA parting film.

         NOTE: Weight of adhesive approximately equal to the weight of the dry fiberglass cloth is required to impregnate cloth.

E. Place repair patch.
   (1) Apply a coat of BMS 8-301, Class 3, adhesive mixture, prepared per BAC 5010, Type 113, or per manufacturer's instructions, over the repair area.
   (2) Remove parting film from one side of the smallest ply of the patch and place its exposed face against the repair area.
   (3) Use a squeegee over parting film that covers the patch to remove wrinkles and entrapped air. Do not remove too much adhesive by excessive pressure. This avoids producing a patch deficient in adhesive.
   (4) After removing parting film from the outer face place the next larger size ply of the impregnated patch over the ply on the repair area with at least 0.80 inch overlap all around.
   (5) Place succeeding plies of the patch as described in steps (3) and (4) above.

   NOTE: On last two plies required, use a complete wrap around ram air duct prepared area as in step C. above. Use adhesive tape to secure last two plies during wrapping operation.

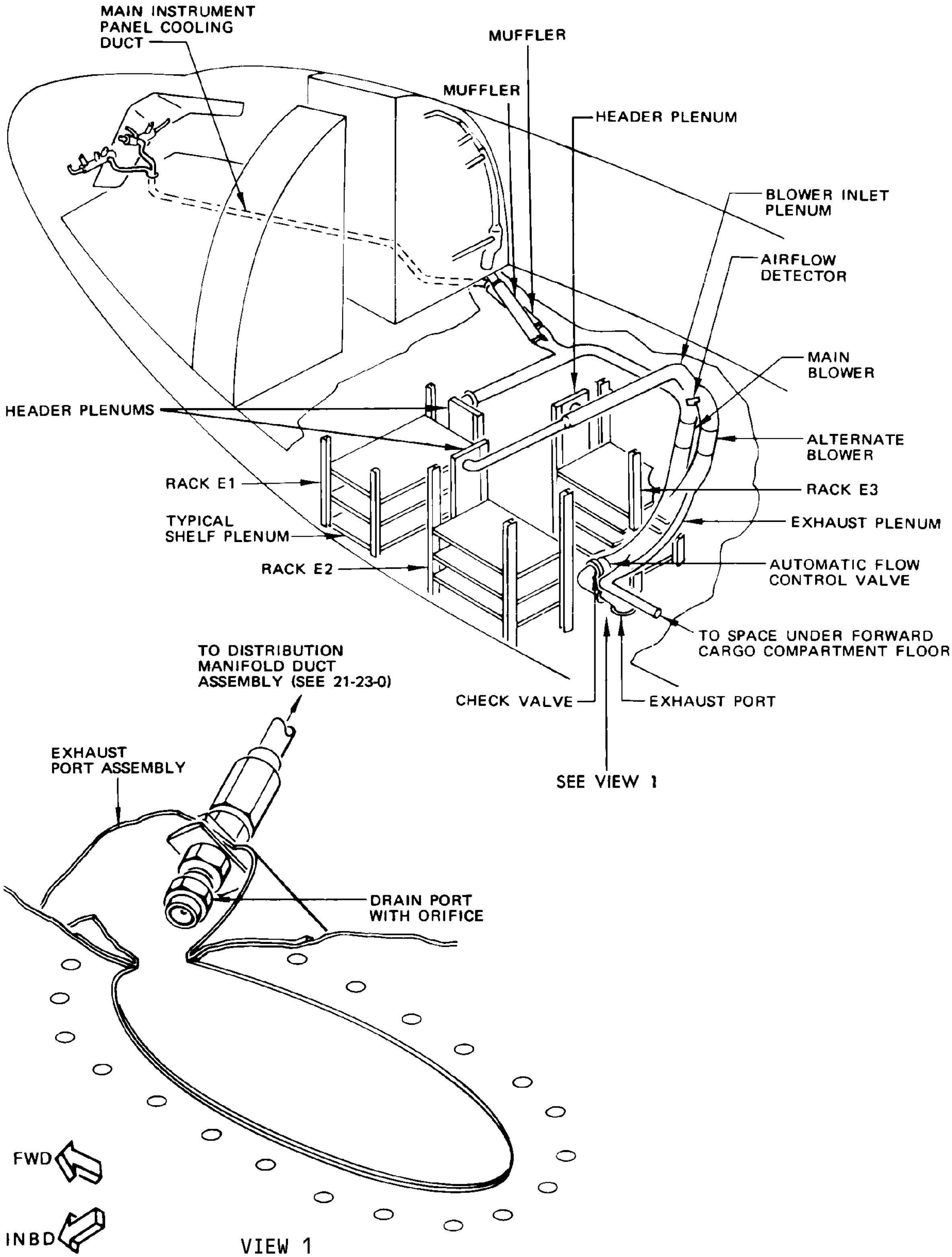
   (6) After placing the last ply, recover the entire lay-up with a piece of parting film extending about 0.50 inch over edges of the patch.
   (7) Sweep excess adhesive to edges of parting film thereby fairing the edges of the patch to the contour of the repair surface. All loose threads shall be embedded in resin.
   (8) Wipe off any excess adhesive that has been squeezed out at the edges of the parting film.
F. Cure Impregnated Patch
   (1) Required curing time for BMS 8-301 adhesive mixture is about 6 days at 75°F or 1 hour at 165°F. A cured patch is hard and resounds when tapped lightly with a coin or other light metallic object.
   (2) Remove parting film from patch after curing.
   (3) The patch should be free from pits, blisters, starved areas, and excess resin deposit.



Ram Air Duct Repair
Figure 801

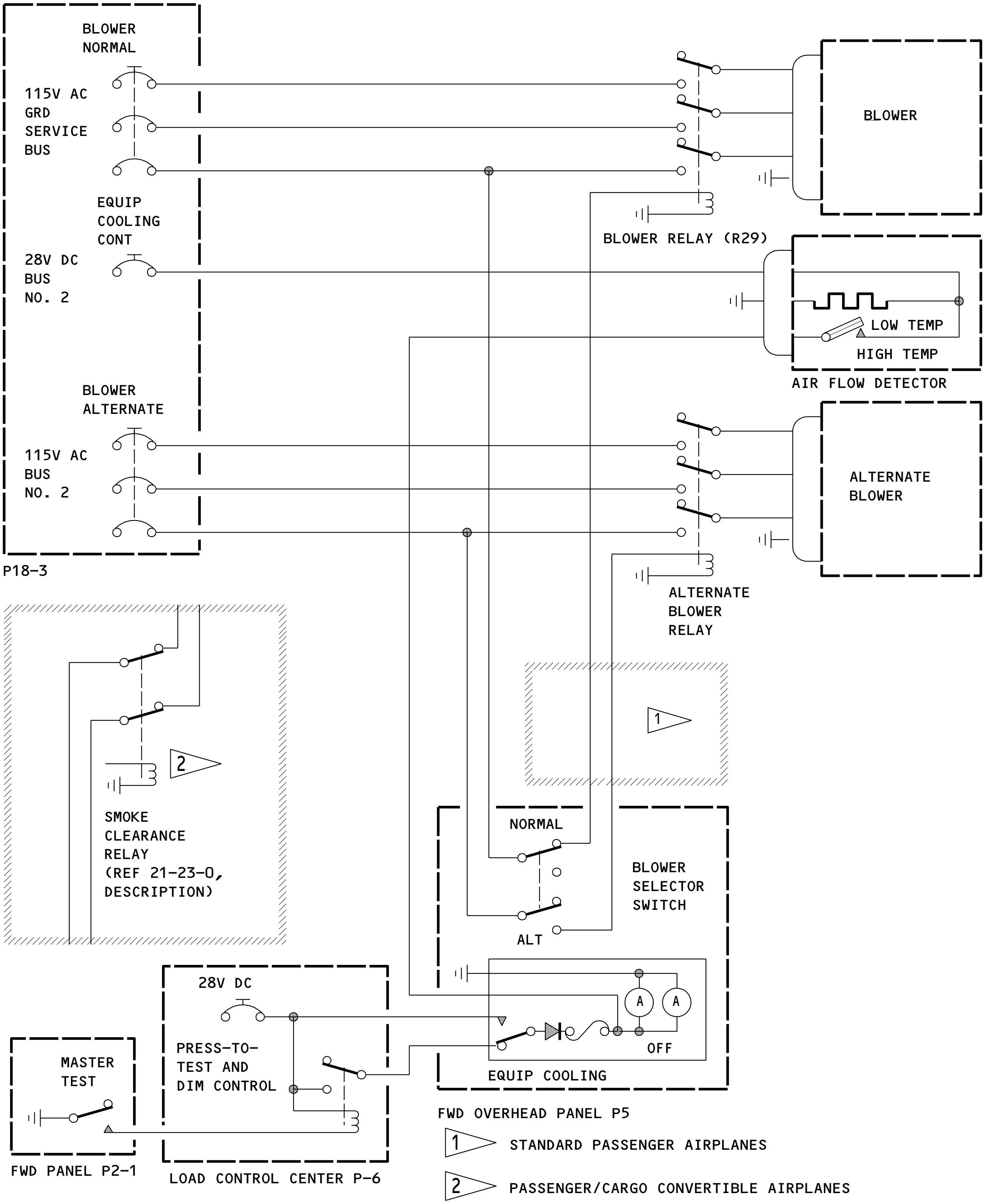
EQUIPMENT COOLING SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The equipment cooling system cools the electrical and electronic equipment on the racks in the electronic compartment, some circuit breaker panels in the control cabin and on some airplanes, the main instrument panel. (See figure 1 for effectivity.) Most of the equipment is cooled by "draw around" air. Equipment on shelves E3-1 and E3-3 is cooled by "draw through" air.
   B. Cabin air is the cooling medium. It is drawn through and around the equipment into a system of ducts and manifolds. Some of the ducts and/or manifolds form the equipment mounting racks. The system leads to the blower inlet plenum. (See figure 1.) Two blowers are connected to the inlet plenum. The blowers exhaust into an exhaust plenum. The exhaust plenum contains an automatic flow control valve, a check valve and an exhaust port. A condensate drain tube from the passenger cabin conditioned air distribution system is connected to the exhaust port. A drain port with orifice in the exhaust port allows moisture, which may have condensed in the distribution manifold duct assembly to be removed before it can get into the overhead distribution system. (See figure 1). The blower inlet plenum is outboard of Rack E3. The exhaust plenum is outboard of Rack E3 and under the electronic compartment floor. When the airplane is on the ground or during low-altitude flight, one of the blowers draws the cooling air through the ducts and discharges it overboard through the automatic flow control valve and the exhaust port. During flight, the cabin-to-ambient pressure differential is adequate to close the flow control valve. The air that flows through the system is then discharged under the forward cargo compartment floor. The air circulates between the cargo compartment insulation and lining and thus heats the cargo compartment before it is discharged overboard through the forward outflow valve.
   C. Two blowers are used in the system. One blower operates continuously when power is supplied to the airplane. If the main blower fails when the airplane is on the ground, the alternate blower may be switched on so the cooling system can continue to operate.
   D. The flow control valve controls the flow through the valve or under the cargo compartment floor to the outflow valve. The blower creates the required cabin-to-ambient differential pressure to induce airflow through the system. Normal operation of the cabin pressurization system will result in an increase of cabin pressure relative to ambient pressure. This increase in differential pressure will, in turn, tend to increase the airflow discharged through the nozzle and control valve. The increase in dynamic pressure is sensed by the flow control valve which begins to move toward the closed position to limit the airflow through the valve.



Equipment Cooling System Component Location
Figure 1

2. Equipment Cooling Blowers
   A. Two identical equipment cooling blowers are used in the equipment cooling system to create the required cabin-to-ambient differential pressure for inducing airflow through the system. Each blower is an axial flow type with an electrical motor mounted on the centerline of the blower cylindrical housing. Operation of the blower is continuous. The motor operates on 115-volt, three-phase power taken from circuit breaker panel P18-3 (Fig. 2) and is designed for continuous operation.
   B. The blowers are in the lower aft section of the electronic compartment. They are connected between the blower inlet plenum and exhaust plenum by short flexible ducts and duct clamps and is secured by the blower support.
   C. Equipment cooling blower operation is controlled by the blower selector switch on the overhead panel P5. The switch positions are NORMAL and ALTERNATE.
3. Automatic Flow Control Valve
   A. The flow control valve is in the exhaust plenum under the floor in the aft section of the electronic compartment. The electronic compartment floor must be removed to gain access to the valve.
   B. The automatic flow control valve is operated by airflow through the valve and sensed across its eccentrically mounted butterfly plate that acts as an airfoil. The butterfly valve, as an airfoil, provides initial movement toward the closed position at a given dynamic pressure. As the butterfly moves closed, an increased pressure differential is developed which acts on the off-centered butterfly to produce a closing torque.
      (1) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-1 THRU -6;
          At 2.0 to 2.8 psi cabin-to-ambient differential pressure the flow control valve will be completely closed and the overboard flow is directed under the floor to the forward cargo compartment.
      (2) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-7; At 0.7 to 1.1 psi cabin-to-ambient differential pressure the flow control valve will be completely closed and the overboard flow is directed under the floor to the forward cargo compartment.
4. Equipment Mounting Shelves and Ducts
   A. The electronic racks are formed by shelves, header plenums, and supporting structure. Holes for airflow are suitably located above each shelf. The holes lead to the header plenum, which leads into the ducts, and these into the blowers. The holes are sized to provide the right amount of cooling airflow when a given differential exists between cabin pressure and plenum pressure.



Equipment Cooling System Circuit
Figure 2

B. Shelves E3-1 and E3-3 are hollow and have individual holes under the equipment for "draw through" cooling. There are sealing strips along the edges of these two trays. The holes lead to the plenum, which leads into the ducts, and these into the blower.
   (1) When changing orifice sizes because of component changes, total orifice inlet area for each shelf must be maintained at the same value. Refer to Equipment Cooling System - Balancing.

5. Airflow Detection System
   A. The airflow detection system provides warning when the equipment cooling system is not supplying enough cooling air for safe electrical or electronic equipment operation. The airflow detection system consists of an equipment cooling OFF warning light and the system circuitry (Fig. 2). Electrical power for operation of the airflow detector and OFF light press-to-test circuit is taken from the 28-volt dc bus on circuit breaker panel P18. The OFF light is also connected to the master test circuit.
   B. The airflow detector consists of a temperature sensitive switch combined with a small heater. With airflow through the equipment cooling system, heat from the detector heater is dissipated. With loss of airflow the heat sensitive switch will close due to the heat rise. The airflow detector is installed in the blower inlet plenum.
   C. The OFF amber warning light is located on the forward overhead panel.

6. Check Valves
   A. Two check valves are installed in the equipment cooling system. These check valves are installed in the blower discharge duct (one for each blower) and prevent recirculating air being discharged from the operating blower back through the nonoperating blower.

7. Operation
   A. The operation of the equipment cooling system is automatic once electrical power is applied to the airplane. With the blower selector switch positioned to NORMAL the main blower will operate unless the GEN BUS No. 1 is de-energized. If for this reason or any other reason the main blower fails to operate, the blower selector switch may be positioned to ALTERNATE. The alternate blower will then operate.
      (1) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-1 THRU -6; The selected blower operates continuously and the flow control valve is in the open position when the differential pressure is less than 2.0 to 2.8 psi.
      (2) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-7; The selected blower operates continuously and the flow control valve is in the open position when the differential pressure is less than 0.7 to 1.1 psi.

B. When electrical power is connected to the airplane, circuit breaker panel P18-3 is energized and the blower and the airflow detector are energized. While the cabin pressure differential is low the blower creates most of the airflow necessary for cooling. In flight, the cabin pressure differential increases causing a greater flow through the blower duct. The increased differential is sensed by the flow control valve that begins to close.

(1) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-1 THRU -6; When the differential pressure reaches 2.0 to 2.8 psi, the valve is closed. While the pressure differential is greater than 2.0 to 2.8 psi, the equipment cooling air will exhaust mainly to the forward cargo compartment.

(2) AIRPLANES WITH FLOW CONTROL VALVES P/N 10-60704-7; When the differential pressure reaches 0.7 to 1.1 psi, the valve is closed. While the pressure differential is greater than 0.7 to 1.1 psi, the equipment cooling air will exhaust mainly to the forward cargo compartment.

C. During normal operation the airflow through the equipment cooling system is sufficient to remove heat from the detector heater, preventing the temperature sensitive switch from activating. When the airflow through the system is not sufficient to remove heat from the heater, the temperature around the heat sensitive switch rises, actuating the switch. This illuminates the OFF warning light. The OFF warning light on the overhead panel will remain on until airflow through the system is sufficient to remove heat from the heater.

EQUIPMENT COOLING SYSTEM - TROUBLESHOOTING

1. General

   A. In troubleshooting the equipment cooling system two cooling problems may exist. One concerns the equipment in the racks and sizing of the orifice openings. The other will result from faulty components in the air-moving portion of the system.

   B. Fixed orifice openings are provided to allow proper airflow for all equipment installed in the airplane. If orifices are not set accordingly, or if additional orifices are added to provide cooling for equipment installed after delivery, it may upset the cooling balance and allow overheating of some electrical/electronic equipment. For a more detailed description of orifices, refer to 21-58-0, Adjustment/Test.

      CAUTION: IF ORIFICE OPENINGS ARE IMPROPERLY ADJUSTED, EQUIPMENT ON THE RACKS MAY OVERHEAT. DO NOT ADD EQUIPMENT OR CHANGE ADJUSTMENTS WITHOUT YOUR ENGINEERING DEPARTMENT APPROVAL.

      (1) Furthermore, it should be noted that cooling of equipment utilizes control cabin exhaust air. This air, drawn through the equipment, may contain impurities such as tars and nicotine that may settle on the equipment. If equipment is not cleaned for a considerable period of time, these deposits could adversely affect their cooling.

      (2) A performance test is provided in Equipment Cooling System - Adjustment/Test to check that airflow through the system is within limits and to isolate any fault which might cause system performance to stray from those limits.

   C. The equipment cooling system has several items that could cause trouble. They are the airflow detector, blowers, automatic flow control valve, and blower relays. When troubleshooting the equipment cooling system, always check that the blower is operating. Check by feel at the blower discharge port on the exterior of the airplane. If there is no airflow at the blower discharge port and the OFF amber warning light is on, check the flow-limiting nozzle. If there is airflow at the flow-limiting nozzle, the flow control valve is stuck shut and must be replaced. If the OFF amber warning light is on and there is airflow at the discharge port or the blower is not operating, trouble shoot per troubleshooting charts.

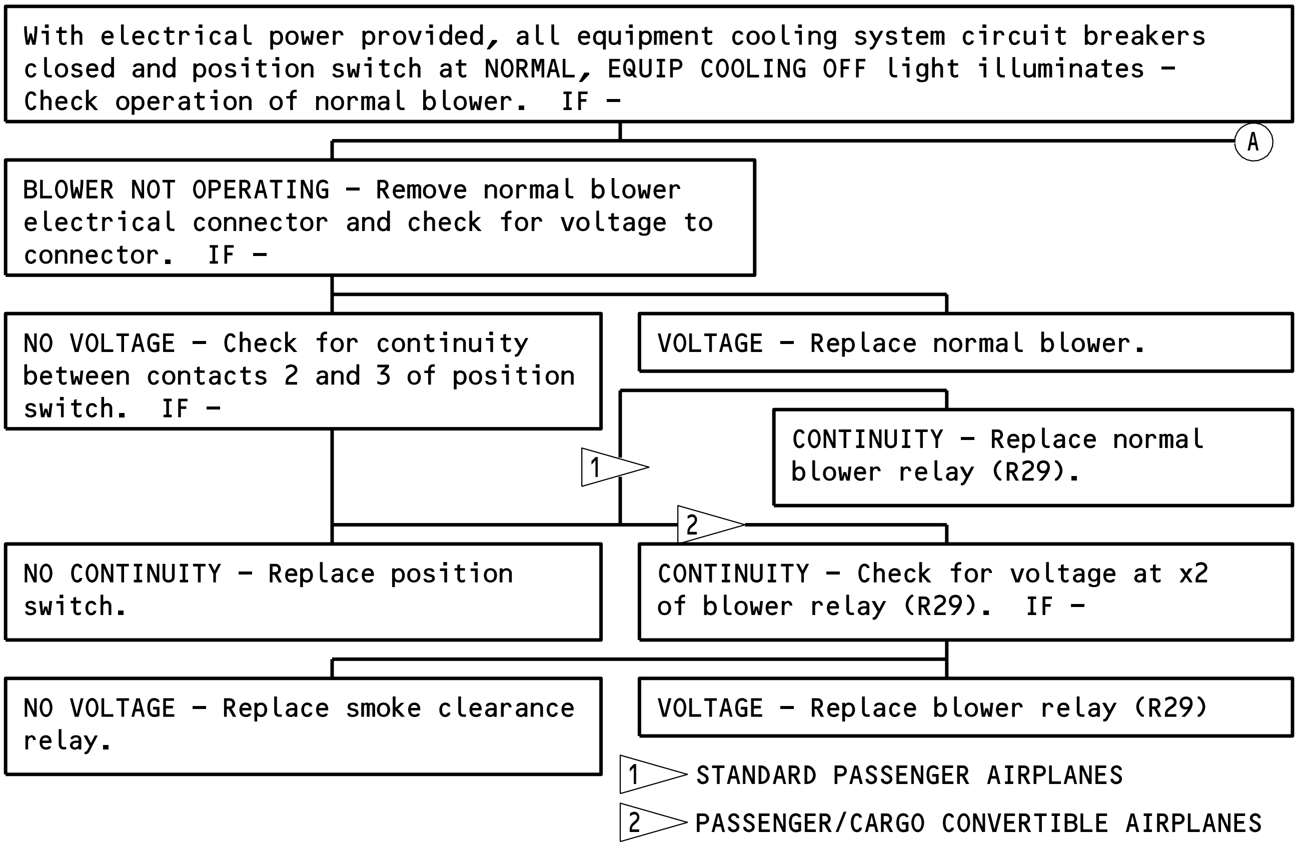
   D. Failure of air movement in the equipment cooling system is indicated when the OFF amber warning light on the forward overhead panel illuminates. The OFF light is actuated by the temperature sensitive switch, a heated unit in the airflow detector system. It actuates the warning light to on anytime there is not enough airflow or failure of air movement in the system.

E. Few components of the equipment cooling system could cause failure of air movement in the system. The following troubleshooting charts are provided to isolate faulty components of the control and indicating system. If after using the troubleshooting charts the problem is not corrected, the trouble may be either in the electrical wiring or connectors. Refer to wiring diagram.

<u>NOTE</u>: Prior to using troubleshooting charts check press-to-test OFF light and on Passenger/Cargo Convertible airplanes, check that smoke clearance switch is in NORMAL position.

F. Troubleshooting Charts

(1) The following chart is for normal blower operation, ie with blower selector switch at NORMAL. If problem was encountered with switch at ALTERNATE, substitute alternate blower and alternate blower relay and reverse check valves positions where applicable. For switch continuity in alternate position check between contacts 4 and 5.



Equipment Cooling System - Troubleshooting
Figure 101 (Sheet 1)

(A)

BLOWER IS OPERATING - Check that automatic flow control valve is open. IF -

VALVE IS OPEN - Check that normal blower check valve is open and alternate blower check valve is closed. IF -

VALVE IS NOT OPEN - Replace automatic flow control valve.

BOTH CHECK VALVES POSITIONS OK - Open EQUIP COOLING CONT circuit breaker and leave open for approximately five minutes then close circuit breaker and check that OFF light does not illuminate immediately.

EITHER CHECK VALVE POSITION NOT OK - Replace applicable check valve.

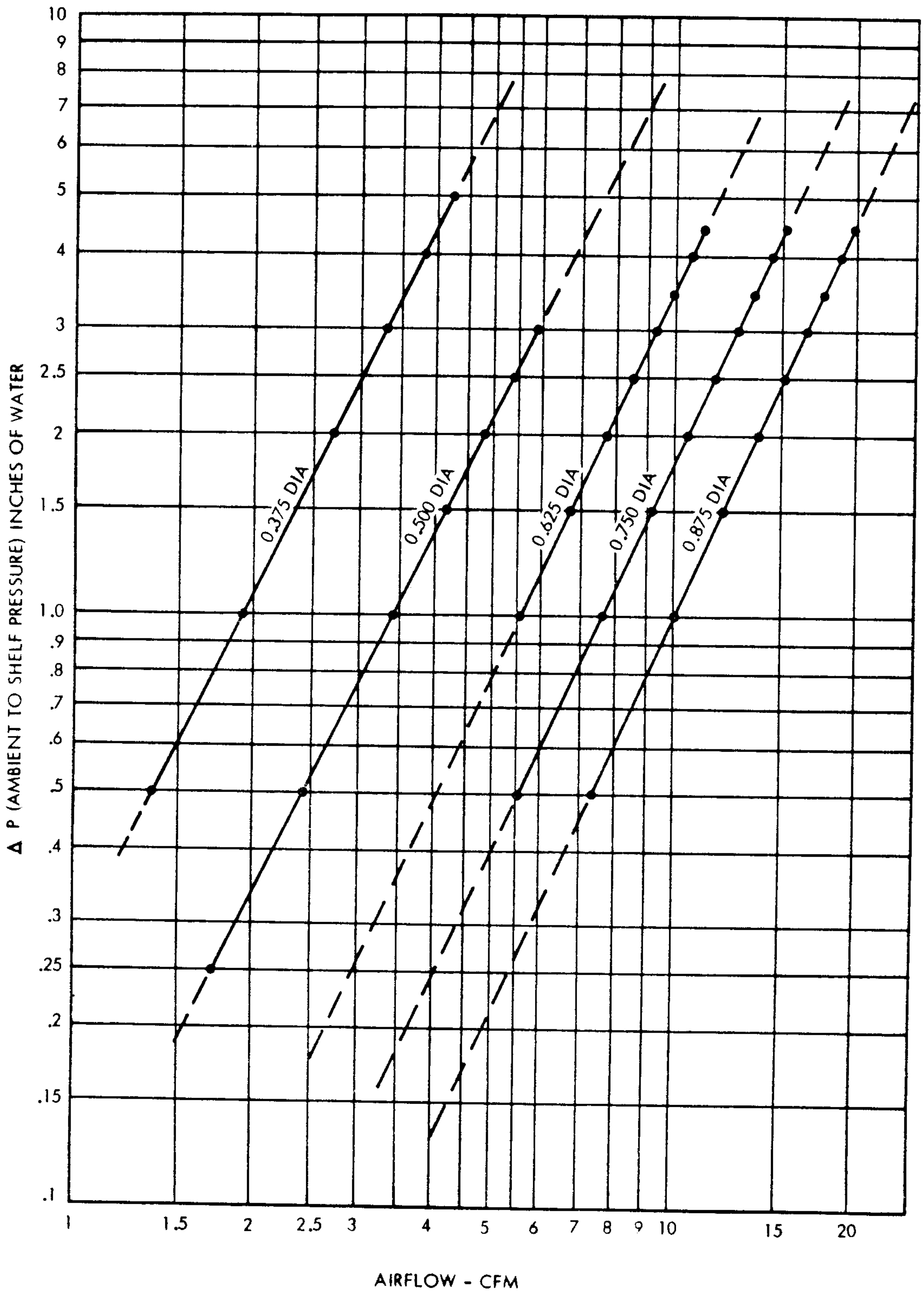
OFF LIGHT ILLUMINATES IMMEDIATELY - Replace airflow detector.

OFF LIGHT DOES NOT ILLUMINATE IMMEDIATELY - Accomplish equipment cooling system performance test and correct condition as identified in fault isolation procedure.

Equipment Cooling System - Troubleshooting
Figure 101 (Sheet 2)

EQUIPMENT COOLING SYSTEM - BALANCING

1. General
   A. No balancing of the heat loads is necessary except for shelves E3-1 and E3-3.
   B. For shelves E3-1 or E3-3 proceed as follows:
      (1) If new item of equipment needs lesser cooling than old item, do not balance system.
      (2) If new item of equipment needs more cooling than old item, balance shelf.
         (a) E3 shelves are designed for a flow of 60 cfm each.
2. Balance Shelves E3-1 and E3-3
   A. Provide enough orifice air inlet area for each shelf so as to obtain the correct airflow in cfm. Airflow for different size orifices is given in figure 201.
   B. Measure shelf negative pressure with a static pressure probe and a manometer of a range of between 0 and 5 inches of water. Measurement must be made with system operating.



Rack Airflow per Orifice
Figure 201

EQUIPMENT COOLING SYSTEM - ADJUSTMENT/TEST

1. General
   A. For maintenance activities requiring main electrical power on for more than 20 minutes at outside ambient temperature greater than 100°F (38°C), it is recommended that conditioned air be supplied to the cabin. This will improve the thermal environment for the electrical equipment.
   B. The electronic racks provide the proper airflow for each shelf to properly cool the equipment for which the rack was designed and a balanced airflow is attained by the use of fixed orifice plates. If equipment is not installed in the airplane at delivery, the orifices in these empty trays are covered with a metering plate or tape. The metering plates or tape must be removed prior to installing equipment to prevent the equipment from overheating.
   C. When equipment for which the racks are designed is rearranged or modified, thereby changing the heat loads, it will be necessary to rebalance the system. Extra space on racks could be used for adding equipment. If extra equipment is added, the other orifices may no longer provide a balanced airflow for their equipment and overheating could occur. Before adding extra equipment engineering must check and resize orifices as necessary to provide proper cooling. Figure 501 shows the location of equipment cooling racks.

      CAUTION: IF ORIFICE OPENINGS ARE IMPROPERLY ADJUSTED, EQUIPMENT ON THE RACKS MAY OVERHEAT. DO NOT ADD EQUIPMENT OR CHANGE ADJUSTMENTS WITHOUT YOUR ENGINEERING DEPARTMENT APPROVAL.

   D. Two test procedures are provided. The Equipment Cooling System Operation Test provides assurance that all equipment cooling system components are operable but does not guarantee that airflow through equipment is optimum. The Equipment Cooling System Performance Test provides a method for checking that adequate airflow is available to all equipment being cooled and, if not, where the problem exists.
2. Equipment Cooling System Operation Test
   A. Test Equipment Cooling System Operation
      (1) Provide electrical power.
      (2) Check that blower selector switch and on Passenger/Cargo Convertible Airplanes, smoke clearance switch on overhead panel are at NORMAL.
      (3) Check that the following circuit breakers are closed:
         (a) EQUIP COOLING CONT (P18)
         (b) BLOWER NORMAL (P18)
         (c) BLOWER ALTERNATE (P18)
         (d) CABIN AIRFLOW (P6, Passenger/Cargo Convertible only)

(4) Check that main blower starts and flow control valve is open.

NOTE: Observe valve position indicator on valve or by noting airflow at exhaust port.

(5) Open BLOWER NORMAL circuit breaker. Check that main blower stops, EQUIP COOLING OFF amber light comes on within 10 minutes and master caution annunciator on light shield comes on.
(6) Close BLOWER NORMAL circuit breaker. Check that main blower starts and EQUIP COOLING OFF light goes off within 5 minutes.
(7) Move blower selector switch on overhead panel to ALTERNATE.
(8) Check that alternate blower starts.
(9) Open BLOWER ALTERNATE circuit breaker. Check that alternate blower stops and EQUIP COOLING OFF light comes on within 10 minutes.
(10) Close BLOWER ALTERNATE circuit breaker. Check that alternate blower starts and EQUIP COOLING OFF light goes off within 5 minutes.
(11) On Passenger/Cargo Convertible Airplanes, check smoke clearance relay operation.
(a) Move smoke clearance switch to P/C PRESS and check that main blower stops.
(b) Move smoke clearance switch to NORMAL and check that main blower starts.
(12) Remove electrical power if no longer required.

3. Equipment Cooling System Performance Test

A. General
(1) In order to check performance of the equipment cooling system it is necessary to measure system pressure in a number of key locations, correct these readings for ambient temperature and pressure, then compare the corrected pressures to a standard for each test port location.
(2) Figure 502 locates all of the test ports and provides instructions for drilling ports if required. Ports already drilled will be covered by an aluminum foil marker also shown in Fig. 502.
(3) Figure 503 provides instructions for using the test equipment. Figure 504 provides a chart for correcting gage pressure readings for ambient pressure and temperature. Figure 505 lists corrected pressures and their limits for a normal operating system. Figure 505 also shows one method in which data may be compiled and evaluated. Pressure readings as well as the nominal pressures listed on the data sheet are actually negative with respect to field pressure. They are listed as positive for simplicity.

B. Equipment and Materials
(1) Equipment Cooling System Performance Test Set - F80237-1, C21001-( ) or items (2) thru (6) listed below.
(2) Portable differential pressure gage - 0 to 10 inches of water, Wallace and Tiernan Model FA141710; Belleville, New Jersey

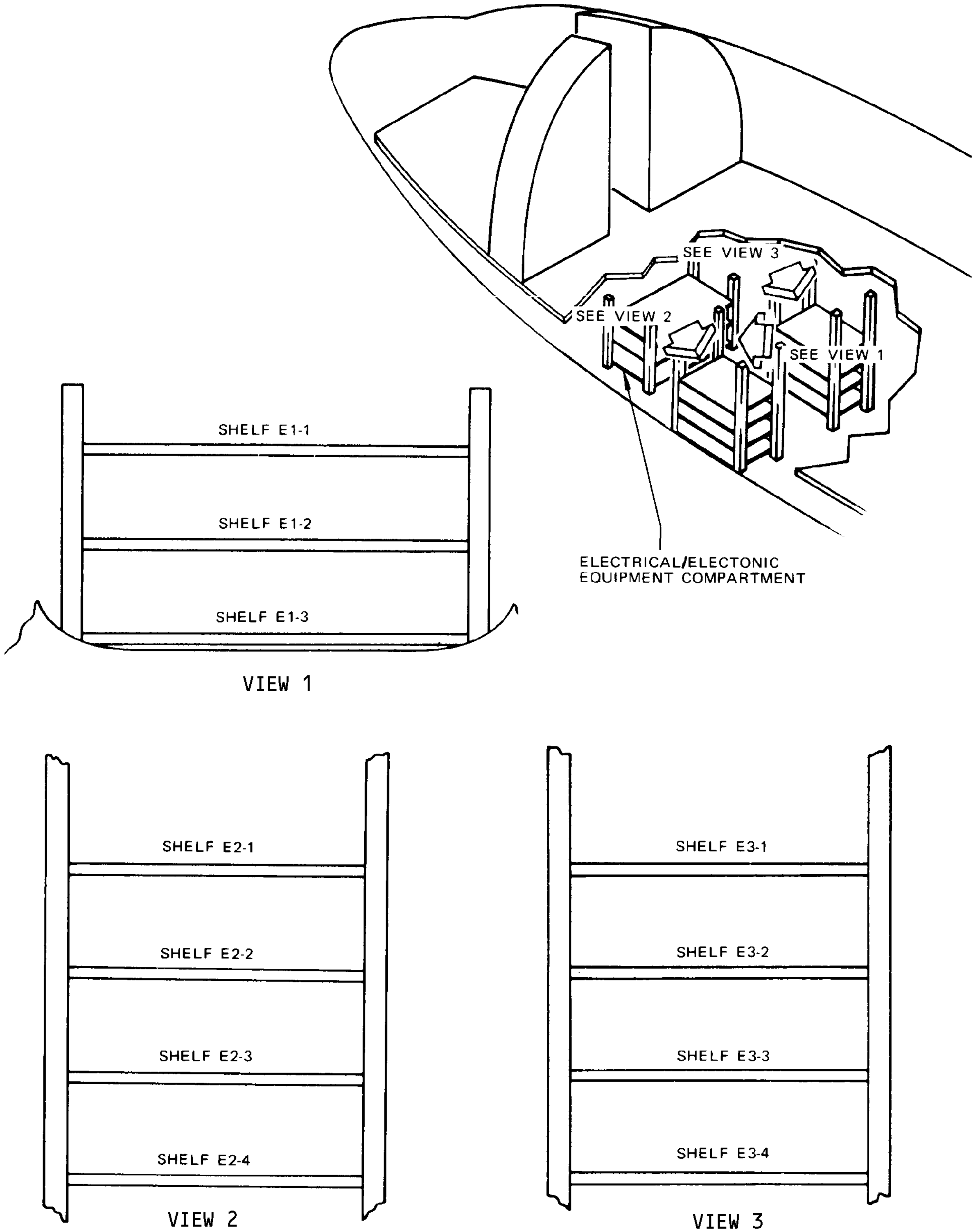
(3) Static pressure probe - United Sensor and Control Corp., 85 School Street, Watertown, Massachusetts; P/N PSC 8
(4) Hypodermic probe - Make from Liemar Needle, P/N 1261 or 1499 Becton-Dickinson and Company, Stanley St., Rutherford, New Jersey 07073

NOTE: Cut off Luer Lok end to mate with 1/8 ID tubing.

(5) Thermometer - 0 to 160°F range with accuracy to ± 2°F
(6) Plastic tubing - 1/8 inch ID, approximately 3 feet
(7) Aluminum Foil Marker - BAC27DEX2015

C. Prepare to Test Equipment Cooling System Performance
(1) Release fasteners on main instrument panel modules and slide aft to stops (airplanes equipped with instrument panel cooling ducts).
(2) Gain access to electrical/electronics compartment and either drill test ports or remove aluminum marker decal from test ports (Fig. 502).
(3) Check that following circuit breakers on P18 panel are closed:
(a) BLOWER NORMAL
(b) BLOWER ALTERNATE
(c) EQUIP COOLING CONT
(4) Check that smoke clearance switch is in NORMAL position (Passenger/Cargo Convertible Airplanes only).
(5) Check position of equipment cooling blower selector switch and if not already there, move to NORMAL.
(6) Close electrical/electronics compartment hatch if ambient temperature is below 40°F.

D. Test Equipment Cooling System Performance
(1) Check and record compartment temperature between the E2 and E3 equipment racks.
(2) Record field barometric pressure.
(3) Check and record pressure at all test ports (Fig. 502 and 503).
(4) Correct pressures read for ambient temperature and pressure and record (Fig. 504).
(5) Compare corrected gage pressures to system normal pressures for each port. If one or more of the test port pressures are out of tolerance correct fault as identified in par. E. If OK, proceed to F.



Equipment Cooling Rack Location
Figure 501

E. Fault Isolation

(1) General

(a) The following procedure should isolate faults in the equipment cooling system, which cause out of tolerance pressure readings noted in the preceding test. Since airflow for each item of equipment is affected by airflow throughout the system it is possible that correcting airflow at one location in the system may reveal another problem area which didn't show up in the preceding test. After faults have been located and corrected, the preceding test must be rerun to assure a trouble-free cooling system.

(b) It would be unusual to find an equipment cooling system suffering from all the faults covered, therefore test data should be analyzed for type of fault before accomplishing fault isolation procedure. If all plenum pressures are low, retest system before proceeding for any other fault.

(2) Low plenum pressures (All, Ref test ports 1, 5 and 8).

NOTE: For this condition to occur low pressures would likely be observed at all test ports although a few of the shelf test ports may possibly be within tolerance.

(a) Check the entire duct system for joint leakage. Do not overlook P6 panel or main instrument panel ducts.

(b) Check that alternate blower check valve is installed and functions properly.

NOTE: If alternate blower check valve sticks in open position, there would be a considerable lessening of airflow from the equipment cooling exhaust port.

(c) Check for obstruction in exhaust ducts.

NOTE: A reduction of airflow from exhaust port would probably accompany this problem.

(d) Check for general system contamination. If signs of contamination are observed remove and clean blower and where applicable, clean equipment rack shelves and plenum outlet duct orifices.

(e) If, after accomplishing (a), (b), (c) and (d) all plenum pressures are still low, replace blower.

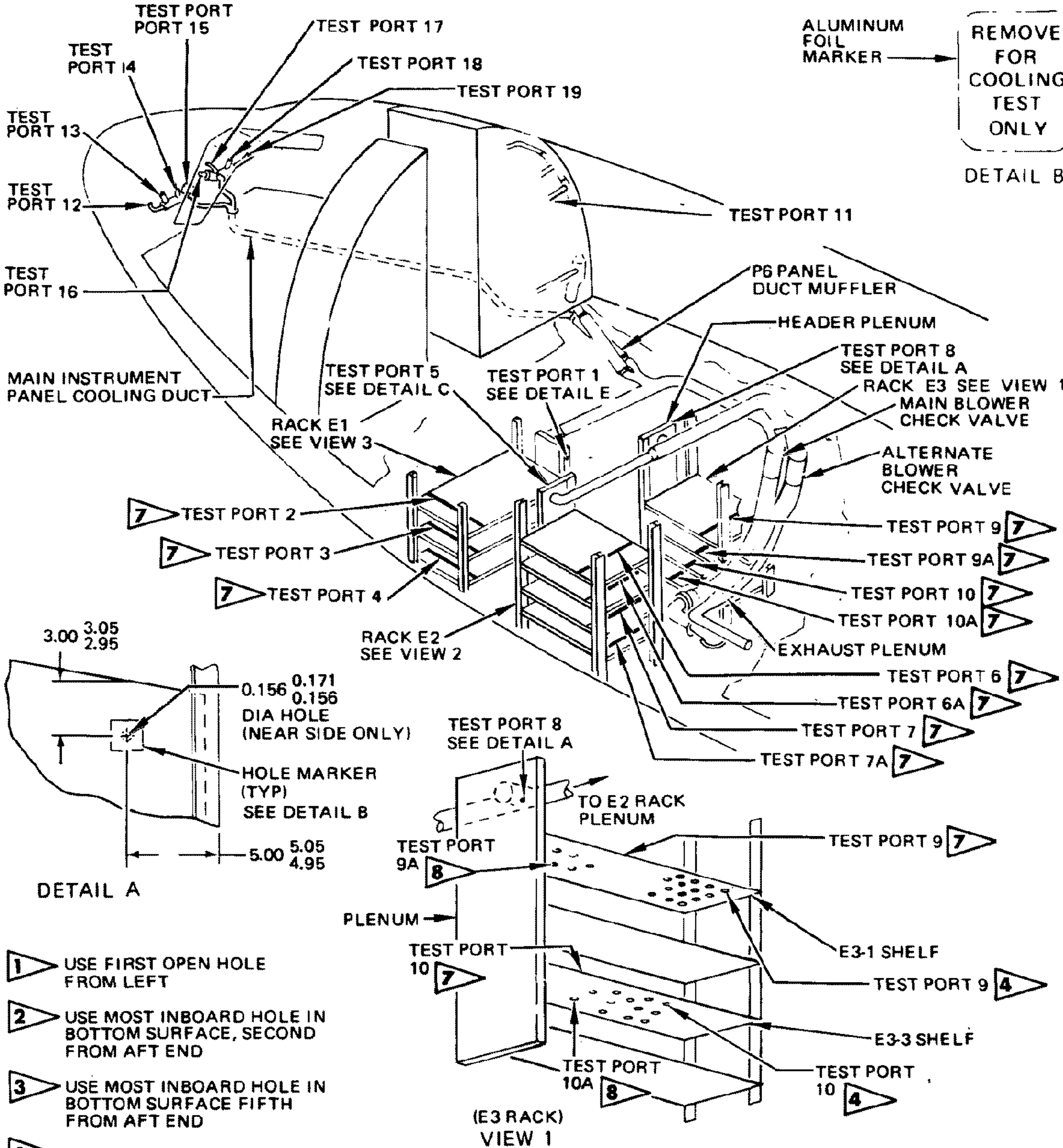
(3) High shelf pressure (test ports 2, 3, 4, 6, 6A, 7, 7A, 9, 9A, 10, or 10A).
  (a) Check applicable equipment rack shelf for unauthorized tape, contaminants or foreign material obstructing shelf orifices. Remove material and/or clean as required.

    NOTE: Metalized tape is properly used to close some of the orifices. Check proper engineering drawing before removing any tape.

  (b) Remove any draw through equipment from applicable shelf and remove any obstruction to orifice found.
  (c) Remove any obstruction found in draw through cooled equipment airflow passages and clean equipment and orifice if excessively contaminated, then install equipment.
(4) Low shelf pressure (test ports 2, 3, 4, 6, 6A, 7, 7A, 9, 9A, 10 or 10A) applicable plenum pressure OK.
  (a) Check shelf airflow orifices for proper configuration and for leakage through orifices which should be taped closed.
  (b) Check shelf to plenum opening and if obstructed remove obstruction.

    NOTE: To check for obstruction remove shelf to plenum fasteners and pull apart only enough to observe opening. Obstruction here may or may not affect plenum pressure depending on the obstruction magnitude.

  (c) Check for excessive leakage where shelf mates to plenum. Repair if necessary.
(5) High plenum pressure (test ports 1, 5 or 8).
  (a) Check for obstruction in shelf to plenum opening (Ref (4)(b) NOTE).
  (b) Check that orifice in plenum outlet duct is not missing, if missing install proper orifice. If not missing check for proper size and replace if necessary.
(6) Low plenum pressure (test ports 1, 5 or 8, but not all).
  (a) Check for obstruction to plenum outlet duct and remove if found. Check also that correct orifice is installed and replace if wrong size.
  (b) Low shelf pressure.
  (c) Check for excessive leakage where shelf mates to plenum and at duct to plenum connection. Repair as applicable.



1 USE FIRST OPEN HOLE FROM LEFT

2 USE MOST INBOARD HOLE IN BOTTOM SURFACE, SECOND FROM AFT END

3 USE MOST INBOARD HOLE IN BOTTOM SURFACE FIFTH FROM AFT END

4 USE MOST INBOARD HOLE IN BOTTOM SURFACE FIRST FROM AFT END

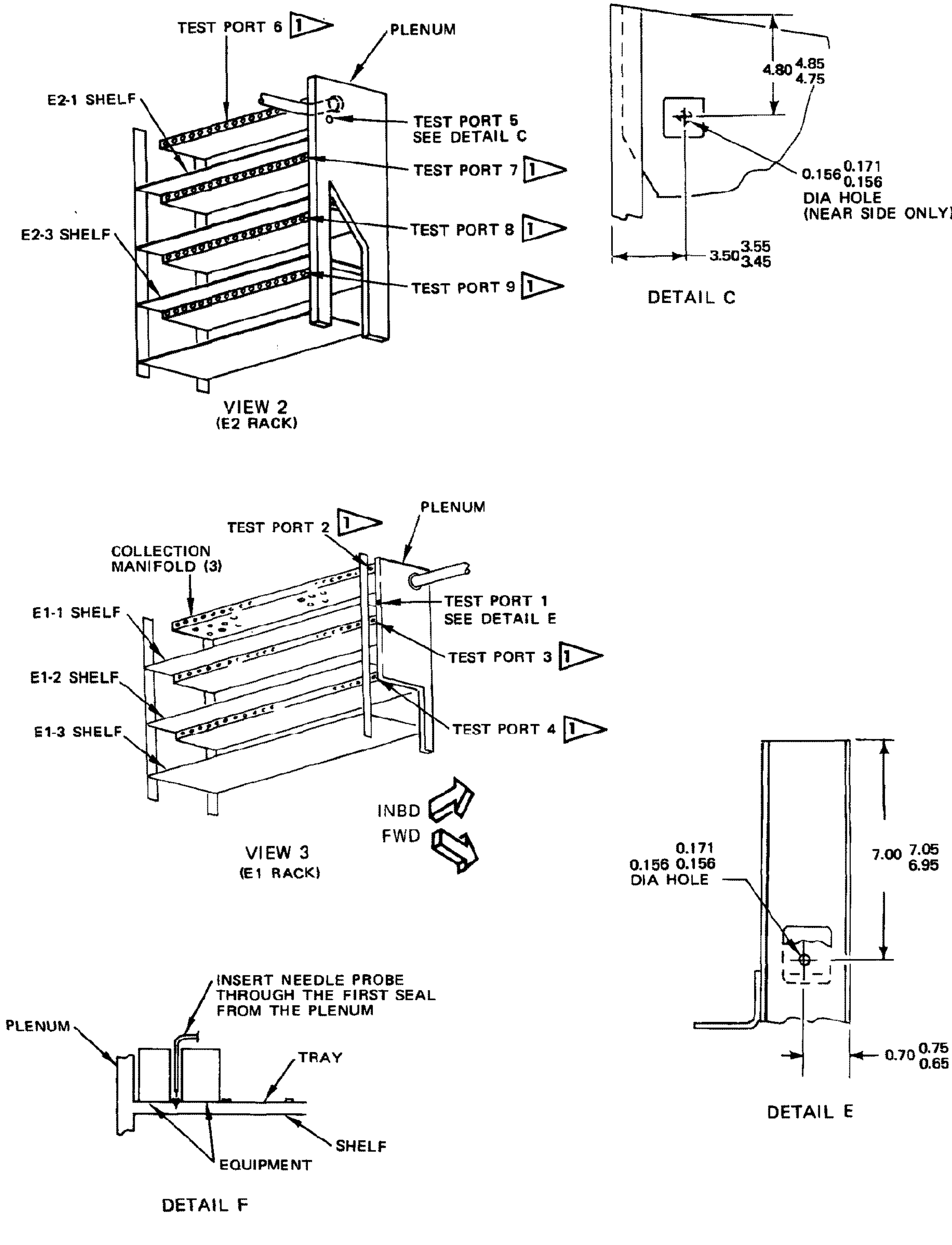
5 USE 20TH OPEN HOLE FROM LEFT

6 USE FIRST OPEN HOLE FROM PLENUM

7 INSERT HYPODERMIC PROBE THROUGH TRAY SEAL. SEE DETAIL F

8 USE FIRST OPEN HOLE FROM PLENUM

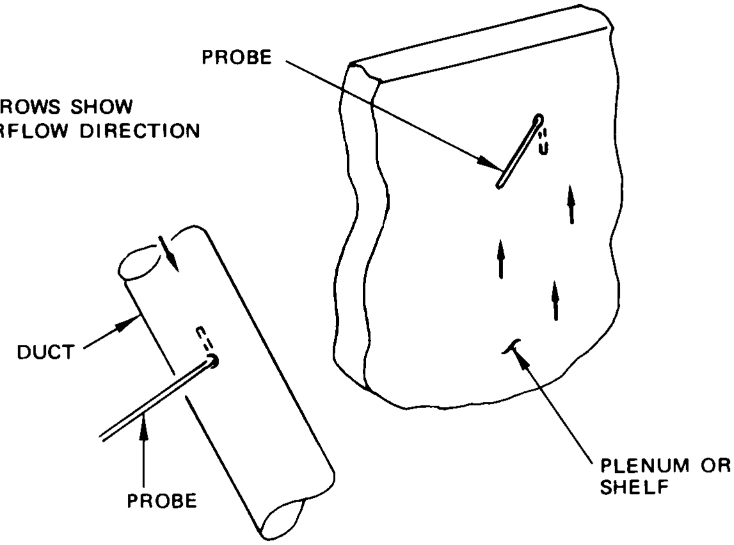
Equipment Cooling System Test Ports
Figure 502 (Sheet 1)



Equipment Cooling System Test Ports
Figure 502 (Sheet 2)

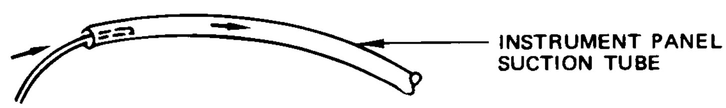
PROBE POSITIONING

NOTE: ARROWS SHOW AIRFLOW DIRECTION



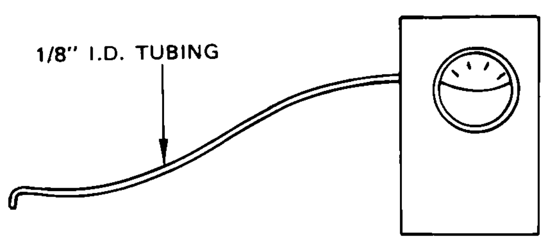
NOTE: ALWAYS INSERT PROBE INTO DUCT OR PLENUM WITH THE PROBE TIP FACING UPSTREAM. VARY PROBE POSITION SLIGHTLY IN ALL DIRECTIONS TO GET THE MAXIMUM PRESSURE READINGS (SMALLEST NEGATIVE PRESSURE).

INSTRUMENT PANEL SUCTION TUBE PRESSURE MEASUREMENT METHOD



NOTE:
1. DO NOT USE STATIC PROBE
2. 1/8" PLASTIC TUBE 2 - 3 INCHES INTO END OF SUCTION TUBE. DO NOT INSERT TUBE MORE THAN 3 INCHES.
3. MAKE SURE THAT PLASTIC TUBE IS HELD IN SUCH A MANNER THAT FINGERS OR HANDS CANNOT RESTRICT FLOW AT END OF SUCTION TUBE.

PRESSURE GAGE



NOTE: THE PRESSURE GAGE SHOULD ALWAYS BE HELD IN A VERTICAL POSITION

Static Pressure Probe and Measurement Methods
Figure 503

TEST PORT	GAGE PRESS IN. H2O	GAGE PRESS CORRECTED IN. H2O	MIN ACCEPTABLE PRESS IN. H2O	MAX ACCEPTABLE PRESS IN. H2O	CORRECTED PRESS STATUS	
					OK	LOW OR HIGH
1			2.6	3.2		
2			0.7	1.1		
3			0.5	0.7		
4			1.3	1.9		
5			2.3	2.7		
6			0.7	1.0		
7			0.6	1.0		
8			2.1	3.4		
9			0.3	0.5		
10			0.3	0.5		
11			0.8	2.5		
12			0.4	1.0		
13			0.4	1.0		
14			0.4	1.0		
15			0.4	1.0		
16			0.4	1.0		
17			0.4	1.0		
18			0.4	1.0		
19			0.4	1.0		

Test Data
Figure 504

(7) Instrument panel cooling tube pressure low (test ports 12, 13, 14, 15, 16, 17, 18 or 19, but not all). (Not installed on all airplanes, see Fig. 502 for effectivity.)
   (a) Straighten out kink in tube or remove obstruction from tube.

   NOTE: If low pressure is observed at all ports of one bank, i.e., test ports 16, 17, 18, and 19, straighten out tube or remove obstruction from tube which draws air from that bank.

(8) All instrument panel cooling tubes pressure low (test ports 12 thru 19). (Not installed on all airplanes, see Fig. 502 for effectivity.)
   (a) Repair leaky duct joint or straighten out kink in main instrument cooling duct.
(9) One or more instrument panel cooling tube pressure(s) high, other panel tube pressure(s) low. (Not installed on all airplanes, see Fig. 502 for effectivity.)
   (a) Condition results from low tube pressure.

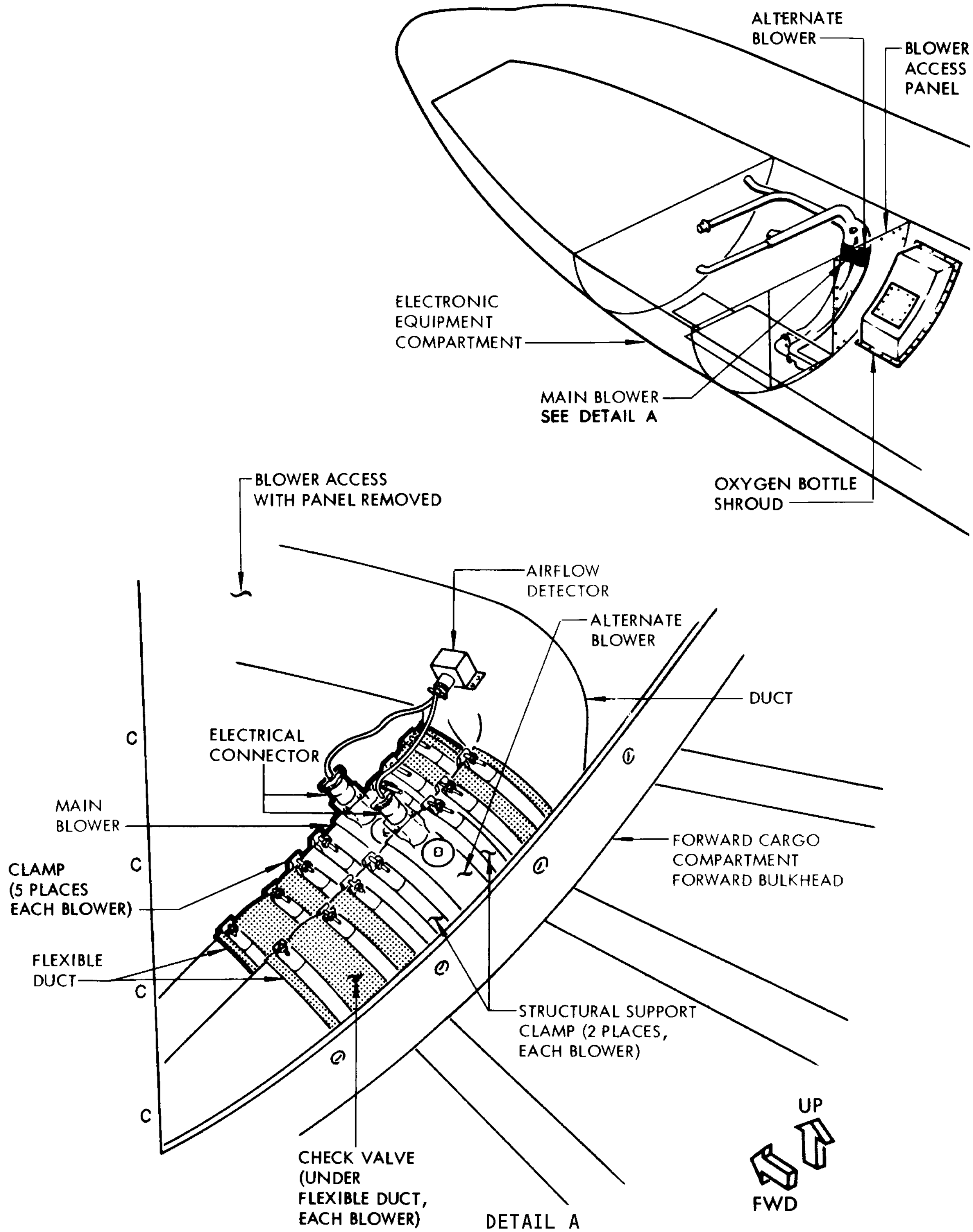
F. Install aluminum decal markers over test ports 1, 5, 8, and 11.
G. Remove all test equipment from airplane.
H. Remove electrical power if no longer required.

EQUIPMENT COOLING MAIN BLOWER - REMOVAL/INSTALLATION

1. Remove Equipment Cooling Main Blower
   A. Open three EQUIPMENT COOLING BLOWER circuit breakers on circuit breaker panel P18-3.
   B. Gain access to the blower.
      (1) Remove oxygen bottle shroud.
      (2) Remove blower access panel.
   C. Loosen five duct clamps that secure flexible duct to blower, check valve, and ducts. (See figure 401.)
   D. Pull flexible connecting ducts away from blower.
   E. Tighten two clamps downstream from blower to secure check valve in place. If desired to remove check valve, do not tighten.
   F. Disconnect equipment cooling main blower electrical connector.
   G. Loosen two duct clamps which secure blower to support.
   H. Remove equipment cooling blower.
2. Install Equipment Cooling Main Blower
   A. Place equipment cooling blower on support and secure with two structural support clamps. (See figure 401.)

      NOTE: Check that flow indicating arrow on equipment cooling blower points down.

   B. Connect equipment cooling blower electrical connector.
   C. Loosen check valve clamps and pull flexible ducts back over blower.
   D. Place all clamps in position and tighten clamp nuts 15 to 20 pound-inches.
   E. Replace access panel and shroud removed in step 1.B.
   F. Close three EQUIPMENT COOLING BLOWER circuit breakers.
   G. Test equipment cooling system. Refer to 21-58-0.



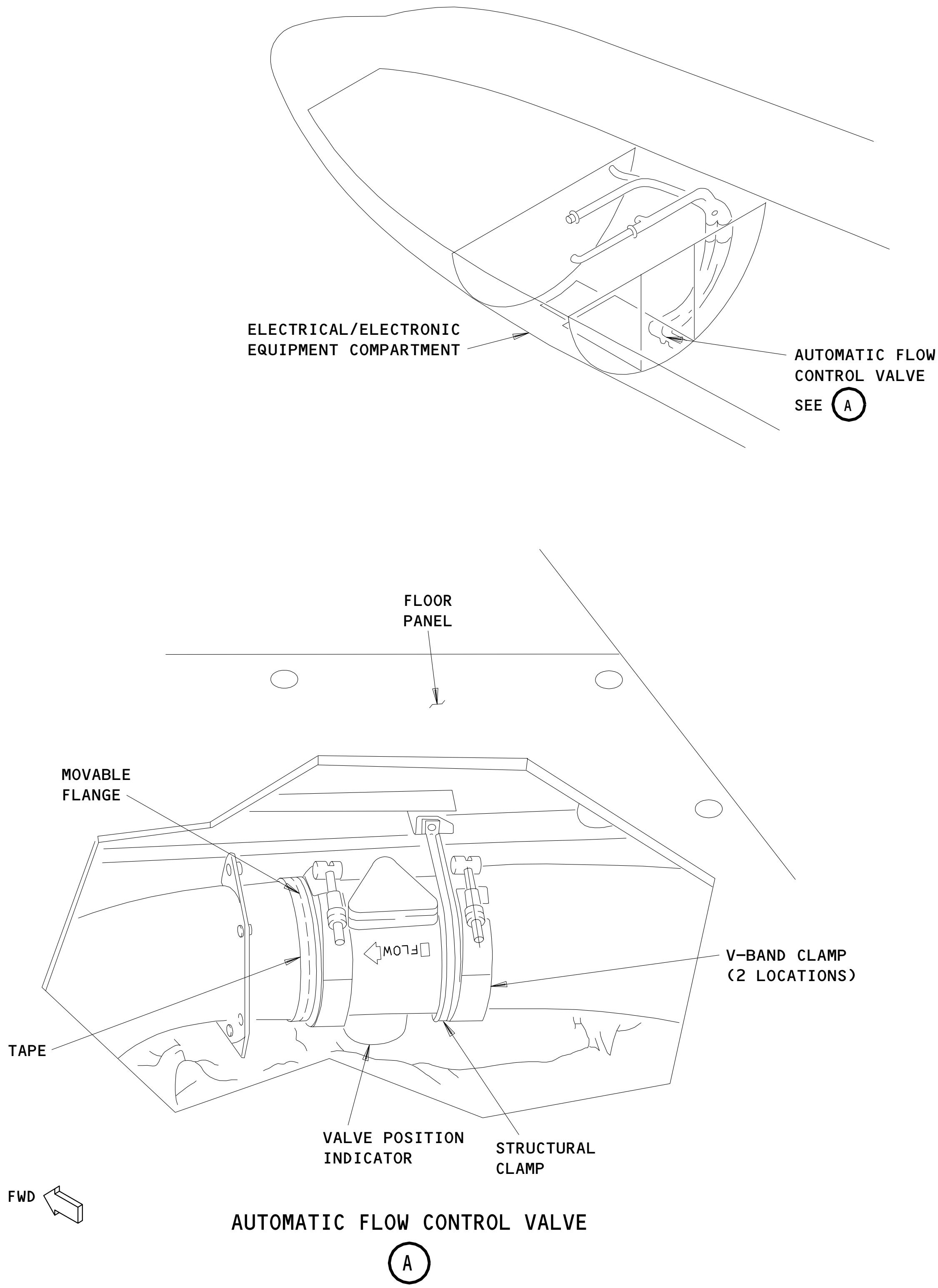
Equipment Cooling Blower Installation
Figure 401

EQUIPMENT COOLING ALTERNATE BLOWER - REMOVAL/INSTALLATION

1. General
   A. Proceed same as in removing/installing equipment cooling main blower, except open or close BLOWER ALTERNATE circuit breaker on circuit breaker panel P18.

AUTOMATIC FLOW CONTROL VALVE - REMOVAL/INSTALLATION

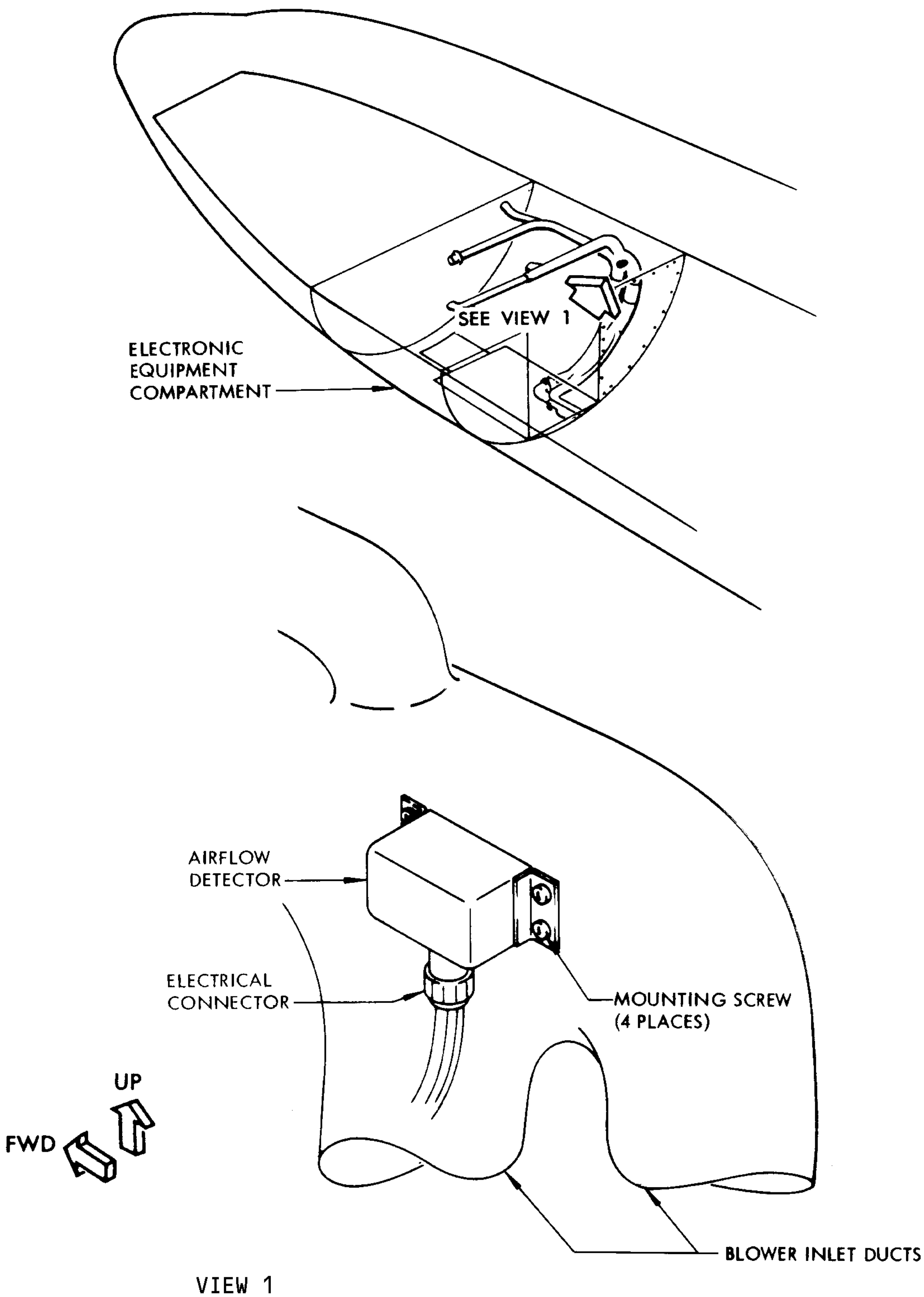
1. Equipment and Materials
   A. Glass Cloth Adhesive Tape, Minnesota Mining and Manufacturing Company No. 361
   B. Cleaning Solvent per BMS 3-2
2. Remove Flow Control Valve
   A. Remove screws and remove floor panel (Fig. 401).
   B. Remove V-band clamps at both ends of valve.
   C. Remove tape attaching movable flange to duct.
   D. Slide movable flange away from valve.
   E. Remove clamp attaching valve to structure.
   F. Remove valve.
   G. Remove and store gaskets.
3. Install Flow Control Valve
   A. Position the valve with the valve position indicator angled in a forward down position.
      (1) Make sure the flow arrow points at the air exhaust port.
      (2) Rotate the valve so that the floor panel sill does not touch the valve.
   B. Install the gaskets.
   C. Loosely install clamp attaching valve to structure.
   D. Clean areas of flange and duct to be taped with cleaning solvent.
   E. Slide movable flange against valve and apply one lap of adhesive tape between flange and duct. Pull tape taut and smooth while applying.
   F. Install V-band clamps at both ends of valve. Tighten clamp nuts a maximum of 15 to 20 pound-inches.
   G. Install floor panel with screws.



Automatic Flow Control Valve Installation
Figure 401

AIRFLOW DETECTOR - REMOVAL/INSTALLATION

1. Remove Airflow Detector
   A. Open EQUIP COOLING CONT circuit breaker on circuit breaker panel P18.
   B. Disconnect airflow detector electrical connector (Fig. 401).
   C. Remove four mounting screws.
   D. Remove airflow detector from blower inlet duct.
2. Install Airflow Detector
   A. Place airflow detector in mounting position with electrical receptacle facing inboard.
   B. Install four mounting screws.
   C. Connect airflow detector electrical connector.
   D. Close EQUIP COOLING CONT circuit breaker on circuit breaker panel P18.
   E. Test equipment cooling system (AMM 21-58-0).



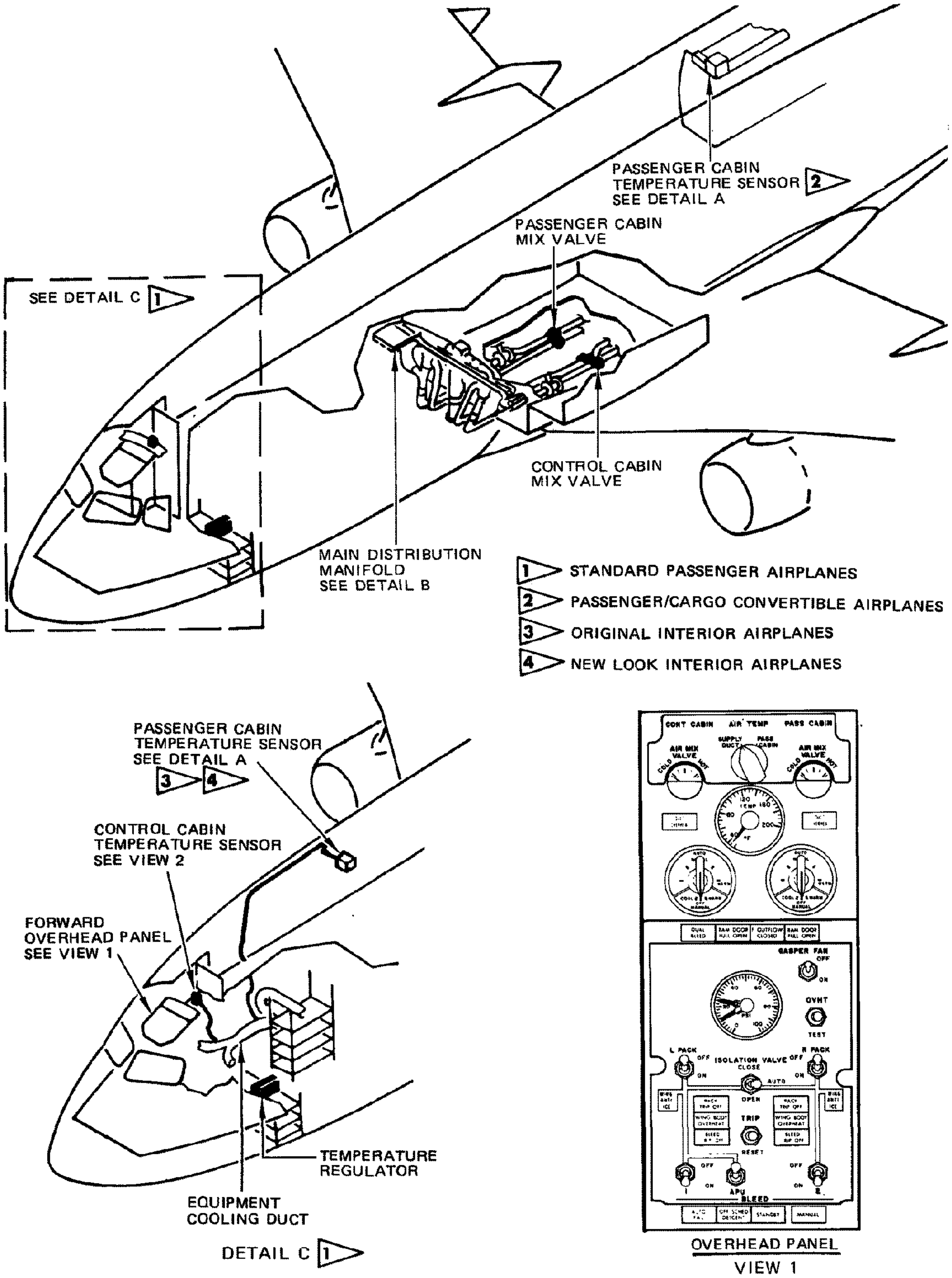
Airflow Detector Installation
Figure 401

EQUIPMENT COOLING BLOWER CHECK VALVE - REMOVAL/INSTALLATION

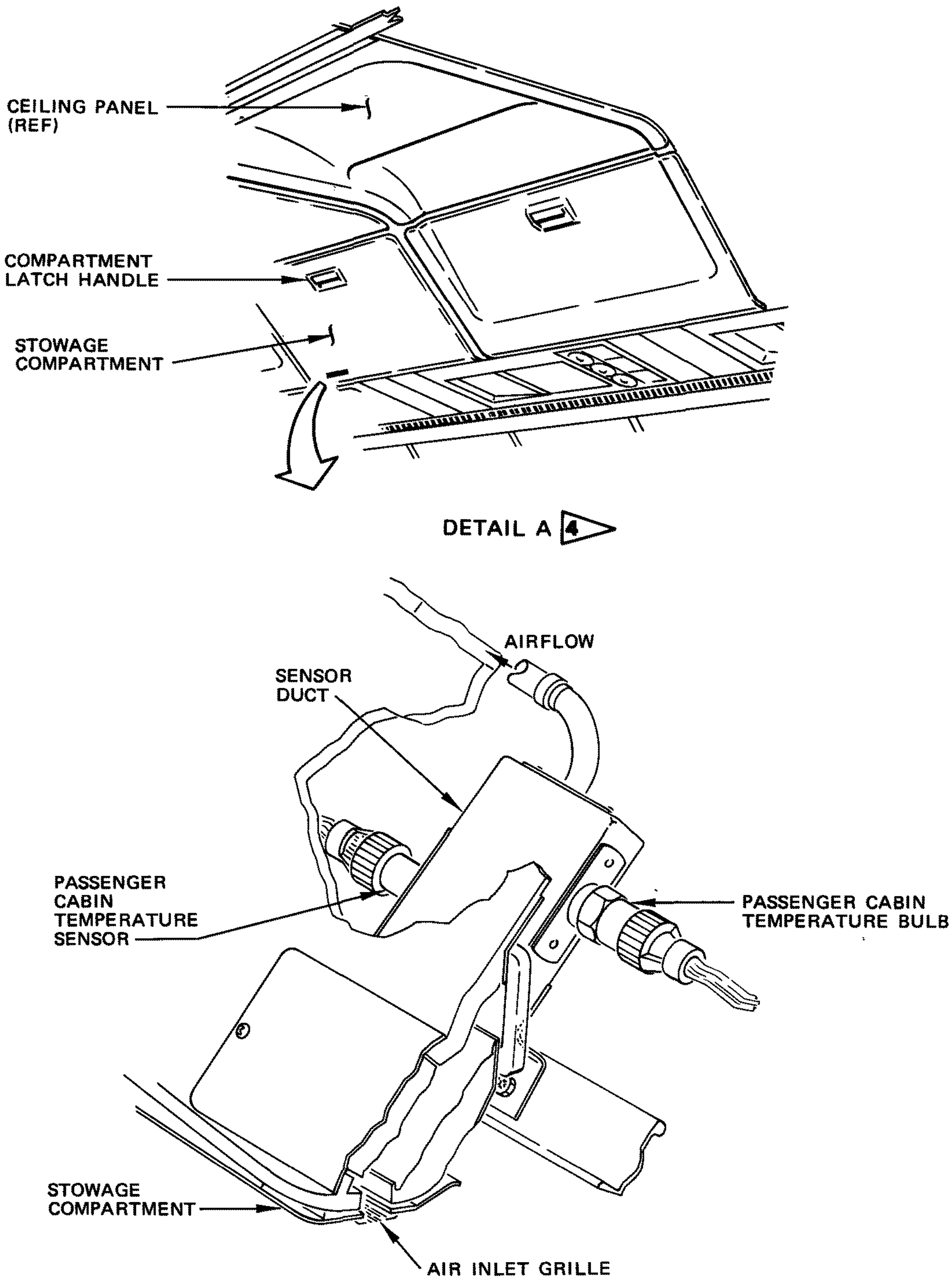
1. General
   A. Check valves are installed downstream of both the equipment cooling main and alternate blowers. (See 21-58-11, figure 401.) Instructions for removing and installing either one are the same.
2. Remove Equipment Cooling Blower Check Valve
   A. Remove equipment cooling blower. Refer to 21-58-11 or 21-58-21.
   B. Loosen clamps and remove check valve from flexible duct.
3. Install Equipment Cooling Blower Check Valve
   A. Install check valve on flexible duct with clamps.
   B. Install equipment cooling blower. Refer to 21-58-11 or 21-58-21.

CONDITIONED AIR TEMPERATURE CONTROL SYSTEMS - DESCRIPTION AND OPERATION

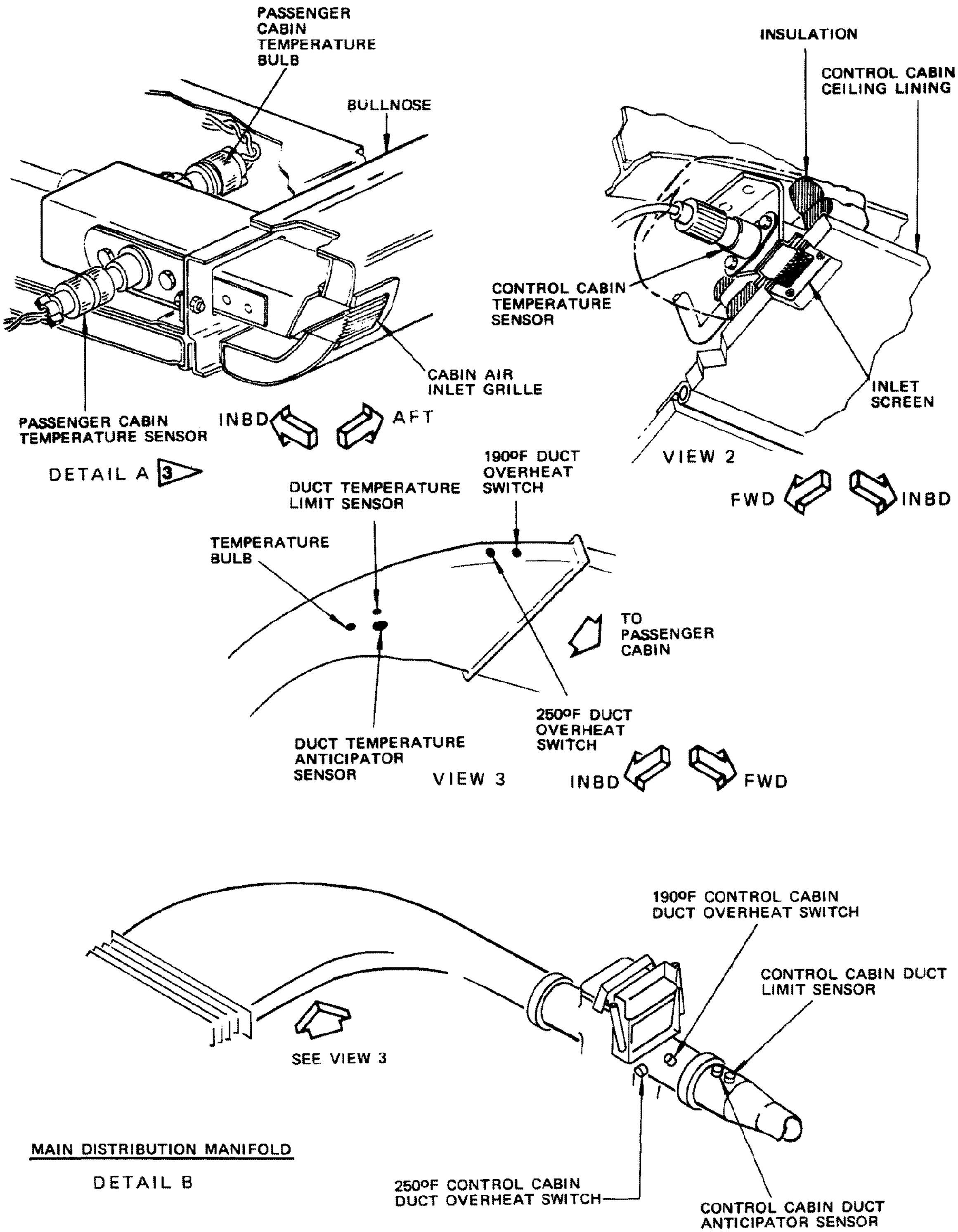
1. General
   A. Conditioned air temperature control covers that portion of the air conditioning system that starts, regulates, and shuts down air conditioning equipment to provide a selected temperature in the control and passenger cabins. Two sets of controls are provided. One set controls the left mix valve for control cabin temperature regulation. The other controls the right mix valve and provides for the passenger cabin. Normally each system functions automatically according to selections made on the forward overhead panel. Separate manual control systems are provided as an alternate method for raising or lowering control and passenger cabin temperature.
   B. Controlling the temperature in the cabins is accomplished by controlling the temperature of air entering the cabins. Air conditioning operation begins when the pack switches are turned on. The switches open the pack valves permitting bleed air from the pneumatic system to enter the air conditioning system.
   C. When the pack valve is opened the pack valve closed limit switch opens to de-energize the pack valve closed relay. When the relay is de-energized, contacts within the relay close to initiate all temperature control and overheat protection circuits in the air conditioning system.
   D. Downstream of the pack valves part of the air branches off and passes forward to the mixing chamber and the remainder passes through the air cycle system to be cooled before going to the mixing chamber. The proportioning of air through the system depends on the position of the air mix valve. The mix valve regulates hot air bypassing the air cycle system and air going through the air cycle system. This air is recombined later in proper proportions at the mix chamber. The position of the valve depends on signals from the temperature control system regulator according to the temperature of the air in the main distribution manifold compared with that requested by the temperature selector.
   E. During automatic operation a regulation system continuously monitors cabin temperature, duct temperature, and changes in cabin supply air temperature to keep the cabins at the selected temperature level. During manual operation the mix valve changes position as a result of direct electrical control. The indicating system permits monitoring of cabin temperature, cabin supply duct temperature, and mix valve position.
   F. Each temperature control system includes an air mix (temperature control) valve, a 190°F duct overheat thermal switch, a 250°F duct overheat thermal switch, a pack switch, and both manual and automatic temperature regulating circuits. (See figure 1.)



Conditioned Air Temperature Control Systems Component Location
Figure 1 (Sheet 1)



Conditioned Air Temperature Control Systems Component Location
Figure 1 (Sheet 2)



Conditioned Air Temperature Control Systems Component Location
Figure 1 (Sheet 3)

G. The manual temperature regulating components consist of two cam-operated switches, in the temperature selector assembly, which are electrically connected to the mix valve actuator. The automatic temperature regulating components include a third cam-operated switch in the temperature selector assembly, a regulator, cabin temperature sensor, anticipator sensor, and a duct temperature limiting sensor.

2. Air Mix Valve

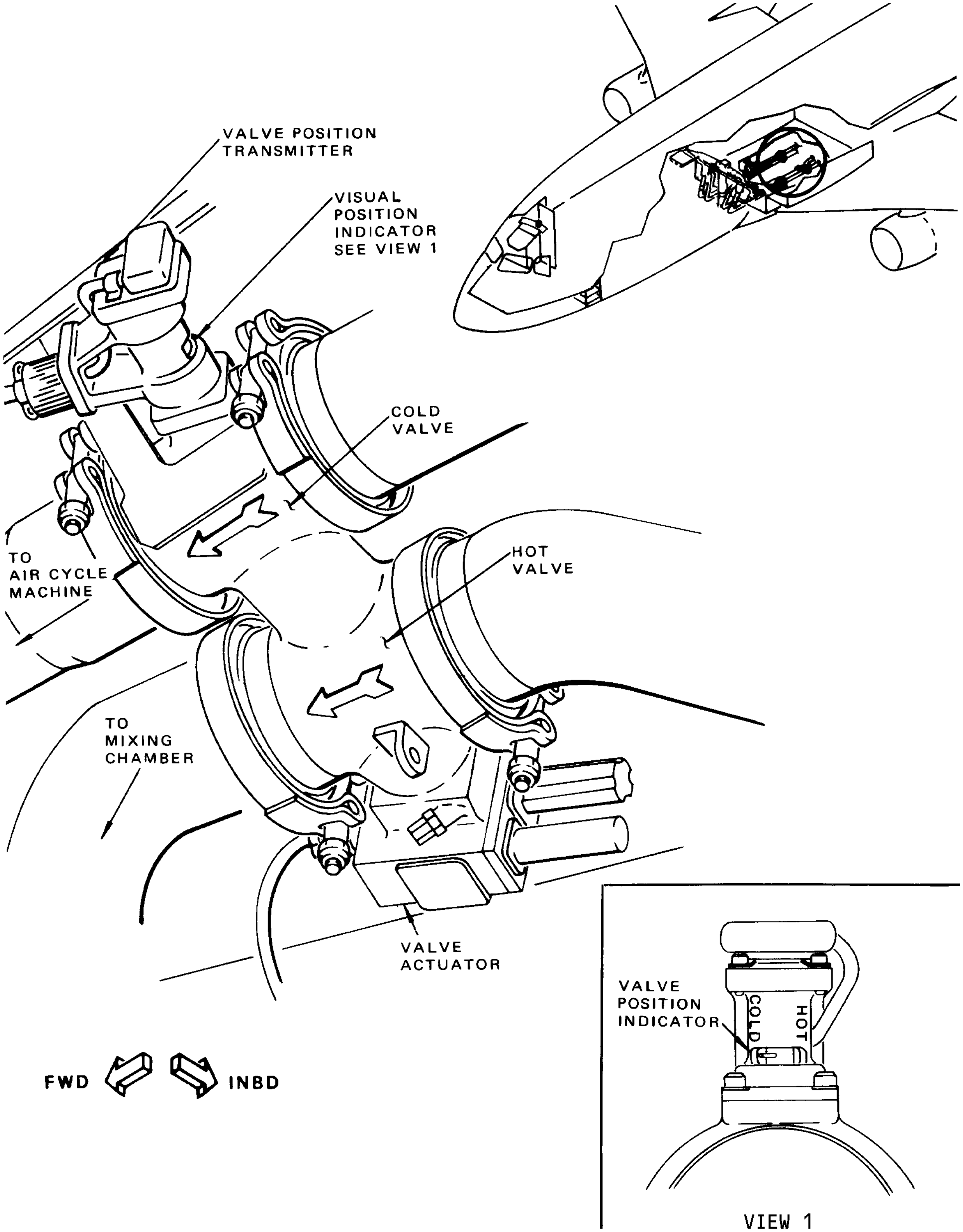
A. The mix valve is in effect two connected butterfly-type valves with each being operated by the same actuator through a common butterfly shaft. The 115-volt ac actuator mounts on a flange of the hot valve to drive the common shaft. When the hot valve butterfly is full open the cold valve is full closed and vice versa. As the hot valve moves toward close the cold valve moves proportionally toward open. A position potentiometer is connected to the opposite end of the shaft from the actuator to permit monitoring the valve position from the control cabin. A visual indicator is also located at the actuator between the potentiometer and the cold valve body (Fig. 2).

B. Limit switches in the actuator housing interrupt current to the actuator motor at either extremity of travel. The mix valve is located in the air conditioning equipment bay inboard of the heat exchangers.

3. Thermal Sensing Units

A. Thermal sensing units in the temperature control system consist of thermal switches, temperature bulbs, and temperature sensors. Thermal switches are used to protect against duct overheat, temperature bulbs are used in conjunction with indicators for monitoring passenger cabin temperature and passenger cabin supply duct temperature, and temperature sensors are used with the automatic temperature regulation systems to automatically position the mix valves in obtaining selected temperatures for the cabins.

B. The thermal switches consist essentially of a bimetal element enclosed in a steel probe. The thermal switch contacts are normally open. At a predetermined temperature the contacts will close. A 190°F passenger cabin duct overheat thermal switch and a 250°F passenger cabin duct overheat thermal switch are used in each control system. The switches are mounted in the main distribution manifold. (See figure 1.)



Air Mix Valve
Figure 2

C. Temperature bulbs consist of a temperature sensitive resistance element within a tube. As the temperature of the element changes, its resistance changes accordingly to cause movement of an indicator pointer.
   (1) The passenger cabin temperature bulb is installed with the passenger cabin temperature sensor inside a duct located in the hatrack bullnose or below the stowage compartment (Detail A, Fig. 1). The duct in the bullnose on Passenger/Cargo Convertible Airplanes is tubing connected to the auxiliary power unit (APU) compartment. On Standard Passenger Airplanes, the duct in the bullnose or below the stowage compartment is tubing connected to the equipment cooling duct in the equipment bay. The low pressure in the APU compartment and equipment cooling ducts draws air from the cabin across the bulb and sensor.
   (2) The passenger cabin supply duct temperature bulb is mounted in the main distribution manifold.

D. The temperature sensors also utilize variable resistance type elements. As temperature increases their resistance decreases and vice versa. The sensors form a part of the automatic regulation system network to maintain selected temperatures in the control and passenger cabin. A duct limit temperature sensor, anticipator sensor, and cabin temperature sensor are used with each regulation system. The duct limit sensors and anticipator sensors are mounted in the main cabin distribution manifold.
   (1) The control cabin temperature sensor is located behind a screened opening in the ceiling, approximately 4 inches left of center, at station 259. A tube connects the sensor box to the equipment cooling duct (Fig. 1). The low pressure in the equipment cooling duct draws air from the control cabin across the sensor.
   (2) The passenger cabin temperature sensor is installed in the same duct which encloses the passenger cabin temperature bulb (Ref par. 3.C.[1]).

4. Temperature Selectors

A. The control and passenger cabin temperature selectors are identical units mounted on the forward overhead panel. The face dial is divided into an automatic and MANUAL range. Three switches inside the selector are provided to direct 115 volts ac to the mix valve. Two cams on a cam plate, fixed to the selector knob, close each switch separately as the knob is turned.

B. In MANUAL, turning the knob clockwise to COOL causes one of the cams to close a switch connected to the mix valve actuator motor, and operate the valve to increase the proportion of cold air passing through the valve. Turning the knob counterclockwise to WARM causes the cam to close a switch connected to the mix valve actuator and operate the valve to increase the proportion of warm air passing through the valve. When the knob is returned to OFF, both switches are open and the mix valve remains in the position to which it was last driven.

C. When the temperature selector knob is turned past the MANUAL range into AUTO, the second cam on the knob shaft closes a switch which directs power to the automatic temperature control circuit. The cam keeps the switch closed throughout the automatic range. In the AUTO range, the knob also drives a potentiometer that forms one leg of a cabin temperature control bridge circuit.

5. Temperature Regulator

A. Control and passenger cabin automatic temperature regulation is obtained from a single unit located in the electronic compartment. This unit contains all parts of each regulation system which are not required to be mounted remotely. Separate identical networks are enclosed for each cabin (Fig. 3).

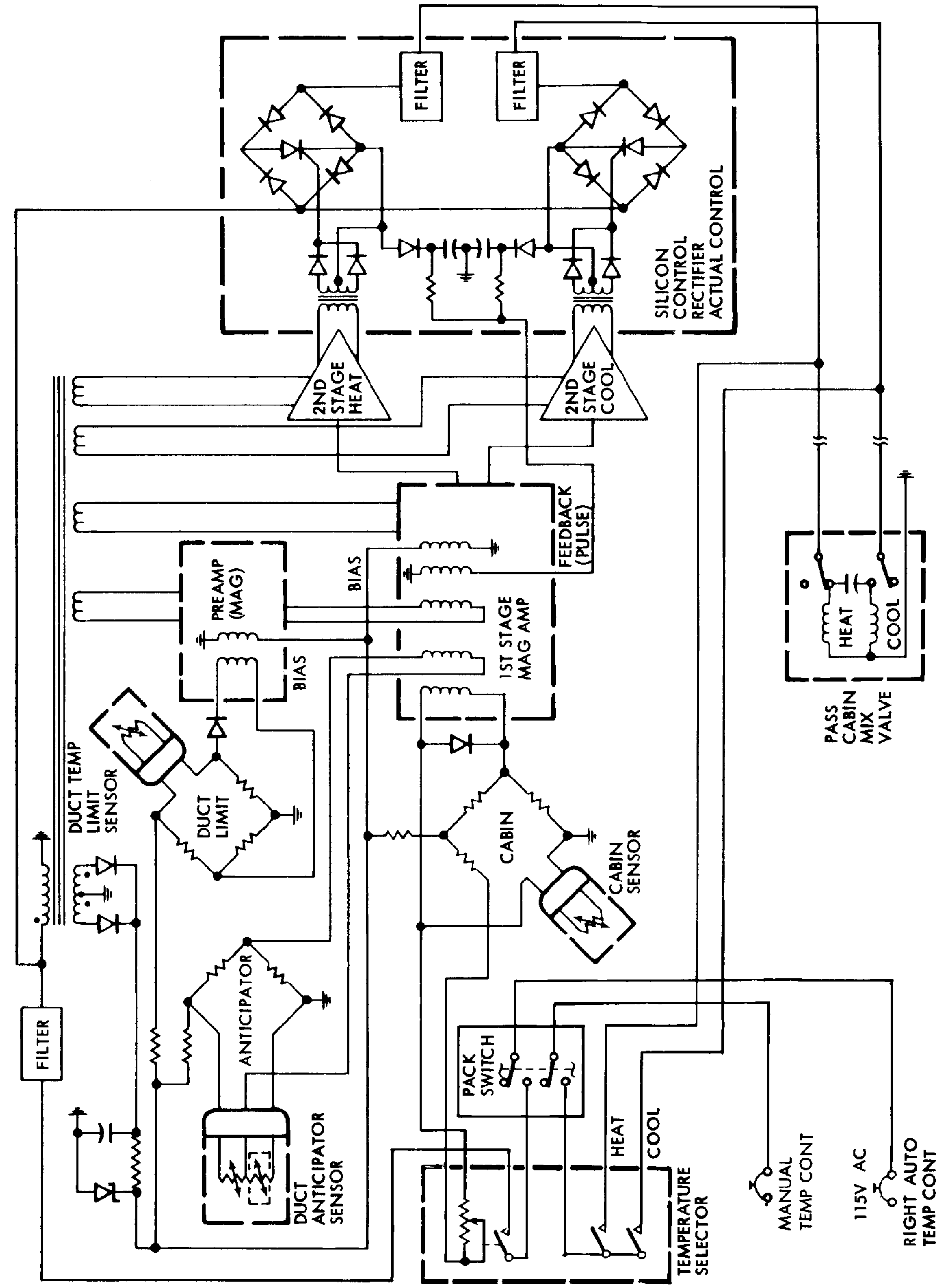
(1) On some regulators (temperature controllers) a built-in test circuit has been added to provide a quick electrical check of temperature control system components. On these controllers a rotary test switch, two sets of GO, NO GO lights and a test instruction decal are provided on the face of the controller. When temperature control system is not being tested the switch must be returned to START position.

B. Each network contains a separate power supply, the fixed resistance legs of three different bridge circuits, a control amplifier, a silicon-controlled rectifier actuator control, and a pulse-forming network.

C. The three bridge circuits in use for automatic control are cabin temperature control bridge, temperature control damping bridge, and duct temperature limit bridge.

D. Each cabin temperature control bridge utilizes two legs that contain variable resistances outside of the regulator. One resistance is located in the temperature selector and is manually set to establish the desired temperature reference. The other is a temperature sensor located in the cabin whose resistance varies according to cabin temperature. The bridge is balanced when cabin temperature causes the temperature sensor resistance to equal the selector resistance.

E. The temperature control damping bridge also has the variable resistors of two of its legs remotely located. The resistors are contained in a single duct anticipator sensor in the main distribution manifold. One resistor is thermally impeded by insulation so that it reacts slowly to temperature change. The other is not insulated, and reacts rapidly to temperature changes. As a result of a sudden temperature change the resistors will not vary at the same rate and the bridge will become unbalanced. The damping bridge slows down system response to prevent delivery of excessively hot or cold air to the cabin. It also assists to prevent overshooting and hunting of the temperature control system when a new temperature is selected.



Temperature Regulator Circuit
Figure 3

F. The duct temperature limit bridge has only one of its resistances remotely located. The duct limit temperature sensor is located such that it senses the temperature of the conditioned air. As the temperature of the air rises the resistance changes and the bridge becomes unbalanced. If the duct temperature approaches an unsafe level the temperature limit bridge signal will cancel out heat demand signals of the control bridge. A polarizing diode between the duct temperature limit bridge and the magnetic amplifier prevents the temperature limit bridge having any effect on the control bridge signals during a cooling demand.

G. Each of the three bridge circuits is connected to a magnetic amplifier. The amplifier interprets the signals received, and then signals the silicon-controlled rectifier actuator control to shut off current to the mix valve, complete a circuit to move the valve toward cold, or to complete a circuit to move it toward hot.

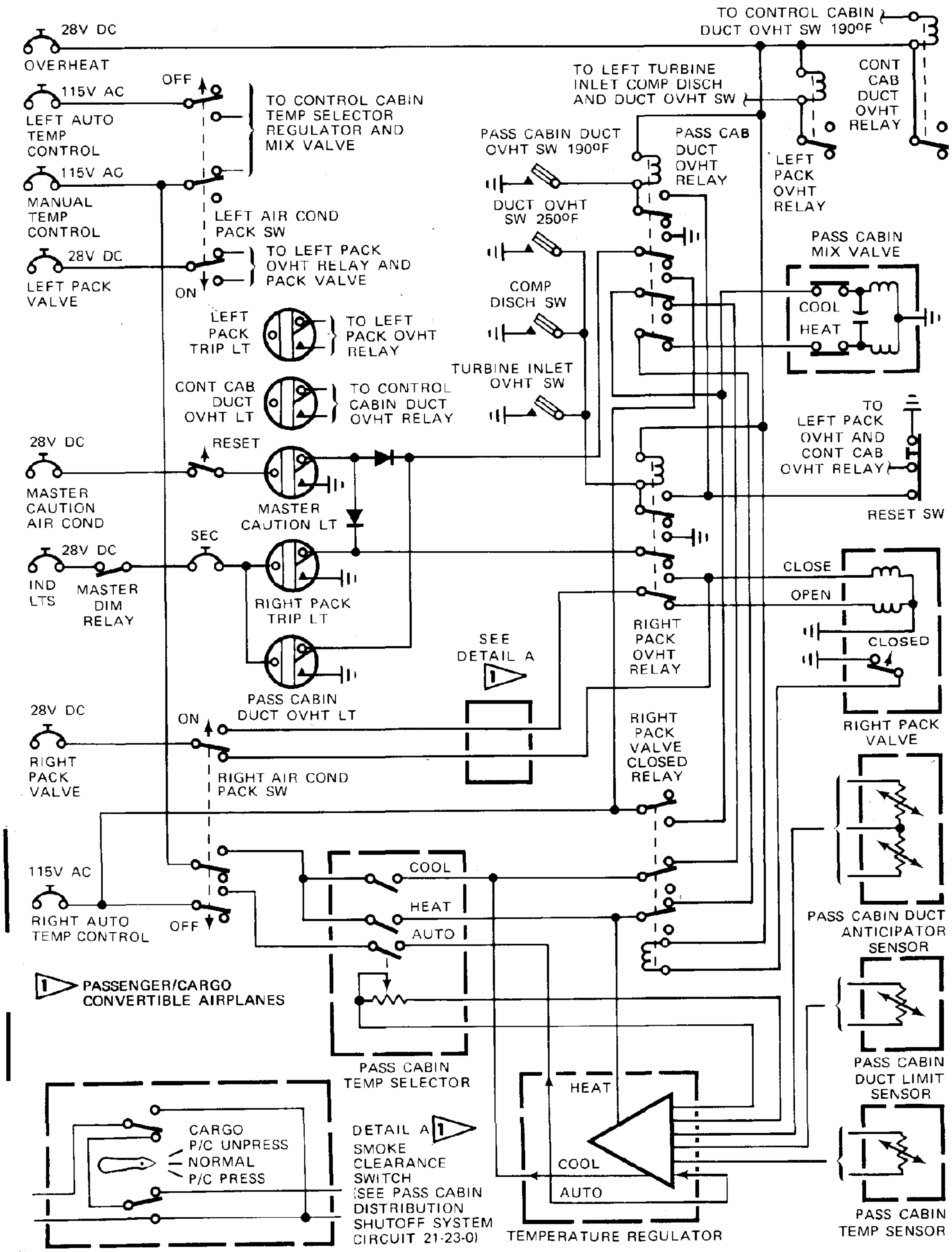
6. Operation

A. Cabin temperature may be adjusted either by a manual or automatic control system. Both systems utilize 115-volt ac current to adjust the mix valve so that air of the desired temperature is directed into the airplane distribution system. Circuit breakers are provided for temperature control system circuit protection. The PACK VALVE circuit breaker and the OVERHEAT circuit breaker provide protection during both manual and automatic control operation, the MANUAL TEMP CONT circuit breaker protects during manual operation, and the LEFT and RIGHT AUTO TEMP CONT circuit breakers protect during automatic control operation (Fig. 4).

B. When air conditioning switches are turned ON the pack valves open and air from the pneumatic system is ducted through the mix valves to the air cycle system and the mixing chamber. The mix valves adjust to allow the proper proportion of cold air from the air cycle system and hot air from the pneumatic system to enter the distribution system for a selected cabin temperature.

C. Manual control requires monitoring of the passenger cabin and supply duct temperature indicator while adjusting the mix valve position to obtain and hold the desired cabin temperature. With the air conditioning switches ON, 115-volt ac current is provided to three switches in the cabin temp- erature selector. If the selector knob is in the MANUAL OFF position all three switches are open. Moving the knob to COOL closes one of the switches and the circuit is completed to move the mix valve such that more air is passed through from the air cycle system and less from the pneumatic system. Moving the knob to WARM closes a different switch moving the valve in the opposite direction. Only one of the switches in the selector can be closed at a particular time. A 190° duct overheat thermal switch gives system protection to prevent adjustment of the mix valve such that air entering the cabin becomes too hot. At approximately 190°F the thermal switch closes, energizing the cabin duct overheat relay. The energized relay completes a circuit to move the mix valve to the full cold position. The thermal switch, when closed, also completes a circuit to illuminate the DUCT OVERHEAT light. After correcting the overheat condition the system may be returned to normal by pushing the reset button. Another thermal switch protects against duct overheat should control power be lost. At approximately 250°F this switch closes to energize the pack overheat relay and complete a circuit to close the pack valve and illuminate the PACK TRIP OFF light. Return to normal after a trip off requires pushing the PACK RESET switch after the condition has been corrected.

D. When the selector knob is moved to AUTO the third switch closes and a circuit is completed to the temperature regulator. Setting the knob pointer for a particular cabin temperature adjusts a potentiometer fixed to the knob shaft. This potentiometer serves as a reference resistance in the regulator temperature control bridge. The cabin temperature sensor provides the resistance in the other leg of the bridge. If cabin temperature is already the same as that asked for by the selector, the silicon-controlled rectifier actuator control will prevent any current passing on to the mix valve. At a cabin temperature other than that selected the temperature sensor will provide a resistance either higher or lower in the other leg of the control bridge. As a result the regulator actuator control will complete a circuit to move the mix valve either toward hot or cold, as required, to bring cabin temperature to agree with selected temperature. The anticipator bridge and the duct temperature limit bridge at the same time sense conditioned air temperature to slow down changes requested by the control bridge and prevent duct overheat. The three bridge circuits feed into a magnetic amplifier that takes the resultant signal to the actuator control. The actuator control then moves the mix valve so that cabin temperature changes without sudden blasts of cold or hot air and without raising duct temperature above limits. The same system overheat protection described under manual control is in effect during automatic control.



Temperature Control Circuit
Figure 4

TEMPERATURE CONTROL - TROUBLESHOOTING

1. General
   A. Temperature control trouble shooting provides a method for isolating faulty regulating components of automatic temperature control and failures or malfunctions in the manual temperature control system.
   B. Each component used during manual control is also used during automatic control. It is practical to check for problems in the manual system, therefore, before checking the automatic system.
   C. Trouble lights and a temperature indication selector system on the overhead panel provides assistance in troubleshooting the temperature control system. For example, the mix valve, whose position is set by temperature control, governs cabin air temperature. The 190-degree duct overheat thermal switch cuts out temperature control and drives the valve to full cold when a duct overheat condition exists. Should the thermal switch fail closed, temperature control will be lost. At the same time the duct overheat light will come on. Since the duct overheat switch and the supply duct temperature bulb are located in the same duct a supply duct temperature selection when the overheat light come on will confirm that a duct overheat condition exists or will call attention to a faulty duct overheat circuit.
   D. Lack of temperature control may be caused by malfunctions in the mix valve, duct overheat relay, pack overheat relays, or in either of the relay circuits as well as in the automatic temperature control regulating components. Accurate cabin temperature changes may not be provided by the cabin temperature sensor and bulb if airflow is restricted by an excessively dirty air grille or duct and outlet tubing.
   E. Troubleshooting, therefore, consists of two steps. First check operation of manual temperature control then check the automatic system. If it is determined by watching airplane instruments that manual control is functioning properly only the regulating portion of automatic control need by checked.
2. Equipment and Materials
   A. Temperature Control System Tester - AiResearch Part Number 62803801 (preferred), 278358-1 (optional) with special adapter rack assembly

      NOTE: Tester is needed for only airplanes whose temperature controllers do not have built-in-test equipment on face of controller. Tester is used for troubleshooting automatic temperature control (Ref par. 4).

   B. Ohmmeter

      CAUTION: AN OHMMETER CONTINUITY CHECK WILL DAMAGE THE FOLLOWING TEMPERATURE SENSORS BEYOND REPAIR.

(1) Cabin Temperature Sensor
(2) Passenger Cabin Duct Anticipator
(3) Passenger Cabin Duct Limit Sensor
(4) Control Cabin Duct Anticipator
(5) Control Cabin Duct Limit Sensor

3. Prepare to Troubleshoot Temperature Control

A. Provide electrical power.
B. Supply pneumatic power.
C. Check that all air conditioning circuit breakers are in (closed).
D. Check that following circuit breakers on panel P6 are closed.
(1) MASTER CAUTION (all except FUEL, if installed)
(2) INDICATOR LTS, MASTER DIM BUS (9 places)
(3) DIM & TEST (1 place)
E. Move AIR TEMP selector to PASS CABIN, then SUPPLY DUCT positions and check that readings on temperature indicator are approximately the same.
F. Move R PACK (L PACK) switch to ON.
G. Check that PACK TRIP OFF and DUCT OVERHEAT lights are off and press-to-test to assure proper light operation.
H. Move temperature selector to MANUAL WARM and check that mix valve moves toward warm by observing mix valve position indicator.
I. If mix valve moves to warm, move selector to MANUAL COOL and check that valve moves back to full cold. If mix valve does not move in response to selector setting, check per trouble shooting chart.
J. If mix valve moves in response to manual temperature selection, or if, after a difficulty has been corrected in manual temperature control system, automatic control still doesn't operate correctly, trouble shoot automatic temperature control system.

4. Trouble Shooting Automatic Temperature Control System

A. On airplanes with built-in-test equipment on face of controller, provide electrical power and perform check per instructions on face of controller.
B. On airplanes whose temperature controllers do not have built-in-test equipment accomplish the following:
(1) Move R PACK (L PACK) switch to OFF (CLOSED) and open MANUAL TEMP CONTROL circuit breaker on the No. 1 TRANSFER BUS.
(2) Gain access to electronics compartment and remove the cabin temperature control module from electronics rack.
(3) Remove special adapter rack assembly from temperature control system tester and install in temperature/control module position in electronics rack. Lock into position.
(4) Connect tester and temperature control module to adapter per tester operating instructions.
(5) Set tester panel switches and controls according to tester operating instructions.
(6) Move temperature selector to approximately midposition of automatic range.

(7) Close MANUAL TEMP CONTROL circuit breaker.
(8) Move R PACK (L PACK) switches to ON (OPEN).
(9) Proceed with trouble shooting per tester operating instructions.

NOTE: The temperature control system tester provides instructions for functional test as well as troubleshooting. The open circuit, short circuit, and resistance measurement checks should isolate any faulty component or circuit in the automatic temperature control system.

(10) After faulty component has been replaced perform temperature control system operation test per 21-61-0 A/T.
(11) Move R PACK (L PACK) switch to OFF (CLOSED).
(12) Remove electrical power if no longer required.

5. Troubleshooting Charts

TEMPERATURE CANNOT BE CONTROLLED MANUALLY OR AUTOMATICALLY

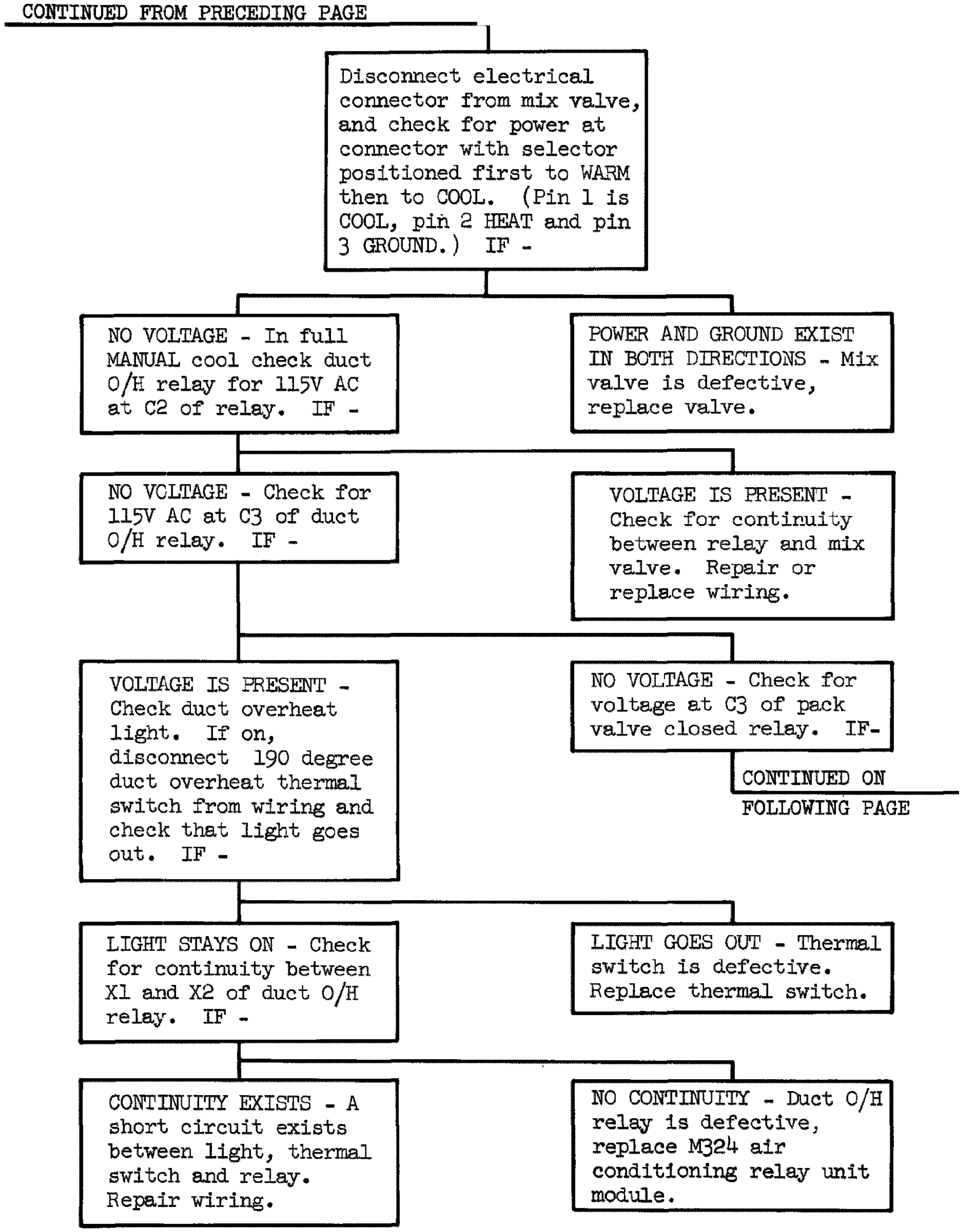
Prepare to trouble shoot temperature control system (refer to par. 3).

Move temperature selector to manual WARM and check that mix valve moves toward HOT by observing valve position indicator. Visually check external position indicator on mix valve housing for agreement with position indicator. Move selector to manual COOL and check that mix valve moves back to full COLD. IF -

- Mix valve moves in response to manual temperature selection, or if, after a difficulty as been corrected in manual temperature control system automatic control still doesn't operate correctly, trouble shoot automatic temperature control system per par. 4.
- Mix valve does not move during automatic or manual temperature control. Pack valve open when PACK switch is moved to ON (OPEN)

CONTINUED ON TOP OF FOLLOWING PAGE

Temperature Control - Trouble Shooting
Figure 101 (Sheet 1)



Temperature Control - Trouble Shooting
Figure 101 (Sheet 2)

CONTINUED FROM PRECEDING PAGE

NO VOLTAGE - Check for 115V AC at C2 of pack valve closed relay. IF -

VOLTAGE IS PRESENT - Check for continuity between C3 of pack valve closed relay and C3 of duct O/H relay. Repair or replace wiring.

VOLTAGE IS PRESENT - Open PACK VALVE circuit breaker, remove electrical connector from pack valve and check for continuity between pack valve pins 1 and 3. IF -

NO VOLTAGE - Check continuity between C2 of pack valve closed relay and pin 3 of temperature selector switch. Repair or replace wiring.

NO CONTINUITY - Check for continuity between C2 and C3 of pack valve closed relay. IF -

CONTINUITY - Valve closed limit switch is defective. Replace pack valve.

CONTINUITY - Close PACK VALVE circuit breaker, install electrical connector on pack valve and check again for continuity between C2 and C3 of pack valve closed relay. IF -

NO CONTINUITY - Relay is defective. Replace M324 air conditioning relay unit module.

NO CONTINUITY - Circuit is grounded between relay and pack valve limit switch. Repair wiring.

Temperature Control - Trouble Shooting
Figure 101 (Sheet 3)

TEMPERATURE CONTROL SYSTEM - ADJUSTMENT/TEST

1. Temperature Control System Test
   A. General
      (1) Two tests are presented for checking the temperature control system. The first, Temperature Control System Electrical Test, requires only that electrical continuity and functional ability of all components of the systems. However, the pack valve will not open without pneumatic pressure in the system. To simulate an open position of the valve to do the test, the electrical connector on the side of visual indicator (valve closed switch) should be disconnected. The procedure for disconnecting the connector is noted in the applicable step. The second, Temperature Control System Operation Test, requires operation of cooling packs which means that in addition to electrical power the pneumatic system must be pressurized. This check also proves the system to be operationally correct, however it checks only the response to normal operation.
      (2) The following tests are written for the passenger cabin temperature control system. The control cabin system is identical except respective control components must be used and only one system may be tested at a time.
      (3) It is recommended that 20-10-171, Maintenance Practices, be reviewed before using heating equipment on temperature control system components during this test.
   B. Temperature Control System Electrical Test
      (1) Equipment and Materials
         (a) Temp Cal Probe Heater BH 3884-40 (attachment to Jet Cal engine analyzer) or H294 Temp Cal Thermal Switch Tester, or H394 Temp Cal Tester with adapter cable BH405 BH24944 Heater Probe Kit (basic P/N)

            NOTE: This kit is necessary to use the testers listed above. Consult with the supplier for the appropriate dash number for a specific airplane model and tester combination.
            Howell Instruments 3479 West Vickery Blvd.
            Fort Worth, Texas 76107

         (b) Controlled cooling source, if ambient temperature is 85°F (30°C) or above
         (c) Standard Thermometer (°F or °C)
      (2) Prepare to Test Temperature Control System
         (a) Remove aft bulkhead of forward cargo compartment.
         (b) Provide electrical power.
         (c) Open air conditioning equipment bay doors.

(d) Check that all air conditioning circuit breakers on panel P6-3 and P6-4 are closed and that air conditioning switches are off.
(e) Move LIGHTS switch on pilots' center panel to TEST position and check that DUCT OVERHEAT light on overhead panel and master caution annunciators on light shield come on.

(3) Test Manual Control
(a) Move AIR TEMP selector knob to PASS CABIN.
(b) Record indicator reading.
(c) Move selector knob to PASS CABIN and then SUPPLY DUCT.
(d) Check that indicator reading is approximately the same as that recorded in step (b).
(e) Move selector knob back to PASS CABIN.
(f) Apply heat to the passenger cabin temperature bulb and check that temperature indicator reading goes up. Do not heat temperature bulb enough to cause the indicator to go off scale.

CAUTION: IF TEMPERATURE APPLIED IS ENOUGH TO CAUSE INDICATOR NEEDLE TO MOVE PAST ITS LIMIT, THE UNIT MAY BE DAMAGED.

NOTE: It will be necessary to remove the sensor cover or stowage compartment and the temperature bulb from the sensor duct before heat may be applied directly to the bulb. As an alternate method, hot or cold air may be blown through the sensor duct inlet to raise or lower bulb temperature.

(g) Check that mix valves are in the full cold position.
(h) Disconnect electrical connector from side of visual indicator or pack valve.
(i) Move the PACK switch to ON.
(j) Hold the temperature selector knob to manual WARM until the CABIN AIR MIX VALVE indicator moves to full HOT.

NOTE: Full HOT is indicated when the pointer aligns with the inner of the two closely spaced index marks at HOT end of the indicator scale. Full COLD is at the inner of the two closely spaced index marks at the other end of the scale.

(k) Check that indicator on mix valve has also moved to the full hot position.
(l) Hold temperature selector knob in the manual COOL position until indicator reads full COLD.
(m) Check that indicator on mix valve reads full cold.

(n) If the position indicator on the forward overhead panel does not align with either the full hot or full cold index mark, adjust the mix valve position transmitter. Refer to Air Mix Valve Position Indicator Control Unit.

<u>CAUTION</u>: DO NOT USE OHMMETER FOR CHECKING THE POSITION TRANSMITTER. THE TRANSMITTER IS A SENSITIVE VARIABLE RESISTANCE ELEMENT WHICH WILL BE DAMAGED BEYOND REPAIR IF SUBJECTED TO AN OHMMETER CHECK.

(4) Test Automatic Control

(a) General

1) Testing the automatic temperature control provides a check that the sensing devices in the regulation system, the temperature selector, the temperature regulator, and the mix valve are functioning properly.

2) The range of cabin temperature selected lies between 65°F (18°C) and 85°F (30°C). The cabin temperature sensor will be approximately ambient temperature. It is necessary therefore to provide a slightly different method for checking the system when ambient temperature is below 65°F or above 85°F. Step (c) describes the test requirements determined by ambient temperature and assumes that inside the cabin the temperature is approximately ambient.

(b) Position the mix valve to midposition.

1) Move the temperature selector knob to manual warm while observing mix valve position on the indicator. When the mix valve reaches approximately its midposition, move the selector knob back to OFF.

2) When ambient temperature is below 65°F (19°C) apply a controlled heat source to the cabin temperature sensor and set it at approximately 75°F (24°C). When ambient temperature is above 85°F (30°C) apply a controlled cold air source to the cabin temperature sensor until it's temperature is approximately 75°F. If ambient temperature is between 65°F and 85°F proceed with step 3).

<u>NOTE</u>: The temperature scale in the automatic temperature range of the temperature selector covers 20°F (11.1°C) from 65°F to 85°F and each index mark is 5°F (2.8°C) separated from the adjacent index mark.

3) Move temperature selector knob until pointer is at approximately the same temperature as the temperature of the sensor then make fine adjustment with knob such that mix valve stops its movement.

<u>NOTE</u>: While making fine adjustment observe mix valve position indicator. If reading on indicator shows the mix valve moving toward hot turn the selector knob counterclockwise. If valve is moving toward cold, adjust knob clockwise. The null setting on the selector should be within ± 1.5°F (± 0.83°C) of sensor temperature.

(c) Move temperature selector knob counterclockwise from the null position approximately 2°F (1.1°C) and check that the mix valve moves toward COLD.

<u>NOTE</u>: 2°F movement on the selector scale corresponds to just less than half the distance between index marks.

(d) Return mix valve to intermediate position per step (b).
(e) Move selector clockwise approximately 2°F (1.1°C) and check that the mix valve moves toward HOT.
(f) Return mix valve to intermediate position per step (b).
(g) Remove the cabin duct temperature limit sensor from the main distribution manifold.
(h) Apply heat to the cabin duct temperature limit sensor probe and check that the mix valve drives to full cold.

<u>NOTE</u>: At approximately 140°F (60°C) the mix valve will start toward the cold position.

(i) Allow the sensor to cool until it may comfortably be held by bare hand, then reinstall in main distribution manifold.
(j) Reposition the mix valve per step (b).
(k) Check that when the DUCT OVERHEAT light is pushed, it comes on, and when it is released, it goes out.
(l) Remove the 190-degree duct overheat thermal switch from the main distribution manifold.
(m) Heat the 190-degree duct overheat thermal switch until the DUCT OVERHEAT light and the MASTER CAUTION and AIR COND annunciators comes on.

<u>NOTE</u>: The 190-degree duct overheat light should come on at a probe temperature of 190 ±5°F (87.8 ±2.8°C).

(n) Check that the mix valve drives to full cold.
(o) Depress MASTER CAUTION light (either) and check that both MASTER CAUTION lights and the AIR COND annunciator light on the lightshield go out and the DUCT OVERHEAT light on the overhead panel remains on.
(p) Push AIR COND annunciator and check that MASTER CAUTION lights and AIR COND annunciator light come back on.
(q) After allowing sufficient time for the thermal switch to cool, push the TRIP RESET button, and check that the DUCT OVERHEAT light and MASTER CAUTION lights and AIR COND annunciator light go out.
(r) Reinstall 190-degree duct overheat thermal switch.
(s) On MH 9M-AGL thru 9M-AQQ, 9M-ARG; SV HZ-AGA thru HZ-AGE; AR LV-JMW thru LV-JMZ, LV-JND, LV-JNE, LV-JTD, LV-JTO; TZ CF-TAN, CF-TAO; VP PP-SMA thru PP-SMF, PP-SMQ thru PP-SMT; IN EI-ASA thru EI-ASH, hold temperature selector knob to manual warmer until mix valve has moved away from full cold position, then release and move PACK switch to OFF. Check that mix valve returns to the full cold position.
    1) Move PACK switch to ON, hold temperature selector knob to manual warmer until mix valve has moved away from the full cold position, then release.
    2) Move PACK switch to OFF.
    3) Connect electrical connector to pack valve.
    4) Check that mix valve returns to the full cold position.
(t) On ALL airplanes EXCEPT those listed in step (s), hold temperature selector knob to manual warmer until mix valve has moved away from full cold position, then release and move PACK switch to OFF. Check that mix valve does not move toward the cold position.
    1) Connect electrical connector to pack valve.
    2) Check that mix valve returns to the full cold position.
(u) Hold thin sheet of paper or streamer over control cabin temperature sensor inlet and verify that air is being drawn into the inlet.

(5) Restore Airplane to Normal Configuration
(a) Remove all test equipment from the airplane.
(b) Reinstall the aft bulkhead of the forward cargo compartment.
(c) Close air conditioning equipment bay doors.
(d) If no longer required, remove electrical power from airplane.

C. Temperature Control System Operation Test

(1) General

(a) The operation test of the temperature control system requires that the pneumatic system be pressurized. Compressed air may be supplied to the system by either engine bleed, auxiliary power unit (APU), or by a ground pneumatic cart. The test is applicable to either PASS CABIN or CONT CABIN temperature control system.

(b) There are three tests provided. Test Temperature Control System Operation and Test Duct Temperature Limit Sensor (Topping Control) check those components within the system which provide correct temperature during normal operation. Test Duct Overheat Protection Operation checks the overheat components and circuit which do not become activated during normal operation.

(c) The tests may be performed in sequence or separately. The test preparation, par. C.(2), however, must be accomplished before starting either or all tests and the restore to normal, par. C.(6), after completing either or all tests.

(d) Prior to running the test it should be determined that the pneumatic system, cooling packs, and ram air systems are functionally correct without excessive leakage from the air supply ducts.

(2) Prepare to Test Temperature Control System

(a) Supply electrical power to all airplane busses.

(b) Pressurize the pneumatic system and open valves as required to provide air supply to the control or passenger cabin air conditioning system being tested (Ref Chapter 36, Pneumatic).

(c) Check that all air conditioning circuit breakers on panels P6-3 and P6-4 are closed and that air conditioning switches are off.

(d) Check that the mix valve is in the full cold position by observing the CABIN AIR MIX VALVE indicator.

<u>NOTE</u>: The indicator is reading full cold when the pointer aligns with the inner of the two closely spaced index marks at the COLD end of the indicator scale. Full hot is at the inner of the two closely spaced index marks at the other end of the scale.

(e) On Passenger/Cargo Convertible Airplanes, check tha CABIN AIRFLOW switch is in NORMAL (guarded) position.

(3) Test Temperature Control System Operation
   (a) Move AIR TEMP selector to the PASS CABIN (CABIN) position and record temperature.

      NOTE: The control cabin temperature may be taken as approximately the same as the passenger cabin when checking control cabin temperature control.

   (b) Check automatic temperature control using appropriate method according to existing cabin temperature.
      1) Check automatic temperature control when existing cabin temperature is below 83°F (28°C).
         a) Set temperature selector a few degrees above cabin temperature as recorded in step (a).
         b) Move PACK switch to ON (OPEN).
         c) Check that mix valve moves toward HOT.
      2) Check automatic temperature control when existing cabin temperature is above 83°F (28.3°C).
         a) Move temperature selector knob to 85°F (30°C) if cabin temperature is above 85°F. If cabin temperature is between 83°F and 85°F, set the selector at cabin temperature.
         b) Move PACK switch to ON (OPEN).
         c) Check that mix valve remains in the full cold position.
         d) Move the selector knob to manual warm and check that mix valve drives toward HOT.
         e) Move the selector knob back to the automatic range at a setting below cabin temperature.
         f) Check that the mix valve moves to the full COLD position.
   (c) Check that air is entering the cabin by feel at cabin inlet.
   (d) Move AIR TEMP selector to SUPPLY DUCT position.
   (e) Move and hold temperature selector to manual WARM while observing temperature indicator and check that duct temperature begins to rise.
   (f) Move and hold temperature selector to manual COOL while observing temperature indicator and check that duct temperature begins to drop.
   (g) Move and hold temperature selector to manual WARM while observing temperature indicator and after duct temperature has reached approximately 100°F (38°C), move selector to AUTO COOL.

(h) After allowing time for temperature to stabilize, check that indicator reads 39 ±5°F (4 ±3°C).

NOTE: If temperature indicated is not within the above limits and/or exhibits signs of surging, there is apparently a problem in the engine bleed air compression control system (21-11-0) or the water separator 35°F control system (21-51-0).

(i) Move PACK switch to OFF (CLOSE)

(4) Test Duct Temperature Limit Sensor (Topping Control)

(a) General

1) In order to perform the topping control test it is necessary to start with a cabin temperature of 75°F (24°C) or less.

(b) Move AIR TEMP selector to PASS CABIN (CABIN) position and check that temperature is 75°F (24°C) or less.

(c) If temperature is above 75°F (24°C), perform the following; if not move PACK switch to ON (OPEN) and proceed to (d).

1) Move PACK switch(es) to ON (OPEN).

2) Move temperature selector(s) to COOL and leave until passenger cabin temperature drops below 75°F (24°C).

3) If both packs were used to lower cabin temperature move PACK switch for system not being tested to OFF (CLOSE).

(d) Move AIR TEMP selector to SUPPLY DUCT position.

(e) Push-to-test DUCT OVERHEAT and PACK TRIP OFF lights.

(f) Move temperature selector to AUTO full WARM position and check that duct temperature increases to 140 ±20°F (60 ±11°C) and that DUCT OVERHEAT and/or PACK TRIP OFF lights do not come on.

(g) Move PACK switch to OFF (CLOSE).

(5) Test Duct Overheat Protection Operation

(a) Check that AIR TEMP selector is in SUPPLY DUCT position.

(b) Move PACK switch to ON (OPEN).

(c) Move temperature selector to MANUAL OFF.

(d) Gradually drive mix valve toward hot by intermittently moving temperature selector to MANUAL WARM while observing temperature indicator, AIR MIX VALVE position indicator, DUCT OVERHEAT light, PACK TRIP OFF light and MASTER CAUTION lights.

NOTE: If duct temperature is increased too fast the duct overheat switch may trip at a temperature below 170°F (76.5°C).

(e) Check that when the following conditions occur, the temperature indicator reads above 170°F (76.5°C).

<u>NOTE</u>: Indicator may read anywhere between 170°F and above to off-scale because of the temperature indicating system tolerance and time lag as well as the anticipating behavior of the thermal switch.

1) DUCT OVERHEAT light and MASTER CAUTION lights come on.

<u>NOTE</u>: OVERHEAT light for system not being tested might also come on since both thermal switches will feel main distribution manifold air temperature.

2) PACK TRIP OFF light remains out.
3) AIR MIX VALVE drives to full COLD after the warning lights come on.

(f) Allow time for duct temperature to drop below 170°F (76.5°C) then push the TRIP RESET switch and check that warning lights go out.
(g) Move temp selector to MANUAL WARM and check that mix valve drives toward HOT.
(h) Move PACK switch to OFF (CLOSE).

(6) Restore Airplane to Normal Configuration
(a) Determine if there is any further need for the pneumatic system being pressurized, if not; depressurize pneumatic system (Ref Chapter 36, Pneumatic).
(b) Remove electrical power if no longer required.

CONDITIONED AIR CONTROL - CLEANING/PAINTING

1. General
   A. The operation of the temperature control and temperature indicating systems will be something less than optimum unless a representative sample of cabin air passes across the respective temperature sensor or temperature bulb. Cabin air passing across the sensing devices contains contaminants which will form a deposit on inlet grilles and sensing devices as well as inside the exhaust tubing. A periodic cleaning of these units will help to keep temperature control and indicating systems performance up.
   B. Two cleaning procedures are provided. The first, Temperature Sensing Units - Air Cleaning, will keep sensing equipment in good operating condition for an exceptionally long time. Should nicotine buildup restrict airflow despite the air cleaning, the Temperature Sensing Units - Liquid Cleaning procedure should be used.
   C. Either cleaning procedure may be used for cleaning passenger and control cabin temperature sensors and passenger cabin temperature bulbs. The temperature sensing units - liquid cleaning procedure requires removing tubing from airplane and therefore, should not be used unless absolutely necessary. When cabin sidewall and overhead trim panels, galleys and other interfering furnishings are removed for other reasons, the tubing can be removed and liquid-cleaned while minimizing access time.
2. Temperature Sensing Units - Air Cleaning
   A. Clean Passenger Cabin Temperature Sensing Units
      (1) Remove air inlet grille (Ref 25-28-21, hatrack type interior or 25-24-315, for wide body look interior airplanes).
      (2) Remove temperature sensor and/or temperature bulb (Ref 21-61-31 and/or 21-62-21).
      (3) Disconnect exhaust tube from sensor duct and blow through tubing with shop air from the sensor/bulb end of tubing.
      (4) Clean temperature sensor and/or temperature bulb with mild detergent and wipe dry with clean lint-free cloth.
      (5) Connect exhaust tube to sensor duct.
      (6) Install temperature sensor and/or temperature bulb (Ref 21-61-31 and/or 21-62-21).
      (7) Install air inlet grille (Ref 25-28-21 or 25-24-315 as applicable).
   B. Clean Control Cabin Temperature Sensing Units
      (1) Remove control cabin temperature sensor (Ref 21-61-61).
      (2) Disconnect exhaust tube from temperature sensor case and blow through tubing with shop air from sensor end of tubing.
      (3) Clean case screen with mild detergent, then blow dry.
      (4) Clean temperature sensor with mild detergent and wipe dry with clean, lint-free cloth.
      (5) Install exhaust tube.
      (6) Install temperature sensor (Ref 21-61-61).

C. Verify Airflow and Acceptable System Leakage.
   (1) Provide airflow.
      (a) On Standard Passenger Airplanes, start equipment cooling system blower.
      (b) On Passenger/Cargo Convertible Airplanes, start equipment cooling system blower and APU.
   (2) Place a 5 by 8 inch sheet of lightweight paper over the sensor air inlet grille and check that the paper is held in place.

   NOTE: If it is impractical to operate equipment coding or APU, a check for free flow of air at the exhaust tube outlet after running air through the tube a minute or so should suffice.

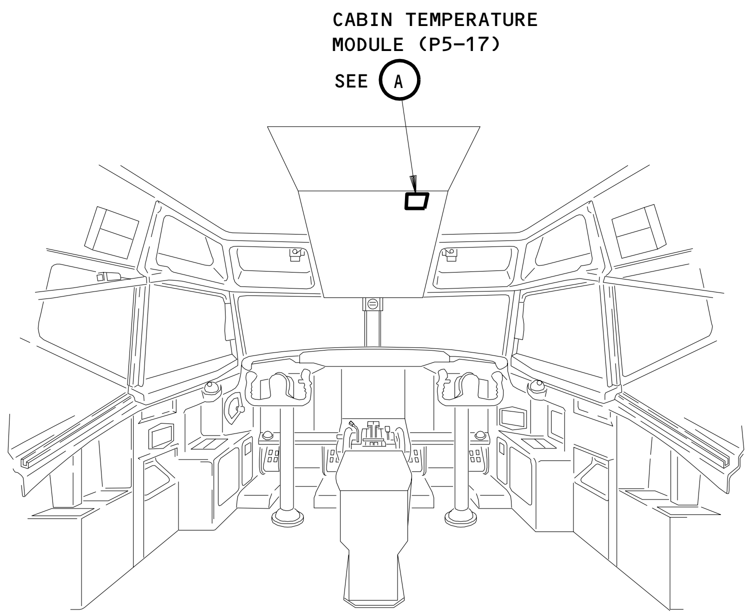
3. Temperature Sensing Units - Liquid Cleaning
   A. General
      (1) The liquid cleaning procedure should be used only when cabin sidewall and overhead panels, galleys and other interfering furnishings are removed. Otherwise, access to exhaust tubing requires such extensive removal effort, the job should not be attempted unless absolutely necessary.
   B. Remove air inlet grille (Ref 25-28-21 for hatrack type interior or 25-24-315 for wide body look interior airplanes).
   C. Remove temperature sensor and temperature bulb (Ref 21-61-31 and 21-62-21).
   D. Disconnect exhaust tube from sensor box.
   E. Gain access to complete exhaust tubing run (Ref par. 3.A.).
   F. Disconnect tubing at joints and remove tube clamps; then remove tubing.
   G. Vapor-degrease all tubing and flush inside of tubing with trichlorethylene, clean sensor, bulb and air inlet grille with mild detergent.
   H. Install tubing; then connect tubing to sensor duct.
   I. Install temperature sensor and temperature bulb (Ref 21-61-31 and 21-62-21).
   J. Install air inlet grille (Ref 25-28-21 or 25-24-315).
   K. Verify airflow and acceptable system leakage (Ref par. 2.C.).

CABIN TEMPERATURE MODULE - REMOVAL/INSTALLATION

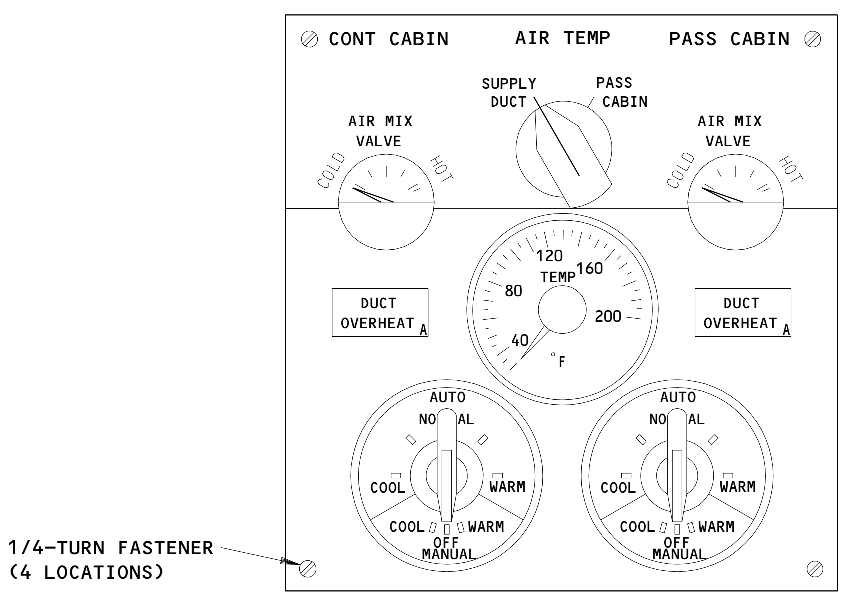
1. General
   A. This procedure provides these tasks:
      (1) Removal of the P5-17 temperature control module
      (2) Installation of the P5-17 temperature control module
2. Temperature Control Module Removal (Fig. 401)
   A. Access
      (1) Location Zone
          101 Control Cabin - Left
          102 Control Cabin - Right
   B. Procedure
      (1) Make sure that the L and R PACK switches on the P5-10 air conditioning panel are set to OFF.
      (2) Open all the circuit breakers on the P6-4 panel for the air conditioning system and the temperature control system and install DO-NOT-CLOSE tags.
      (3) Open these circuit breakers on the P6-3 panel and install DO-NOT-CLOSE tags:
          (a) MASTER CAUTION (all except FUEL, if installed)
          (b) INDICATOR LIGHTS, MASTER DIM BUS (9 locations)
          (c) DIM & TEST (1 location)
          (d) NOSE GEAR AIR/GND
          (e) LANDING GEAR AIR/GND RELAY & LTS
      (4) Lower the P5 panel to get access to the P5-17 temperature control module on the forward overhead panel in the flight deck.
      (5) Disconnect all electrical connectors at the back of the P5-17 temperature control module.

WARNING: HOLD THE TEMPERATURE CONTROL MODULE WHEN YOU LOOSEN THE 1/4-TURN FASTENERS. IF THE MODULE FALLS, INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT CAN OCCUR.

      (6) Loosen the 1/4 turn fasteners at the four corners of the P5-17 temperature control module that attach the module to the P5 forward overhead panel.



FLIGHT COMPARTMENT



CABIN TEMPERATURE MODULE (P5-17)
A

Cabin Temperature Module Installation
Figure 401

(7) Remove the P5-17 temperature control module.

3. Temperature Control Module Installation (Fig. 401)

A. References

(1) AMM 49-11-0/201, APU Power Plant (Operation)

B. Access

(1) Location Zone

101 Control Cabin - Left
102 Control Cabin - Right

C. Procedure

(1) Put the P5-17 temperature control module in its position in the P5 forward overhead panel.

(2) Tighten the 1/4 turn fasteners that secure the temperature control module to the P5 forward overhead panel.

(3) Install the electrical connectors at the back of the panel.

(4) Raise the P5 forward overhead panel to its installed position and secure the fasteners at the lower corners of the panel.

(5) Remove the DO-NOT-CLOSE tags on the P6-4 circuit breaker panel and close the circuit breakers for the air conditioning system and the temperature control system.

(6) Remove the DO-NOT-CLOSE tags on the P6-3 circuit breaker panel and close these circuit breakers:

(a) MASTER CAUTION (all except FUEL, if installed)
(b) INDICATOR LIGHTS, MASTER DIM BUS (9 locations)
(c) DIM & TEST (1 location)
(d) NOSE GEAR AIR/GND
(e) LANDING GEAR AIR/GND RELAY & LTS

D. Temperature Control Module (P5-17) Test

(1) Supply electrical power to the airplane (AMM 24-22-0/201).

(2) Set the LIGHTS switch on the P2-1 panel momentarily to the TEST position and make sure these lights come on and then go off:

(a) CONT CABIN DUCT OVERHEAT
(b) PASS CABIN DUCT OVERHEAT

(3) Make sure that the L and R PACK switches on the P5-10 air conditioning panel are set to OFF.

(4) Pressurize pneumatic system by a ground pneumatic cart or by starting the APU (AMM 49-11-0/201).

(5) Put the APU BLEED switch, on the forward overhead panel, to the ON position, if using the APU for air source.
(6) Put the ISOLATION VALVE switch, on the forward overhead panel, to the OPEN position.
(7) Monitor the two indicators for the duct pressure on the forward overhead panel.
 (a) The indicators must show 30 to 50 psi on each pointer without the systems in operation.
(8) Measure the temperature of the passenger cabin with a thermometer.
(9) Position the AIR TEMP selector on the P5-17 cabin temperature module to PASS CABIN.
 (a) Make sure the indication on the temperature gauge on the P5-17 temperature control module is approximately the same as the thermometer.
(10) Position the AIR TEMP selector to SUPPLY DUCT.
 (a) Make sure the indication on the temperature gage on the P5-17 temperature control module is approximately the same as the temperature indication for the PASS CABIN.
(11) Move the CONT CABIN temperature selector on the P5-17 temperature control module to MANUAL WARM.
(12) Move the L PACK switch on the P5-10 air conditioning panel to AUTO.
 (a) Make sure that the indicator needle on the CONT CABIN - AIR MIX VALVE indicator moves toward HOT.
(13) Move the CONT CABIN temperature selector on the P5-17 temperature control module to MANUAL COOL.
 (a) Make sure that the indicator needle on the CONT CABIN - AIR MIX VALVE indicator moves toward COLD.
(14) Move the CONT CABIN temperature selector to MANUAL OFF.
(15) Move the L PACK switch to OFF.
(16) Move the R PACK switch to AUTO.
(17) Move the PASS CABIN temperature selector to MANUAL WARM.
 (a) Make sure the PASS CABIN - AIR MIX VALVE indicator moves toward HOT.
(18) Move the PASS CABIN temperature selector to MANUAL COOL.
 (a) Make sure the PASS CABIN - AIR MIX VALVE indicator moves toward COLD.

(19) Move the PASS CABIN temperature selector to MANUAL OFF.
(20) Move the R PACK switch to OFF.
(21) Put the airplane back to its usual condition.
    (a) Remove the pressure from the pneumatic system by removing the ground pneumatic cart or by shutting down the APU (AMM 49-11-0/201).
    (b) Remove electrical power from the airplane (AMM 24-22-0/201).

AIR MIX VALVE - REMOVAL/INSTALLATION

1. General
    A. Two air mix valves, one for each cooling system, are located in the air conditioning bay. Since both installations are identical only one is shown.
2. Remove Air Mix Valve (Fig. 401)
    A. Lower air conditioning equipment bay door.
    B. Open the following circuit breakers (P6-4):
        (1) TEMP CONTROL
            (a) AUTOMATIC-R (passenger cabin) or AUTOMATIC-L (control cabin)
            (b) MAN
        (2) AIR CONDITIONING
            (a) POS IND
    C. Remove bonding jumper from mix valve.
    D. Remove position transmitter and valve actuator electrical connectors.
    E. Loosen V-clamps and slide onto adjacent ducts.
    F. Slide flexible couplings onto adjacent ducts (Ref 21-51-61, Removal/Installation).

        NOTE: Support mix valve during flexible coupling removal.

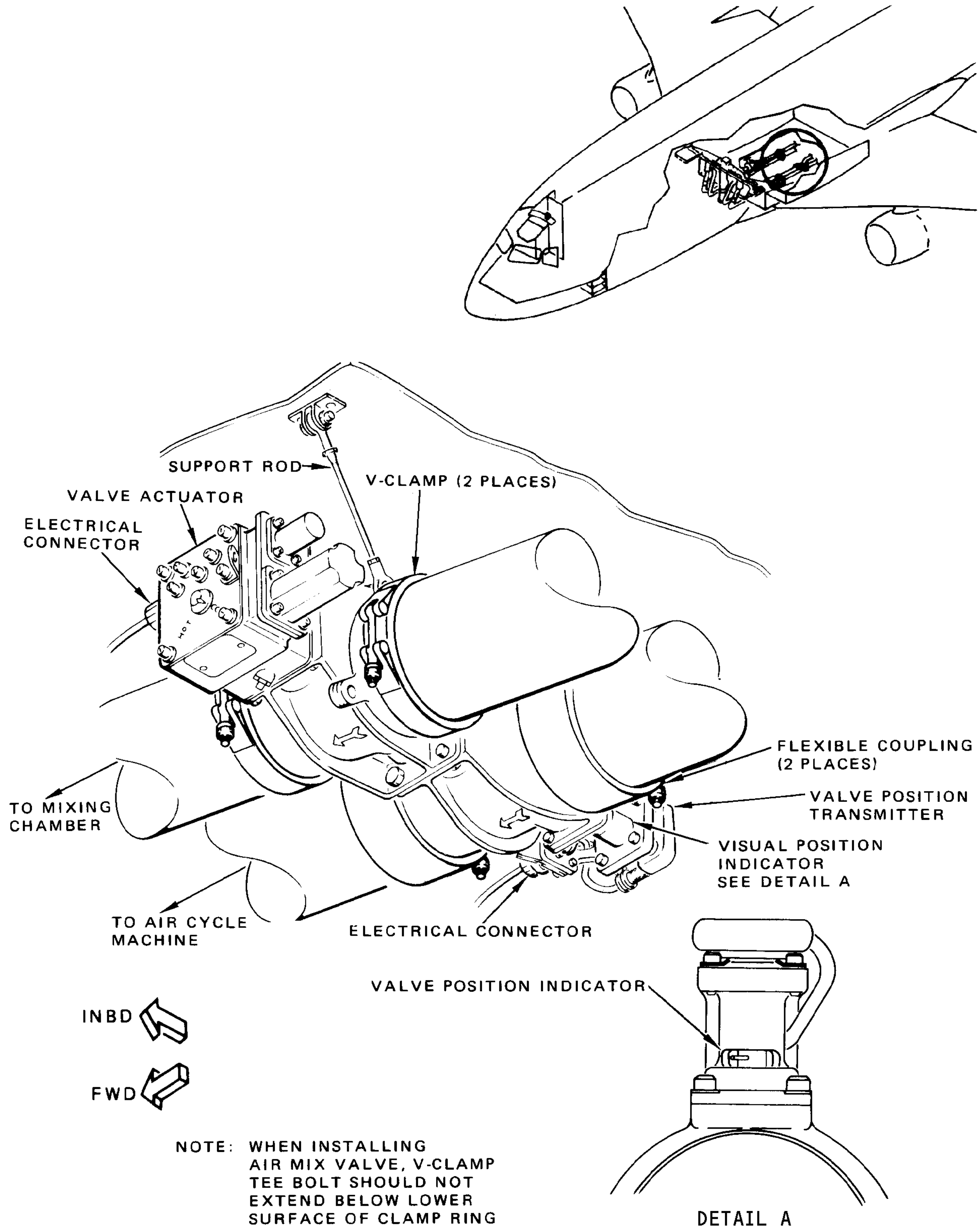
    G. Remove bolt attaching support rod to mix valve body and remove mix valve from airplane.
3. Install Air Mix Valve
    A. If new flexible couplings are to be used replace existing couplings on ducts with the new couplings (Ref 21-51-61, Removal/Installation).
    B. Check that V-clamps are on ducts and raise mix valve into position.
    C. Install bolt through support rod and mix valve lug.
    D. Install flexible couplings (Ref 21-51-61 R/I).

        NOTE: Adjust support rod as necessary for mix valve alignment with air ducts.

    E. Install V-clamps.

        NOTE: When installing mix valve V-clamp tee bolts, check that bolts do not extend below lower surface of clamp ring (Fig. 401).

    F. Check that bonding surfaces are clean then install bonding jumper.
    G. Install position transmitter and valve actuator electrical connectors.
    H. Close circuit breakers opened in 2.B.
    I. Provide electrical power.
    J. Check that pneumatic system is not pressurized.
    K. Check that applicable temperature selector is in OFF position.



Air Mix Valve Installation
Figure 401

L. Check that mix valve is in full cold position and that indicator reads accordingly (See NOTE).

NOTE: Full cold is indicated when the pointer aligns with the inner of the two closely spaced index marks at the COLD end of the indicator scale. Full hot is with pointer alignment at inner index mark at other end of scale.

M. Open OVERHEAT circuit breaker (P6-4).
N. If indicator reads correctly proceed to O. If not, adjust as follows:
   (1) Remove mix valve position transmitter (potentiometer) cap, loosen transmitter retaining screws and rotate transmitter housing relative to its shaft until indicator pointer and inner index mark align.
   (2) Tighten retaining screws.
O. Position applicable PACK valve switch to ON.
P. Hold applicable temperature selector on MANUAL-WARM and check that mix valve moves to full hot.
Q. If indicator pointer moves to full hot position, hold selector to COOL until mix valve moves to full cold then proceed to Q. If not, adjust as follows:
   (1) Remove temperature control module (P5-17) from forward overhead panel.
   (2) Adjust variable resistor R2 (passenger cabin mix valve) or R3 (control cabin mix valve) until pointer and index mark align.
   (3) Hold temperature selector to COOL until mix valve drives to full cool and check that pointer aligns with COLD index mark.
   (4) If pointer does not align rotate mix valve position transmitter to obtain alignment as described in N.(1), then repeat adjustment with mix valve moved to full hot per above.
   (5) Install temperature control module.
R. Install mix valve position transmitter cap. Close OVERHEAT circuit breaker.
S. Pressurize pneumatic system (Ref Chapter 36, Pneumatic).
T. Operate applicable air conditioning pack and check for leakage at mix valve duct clamps.
U. Remove pneumatic pressure if no longer required.
V. Remove electrical power if no longer required.
W. Close air conditioning equipment bay door.

PASSENGER CABIN TEMPERATURE SENSOR - REMOVAL/INSTALLATION

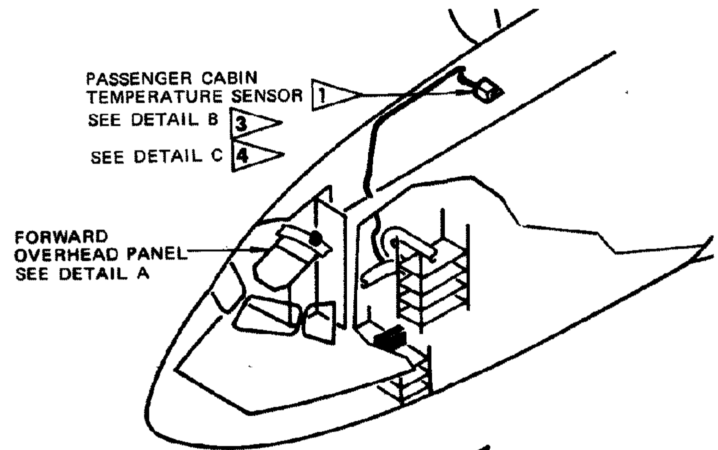
1. General
   A. Passenger cabin temperature sensor installations are not all installed the same (Fig. 401). The following procedure applies to all with any difference noted in the applicable step.
2. Remove Passenger Cabin Temperature Sensor (Fig. 401)
   A. Open RIGHT AUTO TEMP CONTROL circuit breaker (P6-4).
   B. For airplanes with hatrack type interior, remove temperature sensor cover fasteners then remove cover. For airplanes with wide body look interior, remove stowage compartment (Ref Chapter 25, Equipment/Furnishings).
   C. Remove electrical connector from temperature sensor.
   D. Remove fasteners from sensor flange and remove sensor and gasket from sensor duct.
3. Install Passenger Cabin Temperature Sensor
   A. Position temperature sensor and gasket to sensor duct and install fasteners.
   B. Install sensor electrical connector.
   C. Open OVERHEAT circuit breaker (P6), remove limit switch electrical connector from right pack valve, then close OVERHEAT circuit breaker.

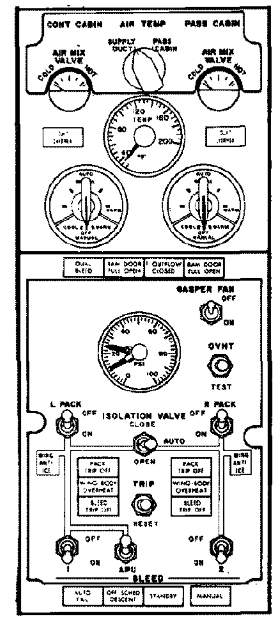
      NOTE: If airplane pneumatic system is pressurized disregard C.

   D. Close circuit breaker opened in 2.A. and check that all other air conditioning system circuit breakers are closed.
   E. Provide electrical power.
   F. Position R PACK switch to ON.
   G. Position passenger cabin temperature selector to an AUTO position which will drive the mix valve to the cold position then switch selector to OFF.

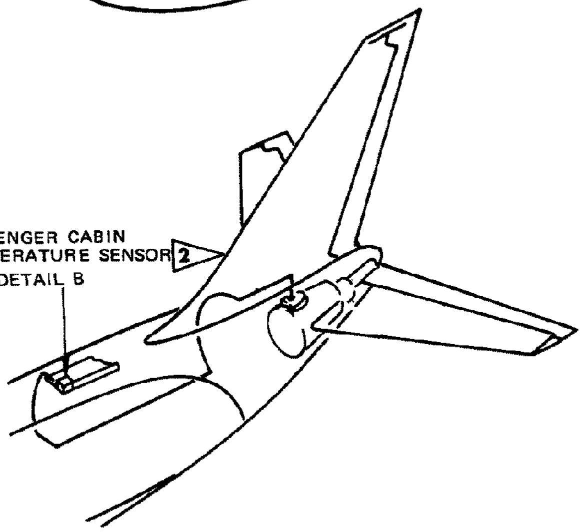
      NOTE: If cabin temperature is below approximately 65°F (18.3°C) it will be necessary to provide warm air to sensor.

   H. Hold temperature selector to MANUAL WARM as required to reposition valve from full cold.
   I. Return temperature selector to position selected in G. and check that mix valve returns to full cold.
   J. Hold temperature selector to MANUAL WARM and check that valve moves toward WARM, then return selector to OFF.
   K. If connector was removed from pack valve limit switch in C., open OVERHEAT circuit breaker, install connector, then close circuit breaker and check that mix valve drives to COLD.
   L. Position R PACK switch to OFF.
   M. Install temperature sensor cover or stowage compartment.
   N. Remove electrical power if no longer required.

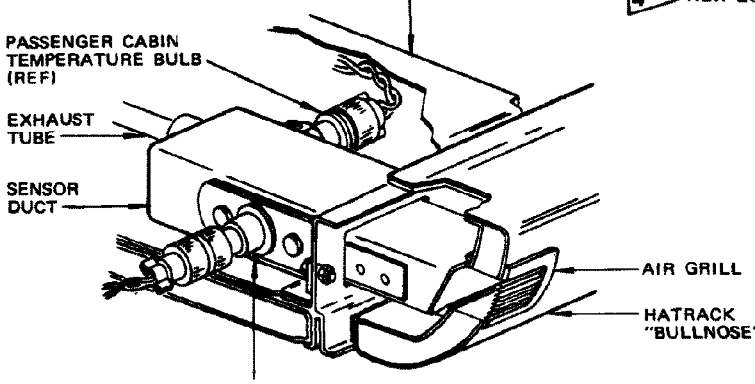




DETAIL A

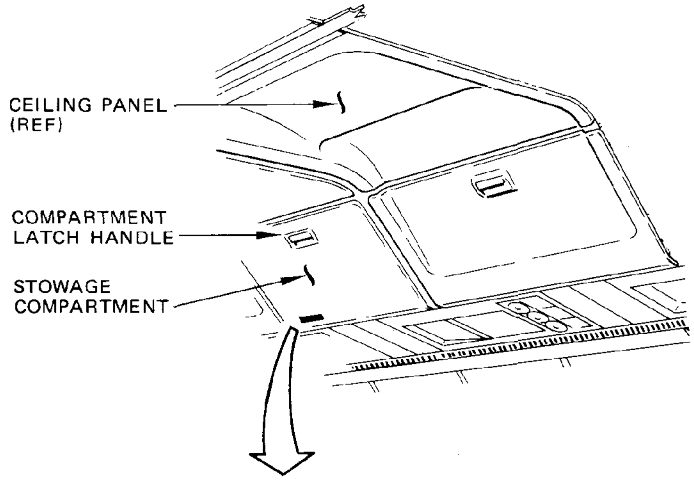


1 STANDARD PASSENGER AIRPLANES
2 PASSENGER/CARGO CONVERTIBLE AIRPLANES
3 ORIGINAL INTERIOR AIRPLANES
4 NEW LOOK INTERIOR AIRPLANES

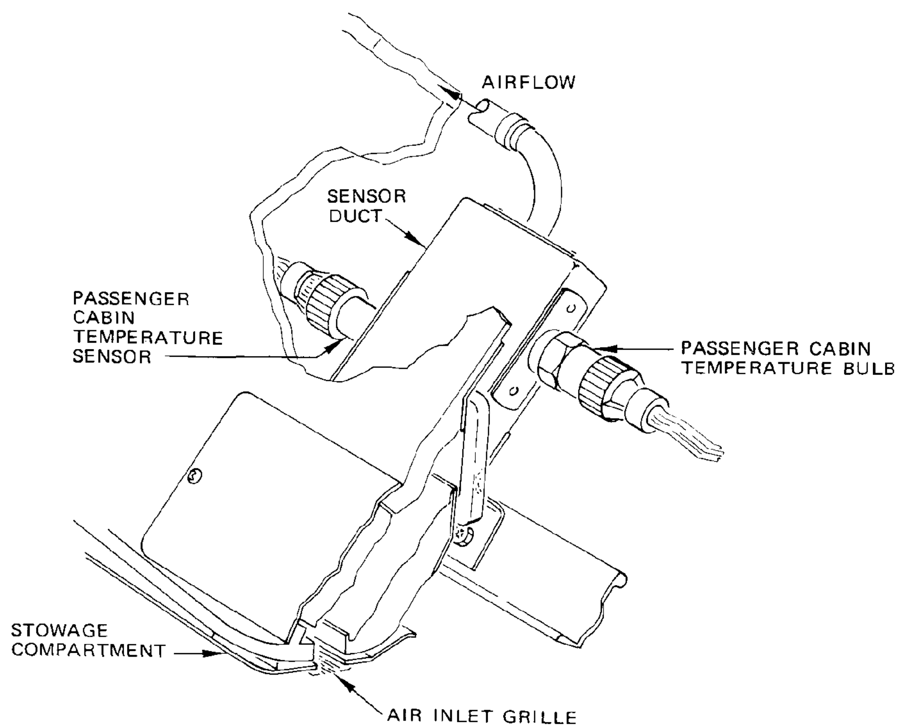


DETAIL B 3

Passenger Cabin Temperature Sensor
Figure 401 (Sheet 1)



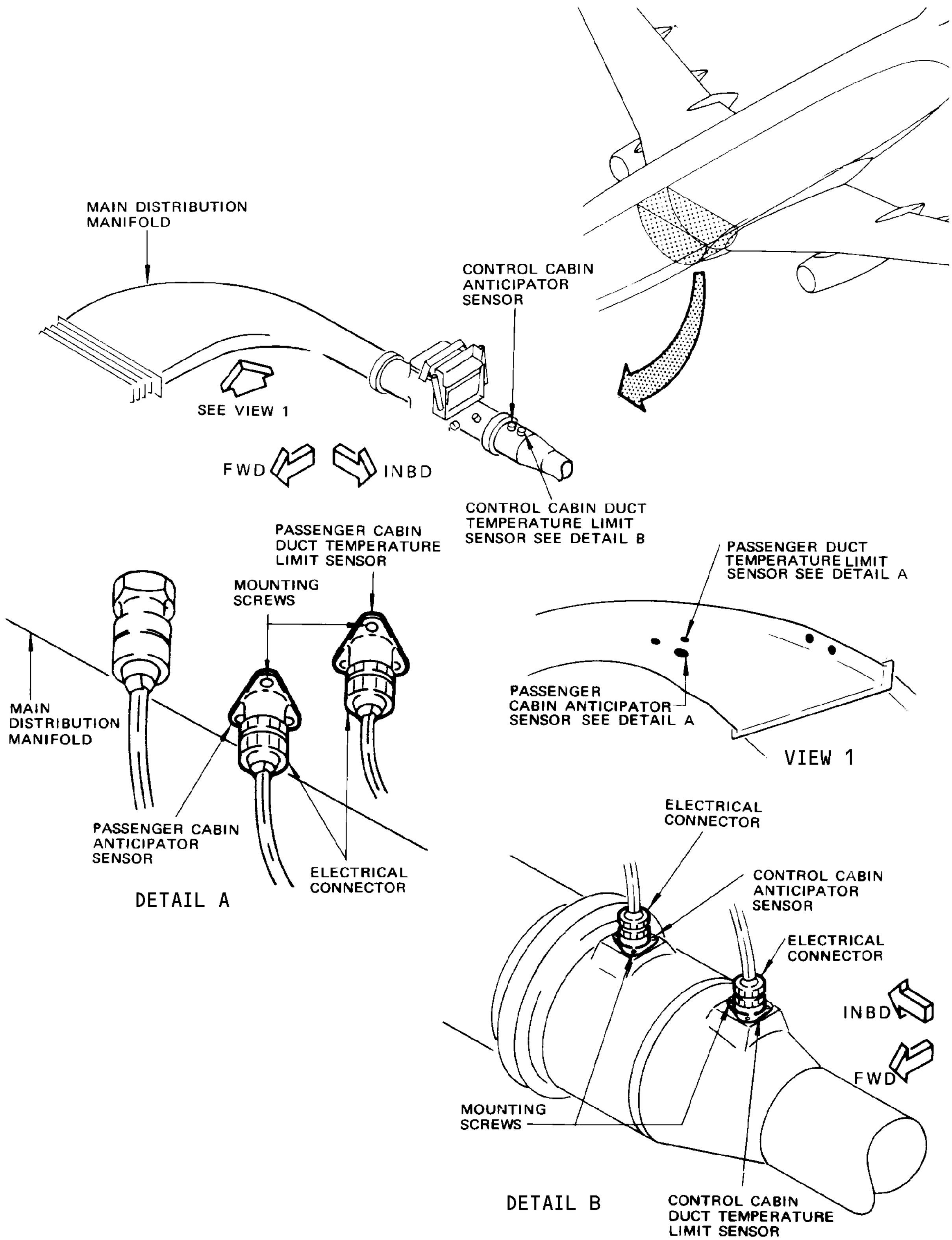
DETAIL C 4



Passenger Cabin Temperature Sensor
Figure 401 (Sheet 2)

DUCT TEMPERATURE SENSORS - REMOVAL/INSTALLATION

1. General
   A. There are four duct temperature sensors consisting of a duct temperature limit sensor, and a cabin anticipator sensor for each system. One duct temperature limit sensor and anticipator sensor is located in the branch of the main distribution manifold leading to the passenger cabin and the other two are in the branch leading to the control cabin. (See figure 401.) Access to the sensors is through the aft bulkhead of the forward cargo compartment.
2. Prepare for Duct Temperature Sensor Removal
   A. Open AUTO TEMP CONT circuit breaker for respective system on load control center circuit breaker panel P6.
   B. Remove center portion of forward cargo compartment aft bulkhead to gain access to main distribution manifold.
3. Remove Duct Temperature Sensor
   A. Disconnect electrical connector from duct temperature sensor.
   B. Remove screws attaching temperature sensor to duct.
   C. Remove temperature sensor.
4. Install Duct Temperature Sensor
   A. Position sensor on duct and install attaching screws.
   B. Connect electrical connector to duct temperature sensor.
   C. Close AUTO TEMP CONT circuit breaker on load control center circuit breaker panel P6.
   D. Test temperature control system operation. Refer to paragraph 1.C. of Temperature Control System - Adjustment/Test, 21-61-0.
   E. Install center portion of forward cargo compartment aft bulkhead.



Duct Temperature Sensor Installation
Figure 401

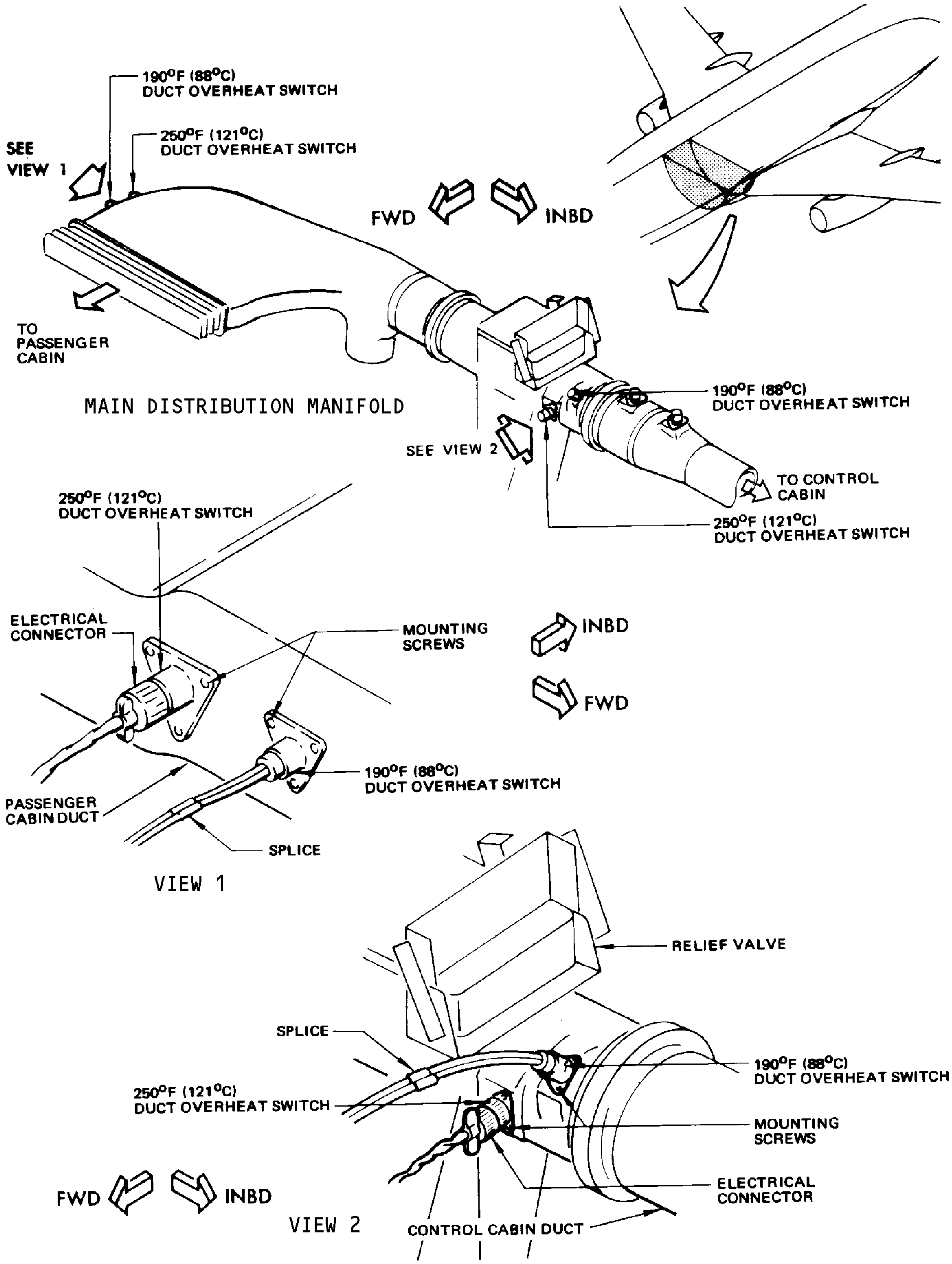
DUCT OVERHEAT SWITCHES - REMOVAL/INSTALLATION

1. General
   A. There are four cabin duct overheat thermal switches. These are a 190°F (88°C) and a 250°F (121°C) overheat switch for each control system. The switch installations are similar and are located in the main distribution manifold (Fig. 401). Access to the switches is through the aft bulkhead of the forward cargo compartment.
2. Equipment and Material
   A. Controlled Heat Source - Temp Cal probe heater (Attachment to Jet Cal engine analyzer), or equivalent.
   B. Jumper Wire
3. Prepare for Removal of Duct Overheat Switch
   A. Open OVERHEAT circuit breaker on load control center circuit breaker panel P6-4.
   B. Remove center portion of forward cargo compartment aft bulkhead to gain access to main distribution manifold.
4. Remove Duct Overheat Switch
   A. Disconnect electrical connector from 250°F (121°C) overheat switch.
   B. Cut wire at splice to disconnect from 190°F (88°C) overheat switch.
   C. Remove screws attaching switch to duct.
   D. Remove switch and gasket from duct.
5. Install Duct Overheat Switch
   A. Test overheat circuit.
      (1) Connect external electrical power.
      (2) Close OVERHEAT circuit breaker on load control center circuit breaker panel P6-4.
      (3) Push-to-test duct OVERHEAT light for the 190°F (88°C) overheat switch or the PACK TRIP OFF light for the 250°F (121°C) overheat switch replacement.
      (4) Install a jumper wire between two pins of electrical connector or between two bared wires and observe that the respective light on the forward overhead panel, both MASTER CAUTION annunciators and the AIR COND annunciator come on.
      (5) Remove jumper wire.
      (6) Push the TRIP RESET switch.
         (a) Check that PACK TRIP OFF light and all master caution annunciators go out.
   B. Connect electrical connector to 250°F (121°C) overheat switch.
   C. Splice wires to make connection to 190°F (88°C) overheat switch.

D. Test duct overheat thermal switch operation.
   (1) Apply controlled heat to thermal switch probe and observe that the respective light on the forward overhead panel, both MASTER CAUTION annunciators and the AIR COND annunciator come on.

   NOTE: Duct OVERHEAT lights should illuminate at a probe temperature of approximately 190°F (88°C) and the PACK TRIP OFF lights at approximately 250°F (88°C).

   (2) Remove the heat source.
   (3) Allow sufficient time for the switch probe to cool then push the TRIP RESET switch.
      (a) Check that PACK TRIP OFF light and all master caution annunciators go out.
   (4) Determine whether there is any further need for electrical power on airplane. If not, remove external power.
E. Position switch and gasket on duct and install attaching screws.
F. Install center portion of forward cargo compartment aft bulkhead.



Duct Overheat Switch Installation
Figure 401

CONTROL CABIN TEMPERATURE SENSOR - REMOVAL/INSTALLATION

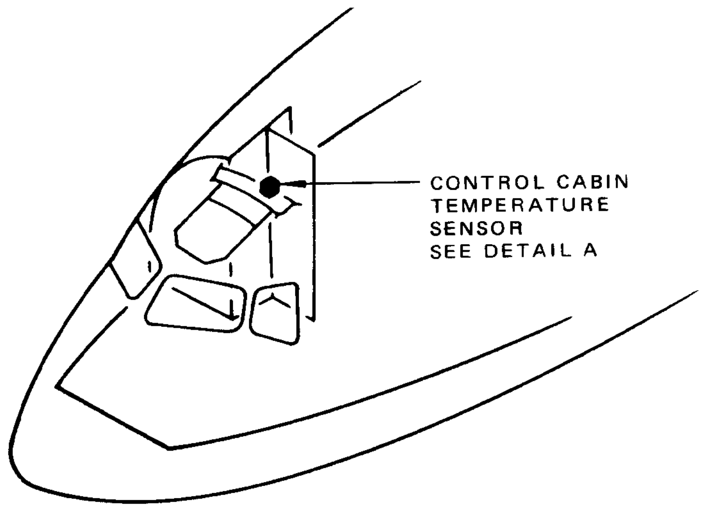
1. General
   A. The control cabin temperature sensor is located behind a screened opening in the ceiling, just forward of the control cabin door approximately four inches left of center (Fig. 401).
2. Remove Control Cabin Temperature Sensor
   A. Open LEFT AUTO TEMP CONTROL circuit breaker on load control center circuit breaker panel P6-4.
   B. Unfasten and remove padded ceiling panel to gain access to temperature sensor.
   C. Peel open insulation blanket around temperature sensor.
   D. Disconnect electrical connector from temperature sensor (Fig. 401).
   E. Remove two screws attaching sensor to sensor bracket and remove sensor.
3. Install Control Cabin Temperature Sensor
   A. Install sensor electrical connector.
   B. Position temperature sensor to bracket and secure with two fasteners.
   C. Open OVERHEAT circuit breaker (P6), remove limit switch electrical connector from left pack valve, then close OVERHEAT circuit breaker.

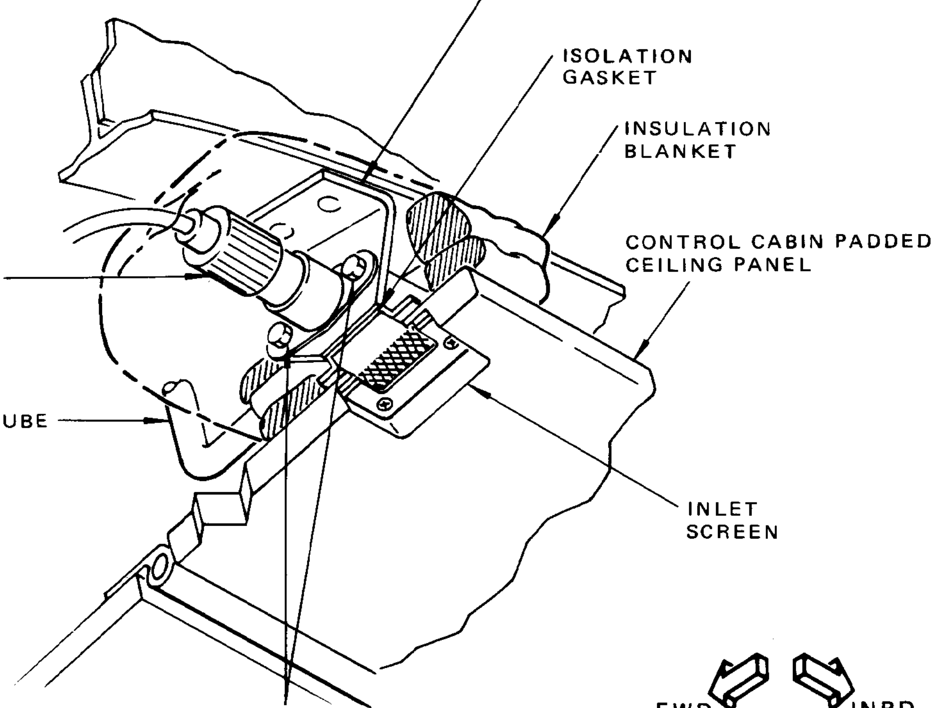
      NOTE: If airplane pneumatic system is pressurized disregard C.

   D. Close circuit breaker opened in 2.A. and check that all other air conditioning system circuit breakers are closed.
   E. Provide electrical power.
   F. Position L PACK switch to ON.
   G. Position control cabin temperature selector to an AUTO position which will drive the mix valve to the cold position then switch selector to OFF.

      NOTE: If cabin temperature is below approximately 65°F (18.3°C) it will be necessary to provide warm air to sensor.

   H. Hold control cabin temperature selector to MANUAL WARM as required to reposition valve from full cold.
   I. Return temperature selector to position selected in G. and check that mix valve returns to full cold.
   J. Hold temperature selector to MANUAL WARM and check that valve moves toward WARM, then return selector to OFF.
   K. If connector was removed from pack valve limit switch in C., open OVERHEAT circuit breaker, install connector, then close circuit breaker and check that mix valve drives to COLD.
   L. Position L PACK switch to OFF.
   M. Seal insulation blanket by pressing open ends together.
   N. Install ceiling panel.
   O. Remove electrical power if no longer required.



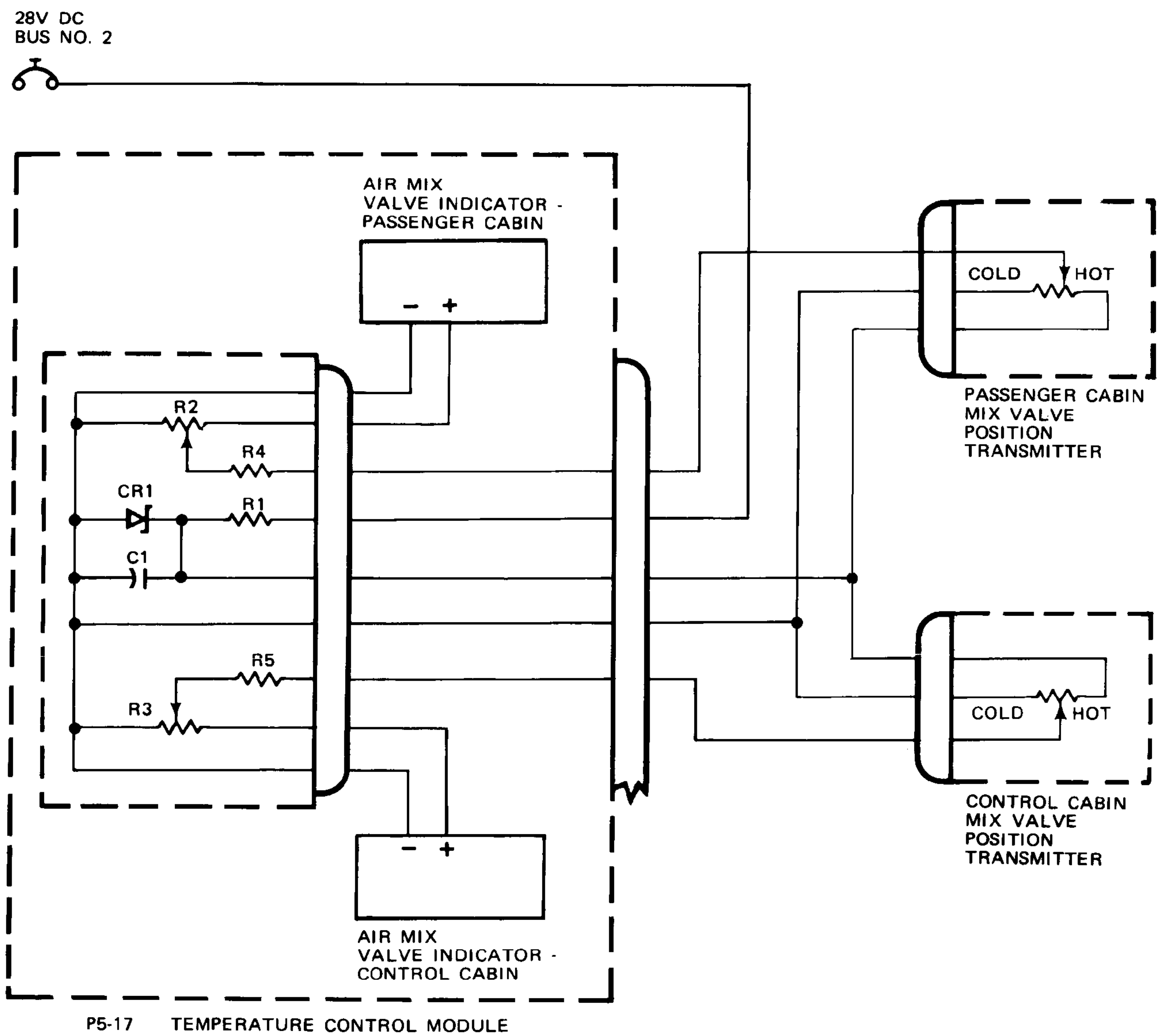


DETAIL A

Control Cabin Temperature Sensor Installation
Figure 401

AIR MIX VALVE POSITION INDICATOR CONTROL UNIT - DESCRIPTION AND OPERATION

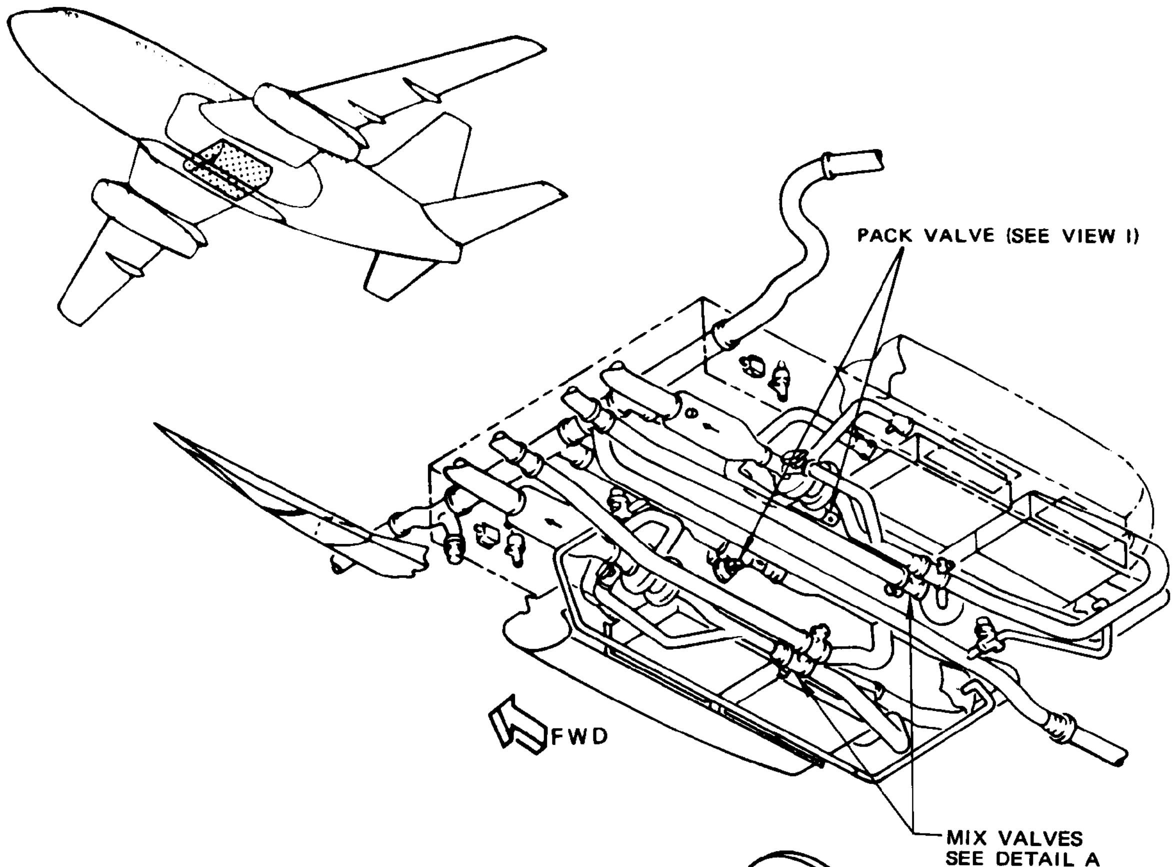
1. General
   A. The position indicator control unit (printed circuit card Al located in P5-17 module) provides regulated voltage and circuit adjustment for position indicators used in the temperature control system. See figure 1.
   B. Power to the control unit is from 28 volt dc bus No. 2 on load control center P6-4.
   C. Regulated current then passes from the control unit to two different position transmitters. Each transmitter is mechanically linked to a valve so that as the valve moves the resistance of the transmitter in the circuit to the position indicator varies. As the resistance varies, so does current, and a corresponding change is induced in the position indicator. A zener diode between power and ground prevents a fluctuating power source from affecting position indication.
   D. The position transmitters (potentiometers) driven by the mix valves provides a voltage proportional to the mix valve position and is sent back to the P5-17 module. The printed circuit card Al in the module contains calibration for this voltage. This voltage is registered on the appropriate mix valve position indicator. The indicators are calibrated by positioning the mix valve transmitter on the mix valve and adjusting the potentiometers in the P5-17 module.
   E. The adjustable potentiometers are numbered R2 and R3 and provide adjustment for indicator pointer sweep of passenger and control cabin mix valves.
   F. The P5-17 module is located in the forward overhead panel. Refer to Position Indicator Control Unit Adjustment/Test for location of adjusting screws.

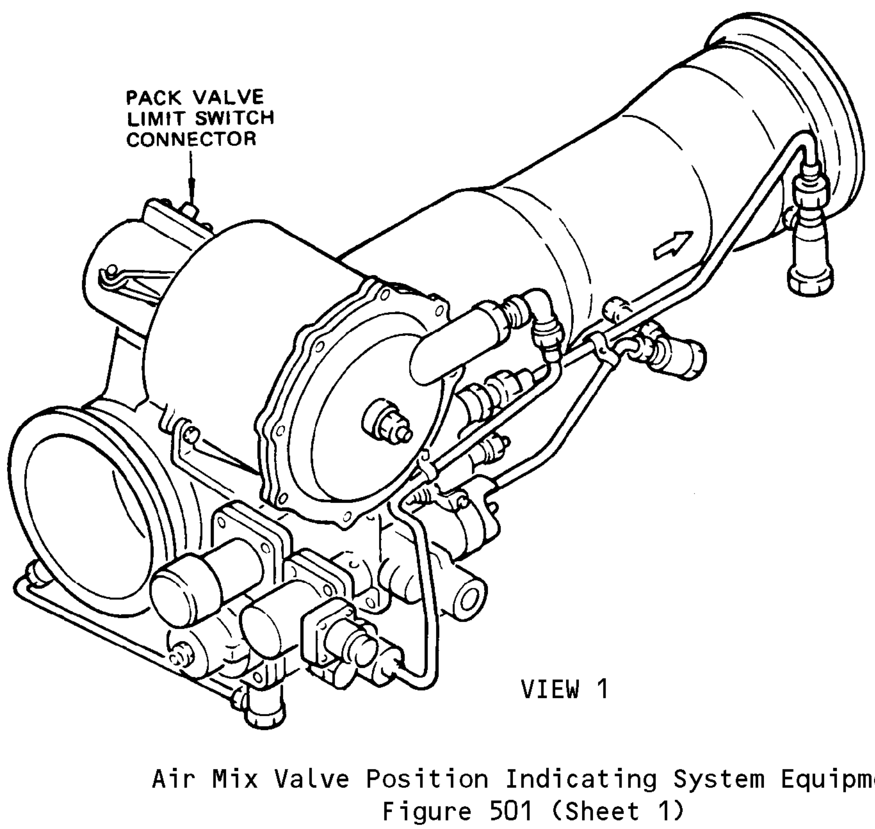


Air Mix Valve Position Indicator Control - Schematic
Figure 1

AIR MIX VALVE POSITION INDICATOR CONTROL UNIT - ADJUSTMENT/TEST

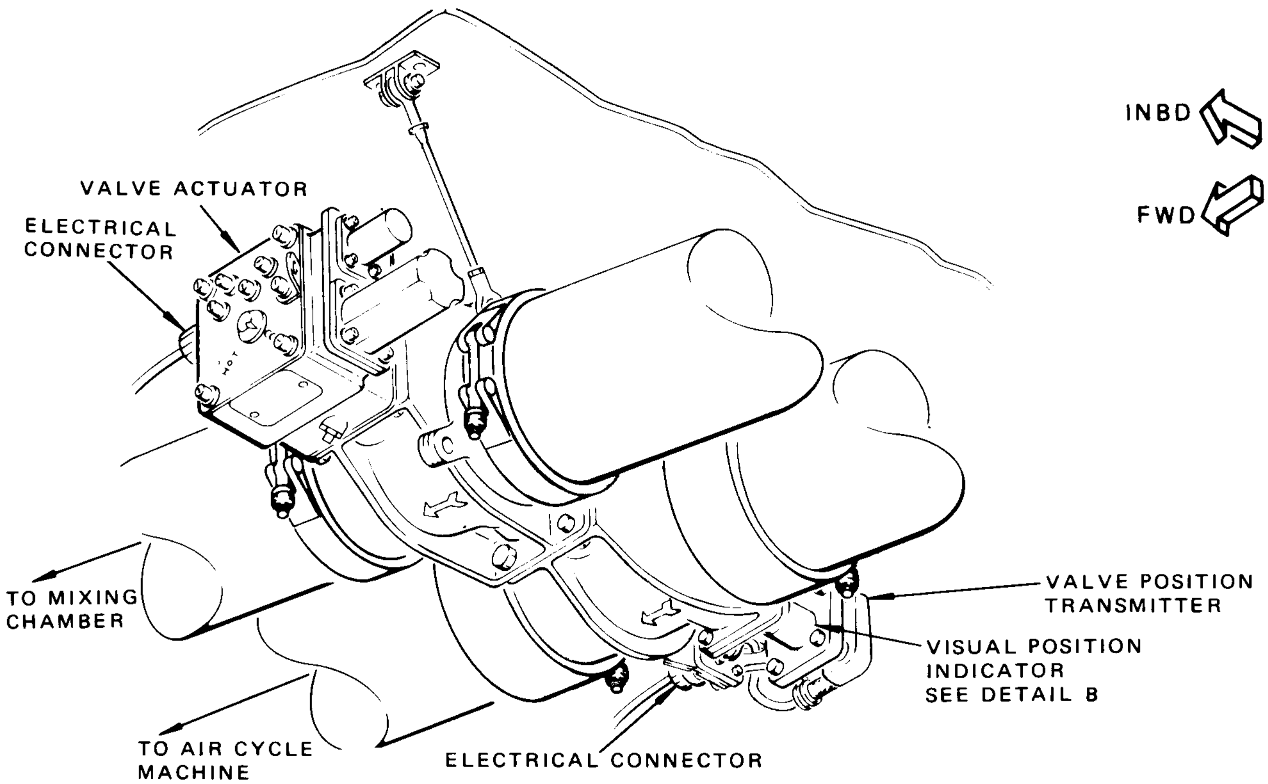
1. General
   A. The position indicator control unit is the key link between position indicators and valve position transmitters. Whether a valve, indicator, or a control unit is being replaced, a check should be made to determine that valve position and indicator reading are the same.
   B. There are two variable resistance potentiometers to be adjusted during maintenance. The potentiometers, numbered R2 and R3, are to be adjusted in conjunction with the valve transmitter. (See figure 501.) Transmitter adjustment is typical for each valve.
   C. The adjustment procedure describes the complete adjustment necessary when a valve and its position transmitter is being replaced. When only an indicator or control unit is replaced it should be unnecessary to adjust valve position transmitters. Their accuracy may be verified by moving the two valves to their extremities of travel and checking the indicator. Disregard steps involving moving transmitters when indicators or control unit is replaced until after the sweep adjustment has been made and then only if necessary.
2. Position Indicator Control Unit Adjustment
   A. Equipment and Materials
      (1) Jeweler's screwdriver or equivalent small, very thin-bladed screwdriver
   B. Prepare for Adjustment
      (1) Open air conditioning equipment bay doors
      (2) Provide electrical power.
      (3) Check that pneumatic system is not pressurized.
      (4) Check that POSITION IND circuit breaker and all air conditioning circuit breakers on panels P6-3 and P6-4 are closed.
      (5) Simulate pack valve open position.
         (a) Open OVERHEAT circuit breaker.
         (b) Remove connector from pack valve limit switch. (See figure 501.)
         (c) Close OVERHEAT circuit breaker.
   C. Adjust Transmitter
      (1) Check that mix valves are in the full cold position by observing position indicator on side of valve. (See figure 501.)
      (2) Check that CABIN AIR MIX VALVE indicator is at full COLD.
      (3) Move the PACK switch to ON.
      (4) Hold temperature selector knob to MANUAL WARM and check that mix valve moves to full hot by observing valve position indicator.
      (5) Hold temperature selector knob to MANUAL COOL and check that mix valve moves to full cold position.



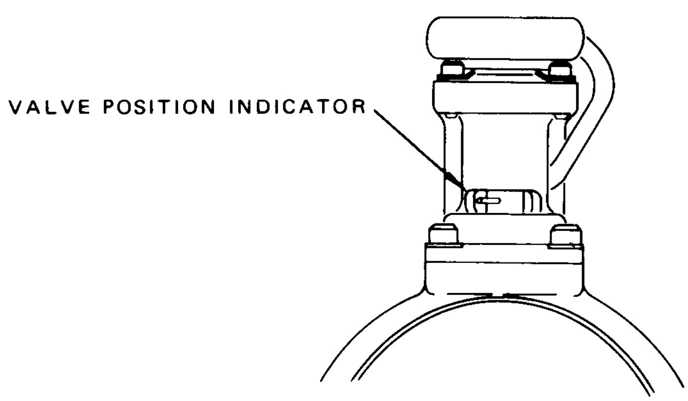


VIEW 1

Air Mix Valve Position Indicating System Equipment
Figure 501 (Sheet 1)



DETAIL A



DETAIL B

Air Mix Valve Position Indicating System Equipment
Figure 501 (Sheet 2)

(6) Check that AIR MIX VALVE indicator pointer is in the full COLD position.

NOTE: Full COLD is indicated when the pointer aligns with the inner of the two closely spaced index marks at COLD end of the indicator scale. Full HOT is at the inner of the two closely spaced index marks at the other end of the scale.

(7) If indicator pointer does not indicate correctly, adjust indicating system.
  (a) Remove position potentiometer cap located on mix valve and loosen screws in the clamp retaining the potentiometer, then rotate potentiometer housing relative to its shaft until the pointer and scale are in alignment.

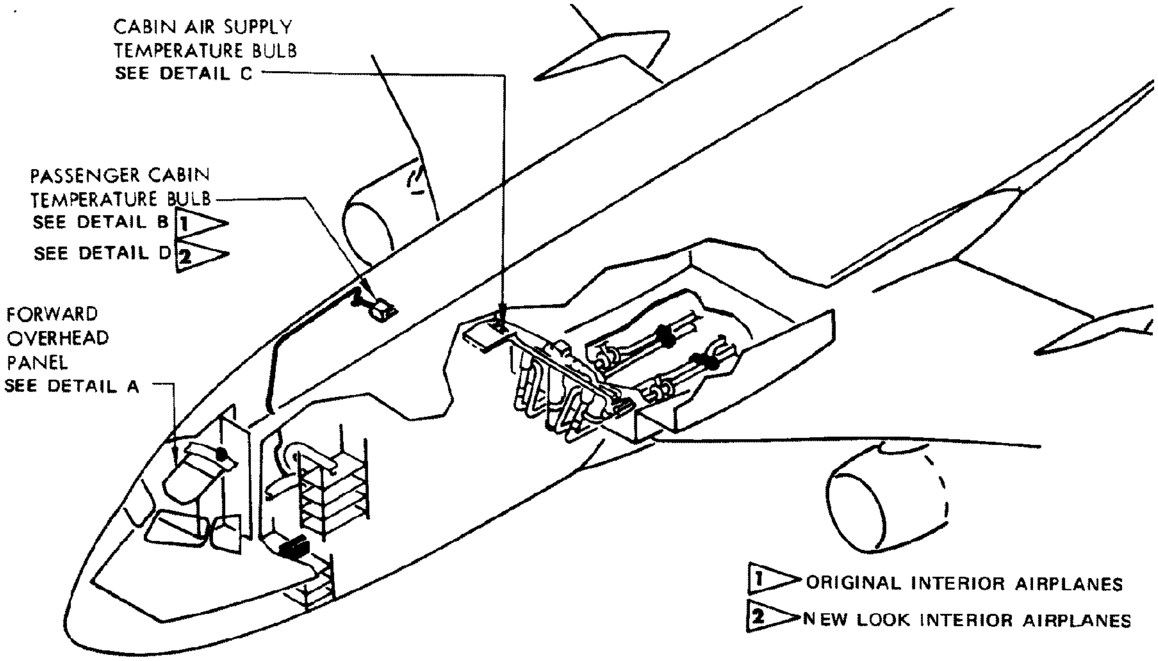
  NOTE: If the CABIN AIR MIX VALVE indicator suddenly goes off scale in the HOT direction while adjusting, rotate the housing of the potentiometer in the opposite direction.

  (b) When the desired reading is obtained, tighten the screws retaining the potentiometer and replace cap.
  (c) Hold temperature selector to MANUAL WARM until valve drives to full hot and check that indicator pointer aligns with inner index mark at HOT end of scale.
  (d) If indicator does not align, adjust trimpot R2 (passenger cabin mix valve) or R3 (Control cabin mix valve) located on the Al card mounted in the P5-17 air conditioning module as required.

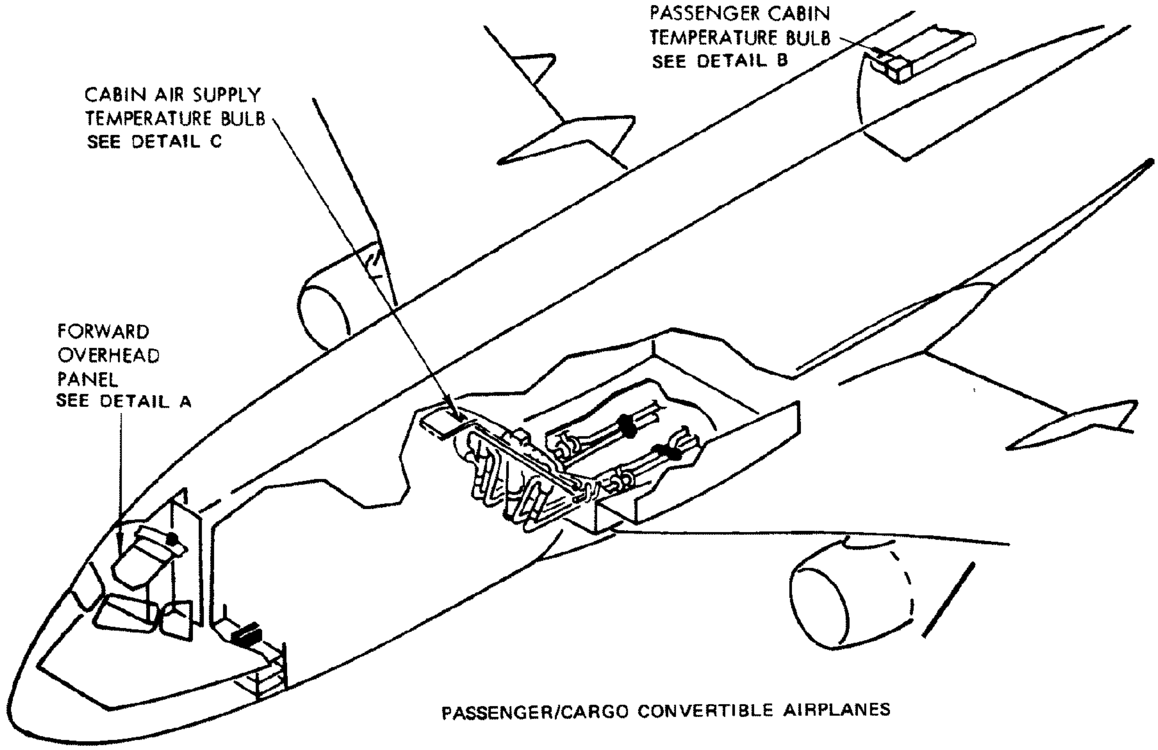
(8) Move the PACK switch to OFF.
(9) Open OVERHEAT circuit breaker.
(10) Install connector to pack valve limit switch.
(11) Close OVERHEAT circuit breaker.
(12) Close air conditioning equipment bay doors.
(13) If no longer required, remove electrical power from airplane.

TEMPERATURE INDICATING SYSTEM - DESCRIPTION

1. General
   A. The temperature indicating system permits monitoring passenger cabin temperature and passenger cabin air supply temperature from the control cabin. The system also provides the crew an early warning of troubles in the air cycle system or air supply and assists in trouble shooting the air conditioning system. The system is not intended as a means for checking accuracy of the various thermal switches and sensors used in air conditioning but may aid in locating one which is malfunctioning.
   B. The temperature indicating system includes a cabin air supply temperature bulb, a passenger cabin temperature bulb, a temperature indicator, and an AIR TEMP selector. (See figure 1.)
   C. Temperature bulbs are discussed in sections 21-51-0, Air Cycle System and 21-61-0, Conditioned Air Temperature Control. It should be noted however, that the slight lag in temperature indicating systems with respect to thermal switch overheat protection of air cycle system and temperature control and the location of temperature bulbs prevents the use of the temperature indicating systems for checking out accuracy of the other thermal sensing devices. The temperature bulb in the passenger cabin air supply duct is for sensing air temperature before it enters the cabin. Air temperature at this location is a result of the position of both mix valves. Since control cabin and passenger cabin temperature requirements are likely to be different, supply temperature does not reflect either air cycle system condition so long as both are operating. A malfunction in either system however, which causes a sudden temperature change, will be noted on the indicator.
2. Temperature Indicator
   A. Passenger cabin air supply and passenger cabin temperature may be monitored by one temperature indicator on the forward overhead panel. Each temperature is read separately according to the position of the AIR TEMP selector.
   B. The indicator is of the electrical resistance, voltage compensated type and operates on 28-volt dc current. The indicator is provided to assist in air conditioning operation, especially during manual control, and to give an early indication of what is taking place in the air conditioning system. It is not intended for checking accuracy of the different thermal switches although it does provide a valuable reference for comparing individual air cycle system operation during trouble shooting. When comparing duct temperature between systems, remember that air from the left system enters the distribution duct a greater distance from the duct temperature bulb than it does from the right system. As a result environmental conditions will affect a duct temperature reading more during left air cycle system operation than during right system operation. With both air cycle systems operating the SUPPLY DUCT (CABIN INLET) temperature represents the resultant temperature from both packs.

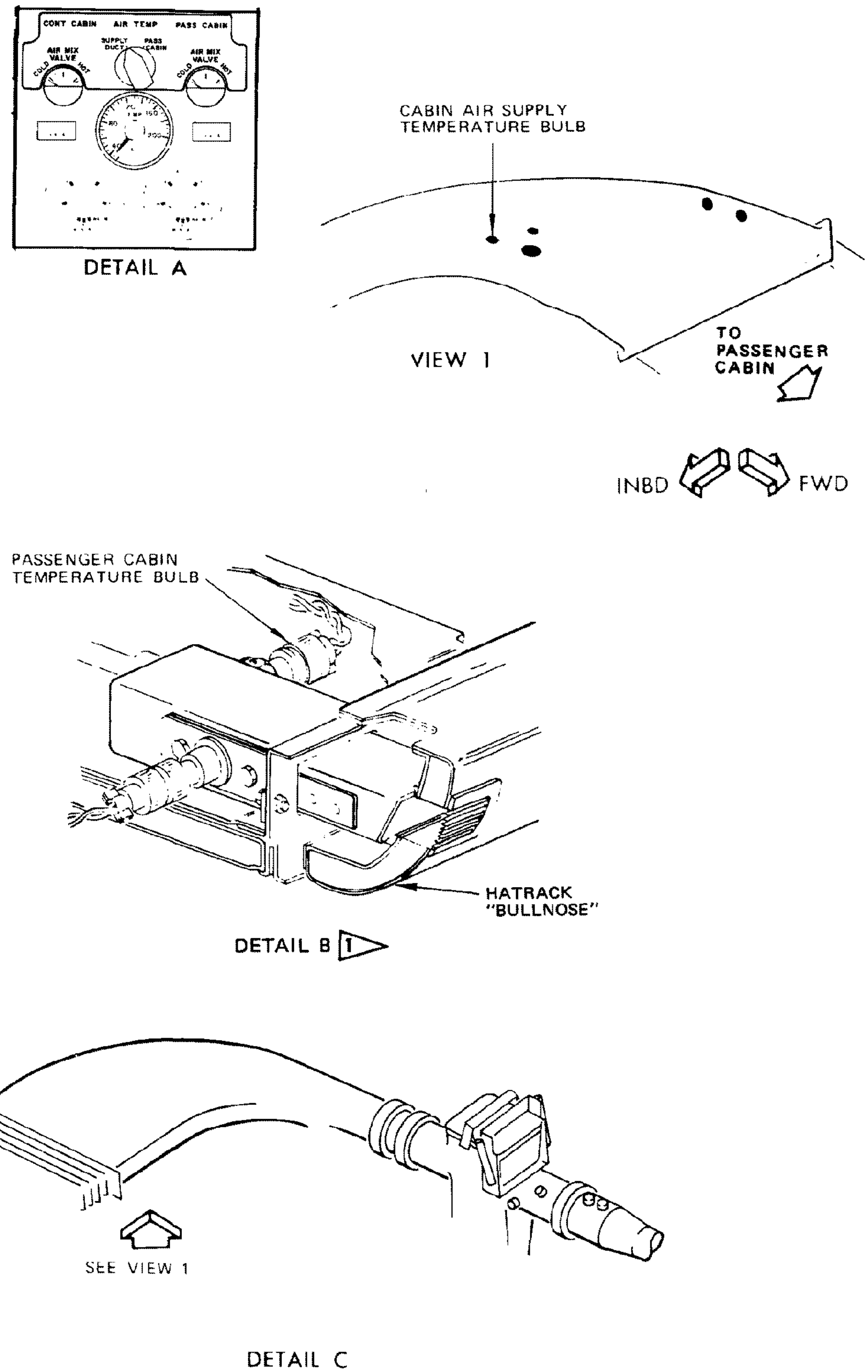


STANDARD PASSENGER AIRPLANES

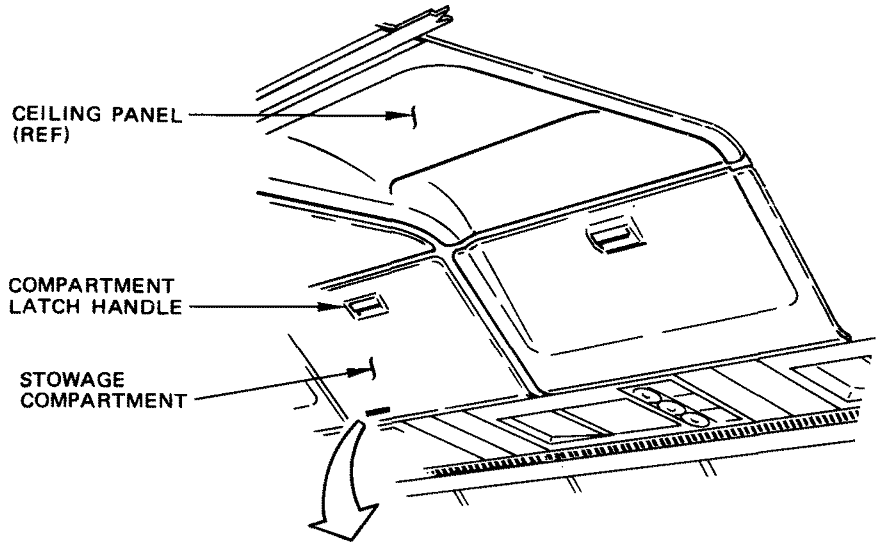


PASSENGER/CARGO CONVERTIBLE AIRPLANES

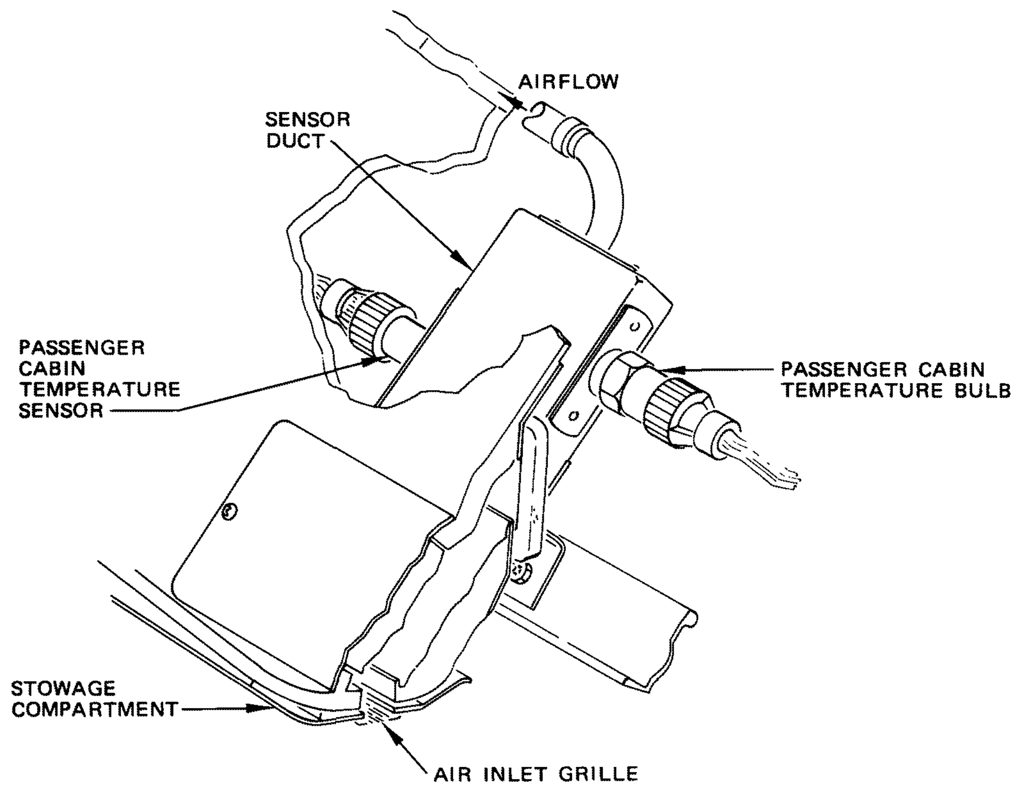
Temperature Indicating System Component Location
Figure 1 (Sheet 1)



Temperature Indicating System Component Location
Figure 1 (Sheet 2)



DETAIL D 2



Temperature Indicating System Component Location
Figure 1 (Sheet 3)

3. Air Temp Selector Switch
   A. The AIR TEMP selector switch is provided to permit switching from one temperature reading to another without the necessity for more than one temperature indicator. Each position completes a circuit through a temperature bulb whose resistance varies with changing temperature. There is no OFF position on the selector, therefore it is recommended that the selector be left in the SUPPLY DUCT (CABIN INLET) position except when spot checking other temperature. In the supply duct position the indicator will reflect sudden changes in temperature of either system considerably faster than in the passenger cabin position.

CABIN AIR SUPPLY TEMPERATURE BULB - REMOVAL/INSTALLATION

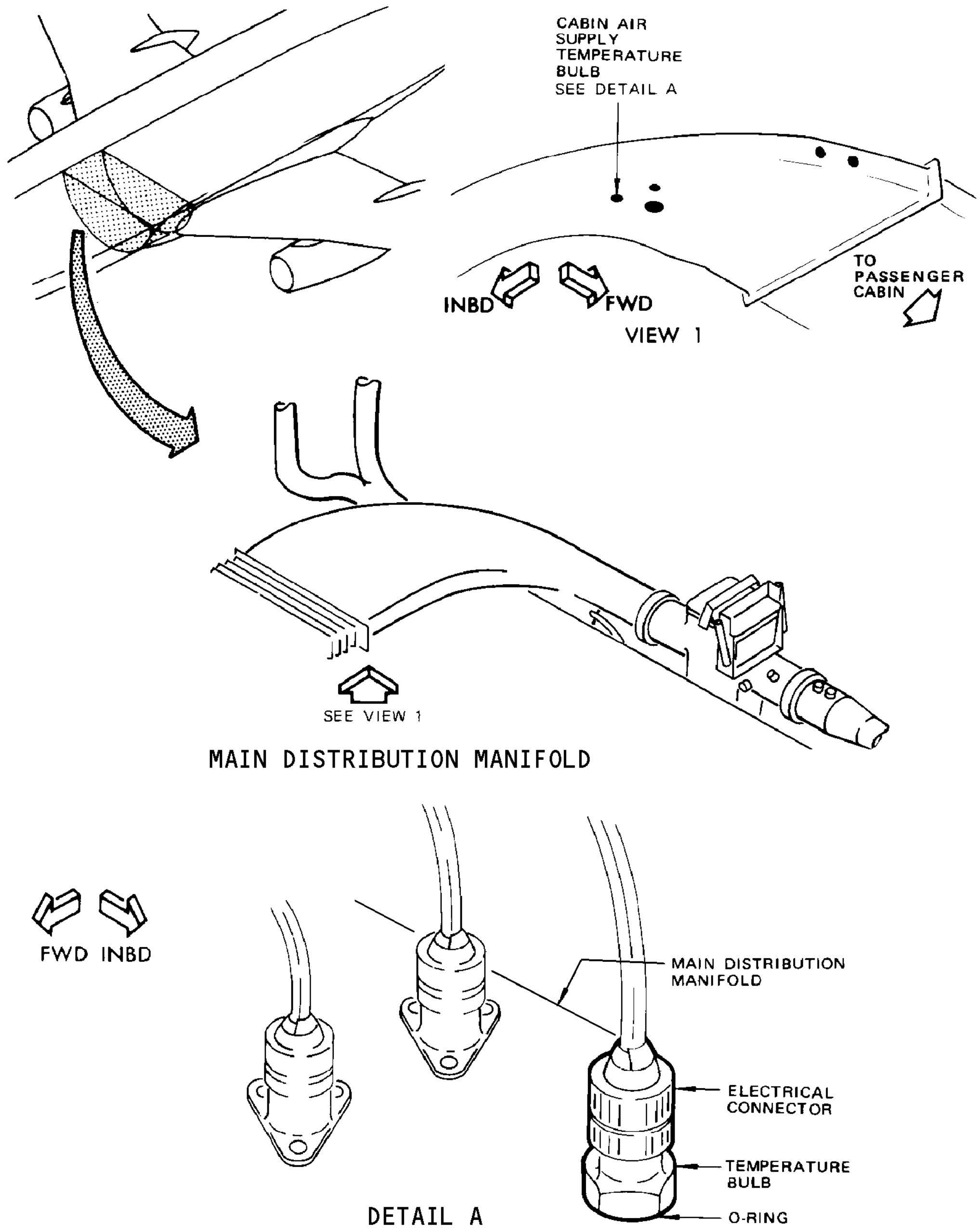
1. General
   A. The cabin supply duct temperature bulb is located on the main distribution manifold. (See figure 401.) Access to the bulb is through the aft bulkhead of the forward cargo compartment.
2. Prepare for Removal of Duct Temperature Bulb
   A. Open TEMP IND circuit breaker on P6-2 circuit breaker panel.
   B. Remove center portion of forward cargo compartment aft bulkhead to gain access to main distribution manifold.
   C. On airplanes with protective shield, remove three screws securing shield to main distribution manifold.
3. Remove Duct Temperature Bulb
   A. Disconnect electrical connector from duct temperature bulb. (See figure 401.)
   B. Unscrew temperature bulb from duct receptacle and remove temperature bulb and gasket.
4. Install Duct Temperature Bulb
   A. Place O-ring gasket on temperature bulb, screw bulb into duct receptacle and tighten. (See figure 401.)

      NOTE: When new bulb is installed, remove asbestos type gasket supplied with bulb and replace with O-ring type.

   B. Connect electrical connector to duct temperature bulb.
   C. Connect external electrical power.
   D. Close TEMP IND circuit breaker on load control center circuit breaker panel P6-4.
   E. Move air temperature selector to SUPPLY DUCT and check that a positive reading registers on the temperature indicator.

      NOTE: If air conditioning has not been in operation the reading will be approximately the temperature of the forward cargo compartment.

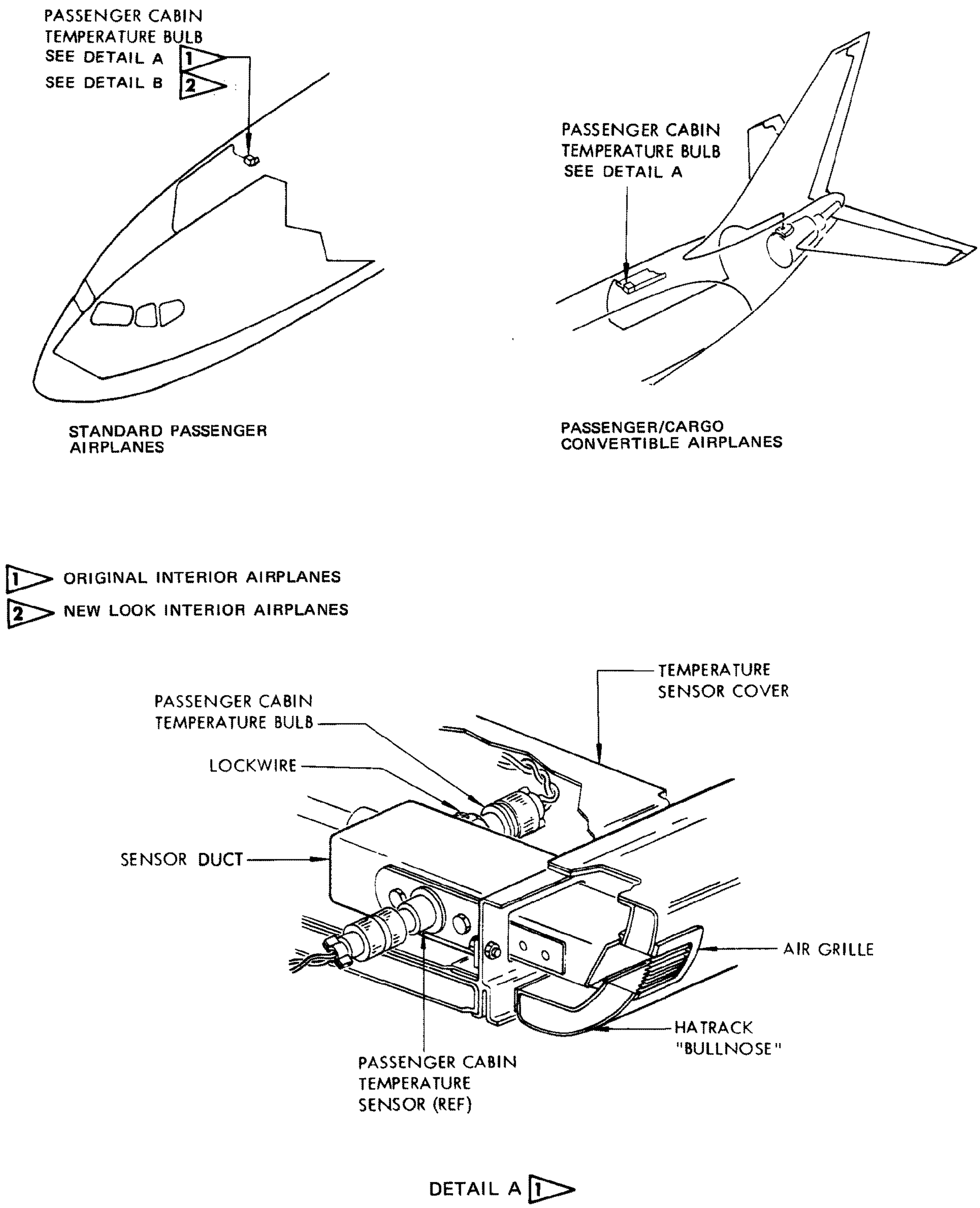
5. Restore Airplane to Normal Configuration
   A. Determine whether there is any further need for electrical power on airplane, if not, remove external power.
   B. On airplanes with protective shield, place shield in position and secure with three screws.
   C. Install center portion of forward cargo compartment aft bulkhead.



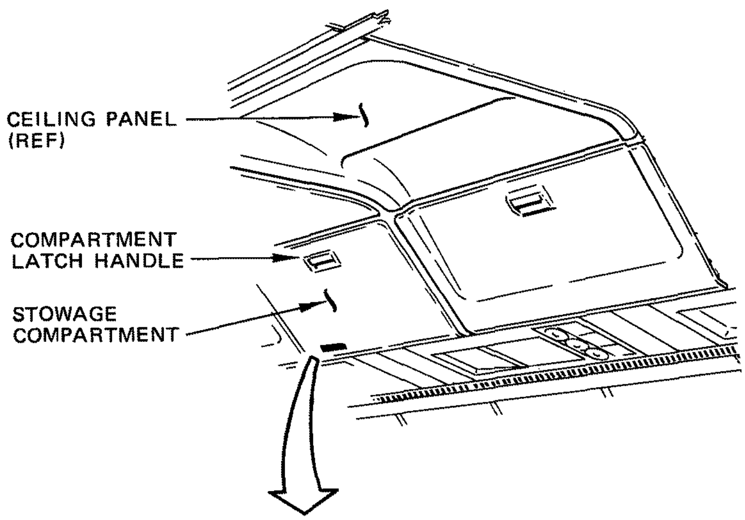
Cabin Air Supply Temperature Bulb Installation
Figure 401

PASSENGER CABIN TEMPERATURE BULB - REMOVAL/INSTALLATION

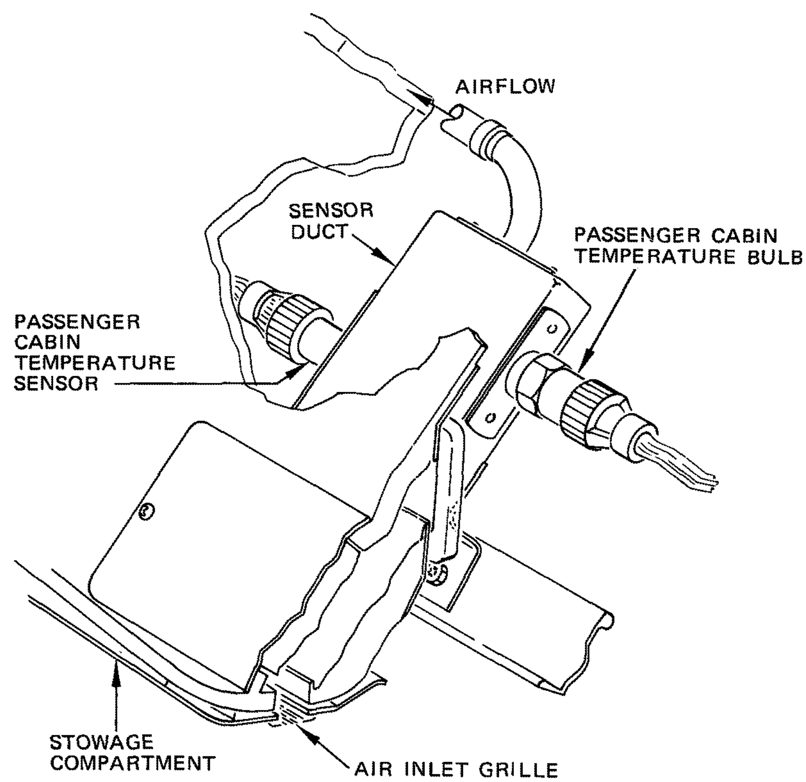
1. General
   A. The passenger cabin temperature bulb is installed with the passenger cabin temperature sensor inside a duct located in the hatrack bullnose or below the stowage compartment (Fig. 401).
2. Prepare for Removal of Passenger Cabin Temperature Bulb
   A. Open TEMP IND circuit breaker on load control center circuit breaker panel P6.
   B. Remove bolts holding temperature sensor cover to hatrack and remove temperature sensor cover or remove stowage compartment. Refer to Chapter 25, Equipment/Furnishings for removal of stowage compartment and Fig. 401 for installation effectivity.
3. Remove Passenger Cabin Temperature Bulb (Fig. 401)
   A. Disconnect electrical connector from temperature bulb.
   B. Remove lockwire, unscrew temperature bulb from sensor duct and remove temperature bulb.
4. Install Passenger Cabin Temperature Bulb (Fig. 401)
   A. Screw temperature bulb into sensor duct and lockwire.
   B. Connect electrical connector to temperature bulb.
   C. Check passenger cabin temperature bulb operation.
      (1) Connect external power and energize load control center circuit breaker panel P6.
      (2) Close TEMP IND circuit breaker on load control center circuit breaker panel P6.
      (3) Place AIR TEMP selector switch to passenger cabin position and check that temperature indicator reads approximately the same as ambient temperature.
5. Restore Airplane to Normal Configuration
   A. Position temperature sensor cover and bolt in place or install stowage compartment.
   B. Remove electrical power if no longer required.



Passenger Cabin Temperature Bulb
Figure 401 (Sheet 1)



DETAIL B 2



Passenger Cabin Temperature Bulb
Figure 401 (Sheet 2)