SECTION 13

UTILITY SYSTEMS

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13-1. HEATING, VENTILATING, AND DEFROSTING SYSTEM (NON-TURBOCHARGED AIRCRAFT).

13-2. Ram air, routed through ducts connected to the horizontal baffles of the front engine, is ducted through the heat exchange section of the engine exhaust mufflers to mixing airboxes on the forward side of the firewall. Unheated ram air, routed through ducts connected to the vertical baffles of the front engine, is also ducted to these airboxes. The position of a valve on the forward end of each airbox controls the temperature of air entering the cabin. Air is distributed into the forward cabin area through holes in two ducts, one located behind each airbox, on the aft side of the firewall. The rear cabin area receives air which flows around and between the front seats. Additional air for the rear cabin is routed through ducts attached to the firewall ducts. Openings for these ducts are provided at the forward door posts in the side panels. Two temperature control knobs on the instrument panel individually control the position of a valve in each airbox. Rotating the knob clockwise gradually opens the heated air passage and simultaneously closes the unheated air passage. Intermediate settings blend heated and unheated air. The DEFROST knob operates a damper valve at the defroster supply duct. Pulling the knob gradually increases airflow to the defroster outlets. In addition to fresh air supplied through the heating and ventilating system, individual fresh air control valves are provided for the occupant of each seat, including the optional fifth and sixth seats, when installed. The air control valves for the pilot and copilot are located in a plenum box mounted immediately forward of the overhead console. This plenum box receives fresh air from ducts routed from an inlet in the leading edge of the wing root fairing of each wing. The four rear seat air control valves, mounted above the side windows at each seat, receive fresh air from ducts routed from an inlet in the leading edge of each wing. Rotating air control valves counterclockwise gradually increases air flow through each valve. A cabin air exhaust vent is installed in the rear firewall to route stale air overboard through an outlet duct. The exhaust vent also provides better circulation of incoming cabin air. Beginning with the 1967 model, the cabin air ventilation system was redesigned to incorporate a plenum chamber with a valve which meters the incoming cabin ventilation air. This provides a chamber for the expansion of cabin air which greatly reduces inlet air noise. An additional floor air distribution box is added to each duct across the aft side of the firewall.

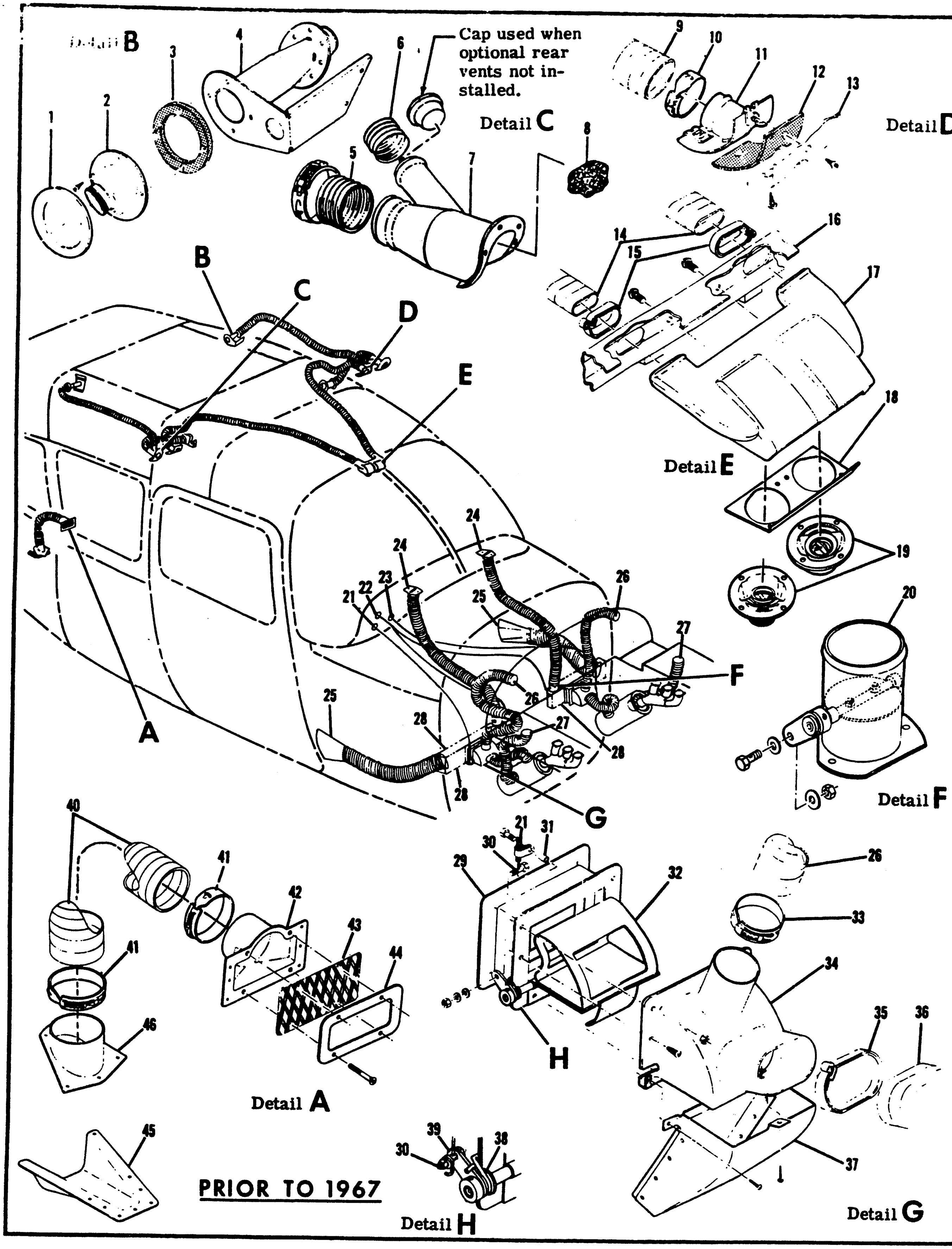


Figure 13-1. Heating, Ventilating, and Defrosting Systems (Sheet 1 of 7)

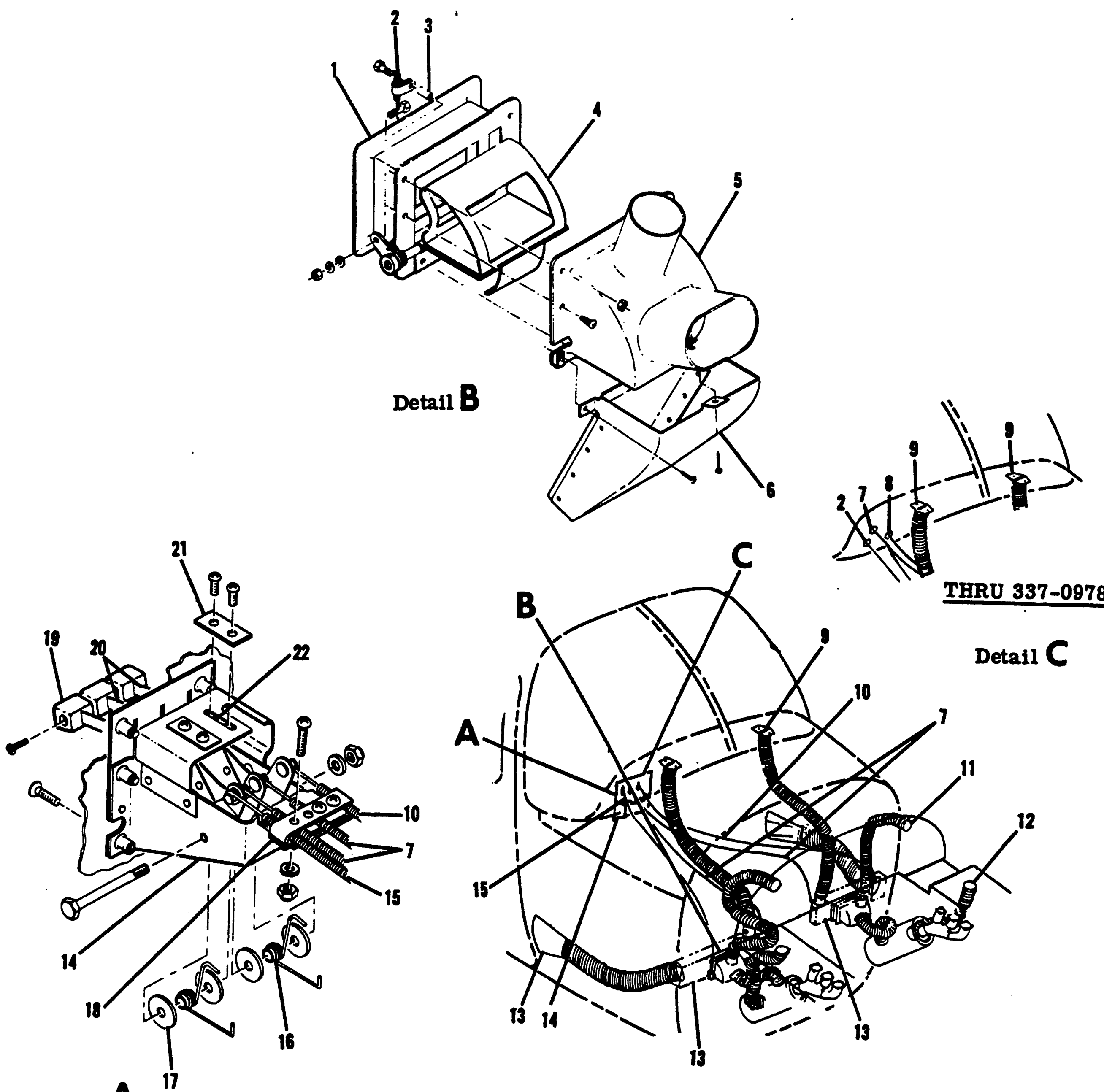
13-3. Beginning with the 1969 Models 337D and T337D, the aircraft are equipped with quadrant-type heater controls. The standard aircraft has three vertical operating controls; left and right cabin air controls and the defroster control. The "OFF" position for all three controls is at the top of the panel. The cabin air control levers increase the amount of fresh air entering the cabin as the control is moved downward. The maximum fresh air position is just below the center of the panel. As the controls are moved downward from this position, the fresh air is slowly closed off and heat is added to the system. Maximum heat is attained when the control is in the full down position. The heater controls on turbo-charged aircraft have the cabin air volume control on the left and the defroster control in the center with the "OFF" position of both controls at the top of the panel. The thermostat control is located on the right with the "LOW" position at the top of the panel. Refer to figure 13-1 for heater controls beginning with the 337D Series.

13-4. TROUBLE SHOOTING. Most of the operational troubles in the heating, ventilating, and defrosting system are caused by sticking or binding air valves and their controls, damaged air ducting, or defects in the exhaust muffler. In most cases, lubrication will free sticking or binding parts. Damaged or broken parts should be repaired or replaced. Check that flexible hoses are properly secured and replace hoses that are crushed, frayed, burned, or otherwise damaged. Check that valves respond freely when operated by their controls, that they move in the correct direction, and that they move through their full range of travel and seal properly. If fumes are detected in the cabin, a very thorough inspection of the exhaust muffler should be conducted. Refer to applicable paragraphs in Section 10 for this inspection. Since any holes or cracks may permit engine exhaust fumes to enter the cabin, replacement of defective parts is imperative because exhaust fumes in the cabin are extremely dangerous.

13-5. REMOVAL AND INSTALLATION OF COMPONENTS. Figure 13-1 shows the various parts of the heating, ventilating, and defrosting systems, and may be used as a guide for replacement of parts. When assembling components shown on sheet 6 of figure 13-1, apply Loctite, Grade A-A to all contacting parts of valve plate (3), star washer (13), plate (14), shaft (18), and associated nuts at final assembly. Seal between plate assembly (5) and lower housing (8) with Presstite 579.6 sealer, or equivalent, as required to prevent air leaks. Use tire talc (powdered soapstone) between plate (14) and seal (15). At both ends of springs, use Dow Corning Silicone grease #33 medium, or equivalent. When assembling plenum chamber and silencer assembly, torque nuts to 40 pound-inches. When installing a new flexible hose, cut to length and install in the original routing. Trim the hose winding shorter than the hose to allow hose clamps to be fitted securely.

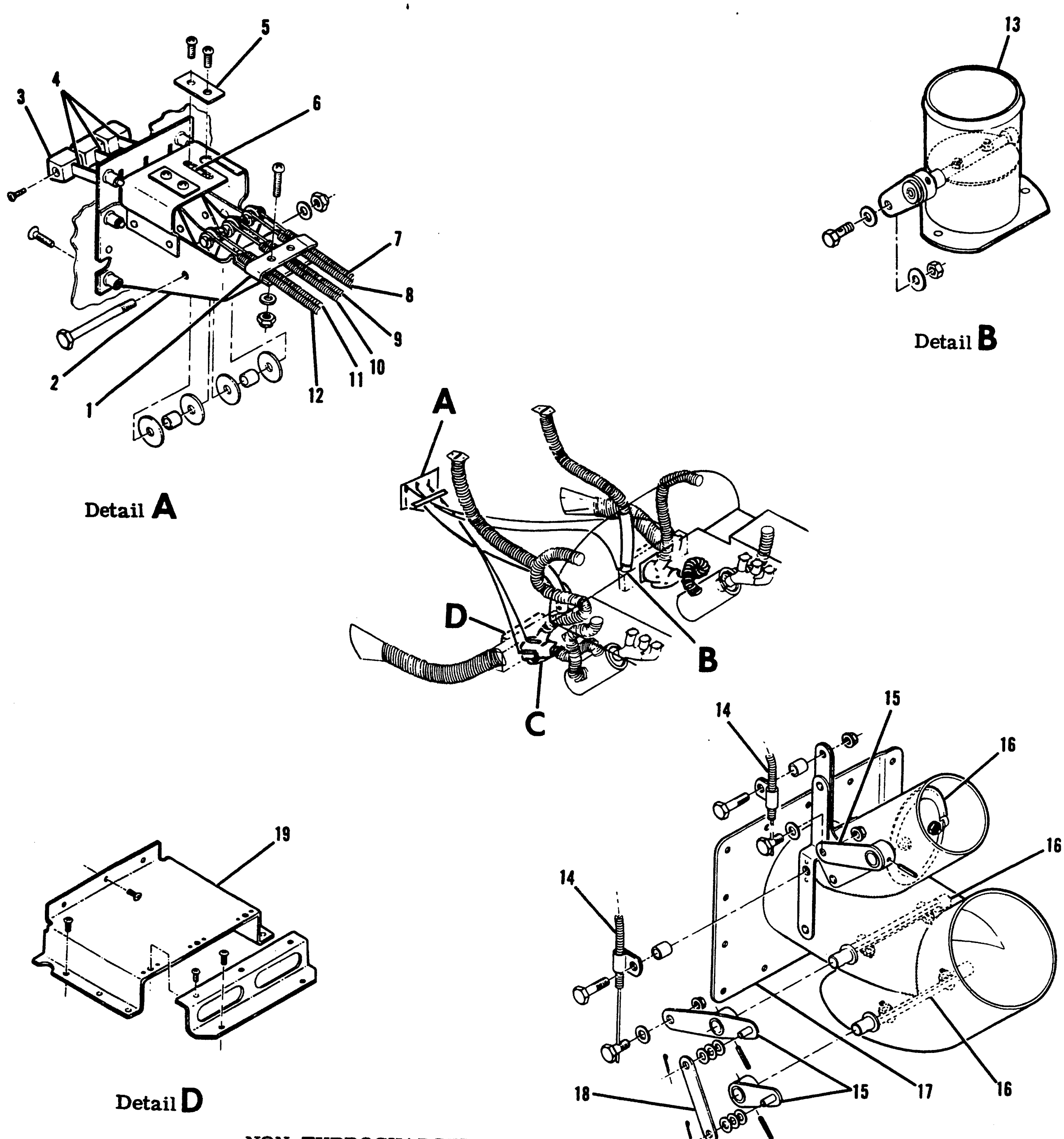
References for Figure 13-1 (Sheet 1)

1. Cover
2. Valve
3. Gasket
4. Air Outlet
5. Air Duct
6. Air Duct
7. Air Scoop
8. Noise Filter
9. Air Duct
10. Clamp
11. Adapter
12. Seal
13. Wing Leading Edge
14. Air Duct
15. Clamp
16. Aircraft Structure
17. Plenum Chamber
18. Plate
19. Valve Assembly
20. Defrost Valve Outlet
21. Right Hand Heat Control
22. Defroster Control
23. Left Hand Heat Control
24. Defrost Outlet
25. Air Outlet Duct
26. Fresh Air Inlet Duct
27. Air Duct
28. Heater Duct Assembly
29. Valve Assembly
30. Clamp Bolt
31. Spacer
32. Body Valve
33. Clamp
34. Air Box Assembly
35. Clamp
36. Air Duct
37. Baffle
38. Spring
39. Arm
40. Air Outlet Duct
41. Clamp
42. Adapter
43. Screen
44. Retainer
45. Air Outlet
46. Exhaust Vent Adapter



1. Valve Assembly
2. Right Hand Heat Control
3. Spacer
4. Valve Body
5. Air Box Assembly
6. Baffle
7. Defroster Control
8. Left Hand Heat Control
9. Defroster Outlet
10. Left Hand Air Mixture Control
11. Fresh Air Inlet Duct
12. Air Duct
13. Heater Duct Assembly
14. Heater Control Assembly
15. Right Hand Air Mixture Control
16. Spring
17. Washer
18. Clamp
19. Knob
20. Lever and Cam Assembly
21. Stiffener
22. Spring

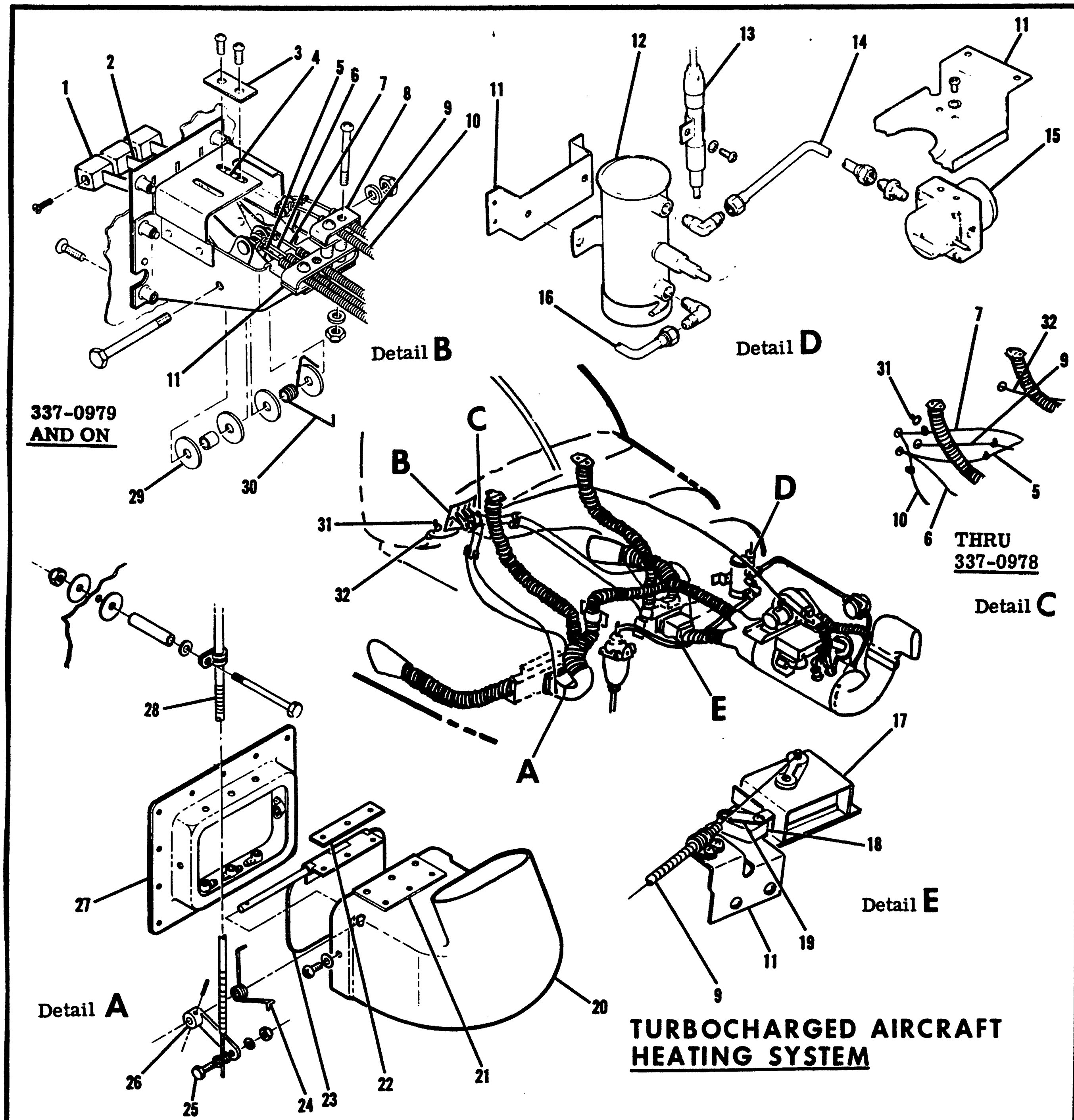
Figure 13-1. Heating, Ventilating, and Defrosting Systems (Sheet 2 of 7)



NON-TURBOCHARGED AIRCRAFT
HEATING SYSTEM (BEGINNING WITH 1971)

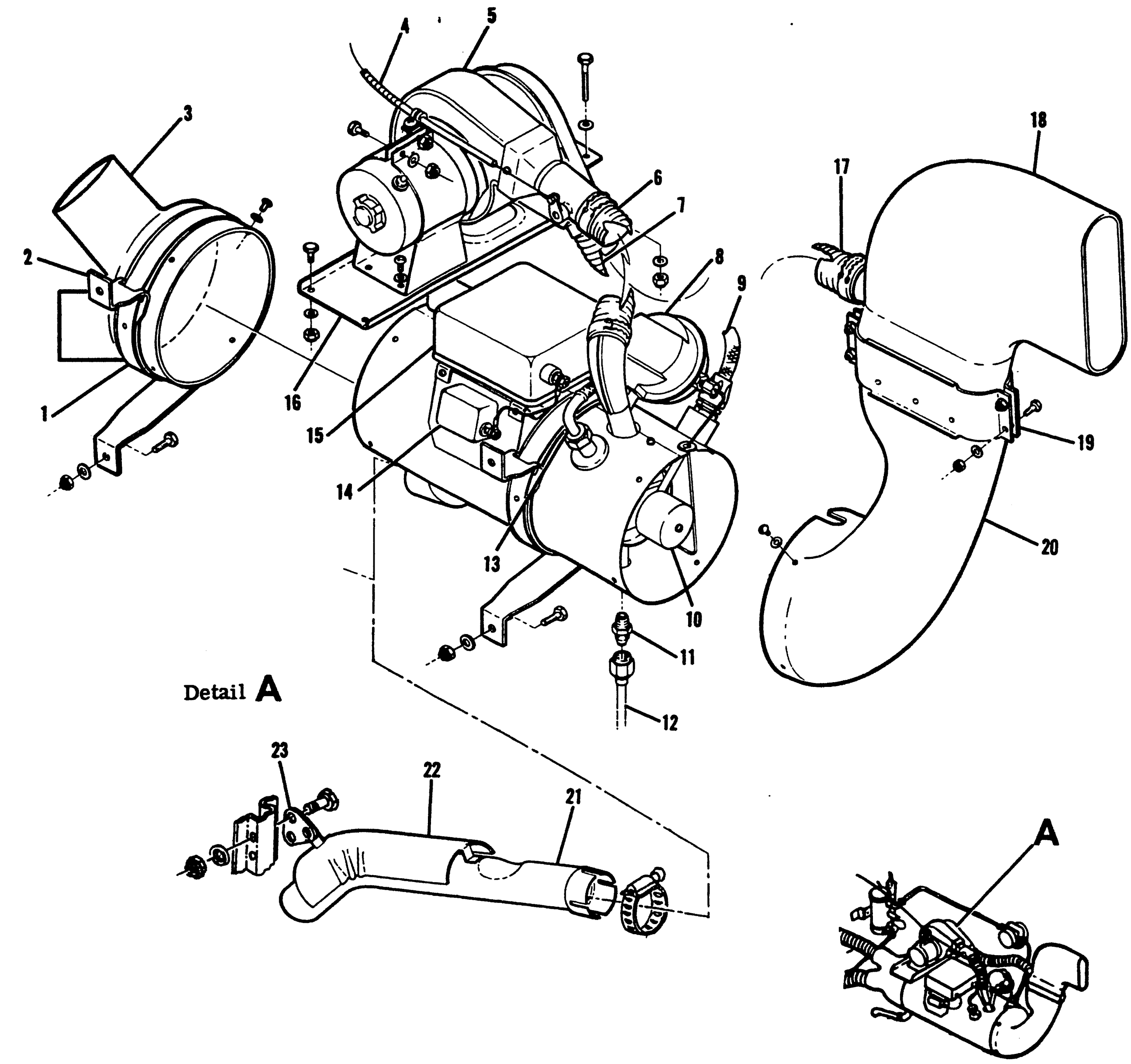
1. Clamp
2. Control Box
3. Knob
4. Lever and Cam Assembly
5. Stiffener
6. Spring
7. LH Air Control
8. RH Air Control
9. LH Heat Control
10. RH Heat Control
11. LH Defrost Control
12. RH Defrost Control
13. Defrost Valve Outlet
14. Control
15. Arm Assembly
16. Valve Assembly
17. Plenum Chamber
18. Link
19. Floor Heater Vent

Figure 13-1. Heating, Ventilating, and Defrosting Systems (Sheet 3 of 7)



1. Knob
2. Lever and Cam Assembly
3. Stiffener
4. Spring
5. Left Hand Air Mixture Control
6. Right Hand Air Mixture Control
7. Left Hand Defroster Control
8. Clamp
9. Temperature Control
10. Right Hand Defroster Control
11. Bracket
12. Fuel Pump
13. Electrical Lead
14. Fuel Outlet Line
15. Fuel Regulator and Shut-Off Valve
16. Fuel Inlet Line
17. Heater Switch Assembly
18. Switch
19. Actuator
20. Valve Body
21. Reinforcement
22. Shim
23. Valve Plate
24. Spring
25. Clamp Bolt
26. Control Arm
27. Valve Seat Assembly
28. Air Mixture Control
29. Washer
30. Spring
31. Heater Start Switch
32. Aux Cabin Heat Control

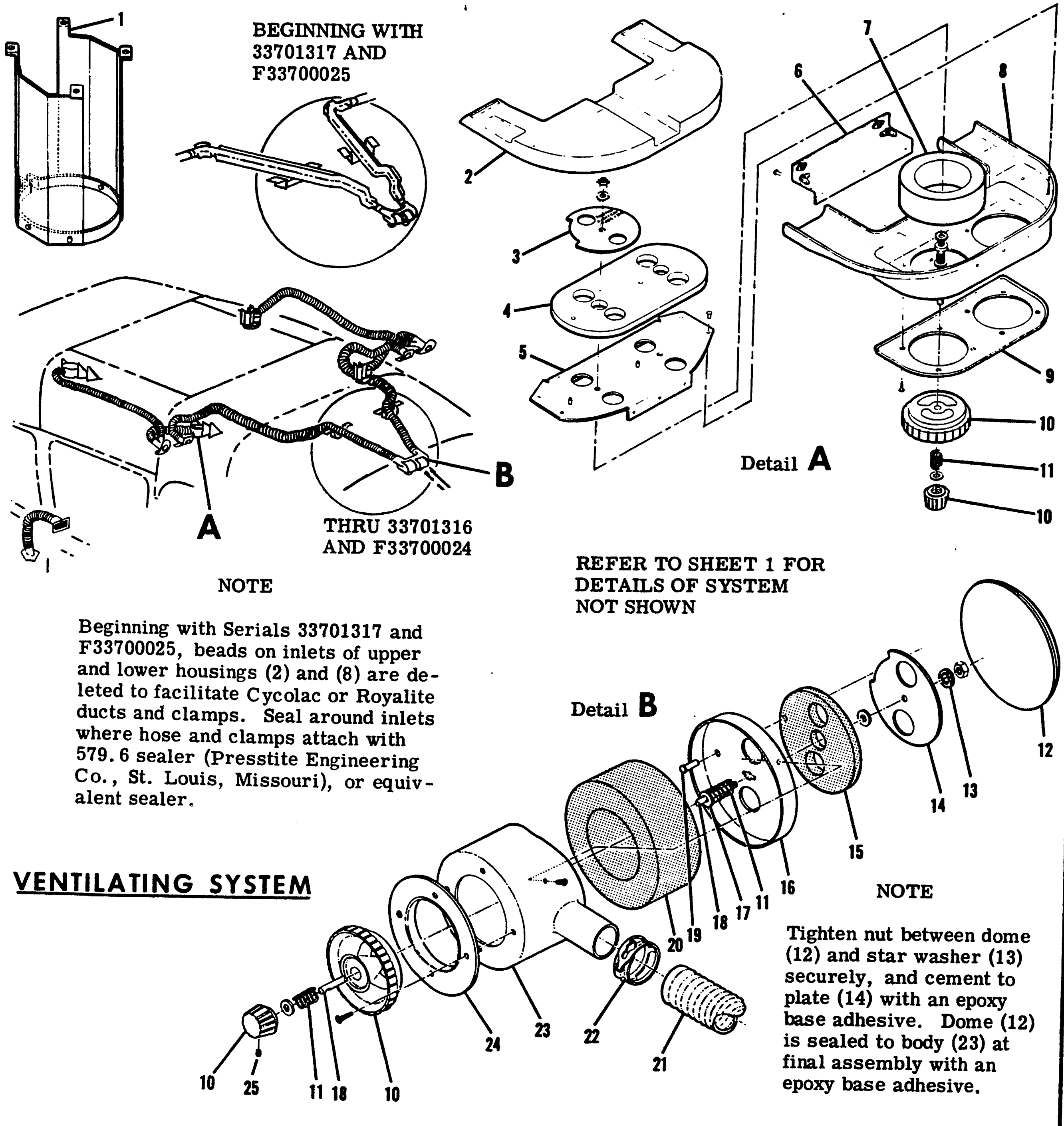
Figure 13-1. Heating, Ventilating, and Defrosting Systems (Sheet 4 of 7)



TURBOCHARGED AIRCRAFT HEATER DETAILS

1. Clamp
2. Support Assembly
3. Outlet Duct
4. Cabin Heat Control
5. Combustion Air Blower
6. Combustion Air Blower Outlet
7. Combustion Air Blower Inlet
8. Combustion Air Pressure Switch
9. Fuel Inlet Line
10. Solenoid Valve
11. Nipple
12. Drain Line
13. Spark Plug Lead
14. Radio Noise Filter
15. Ignition Assembly
16. Bracket
17. Combustion Air Blower Inlet
18. Fresh Air Adapter
19. Clamp
20. Inlet Duct
21. Exhaust Stack Extension
22. Shroud
23. Bracket

Figure 13-1. Heating, Ventilating, and Defrosting Systems (Sheet 5 of 7)



NOTE

Beginning with Serials 33701317 and F33700025, beads on inlets of upper and lower housings (2) and (8) are deleted to facilitate Cycolac or Royalite ducts and clamps. Seal around inlets where hose and clamps attach with 579.6 sealer (Presstite Engineering Co., St. Louis, Missouri), or equivalent sealer.

NOTE

Tighten nut between dome (12) and star washer (13) securely, and cement to plate (14) with an epoxy base adhesive. Dome (12) is sealed to body (23) at final assembly with an epoxy base adhesive.

1. Bracket
2. Upper Housing
3. Valve Plate
4. Sealer
5. Plate Assembly
6. Bracket
7. Muffler Ring
8. Lower Housing
9. Escutcheon
10. Knob
11. Spring
12. Dome
13. Star Washer
14. Plate
15. Seal
16. Cap Assembly
17. Washer
18. Shaft
19. Spacer
20. Insulator
21. Hose
22. Clamp
23. Body
24. Escutcheon
25. Setscrew

Figure 13-1. Heating, Ventilating and Defrosting Systems (Sheet 6 of 7)

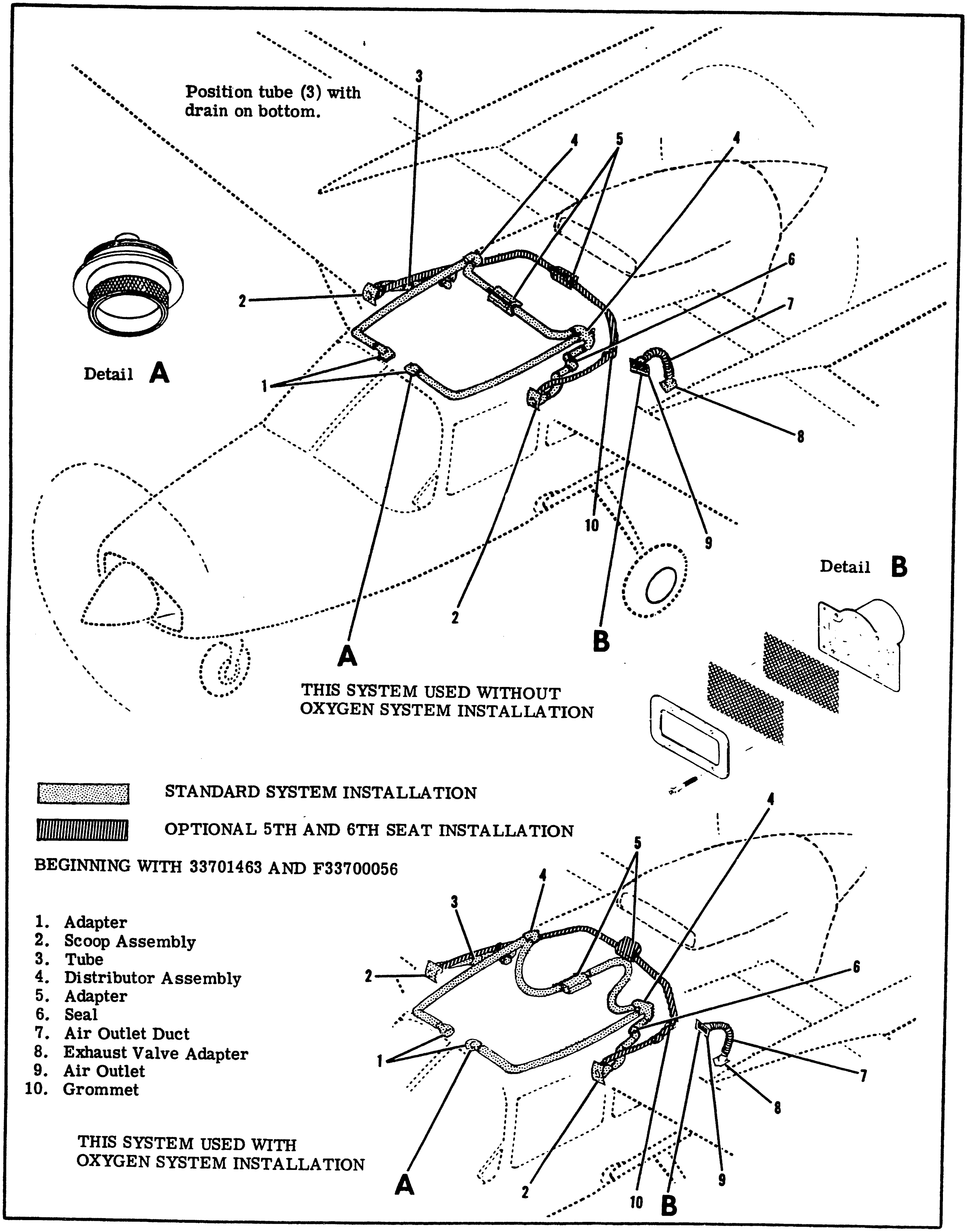


Figure 13-1. Heating, Ventilating and Defrosting Systems (Sheet 7 of 7)

13-6. HEATING, VENTILATING AND DEFROSTING SYSTEM (TURBOCHARGED AIRCRAFT).

13-7. Ram air, routed through an elbow duct, connected to an opening in the left side of the forward engine nose cap, is ducted through the heat exchange section of a gasoline heater mounted in the left side of the forward engine cowling, to the aircraft heating, ventilating, and defrosting systems. A portion of this ram air is routed through a small opening in the aft part of the elbow duct, to a combustion air blower mounted immediately above the heater. The combustion air blower supplies air to the combustion chamber of the heater in such a way that a whirling motion is created. Fuel is routed from the fuel strainer in the forward wheel well, through an electric fuel pump on the forward side of the front firewall to a fuel solenoid regulator which regulates fuel pressure to 7 psi. Fuel from the regulator is routed to a spray nozzle in the combustion chamber of the heater where the fuel-air mixture is ignited by a spark plug. Electric current for ignition is supplied by an ignition unit that converts 24-volt current to a high-voltage, oscillating current, which provides a continuous spark. Electric current is supplied when the heater switch is turned from OFF to the START position momentarily, then allowed to return to the RUN position.

CAUTION

Do not operate heater switch unless front engine is running. The heater is dependent upon front-engine propeller slipstream pressure for heater airflow during ground operation. Heater operation in flight is independent of engine operation.

The stable, whirling flame sustains combustion under the most adverse conditions because it is whirled around itself many times. This type of flame is self-piloting, and ignition is continuous. The burning gases travel the full length of the combustion chamber, flow around the outside of the chamber, pass through cross-over passages into an outer radiating area, then travel the length of the assembly and out the exhaust. This causes the ventilating air passing through the heater to come in contact with two or more heated cylindrical surfaces. An auxiliary heat knob operates a butterfly valve in the combustion air blower outlet. Pulling out the control knob partially closes the butterfly valve and decreases the flow of combustion air into the heater. As combustion airflow increases, a combustion air pressure switch mounted on the combustion air inlet tube of the heater closes, and actuates the ignition unit and solenoid regulator valve. Fuel then flows through the regulator valve into the spray nozzle, which injects a conical spray of fuel into the combustion chamber where the spark plug is already sparking; thus combustion occurs. The temperature control rheostat knob actuates a duct switch mounted on the left heater duct, on the aft side of the front firewall. The duct switch acts as a thermostat which senses the heater air outlet temperature. As the heated air exceeds the thermostat setting, the thermostat automatically closes the solenoid in the regulator valve, stopping fuel flow into the heater. As the heater cools, the thermostat opens the solenoid, allowing fuel to flow. Combustion takes place since the spark plug is continuously sparking whenever the heater switch is turned from the OFF position. By cycling, on and off, the heater maintains an even air temperature in the cabin. The heater is protected by an overheat switch mounted on the heater jacket to sense the outlet temperature of the ventilating airstream. Should this temperature become too high, the overheat switch will automatically shut off the flow of fuel to the heater. When the heater is turned off, unheated ram air passes through the heater to the aircraft ventilating and defrosting systems, described in paragraph 13-2.

13-8. TROUBLE SHOOTING. For trouble shooting of the heating, ventilating, and defrosting distribution system refer to paragraph 13-4. For trouble shooting, maintenance, and overhaul of the gasoline heater, refer to "Cessna Heater and Components Service/Parts Manual."

13-9. REMOVAL AND INSTALLATION OF COMPONENTS. Figure 13-1 illustrates the parts of the heating, ventilating, and defrosting system, and may be used as a guide for replacement of parts. Also refer to paragraph 13-5.

a. Remove the left engine cowling and nose cap.

b. Disconnect:

1. Electrical wires at terminal block.
2. Auxiliary air control (10) at combustion air blower.
3. Drain line (11) at front of heater.
4. Exhaust tube (12) at lower aft end of heater.
5. Fuel line (24) at heater nozzle inlet.

c. Remove:

1. Inlet air hose (17) from combustion air blower.
2. Outlet air hose (22) from combustion air blower and heater inlet.
3. Fresh air adapter (18) from front of heater.
4. Four bolts securing combustion air blower to support brackets and remove combustion air blower.
5. Outlet duct (13) at aft end of heater.
6. Two clamps securing heater to support assemblies.

d. Remove heater from airplane. Reverse the preceding steps to install the heater.

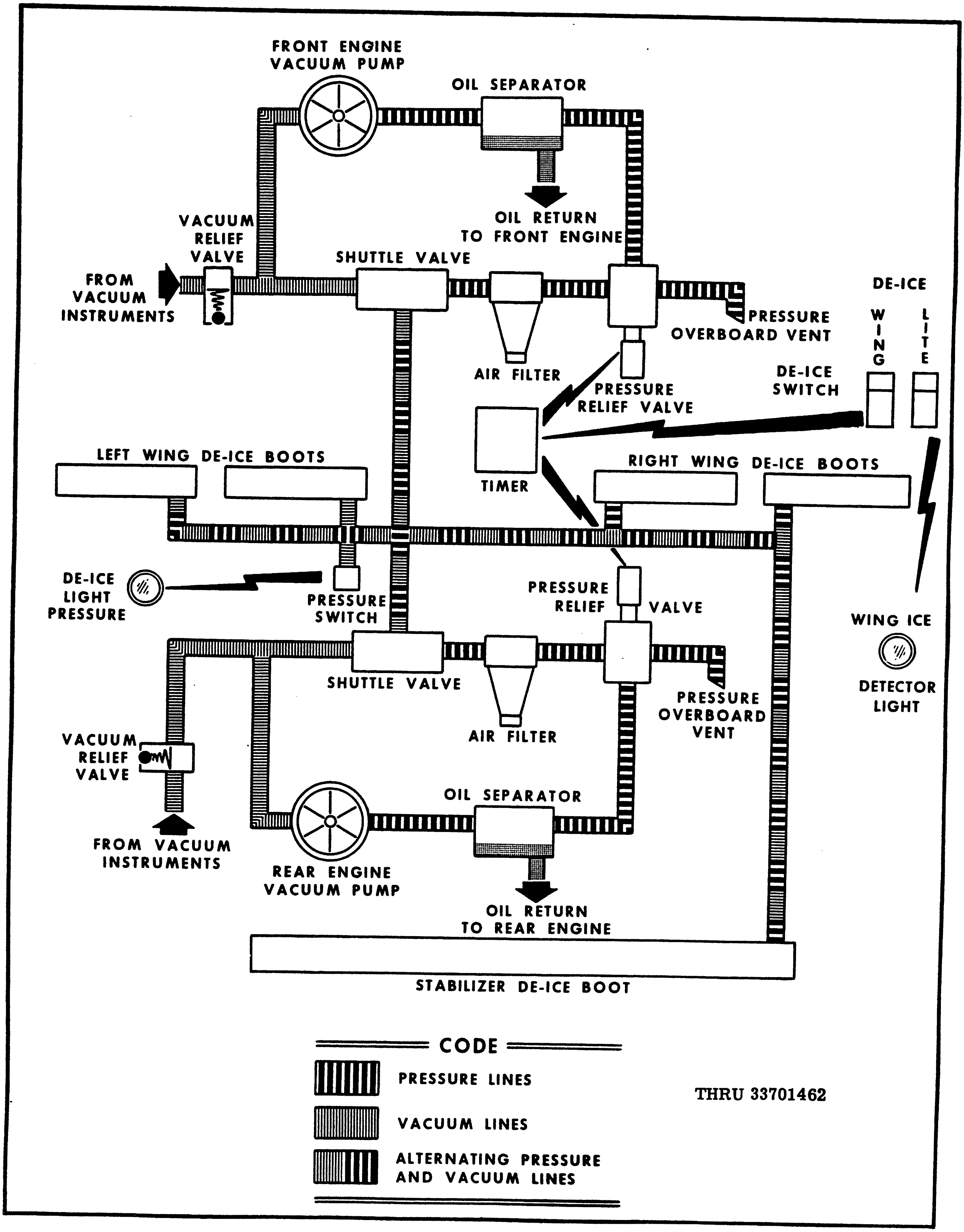
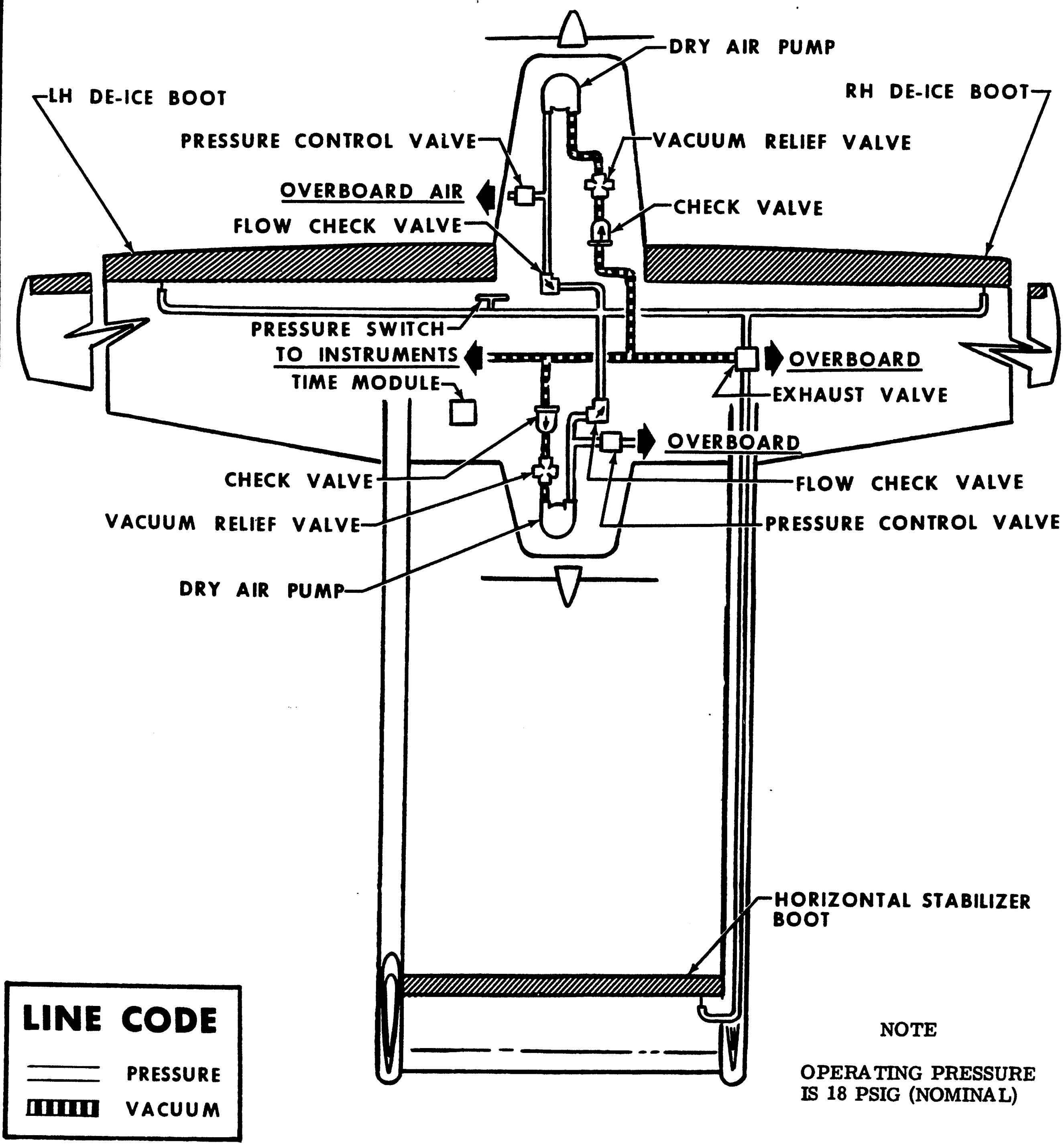


Figure 13-2. De-Ice Schematic (Sheet 1 of 2)



NOTE

OPERATING PRESSURE IS 18 PSIG (NOMINAL)

1. Pressure Control Valve set at 18± PSIG (Nom).
2. Vacuum Relief Valve to be set at 5" HG.
3. Momentary actuation of control switch will provide one 6-second de-icing cycle.

BEGINNING WITH 33701463

Figure 13-2. De-Ice Schematic (Sheet 2 of 2)

13-10. DE-ICE SYSTEM (Thru 33701462).

13-11. An optional light weight de-ice system may be installed on the Models 337 and T337. De-icing of the wing and horizontal stabilizer leading edge is accomplished by inflation and deflation of rubber boots attached to these surfaces. The duration of each inflation and deflation cycle is controlled by valves which in turn are controlled by an electronic timer.

CAUTION

Always allow sufficient ice build-up for efficient ice removal before actuating the de-ice system. If de-ice system is actuated continuously or before ice has reached sufficient thickness, the ice will build up over the boots instead of cracking off.

The de-ice system consists of two engine-driven vacuum pumps with an oil separator, pressure relief valve, air filter, and shuttle valve for each engine. A pressure switch, timer, two boots on the leading edge of each wing, and a boot on the leading edge of the horizontal stabilizer complete the system. The standard vacuum system components also serve the de-ice vacuum system and the vacuum relief valve adjustment should be maintained in the manner outlined in the Relief Valve Adjustment paragraph in Section 14. The standard dry-type vacuum pumps are replaced with oil-lubricated pumps. An ice detector light is incorporated in the left side of the fuselage at the wing leading edge to aid checking for ice formations during night operation.

NOTE

The de-ice system will operate satisfactorily on either or both engines. During single-engine operation, if the vacuum relief valve to the gyros is set too low, suction to the gyros will drop momentarily during the boot inflation cycle. This suction variation can be corrected with proper vacuum relief valve adjustment. Check valves are included in the standard vacuum system, so that the front and rear systems will operate independently.

13-12. DE-ICE SYSTEM OPERATION. An engine-driven vacuum pump is mounted on the top center of each engine accessory housing and provides both pressure and vacuum for the inflation and deflation of the de-ice boots. Air from the outlet (pressure) side of the pump passes through an oil separator, across the pressure relief valve, and overboard when the system is not operating. When the de-ice switch is turned on, the timer closes the pressure relief valve overboard line and directs the air from the pressure side of the vacuum pump through a filter, shuttle valve, and into the de-ice boots for the inflation cycle. Inflation time of the boots is approximately six seconds and the de-ice light on the switch panel should be illuminated during the inflation cycle. At the completion of the inflation cycle, the timer opens the pressure relief valve, returning vacuum pump pressure overboard. Pressure in the boots is returned through the system and overboard through the pressure relief valve. When the shuttle valve has less than one psi against it, it closes and the vacuum side of the vacuum pumps holds the boots in a deflated position. The timer automatically repeats the cycle after a pause of approximately 3 minutes to allow sufficient ice build-up for efficient de-icing.

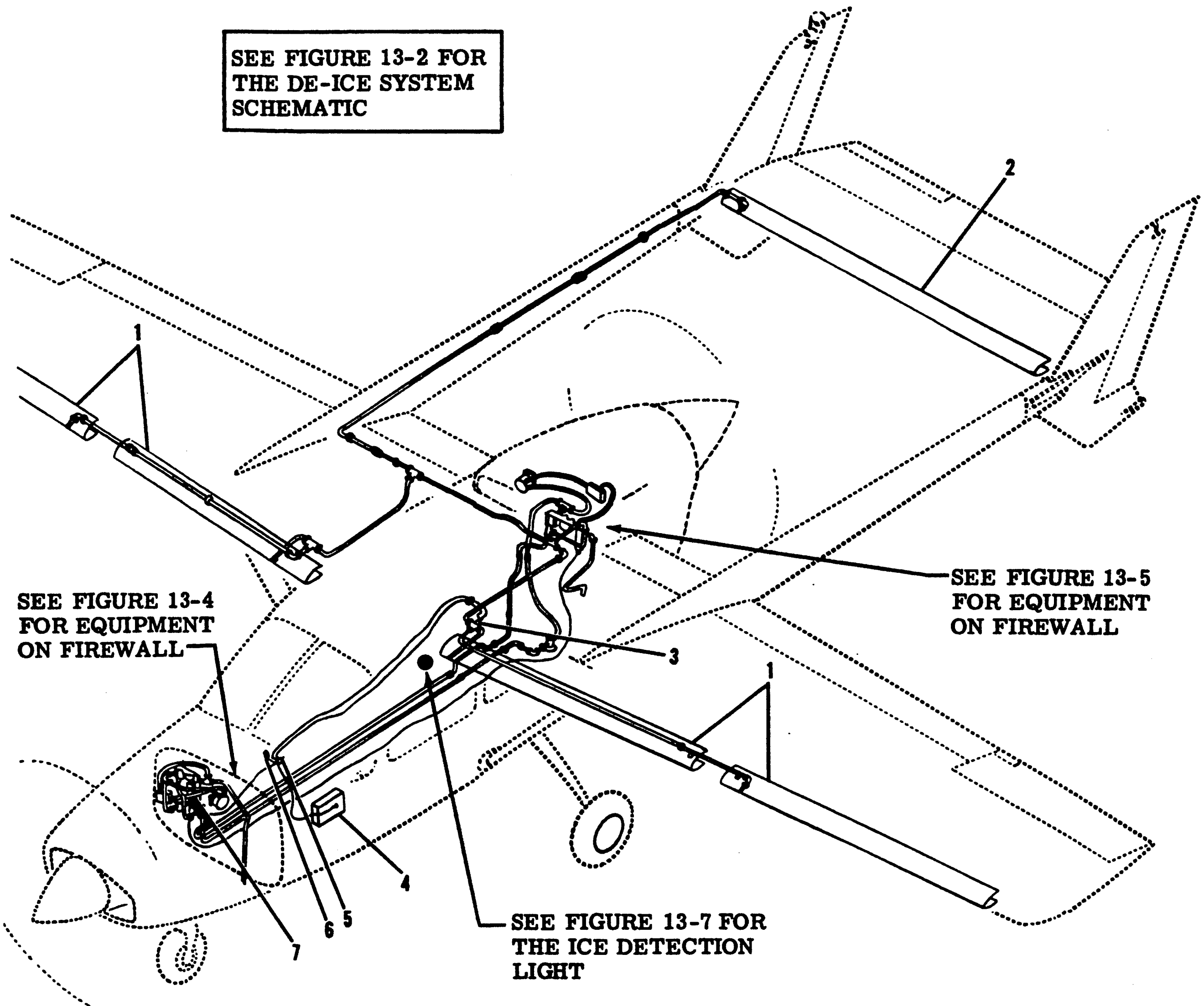
13-13. REMOVAL AND INSTALLATION OF DE-ICE SYSTEM. For removal and installation of de-ice system components refer to figures 13-3 through 13-6. Refer to figure 13-7 for ice detector light.

13-14. TROUBLE SHOOTING.

TROUBLE	PROBABLE CAUSE	REMEDY
DE-ICE BOOTS DO NOT INFLATE OR INFLATE SLOWLY	Loose or faulty wiring.	Repair or replace wiring.
	Loose or damaged hose.	Tighten or replace hose.
	Loose or missing gasket.	Tighten fitting and/or replace gasket.
	Shuttle valve malfunction.	Replace shuttle valve.
	Pressure relief valve set too low.	Reset or replace valve.
	Pressure relief valve malfunction.	Replace pressure relief valve.
	Defective timer.	Replace timer.

NOTE

With both vacuum pumps inoperative, this system will not operate.



1. Wing De-Ice Boots
2. Stabilizer De-Icer Boot
3. Pressure Switch
4. Circuit Breaker Panel
5. De-Ice Switch
6. Pressure Indicator Light
7. Timer

THRU 33701462

Figure 13-3. De-Ice System (Sheet 1 of 2)

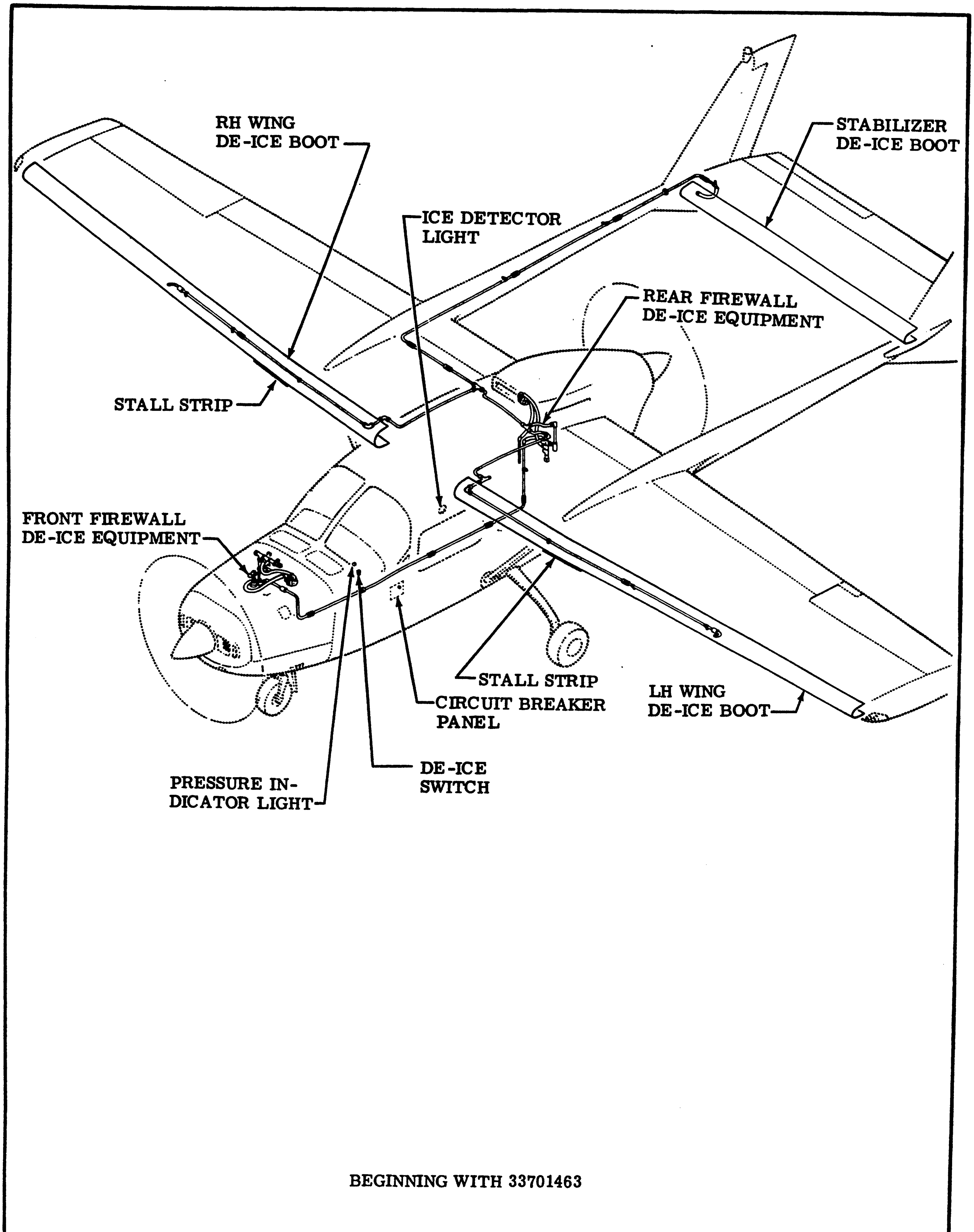
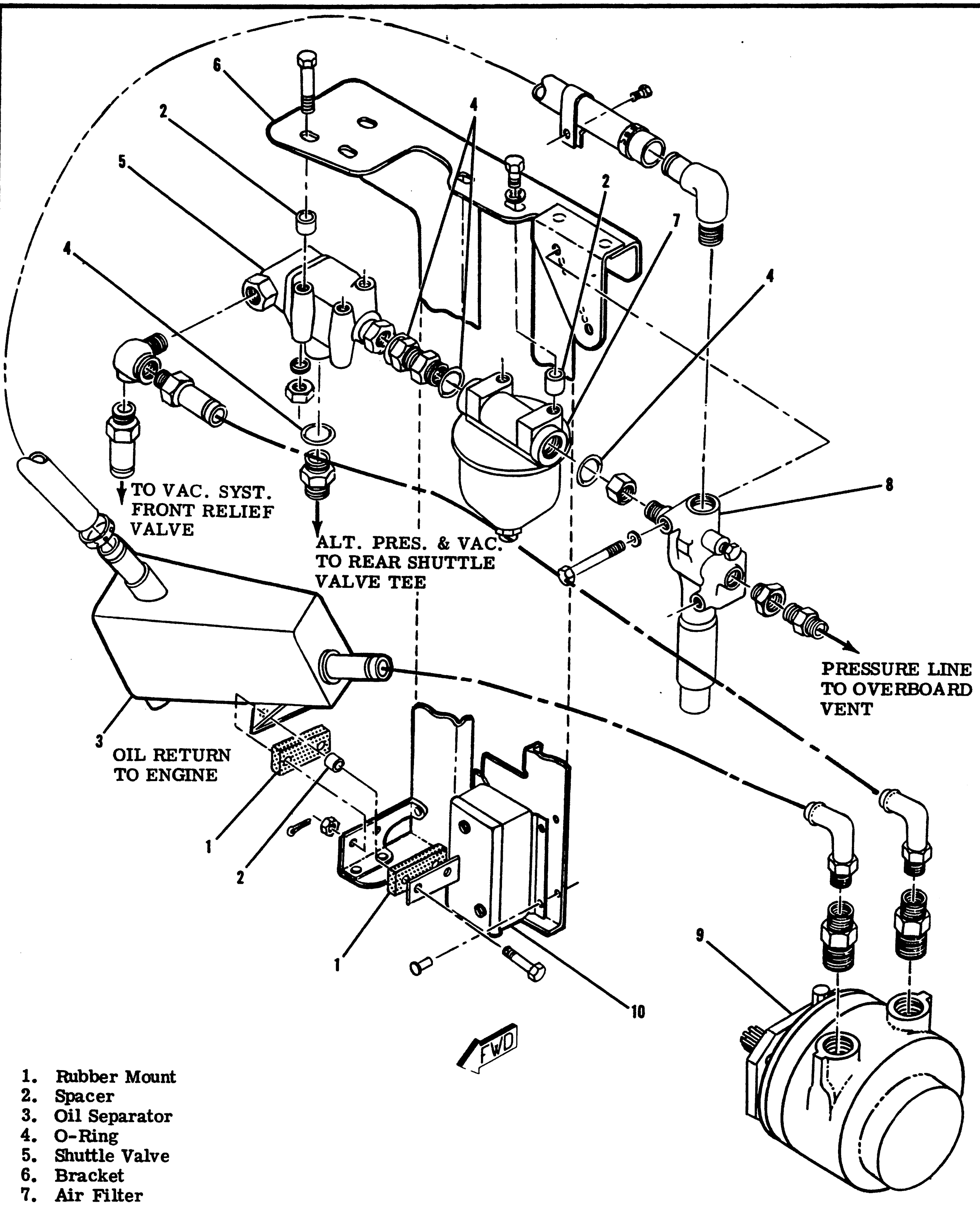


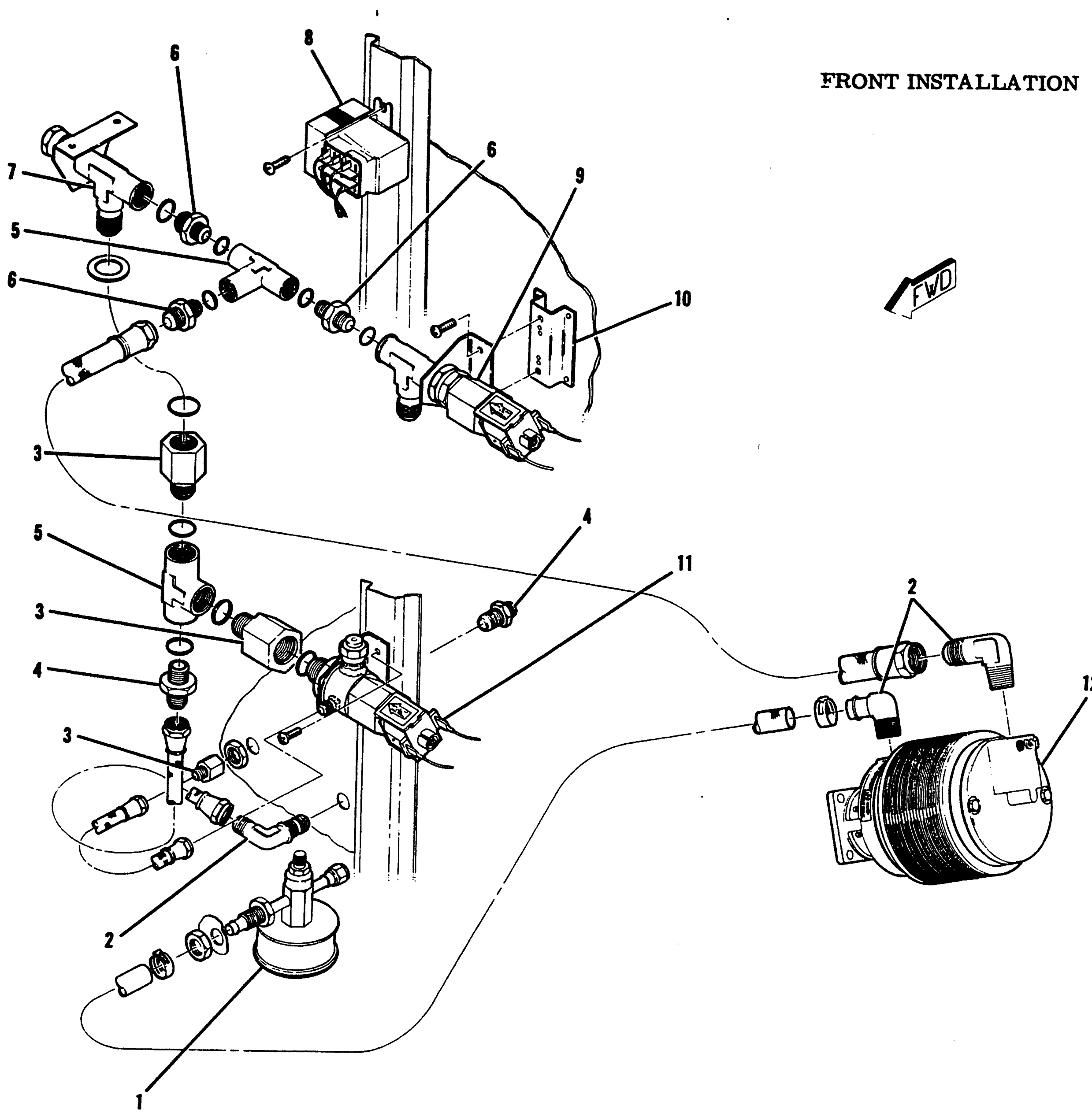
Figure 13-3. De-Ice System (Sheet 2 of 2)



1. Rubber Mount
2. Spacer
3. Oil Separator
4. O-Ring
5. Shuttle Valve
6. Bracket
7. Air Filter
8. Pressure Relief Valve
9. Engine Driven Pump
10. Timer

THRU 33701462

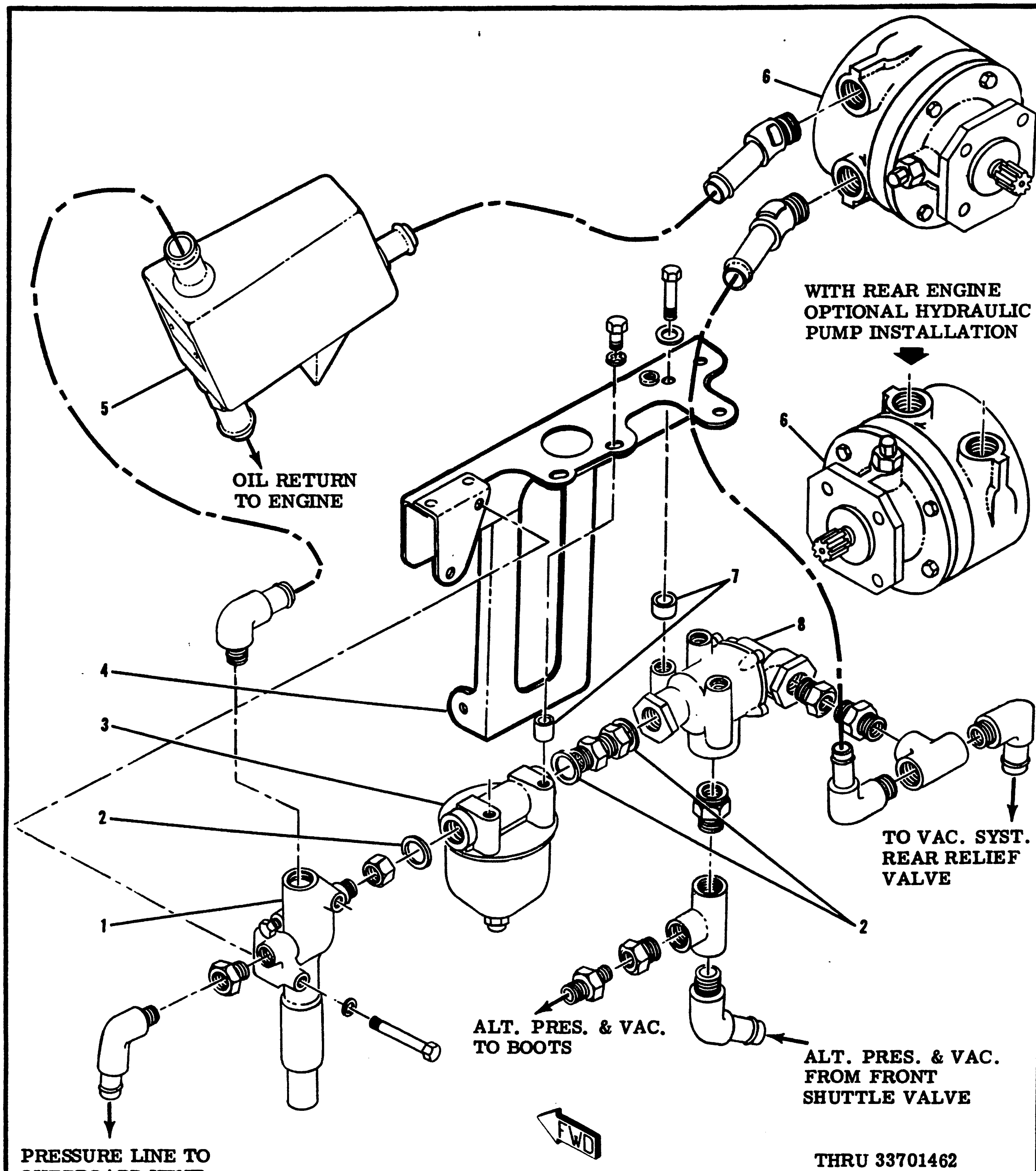
Figure 13-4. Front Firewall De-Ice Components (Sheet 1 of 2)



BEGINNING WITH 33701463

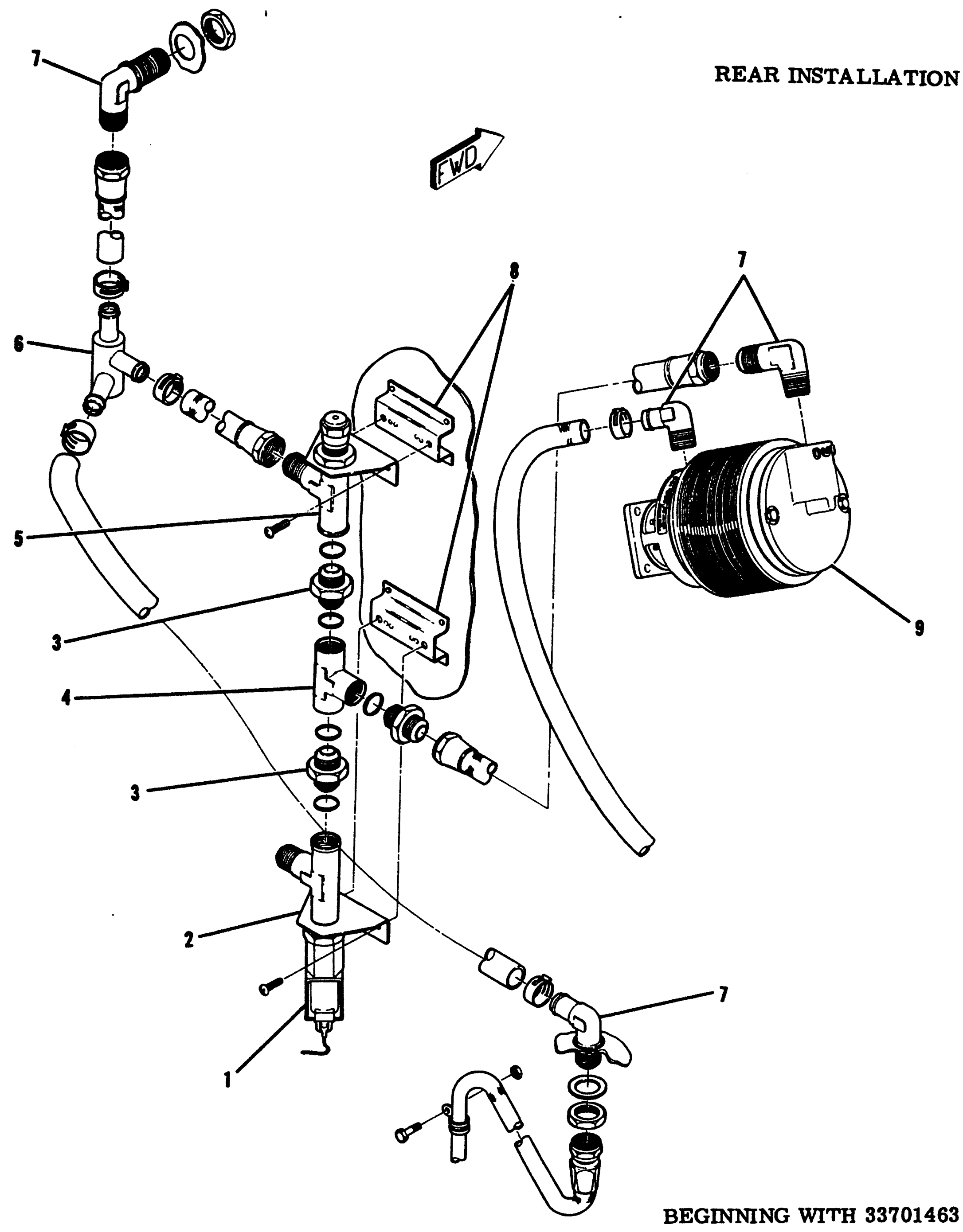
1. Vacuum Relief Valve
2. Elbow
3. Bushing
4. Union
5. Tee
6. Reducer
7. Check Valve
8. Timer
9. Control Valve
10. Bracket
11. Exhaust Valve
12. Dry Air Pump

Figure 13-4. Front Firewall De-Ice Components (Sheet 2 of 2)



1. Pressure Relief Valve
2. O-Ring
3. Air Filter
4. Bracket
5. Oil Separator
6. Engine Driven Pump
7. Spacer
8. Shuttle Valve

Figure 13-5. Rear Firewall De-Ice Components (Sheet 1 of 2)



1. Pressure Control Valve
2. Bracket
3. Reducer
4. Tee
5. Check Valve
6. Tee Assembly
7. Elbow
8. Bracket
9. Pump

Figure 13-5. Rear Firewall De-Ice Components (Sheet 2 of 2)

13-14. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
DE-ICE BOOTS DO NOT DEFLATE OR DEFLATE SLOWLY.	Pressure relief valve malfunction.	Replace pressure relief valve.
	Shuttle valve malfunction.	Replace shuttle valve.
	Defective timer.	Replace timer.

13-15. DE-ICE SYSTEM OPERATIONAL CHECK.

a. Electrical Test:

1. Turn WING DE-ICE switch to off position.
2. Place master switch in on position.
3. Press WING DE-ICE indicator light to check light circuit and bulb. Make sure dimming lens on indicator is open.
4. Turn WING DE-ICE switch on and repeat step 3.
5. If indicator light does not function in steps 3 and 4, the circuit breaker may have opened. Check for short in the system. Reset circuit breaker and repeat step 3.

b. Air Leakage Test:

1. This test can be performed in either the front or rear engine compartments.
2. Disconnect pressure hose from pressure relief valve inlet port.
3. Disconnect vent tube from overboard port, and cap port.
4. Connect a source of clean air to the pressure relief valve inlet port. It is necessary that the inlet pressure be a minimum of 18-20 psi to perform this test. Include a pressure gage in the air line to observe the system pressures.
5. Apply 18 psi pressure to the system and, by means of a hand-operated valve, trap the pressure in the de-ice system. Observe the system for leakage. The leakage rate should not exceed a pressure drop of 4.0 psi per minute.
6. If the leakage exceeds 4.0 psi per minute, use a soap and water solution to locate leaks. Tighten connections as required.
7. To check the pressure switch, place master switch on while de-ice system is pressurized. The indicator light should illuminate.
8. Remove test equipment, lubricate all threads and connect all system components disconnected.

c. Vacuum Relief Valve Adjustment and System Tes

1. Adjust vacuum relief valve as outlined in paragraph 14-21.
2. With vacuum relief valve adjusted and one engine operating at 2400 rpm, place WING DE-ICE switch to on position and observe de-ice system operation. System is functioning satisfactorily if the WING DE-ICE indicator light illuminates within 4.0 seconds after turning WING DE-ICE switch on.
3. Repeat the above procedure for the other engine.

d. Timer Cycle Check:

1. With engines operating at 2100 rpm, place WING DE-ICE switch to on position. As soon as de-ice boots inflate, reduce engine speed to normal idle for approximately 2 1/2 minutes. This permits timer to complete its cycle. At the end of the 2 1/2 minute idle period, increase engine speed to 2100 rpm and observe de-ice boots for inflation. Elapsed time from inflation to inflation should be approximately 3 minutes.
2. If it appears that the timer is defective, apply 28 vdc to pins # 1 and #2 and listen for action of stepping switch.

CAUTION

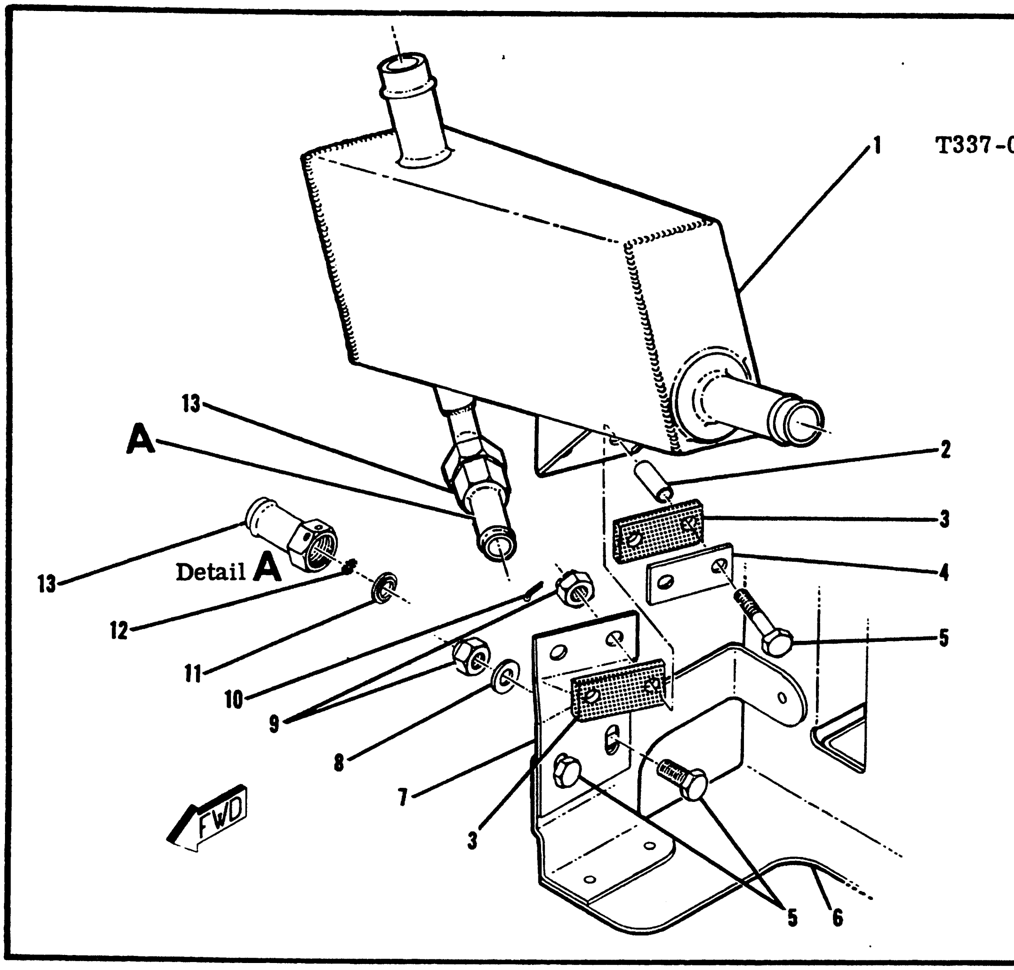
The negative ground must be applied to pin #1; pin #2 is positive. A reverse voltage will ruin the timer diode. The 28 vdc must be filtered if it is rectified from ac; a battery should be used.

13-16. DE-ICE SYSTEM (Beginning with 337-1463).

13-17. DESCRIPTION. Air pressure and vaccum required for operation of the pneumatic de-icing system are provided by engine-driven pumps. Vacuum from the pumps is routed to a vacuum manifold which supplies the instruments and through the exhaust valve to the de-icers. Pressure from the pumps is routed to flow check valves, then through the pressure manifold to the de-icers. A pressure control valve , located on a tap between the pump and the flow check valve in each engine compartment, regulates the pump output pressure. Control of the operation of the pressure control valves and exhaust valve is provided through a time-delay relay. A pressure switch, located on a tap off the pressure line between the flow check valves and the de-icers, is used in conjunction with a light on the instrument panel to indicate that all de-icers are being inflated. During non-operating periods, vacuum is applied to the de-icers through the exhaust valve while the pressure control valves relieve the pressure produced by the pumps. Operation of the de-icers is initiated through a control switch which activates the time-delay relay. The time-delay relay provides power to the solenoids of the pressure control valves and the exhaust valve. When energized, the pressure control valves regulate the pump output air to de-icer system vacuum. After six seconds, the time-delay relay shuts off the power to the solenoids of the pressure control valves and the exhaust valve. Then, pressure in the de-icers is released through an integral pressure relief section of the exhaust valve and vacuum is reapplied.

13-18. COMPONENT DESCRIPTION.

a. Pneumatic De-Ice Boot:
The de-icer consists of a smooth rubber and fabric



T337-0750 THRU 33701462

NOTE

Inspect screen (12) and washer (11) in fitting (13) at each 50- hour inspection.

1. Oil Separator
2. Spacer
3. Rubber Mount
4. Plate
5. Bolt
6. Firewall Bracket
7. Extension Bracket
8. Washer
9. Nut
10. Cotter Pin
11. Washer
12. Screen
13. Fitting

Figure 13-6. Oil Separator Installation

blanket containing small spanwise de-icing tubes. All tubes in each de-icer are simultaneously inflated through a single air connection. The de-icer is cemented to the airfoil leading edge. When the system is "OFF", vacuum is applied to the de-icer tubes. This is necessary to resist negative aerodynamic pressures and to maintain the tubes in a flat or deflated condition. When icing conditions are encountered, it is recommended that at least 1/4" of ice be allowed to accumulate before the de-ice system is operated; however, the de-icer will effectively remove both thicker and thinner ice accumulations.

b. Dry Air Pump:
An air pump, mounted on the accessory pad of each engine, provides positive pressure and vacuum for the de-icing system.

c. Flow Check Valve:
This valve controls the flow of operating air to the de-icers. The valve will open at a predetermined pressure and remain open during the time the de-icers are being pressurized. At the end of the de-icing cycle, when the pressure is relieved, the valve will close automatically to function as a vacuum check valve.

d. Pressure Control Valve:
This valve, located on a tap between the pump and flow check valve, regulates the pump output pressure.

e. Exhaust Valve:
This valve is located on a tap off the vacuum manifold It provides the vacuum necessary to maintain the de-icing tubes in a deflated condition, resisting negative aerodynamic pressures. When the de-icer system is "ON", the exhaust valve solenoid is energized, closing the vacuum port. After the de-icing cycle, pressurized air within the de-icers is released through an integral pressure relief section of the exhaust valve and vacuum is reapplied.

13-19. SYSTEM OPERATION. Refer to paragraph 13-17.

13-20. REMOVAL AND INSTALLATION OF DE-ICE SYSTEM. For removal and installation of de-ice system components, refer to figures 13-3 through 13-6.

13-21. DE-ICE BOOT REPAIR (COLD PATCH).

13-22. DESCRIPTION. There are four types of damage that are most common to the de-icer boots. The following procedures describe the damage and outline techniques for the repair.

13-23. REPAIR.

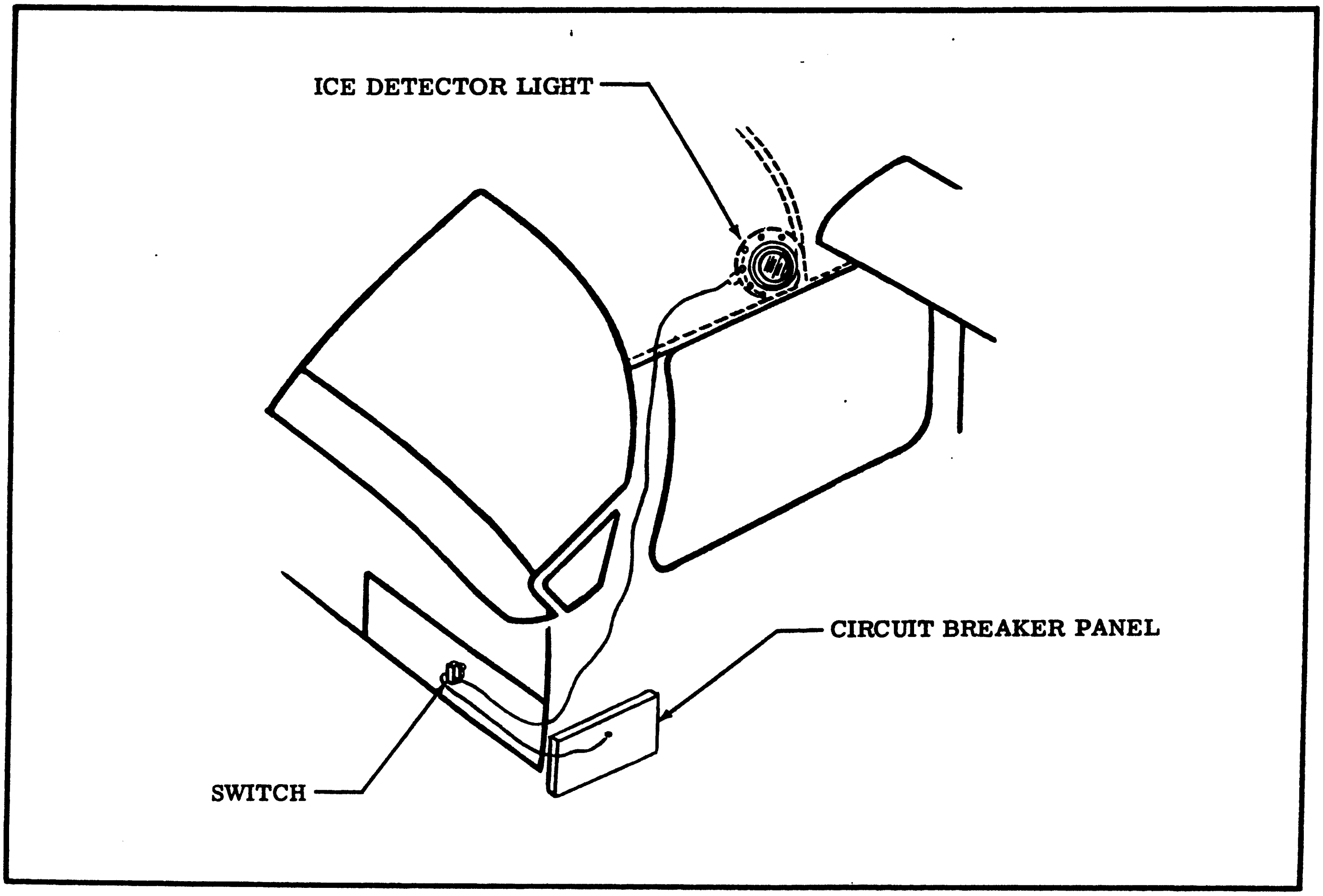


Figure 13-7. Ice Detector Light

NOTE

When repairing the de-ice boots and replacement layers are being installed, exercise care to prevent trapping air beneath the replacement layers. If air blisters appear after material is applied, remove them with a hypodermic needle.

Scuffed or Damaged Surface:

This type of damage is the most commonly encountered and is usually caused by scuffing the outer surface of the de-ice boots while using scaffolds, refueling hose, ladders, etc. Repair is generally not necessary because the thick outer veneer provides protection to the natural rubber underneath. If the damage is severe and has caused removal of the entire thickness of veneer (exposing the brown natural rubber underneath), the damage should be repaired as follows:

a. Select a patch (B. F. Goodrich Part Number 3306-1, 3306-2, or 3306-3) large enough to cover the damaged area.
b. Using a clean cloth dampened with solvent, thoroughly clean the damaged area.
c. Buff the area around the damage with steel wool so that the area is moderately but completely roughened.
d. Wipe the buffed area clean with a cloth slightly dampened with solvent to remove all loose particles.
e. Apply one even thorough coat of EC-1403 (Minnesota Mining and Manufacturing Co.) cement to the patch and corresponding damaged area of the de-ice boot and allow cement to dry completely.
f. Reactivate cemented surfaces with solvent. Apply patch to the de-ice boot with an edge or the center adhering first, and work the remainder of the patch down, being careful to avoid air pockets between patch and boot.
g. Roll the patch thoroughly with a stitcher-roller (Part Number 3306-10) and allow to set for 10 to 15 minutes.
h. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
i. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to the patched area to restore conductivity.

NOTE

Satisfactory adhesion should be obtained in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the de-ice boots may be inflated to check the repair.

Damage to Tube Area:

This type of damage consists of cuts, tears, or ruptures to the inflatable tube area and a fabric reinforced patch must be used for this repair. Damage to the tube area should be repaired as follows:

a. Select a patch (B. F. Goodrich Part Number 3306-4, 3306-5, or 3306-6) of ample size to extend at least 5/8-inch beyond the damage area.

NOTE

If none of these patches are of proper size, one may be cut to the size desired from one of the larger patches. If this is done, the edge should be beveled by cutting with the shears at an angle. These patches are manufactured so they will stretch in one direction only. Be sure to cut patch selected so that the stretch is in the widthwise direction of the inflatable tubes.

b. Using a clean cloth dampened with solvent, thoroughly clean the area to be repaired.
c. Buff the area around the damage with steel wool so that the area is moderately but completely roughened.
d. Wipe the buffed area clean with a cloth slightly dampened with solvent to remove all loose particles.
e. Apply one even thorough coat of EC-1403 (Minnesota Mining and Manufacturing Co.) cement to the patch and the corresponding damaged area of the de-ice boot. Allow cement to dry completely.
f. Reactivate cemented surfaces with solvent. Apply patch to de-ice boot with the stretch in the widthwise direction of the inflatable tubes, sticking edge of patch in place first and working remainder down with a very slight pulling action so the injury is closed. Use care to avoid air pockets between patch and de-ice boot surface.
g. Roll the patch thoroughly with a stitcher-roller (Part Number 3306-10) and allow to set for 10 to 15 minutes.
h. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.
i. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

NOTE

Satisfactory adhesion of patch to de-ice boot should be reached in four hours; however, if the patch is allowed to cure for a minimum of 20 minutes, the de-ice boots may be inflated to check the repair.

Damage to Fillet Area:

This includes any tears or cuts to the tapered area aft of the inflatable tubes. Damage to the fillet area should be repaired as follows:

a. Trim damaged area square and remove excess material. Cut must be sharp and clean to permit a good butt joint of the inlay.
b. Cut an inlay from tapered fillet (B. F. Goodrich Part Number 3306-7) to match cutout area.
c. Using solvent, loosen edges of de-ice boot around cutout area approximately 1 1/2 inches from all edges.
d. Thoroughly clean the area to be repaired, using a cloth dampened with solvent.
e. Lift edges of loosened boot around cutout, and apply one coat of EC-1403 (Minnesota Mining and Manufacturing Co.) cement to underneath side of boot.
f. Apply one coat of EC-1403 cement to the wing skin underneath the loosened edges of de-ice boot, allowing cement to extend 1-1/2 inches beyond edges of boot into cutout area.
g. Apply a second coat of EC-1403 cement to underneath side of boot as outlined in step "e."
h. Apply one coat of EC-1403 cement to one side of a 2-inch wide, neoprene-coated fabric tape (Part Number 3306-8) and allow cement to dry. Trim the tape to size of cutout. This tape is necessary to reinforce splice.

i. Reactivate cemented surface of tape and wing skin with solvent and apply tape to wing skin. Use care to center tape under all edges of cutout.
j. Roll down tape on wing skin with stitcher-roller (Part Number 3306-10) to assure good adhesion, being careful to avoid air pockets between tape and wing skin.
k. Apply one coat of EC-1403 cement to top surface of tape and allow cement to dry approximately 5 to 10 minutes.
l. Reactivate cemented surfaces of boot wing skin and tape with solvent. Working toward the cutout, roll down carefully the edges of the loosened boot to prevent trapping air. The boot edges should overlap the tape approximately 1 inch.
m. Roughen back surface of inlay repair material (Part Number 3306-7, previously cut to size) with steel wool. Thoroughly clean with solvent and apply one coat of EC-1403 cement.
n. Apply one coat of EC-1403 cement to wing skin inside cutout area and allow to dry.
o. Apply the second coat of EC-1403 cement to inlay repair material and allow to dry.
p. Reactivate cemented surfaces with solvent and carefully insert inlay material with feathered edge of inlay aft. Working from forward edge aft, carefully roll down the inlay to avoid trapping air.
q. Roughen area on outer surface of de-ice boot and inlay with steel wool 1-1/2 inch on either side of splice. Clean with solvent and apply one coat of EC-1403 cement.
r. Apply one coat of EC-1403 cement to one side of 2-inch wide, neoprene-coated fabric tape (Part Number 3306-8), trim to size, and center tape over splice on three sides.
s. Roll down tape on de-ice boot and inlay with stitcher-roller (Part Number 3306-10) to assure good adhesion, being careful to avoid trapping air.
t. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

Veneer Loose From De-Ice:

If the veneer should become loose from the de-ice boot, repair should be made as follows:

a. Peel and trim the loose veneer to a point where the adhesion of veneer to the de-ice boot is good.
b. Roughen area in which veneer is removed with

steel wool. Motion must be paralled to cut edge of veneer ply, to prevent loosening it.

c. Taper edges of veneer down to the tan rubber ply by rubbing parallel to cut edge of veneer with steel wool and solvent.

d. Cut a piece of veneer material (Part Number 3306-9) large enough to cover the damaged area and extend at least 1 inch beyond in all directions.

e. Mask off the damaged boot area 1/2-inch larger in width and length than the patch.

f. Apply one coat of EC-1403 cement to damaged boot area and allow to dry.

g. Apply second coat of EC-1403 cement to damaged boot area and allow to dry.

h. Reactivate cement surface with solvent. Peel the backing from the veneer, and for 6 inches of its length, and roll the veneer to the boot with a 2-inch roller. Roll edges with stitcher-roller (Part Number 3306-10).

i. Continue stripping the backing from the veneer as the rolling progresses, applying a slight tension on the veneer ply to prevent wrinkling.

j. Be careful to prevent trapping air. If air blisters appear after veneer is applied, remove them with a hypodermic needle.

k. Wipe the patch and surrounding area, from the center of the patch outward, with a cloth slightly dampened with solvent.

l. Apply one light coat of A-56-B conductive cement (Part Number 3306-13) to restore conductivity.

NOTE

B. F. Goodrich "cold patch" Repair Kit No. 74-451C for surface ply de-ice boot repair is available from the Cessna Service Parts Center.

13-24. REPLACEMENT OF DE-ICE BOOTS. To remove or loosen installed de-ice boots, use toluol or toluene to soften the "cement" line. Apply a minimum amount of this solvent to the cement line as tension is applied to peel back the boot. Removal should be slow enough to allow the solvent to undercut the cement so that parts will not be damaged. To install a wing de-icer boot, proceed as follows:

a. Clean the metal surfaces and the bottom side of the de-icer thoroughly with Methyl Ethyl Ketone or Methyl Isobutal Ketone. This shall be done by wiping the surfaces with a clean, lint-free rag soaked with the solvent and then wiping dry with a clean, dry, lint-free rag before the solvent has time to dry.

b. Place one inch masking tape on wing to mask off boot area allowing 1/2 inch margin. Take care to mask accurately so that clean-up time will be reduced.

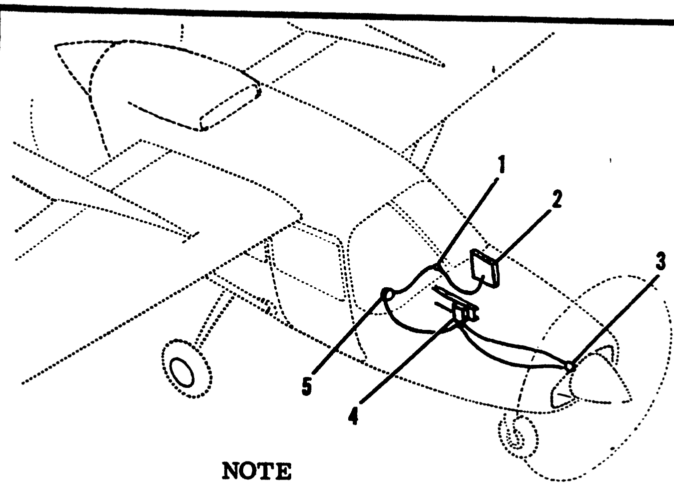
c. Stir EC-1300L (EC-1403) cement thoroughly before using. Apply one even brush coat to the metal and to the rough side of the boot, brushing well into the rubber. Allow cement to air dry for a minimum of 30 minutes and then apply a second coat to each of the surfaces. Allow at least 30 minutes, preferably one hour, for drying.

d. Snap a chalk line along the leading edge line of the wing and a corresponding line on the inside of the de-icer if it does not have a centerline. Securely attach hoses to the deicer connections. Position the centerline of the boot with the leading edge of the wing, and using a clean, lint-free cloth heavily moistened with toluol, reactivate the surface of the cement on the wing and the boot in small spanwise areas about six inches wide. Avoid excess rubbing of the cement, which would remove it from the surface. Have enough help to hold boot in a vertical plane. Place the chalk lines in alignment, and starting at one end of the boot, tack it to the wing along the leading edge line. Hold the rest of the boot clear of the wing. Roll along the leading edge line with a rubber roller, and an inch or two on either side. Taking approximately six inches of chord at a time, roll from the leading edge aft in firm, overlapping, chordwise strokes of the rubber roller until the entire boot is in contact with the airfoil. It is important that all air be removed from between the rubber and the metal, and that the boots be distorted to a minimum amount. If any air is trapped between the rubber and the metal, it may be removed by the careful use of a small hypodermic needle, except in the tube area. Use the metal stitcher roller around the edges of the boot and connections. Fill any gaps between adjoining boots with EC-539 sealer. Apply a coat of EC-539 sealer along the trailing edges of the boot to the surface of the skin to form a neat straight fillet.
Remove masking tape and clean surfaces with toluol.

e. When installing the large inboard boot, it will be helpful to place a clean, lint-free, folded liner of canvas on the top of the wing, back of the leading edge with the fold forward. The boot can be laid on top of the liner and the liner pulled back about six inches at a time as the rolling progresses aft. The bottom portion of the boot will, of course, hang free of the wing, preventing premature contact. This should be done in a manner to align the rear edges of adjoining boots and the carpenter's chalk line should be used for this purpose. Trim butting edges of adjoining boots to keep gaps to a minimum. If gaps result, they may be filled with EC-539 sealer. Apply a coat of EC-539 sealer along the trailing edges of the boot to the surface of the skin to form a neat straight fillet.

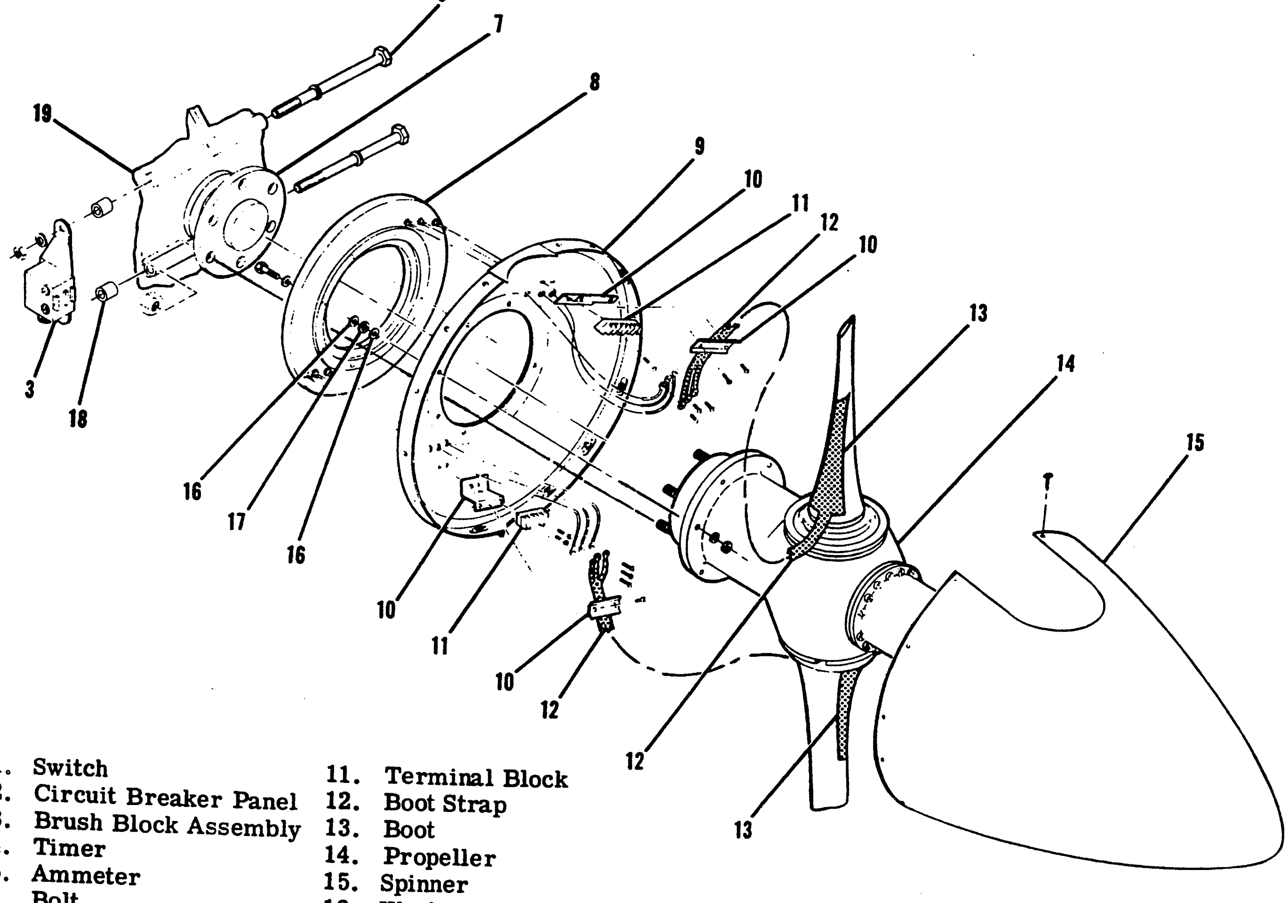
f. Remove masking tapes and clean edge surfaces with toluol.

13-25. PROPELLER DE-ICE SYSTEM. The system is of an electrothermal type, consisting of electrically heated de-icers bonded to each propeller blade, a slip ring assembly for power distribution to the propeller de-icers, a brush block assembly to transfer electrical power to the rotating slip ring, a timer to cycle electric power to the de-icers in proper sequence, an ammeter, mounted in the instrument panel, a switch and a circuit breaker. The de-ice system applies heat to the surfaces of the propeller blades where ice normally would adhere. This heat, plus centrifugal force and the blast from the airstream, removes accumulated ice. Each de-icer has two separate electrothermal heating elements, an inboard and an outboard section. When the switch is turned on, the timer provides power through the brush block and slip ring to outboard elements for approximately 34 seconds, reducing ice adhesion in these areas. Then, the timer switches power to inboard heating elements for approximately 34 seconds.



NOTE

Lockwashers (17) and flat washers (16) are used as required to align plane of slip ring perpendicular to engine crankshaft within a total deviation of .005 inches, with .002 inch deviation within any four inches at circumference of slip ring. Check with dial indicator.



1. Switch
2. Circuit Breaker Panel
3. Brush Block Assembly
4. Timer
5. Ammeter
6. Bolt
7. Engine Crankshaft
8. Slip Ring
9. Spinner Bulkhead
10. Clip Assembly
11. Terminal Block
12. Boot Strap
13. Boot
14. Propeller
15. Spinner
16. Washer
17. Lockwasher
18. Spacer
19. Engine Crankcase

NOTE

Torque bolts (6) 90 to 110 lb-in.

Figure 13-8. Propeller Anti-Ice System (Sheet 1 of 2)

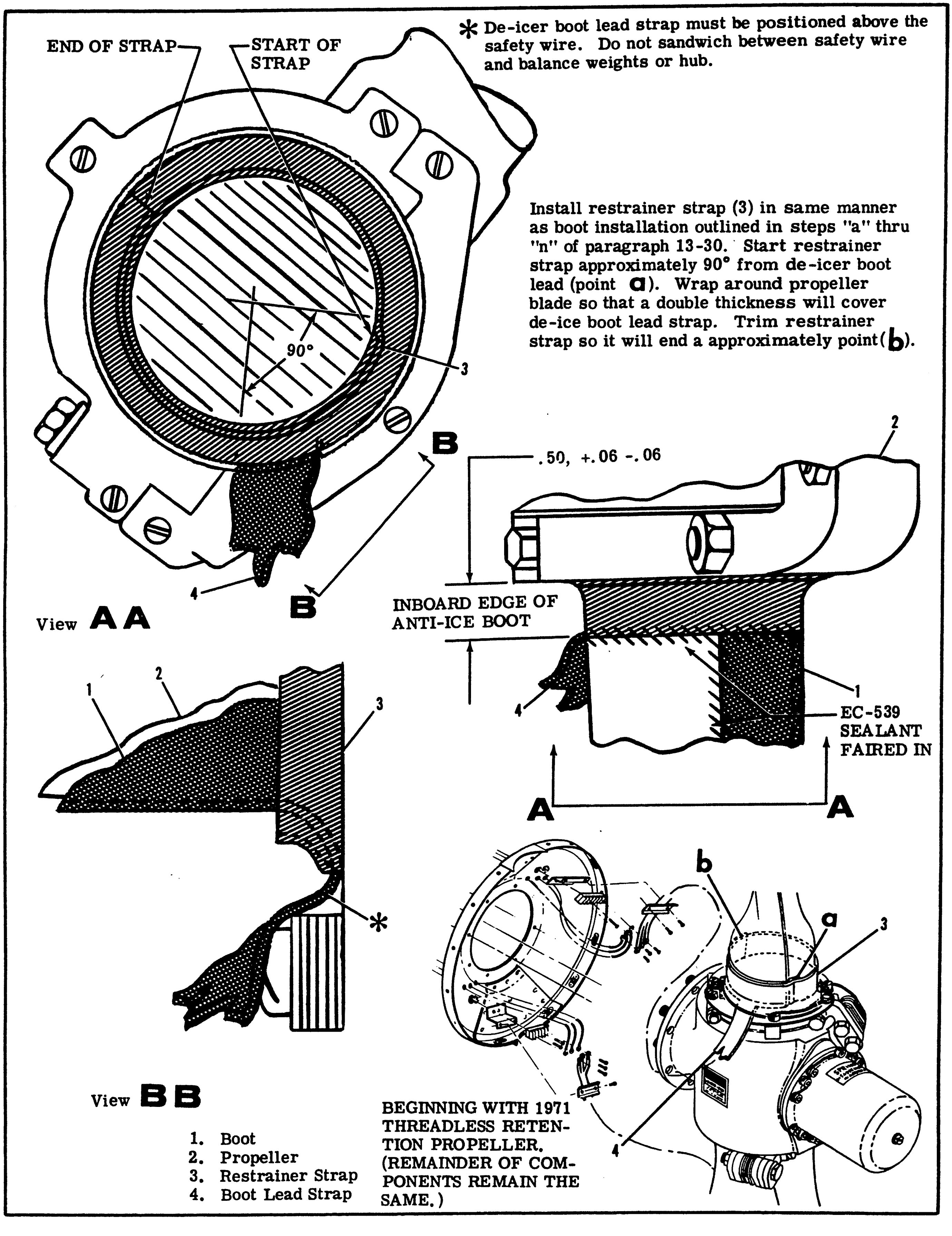


Figure 13-8. Propeller Anti-Ice System (Sheet 2 of 2)

It then returns to the outer elements and continues cycling action. This outboard-inboard sequence is important since the loosened ice tends to move outboard. Heating may begin at any phase in the cycle, depending on the timer position when the switch was turned off from previous use. Ground checkout of the system is permitted with the engine not running. System components may be removed and replaced, using figure 13-8 as a guide. Propeller removal is necessary before de-ice system components, except brush block assembly, can be installed or removed.

13-26. SLIP RING ALIGNMENT. After installation, the slip ring assembly must be checked for run-out, and adjustments made, if necessary.

NOTE

Excessive slip ring run-out will result in severe arcing between the slip ring and brushes, and cause rapid brush wear. If allowed to persist, this condition will result in rapid deterioration of the slip ring and brush contact surfaces, and lead to the eventual failure of the De-Icing System.

a. Securely attach dial indicator gauge to the engine, and place the pointer on the slip ring.
b. Rotate propeller slowly by hand, noting the deviation of the slip ring from a true plane as indicated on the gauge.
c. Check that total run-out does not exceed 0.005 inch (±0.0025 inch) for the Model 337, or 0.008 inch (±0.004 inch) for the Model T337. Also check that run-out does not exceed 0.002 inch within any 4 inches of slip ring travel for either type of engine.

CAUTION

Due to the loose fit of some propeller bearings, a considerable error may be indicated in the readings by pushing in or pulling out on the propeller while rotating it. Care must be taken to exert a uniform push or pull on the propeller to hold this error to a minimum.

d. If slip ring run-out is within the limits specified, no corrective action is required. A small amount of run-out may be corrected by varying the torque of the attachment bolts within the limits specified by the propeller manufacturer.
e. If the procedure outlined in step "d" does not produce acceptable run-out, fabricate small washer-shaped shims (approximately .010 inch), and place on attachment bolts, limit one washer per bolt, between slip ring and spinner bulkhead or mounting plate.
f. Recheck run-out. Adjust shim thickness and vary torque of attachment bolts until slip ring runs true within the prescribed tolerance.

13-27. TROUBLE SHOOTING.

NOTE

The propeller anti-ice ammeter may be used while trouble shooting the system. The ammeter needle should rest within the shaded band except for "flickers" approximately 34 seconds apart, as the step switch of the timer operates. The ammeter will also reflect a bad connection or open circuit by reading below normal or zero. A high reading indicates a short circuit.

TROUBLE	PROBABLE CAUSE	REMEDY
ELEMENTS DO NOT HEAT.	Circuit breaker out or defective.	Reset circuit breaker. If it pops out again, determine cause and correct. Replace defective parts.
	Defective wiring.	Repair or replace wiring.
	Defective switch.	Replace switch.
	Defective timer.	Replace timer.
	Defective brush-to-slip ring connection.	Check alignment. Replace defective parts.
SOME ELEMENTS DO NOT HEAT.	Incorrect wiring.	Correct wiring.
	Defective wiring.	Repair or replace wiring.
	Defective timer.	Replace timer.
	Defective brush-to-slip ring connection.	Check alignment. Replace defective parts.

13-27. TROUBLE SHOOTING (Cont).

TROUBLE	PROBABLE CAUSE	REMEDY
CYCLING SEQUENCE NOT CORRECT OR NO CYCLING.	Crossed connections.	Correct wiring.
	Defective timer.	Replace timer.
RAPID BRUSH WEAR, FREQUENT BREAKAGE, SCREECHING OR CHATTERING.	Brush block or slip ring out of alignment.	Align properly.

13-28. TIMER TEST.

a. Remove connector plug of wire harness from timer and jump power input socket of wire harness to timer input pins. (Refer to chart following this step for pin identification.)

Timer P/N	Power Input Pin & Socket	Ground Pin	Output Sequence, Time, Voltage	Total Repeat Cycle Time (minutes)
3E1540-1	B (14 VDC)	A (14 VDC)	C, D - 34 sec. each, then repeats (14 VDC)	1.1

b. Jump timer ground pin to ground.

c. Turn on De-Icing System.

d. Check timer operation per the chart preceding step "b." (Use a voltmeter.)

e. Check volts to ground in each case. If engine is not running, and auxiliary power is not used, voltage will be battery voltage and cycle time may be slightly longer than indicated.

f. Hold voltmeter probe on the pin until the voltage drops to 0. Move the probe to the next pin in the sequence shown in the chart. Check voltage at each pin in sequence. When correctness of the cycling sequence is established, turn propeller De-Icing switch off at the beginning of one of the on-time periods, and record the letter of the pin at which the voltage supply is present.

NOTE

Timers do not home to pin "C" when turned off.

13-29. INSTALLATION AND ALIGNMENT OF BRUSH BLOCK ASSEMBLY. (Refer to Figure 13-9.)

NOTE

Installation of the brush block should be deferred, when possible, until after the slip ring, propeller, and related components are installed. However, the brush block assembly may be replaced without removing the propeller. To avoid breakage when installing the brush block assembly, keep brushes retracted in brush block until slip ring and propeller assemblies have been installed.

CAUTION

Make sure that slip ring run-out has been corrected before attempting to align brushes on slip ring.

a. In order to get smooth, efficient and quiet transfer of electric power from the brushes to the slip ring, brush alignment must be checked and adjusted, if necessary to meet the following requirements.

1. Projection must be such that the distance between the brush block and the slip ring is .06" ± .03".

2. The brushes must be lined up with the slip ring so that the entire face of each brush is in contact with the slip ring throughout the full 360° of slip ring rotation.

3. The brushes must contact the slip ring at an angle of approximately 2° from perpendicular to the slip ring surface, measured toward the direction of rotation of the slip ring.

b. Brush projection can normally be adjusted by loosening hardware attaching the brush block and holding the brushes in the desired location while retightening the hardware. Slotted holes are provided.

c. One method for face alignment is described in step "b". Another is to use shims between brush block and bracket. Laminated metal shims are generally provided. Layers of metal .003" are used to make up shims which are approximately 0.20" thick overall. Shims may be fabricated locally.

d. Loosen mounting bolts and twist block while tightening to attain proper angular adjustment.

CAUTION

Use care not to disturb other adjustments when adjusting angular alignment.

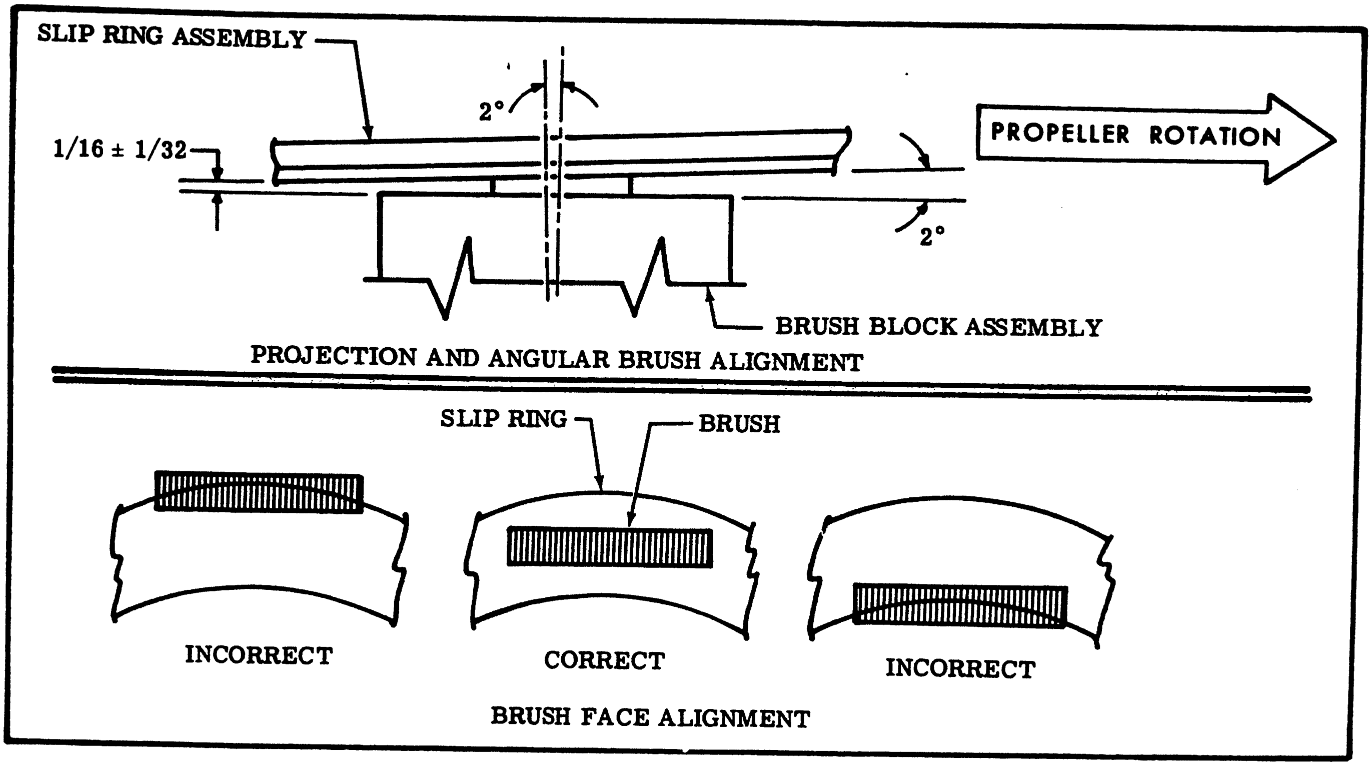


Figure 13-9. Brush Face Alignment and Projection and Angular Brush Alignment

13-30. REPLACEMENT OF DE-ICE BOOTS. To remove or loosen installed de-ice boots, use toluol to soften the "cement line." Apply a minimum amount of this solvent to the cement line as tension is applied to peel back the boot. Removal should be slow enough to allow the solvent to undercut the cement so that parts will not be damaged. To install a propeller anti-ice boot, proceed as follows:

a. Clean the metal to be bonded with Methyl Ethyl Ketone, (MEK). For final cleaning, wipe the solvent film off quickly with a clean, dry cloth before it has time to dry.

b. Prepare a pattern the size of the boot, including three inches of the boot strap. Draw a centerline (lengthwise) through the pattern.

c. Draw a line on the centerline of the leading edge of the blade. Position the pattern centerline over the leading edge centerline. Position pattern so bottom of boot is 1/2" below spinner cutout. Draw a line on the propeller hub on each side of the pattern boot strap where it crosses the hub. Check boot strap poaition by fitting restraining strap on the hub and comparing its position with the marked position of the strap.

d. Mask off an area 1/2" from each side and outer end of the pattern, and remove the pattern.

e. Mix EC-1300L cement (Minnesota Mining & Mfg. Co.) thoroughly and apply one even coat to the cleaned metal surface. Allow to dry for a minimum of one hour, then apply a second coat of the cement.

f. Moisten a clean cloth with Methyl Ethyl Ketone and clean the unglazed back surface of the boot, changing cloths frequently to avoid contamination of the cleaned area.

g. Apply one even coat of EC-1300L cement to back surface of boot. It is not necessary to cement more than 1/2" of the boot strap.

h. Using a silver-colored pencil, mark a centerline along the leading edge of the propeller blade and a corresponding centerline on the cemented side of the boot.

i. Reactivate the surface of the cement using a clean, link-free cloth, heavily moistened with toluol. Avoid excessive rubbing of cement, which would remove the cement.

j. Position the boot centerline on the propeller leading edge, starting at the hub end at the position marked. Make sure that boot strap will fall in the position marked. Tack the boot centerline to the leading edge of the propeller blade. If the boot is allowed to get off-center, pull up with a quick motion and replace properly. Roll firmly along centerline with a rubber roller.

k. Gradually tilting the roller, work the boot carefully over either side of the blade contour to avoid trapping air in pockets.

l. Roll outwardly from the centerline to the edges. If excess material at the edges tends to form wrinkles, work them out smoothly and carefully with fingers.

m. Apply one even coat of EC-539 (Minnesota Mining & Mfg. Co.), mixed per manufacturer's instructions, around the edges of the installed boot.

n. Remove masking tape from the propeller and clean the surface of the propeller by wiping with a clean cloth dampened with toluol.

o. Install restraining strap in accordance with figure 13-8, and secure with screws, washers and sleeves.

13-31. OXYGEN SYSTEM.

WARNING

Under NO circumstances should the ON-OFF control on the oxygen regulator be turned to the "ON" position with the outlet (low pressure) ports open to atmosphere. Operation of these units in this manner will induce serious damage to the regulators and have the following results:

1. Loss of outlet set pressure.
2. Loss of oxygen flow through the regulator which will result in inadequate oxygen being fed through the aircraft system.
3. Internal leakage of oxygen through regulator.

Opening of the control lever with the outlet ports open to atmosphere, results in an "overshoot" of the regulator metering device due to the extreme flow demand through the regulator. After overshooting, the metering poppet device goes into oscillation, creating serious damage to the poppet seat and diaphragm metering probe. This condition can occur even by turning the control lever on and then turning it quickly off.

A potential hazard exists to aircraft in the field where inexperienced personnel might remove the cylinder and regulator assembly from the aircraft and for some reason, attempt to turn the regulator to the "ON" position with the outlet ports open. Unfortunately, after the units have been improperly operated as noted, there is no outward appearance indicating that damage has occurred.

Testing these regulators should be accomplished only after installation in the aircraft, with the "downstream" low pressure line attached.

13-32. DESCRIPTION. The system is comprised of two oxygen cylinders, a pressure regulator, filler valve, pressure gage, pressure lines, outlet and mask assemblies. The oxygen cylinders are mounted in the cabin top area. Locations of system components are shown in figure 13-10. The pilot's supply line is designed to receive a greater flow of oxygen than the passengers. The pilot's mask is equipped with a microphone, keyed by a switch button on the pilot's control wheel. The filler valve is located in the leading edge of the right wing.

WARNING

Oil, grease or other lubricants in contact with high-pressure oxygen, create a serious fire hazard and such contact should be avoided. Do not permit smoking or open flame in or near aircraft while work is performed on oxygen systems.

13-33. MAINTENANCE PRECAUTIONS.

a. Working area, tools and hands must be clean.

b. Keep oil, grease, water, dirt, dust and all other foreign matter from system.

c. Keep all lines dry and capped until installed.

d. Use only MIL-T-5542 thread compound or teflon lubricating tape on threads of oxygen valves, tubing connectors, fittings, parts of assemblies which might under any conditions, come in contact with oxygen. The thread compound must be applied sparingly and carefully to only the first three threads of the male fitting. No compound shall be used on aluminum flared fittings or on the coupling sleeves or on the outside of the tube flares. The teflon tape shall be used in accordance with the instructions listed following this step. Extreme care must be exercised to prevent the contamination of the thread compound or teflon tape with oil, grease or other lubricant.

1. Lay tape on threads close to end of fitting. Clockwise on standard threads, opposite on left hand threads.
2. Apply enough tension while winding so tape forms into thread grooves.
3. After wrap is complete, maintain tension and tear tape by pulling apart in direction it was applied. Resulting ragged end is the key to the tape staying in place. (If sheared or cut, tape may unwind.)
4. Press tape well into threads.
5. Make connections.

e. Fabrication of oxygen pressure lines is not recommended. Lines should be replaced by part numbers called out in the aircraft Parts Catalog.

f. Lines and fittings must be clean and dry. One of the following methods may be used.

1. Clean by degreasing with stabilized trichlorethylene, conforming to Federal Specifications O-T-634 or MIL-T-27602. These items can be obtained from American Mineral Spirits of Houston, Texas.

NOTE

Most air compressors are oil lubricated, and a minute amount of oil may be carried by the airstream. If only an oil lubricated air compressor is available, drying must be accomplished by heating at a temperature of 250° to 300°F for a suitable period.

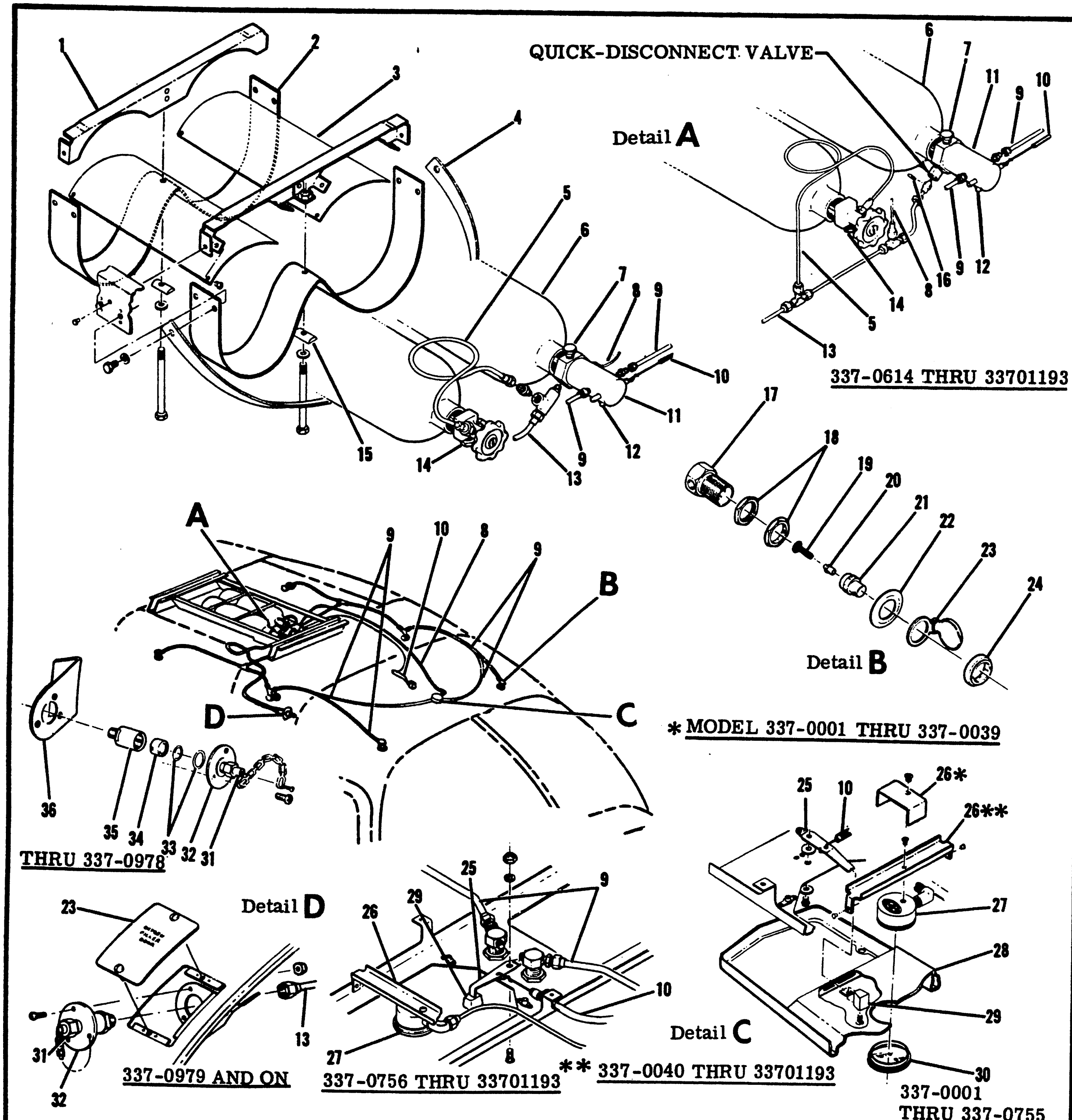
NOTE

Cap lines at both ends immediately after drying to prevent contamination.

13-34. REPLACEMENT OF COMPONENTS. Removal, disassembly, assembly and installation of system components may be accomplished while using figure 13-10 as a guide.

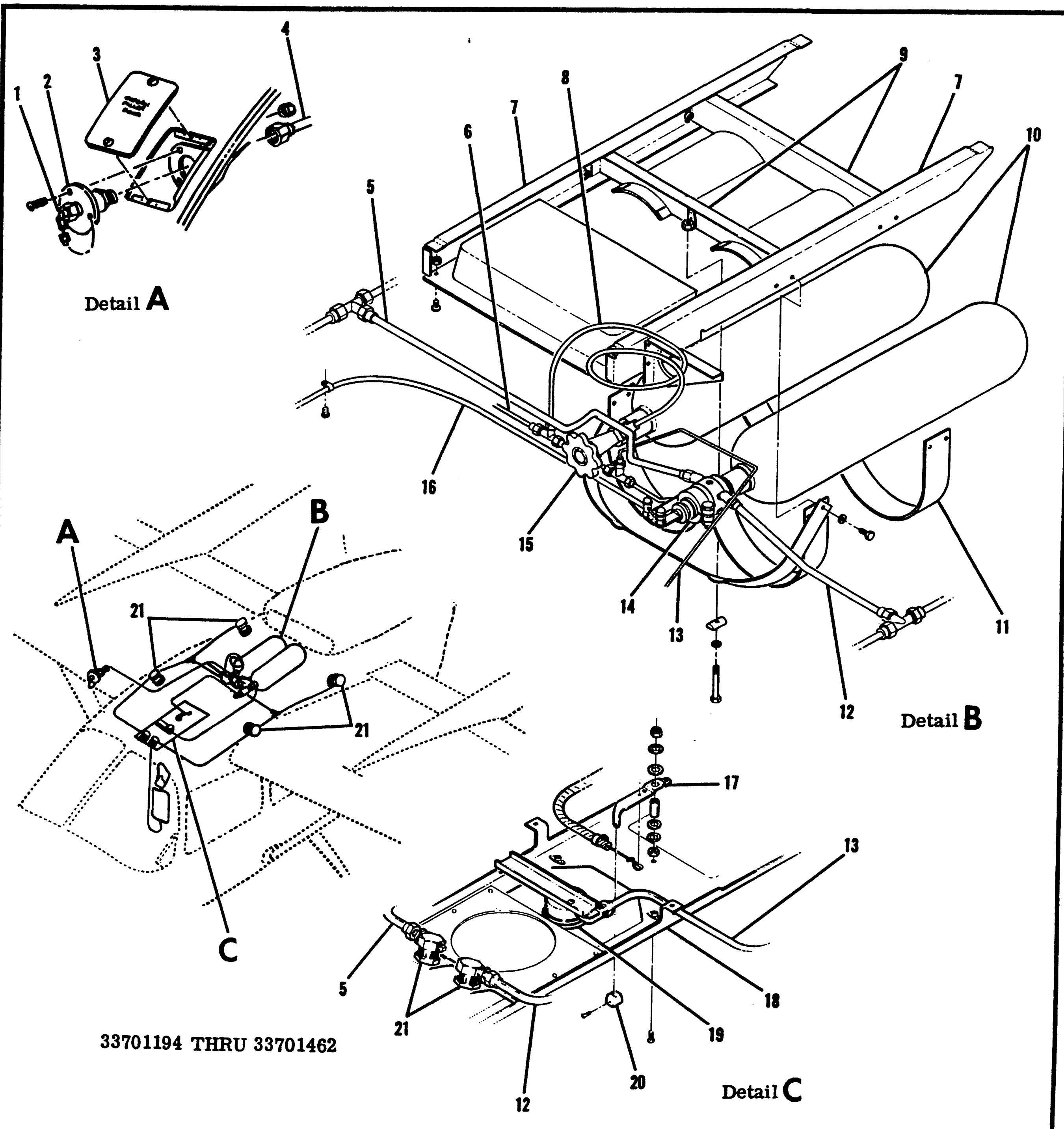
CAUTION

The pressure regulator, pressure gage and line and filler valve should be removed and replaced only by personnel familiar with high-pressure fittings. Observe the maintenance precautions listed in the preceding paragraph.



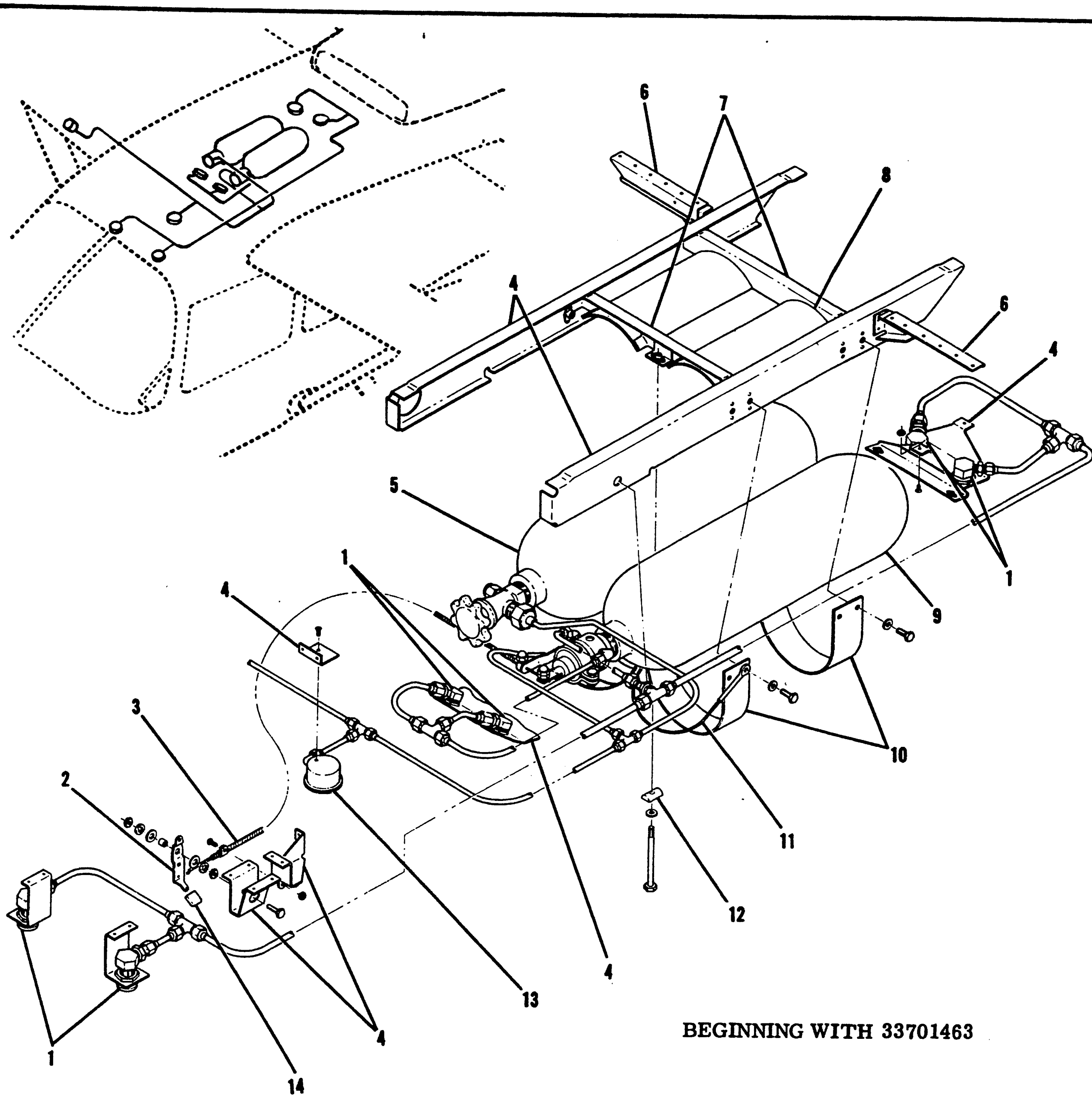
1. Cradle Support
2. Strap
3. Cradle
4. Strap
5. Interconnect Line
6. Cylinder
7. High-Pressure Relief Valve
8. Pressure Gage Line
9. Outlet Line
10. ON-OFF Control
11. Regulator
12. Low-Pressure Relief Valve
13. Filler Valve Line
14. High-Pressure Relief Valve
15. Spacer
16. O-Ring
17. Base
18. Jamb Nut
19. Spring
20. Poppet
21. Core
22. Escutcheon
23. Cover
24. Lock Ring
25. Control Arm
26. Bracket
27. Pressure Gage
28. Console
29. Knob
30. Bezel
31. Cap
32. Valve
33. O-Ring
34. Piston
35. Seat
36. Bracket

Figure 13-10. Oxygen System (Sheet 1 of 3)



1. Cap
2. Valve
3. Cover
4. Filler Valve Line
5. RH Low Pressure Line
6. Filler Line
7. Support
8. Interconnect Line
9. Cradle Support
10. Oxygen Cylinders
11. Strap
12. LH Low Pressure Line
13. Capillary Line
14. Regulator
15. Valve
16. Control
17. Control Arm
18. Console
19. Pressure Gage
20. Knob
21. Outlet

Figure 13-10. Oxygen System (Sheet 2 of 3)



1. Outlet
2. Arm
3. Control
4. Support
5. Cylinder and Valve Assembly
6. Stiffener
7. Cradle Support
8. Cradle
9. Cyliner and Regulator Assembly
10. Strap
11. Cable Assembly
12. Spacer
13. Gage
14. Knob

Figure 13-10. Oxygen System (Sheet 3 of 3)

NOTE

Oxygen cylinder and regulator assemblies may not always be installed in the field exactly as illustrated in figure 13-10, which shows factory installation. Important points to remember are as follows.

a. Before removing cylinder, release low-pressure line by opening cabin outlets. Disconnect push-pull control cable, filler line, pressure gage line and outlet line from regulator. CAP ALL LINES IMMEDIATELY.

b. If it is necessary to replace filler valve O-rings, remove parts necessary for access to filler valve. Remove line from quick-disconnect valve at the regulator, then disconnect chain, but do not remove cap from filler valve. Remove screws securing valve and disconnect pressure line. Referring to applicable figure, cap pressure line and seat. Disassemble valve, replace O-rings and reassemble valve. Install filler valve by reversing procedures outlined in this step.

c. A cabin outlet is illustrated in figure 13-10. Repair kit, (part no. C166006-0108), available from the Cessna Service Parts Center, may be used for replacement of components of the outlet assembly.

d. To remove entire oxygen system, headliner must be lowered and soundproofing removed to expose lines. Refer to Section 3 for headliner removal.

13-35. OXYGEN CYLINDER GENERAL INFORMATION. The following information is permanently steel stamped on the shoulder, top head or neck of each oxygen cylinder:

a. Cylinder specification, followed by service pressure (e.g. "ICC-3AA1800" and "ICC-3HT1850" for standard and light weight cylinders respectively).

NOTE

Effective 1 January 1970, all newly-manufactured cylinders will be stamped "DOT" (Department of Transportation), rather than "ICC" (Interstate Commerce Commission). An example of the new designation would be: "DOT-3HT1850".

b. Cylinder serial number is stamped below or directly following cylinder specification. The symbol of the purchaser, user or maker, if registered with the Bureau of Explosives, may be located directly below or following the serial number. The cylinder serial number may be stamped in an alternate location on the cylinder top head.

c. Inspector's official mark near serial number.

d. Date of manufacture: This is the date of the first hydrostatic test (such as 4-69 for April 1969). The dash between the month and the year figures may be replaced with the mark of the testing or inspection agency (e.g. 4L69).

e. Hydrostatic test date: The dates of subsequent hydrostatic tests shall be steel stamped (month and year) directly below the original manufacture date. The dash between the month and year figures can be replaced with the mark of the testing agency.

f. A Cessna identification placard is located near the center of the cylinder body.

g. Halogen test stamp: "Halogen Tested", date of test (month, day and year) and inspector's mark appears directly underneath the Cessna identification placard.

13-36. OXYGEN CYLINDER SERVICE REQUIREMENTS.

a. Hydrostatic test requirements:

1. Standard weight (ICC or DOT-3AA1800) cylinders must be hydrostatically tested to 5/3 their working pressure every five years commencing with the date of the last hydrostatic test.

2. Light weight (ICC or DOT-3HT1850) cylinders must be hydrostatically tested to 5/3 their working pressure every three years commencing with the date of the last hydrostatic test.

b. Service life requirements:

1. Standard weight (ICC or DOT-3AA1800) cylinders have no age life limitations and may continue to be used until they fail hydrostatic test.

2. Light weight (ICC or DOT-3HT1850) cylinders must be retired from service after 12 years or 4, 380 filling cycles after date of manufacture, whichever occurs first.

NOTE

These test periods and life limitations are established by the Interstate Commerce Commission Code of Federal Regulations, Title 49, Chapter 1, Para. 73.34.

13-37. OXYGEN CYLINDER INSPECTION REQUIREMENTS.

a. Inspect the entire exterior surface of the cylinder for indication of abuse, dents, bulges and strap chafing.

b. Examine the neck of cylinder for cracks, distortion or damaged threads.

c. Check the cylinders to determine if markings are legible.

d. Check date of last hydrostatic test. If the periodic retest date is past, do not return the cylinder to service until the test has been accomplished.

e. Inspect the cylinder mounting bracket, bracket hold-down bolts and cylinder holding straps for cracks, deformation, cleanliness, and security of attachment.

f. In the immediate area where the cylinder is stored or secured, check for evidence of any types of interference, chafing, deformation or deterioration.

13-38. OXYGEN SYSTEM COMPONENT SERVICE REQUIREMENTS.

a. PRESSURE REGULATOR. The regulator shall be functionally tested every two years or 1, 000 hours for aircraft operating under 15, 000 ft. and one year for aircraft operating over 15, 000 ft. The regulator shall be overhauled every five years ao at time of hydrostatic test.

b. FILLER VALVE. The valve shall be functionally tested every two years and overhauled every five years or at time of hydrostatic test.

c. QUICK-RELEASE COUPLING. The coupling shall be functionally tested every two years and overhauled every five years or at time of hydrostatic test.

d. PRESSURE GAGE. The gage shall be checked for accuracy and overhauled by an FAA approved facility every five years.

e. OUTLETS. The outlets shall be disassembled and inspected and the sealing core replaced, regardless of condition, every five years.

13-39. OXYGEN SYSTEM COMPONENT INSPECTION REQUIREMENTS.

a. Examine all parts for cracks, nicks, damaged threads or other apparent damage.

b. Actuate regulator controls and valve to check for ease of operation.

c. Determine if the gage is functioning properly by observing the pressure build-up and the return to zero when the system oxygen is bled off.

d. Replace any oxygen line that is chafed, rusted, corroded, dented, cracked or kinked.

e. Check fittings for corrosion around the threaded area where lines are joined together. Pressurize the system and check for leaks.

13-40. MASKS AND HOSE.

a. Check oxygen masks for fabric cracks and rough face seals. If the mask is a full-faced model, inspect glass or plastic for cleanliness and state of repair.

b. Flex the mask hose gently over its entirety and check for evidence of deterioration or dirt.

c. Examine mask and hose storage compartment for cleanliness and general condition.

13-41. MAINTENANCE AND CLEANING.

a. Clean and disinfect mask assemblies after use, as appropriate.

NOTE

Use care to avoid damaging microphone assembly while cleaning and sterilizing.

b. Wash mask with a mild soap solution and rinse it with clear water.

c. To sterilize, swab mask thoroughly with a gauze or sponge soaked in a water/merthiolate solution. This solution should contain 1/5 teaspoon of merthiolate per one quart of water. Wipe the mask with a clean cloth and let air dry.

d. Observe that each mask breathing tube end is free of nicks and that the tube end will slip into the cabin oxygen receptacle with ease and will not leak.

e. If a mask assembly is defective (leaks, does not allow breathing or contains a defective microphone) it is advisable to return the mask assembly to the manufacturer or a repair station.

f. Replace hose if it shows evidence of deterioration.

g. Hose may be cleaned in the same manner as the mask.

13-42. SYSTEM PURGING. Whenever components have been removed and reinstalled or replaced, it is advisable to purge the system. Charge oxygen system in accordance with procedures outlined in paragraph 13-45. Plug masks into all outlets and turn the pilot's control to ON position and purge system by allowing oxygen to flow for at least 10 minutes. Smell oxygen flowing from outlets and continue to purge until system is odorless. Refill cylinders as required during and after purging.

13-43. FUNCTIONAL TESTING. Whenever the regulator and cylinder assembly has been replaced or overhauled, perform the following flow and internal leakage tests to check that the system functions properly.

a. Fully charge oxygen system in accordance with procedures outlined in paragraph 13-45.

b. Disconnect line and fitting assembly from pilot's mask and line assembly. Insert outlet end of line and fitting assembly into cabin outlet and attach opposite end of line to a pressure gage (gage should be calibrated in one-pound increments from 0 to 100 PSI). Place control lever in ON position. Gage pressure should read 75±10 PSI.

c. Insert mask and line assemblies into all remaining cabin outlets. With oxygen flowing from all outlets, test gage pressure should still be 75±10 PSI.

d. Place oxygen control lever in OFF position and allow test gage pressure to fall to 0 PSI. Remove all adapter assemblies except the one with the pressure gage. The pressure must not rise above 0 PSI when observed for one minute. Remove pressure gage and adapter from oxygen outlet.

NOTE

If pressures specified in the foregoing procedures are not obtained, the oxygen regulator is not operating properly. Remove and replace cylinder-regulator assembly with another unit and repeat test procedure.

e. Connect mask and line assemblies to each cabin outlet and check each mask for proper operation.

f. Check pilot's mask microphone and control wheel switch for proper operation. After checking, return all masks to mask case.

g. Recharge oxygen system in accordance with procedures outlined in paragraph 13-45.

13-44. SYSTEM LEAK TEST. When oxygen is being lost from a system through leakage, a sequence of steps may be necessary to locate the opening. Leakage may often be detected by listening for the distinct hissing of escaping gas. If this check proves negative, it will be necessary to soap-test all lines and connections with a castile soap and water solution or specially compounded leak-test material. Make the solution thick enough to adhere to the contours of the fittings. At the completion of the leakage test, remove all traces of the leak detector or soap and water solution.

CAUTION

Do not attempt to tighten any connections while the system is charged.

NOTE

Each interconnected series of oxygen cylinders is equipped with a single gage. The trailer type cascade may also be equipped with a nitrogen cylinder (shown reversed) for filling landing gear struts, accumulators, etc. Cylinders are not available for direct purchase, but are usually leased and refilled by a local compressed gas supplier.

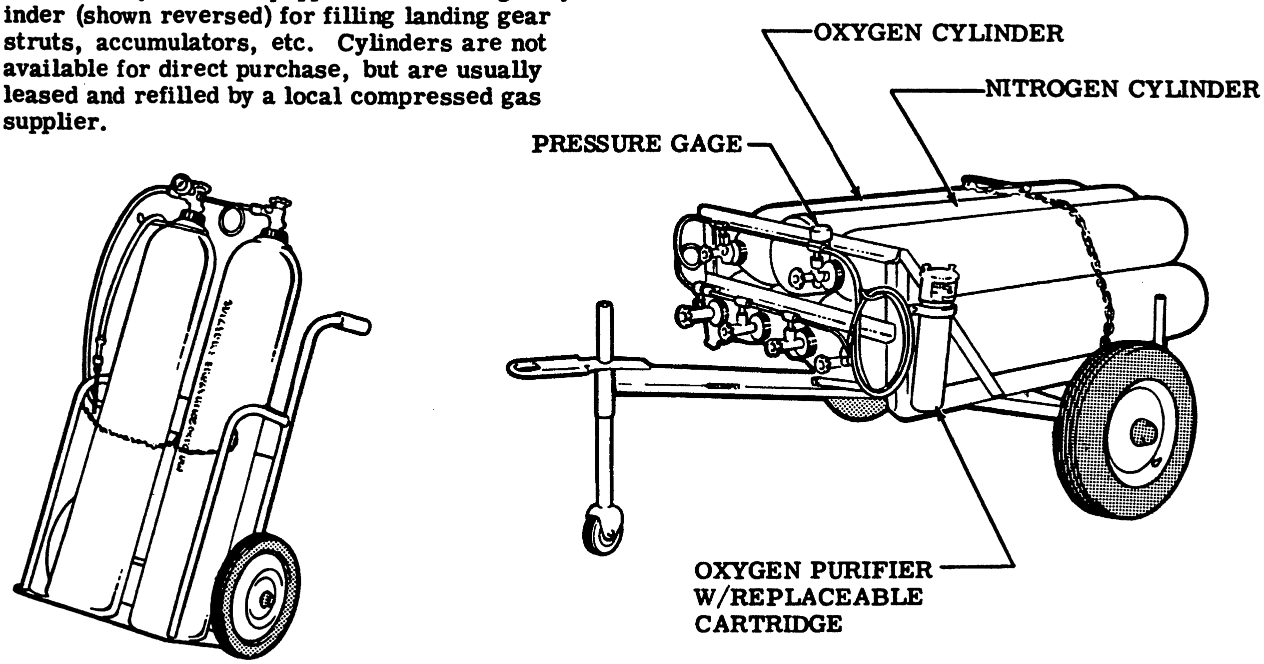


Figure 13-11. Typical Portable Oxygen Cascades

13-45. SYSTEM CHARGING.

WARNING

BE SURE TO GROUND AIRCRAFT AND GROUND SERVICING EQUIPMENT BEFORE CHARGING OXYGEN SYSTEM.

a. Do not attempt to charge oxygen cylinders if servicing equipment fittings or filler valve are corroded or contaminated. If in doubt, clean with stabilized trichlorethylene and let air dry. Do not allow solvent to enter any internal parts.

b. If cylinder is completely empty, do not charge, as the cylinder must then be removed, inspected and cleaned.

CAUTION

A cylinder which is completely empty may well be contaminated. The regulator and cylinder assembly must then be disassembled, inspected and cleaned by an FAA approved facility, before filling. Contamination, as used here, means dirt, dust or any other foreign material, as well as ordinary air in large quantities. If a gage line or filler line is disconnected and the fittings capped immediately, the cylinder will not become contaminated unless temperature variation has created a suction within the cylinder. Ordinary air contains water vapor which could condense and freeze. Since there are very small orifices in the system, it is very important that this condition not be allowed to occur.

c. Connect cylinder valve outlet or outside filler valve to manifold or portable oxygen cascade.

d. Slowly open valve on cascade cylinder or manifold with lowest pressure, as noted on pressure gage, allow pressure to equalize, then close cascade cylinder valve.

e. Repeat this procedure, using a progressively higher pressure cascade cylinder, until system has been charged to the pressure indicated in the chart immediately following step "f" of this paragraph.

f. Ambient temperature listed in the chart is the air temperature in the area where the system is to be charged. Filling pressure refers to the pressure to which aircraft cylinders should be filled. This table gives approximations only and assumes a rise in temperature of approximately 25°F. due to heat of compression. This table also assumes the aircraft cylinders will be filled as quickly as possible and that they will only be cooled by ambient air; no water bath or other means of cooling be used.

Example: If ambient temperature is 70°F., fill aircraft cylinders to approximately 1,975 psi or as close to this pressure as the gage may read. Upon cooling, cylinders should have approximately 1,850 psi pressure.

TABLE OF FILLING PRESSURES

Ambient Temp. °F	Filling Press. psig	Ambient Temp. °F	Filling Press. psig
0	1650	50	1875
10	1700	60	1925
20	1725	70	1975
30	1775	80	2000
40	1825	90	2050

SHOP NOTES: