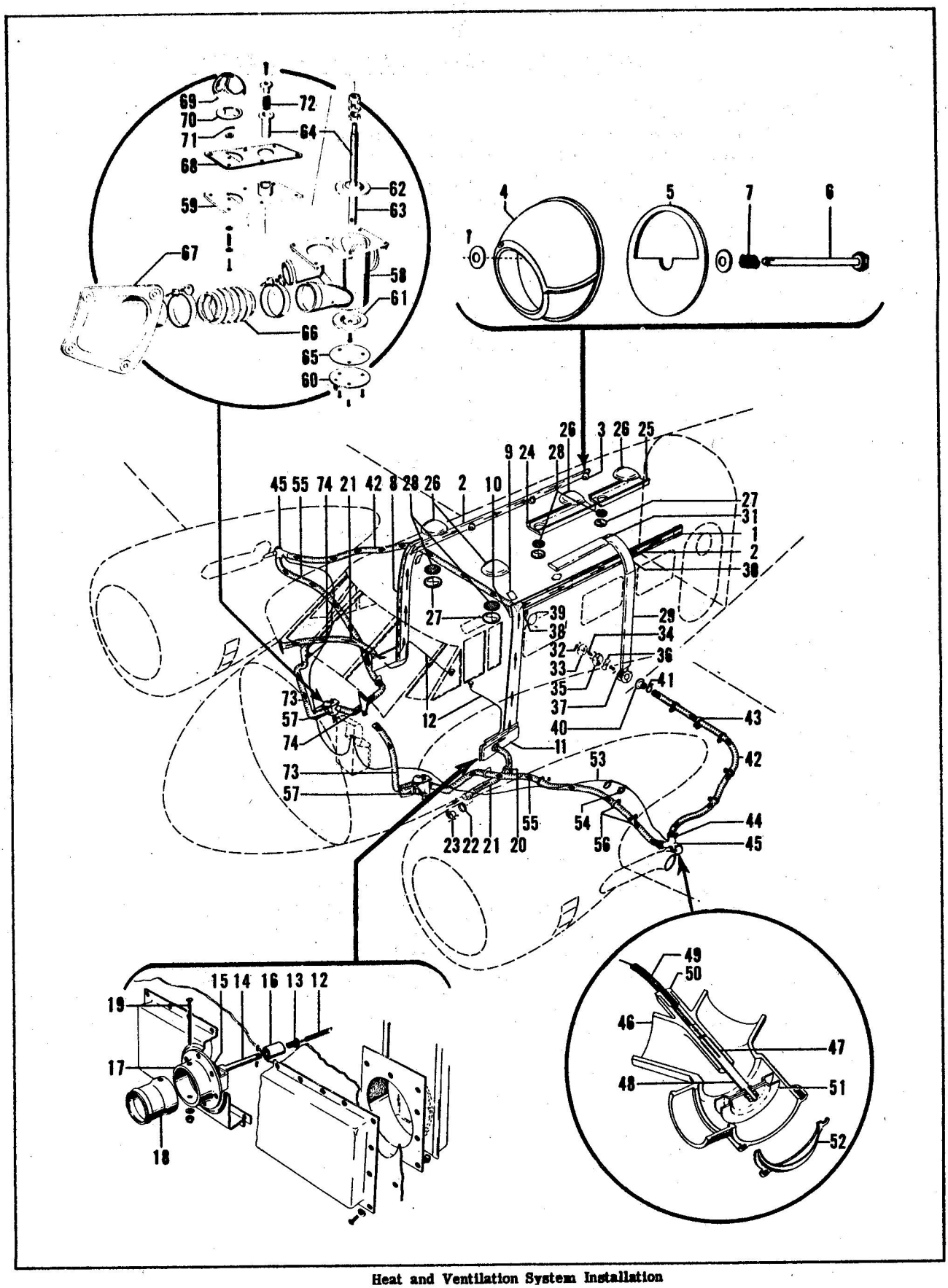
PHASE 5

UTILITY SYSTEM



Heat and Ventilation System Installation

HEAT AND VENTILATION SYSTEM INSTALLATION

1 End Assembly
2 Duct Assembly - cabin cold air LH and RH
3 Outlet Installation - cold air duct
4 Cap Assembly - cold air plastic
5 Gasket - cold air outlet
11 Box Assembly - cold air valve
12 Control - cold air valve
21 Duct - cold air
23 Flange Assembly - cold air inlet RH and LH
24 Duct Assembly - cabin exhaust
25 Duct Assembly - cabin exhaust
26 Vent - cabin exhaust
27 Ventilator assembly
28 Screen
29 Duct - astrodome defroster lower
30 Duct - astrodome defroster centre
31 Duct - astrodome defroster upper
32 Handle - astrodome defroster valve
33 Plate Assembly - cabin heat diffuser LH
34 Shaft - astrodome heat valve
35 Diffuser Assembly - cabin heat LH
36 Valve - astrodome
37 Housing assembly - astrodome heat valve
38 Diffuser - cabin heat RH
45 Valve Assembly - cabin air
46 Valve - cabin air
47 Bushing
48 Rod push - cabin heater valve
49 Control assembly - cabin heater valve
50 Bushing
51 Diaphragm
57 Valve assembly - cockpit air LH and RH
58 Valve - cockpit air LH and RH
59 Cover Assembly - cockpit air valve top
60 Cover Assembly - cockpit air valve bottom
64 Control - cockpit air valve
67 Scoop - cockpit cold air LH and RH
74 Outlet Assembly - windshield defroster LH and RH

UTILITY SYSTEMS - EXPEDITOR AIRCRAFT

General Information

This part covers the maintenace, trouble shooting, and repair of utility systems used for the comfort and safety of the aircraft occupants, or systems instaled for operation under specific conditions. The systems covered in this section are heating, ventilating, de-icing, fire extinguisher, fire detection and windshield wiper.

Heating System

The heating system is designed to operate efficiently through a wide temperature range. Heat for the cabin and pilots compartment is derived from intensifier tubes inserted in the exhaust stack on each engine. Fresh air flows through an intake port into the intensifier tube where it is heated. A two outlet control valve is located at the discharge end of each intensifier tube. They are actuated by the cabin heat controls on the control pedestal. The control valves route the heated air into the cabin and pilots compartment, or overboard, depending on the position of the cabin heat controls. Individual temperature controls are installed at the pilots and co-pilots air ports. Heated air for windshield defrosting is routed through extensions of the conductor tubes under the pilots compartment floorboards. A duct running from the left cabin heat inlet up to the side wall and forward on the overhead to the astrodome, routes the heated air for astrodome defrosting. An on-off control is mounted in the cabin heat inlet.

Intensifier Tubes

Intensifier tubes of corrosion-resistant steel are located in the exhaust stack of each engine. They connect at their foreard ends to an air inlet located in the engine baffles. The intensifier tubes are dimpled to provide greater heat transfer.

NOTE: To allow for expansion clearance ensure a minimum of 9/32 of an inch exists between the end of the intensifier tube extension of the tail pipe and the heater control box.

Hot Air Control Valve

The hot air control valves are attached to the aft end of each intensifier tube. The valve consists of an inlet, two outlets and a by pass opening to discharge the hot air when heat is not required. Controls for the hot air valves are located on the lower part of the pilots control pedestal.

Minor Repair and Parts Replacement

Minor repairs and parts replacement will consist of replacement of the entire valve assembly.

Adjustments

Unscres control housing nut from valve casting. If valve was not going to the full hot position, turn control housing nut up the housing and screw nut back into valve. If valve does not shut off hot air, turn nut down on control housing of few turns and reinstall in valve. Safety the nut.

NOTE: Adjust control so there will be $\frac{1}{4}$ inch spring back of the control handle when released, to ensure positive closing of the valve.

Ventilating System

Cold air inlets are provided at four places, onein the leading edge of each centre section wing, and one each on the lower outboard side of the fuselage under the pilots and co-pilots floorboards. Air entering the centre section wing inlets is routed through conductor tubes of neoprene and glass fibre construction to a distributor box on each side of the fuselage. A valve in each distributor regulates the amount of cold air that flows from the boxes into the cabin air ducts. Individually controlled outlets installed in the cabin air duct above each seat are regulated by the passengers.

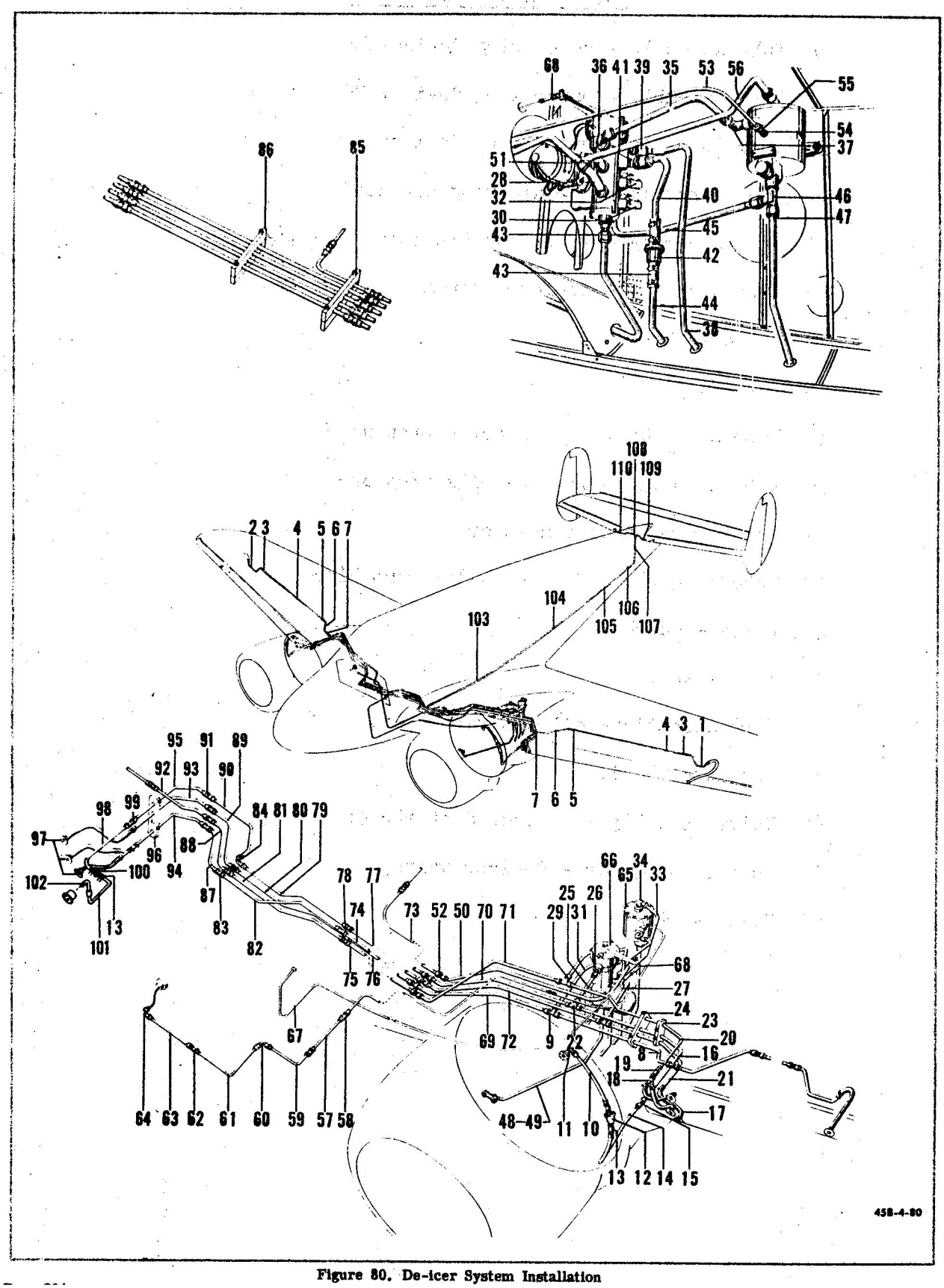


Figure 80. De-icer System Installation

DE-ICER SYSTEM INSTALLATION

1 Tube Assembly - outer wing de-icer LH

2 Tube Assembly - outer wing de-icer RH

4 Tube Assembly - outer wing de-icer

6 Tube Assembly - inboard wing de-icer

8 Tube Assembly - left wing tip boot

10 Tube Assembly - de-icer system

12 Valve - check

13 Hose

14 Tube Assembly - left nacelle pressure

16 Tube Assembly - left nacelle pressure

17 Hose - wing boot connector

38 Tube Assembly - de-icer valve vent line

42 Valve - check

44 Tube - vent

47 Tube Assembly - oil separator vent

65 Separator - oil

66 Valve assembly - de-icer distributor

67 Control Assembly - de-icer valve

100 Valve - check

ANTI and De-Icing Systems

Detrimental Effects of Ice

(a) Reduces aerodynamic efficiency of the lifting surfaces.
(b) Causes excessive drag.
(c) Increases vibration and reduces thrust of propellors.
(d) Lowers engine performace (due to reduced air supply to the carburetor)
(e) Reduction of control and stability of the aircraft.
(f) Poor visibility.

Types of Ice.

(a) Rime Ice. Formed from large moisture particles when the temperature is near 32 deg. F. It has a rough porous surface and usually forms on the leading edges of the aerofoils. It therefore distorts the lifting surfaces causing aerodynamic inefficiency.

(b) GLAZE OR CLEAR ICE Formed from small drops of moisture at low temperatures. It is clear, quite smooth and adheres to large surfaces. This rapidly increases the weight of the aircraft.

(c) Rime Frost Formed from very small drops at low temperatures. It adheres to all surfaces thereby alters the handling characteristics of the aircraft near stalling speeds.

PREVENTION ANTI-ICING

(a) Heat Using the exhaust or engine heat piped to the required areas. Heating by electric wires may also be used.

(b) CHEMICAL - Liquid in the form of glycol or alcohol which lowers the freezing point of water may be used. It can be pumped to the leading edges of aerofoils or sprayed against windshields, etc.

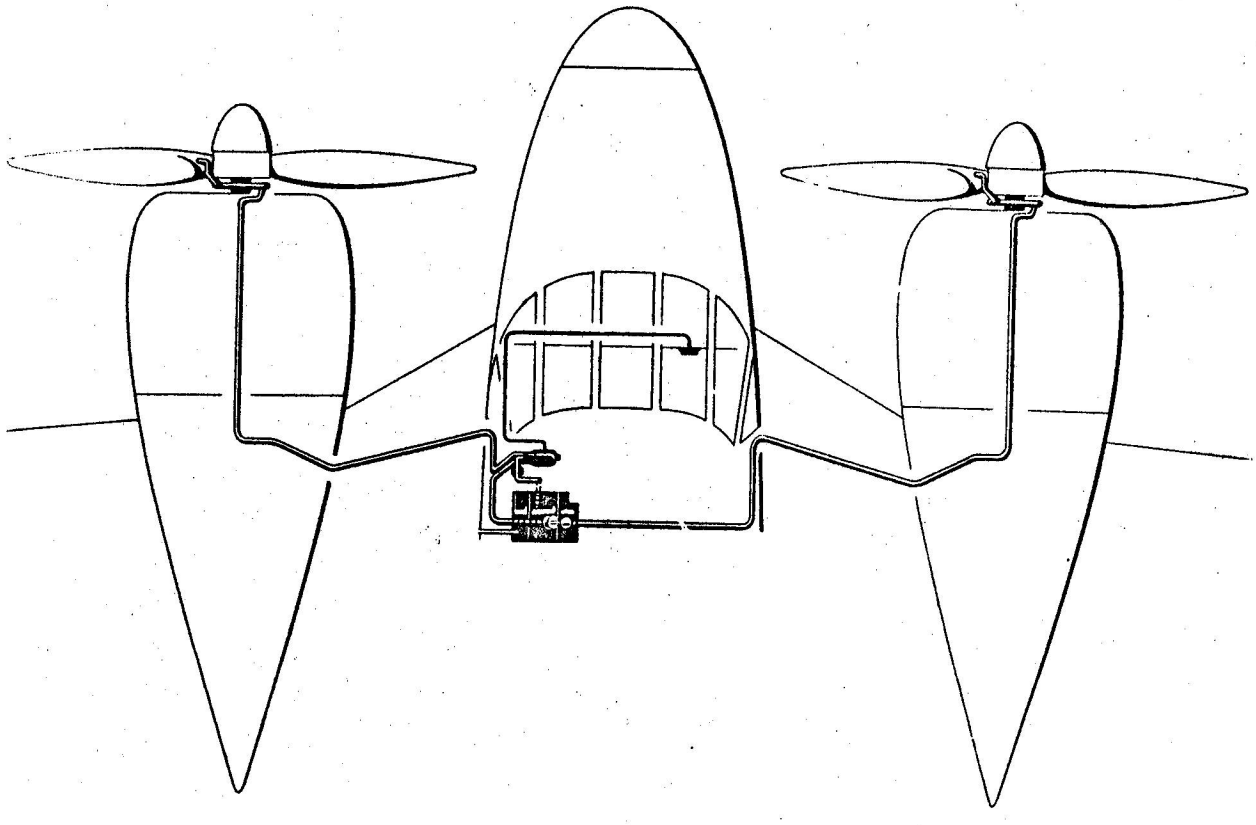
REMOVAL (DE-ICING)

(a) Heat Used as mentioned above.

(b) DISTORTION At present this is the most common method employed and a unit of this type is the "Goodrich De-Icer."

The Goodrich De-Icer

A pump supplies compressed air through a distributor valve to a number of cells within rubber boots that are mounted on leading edges of various aerofoils (mainplanes, empennage) and sometimes other



Anti-Icing System

components. These cells are expanded by the compressed air, crack the ice, and the airflow carries the ice away. The cells are deflated, (exhausted to atmosphere) through the distributor valve. When the de-icer is "off" the air supply is by-passed through the distributor valve to atmosphere for their comfort. The fuselage inlets route the air through short conductor tubes to the pilots and co-pilots individual Air ports.

Diaphragm type valves are instaled in each distributor box to control the flow of cold air. They are operated by controls mounted on bulkhead 5 behind the pilots and co-pilots seat.

Cold Air Ducts

Outisde air is distributed in the cabin from ducts extending fore and aft along the curved corner formed by the overhead and sidewalls. Constructed of formed aluminum sheet these horizontal ducts connect with vertical ducts at distributor boxes just aft of bulkhead 5.

Cabin Air Exhaust

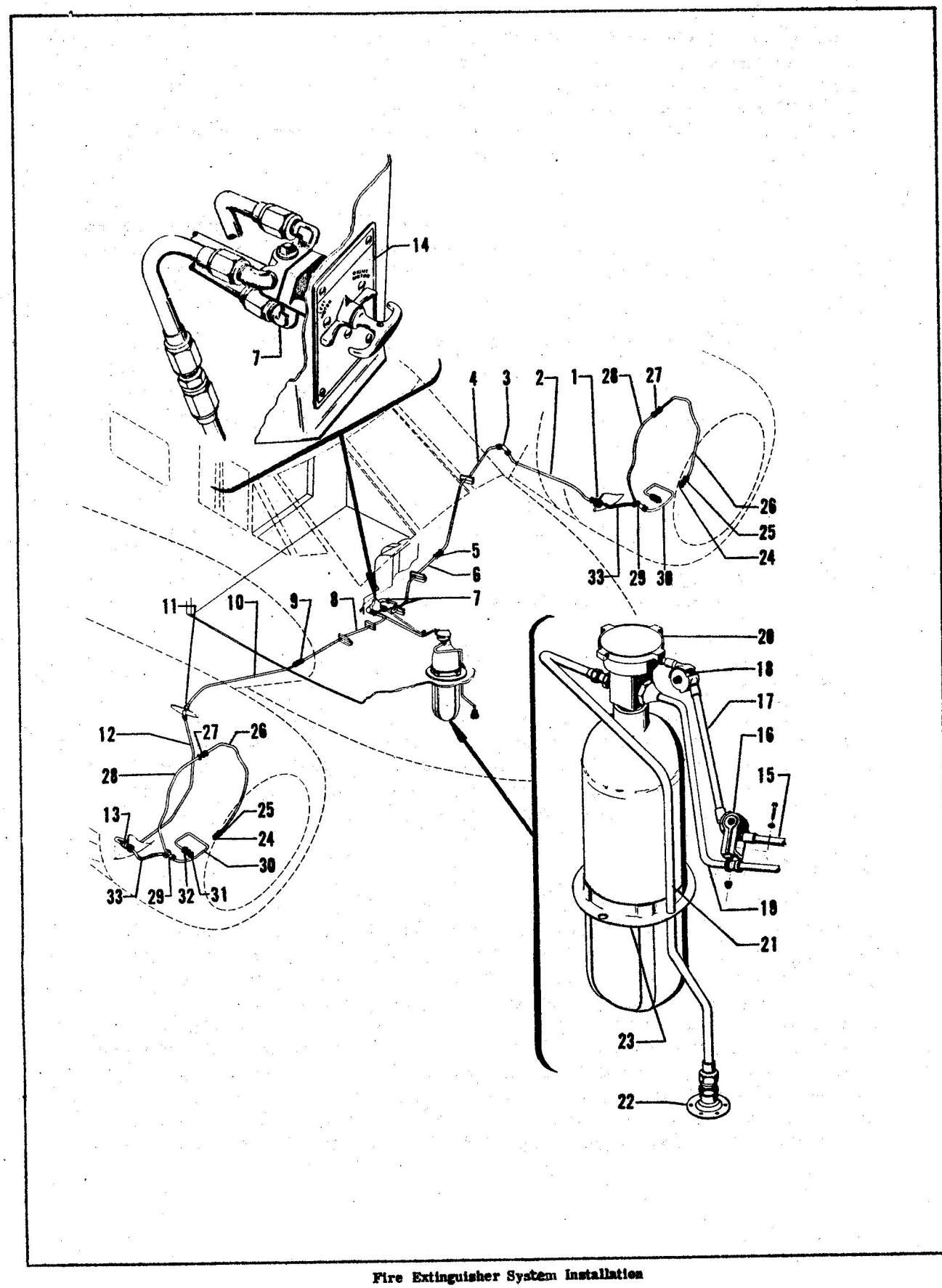
The cabin air exhaust system consists of two formed aluminum sheet ducts riveted to the cabin ceiling. Onthe lower side of each duct is an adjustable opening forthe exhaust air to pass out of the cabin. On the upper side of each duct is an opening in the outside skin. Low pressure behind thedischarge covers pulls air out of the cabin.

Anti-Icer Tank

An anti-icer tank with a capacity of 2.5 Imperial (3 US) gallons, is located just behind the pilots seat on the deck. It is serviced from the pilots compartment. They should be checked and filled before each flight during winter operations and before all other flights on which propellor icing might be encountered.

De-Icing System

De-Icer boots are mounted on the leading edges of wings and horizontal stabilizer. The boots are inflated by air pressure from the exhaust side of theengine driven vacuum pumps. Air lines run from the pumps to oil separators located in each engine accessory compartment. From the oil separator in each engine section, lines run to a three way valve. From the three way valve the air is routed through the de-icing system oil separator to the distributor. When the de-icing system is used, the vacuum pump exhaust is discharged directly into the system, when not is use, it is directed overboard by a vent line. The three way valve directing the vacuum pump discharge is operated by a push-pull control.



Fire Extinguisher System Installation

FIRE EXTINGUISHER SYSTEM INSTALLATION

2 Tube Assembly - nacelle fire extinguisher LH

4 Tube Assembly - root rib fire extinguisher LH

6 Tube Assembly - fuselage discharge LH

8 Tube Assembly - fuselage discharge RH

10 Tube Assembly - root rib fire extinguisher RH

12 Tube Assembly- nacelle fire extinguisher RH

14 Panel - control

15 Tube Assembly - cable discharge lower

16 Pulley

17 Tube Assembly - cable discharge upper

19 Tube Assembly - discharge bottle to valve

20 Cylinder and valve assembly

21 Tube Assembly - overboard discharge

22 Indicator

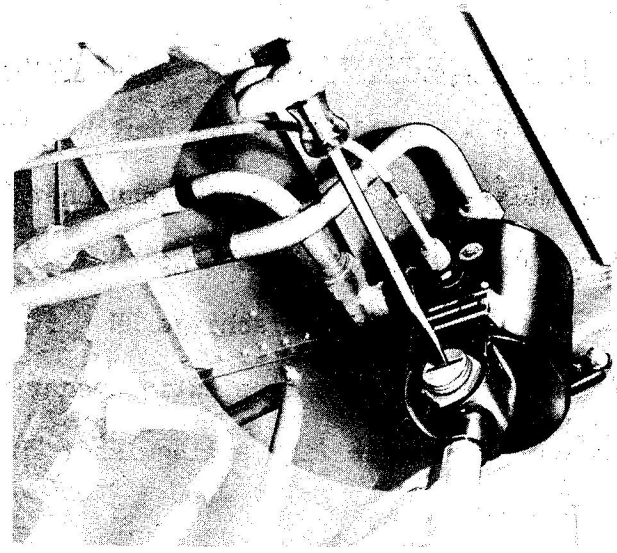
23 Support Assembly - cylinder

26 Tube Assembly - extinguisher discharge fire LH

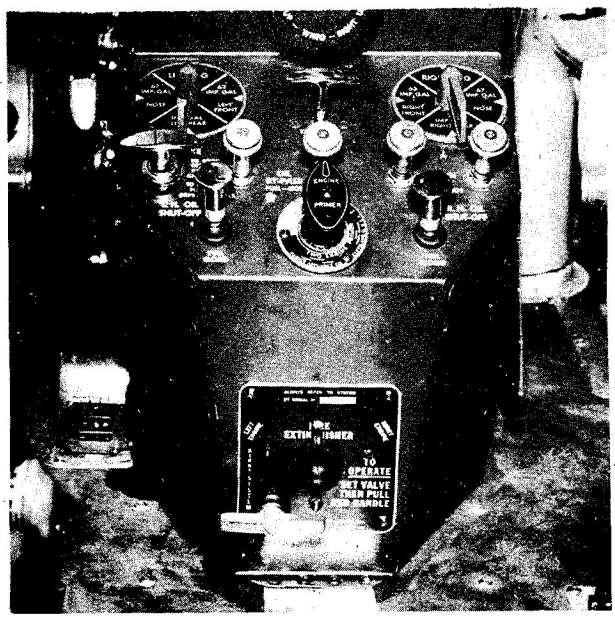
28 Tube Assembly - extinguisher discharge fire RH

30 Tube Assembly - extinguisher discharge carburettor

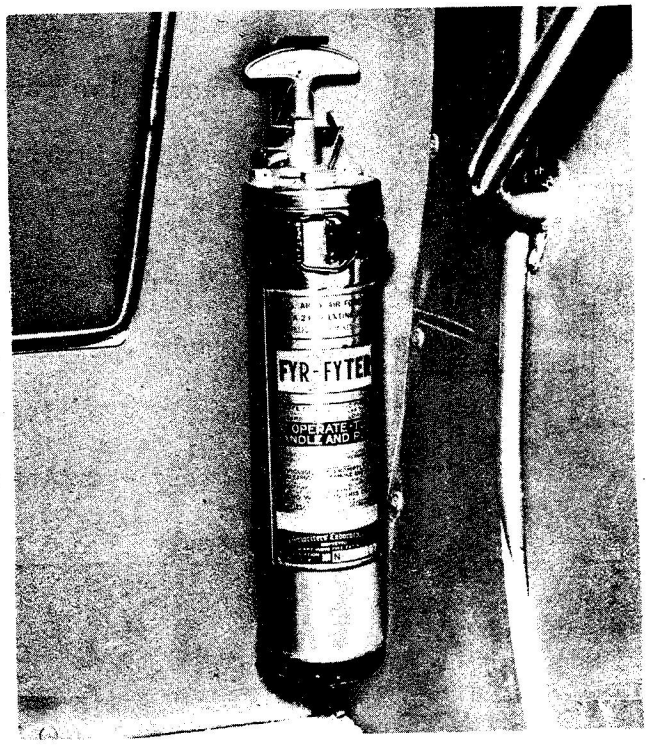
33 Hose Assembly



De-Icer System Relief Valve Adjustment



Engine Fire Extinguisher Selector Valve and Release Handle



Hand Fire Extinguisher

Boots are inflated in four stages once every 40 seconds by rotation of a distributor valve. All de-icer boots are inflated and deflated once each revolution. A pressure relief is incorporated in the oil separator in the left nacelle.

Minor Repairs and Parts Replacement

Refer to E 15-80-2C Description and Maintenance Instructions. De-Icer Shoes.

Testing

When testing the de-icer system, check allconnections for leaks and check boots for tears and leaks. With engine running set operating pressure at 7½ PSI. Note the inflation cycle of boots to see if all are operating properly. The cycle of de-icer boots when inflate and deflate once over 40 seconds.

CAUTION: Do not exceed ten pounds pressure at any time in the de-icer boots.

Adjustments

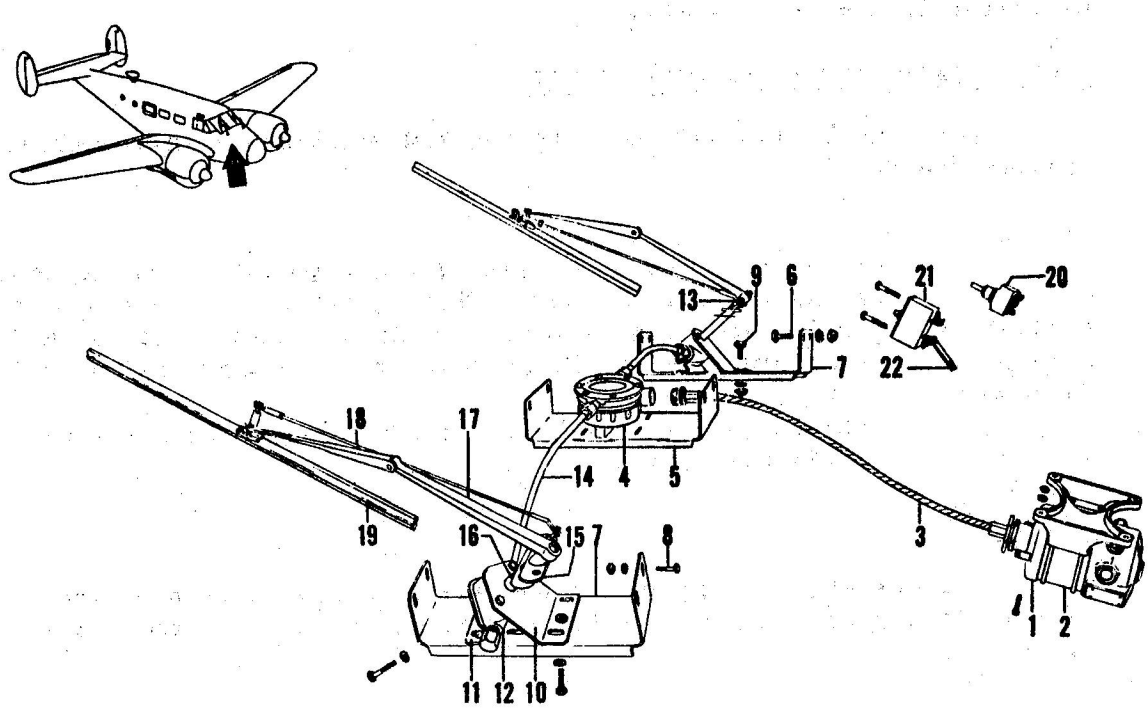
The operating pressure for the de-ieing system is not less than 7 PSI and not more than 8 PSI adjustment is made at the oil separator.

FIRE EXTINGUISHER SYSTEM - EXPEDITOR (Safety Equipment)

Engine Fire Extinguisher

The engine fire extinguisher equipment is installed to discharge CO2 into each engine accessory compartment. Thesupply cylinder and valve assembly are located forward of the co-pilots rudder pedals. A control panel consisting of an engine selector valve and a release handle, is located at the base of the pilots control pedestal. A line runs from the supply cylinder to the engine selector valve and from the valve to each engine compartment A line extends from the cylinder to a safety plug outlet on the lower side of the fuselage below the cylinder to a safety plug outlet on the lower side of the fuselage below the cylinder. Therelease handle on the control pedestal is connected by a flexible cable to a valve on this cylinder.

CAUTION: When removing engine fire extinguisher extreme care should be taken in removing the release cable from a full bottle to prevent accidental discharge.



Windshield Wiper Installation

1 Motor assembly
2 Clamp
3 Drive Assembly
4 Converter assembly
5 Bracket - converter support
6 Bolt - aircraft no 10-32 x $\frac{1}{2}$ inch
7 Bracket - main windshield wiper mouting
8 Bolt - aircraft no 10-32 x $\frac{1}{2}$ inch
9 Bolt - aircraft no 10-32 x $\frac{1}{2}$ inch
10 Bracket - windshield wiper unit forward
11 Bracket - windshield wiper unit aft
12 Unit assembly - 2
13 Seal
14 Control assembly
15 Plate assembly LH and RH
16 Gasket
17 Arm Assembly - drive
18 Rod Assembly - Tie
19 Blade and holder assembly LH and RH
20 Switch - windshield wiper
21 Breaker - circuit
22 Bar - bus

Minor Repairs and Parts Replacement

Service other than replacement of empty bottles should not be attempted.

Hand Fire Extinguishers

Hand fire extinguishers, type A-20 are mounted just inside the cabin door below the baggage compartment door and at the entrance to the pilots compartment. Spring clips hold the extinguishers in place ready for immediate use. 3T models incorporate the hand extinguisher under the co-pilots seat.

WINDSHIELD WIPER SYSTEM - EXPEDITOR

The windshield wiper mechanism is installed inside the nose baggage compartment on the overhead between bulkhead 2 & 3. An electrical motor is coupled to a converter by a flexible shaft. The converter changes the rotary motion of the electric motor to an oscillating motion. Extending outboard from the converter are two flexible cables encased in rigid housings. The ends of these cables are attached to the actuating shafts. The actuating shafts are provided with splined ends so the position of the wiper blades in relation to the windshield may be altered. An aligning rod is also provided so theproper position of the wiper blade can be maintained.

WINDSHIELD WIPER MOTOR

The windshield wiper motor is a two speed, 24 volt, 1/6 hp motor, controlled from the pilots compartment.

MINOR REPAIR AND PARTS REPLACEMENT

The minimum brush length is 3/8 inch. Brushes should be replaced when the room to this measurement. The commutator should be kept clean.

Converter, Actuating Rods, and Aligning Rods.

The converter is connected directly to the motor and changes the rotary motion of the motor to oscillating motion. Running outboard to the windshield wiper actuating shafts on either side are flexible shafts encased in rigid housings. These shafts in turn attach to the wiper arms and blades. Aligning rods are provided to align the blade to the windshield.

Minor Repairs and Parts Replacement

Repalce the windshield wiper blades by removing safety wire and pulling clevis pin.

Converter repairs are limited to replacement of the unit.

Adjustmemt

In the event that one or both of the wiper blades strike the sides of the windshield, adjustment at the actuating shaft is necessary. Remove the nut holding the wiper arm to the actuator shaft. Slip the wiper arm off the actuator shaft and move one or more serrations away from the point where it was striking. Remove the cotter pin from the clevis pin of the aligning rod and lengthen, or shorten the aligning rod to brind the blade in a position parallel to the inboard windshield frame. Reinstall the aligning rod and safety with a cotter pin. Test the wiper assembly. Repeat the above operation if necessary until the blade clears both the side windshield frames. Check operation at high and low speeds.