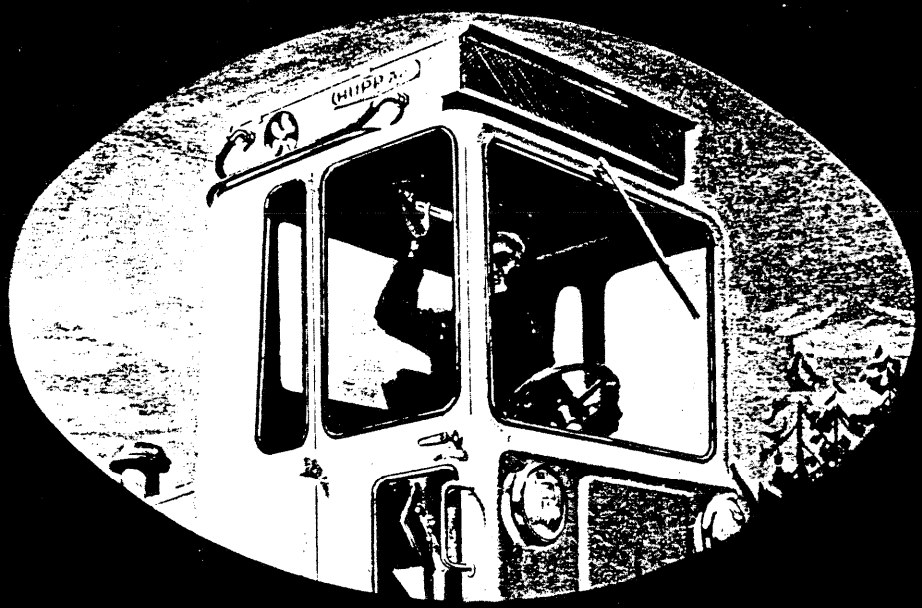
# HUPP-Aire

## AIR CONDITIONER—PRESSURIZER—HEATER



## INSTALLATION - OPERATION - SERVICE MANUAL

MOBILE MP PRODUCTS

*HUPP all-season climate control*

80-406 (8-90)

wagner
a division of allied systems company

# HUPP-Aire MANUAL

## INSTALLATION—OPERATION—MAINTENANCE—SERVICE

## AIR CONDITIONER—PRESSURIZER—HEATER

## SECTION I — INTRODUCTION

### 1.1 General

This manual contains installation information and complete operation, maintenance and diagnosis instructions for HUPP-Aire models 524AX- 12VF, 24VF and 524AX— 12VT, 24VT manufactured by HUPP Mobile Products Div. (See figs. 1 & 2.)

Both models are roof mounted units and are self-contained with the exception of the compressor which is engine mounted. (The -F models use a Delco compressor and the -T models use a Tecumseh compressor.) They are ruggedly built and are designed for installation on slow moving construction, farm or industrial equipment.

### 1.2 Packaging

Both 524AX models are shipped in two cartons which include (1) basic roof top unit including mounting frame and interior control and outlet (console) assembly, and (2) balance of all necessary parts such as hoses, fittings, clamps and compressor. (See figs. 3 & 4.)

NOTE: Additional items are necessary to complete the installation. These are the electro-magnetic clutch to drive the compressor (included in -F models) and an adapter kit to mount the compressor to the engine. These adapter kits are available for some equipment, but have to be hand fabricated for others.

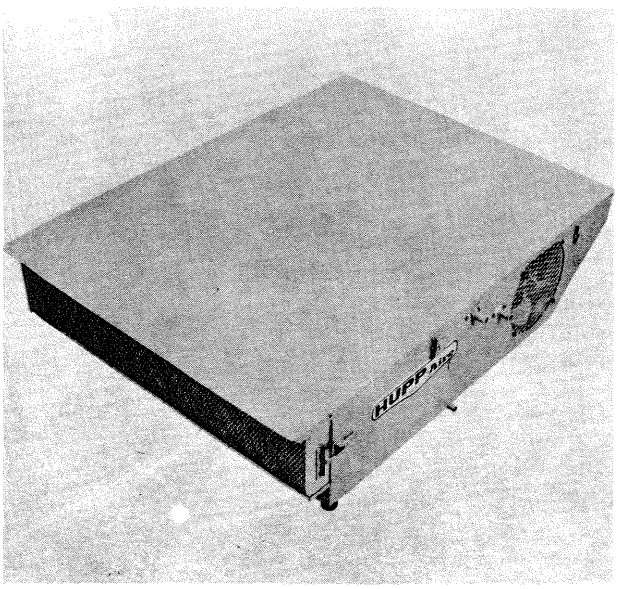


**FIGURE 1**

FRONT VIEW OF HUPP-Aire MODEL 524AX

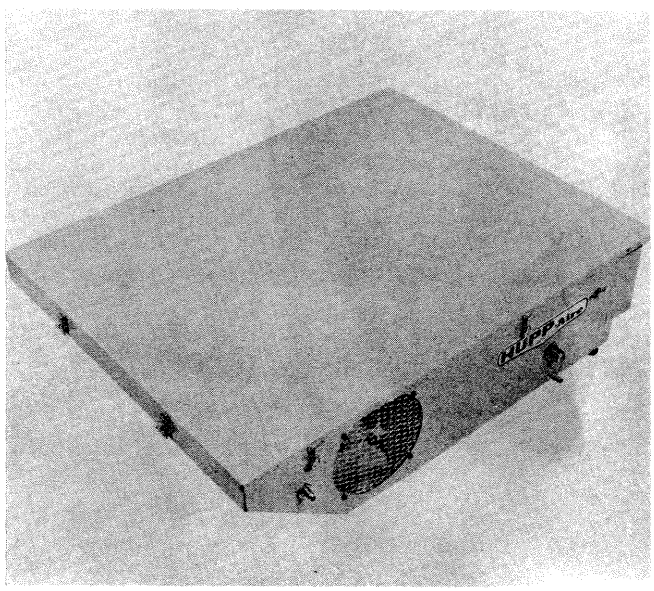


**FIGURE 2**

REAR VIEW OF HUPP-Aire MODEL 524AX

## 1.3 Specifications

The following chart shows the nominal operation characteristics and capacities:

| | |
|---|---|
| Model | 524AX-12/24V-F or T |
| Height | 10¾" |
| Width | 33" |
| Length | 39" |
| Length (at Mounting Surface) | 30⅛" |
| Weight (on Roof) | 150 lbs. |
| C.F.M. (Cooling) | 458 |
| C.F.M. (Heating) | 380 |
| Volts | 12/24 |
| Amps — Cooling (Above 55°F) | 35/17.5 |
| Amps — Heating (Below 50°F) | 16/8 |
| BTU Capacity — Cooling (90°F. D.B. —75°F. W.B.) | 23,000 |
| BTU Capacity — Heating (150°F. Diff.) | 30,000 |
| Compressor C.I.D. (Delco) | 12.6 |
| Compressor C.I.D. (Tecumseh) | 10.5 |

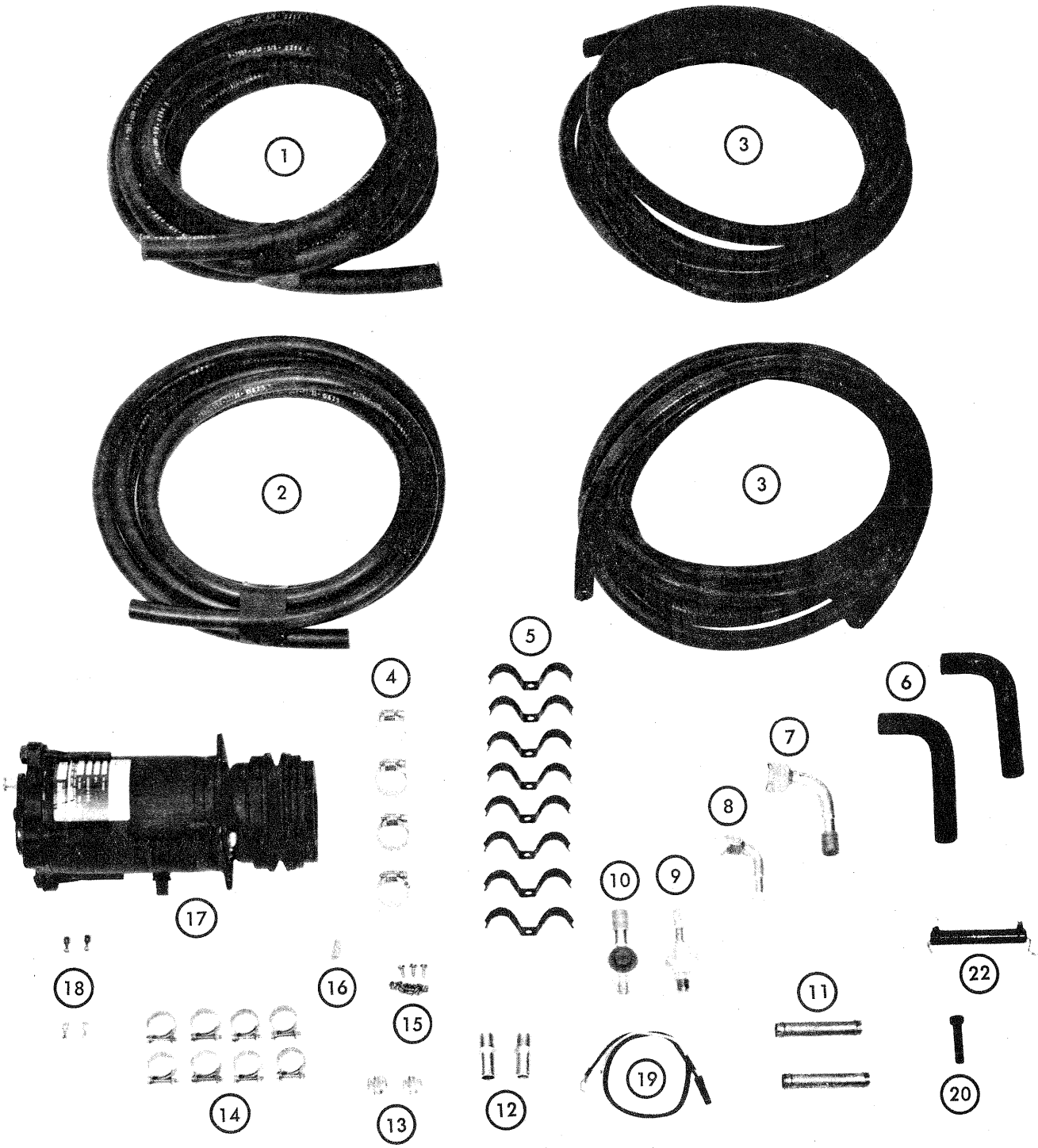



**FIGURE 3**

KIT PARTS FOR — F MODELS (SEE PARTS LIST FOR IDENTIFICATION)

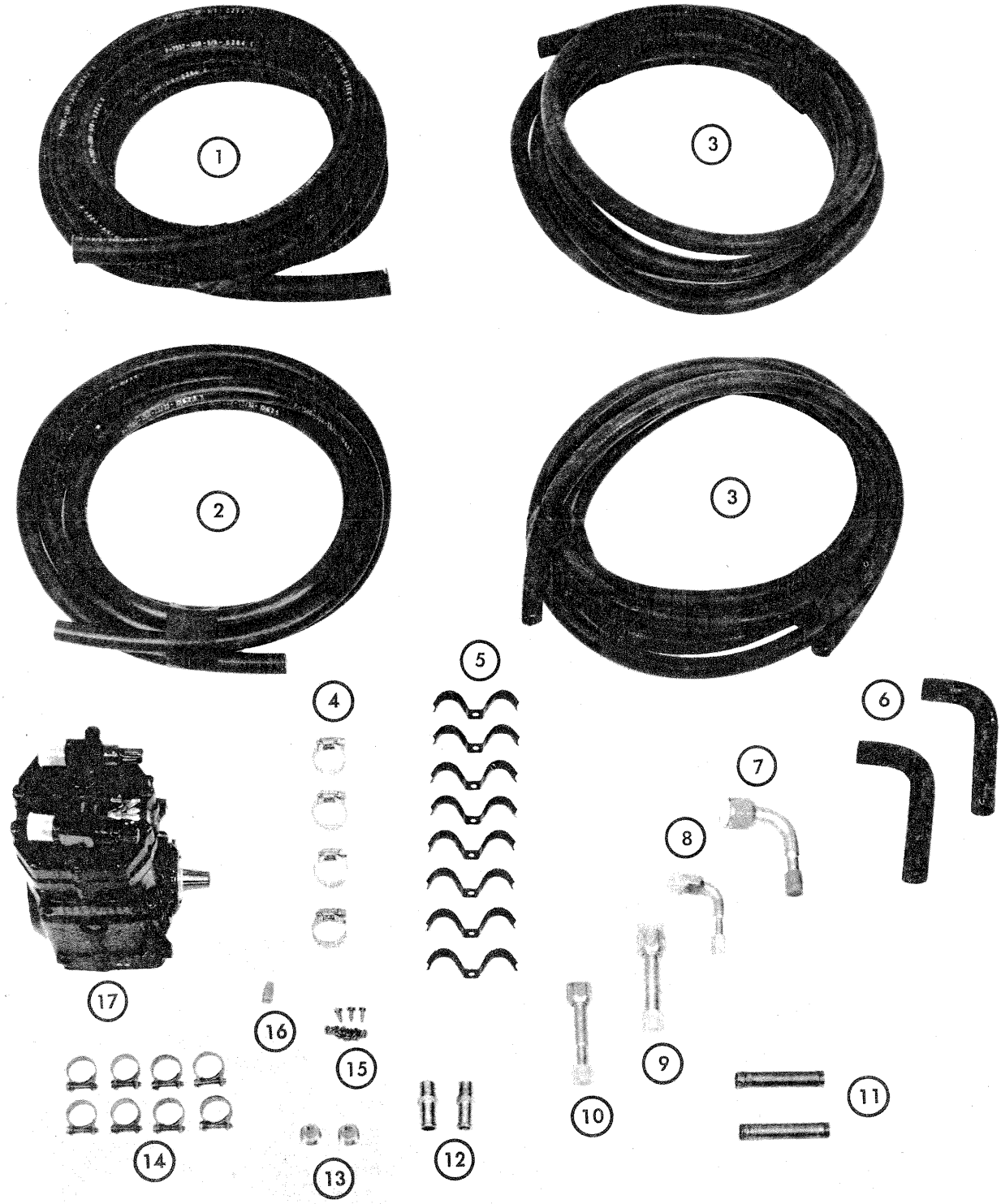



**FIGURE 4**

KIT PARTS FOR — T MODELS (SEE PARTS LIST FOR IDENTIFICATION)

# SECTION II — INSTALLATION

## 2.1 Tools

In order to make the installation easily and properly, the installing mechanic should have the general tools of his trade, including sockets, wrenches, snips, screw drivers, power drills, saws, etc. The following list covers additional items necessary to easily complete the installation and charge the system when completed.

1 Bonney #RF-45 reversible ratchet wrench
1 Robinair manifold with gages and hoses
1 Madden #CAC-10 dispensing valve
1 Turner #LP777 leak detector
1 TelTru 0°-220°F. Thermometer
1 Portable vacuum pump
as req'd Supply of 1 lb. cans of Refrigerant 12

NOTE: Equal tools of other manufacturers are satisfactory.

## 2.2 Helpful Hints

Read these instructions carefully before starting on the installation to become familiar with all operations. The following instructions are step by step procedures, but time will be saved by anticipating the next operation before completing the preceding one.

DO NOT drill, cut or saw a hole anywhere before first determining what is on the other side.

DO NOT remove any plugs from any hose connection of any component for any reason, until you are ready to make the connection. This procedure will eliminate the possibility of dirt or moisture getting into the system.

Be sure work area and the equipment are clean and dry before starting the installation.

## 2.3 Roof Top Unit (Evaporator and Condenser)

**2.3.1** Locate template on top of roof in the general area where the interior console is desired. The front of the hole should be at least seventeen inches from the front of the cab roof. Adjust template also so that the cutout will not interfere with any roof supports or stiffeners. When all above requirements are met, square the template to the roof and tape in place.

**2.3.2** Using template as a guide, punch centers of twelve mounting holes in roof and drill with 5/16" drill. Punch center of two front mounting holes and drill with 5/8" drill. Mark corners of cutout on roof, remove template and scribe cutout edges. Cut hole with snips or sabre saw. (Flame cut if real heavy material such as used on some construction equipment taking care not to burn any roof insulation.)

**2.3.3** Unbolt the heavy mounting frame from the underside of unit by removing six nuts. (See fig. 5.) Using the 1/4" x 1" gasket material, attach it to the bottom flange of the mounting frame and then bolt the frame to the roof using the 1/4-20 x 1/2" bolts and 1/4" lock washers. (First cut clearance holes in gasket at hole locations.) Insert bolts from inside cab and tighten securely.

**2.3.4** Now attach 1/4" x 1" gasket material to top flange of mounting frame and cut clearance holes in gasket at the six hole locations.

**2.3.5** Carefully raise the unit over the cab roof and lower it onto the mounting frame making sure the six studs enter the holes in the frame and do not damage the gasket. Tighten securely in place from inside the cab with the six nuts previously removed in paragraph 2.3.3. At front of cab and unit, insert the 1/2" x 2" bolts (with a large washer at the head) from the inside the cab, through the large hard rubber disc spacers and into the tapped holes in the bottom

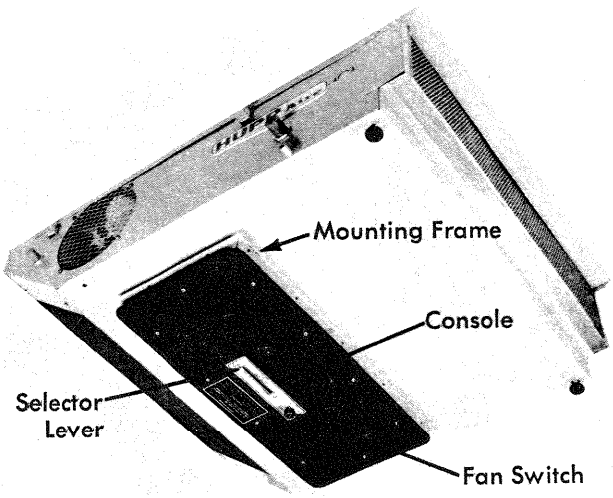



**FIGURE 5**

UNDERSIDE VIEW OF HUPP-Aire MODELS

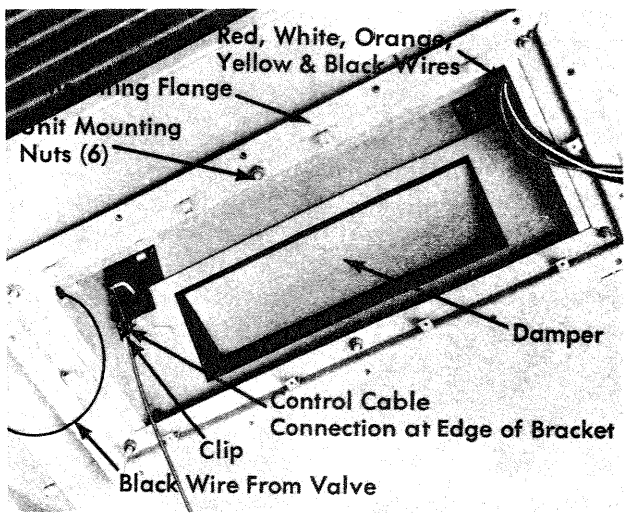



**FIGURE 6**

CONTROL CABLE, DAMPER AND WIRES

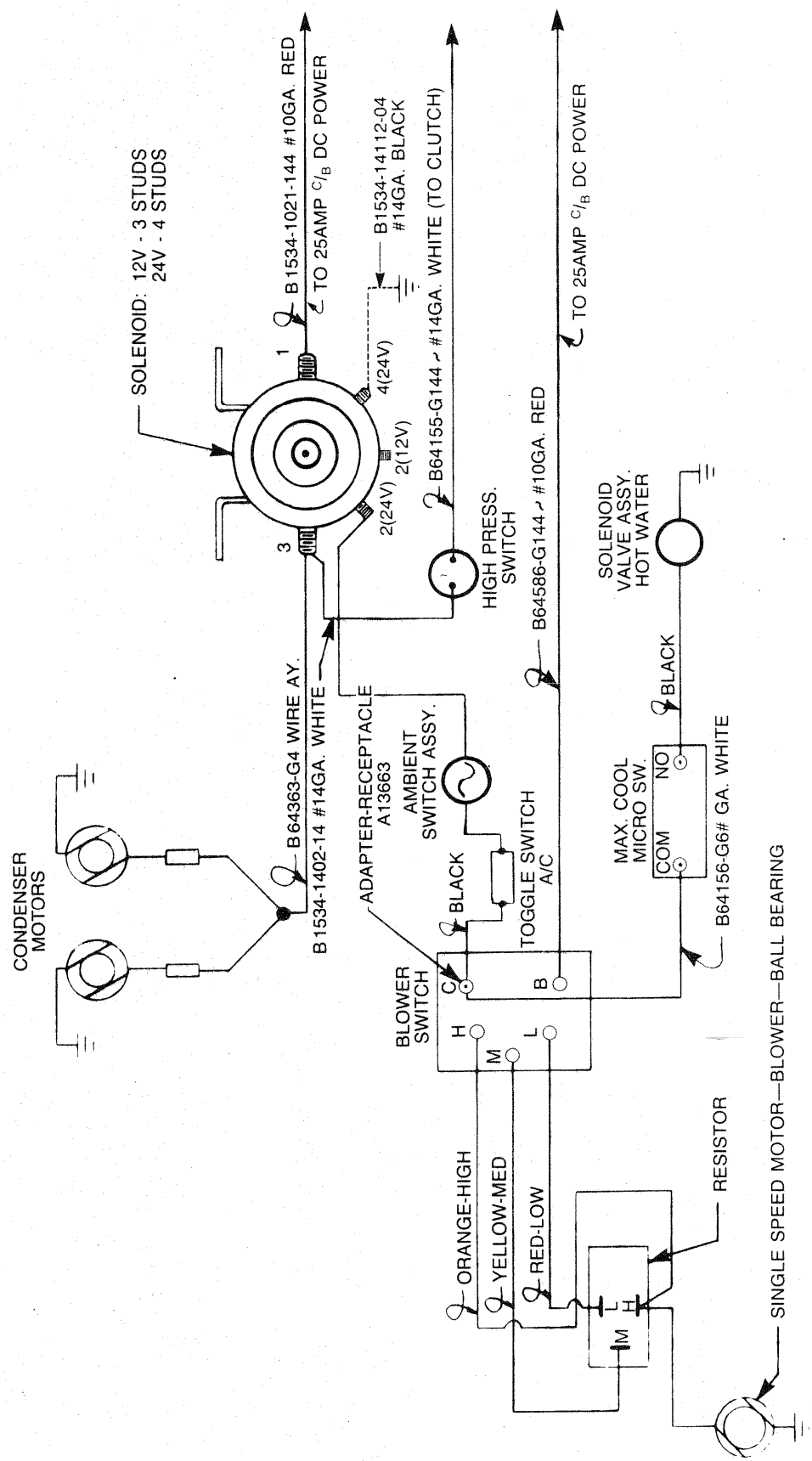



**FIGURE 7**

**WIRING DIAGRAM**

front corners of the unit. Tighten securely. Remove filter and screw on jam nuts tightly over protruding ends of bolts.

## 2.4 Console

**2.4.1** One heavy red wire and one white wire are loosely coiled in the roof opening of the unit. Another heavy red wire is packed separately in the kit and this will be connected at one end to the switch in the console. Keeping this in mind, route all three wires to a convenient cab corner post — later to be attached to a "hot" battery connection (red wires) and compressor clutch (white wire). It is best to thread the wires toward the post between the roof panel and the cab roof insulation. Be careful not to scuff wires on any sharp corners or edges.

**2.4.2** If the control cable is not already attached to the damper handle in the unit, slip the looped end over the crank handle and place the wire sheath over the bracket so that the end of the sheath is even with the side of the bracket. (See fig. 6.) A small spring steel clip is packed separately. The tongue of this clip should be inserted into the hole in the bracket and the clip end forced and snapped over the bracket end with pliers.

**2.4.3** Extending into the roof opening are six wires with loose ends; 1 orange, 1 yellow, 2 red, and 2 black. These must be attached to their proper terminals on the console. (See fig. 6.) Holding the console just below its final position on the cab ceiling (the louvers will be toward the front of the unit and the selector lever will be toward the rear of the unit):

1. Connect the orange wire to terminal "H" on the fan switch.
2. Connect the yellow wire to terminal "M" on the fan switch.
3. Connect the lighter (gage) red wire to terminal "L" on the fan switch.
4. Connect the heavy (gage) red wire to terminal "B" on the fan switch.
5. Connect the black wire (leading in from the right side) to terminal "C" on the fan switch.
6. Connect the other black wire (leading in from the left side — water valve) to the open (NC) terminal of the switch on the lever bracket.

NOTE: (Refer to fig. 7 — Wiring Diagram.)

**2.4.4** This next operation is better as a two man job. (See fig. 8). Holding the console in close final position, put the selector lever in full 'cool" position. Insert offset end of control cable into center hole of selector lever. Attach cable sheath loosely to side of bracket using small "C" shaped clip and screw provided. Holding lever in "cool" position fully open damper in unit by hand. At this time tighten "C" clip securely. Now move selector lever to "hot" position. The damper should close completely. If it does not, move control cable to lower hole in selector lever and repeat above instructions. If lever stops before reaching "hot" position, move control cable to upper hole.

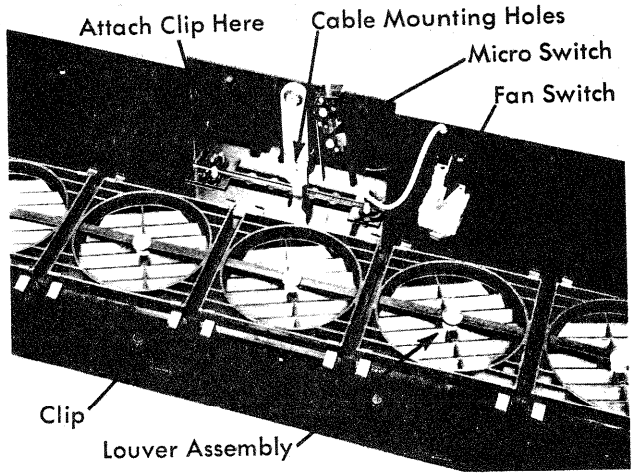



**FIGURE 8**

CONSOLE ASSEMBLY SHOWING SLIDE CONTROL LEVER

**2.4.5** Attach console to roof by the ten chrome plated screws provided. (The screws provided are for average thickness roof insulation. Longer or shorter screws may be needed depending on insulation thickness or headlining spacing.)

## 2.5 Compressor Mount & Drive Adapter Kit

For some installations, these kits are available (see your dealer for availability list). These kits come with complete instructions and include step-by-step procedures to follow. As each kit is different for each different model of equipment, it is impossible to elaborate on each installation. We can only stress the fact that the instructions be followed carefully.

On equipment for which no adapter kit is available, one will have to be hand fabricated from at least 1/4" steel plate and attached to engine with necessary support brackets to hold compressor securely without vibration. Grooves in compressor clutch should line up exactly with available grooves in crankshaft or other accessory drive pulleys. Provisions should be made for adjustable idler pulleys or adjustment holes in compressor mounting plate in order to install and later tighten the drive belt.

## 2.6 Compressor

### 2.6.1 Tecumseh Compressor

Depending upon the mount kit, the compressor can be mounted either vertically or on its side, in either right or left hand position without any modification. It may also be operated in any rotation without damage. Attach the compressor to its mount as directed in the kit instruction. NOTE: Upon checking, you may find it more convenient to attach the compressor with the clutch attached to the compressor mount before installing it on the engine.

### 2.6.2 Frigidaire (Delco) Compressor

This compressor can only be mounted horizontally with the oil sump down. Permissible variance from vertical centerline is +/– 15°. It can also be run in one rotation only and that is clockwise as viewed from the clutch end. This compressor is complete and includes a magnetic clutch as an integral part.

## 2.7 Clutch

The clutch for the Tecumseh compressor is generally furnished in the mount and drive adapter kit. If no kit is available, it will need to be purchased separately. The clutch as furnished consists of two main parts which are: the field assembly and the pulley assembly. Attach the field assembly to the compressor mounting base using the four 1/4-20 bolts furnished in the package. Wipe the compressor shaft clean. Check the Woodruff key location. It must be fully seated into the shaft key slot and the top of the key must be parallel to the shaft taper. Slide the pulley assembly onto the tapered compressor shaft, making sure the hub keyway is aligned with the Woodruff key in the shaft. Lock the pulley assembly to the compressor shaft using the 5/16″ cap screw and washer furnished. Rotate the pulley to be sure there is no rubbing interference with the stationary field. (Any interference with the stationary field could be due to improper seating of the hub on the compressor shaft.)

## 2.8 Refrigerant Lines

Due to the variety of equipment on which these models can be installed, the refrigerant lines are not complete assemblies, but are to be custom fitted to the equipment by means of bulk hose lengths, fittings, and clamps. Careful planning of the routing of the refrigerant lines should be done to assure a neat installation.

### 2.8.1 Compressor Fittings

If a Frigidaire (Delco) compressor is used, suction and discharge fittings must be attached. Slowly unscrew the bolt holding the shipping cover plate in place (the compressor is shipped under pressure) and remove it. Carefully place the hex bodied 5/8″ (suction) and 13/32″ (discharge) fittings in place (See fig. 3 Items 9 and 10) directing the barbed ends in the proper direction for later attachment to the freon lines. The 5/8″ fitting should attach to the left hand port (screened). Fasten securely in place with the previously removed cover plate and 3/8-24x2″ bolt (fig. 3 Item 20). Torque bolt to 15-25 foot pounds.

If a Tecumseh compressor is used, attach the large 5/8″ straight barbed fitting and the smaller 13/32″ connection (see fig. 4 Items 9 and 10). NOTE: On the above fittings and on all subsequent ones, always use a small amount of refrigerant oil on all threads and connections for lubrication and positive sealing. Also double wrench all connections to prevent distortion and breaking of parts.

### 2.8.2 Suction Line

Start at the compressor with the 5/8″ I.D. hose (figs. 3 and 4, Item 1) and one large worm gear hose clamp with a locating hook (fig. 3 and 4, Item 4). Place the hose clamp over the hose with the hook against the hose end. Push the hose over the 5/8″ fitting (lubricate with refrigerant oil) until the end of the hose is against the flange. The hook on the clamp properly locates the clamp on the hose. Tighten the hose clamp to 40 inch pounds. Route the hose as desired to the evaporator connection on the roof top unit and, using the large 90° connector fitting as a guide (figs. 3 and 4, Item 7) cut the hose to the proper length, making sure no cuttings or foreign matter enter the hose. Again place a large hose clamp with hook over hose, insert fitting and tighten clamp to 40 inch pounds. Connect elbow fitting to evaporator connection from roof top unit.

### 2.8.3 Discharge Line

Follow the same procedure as above with the 13/32″ I.D. hose (figs. 3 and 4, Item 2). This hose with the proper fittings attached should be connected to the "Discharge" or "D" port on the compressor and to the condenser connection on the roof top unit.

## 2.9 Hot Water Line

NOTE: Before proceeding, it is necessary to drain the radiator. Also careful planning of hose routing is necessary to assure a neat installation.

### 2.9.1 Engine Fittings

Hot water from the engine is usually obtained through a tapped connection on the head, block, or thermostat housing of the engine. Locate this connection and screw in one of the straight hose connectors (figs. 3 and 4, Item 12). The water return to the engine is usually made at a tapped connection on the water pump or at a location somewhere between the pump and the lower radiator connection. Into this hole, screw in the other straight connector.

### 2.9.2 Hot Water Hoses

Using the hose clamps provided (figs. 3 and 4, Item 14) attach the short ends of the two rubber elbows (figs. 3 and 4, Item 6) to the connections on the side of the unit. Angle in the proper direction for continuation of hose to the engine. Then insert into each open end of the elbows the two copper tubes (figs. 3 and 4, Item 11) (halfway), and secure with two other clamps. Now attach and clamp securely the long heater hoses (figs. 3 and 4, Item 3) to these elbows, and route them to the engine fittings previously installed. NOTE: The hot water supply from the engine should be attached to the hose leading to the lower connection on the roof top unit and the return to the engine from the upper connection.

### 2.9.3 Securing of Hoses

Eight dual clamps (figs. 3 and 4, Item 5) have been provided and should be used to retain all hoses to the cab, etc. to prevent scuffing and sloppy appearance, and be completed in a workmanshiplike manner.

## 2.10 Electrical Connections

### 2.10.1 Main Power Lead

Connect the red main power leads to the hot side of the engine starter solenoid after routing them neatly from the console. However, before securing them to the post, cut the wires at a convenient location to fasten the two circuit breakers provided and connect one of each to each line.

### 2.10.2 Clutch Lead — Tecumseh

Neatly route the white lead from the console to the clutch lead at the compressor. Faster together securely with the wire twist nut provided (fig. 4, Item 16).

### 2.10.3 Clutch Lead — Frigidaire (Delco)

Using the short two wire harness provided (fig. 3, Item 19), push the terminal connector end over the terminals on the compressor and ground the opposite end with the terminal to a convenient location. Now neatly route the white lead from the console to the open wire from the compressor. On 24 volt units, the 4 ohm, 50 watt resistor provided (fig. 3, Item 22) should be soldered between the white lead and the open wire from the compressor. Fasten resistor securely. NOTE: Tape or otherwise secure the power clutch leads to their route surfaces to prevent scuffing and give a good workmanshiplike appearance.

### 2.11 Electrical Inspection

With the selector lever (fig. 5) in full "cool" position, rotate the fan switch slowly clockwise through the three detents. At each position the blower fan should run and deliver air in three steps as noted on the switch plate. When going through these positions the clutch should engage (a clicking sound) and the condenser fans should run. With the fan switch in position, move the selector lever to any position toward "hot". Another clicking sound should be heard from the water solenoid shut off valve at the water inlet hose on the roof top unit.

### 2.12 Final Operation (fill radiator)

Before starting to fill radiator, disconnect clutch lead at clutch terminal. **This is important.** Fill radiator and start engine. Turn on unit fan switch to low position and move selector lever to "hot" position. Rev up engine and continue to fill radiator as long as necessary. Check for leaks at all connections. Shut off engine and rap radiator when both heater hoses are warm, indicating circulation. Turn off fan switch. Reconnect clutch lead.

## SECTION III — EVACUATION AND CHARGING SYSTEM

### 3.1 Attaching Manifold and Gages (fig. 9)

1. Remove compressor valve port caps (and stem covers — Tecumseh only).

2. Using manifold and gages with three charging hoses, connect:

   a. Compound gage (suction and pressure) to compressor suction valve port.

   b. Pressure gage to compressor discharge valve port. NOTE: During this procedure, be sure gage valves are closed.

### 3.2 Evacuation by Vacuum Pump (fig. 9)

1. Hook up center hose to vacuum pump.

2. Back out both compressor valve port stems completely and then turn in valve stems two turns to "cracked position (Tecumseh only).

3. Open gage valves and turn on vacuum pump.

4. Allow pump to operate approximately 30 minutes, then close gage valves and disconnect pump.

5. The reading on the compound gage should remain constant at approximately 28 inches vacuum. Let the system remain idle for fifteen minutes. If the reading remains constant, the system is ready for charging. If the vacuum drops off, it is an indication of a leak which must be located and sealed.

### 3.3 Charging System (fig. 10)

1. Install valve on Charge-A-Can (per manufacturer's instructions) and attach center hose to valve.

2. Open Charge-A-Can valve, bleed air from center hose at manifold.

3. Open both gage valves.

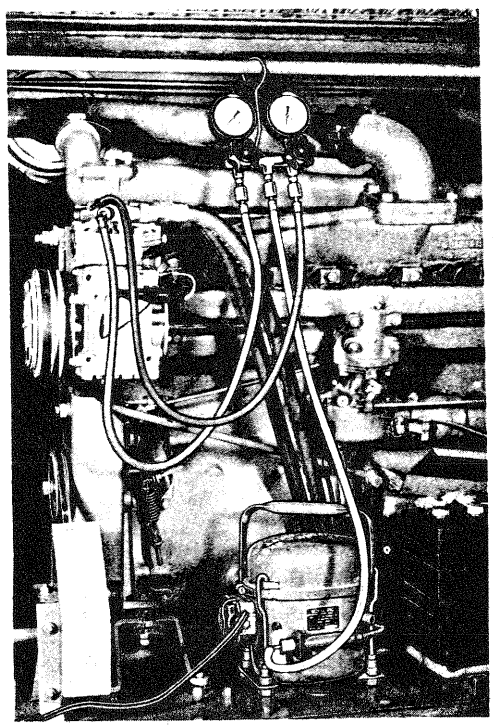


**FIGURE 9**

ATTACHMENT OF GAUGES AND VACUUM PUMP TO SYSTEM COMPRESSOR

4. When gages are equal, close pressure gage valve (check for leaks — See 3.4).

5. Start engine and run at slightly more than "idle" with fan switch "on" and air conditioner lever set at "cool".

6. When Charge-A-Can is empty, close suction gage valve and Charge-A-Can valve and remove empty can.

7. Attach second Charge-A-Can, open Charge-A-Can valve and suction gage valve. Empty can. (Repeat 6 and 7 until four cans have been emptied.) Sight glass should now be clear and free of bubbles. (figs. 12 and 13).

8. Back out compressor discharge valve port stem (Tecumseh only).

9. Open pressure gage valve (Tecumseh only).

10. Back out compressor suction valve port stem (Tecumseh only).

11. Remove hoses and Charge-A-Can (being careful as they are under slight pressure).

12. Screw on compressor valve port caps (and stem covers on Tecumseh compressors).

13. Turn off fan and engine.

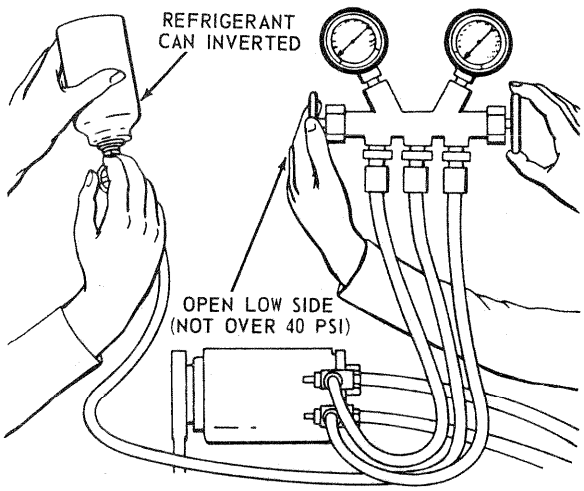



**FIGURE 10**

CHARGING THE SYSTEM

### 3.4 Leak Detection (fig. 11)

Leaks of refrigerant 12 can be detected and located by means of a Halid-Torch. It is a propane torch, to which has been added a "Sniffing" tube for drawing air samples, when checking for leaks. If a leak is present, the flame will switch color from blue to green. Explore the system, holding the open end of the "Sniffing" tube close to every joint and passing it around the joint. Do not hurry, as it takes time for any escaping gass to reach the flame.

### 3.5 Discharging System

This procedure should be followed before removing components for service, or for complete re-charging of the system.

1. Attach manifold gage set as described in 3.1.

2. On Tecumseh compressor, turn in discharge valve port stem one to three turns.

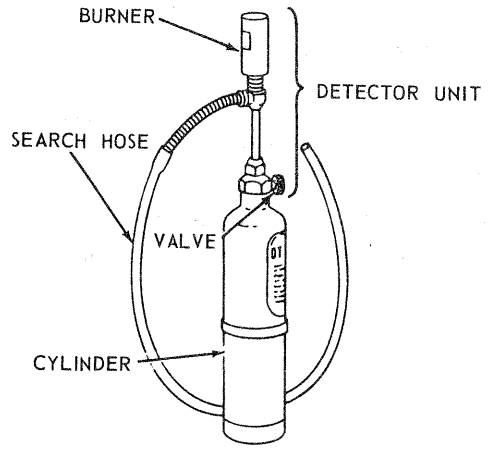



**FIGURE 11**

LEAK DETECTOR

**Caution:** Avoid breathing the fumes, given off from the burner as they are poisonous. If a leak is detected at a connection, tighten it carefully and re-check. If the leak is still apparent, discharge the system (3.5) and replace the damaged connection or component and recharge the system.

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3. Place open end of center manifold hose in container to collect any oil that may be discharged with refrigerant.

4. Slowly open high side (discharge) manifold valve until refrigerant starts to flow out without discharging refrigerant oil from the line.

5. Discharge until all pressure is released from system.

6. Measure any quantity of oil that might have been discharged from the system so that it can be replaced with an equal amount of new refrigerant oil when recharging. NOTE: It is advisable to release the charge in an open area (other than the service area) to prevent air contamination and subsequent erroneous leak detection checks.

### 3.6 Adding Refrigerant to System (fig. 10)

1. Remove compressor valve port caps (and stem covers Tecumseh only).

2. Using manifold and gages with three charging hoses, connect:

   a. Compound gage to compressor suction valve port.

   b. Pressure gage to compressor discharge valve port.

   NOTE: Be sure gage valves are closed.

3. Turn "in" valve port stems two turns (Tecumseh only).

4. Bleed air from hoses by cracking manifold valves slowly and individually for three seconds each, then close valves.

5. Install valve on Charge-A-Can and attach center hose to valve.

6. Open Charge-A-Can valve, bleed air from center hose at manifold.

7. Open suction gage valve.

8. Start engine and run at slightly more than "idle" with fan "on" and air conditioner lever at "cool".

9. Add refrigerant until the receiver-drier sight glass is clear and has no bubbles. Close Charge-A-Can valve and suction gage valve.

10. Slowly remove center hose from Charge-A-Can valve. (Leave valve on can if not empty.)

11. Back out compressor discharge valve port stem (Tecumseh).

12. Back out compressor suction valve port stem (Tecumseh).

13. Remove hoses from compressor valve ports.

14. Screw on compressor valve port caps (and stem covers, Tecumseh).

15. Turn off fan and engine.

# SECTION IV — DESCRIPTION OF HUPP-Aire AIR CONDITIONING SYSTEM

## 4.1 Fundamentals

This book is written on the basis that the reader has a basic knowledge of the principles of air conditioning. If this is not the case, two good publications are known to be available. Their titles and procurement source are as follows:

**"Automotive Air Conditioning Service Manual"**
**No. 15D-1 (or later issue if available)**
**Service Training**
**United Delco Division**
**3044 West Grand Boulevard**
**Detroit, Michigan**

**"Fundamentals of Service-Air Conditioning"**
**John Deere Service Publications**
**John Deere Road**
**Moline, Illinois 61265**

## 4.2 Operation of Unit

Operation of the HUPP-Aire air conditioner is simple —even more so than the ones in automobiles. After starting the engine and running it as speeds above idle, all you have to do is rotate the fan switch (fig. 5) to the desired air flow (usually start at "high" and adjust later), and position selector lever (fig. 5) to "cool" or "hot" and adjust to in-between temperatures after initial cooldown or warmup.

The above describes all you do to be comfortable in the cab, however, certain components play a big part in making the unit work efficiently and a more detailed account of how the system operates follows:

When the fan switch is turned "on" it operates a twin high pressure blower (fig. 13) that draws outside air through an efficient filter (fig. 13) and then discharges it into the evaporator section of the unit. The air passes through the evaporator coil (fig. 13) and is cooled. Leaving this coil, the air is either diverted immediately into the cab through directional louvers in the console, (fig. 5) or it can be deflected through a heater coil (fig. 13) to warm it if it is too cool. This diversion of air is caused by a damper (fig 6) which is operated by the selector lever in the console. This damper can be positioned to give variable degrees of temperature by proportionate blending of the

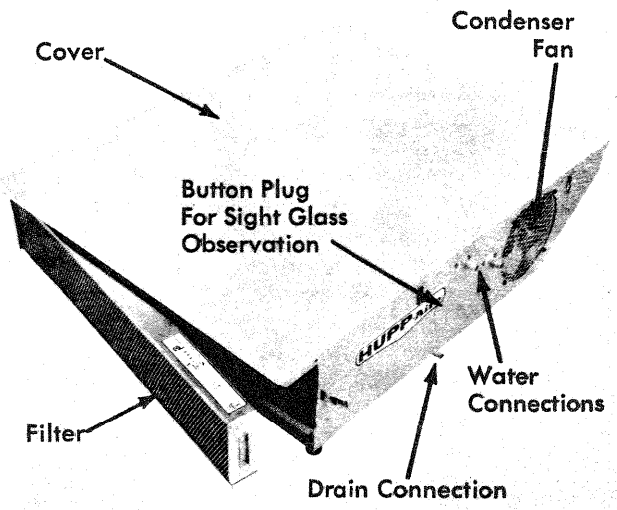



**FIGURE 12**

air leaving the evaporator coil. Another function of the fan switch is to energize the compressor clutch and a relay to operate the condenser fans (fig. 14). An ambient temperature sensing switch (fig. 13) is in series with these parts and if the temperature is below 50°F. it prevents their operation. A toggle switch has also been placed in the circuit to disengage the condenser fans and clutch when more heat is required above 50° ambient temp. Also this fan switch will energize a solenoid water valve (fig. 13) through a micro switch (fig. 8) activated by the selector lever in the console. Thus, if the lever is in full "cool" position the valve will not open, but just as soon as the lever begins to move toward "hot" the valve will open allowing hot water to flow through the heater coil (fig. 14) with resultant rise in air temperature. This mixture of air is directed into the cab through adjustable directional louvers which allow the air to be directed as you require for comfort. All air entering the cab is drawn from the outside, thus the cab is pressurized, which prevents infiltration of dirty un-filtered air through cracks and other possible openings in the cab. No recirculated air is used as pressurization would be lost and dirty air could infiltrate the cab. For safety reasons, a high

pressure switch (fig. 14) is in the clutch circuit which will deactivate the compressor should the refrigerant pressure become uncommonly high.

To help interpret the system, it is suggested that you refer to the wiring diagram (fig. 7) and refrigerant system diagram (fig. 16).

### 4.3 Description and Operation of System Components

All automotive air conditioning systems utilize the same basic components such as evaporator, compressor, condenser, receiver drier and expansion valve. The HUPP-Aire unit naturally uses these and other parts such as the evaporator pressure control, ambient switch, high pressure cutoff switch, and water valve switch. The following are descriptions of these components and others.

#### 4.3.1 Evaporator Coil (figs. 13 and 14)

The evaporator coil is constructed with copper tubing, through which passes the Refrigerant-12, and aluminum fins, for heat transfer. The refrigerant evaporates within the copper tubes due to heat, which it absorbs from the air passing over and around the tubes and fins. This absorption of heat reduces the temperature of the air passing through the coil, thus cooling the cab.

#### 4.3.2 Evaporator Pressure Control (POA Valve) (fig 15)

The function of the POA valve is to control evaporator pressure, with resultant temperature control. This is accomplished by controlling the evaporator to a minimum pressure to provide maximum cooling at all times, yet protecting the coil from freeze ups.

#### 4.3.3 Compressors (fig. 3 and 4)

The compressor is usually located in or alongside of the engine compartment. The purpose of the compressor is to circulate the refrigerant through the system at the different pressures required for operation. Therefore, the compressor draws low pressure gas from the evaporator, compresses it into a high pressure and temperature gas which enters the condenser

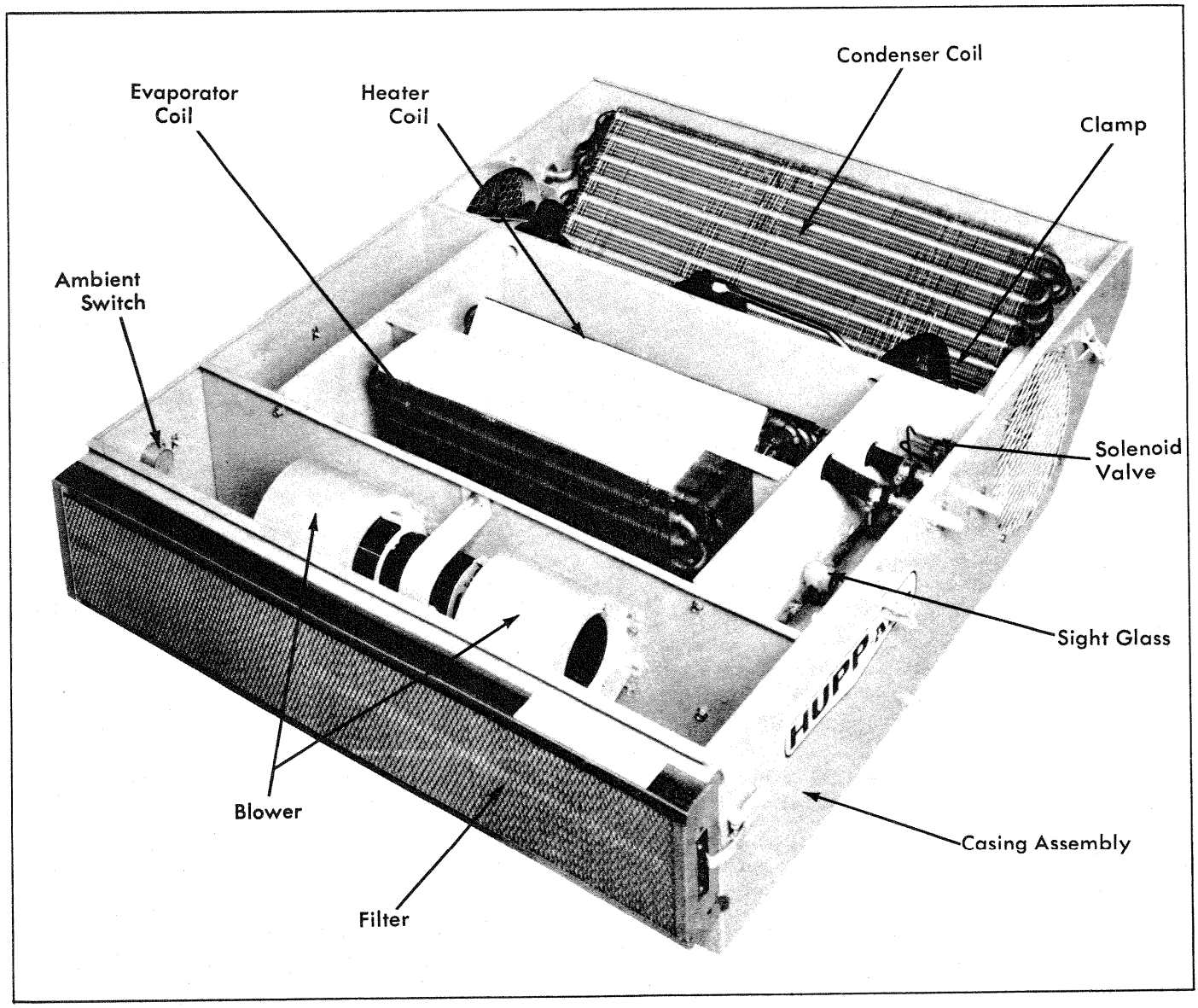



**FIGURE 13**

for cooling and condensing into a liquid which is circulated through the rest of the system.

The compressor is belt driven by the engine through a clutch pulley. Rotation of the compressor shaft operates the pistons, drawing refrigerant vapor into the suction cavity on the intake strokes. On the compressor strokes, the gas is compressed into the discharge cavity into the discharge line to the condenser.

Two compressors are available for the HUPP-Aire unit as follows:

#### 4.3.3.1 Frigidaire Compressor (Delco) (fig. 3)

The Frigidaire compressor is of basic double action piston type. Three horizontal double acting pistons make up the six cylinder compressor. The pistons operate with a 1.5 inch bore and have a 1.25 inch stroke. An axial plate pressed to the shaft drives the pistons. The shaft is driven through a magnetic clutch and pulley (explained later in this section). An oil pump mounted at the rear of the compressor picks up oil from the bottom of the compressor (from sump) and lubricates the bearings and other internal parts of the compressor.

Reed type valves at each end of the compressor open or close to control the flow of incoming and outgoing refrigerant. Two gas tight passages interconnect chambers of the front and rear heads so that there is one common suction port and one common discharge port.

#### 4.3.3.2 Tecumseh Compressor (fig. 4)

The Tecumseh compressor is a two cylinder "in line" reciprocating piston type. It has a single cylinder head which incorporates connections for both high and low side service fittings.

The Tecumseh compressor is made of cast iron. It is lubricated by a positive pressure system using the differential pressure between the suction intake and the crankcase, plus centrifugal force, as a means of circulating oil to and from the sump. NOTE: The oil in the compressors is a special high quality refrigeration oil. Its use is a must, as other oils will contaminate the system and put it out of order.

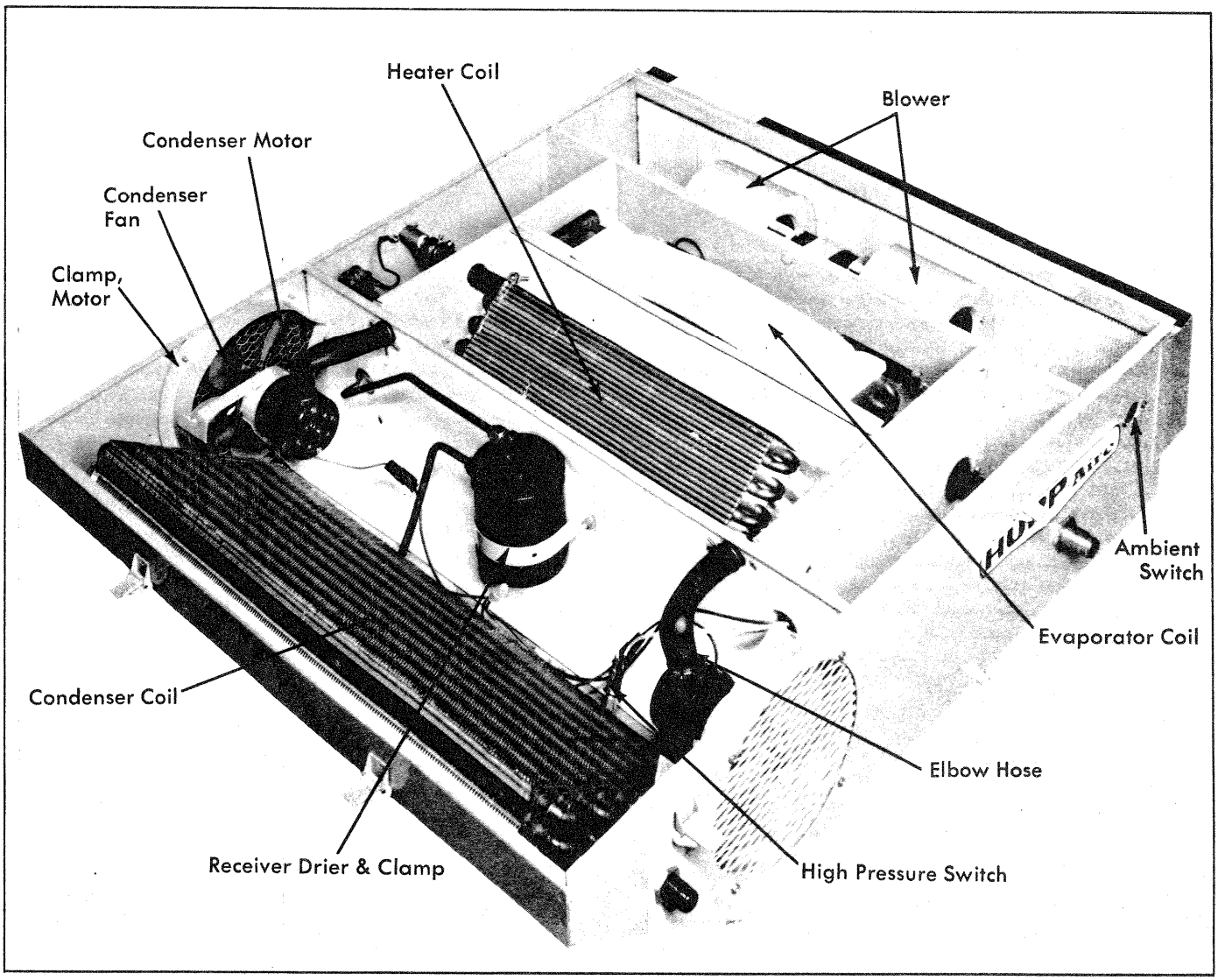



**FIGURE 14**

### 4.3.4 Condenser Coil (figs. 13 and 14)

The condenser coil is constructed similarly to the evaporator coil except it is bigger. Hot refrigerant-12 from the compressor enters the top of the condenser and flows downward through the copper tubes. Cool air being passed through the fins removes the heat from the refrigerant gas, and as it becomes cooler it condenses into a liquid and passes to the receiver-drier.

### 4.3.5 Receiver-Drier (fig. 14)

The receiver-drier provides a storage space for excess refrigerant in the system, necessary in case of slight leaks in the system. It contains a built in strainer to prevent any foreign matter from circulating through the system, which might cause faulty operation of the components. A drying agent is also placed in the receiver to absorb any moisture in the system, which could ice up the expansion valve, causing non-operation of the system.

### 4.3.6 Sight Glass (fig. 13)

A sight glass is located behind the button plug (fig. 12) on the left side of the unit. By removing this plug one can observe the freon condition of the system. When the unit is running and bubbles are present, flowing past the glass window, it indicates a low charge condition. If the sight glass is clear, sufficient freon is in the system. Also if the glass appears green, there is no moisture present, however, if it appears yellow, there is moisture in the system which should be discharged by changing the receiver-drier.

### 4.3.7 Expansion Valve (fig. 15)

The expansion valve is a metering valve which regulates the flow of refrigerant to the evaporator coil and is located on the evaporator. This valve is the dividing point between the low and high pressure sides of the system. Its function is wholly automatic and is controlled by both thermal and pressure means. The thermal control consists of a temperature sensing bulb, attached to the outlet manifold of the evaporator core, connected to a diaphragm on the valve by a capillary tube. The diaphragm activates a plunger, that opens or closes the valve. The pressure control consists of a spring, pre-set at the factory to maintain the proper operating pressure difference, acting against the valve with a tendency to close it. Also, a tailpipe is connected to the underside of the diaphragm and to the POA valve. During operation, the sensing bulb on the discharge manifold of the evaporator core senses its temperature. As the temperature increases, the thermal charge in the bulb expands and exerts pressure on the diaphragm, which pushes the plunger, opening the valve, allowing more refrigerant to enter the evaporator core. As the temperature decreases, the thermal charge contracts, lessening the diaphragm pressure, allowing the plunger to move and close the valve. Under actual operation, the valve will not close completely, but will act in a throttling manner, allowing the proper amount of refrigerant to flow. When the compressor stops, the pressure exerted against the bottom of the diaphragm, and the sensing bulb pressure exerted against the top of the diaphragm equalize, and the spring pressure then closes the valve.

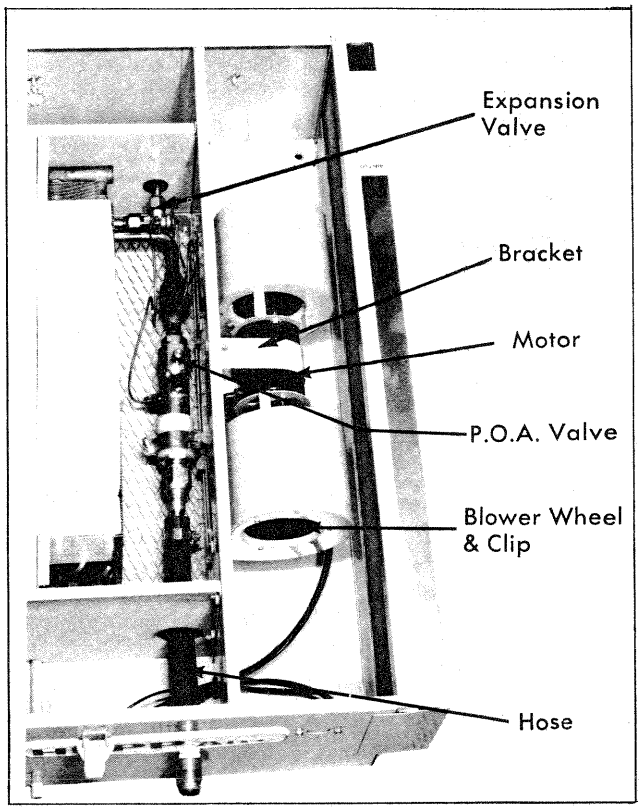



**FIGURE 15**

The expansion valve is factory pre-set to operate satisfactorily under all operating conditions and should not be tampered with.

### 4.3.8 Ambient Switch (figs. 13 and 14)

The ambient switch senses outside air temperature and is designed to prevent compressor clutch engagement when air conditioning is not required or when compressor operation might cause internal damage to seals and other parts.

The switch is in series with the compressor clutch electrical circuit and closes at about 55°F. At all lower temperatures the switch is open, thus preventing clutch engagement.

### 4.3.9 High Pressure Switch (fig. 14)

The high pressure switch is located in the refrigerant line just before it enters the condenser. It senses safe operating pressures of the refrigerant. Should the pressure rise to an unnatural condition, the normally closed contacts open and deactivate the clutch, shutting off the compressor.

### 4.3.10 Refrigerant-12

Refrigerant-12 is one of a family of liquid refrigerants, basically a hydro-carbon, that has been found to be best suited for automotive air conditioning. It will evaporate at −21°F. at atmospheric pressure. Refrigerant-12 has a desirable feature in that it has a direct relationship between temperature and pressure. This feature makes it easy to understand and service the air conditioning system. The pressure temperature relationship of Refrigerant-12 is generally one pound of pressure per one degree Fahrenheit,

except in cases of pressure below 20 pounds or above 75 pounds. In general, a serviceman can easily determine the temperature of the evaporator core by observing the pressure recorded on his gages. When the low side pressure gage reads 35 pounds, one knows the evaporator temperature is approximately 35°F. If the gage reads 30 pounds, the evaporator temperature is approximately 30°F.

### 4.3.11 Heater Coil (figs. 13 and 14)

The heater coil is constructed the same as the evaporator and condenser coils in that it consists of copper tubing, over which are pressed aluminum fins. Hot water from the engine is circulated through the tubes and heat is given off to the air supplied by the blower assembly.

### 4.3.12 Water Control Solenoid Valve (fig. 13)

An in-line water control valve is installed in the supply water line. It is an electrically operated solenoid actuated valve. It is activated by movement of the selector lever in the console when moved toward "hot".

### 4.3.13 Water Control Switch (fig. 8)

The water control switch is a normally closed lever actuated switch mounted on the console. It is activated by the selector lever in the console. When this lever is in "cool" position, the contacts are open. They close when the selector lever moves toward "hot" releasing tension on the switch lever.

### 4.3.14 Pressurizer Blower (figs. 13 and 14)

A low profile, high pressure twin centrifugal type blower is located in the evaporator section. It is equipped with HUPP molded plastic wheels for quiet and vibration free operation. These light weight wheels put less load on the high performance ball bearing motor. This efficient blower has ample capacity to pressurize the cab while drawing air through a special purpose filter.

### 4.3.15 Control Fan Switch (fig. 5)

Located on the console is a three position fan switch that controls the operation of the pressurizer blower. Rotating the switch clockwise controls the speed of the blower through "Lo-Med-Hi". The off position is fully counter clockwise. This switch also controls power to the condenser fans and compressor clutch.

### 4.3.16 Solenoid, Condenser Motor

Due to the current draw of the consenser motors being more than the contacts on the control switch can handle, a solenoid is necessary to control this electrical load.

### 4.3.17 Filter (figs. 12 and 13)

An easily removable filter is located at the front of the unit. This filter is made of many corrugations of porous paper and is more than 98% efficient. It has approximately 17 sq. ft. of filter surface. The importance of this filter cannot be over emphasized as it allows only clean air to pass through the evaporator coil. Clean it often, as a dirty filter restricts air flow. Never operate the unit without this filter as dirty air will drop off its impurities on the wet evaporator coil causing mud and eventual blocking of the coil with resultant expensive repairs.

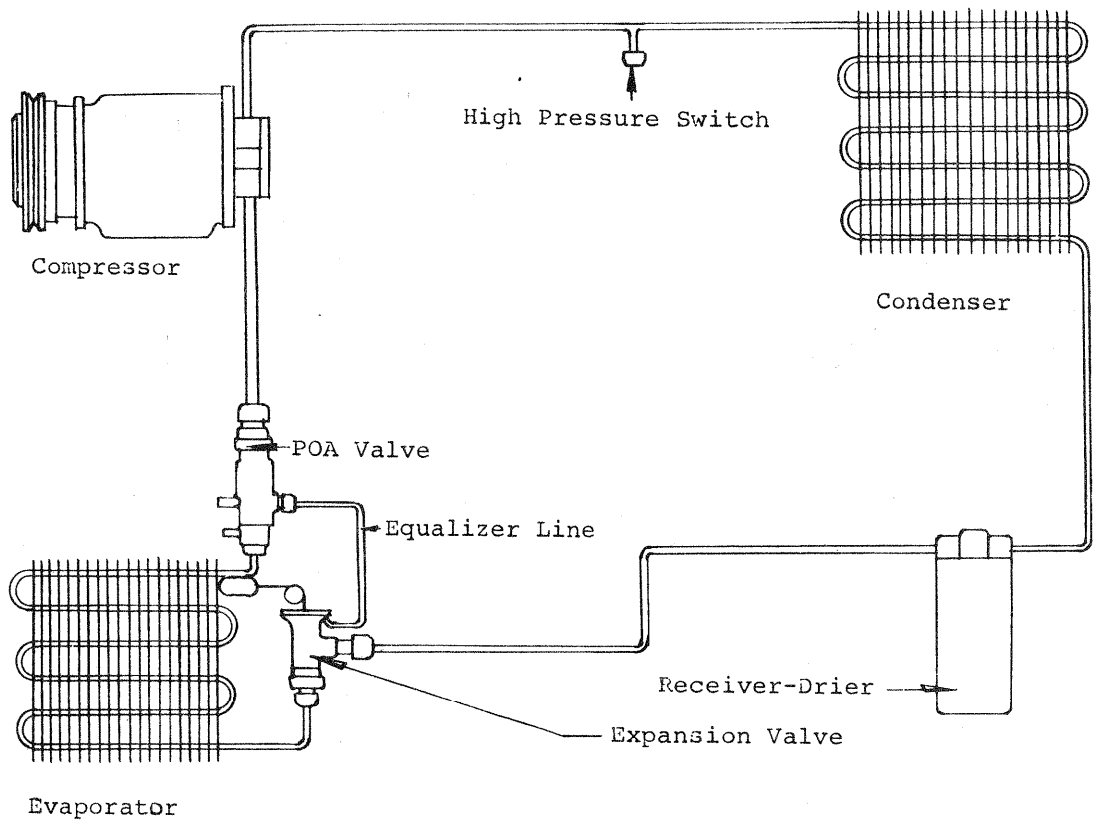
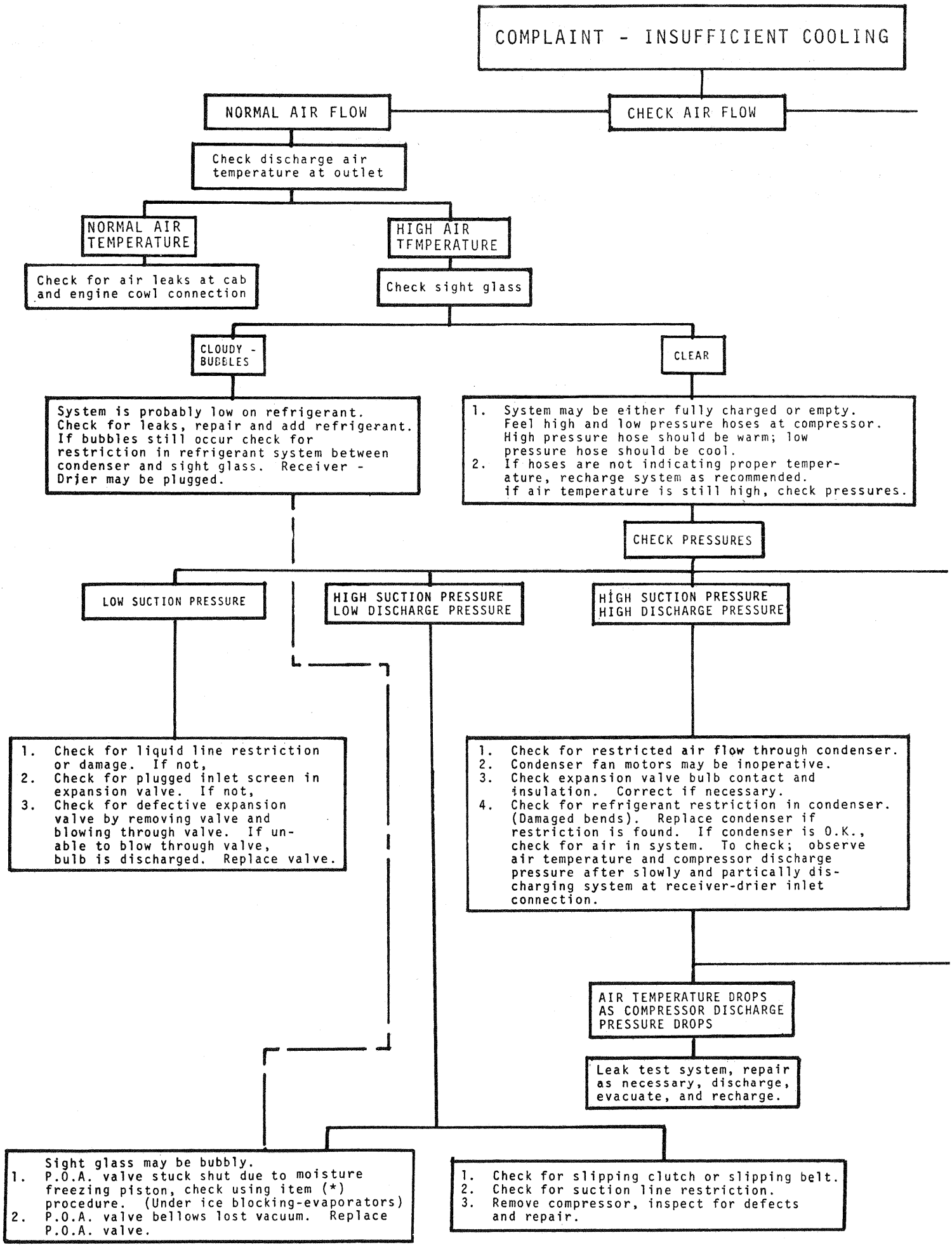
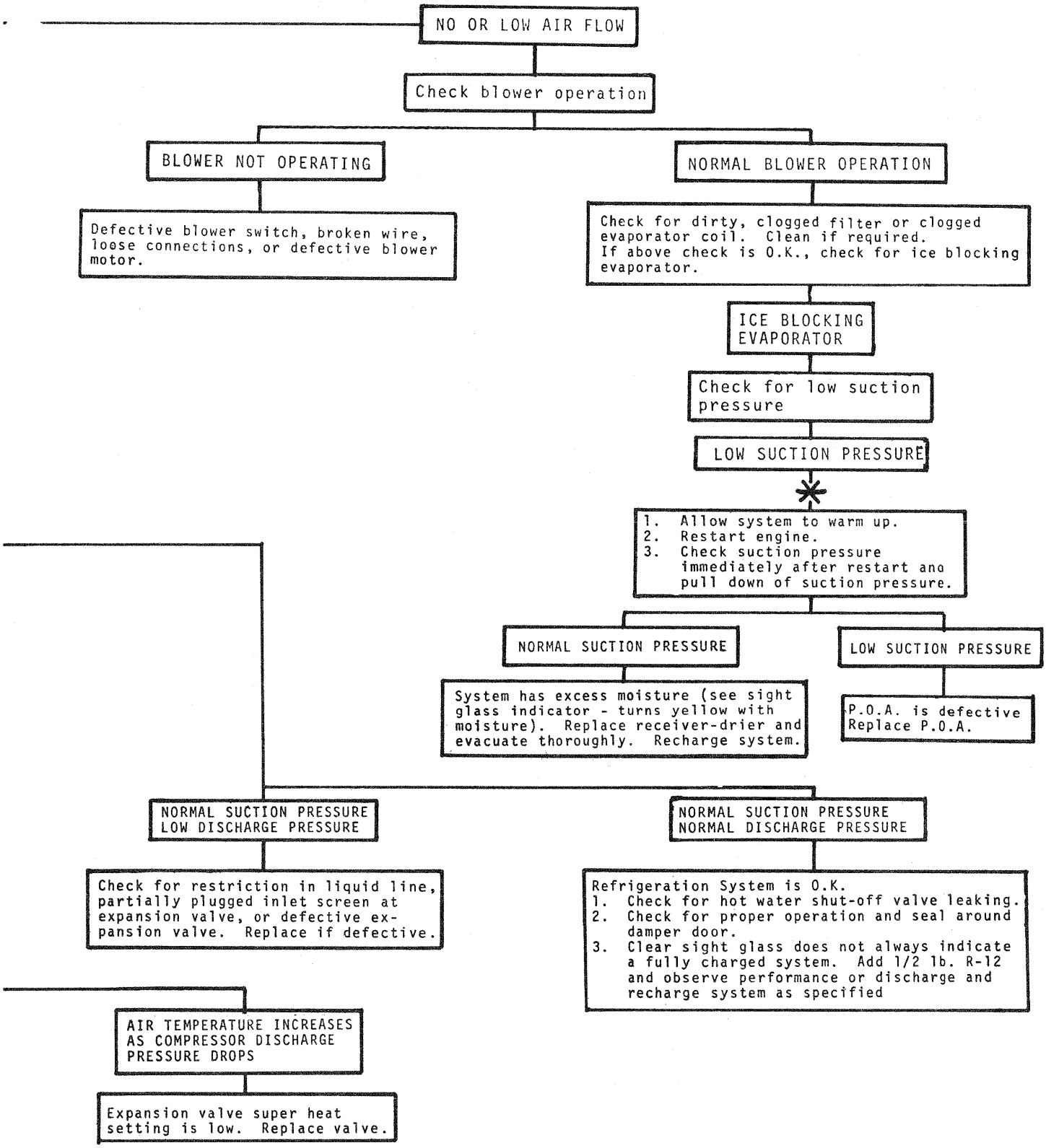



**FIGURE 16** REFRIGERATION SYSTEM DIAGRAM


COMPLAINT - INSUFFICIENT COOLING
NORMAL AIR FLOW
CHECK AIR FLOW
Check discharge air temperature at outlet
NORMAL AIR TEMPERATURE
HIGH AIR TEMPERATURE
Check for air leaks at cab and engine cowl connection
Check sight glass
CLOUDY - BUBBLES
CLEAR
System is probably low on refrigerant. Check for leaks, repair and add refrigerant. If bubbles still occur check for restriction in refrigerant system between condenser and sight glass. Receiver - Drier may be plugged.
1. System may be either fully charged or empty. Feel high and low pressure hoses at compressor. High pressure hose should be warm; low pressure hose should be cool.
2. If hoses are not indicating proper temperature, recharge system as recommended. if air temperature is still high, check pressures.
CHECK PRESSURES
LOW SUCTION PRESSURE
HIGH SUCTION PRESSURE LOW DISCHARGE PRESSURE
HIGH SUCTION PRESSURE HIGH DISCHARGE PRESSURE
1. Check for liquid line restriction or damage. If not,
2. Check for plugged inlet screen in expansion valve. If not,
3. Check for defective expansion valve by removing valve and blowing through valve. If unable to blow through valve, bulb is discharged. Replace valve.
1. Check for restricted air flow through condenser.
2. Condenser fan motors may be inoperative.
3. Check expansion valve bulb contact and insulation. Correct if necessary.
4. Check for refrigerant restriction in condenser. (Damaged bends). Replace condenser if restriction is found. If condenser is O.K., check for air in system. To check; observe air temperature and compressor discharge pressure after slowly and partically discharging system at receiver-drier inlet connection.
AIR TEMPERATURE DROPS AS COMPRESSOR DISCHARGE PRESSURE DROPS
Leak test system, repair as necessary, discharge, evacuate, and recharge.
Sight glass may be bubbly.
1. P.O.A. valve stuck shut due to moisture freezing piston, check using item (*) procedure. (Under ice blocking-evaporators)
2. P.O.A. valve bellows lost vacuum. Replace P.O.A. valve.
1. Check for slipping clutch or slipping belt.
2. Check for suction line restriction.
3. Remove compressor, inspect for defects and repair.




## DIAGNOSIS AND TROUBLE SHOOTING CHART

**FIGURE 17**

# SECTION V — DIAGNOSIS AND TROUBLE SHOOTING

## 5.1 Diagnosis and Trouble Shooting

Before making a complete performance diagnosis, check should be made for:

1. Proper belt alignment and tension.
2. Proper clutch wire connection.
3. Proper engagement of clutch.
4. Loose fittings and/or chafed or burst hose.
5. Condenser free of foreign material.
6. Clean fresh air filter.

After making necessary checks and everything being in good order, install gages to compressor according to para. 3.1 and run the unit. Compare readings with the average readings shown in para. 5.2 and then on the Diagnosis Trouble Shooting Chart (fig. 17) find the proper set of conditions, i.e. "High Suction Pressure — Low Discharge Pressure" and determine source of trouble and making necessary correction, repair or replacement.

## 5.2 Normal System Pressures

In order to use the Diagnosis Trouble Shooting Chart intelligently, a normal set of pressures and temperatures is needed for comparison purposes. See following chart:

| Ambient Temperature | Discharge Pressure | Suction Pressure | Outlet Temperature |
|---|---|---|---|
| 70° | 140-220 | 17-20 | 54° |
| 80° | 170-250 | 19-22 | 61° |
| 90° | 210-290 | 23-27 | 68° |
| 100° | 240-340 | 27-31 | 75° |

NOTE: Pressures and outlet temperatures shown are for 50% relative humidity and the unit equipped with a clean filter. Pressures and temperatures may vary slightly higher on more humid days or lower on dry days.