# 1962

# PONTIAC TEMPEST

# HEATING, VENTILATING and AIR CONDITIONING MANUAL

PONTIAC MOTOR DIVISION

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# HEATING, VENTILATING AND AIR CONDITIONING MANUAL

## GENERAL

This shop manual applies to 1962 models and includes all pertinent subject matter available at the time it was prepared for publication.

## CONTENTS

Arrangement of the material is shown by the table of contents on the right side of this page. Black tabs on the first page of each section can be seen on the edge of the book below the section title. More detailed table of contents precedes each section, and an index is included in the back of the manual.

## AIR CONDITIONING CAUTION

**Air conditioning, like many other things, is fairly simple to service once it is understood. If proper methods and precautions are not followed, repairs may be complicated and equipment damage and personal injury could result. For this reason, it is strongly urged that the information herein be studied thoroughly before attempting to service an air conditioning system.**


PONTIAC MOTOR DIVISION

GENERAL MOTORS CORPORATION

PONTIAC 11, MICHIGAN


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S-6204 HAC December, 1961 Litho in U.S.A.

# HEATING

## CONTENTS OF THIS SECTION

# CIRC-L-AIRE HEATER

## DESCRIPTION AND OPERATING INSTRUCTIONS

### GENERAL DESCRIPTION

Pontiac's heating and defroster system provides rapid warm-up sensation and even distribution of warmed air to all parts of the car. All air entering the system is taken through hood high cowl vents providing air with a minimum of dust, foreign material and undesirable fumes.

The use of outside air exclusively provides constant and rapidly changing air inside the car, eliminating a smoke-filled interior and keeps the occupants comfortable.

The driver has fingertip control of the temperature of the warmed air entering the car. When heated air is desired, the blower forces air taken from the hood high cowl air inlet housing through the heater core and then through an air distributing system to the air outlets.

The design of the heater and defroster system, its valves and controls permits a method of obtaining three different amounts of forced air flow for ventilation.

### *AIR OUTLETS AND CONTROLS*

#### AIR OUTLETS

Heated air enters the interior of the car and is distributed by a center outlet under the heater duct which disperses air over the front floor area and to the rear passenger compartment.

Additional air distribution outlets are provided; one each on the left and right end of the heater outlet air duct. These direct air to the driver and front seat passenger side respectively.

#### CONTROL PANEL PUSH BUTTONS

The heater control panel is located to the right of the steering column on the lower section of the instrument panel. Three push buttons across the top of the panel control air flow through the system. These positions are "OFF", "NORMAL" and "DE-ICE" (Fig. 1-2).

This push button selector panel directs vacuum to diaphragms which, by mechanical linkage, cause air control valves to function in the following manner:

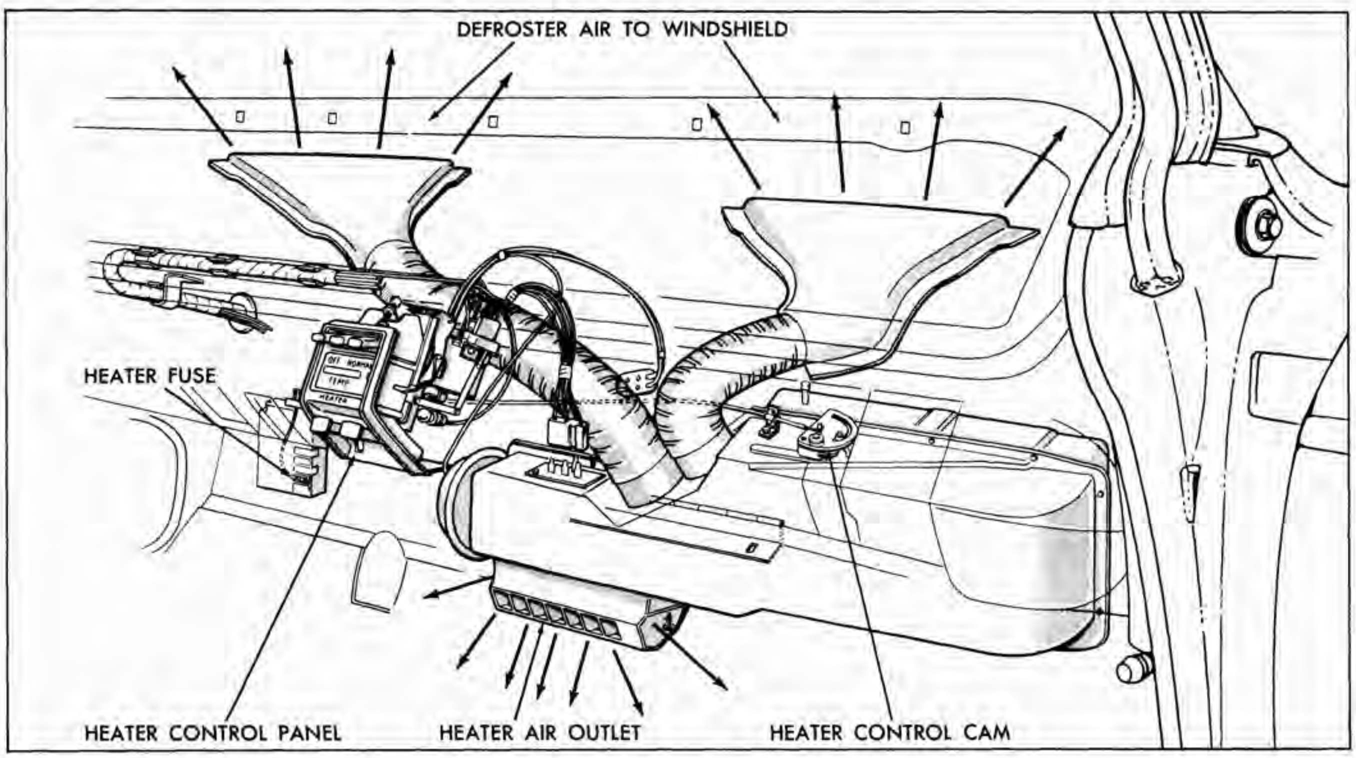



Fig. 1-1 Circ-L-Aire Heater Air Outlets and Controls

"OFF" button pushed in ("NORMAL" and "DE-ICE" buttons in out position): No air flow, no heating.

"NORMAL" button pushed in ("OFF" and "DE-ICE" buttons in out position): Outside air valve opens to admit outside air into the car through heater air outlets, with a limited amount directed to the defroster nozzles.

"DE-ICE" button pushed in ("OFF" and "NORMAL" buttons in out position): Outside air valve opens to admit outside air into the heater air system. Defroster air valve swings down to direct most of heater air to the air outlets at the windshield. At the same time, depressing this button causes the blower to operate at super speed.

NOTE: When the defroster air valve swings down, it directs all but approximately 20% of the air to the air outlets at the windshield. The remainder of the air passes through the heater air outlets to keep occupants comfortable.

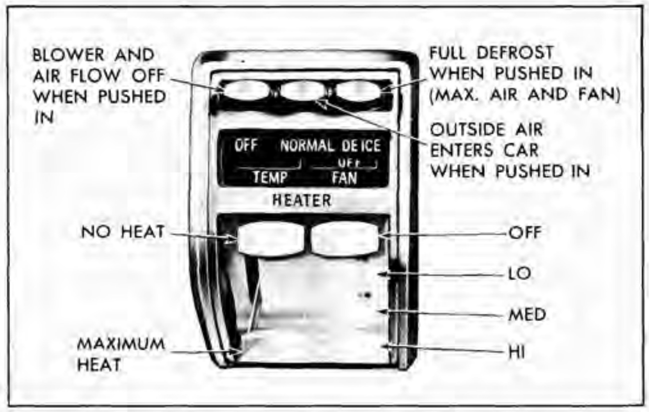



Fig. 1-2 Circ-L-Aire Heater Control Panel

During winter months, "de-icing" or "de-fogging" may be somewhat accelerated by opening the front door vent window or lowering the door window approximately ½"; however, this practice may cause objectionable cold air drafts to rear seat passengers.

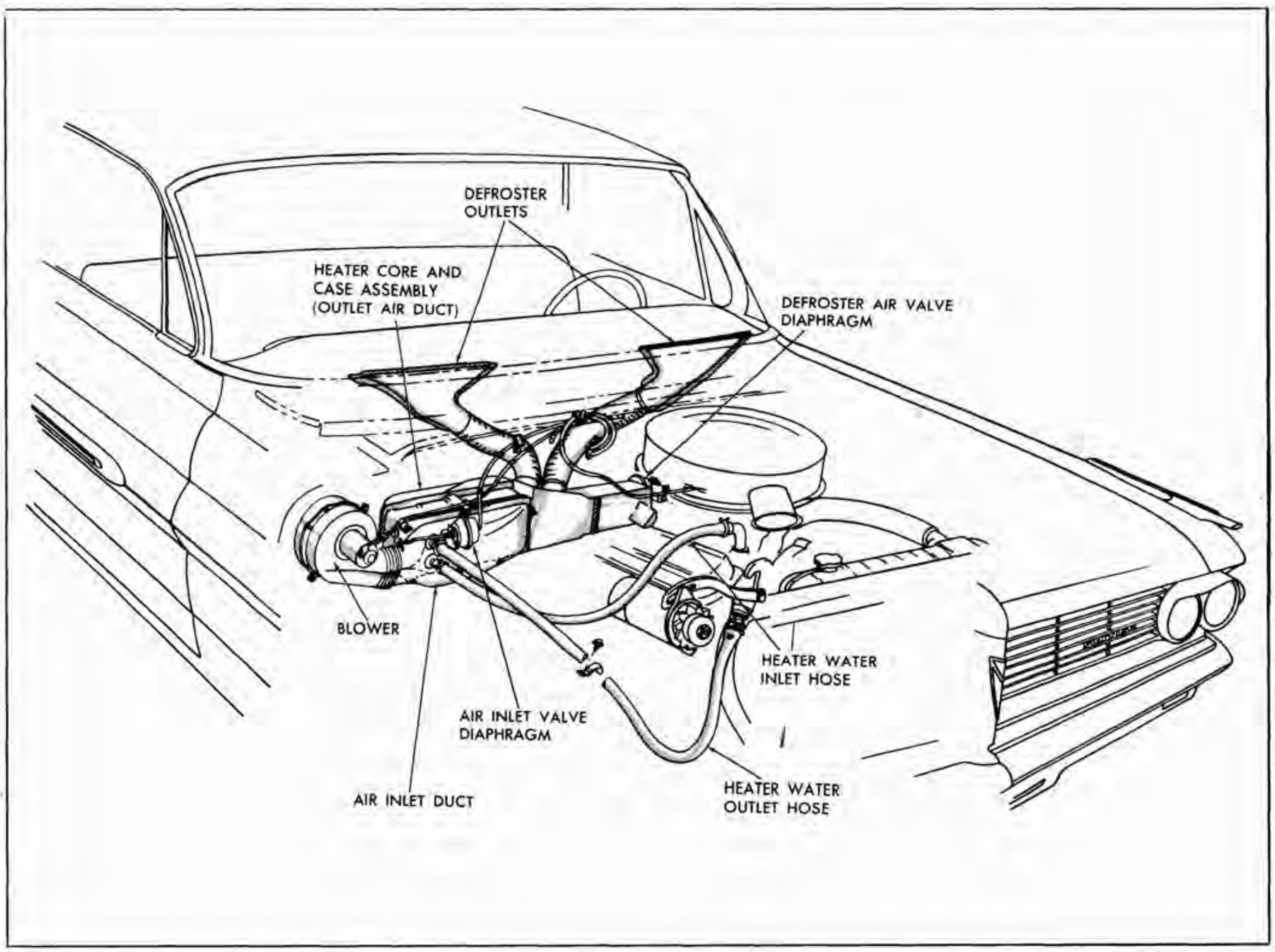



Fig. 1-3 Location of Units in Pontiac's Circ-L-Aire Heater System

## BLOWER CONTROL

The blower control lever is located in the lower right part of the control panel and moves vertically to control three blower speeds to regulate the amount of forced air movement.

When the blower control lever is in the up position and letters "OFF" appear in the "FAN" window, the blower will not operate. As the blower control lever is moved down, the letters "LO", "MED" and "HI" appear in the "FAN" window to operate the blower at these various speeds. Moving the blower control lever to the full down position reveals the letters "HI" in the window and the blower will operate at high speed.

The blower will operate at "LO", "MED" and "HI" speed only when the "NORMAL" push button is depressed.

## TEMPERATURE CONTROL

The temperature control lever is located in the lower left part of the heater control panel and moves vertically to tailor the temperature of heated air entering the interior of the car.

In the extreme up position no heated air enters the car because the temperature air valve is closed. This feature permits forced air for ventilation without warming this air.

As the temperature control lever is depressed the temperature control valve permits more and more warmed air to mix with outside air as it passes through the heater air mixing chamber—at the same time a dial opening in the panel above the lever shows progressively increasing bands of red color to indicate increased heating. Maximum heating is obtained when the lever is in the full down position.

Depress the temperature control lever to the full down position during engine warm up. After the inside of the car is at the desired level adjust the "TEMP" lever to maintain desired temperature.

## OPERATING INSTRUCTIONS

To warm a car under various weather and driving conditions, use the following control settings after the green light indicating a "COLD" engine goes out:

### FAST WARM-UP

(CAR WHICH HAS BEEN STANDING IN COLD)

| CONTROL | SETTING |
|---|---|
| Push button | "DE-ICE" pushed in until windshield is de-iced or de-fogged, then "NORMAL" |
| Blower control lever | down, for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for occupant comfort |
| Car windows | front door vent and door window open slightly to assist in de-icing or de-fogging, then closed or positioned to provide comfort for all occupants |

### SLOW CITY DRIVING IN COLD WEATHER

| CONTROL | SETTING |
|---|---|
| Push button | "NORMAL" pushed in |
| Blower control lever | down, for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for comfort |
| Car windows | closed |

### NORMAL COOL WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Push button | "NORMAL" pushed in |
| Blower control lever | "LO" or "MED" for low or medium speed |
| Temperature control lever | position to obtain desired temperature |
| Car windows | closed, door vent(s) may be opened to suit occupant comfort |

### COLD WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Push button | "NORMAL" pushed in |
| Blower control lever | "MED" or "HI", for medium or high blower speed |
| Temperature control lever | down, for maximum heating, then adjusted for occupant comfort |
| Car windows | closed |

## TIPS ON USE OF HEATER AND DEFROSTER SYSTEM

### *KEEPING COMFORTABLE IN EXTREMELY HUMID "MUGGY" WEATHER*

When the relative humidity is extremely high, causing discomfort on a day when the temperature is 55°F.-70°F., depress the "NORMAL" button and move the temperature control lever down slightly. This will provide minimum heating. Move the blower control lever to the low or medium speed position.

### *KEEPING COMFORTABLE IN MILD WEATHER*

When the weather is cool, but the sun is very bright, as in spring or fall or at high altitudes, use both the heater and the cowl ventilators at the same time, setting the temperature control and blower speed for desired comfort.

### *CONTROLLING TEMPERATURE IN CAR*

The most satisfactory method of controlling the temperature in the car is to:

1. Depress "NORMAL" push button.

2. Position temperature control lever down for maximum heating, then adjust to maintain the desired temperature in the car.

3. Set blower speed for your personal comfort.

### *USING THE HEATING SYSTEM FOR VENTILATION*

The heating system is designed so that it can also be used for ventilation when it is not necessary to warm the air. Ventilation may be obtained by placing the temperature control lever in the extreme up position, depressing the "NORMAL" push button, and selecting the amount of air flow desired by positioning the blower control lever to "LO", "MED" or "HI" speed.

# PRINCIPLES OF OPERATION

CONTENTS OF THIS SECTION



## DESCRIPTION OF HEATER CORE

The copper heater core is of "tube and center" construction and is designed to permit the engine water (coolant) to flow in a "U" path through the core (Fig. 1-4). This core construction permits a high volume of air to pass through the core as well as a rapid heat dissipation from the water to the core surfaces, which provides for rapid transfer of heat to the air.

The heater is located on the right side center of the dash (inside the car body). Its location permits maximum heating of all air passing over the heater core with this heated air remaining inside the car.

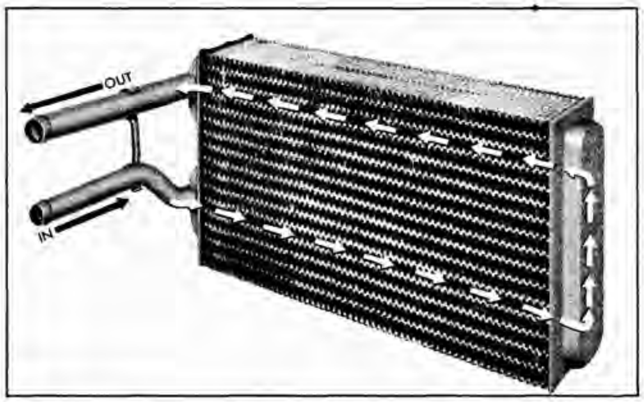



Fig. 1-4 Flow of Engine Coolant Through Heater Core

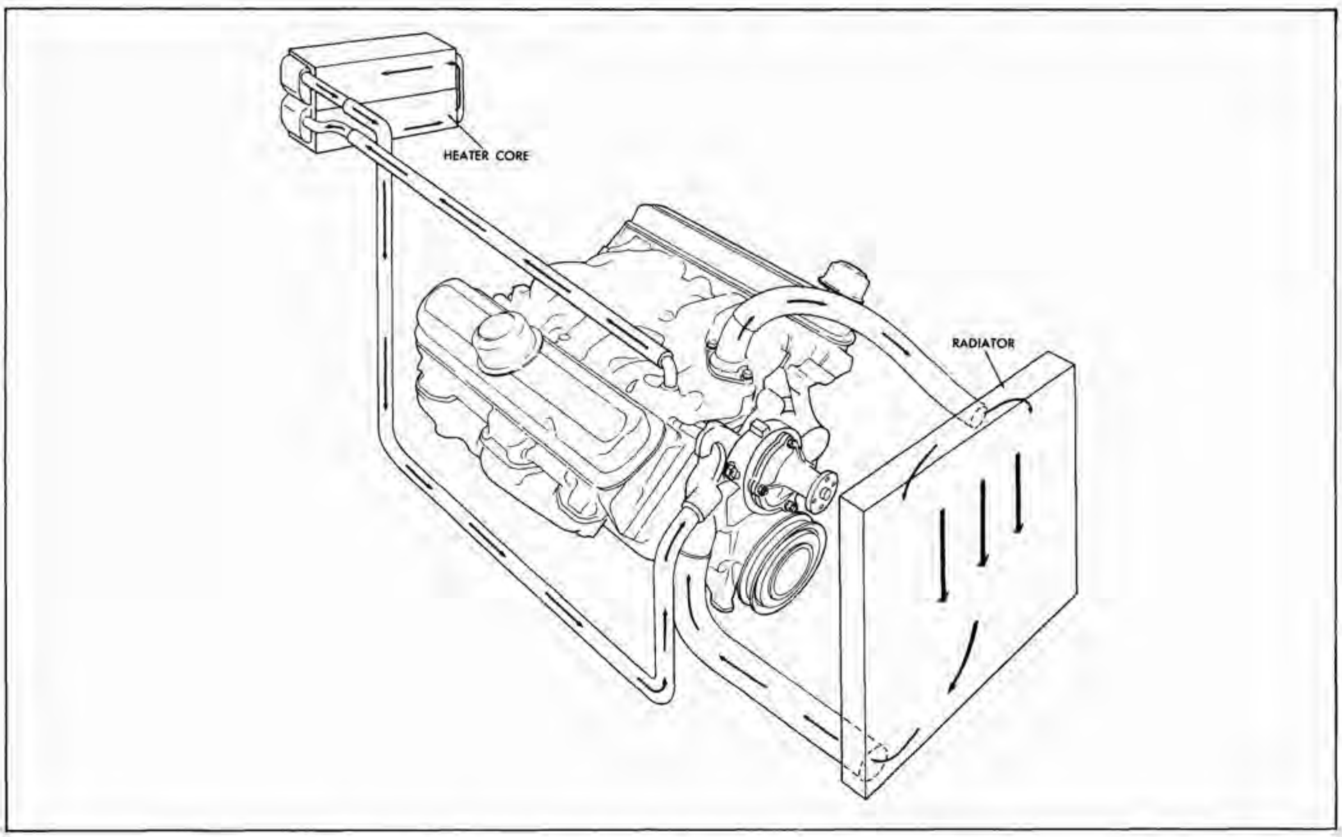



Fig. 1-5 Water Flow Through the Circ-L-Aire Heater System

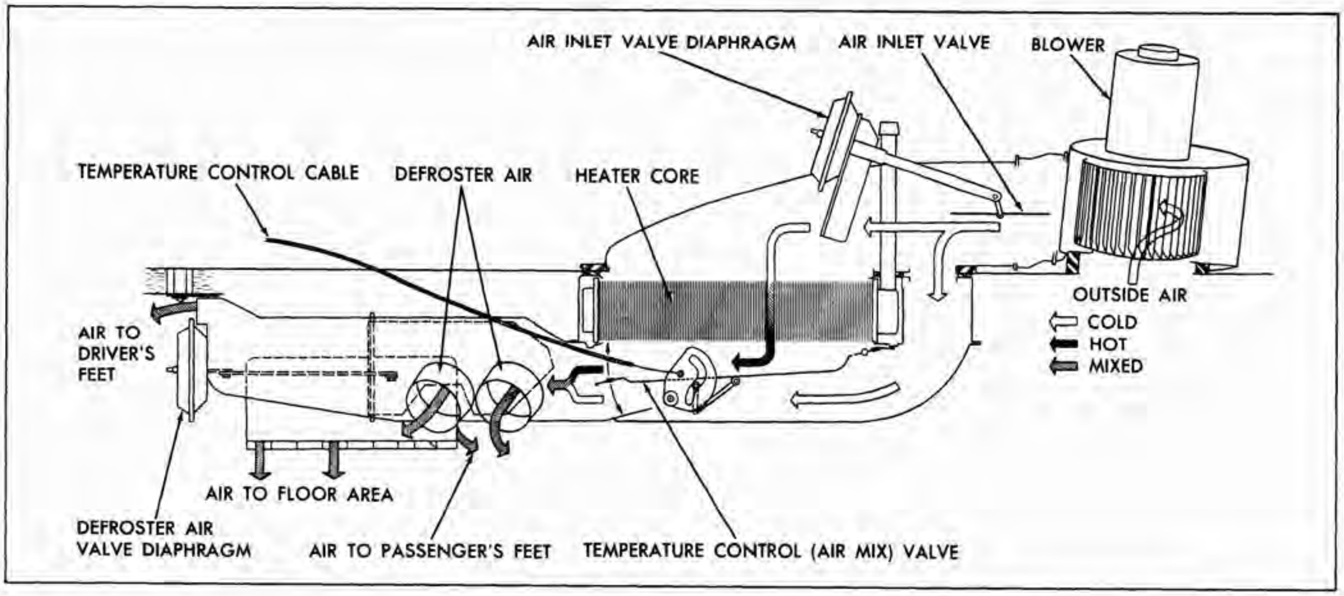



Fig. 1-6 Circ-L-Aire Heater Air Flow

The air passing over the hot heater core is warmed and also cools the hot engine coolant which returns to the intake area of the water pump.

## WATER FLOW

Water flow in the heater system is taken from the engine cooling system from a water passage in the engine intake manifold, via a hose to the heater core inlet (on the dash shroud), through the heater core, via a hose to the intake area of the water pump, and back to the engine cooling system (Fig. 1-5).

Water entering the core from the intake manifold fills the lower half of the core and flows to the left where it enters a chamber connecting the lower half of the core with the upper half. Engine cooling system pressure (created by heat and the water pump) forces the water into the upper half of the core and then back to the intake area of the water pump.

The hot water flowing through the heater core is constant and is controlled by the engine water pump.

## AIR SYSTEM

Outside air enters through an intake grille mounted flush with the hood directly below the windshield. Air in this chamber is pulled by the blower and forced to the heater air inlet duct assembly positioned on the right side of the dash in the engine compartment. The air then enters the body through the heater core and case assembly; part of the air by-passes the heater core and part of the air is directed through the heater core (Figs. 1-6 and 1-7). The amount of the by-pass air versus the amount of air flow through the

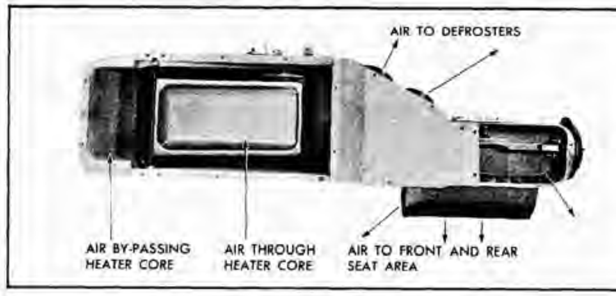



Fig. 1-7 Air Flow into Heater Core Case

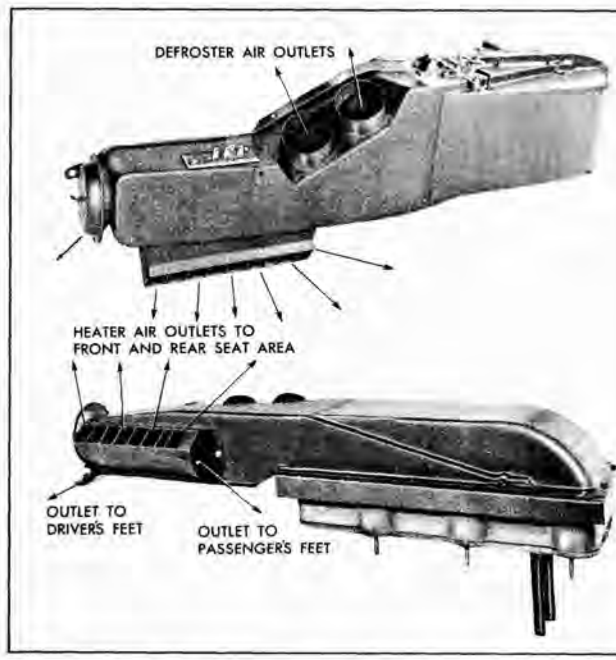



Fig. 1-8 Air Outlets in Circ-L-Aire Heater Core Case

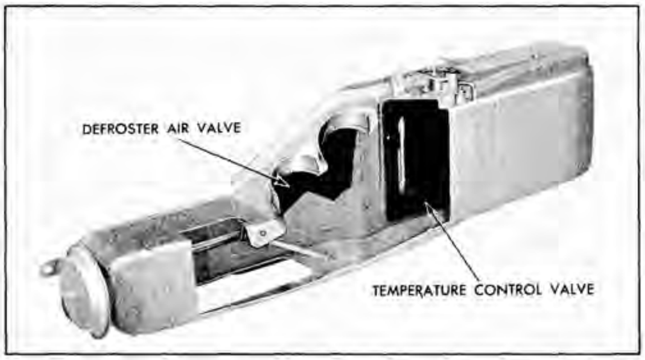



Fig. 1-9 Defroster Air Valve in "NORMAL" (Up) Position

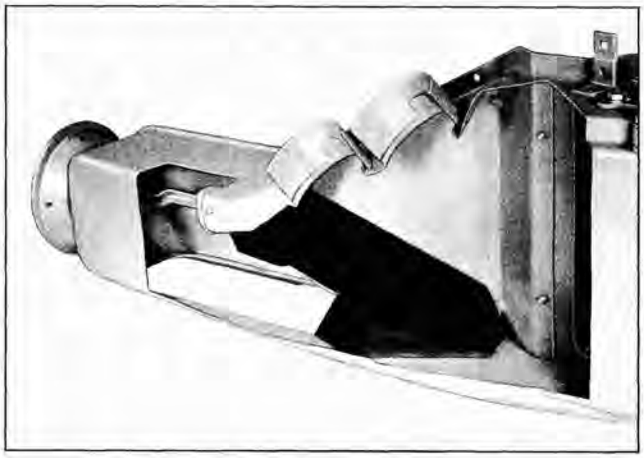


Fig. 1-10 Defroster Air Valve in "DE-ICE" (Down) Position

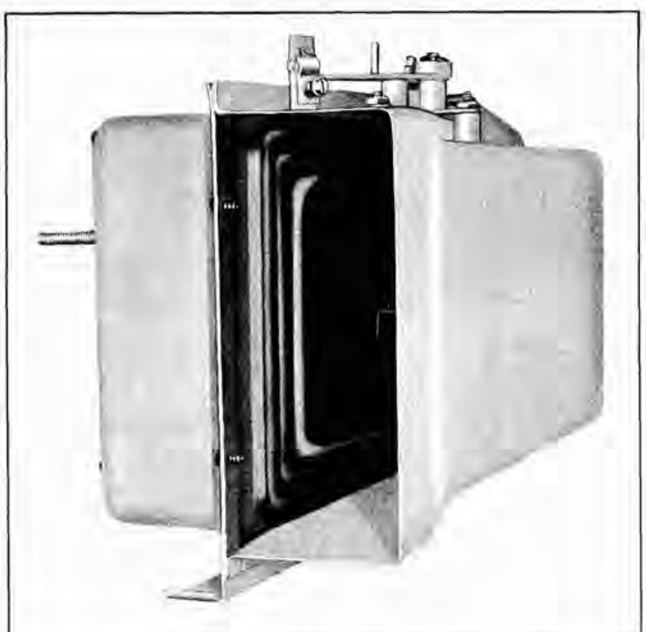


Fig. 1-11 Temperature Control Valve at Full Cold Position

heater core will depend upon the outside air temperature and the comfort or desired temperature in the car.

Heater air is distributed by a center outlet under the heater duct which disperses air over the front floor area and to the rear passenger compartment. An outlet on each side of the heater air outlet duct directs air to the driver and passenger side for additional air distribution to the front seat floor area (Fig. 1-8).

Flexible hoses, extending from the heater duct, are attached to two nozzles located along the base of the windshield for effective defrosting. The defroster air valve is designed to allow some heater air to go to the defroster outlets, at all times, for de-fogging purposes (Fig. 1-9).

Air flow through Pontiac's Circ-L-Aire Heater system is controlled by push buttons and a blower control switch in the heater control panel (located to the right of the steering column). These buttons operate a vacuum switch which appropriately applies vacuum to diaphragms that operate the heater inlet air valve in the heater air inlet duct assembly (located on the engine side of the dash shroud) and the defroster valve in the heater core case duct assembly (located on the passenger side of the dash shroud).

A defroster valve is hinged to the top of the duct assembly and operates to direct maximum amount of air from the duct to the windshield whenever "de-icing" the windshield (Fig. 1-10).

Since coolant flows through the heater core at all times, warmed air is allowed to mix with outside air by moving the temperature control lever which in turn moves a temperature air valve in the heater air duct; no heated air—all by-pass air with the temperature control lever in the full up position, all heated air—no by-pass air in the full down position (Figs. 1-11 and 1-12).

The amount of air flow through the heater air system can be varied with the "FAN" switch which is the right vertical control lever in the heater control panel. The "FAN" and "DE-ICE" switches are connected to the electrical system through the chassis wiring harness. Their purpose is explained in ELECTRICAL SYSTEM and their operation can be traced in the wiring schematic illustrations.

## VACUUM SYSTEM

Vacuum input to the heater vacuum switch is through a tee connection fed from the vacuum connector on the carburetor throttle body. This vacuum is applied through a blue tipped hose to the No. 1 post of the heater vacuum switch (Fig. 1-13).

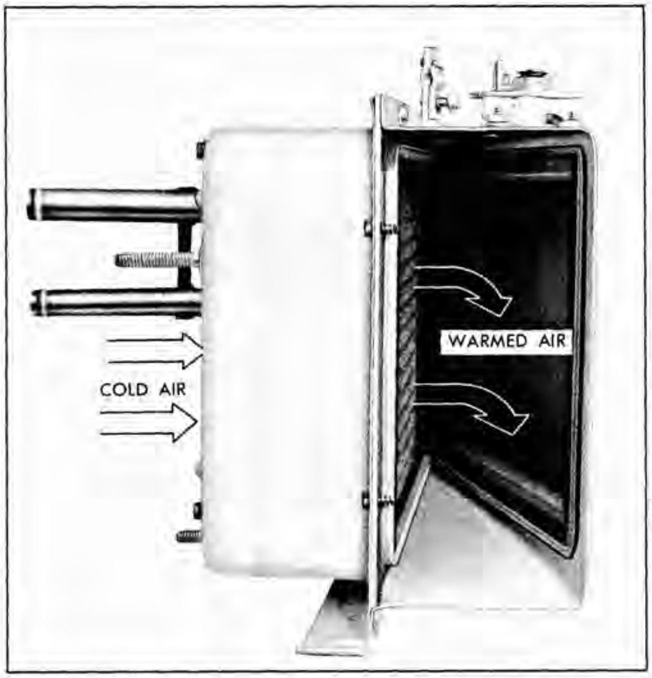



Fig. 1-12 Temperature Control Valve at Maximum Heat Position

NOTE: The heater vacuum switch has five vacuum post outlets. Cars equipped with heater only use No. 1, No. 2 and No. 3 vacuum posts; No. 4 and No. 5 are capped on cars equipped with heater only. Posts No. 4 and No. 5 are provided for use with the Circ-L-Aire conditioning system.

### "OFF" POSITION

With the engine running and the heater control "OFF" push button placed in the "OFF" position, the off slide bar positions the vacuum switch so no vacuum passes through the switch. Atmospheric pressure is on both sides of the heater inlet air valve diaphragm and spring tension holds the inlet air valve (at the dash shroud) in a position to close the opening for air to enter the heater air system. Atmospheric pressure is also on both sides of the defroster air valve diaphragm and spring tension holds this valve tight against the underside of the air outlets to the defroster ducts in the heater core case and duct assembly.

### "NORMAL" POSITION

When the "NORMAL" button is pushed, the normal slide bar moves the vacuum control switch to apply vacuum coming to the switch through the blue tipped hose to the No. 1 post of the vacuum switch, through the switch and the No. 3 post, through the red tipped hose which connects this vacuum post to

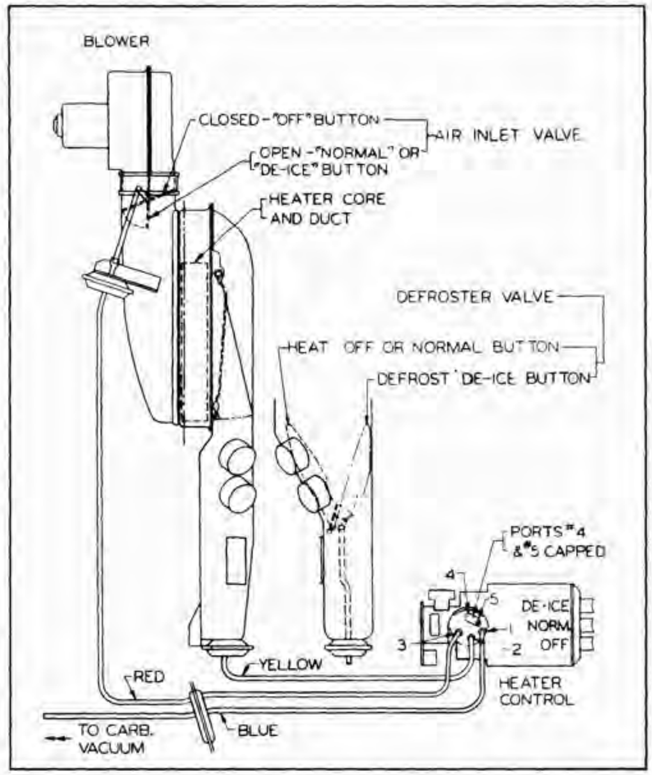



Fig. 1-13 Circ-L-Aire Heater Vacuum Hose Diagram

the heater inlet air valve diaphragm. Atmospheric pressure which is now only on one side of this diaphragm is sufficient to overcome spring tension and turns the heater inlet air valve to open position. Atmospheric pressure is on both sides of the defroster air valve diaphragm and spring tension holds this valve tight against the underside of the air outlets to the defroster ducts in the heater core case and duct assembly.

All air entering the heater system passes through the heater air inlet duct. It is then divided so part of the air by-passes the heater core and part of the air passes through the heater core. Warmed air mixes with the by-pass air and is directed to the floor of the front seat and to the windshield.

### "DE-ICE" POSITION

Pushing the "DE-ICE" button moves the de-ice slide bar to position the vacuum switch to apply vacuum coming to the switch through the blue tipped hose to the No. 1 post of the vacuum switch, through the switch and the No. 3 post, through the red tipped hose which connects this vacuum post to the heater inlet air valve diaphragm. Atmospheric pressure which is now only on one side of this diaphragm is sufficient to overcome spring tension and turns the heater inlet air valve to the open position.

The vacuum switch also permits vacuum to enter the No. 2 post of the vacuum switch, through the yellow tipped hose which connects this vacuum post to the defroster air valve diaphragm. Atmospheric pressure which is now on only one side of the diaphragm is sufficient to overcome spring tension and swings the defroster air valve downward.

All air entering the heater system passes through the heater air inlet duct. It is then divided so part of the air by-passes the heater core and part of the air passes through the heater core where warmed air mixes with the by-passed air. With the defroster valve down, the valve acts as a ramp to permit more air to be directed to the area above the baffle and to the windshield. A small amount of air is permitted to pass through the irregular shaped valve to be directed to the front and rear floor area.

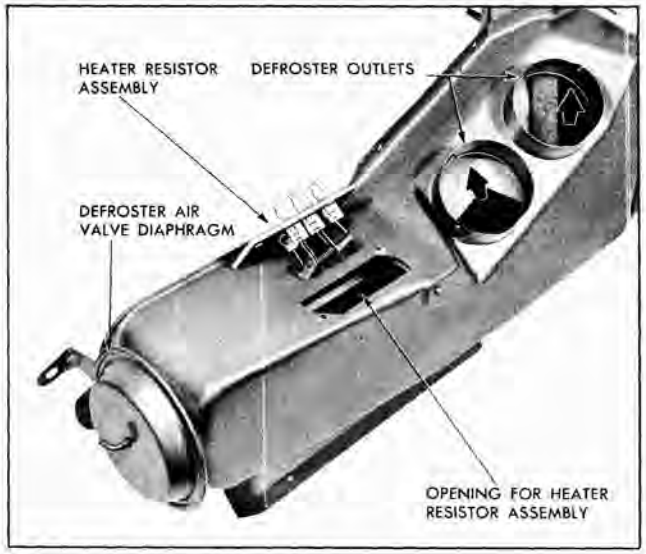



Fig. 1-14 Location of Circ-L-Aire Heater Resistor

## ELECTRICAL SYSTEM

The heater control panel lamp is fed from the instrument panel rheostat output circuit which is protected by a 4 amp. fuse in the lower left corner of the fuse block.

The blower circuit of the heater system receives its electrical supply from the heater terminal on the fuse block. Overload protection of the heater electrical systems is provided by a 14 amp. fuse located in the lower right corner of the fuse block.

When the ignition switch is turned to the start position, the accessory terminal of the ignition switch is cut out. This prevents operation of the accessories connected through the ignition switch while starting the engine. Thus, the starting motor receives maximum battery current while cranking the engine because there is no current to the heater electrical system.

When the "OFF" push button is depressed, the heater master switch is opened and no current reaches the blower or defroster switches.

When either the "NORMAL" or "DE-ICE" push button is depressed the master switch is closed. Current will not flow to the blower in "NORMAL" position unless the blower switch is in the "LO", "MED" or "HI" speed position. When the "DE-ICE" button is depressed the circuit is closed to the blower to operate it at superspeed.

The heater blower switch is a four position switch but only provides for three blower speeds; low, medium and high. The blower is fed through a single connection at its input; a black colored wire.

### *CURRENT FLOW THROUGH HEATER CONTROL POSITIONS*

Four positions of the heater blower switch control current flow to the blower as follows:

"OFF" position opens the heater blower switch and prevents the flow of current to the blower motor.

"LO" position closes the heater blower switch which closes the circuit to the blower motor. This allows current from the "HTR" terminal on the fuse block to flow through the heater master control switch to the blower switch via a tan colored wire, through the blower switch "LO" terminal and through a yellow wire to the resistor assembly (located in the heater air outlet duct as shown in Fig. 1-14). Current flows through all the resistors in the resistor block (.60 ohm, .50 ohm and .30 ohm) then through a black wire to the defroster (DE-ICE) switch terminal and to the blower via a black wire. See Figs. 1-15 and 1-16.

"MED" position closes the heater blower switch which closes the circuit to the blower motor. This allows current from the "HTR" terminal on the fuse block to flow through the heater master control switch to the blower switch via a tan colored wire, through the blower switch "MED" terminal and through a brown colored wire to the resistor assembly (located in the heater air outlet duct). Current flows through two resistors (.50 ohm and .30 ohm) then through a black colored wire to the defroster (DE-ICE) switch and to the blower via a black colored wire (Fig. 1-15).

"HI" position closes the heater blower switch which closes the circuit to the blower motor. This allows

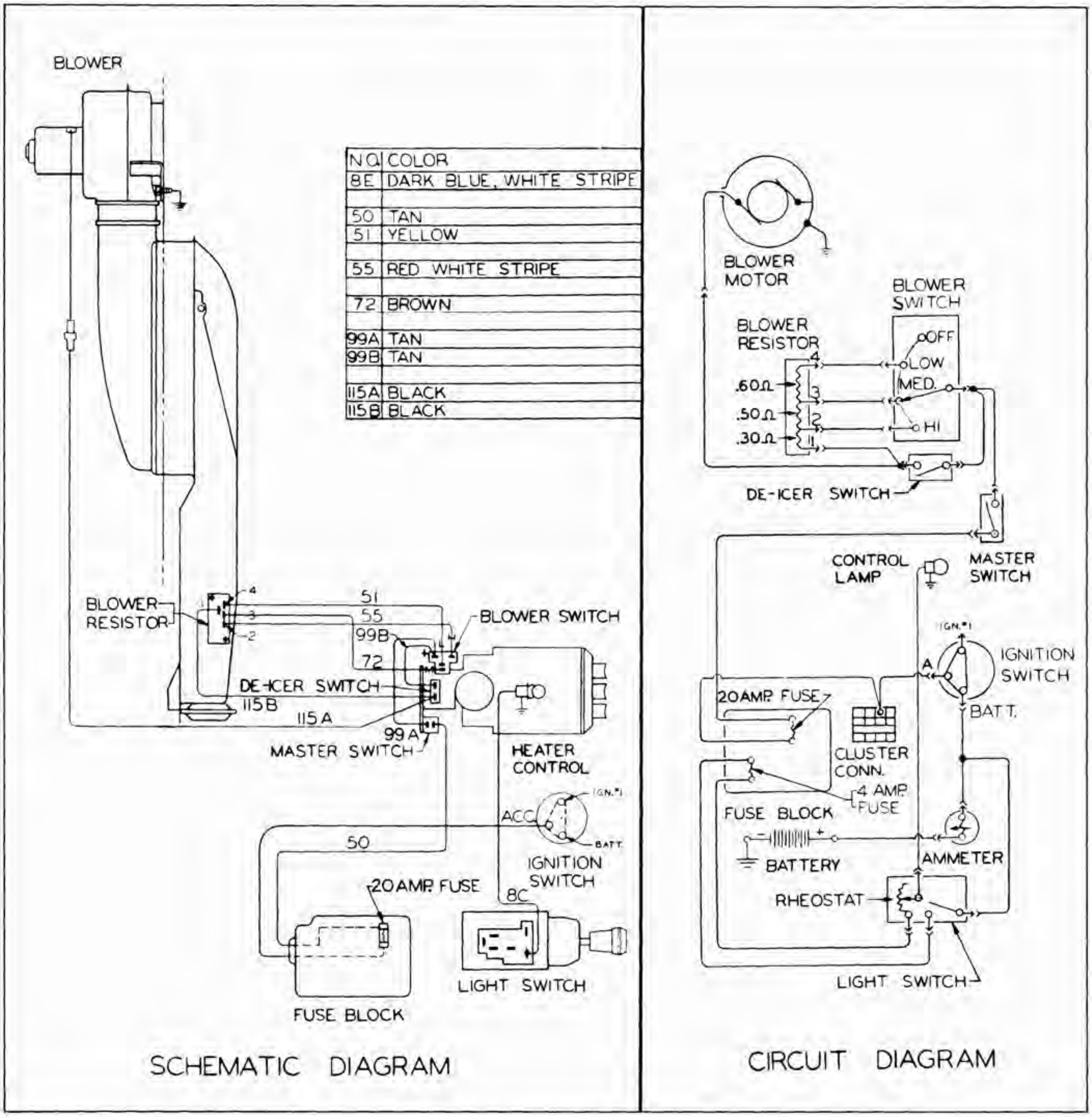



Fig. 1-15 Schematic and Circuit Diagrams of Circ-L-Aire Heater Electrical System

current from the "HTR" terminal on the fuse block to flow through the heater master control switch to the blower switch via a tan colored wire, through the blower switch "HI" terminal and through a red wire with a white stripe to the resistor assembly (located in the heater air outlet duct). Current flows through one resistor (.30 ohm), then through a black wire to the defroster switch and to the blower via a black wire.

### *CURRENT FLOW THROUGH DEFROSTER (DE-ICE) CONTROL POSITION*

When the "DE-ICE" (defroster) button is pushed in, the heater blower switch is by-passed. Current flows from the "HTR" terminal of the fuse block through the heater master control switch to the blower switch at the input terminal, back to the defroster switch and through a single input connection. The

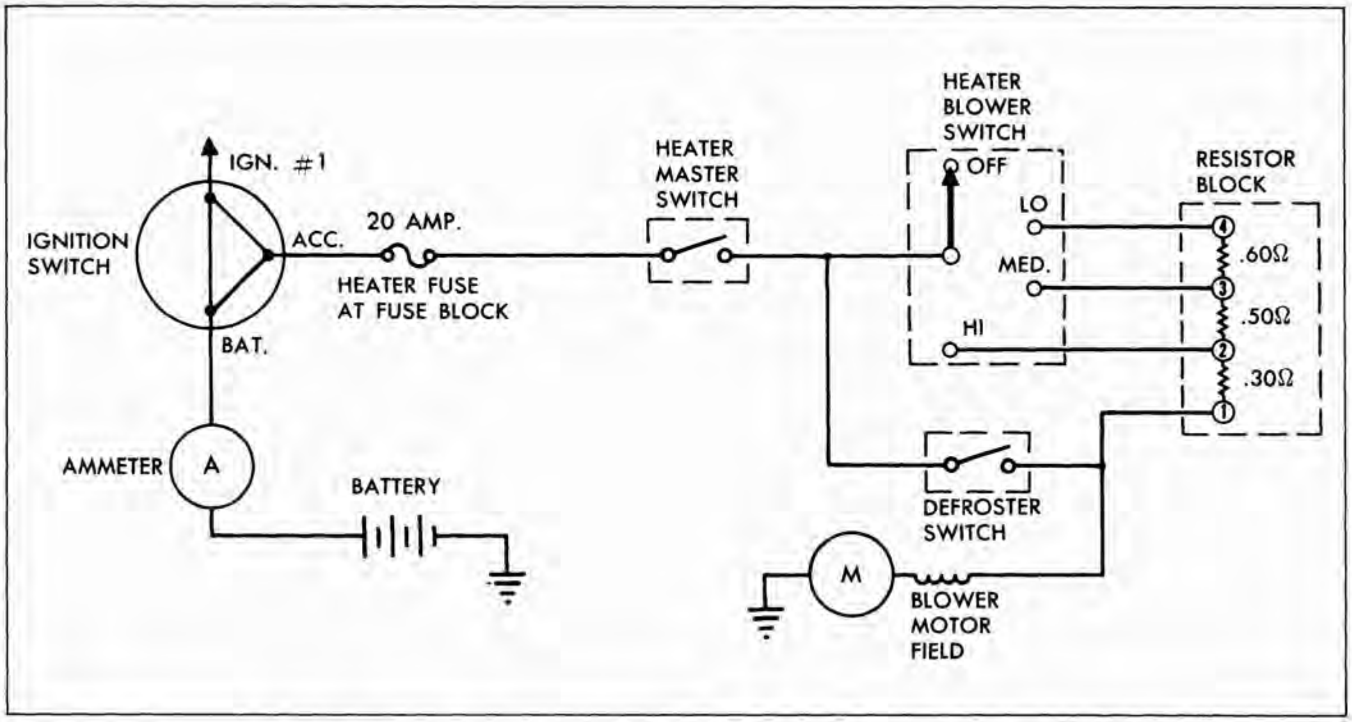



Fig. 1-16 Simplified Circuit Diagram of the Circ-L-Aire Heater Electrical System

outlet portion of the switch has a two wire connection; one black colored wire to the resistor assembiy at the output side of the 30 ohm resistor (located in the heater air outlet duct); the other is through a black colored wire to the blower.

In the "DE-ICE" position, there is no "fixed" resistor in the circuit and therefore the blower operates faster than it does in the blower "HI" position.

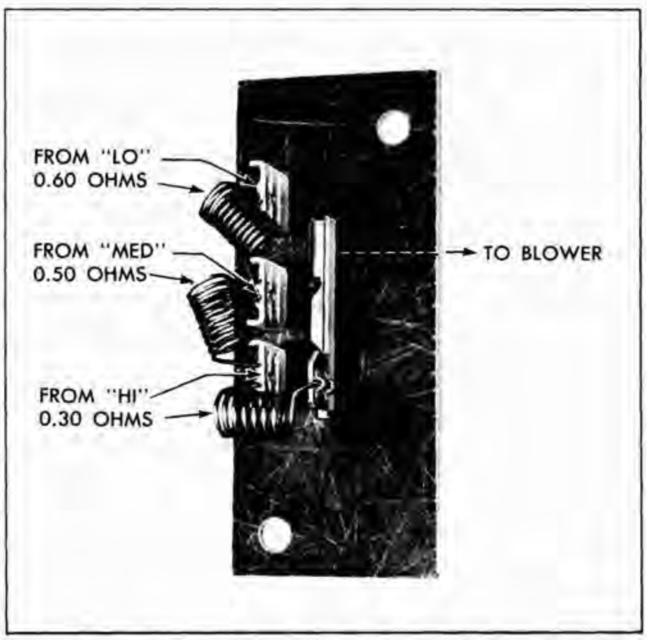



Fig. 1-17 Circ-L-Aire Heater Resistance Values at Coils

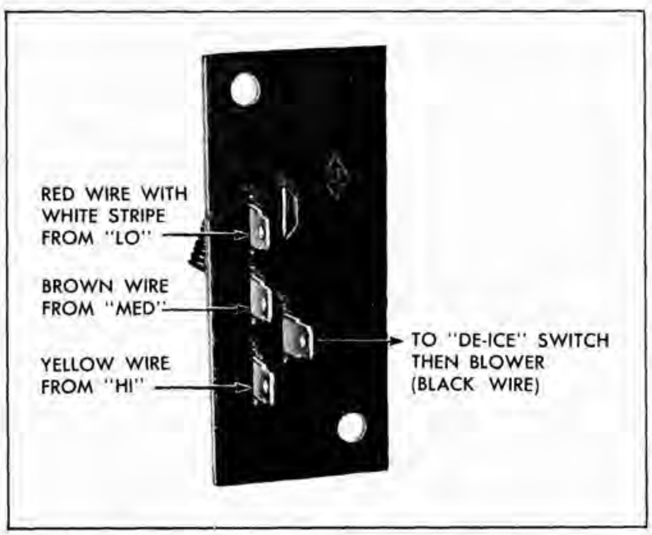



Fig. 1-18 Circ-L-Aire Heater Resistor Terminal Identification

# MINOR SERVICES AND REPAIRS

CONTENTS OF THIS SECTION



## ADJUSTMENTS ON CAR

### *TEMPERATURE CONTROL CABLE*

NOTE: This adjustment should be checked when slightly warmed air leaves the heater outlets when the "OFF" button is depressed or the temperature control lever is in the full up (OFF) position, or when insufficient heat is obtained with the temperature control lever in the full down position.

1. Remove the glove box.

2. Move "TEMP" lever (at the heater control panel) making sure lever moves up against its stop.

NOTE: The "TEMP" lever and heater "FAN" lever should be in alignment when the "FAN" lever is in the "OFF" position.

a. If "TEMP" lever requires adjustment, loosen cable clamp screw at heater control panel and move cable assembly as necessary to adjust.

b. Holding cable housing, move "TEMP" lever to full down position and slide the temperature control cable housing away from the heater control panel front face (toward front of car) as necessary to remove any slack in the cable and tighten housing clamp screw securely.

c. Recheck "TEMP" lever in the full up position.

3. Insert dowel pin through heater cam into cam bracket (Fig. 1-19).

4. Install looped end of cable on heater cam pin with cable housing passing through cable clamp on heater duct.

5. Hold the "TEMP" lever in the full up (cold) position and tighten cable clamp on the heater duct.

### *TEMPERATURE AIR VALVE*

NOTE: This adjustment should be made only if adjustment of the temperature control cable does not prevent warm air from coming into the car when the heater is "OFF" or the "TEMP" lever is in the full up (cold or off) position, or does not give sufficient heat with the "TEMP" lever in the full down position.

1. Remove glove box.

2. Remove heater outlet nozzle left screw and rotate outlet to the right. (Remove outlet nozzle on cars equipped with Circ-L-Aire Conditioning.)

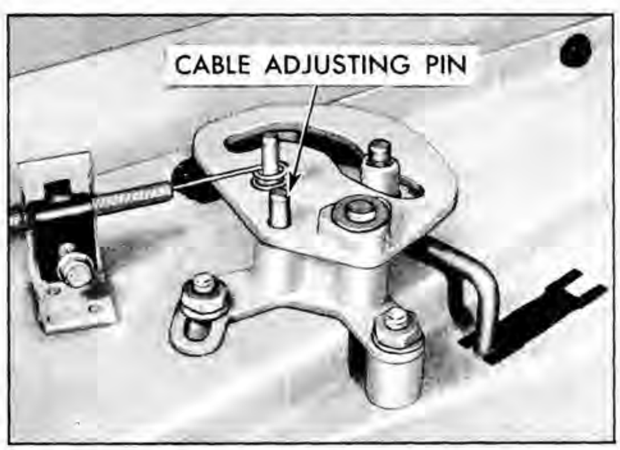



Fig. 1-19 Temperature Control Cable Adjusting Pin in Position

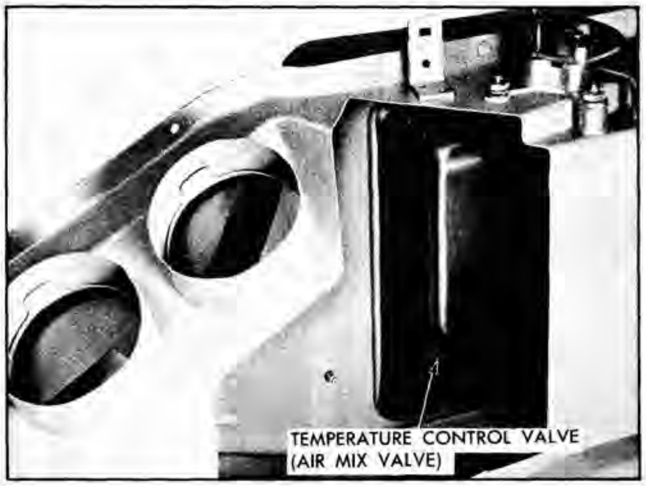



Fig. 1-20 Temperature Control Valve Crush to Heater Core

3. Disconnect defroster nozzle hoses at heater outlet duct.

4. Loosen the two heater temperature control valve cam mounting bracket to outlet duct nuts using 3/8" wrench.

5. Insert a 3/16" dowel pin (approximately 1" long) through the heater cam into the cam bracket as shown in Fig. 1-19.

6. Shine a light through the defroster outlets and using a mirror in the heater outlet nozzle opening move bracket and cam assembly (with pin installed) so the rubber edge of valve *just contacts* the heater core flange. Continue to move this assembly in the same direction slightly to place a slight "crush" (approx. 3/32") on the rubber portion of the valve (Fig. 1-20).

7. Hold the cam and bracket assembly in this position and tighten bracket nuts.

8. Adjust temperature "TEMP" control cable.

a. Align "TEMP" lever with "FAN" lever in full up (no heated air) position.

b. Loosen cable clamp screw at heater control panel and slide coiled conduit away from the heater control assembly to remove cable slack. Tighten retaining clamp securely.

c. Loosen cable conduit retaining clamp at heater assembly.

d. Insert a 3/16" dowel pin (approximately 1" long) through the heater cam and into the cam bracket.

e. Holding "TEMP" lever in full up position (no heated air), tighten cable clamp securely at heater.

f. Remove dowel pin.

9. Operate "TEMP" lever observing valve to see that the rubber is crushed when the lever is in the full up position (no heated air) as well as the full down position (maximum heat) and correct as necessary to obtain a slight crush of the rubber at both ends of the cable travel.

10. Attach defroster outlet hoses and replace glove box.

11. Replace heater air outlet nozzle.

## HEATER CONTROL PANEL ASSEMBLY

### *REMOVE AND REPLACE*

1. Completely detach temperature control cable at the heater control panel.

2. Disconnect wire connectors from the control panel assembly.

3. Back off screw which retains top of control assembly to back side of instrument panel.

4. Remove two control panel to instrument panel screws at lower edge of heater control panel.

5. Move heater control assembly out from instrument panel part way.

6. Remove control panel lamp and disconnect vacuum hoses.

7. Remove heater control assembly.

8. Replace by reversing the above procedure.

NOTE: When replacing vacuum hoses, connect them as follows:

Connect blue tipped hose to the No. 1 vacuum post, the yellow tipped hose to the No. 2 vacuum post, and the red tipped hose to the No. 3 vacuum post.

Number 4 and 5 posts are for use with Circ-L-Aire Conditioning and are to be capped on cars equipped with Circ-L-Aire Heater only.

9. Adjust temperature control cable.

## HEATER VACUUM SWITCH ASSEMBLY

### *REMOVE AND REPLACE*

1. Remove heater control panel assembly.

2. Remove heater vacuum switch assembly.

3. Replace switch by reversing the above procedure using a new switch retainer.

4. Adjust temperature control cable.

## HEATER MASTER SWITCH

*REMOVE AND REPLACE*

1. Disconnect wire connector at heater master switch.

2. Remove two nuts securing heater master switch and remove switch (Fig. 1-21).

3. Replace switch and check to make sure plastic end of switch arm contacts the "OFF" push button sliding bar.

4. Connect wire connector to switch.

## HEATER BLOWER SWITCH

*REMOVE AND REPLACE*

1. Disconnect wire connector at switch.

2. Remove blower switch arm plastic rivet. Push the plastic center pin (Fig. 1-22) out of the plastic rivet and then the rivet can be slid out of the switch lever.

3. Remove two screws retaining heater blower switch and remove switch.

4. Replace heater blower switch (connecting arm with the plastic rivet by inserting the rivet and then the plastic center pin, Fig. 1-22).

5. Check operation of heater switch control lever making sure switch moves freely in all positions and that the "OFF", "LO", "MED" and "HI" letters are centered in the "FAN" window. Adjust switch as necessary.

## DEFROSTER SWITCH

*REMOVE AND REPLACE*

1. Disconnect wire connector at defroster switch.

2. Remove two nuts securing defroster switch and remove switch.

3. Replace switch and check to make sure plastic end of switch properly contacts the "DE-ICE" push button sliding bar.

NOTE: The switch should be closed when the "DE-ICE" push button is pushed in and open when either the "NORMAL" or "OFF" button is depressed. Adjust by moving switch in line with the heater control panel sliding selector bars.

4. Connect wire connector to switch.

## TEMPERATURE CONTROL CABLE

*REMOVE AND REPLACE*

1. Remove glove box.

2. Disconnect temperature control cable at top of heater core and air outlet duct.

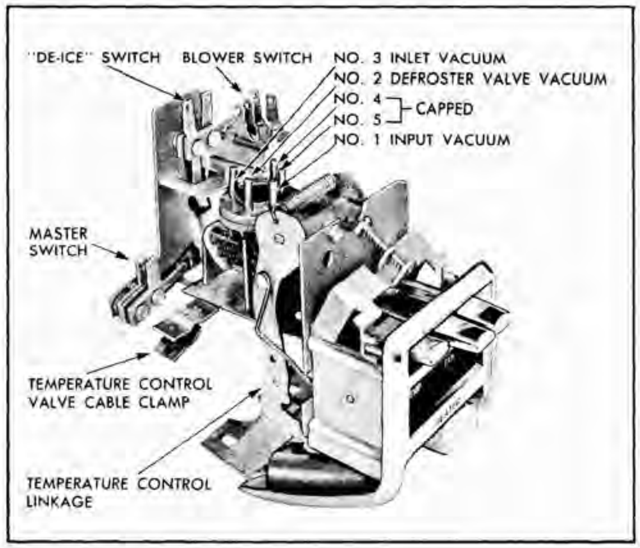



Fig. 1-21 Control Panel Switch Identification

3. Disconnect cable from heater control panel.

4. Move temperature control lever to full down position and remove temperature control cable.

5. Replace cable by reversing the above procedure.

6. Adjust temperature control cable.

## BLOWER MOTOR

*REMOVE AND REPLACE*

1. Hoist front end.

2. Remove right front wheel assembly.

3. Remove right front headlamp assembly.

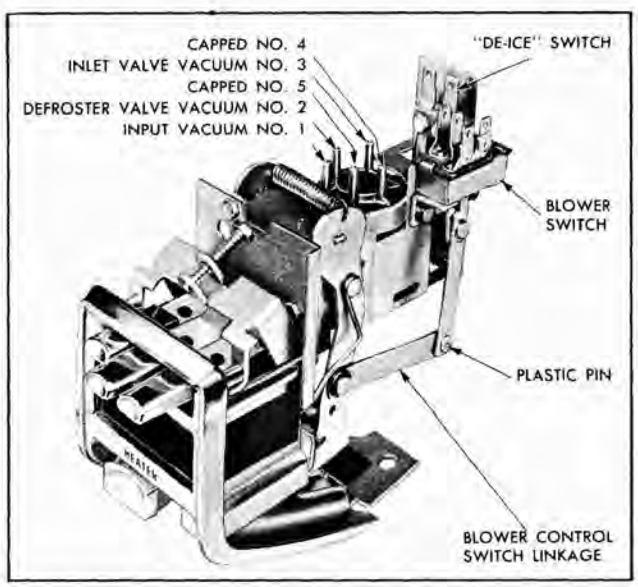



Fig. 1-22 Blower Control Linkage at Control Panel

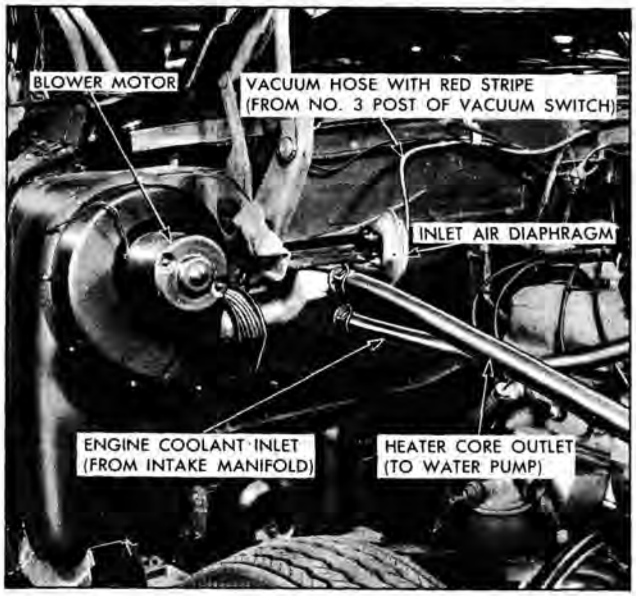



Fig. 1-23 Circ-L-Aire Heater Air Inlet Duct Assembly on Dash Shroud

4. Disconnect right front fender skirt assembly; move skirt toward rear of car and downward.

5. Disconnect wires at blower motor (Fig. 1-23).

6. Remove blower motor assembly.

7. Replace by reversing the above procedure.

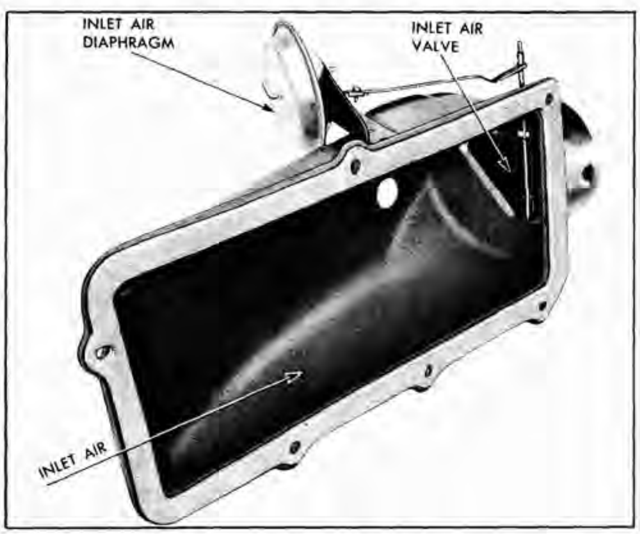



Fig. 1-24 Inlet Air Duct Assembly

## AIR INLET DUCT ASSEMBLY

### *REMOVE AND REPLACE TO SERVICE ASSEMBLY*

1. Drain radiator.

2. Disconnect vacuum hose at air inlet duct diaphragm.

3. Disconnect heater inlet and outlet water hoses at heater.

4. Remove six nuts securing air inlet duct assembly and remove assembly and duct to housing sleeve. See Fig. 1-24.

5. Replace by reversing the above procedure.

## HEATER CORE

### *REMOVE AND REPLACE*

1. Drain radiator.

2. Disconnect vacuum hose at air inlet duct diaphragm.

3. Disconnect heater inlet and outlet water hoses at heater.

4. Remove six nuts securing air inlet duct assembly and remove assembly and duct to housing sleeve.

5. Remove glove box.

6. Disconnect temperature control cable at top of heater core and air outlet duct.

7. Disconnect vacuum hose from defroster air valve diaphragm.

8. Disconnect air outlet hoses to defroster outlet assemblies.

9. Remove wire connector from resistor assembly at top left side of the heater air outlet duct assembly by prying connector up with flat blade screwdriver.

10. Remove spring retainer on heater core stud at engine side of dash shroud.

11. Remove the heater core and case assembly.

12. Remove the heater core assembly noting position and location of seals (Figs. 1-25 and 1-26).

13. Replace by reversing the above procedure.

14. Adjust temperature control cable.

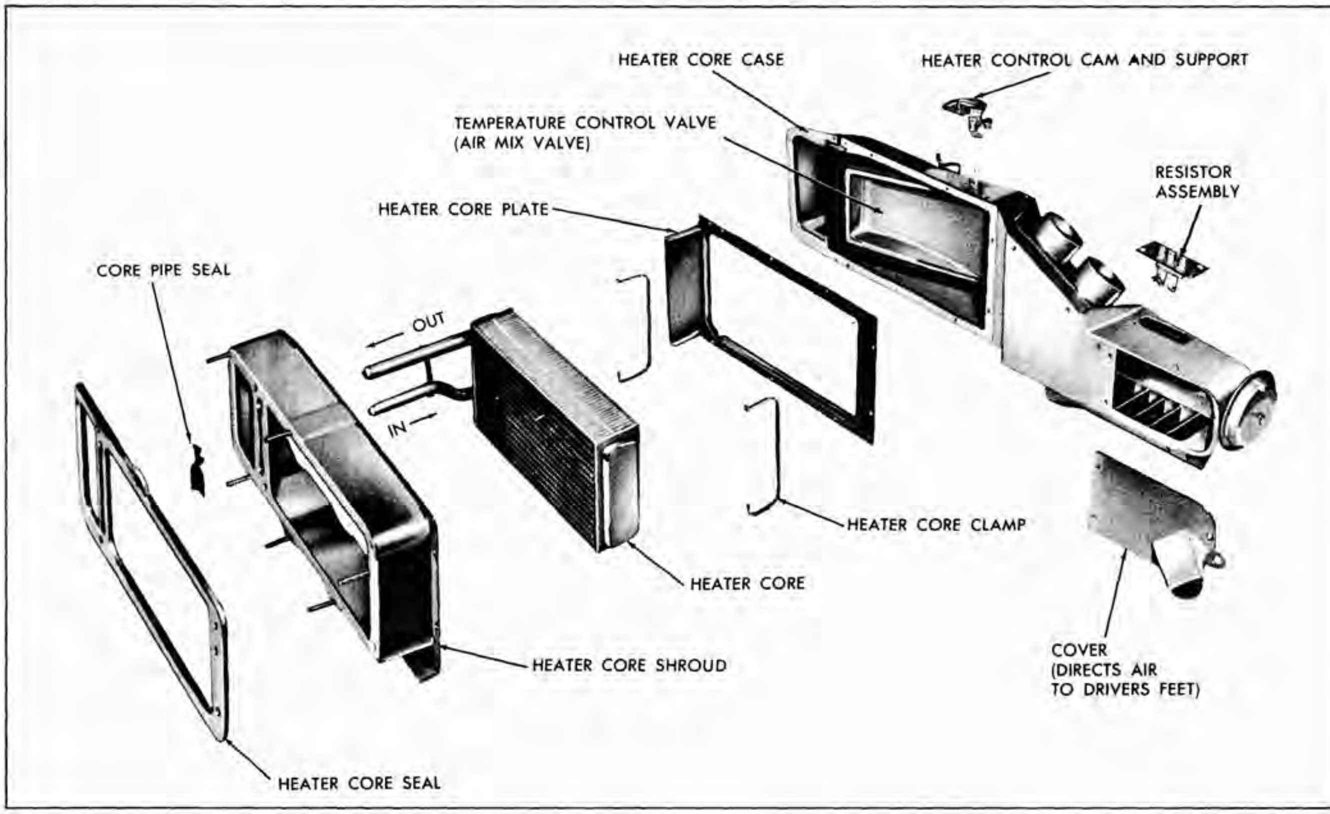



Fig. 1-25 Circ-L-Aire Heater Core and Case Assembly (Heater Only)—Exploded View

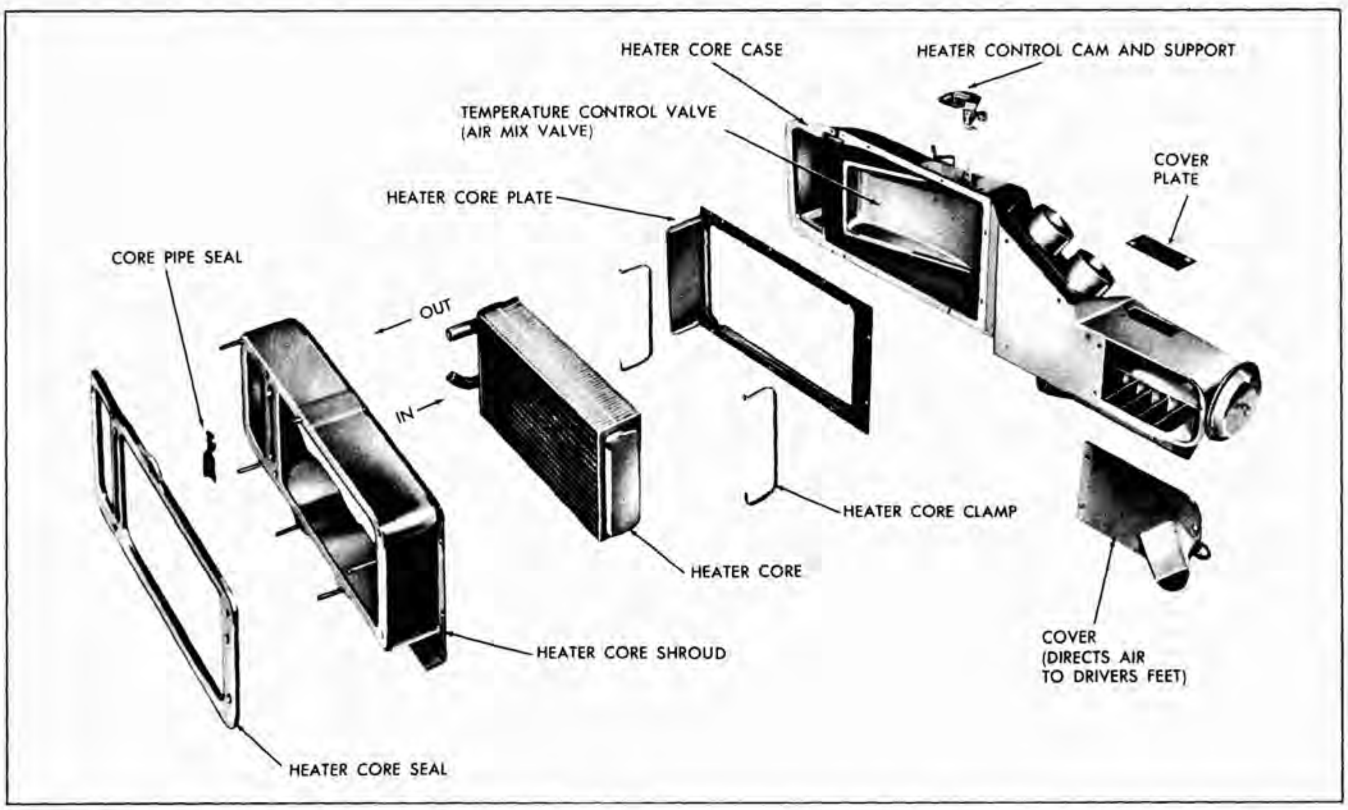



Fig. 1-26 Circ-L-Aire Heater Core and Case Assembly (With Circ-L-Aire Conditioning)—Exploded View

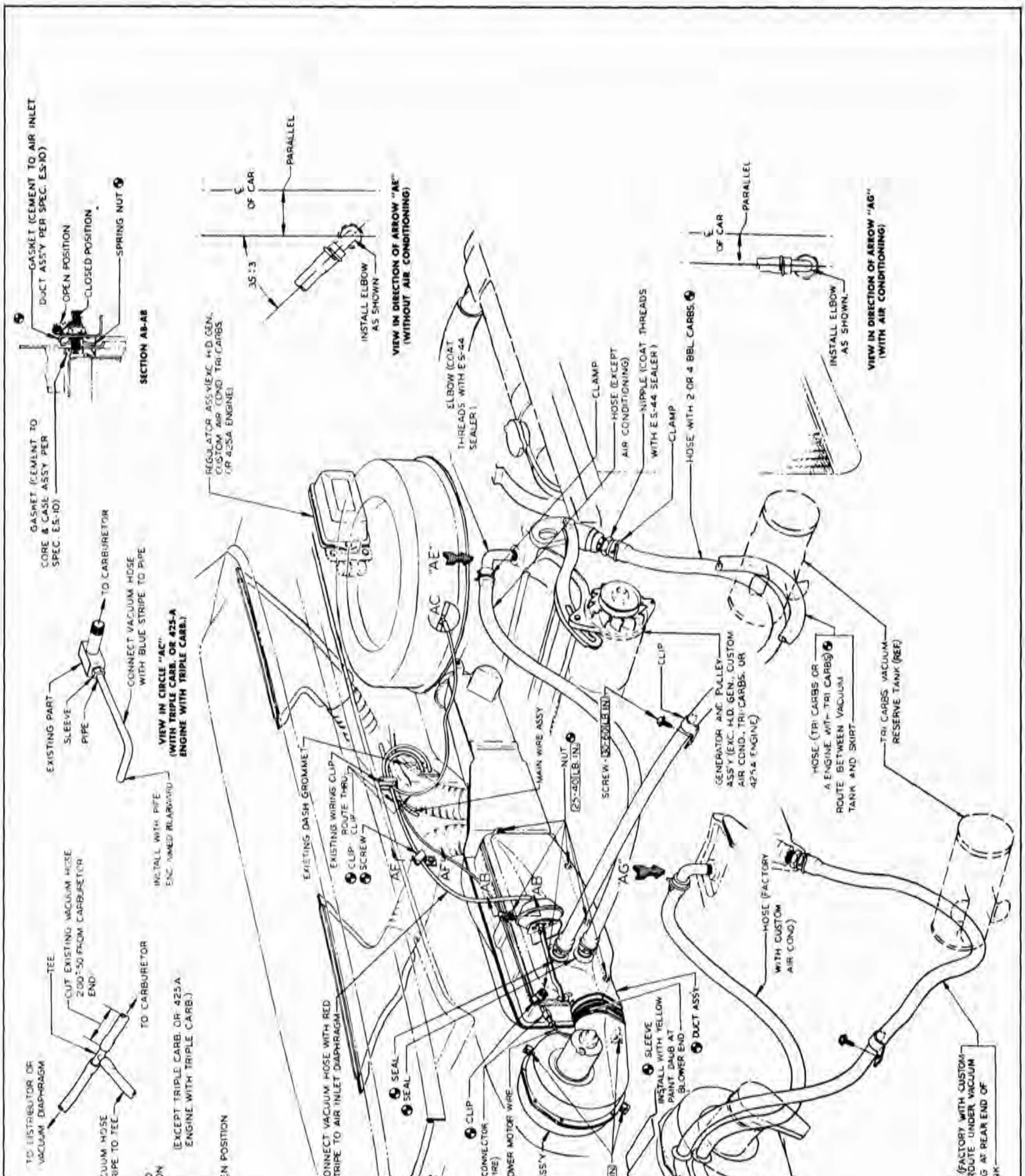



Fig. 1-27 Reference Illustration—Circ-L-Aire Heater Parts in Engine Compartment

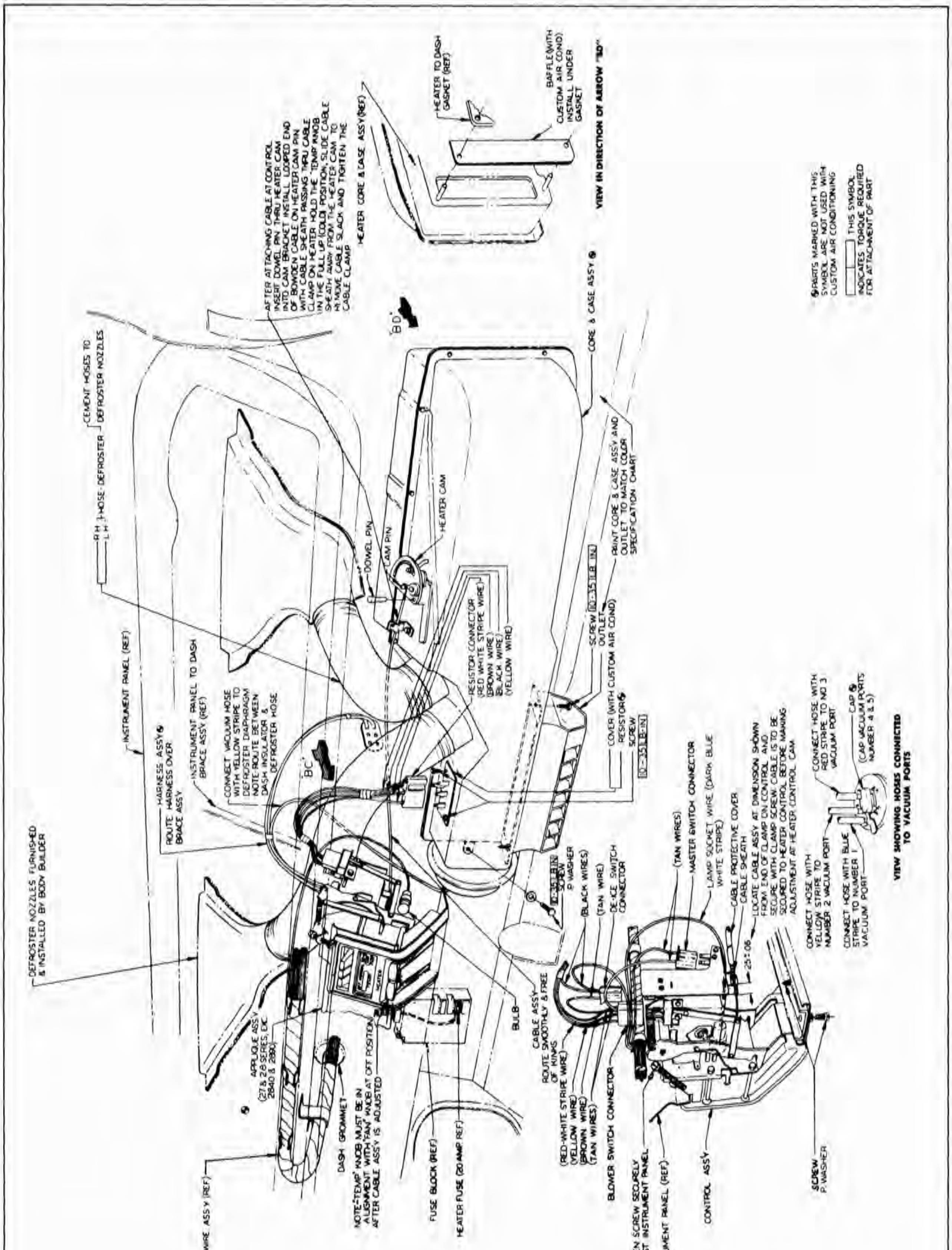


Fig. 1-28 Reference Illustration—Circ-L-Aire Heater Parts in Body Interior

# TESTING AND DIAGNOSIS

CONTENTS OF THIS SECTION



## TESTING

### OPERATIONAL TEST

The purpose of performing a heater operational test is to prove the heater system is operating properly.

### PRELIMINARY CHECKS

Engine Compartment

1. Check radiator for proper engine coolant level.

2. Inspect radiator core and heater hoses for leaks, at the same time inspecting for kinked or collapsed heater hoses.

3. Check vacuum hose connection at heater air inlet duct diaphragm for proper installation. This vacuum hose should have a red tip at its end.

4. Inspect the air inlet duct to heater blower sleeve to see that it is not torn or damaged and that it is properly installed (to prevent any air leaks from engine compartment which may have objectionable fumes or odors).

Inside Car Body

1. Check to see that a vacuum hose having a yellow tipped end is attached to the defroster valve diaphragm at the left end of the heater core and case assembly.

2. Start engine.

3. Place "FAN" control lever in up position. Depress heater "OFF" push button and check "FAN" control lever in "OFF", "LO", "MED" and "HI" positions; blower should not operate.

4. Depress "NORMAL" push button and check "FAN" control in "OFF", "LO", "MED" and "HI" positions. Blower should not operate at "OFF", operate at "LO" and increase in speed at "MED" and "HI" directing air through all heater and defroster outlets.

5. Depress the "DE-ICE" push button. Blower should operate faster than the "HI" speed position, directing most of the air through the defroster outlets onto the windshield.

6. Position "FAN" control in the full up position. Blower should continue to operate.

7. Return heater controls to original position and turn engine off.

Should the heater operate satisfactorily during the above checks, it would appear that heater operation is normal. If during the checks irregularities are noted or complaints on heater operation could not be noted or determined, then refer to TROUBLE DIAGNOSIS for the complaint or cause and the remedy.

## TROUBLE DIAGNOSIS

### INSUFFICIENT HEATING

| COMPLAINT OR CAUSE | REMEDY |
|---|---|
| Slow warming in car. | Incorrect operation of controls. Advise operator of proper operation of heater controls. Explain operation of cowl vents and controls. |
| | Checks for good seal between hood and cowl. |
| Objectionable engine or exhaust fumes in car. | Check for seal between vent grille and cowl. |
| | Check for damaged and/or proper installation of sleeve between air inlet duct and blower motor. |

***INSUFFICIENT HEATING—Continued***

| COMPLAINT OR CAUSE | REMEDY |
|---|---|
| Objectional engine or exhaust fumes in car—continued. | Locate and seal any other air leaks. |
| | Check and adjust cowl vent control. |
| Cold drafts on floor. | Check operation and adjustment of cowl vent cables. |
| | Advise operator of proper operation of heater system. |
| | Door vents open or improperly adjusted. |
| | Advise owners to use blower to force air to rear seat area. |
| | Check to be sure front floor mat is under floor mat retainer. |
| Insufficient heat to rear seat. | Obstruction on car floor, possibly wrinkled or torn deadener felt between front seat and floor. |
| | Operate blower at higher speed. |
| Low engine coolant level. | Check radiator and engine cooling system for leaks, correct and fill to proper level. Run engine to clear any air lock. |
| Failure of engine cooling system to warm up. | Check radiator cap and engine thermostat and replace if required. |
| Kinked heater hoses. | Remove kink or replace hose. |
| Foreign material obstructing water flow in or through heater core. | Remove foreign material if possible, otherwise replace core. |
| Temperature control cable improperly adjusted. | Adjust cable. |
| Temperature air valve improperly adjusted. | Adjust valve. |
| Air valves do not operate. | See VACUUM SYSTEM DOES NOT OPERATE AIR VALVES. |

***INADEQUATE REMOVAL OF FOG OR ICE***

| CAUSE | REMEDY |
|---|---|
| Air valve does not open. | See VACUUM SYSTEM DOES NOT OPERATE AIR VALVES. |
| Defroster valve does not open fully. | Adjust operating linkage. |
| Obstructions in defroster outlets at windshield. | Remove obstruction. On cars with instrument panel pads, look for and fix loose panel pad cover at defroster outlets. |
| Dinged defroster outlets. | Reshape outlet flange with pliers. The outlet should have a uniform opening, 5/16" wide. |
| Blower motor not connected. | Connect wire. |
| Inoperative blower motor. | Replace motor. Check heater fuse. |
| Inoperative blower motor switch. | Replace switch. |
| Inoperative master switch. | Replace switch. |

### TOO WARM IN CAR

| CAUSE | REMEDY |
|---|---|
| Temperature air valve improperly adjusted. | Adjust valve. |
| Obstruction in air hoses to defroster outlets. | Check for air flow through these hoses and repair if obstructed. |
| Incorrect operation of controls. | Advise operator of proper operation of heater system. |

### VACUUM SYSTEM DOES NOT OPERATE AIR VALVES

| CAUSE | REMEDY |
|---|---|
| Little or no vacuum at valve diaphragm. | Check for vacuum leaks. |
| Leak in vacuum system. | Check vacuum lines for leaks or obstructions. |
| | Check heater control panel vacuum switch. Replace if necessary. |
| Air valve sticking. | Check for bind or obstruction in air valve. |

### BLOWER INOPERATIVE

| CAUSE | REMEDY |
|---|---|
| Blown fuse. | Replace fuse. |
| Inoperative motor. | Replace motor. |
| Open circuit. | Repair circuit between ignition switch, blower switch, and blower motor. See wiring diagrams. |
| Inoperative blower motor or master switch. | Adjust or replace faulty switch. |

### MISCELLANEOUS

| CAUSE | REMEDY |
|---|---|
| Control levers not aligned due to incorrect adjustment. | Adjust temperature control cable. |
| Blown fuses. | Shorts in electrical system; locate and correct short. |
| | Blower wheel rubbing on case. |
| | Failed blower motor. |
| Front floor mat wet under heater. | Windshield improperly sealed. Manual antenna improperly sealed. |
| | Heater core leaking. Repair if possible, otherwise replace. |
| | On Circ-L-Aire air conditioned cars, check for proper gasket and/or seal to dash. Check also for leak at hose connection at heater core. |
| Heater "gurgle". | Check engine coolant level in radiator. |

## SPECIFICATIONS

### Circ-L-Aire Heater Current and Voltages

NOTE: Data for conditions of car windows and doors closed and at room temperature.

| Control Position | Input Voltages at Junction Block | Blower Current | Motor Voltage | Impeller Speed |
|---|---|---|---|---|
| DE-ICE | 12.2 | 6.0 | 11.7 | 2025 |
| HI | 12.2 | 6.15 | 11.65 | 1965 |
| MED | 12.2 | 4.6 | 8.4 | 1575 |
| LO | 12.2 | 3.7 | 6.45 | 1305 |
| DE-ICE | 13.5 | 6.65 | 12.9 | 2160 |
| HI | 13.5 | 6.85 | 12.85 | 2115 |
| MED | 13.5 | 5.0 | 9.3 | 1695 |
| LO | 13.5 | 4.05 | 7.1 | 1410 |
| DE-ICE | 14.5 | 7.1 | 13.9 | 2280 |
| HI | 14.5 | 7.35 | 13.85 | 2220 |
| MED | 14.5 | 5.35 | 10.0 | 1785 |
| LO | 14.5 | 4.3 | 7.7 | 1485 |

### Cooling System Capacity

Engine With Heater ........ 19.5 qts.

### Fuse

Heater Electrical System (on fuse block) ........ 20 amp.

Heater Control Panel Lamp (on fuse block) ........ 4 amp.

**Generator Model** ........ 1102303

Brush Spring Tension, Oz. ........ 28

Cold Output ........ 35 amps., 14 V.<br>2540 gen. rpm<br>925 engine rpm

Field Current Draw ........ 1.69-1.70 amps.<br>12 V., 80°F.

| | |
|---|---|
| **Regulator Model** | 1119668 |
| Fuse assembly | 1945172–45 amp. |
| Paint Code Identification (daub) | Yellow |
| Cutout Relay: | |
| Air Gap In | .020 |
| Point Opening, In | .020 |
| Closing Voltage, volts | 11.8-13.0 |
| Voltage Regulator: | |
| Air Gap, In. | .067 |
| Normal Range (125°F) volts | 13.8-14.8 |
| Current Regulator: | |
| Air Gap, In. | .075 |
| Allowable Limits (125°F.), ampere | 27-33 |

# TEMPEST HEATER

## (1962 EARLY TYPE)

CONTENTS OF THIS SECTION



## DESCRIPTION AND OPERATING INSTRUCTIONS

### GENERAL DESCRIPTION

Pontiac's Tempest Heating and Defroster System provides rapid warm-up sensation and even distribution of warmed air to all parts of the car. All air entering the system is taken through hood high cowl vents providing air with a minimum of dust, foreign material and undesirable fumes.

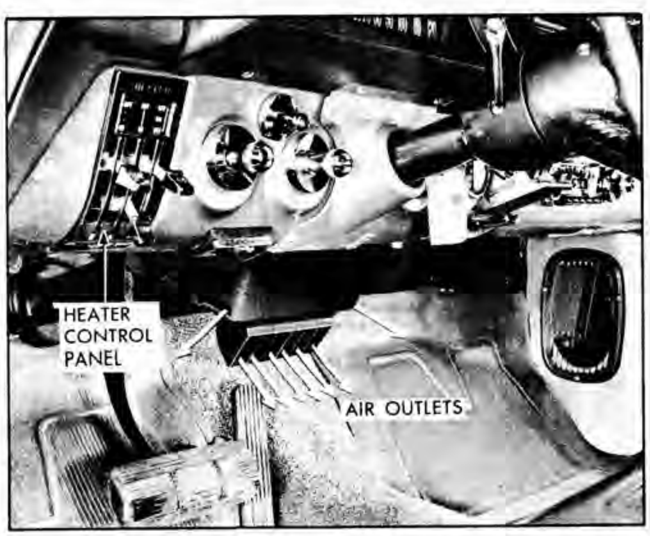



Fig. 2-1 Air Outlets and Controls

The use of outside air exclusively provides constant and rapidly changing air inside the car, eliminating a smoke-filled interior and keeps the occupants comfortable.

The driver has fingertip control of the temperature warmed air entering the car. When heated air is desired, the blower forces air taken from the hood high cowl inlet duct through the heater core and then through an air distributing system to the air outlets.

The design of the heater and defroster system, its valves and controls permits a method of obtaining different amounts of forced air flow for ventilation.

#### *AIR OUTLETS AND CONTROLS*

#### AIR OUTLETS

Heated air enters the interior of the car and is distributed by a center outlet grille opening at the bottom of the heater duct, which disperses air over the front floor area and is so aimed that it also directs air to the rear passenger compartment.

Additional outlets are provided on the right and left sides of the heater outlet air duct for additional air distribution to the driver and front seat passenger floor area.

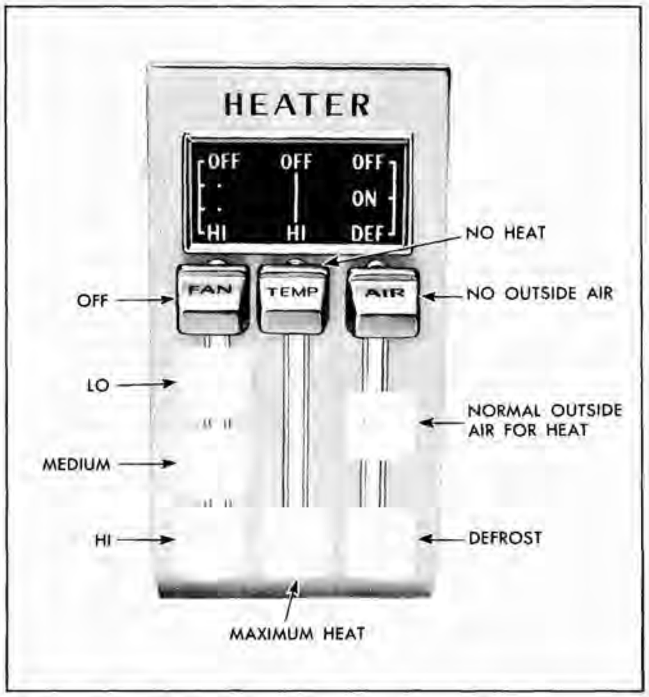



Fig. 2-2 Tempest Heater Control Panel

## CONTROLS

The heater control panel is located to the left of the steering column on the lower section of the instrument panel. The panel has three levers sliding in a vertical plane which control air flow and fan speed; one each for "FAN", "TEMP", and "AIR". When all levers are in the full up position, all valves and control units are closed and the fan blower motor is off.

### *"FAN"*

The fan control lever has four distinct positions—"OFF", "LO", "MED", and "HI"; "OFF" is in the full up position, "LO" and "MED" partially down, and "HI" in the full down position.

### *"TEMP"*

When the temperature control lever is in the full up position no heated coolant enters the heater core to provide heat. As the lever is progressively moved downward, more and more heated engine coolant is permitted to flow through the heater core. In the full down position maximum heat is obtained.

Depress the temperature control to be in the full down position during engine warm up. After the inside of the car is at the desired level adjust the "TEMP" lever to maintain this desired temperature.

### *"AIR"*

With the air lever in the full up position no air enters the car. As the lever is depressed more and more air is permitted through the heater air system until maximum outside air is admitted when lever is in the midway position where a detent will be felt.

This position permits partial air flow out of the defroster nozzles while providing the majority of air flow through the heater air system.

Moving the "AIR" lever further downward from the detent position permits more and more air to be directed to the windshield until in the full down position full defrost air is obtained, with only a limited amount of air coming out of the heater outlets.

## OPERATING INSTRUCTIONS

To warm a car under various weather and driving conditions, use the following control settings after the green light indicating a "COLD" engine goes out:

### *FAST WARM-UP*

(CAR WHICH HAS BEEN STANDING IN COLD)

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for occupant comfort |
| Air control lever | full down until windshield is "de-iced" or "defogged", then to midway position for maximum air flow and partial defrost |
| Car windows | front door vent open slightly to assist in defogging, then closed |

### *SLOW CITY DRIVING IN COLD WEATHER*

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |

#### SLOW CITY DRIVING IN COLD WEATHER—Continued

| CONTROL | SETTING |
|---|---|
| Temperature control lever | down, for maximum heating, then adjusted for comfort |
| Air control lever | at midway position for maximum air flow and partial defrost |
| Car windows | closed |

#### NORMAL COOL WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | position to obtain desired temperature |
| Air control lever | at midway position for maximum air flow and partial defrost |
| Car windows | closed, door vent(s) may be opened to suit occupant comfort |

#### COLD WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | down, for maximum heating, then adjust for occupant comfort |
| Air control lever | at midway position for maximum air flow and partial defrost |
| Car windows | closed |

## TIPS ON USE OF HEATER AND DEFROSTER SYSTEM

#### KEEPING COMFORTABLE IN EXTREMELY HUMID "MUGGY" WEATHER

When the relative humidity is extremely high causing discomfort on a day when the temperature is 55°F.-70°F., depress the air control lever to the midway position and move the temperature control lever down slightly. This will permit hot engine coolant to enter the heater core and provide minimum heating. Move the fan control lever to the low speed position.

#### KEEPING COMFORTABLE IN MILD WEATHER

When the weather is cool, but the sun is very bright, as in spring or fall or at high altitudes, use both the heater and the cowl ventilators at the same time, setting the temperature control, and fan speed for desired comfort.

#### CONTROLLING TEMPERATURE IN CAR

The most satisfactory method of controlling the temperature in the car is to:

1. Set air control lever down for maximum air flow (midway position).

2. Position temperature control lever down for maximum heating, then adjust to maintain the desired temperature in the car.

3. Set fan speed for your personal comfort.

#### USING THE HEATING SYSTEM FOR VENTILATION

The heating system is designed so that it can also be used for ventilation when it is not necessary to warm the air. Ventilation may be obtained by placing the air control lever in the midway position for maximum air flow and the temperature control lever in the extreme up position to prevent the flow of heated coolant from entering the heater core. Select the amount of air flow desired by positioning the fan control lever at the speed desired.

# PRINCIPLES OF OPERATION

## CONTENTS OF THIS SECTION



## DESCRIPTION AND OPERATION OF INDIVIDUAL UNITS

### *TEMPERATURE CONTROL VALVE*

#### DESCRIPTION

The temperature control valve has a water inlet connection (from the intake manifold) and a water outlet connection (to the heater core). The amount of water flowing through the water outlet opening is controlled by a poppet valve connected to an over-ride spring retainer at one end of a valve control lever which pivots about a stationary pivot point "D" (Fig. 2-4).

The lever spring retainer is held in position with a lever spring between the retainer and valve control lever. A valve adjusting screw contacts the motor unit piston (actuated by a capillary tube) and is at the opposite end of the valve control lever to balance the assembly. The distance from the adjusting screw

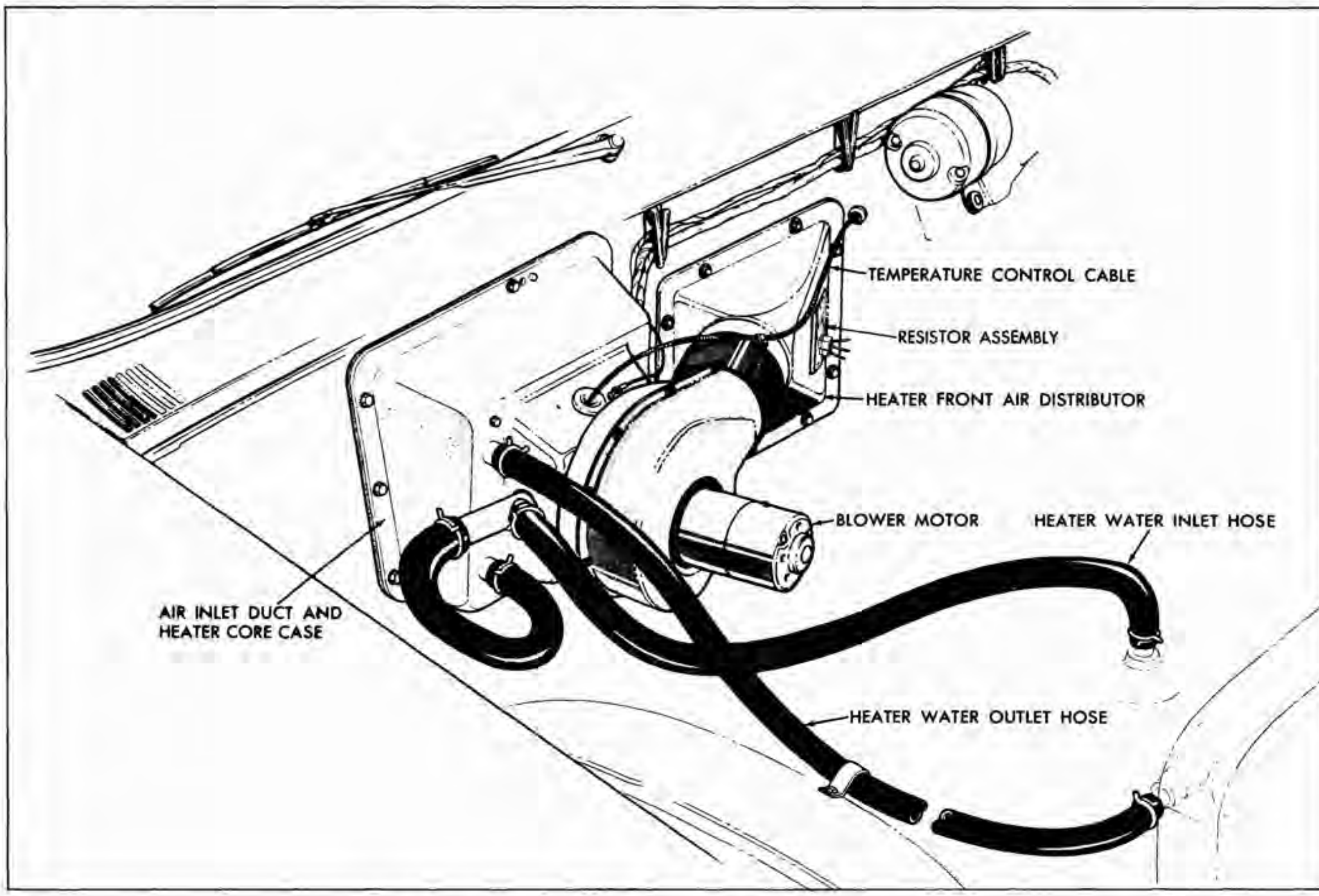



Fig. 2-3 Location of Units in the Tempest Heater System

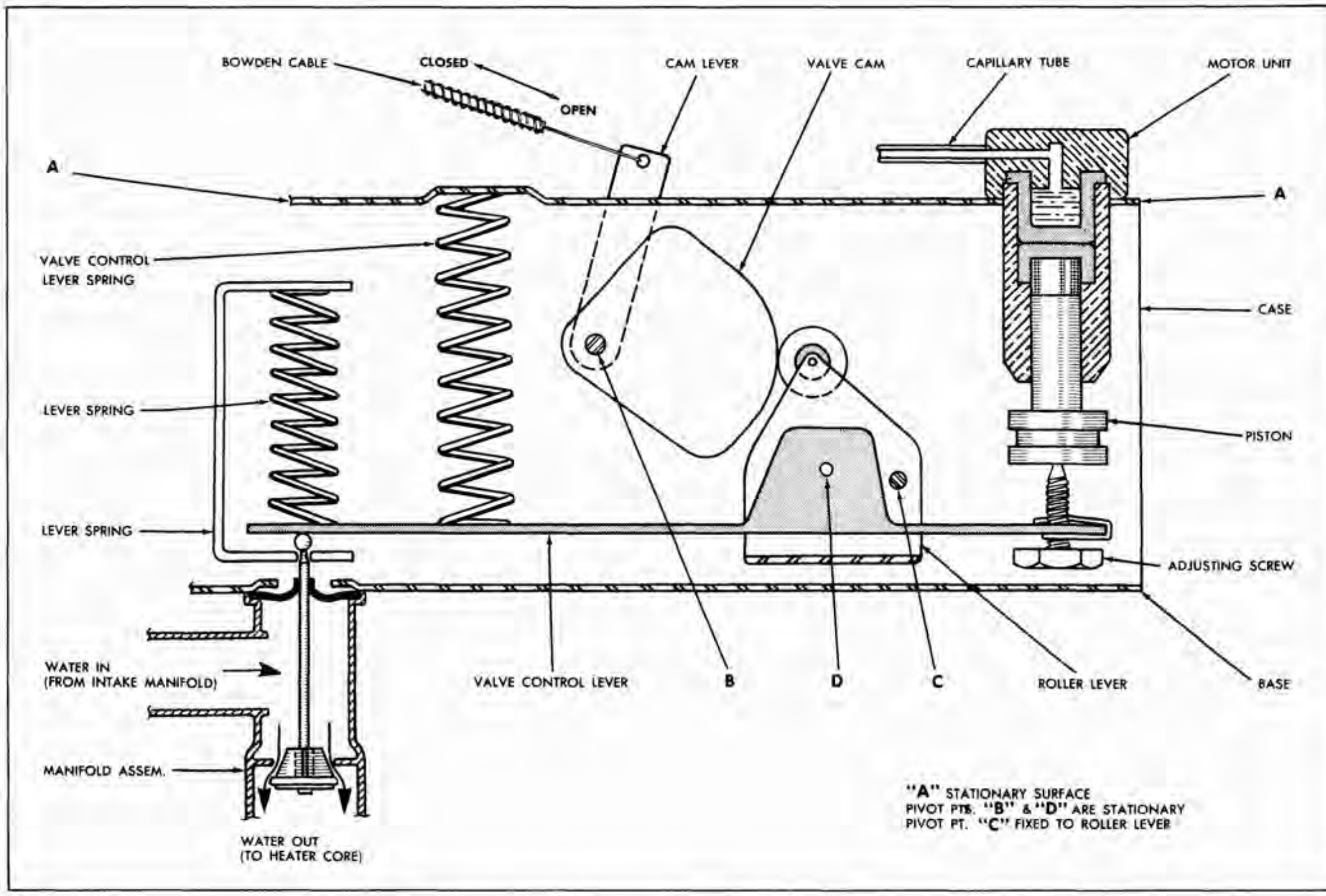



Fig. 2-4 Schematic Diagram of Temperature Control Valve

to pivot point "D" is one-half of the distance from "D" to the valve. A bowden cable from the control panel operates the valve cam.

While this valve is located at the inlet of the heater core (at lower right corner) the capillary tube is attached to the heater core air outlet side (Fig. 2-5).

## FUNCTION

The purpose of the temperature control valve is to regulate the flow of engine coolant into the heater core and thereby maintain the desired heater outlet temperature.

This valve controls water flow into the heater core by a direct connection to the valve from the temperature control lever at the heater control panel.

A capillary tube filled with a solution of three parts of ethylene glycol to one part water provides the temperature regulation of the temperature control valve. This capillary tube is fastened to the air outlet side of the heater core so that it communicates the temperature of the heated air at that point to the motor unit in the valve. If the temperature of the air coming from the core falls appreciably below the valve setting, the valve automatically opens to increase the flow of hot water to the core. If the temperature increases, the valve will restrict the flow of hot water to the core.

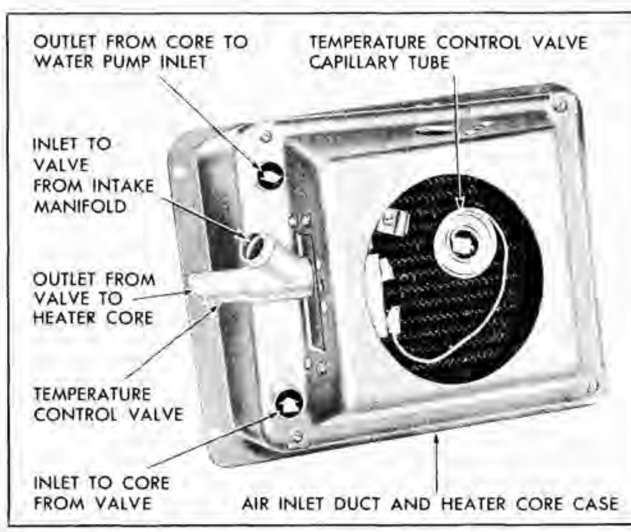



Fig. 2-5 Temperature Control Valve and Heater Core

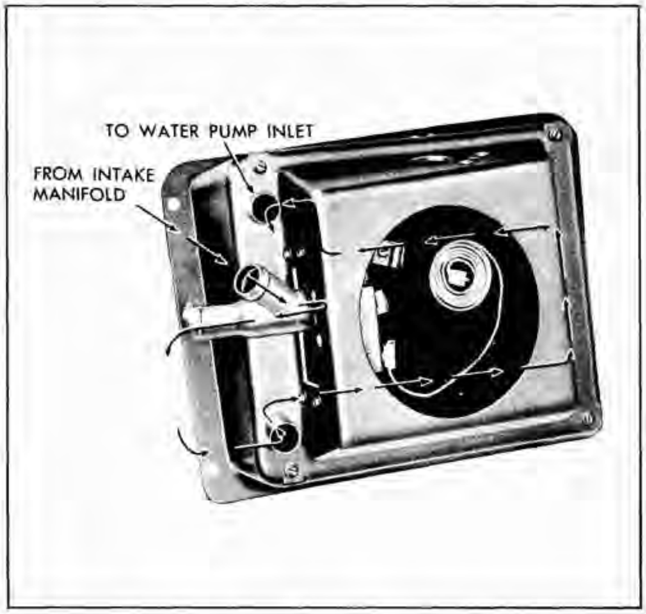



Fig. 2-6 Flow of Engine Coolant Through Valve and Core

It is the temperature of the air passing over the capillary tube that influences the amount of hot water that will enter and pass through the core. When the air is very warm, the heat transfer from the water to the air is small and a lesser quantity of hot water is required to warm the air and to achieve the desired temperature control. When the air passing over the heater core is cool, the heat transfer is great and a greater quantity of hot water is required to warm the air and to achieve the desired temperature control.

A mechanical adjustment located within the valve is provided to regulate the amount of water flow control through the valve. This is accomplished by an adjusting screw which, when turned, moves the valve control lever to increase or decrease the tension on the lever springs. By varying the tension on the lever spring, it is possible to regulate the point at which the tapered valve head begins to open or close, thereby regulating flow into the heater core. *All valves are preset at the time of manufacture and should not be disturbed.*

### OPERATION

When the heater temperature control valve control lever is in the up position the valve is manually positioned to close the valve outlet to the heater core, regardless of the temperature of the air that flows over the valve's capillary tube. With the valve in this condition no water flows into or through the heater core.

Moving the temperature control lever down slightly will manually unlock the valve permitting capillary control of the valve. Depressing the air control lever opens the inlet air valve to permit outside air to flow through the system. Moving the fan control lever to the low, medium or high speed position starts the blower to force outside air through the system.

When the heater core is cool, any air passing over the core surface will not be heated. This cool air will cause the solution in the capillary tube to drop in pressure, permitting maximum opening of the valve at that temperature.

As the engine warms the water (flowing through the heater core), any air forced over the core is warmed and the warm air in turn warms the capillary tube of the temperature control valve. Warming the capillary tube causes the solution to increase in pressure (expand) and force the piston in the motor unit in the temperature control valve to move downward against the adjusting screw and the lever. This action compresses the valve lever springs, and moves the valve to restrict water flow through the core.

### *HEATER CORE*

The copper heater core is of tube and center construction and is designed to permit the engine water (coolant) to flow in a "U" path through the core (Fig. 2-6). This core construction permits a high volume of air to pass through the core as well as a rapid heat dissipation from the water to the core surfaces which provides for rapid transfer of heat to the air.

The heater is located on the right side center of the dash shroud in the engine compartment, with the air duct outlet in the center of the dash shroud inside the car body. Its location permits maximum heating of all air passing over the heater core. The air passing over the hot heater core is warmed and also cools the hot engine coolant which returns to the intake side of the water pump.

## WATER FLOW

Water flow in the heater system is taken from the engine cooling system from a water passage in the engine intake manifold, via a hose to the heater temperature control valve located at the heater core inlet, through the valve to a hose to the core, through the heater core, via a hose to the intake side of the water pump, and back to the engine cooling system (Fig. 2-7).

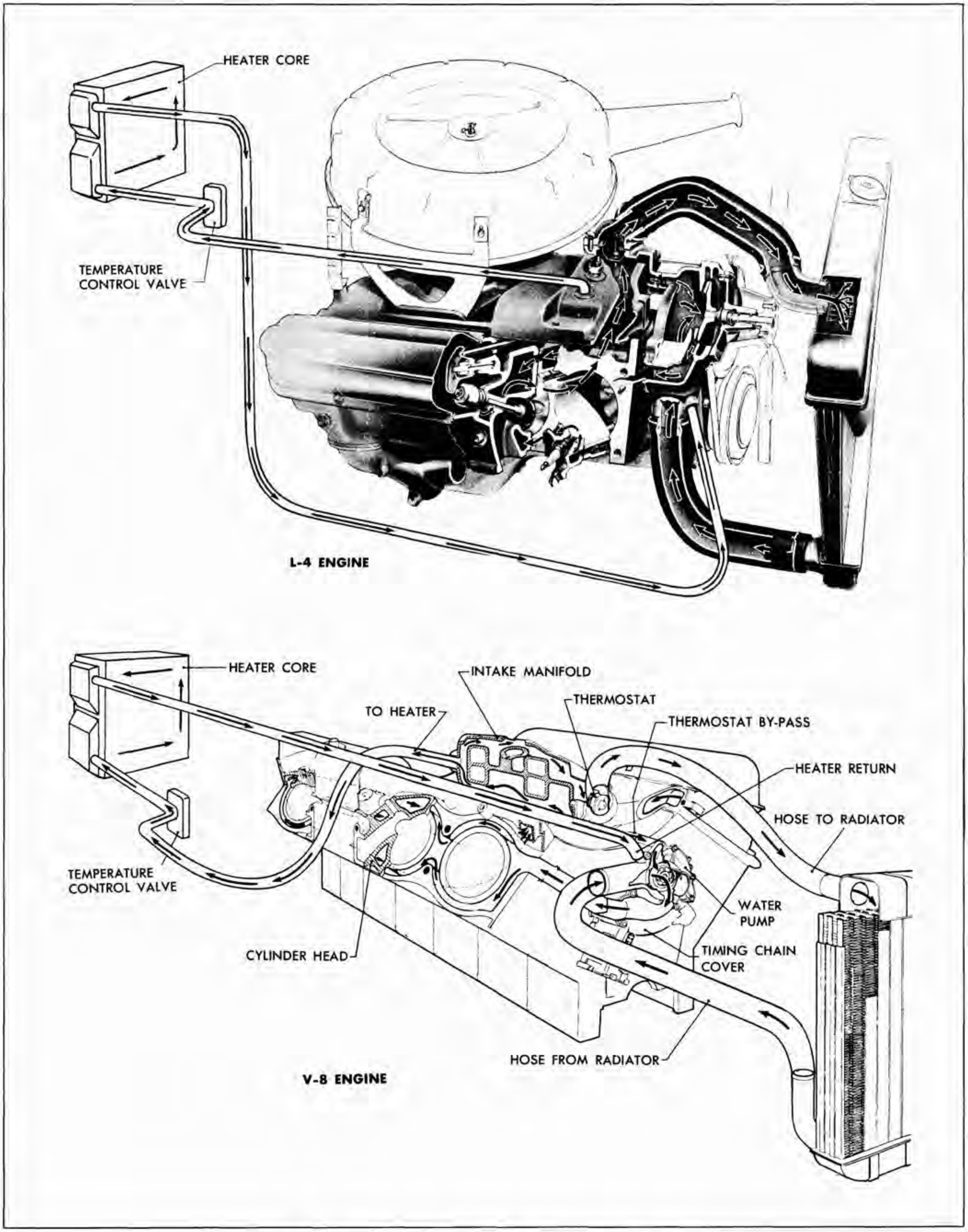



Fig. 2-7 Water Flow Through Tempest Heater System

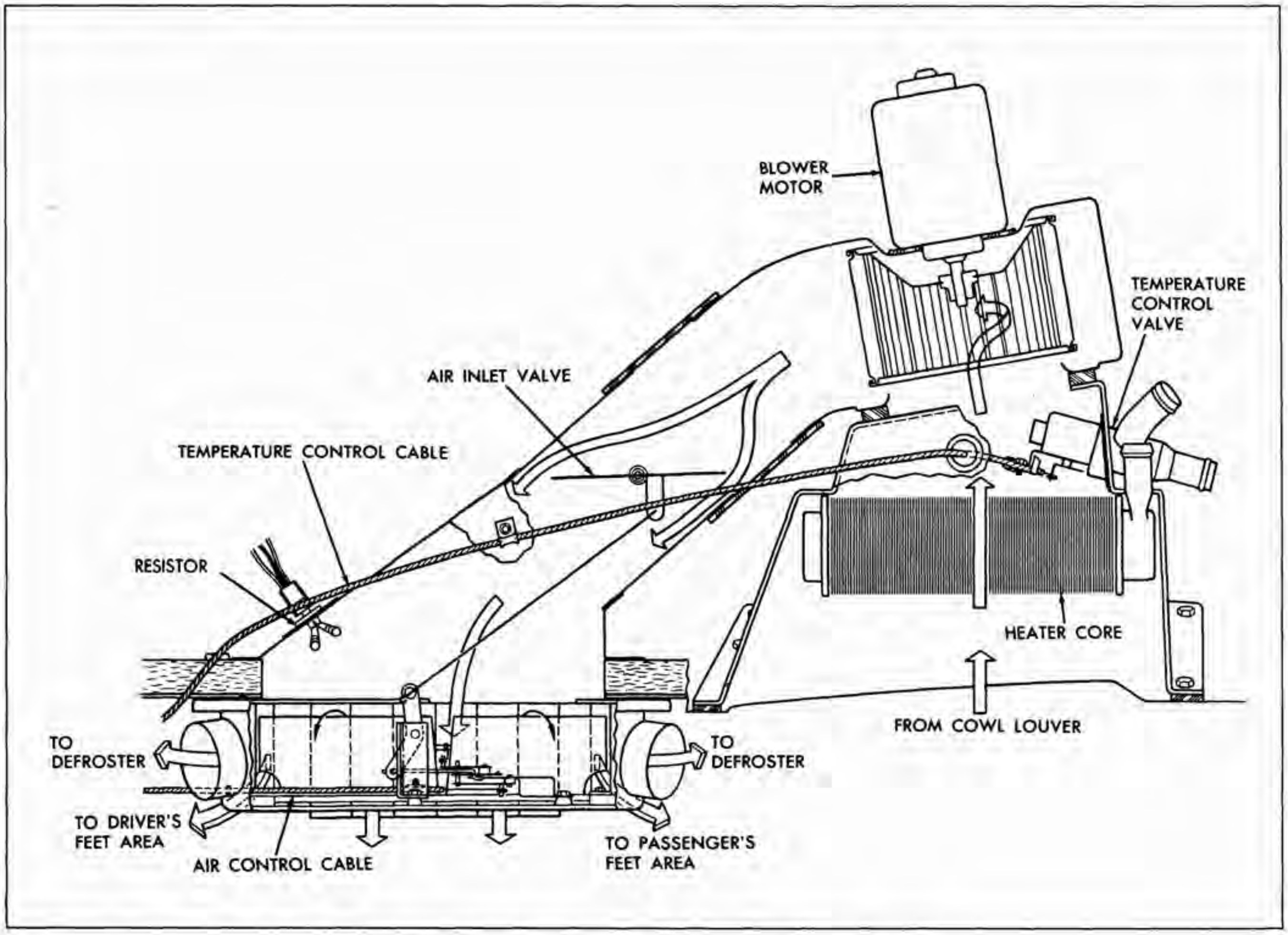



Fig. 2-8 Air Flow Through the Tempest Heater System

Water entering the core from the temperature control valve (at right) fills the lower half of the core and flows to the left where it enters a chamber connecting the lower half of the core with the upper half. Engine cooling system pressure (created by the water pump) forces the water into the upper half of the core and then back to the intake side of the water pump.

The amount of hot water flowing through the heater core is controlled in two ways; mechanically by the setting of the temperature control lever located on the dash, and automatically by the temperature control valve. A thermostatic element (connected to a valve in the inlet opening) controls the air temperature as it leaves the heater core. If more heat is required, hot water supply to the core is automatically increased by the temperature control valve and conversely, if heat is desired, the supply of hot water to the core is decreased.

## AIR SYSTEM

Outside air enters through an intake grille mounted flush with the hood directed below the windshield. Air in this chamber is pulled by the blower through the air inlet duct and heater core assembly positioned on the right side of the dash in the engine compartment. Air is directed through the dash shroud, and then enters the body through the heater rear air distributor duct (air outlet duct) (Fig. 2-8).

Heater air is distributed by a center outlet grilled opening in the heater air outlet duct which disperses air over the front floor area and is so aimed as to also direct air to the rear passenger compartment. Openings in the right and left side of the heater outlet air duct are for additional air distribution to the front seat area (Fig. 2-9).

Flexible hoses, extending from the heater air outlet duct, are attached to two nozzles located along the base of the windshield for effective defrosting. A valve in the heater air outlet duct assembly (controlled at the control panel) may be positioned to direct varying amounts of air to the defroster nozzles.

Air flow through the Tempest heater system is controlled by levers that slide in a vertical plane in the heater control panel which is located to the left of the steering column. These levers control and operate the heater inlet air valve in the heater front air distributor (air inlet duct) assembly located on the engine side of the dash shroud, the temperature control valve (located adjacent to the heater core on the engine side of the dash shroud), the defroster valve in the heater air outlet duct assembly (located on the passenger side of the dash shroud) and the fan control switch for "OFF", "LO", "MED" and "HI" speed.

The amount of air flow through the heater system can be varied with the "AIR" control valve lever in the heater control panel and also with the "FAN" lever.

With the "FAN" lever in the full up position the blower is off. Moving the lever to the first (1/3 down) position operates a blower switch with linkage to provide for "LO" blower.

With the "FAN" lever in the second (2/3 down) position the blower switch will provide "MED" blower speed.

With the "FAN' lever in the full down position, "HI" blower speed is obtained to provide for maximum air flow through the system (Fig. 2-10).

Fig. 2-9 Air Outlets to Floor Area

## ELECTRICAL SYSTEM

The heater control panel lamp is fed from the instrument panel rheostat output circuit which is protected by a 4 amp. fuse in the upper right corner of the fuse block.

The blower circuit of the heater system receives its electrical supply from the heater terminal on the fuse block. Overload protection of the heater electrical systems is provided by a 20 amp. fuse located in the lower left corner of the fuse block.

When the ignition switch is turned to the start position, the accessory terminal of the ignition switch

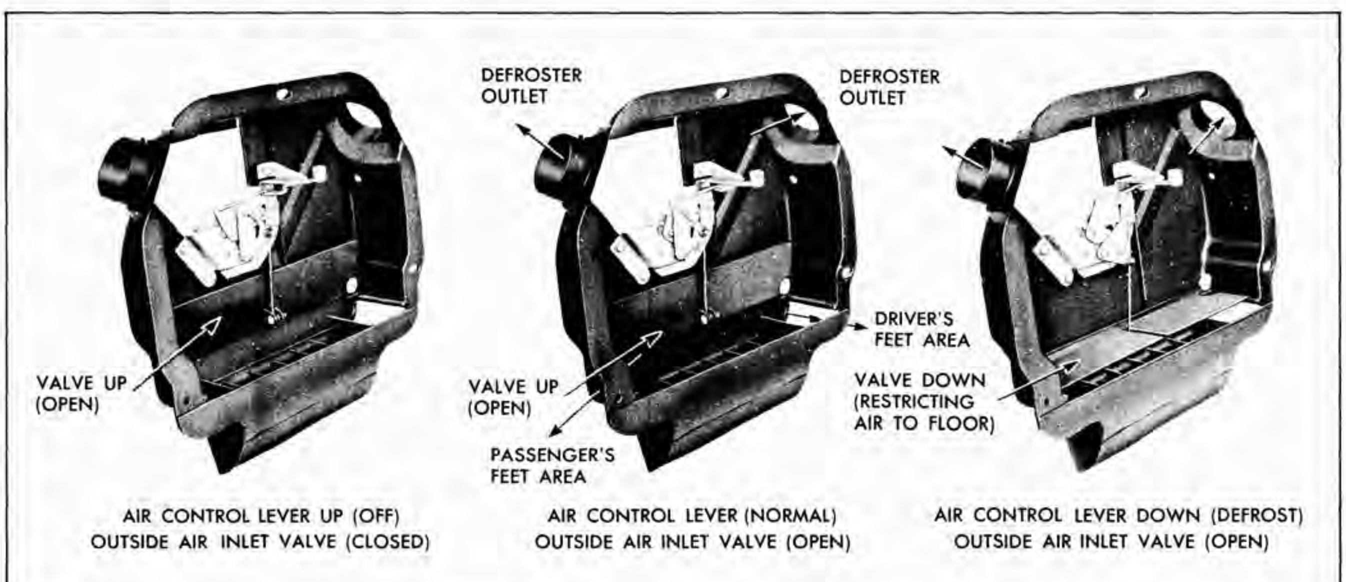



Fig. 2-10 Air Outlet Linkage Position for Air Control Positions

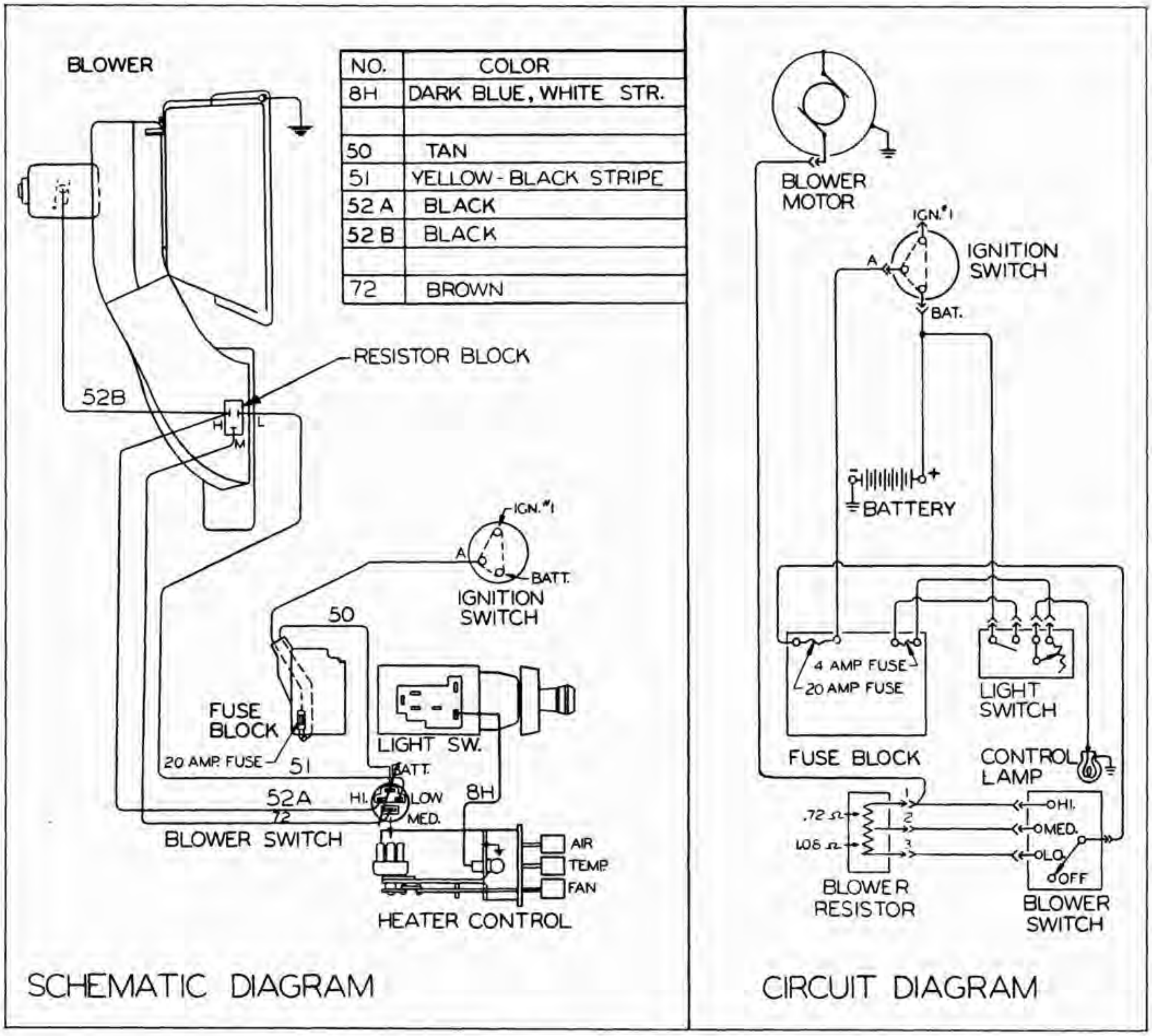



Fig. 2-11 Schematic and Circuit Diagrams of Tempest Heater Electrical System

is cut out. This prevents operation of the accessories connected through the ignition switch while starting the engine. Thus, the starting motor receives maximum battery current while cranking the engine because there is no current to the heater electrical system.

When the "FAN" control lever is in the full up position, no current flows through the blower switch.

The heater blower switch is a four position switch that provides for three blower speeds; low, medium and high. The blower is fed through a single connection at its input; a black colored wire.

***CURRENT FLOW THROUGH HEATER FAN CONTROL POSITIONS***

Four positions of the heater blower switch permit current flow to the blower as follows:

When the "FAN" control lever is in the "OFF" (full up) position, the blower switch is open and no current flows through the switch.

When the "FAN" control lever is in "LO" position, the circuit is closed to the blower. This allows current to flow from the "HTR" terminal of the fuse block through a tan colored wire to the blower switch, through the switch to the resistor block resistance

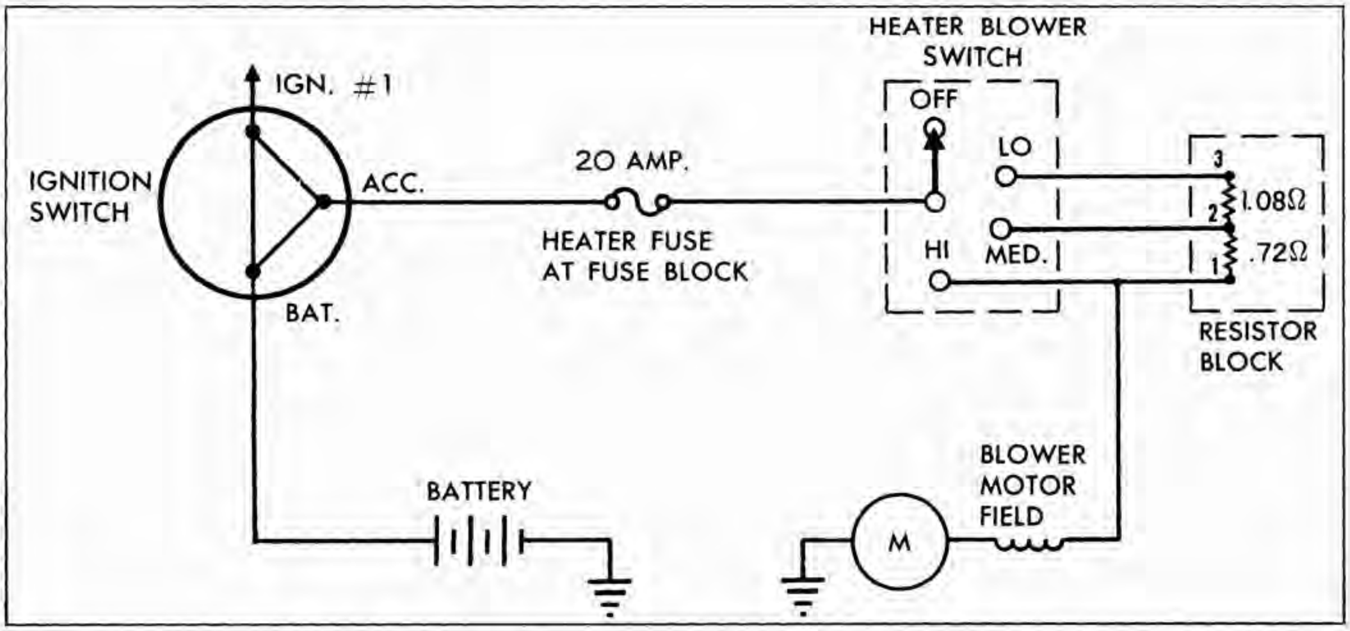



Fig. 2-12 Simplified Circuit Diagram of Tempest Heater Electrical System

coil (having 1.80 ohms) and to the blower motor via a black colored wire (Fig. 2-11).

When the "FAN" control lever is on "MED" the current flows from the "HTR" terminal of the fuse block through a tan wire to the blower switch. The current then flows through the medium terminal of the blower switch and to the resistor block resistance coil (having 0.72 ohms) and then through a black wire to blower motor (Fig. 2-11).

High blower speed is obtained when the "FAN" control lever is in the "HI" (full down) position. This position closes the circuit to the blower motor and allows current to flow from the "HTR" terminal of the fuse block through a tan colored wire to the blower switch. Current flows through the switch to the resistance block, then through a black colored wire to the blower motor for high speed (Figs. 2-11 and 2-12).

# MINOR SERVICES AND REPAIRS

CONTENTS OF THIS SECTION



## ADJUSTMENTS ON CAR

### *TEMPERATURE CONTROL VALVE CABLE ADJUSTMENT*

NOTE: This adjustment should be checked when insufficiently heated or slightly warmed air leaves the heater outlets.

1. Remove the blower assembly from the heater core case.

2. Check to see that temperature control valve cable housing extends no more than $\frac{1}{16}''$ beyond cable housing clamp on control panel assembly (Fig. 2-13).

3. Move temperature control valve lever (at the heater control panel) making sure lever moves up against its stop.

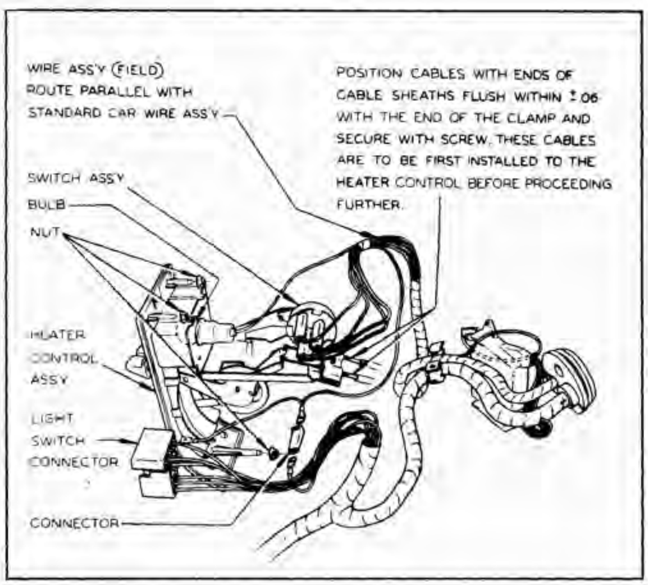



Fig. 2-13 Control Cable Connections at Control Panel

4. Loosen cable housing clamp screw at temperature control valve.

5. Slide cable housing and temperature control arm apart (temperature control arm will move down) to remove cable slack and secure cable housing clamp.

6. Check operation of cable.

7. Replace heater blower assembly.

NOTE: After adjustment , the "TEMP" lever knob must be in alignment with the "AIR" and "FAN" lever knobs, with all in the full up position.

### *AIR CONTROL CABLE ADJUSTMENT*

This procedure adjusts a link which connects the air inlet valve (in the heater front air distributor on the engine side of the dash shroud) and the valve bracket assembly (in the heater rear air distributor or air outlet duct on the body interior side of the dash shroud).

1. Remove inspection hole cover on the heater rear air distributor (air outlet duct), Fig. 2-14.

2. Check to see that the air cable housing does not extend any farther than $\frac{1}{16}''$ beyond the cable housing clamp on the control panel.

3. Loosen the bowden cable clamp in the heater air outlet duct. Access is through inspection hole.

4. With the "AIR" control in the "HEAT" (detent) position, install a $\frac{3}{16}''$ dowel pin (approximately 1" long) through the holes in the air selector cam and the cam bracket.

5. Adjust air inlet valve link so air inlet valve is in full open position.

NOTE: A tool made as shown in Fig. 2-15 will facilitate adjustment of the link.

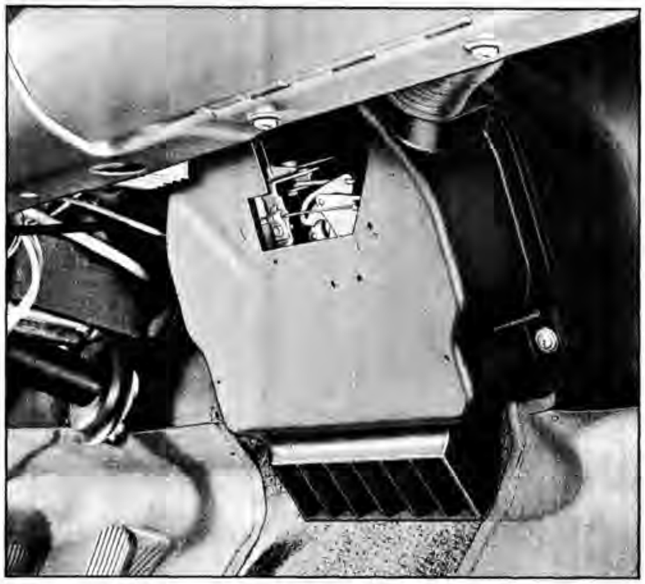


Fig. 2-14 Inspection Hole in Air Outlet Duct

6. With the "AIR" control lever in "HEAT" (detent) position, and the $\frac{3}{16}''$ dowel pin installed, slide bowden cable housing to its neutral position in the bowden cable clamp in the heater outlet duct and secure the bowden cable housing clamp.

7. Remove dowel pin.

8. Move "AIR" control lever to "OFF" (full up) position and check adjustment of air inlet valve. Valve should be closed. If not, re-adjust so air inlet valve closes when air control lever is in "OFF" (up) position.

9. Replace inspection hole cover.

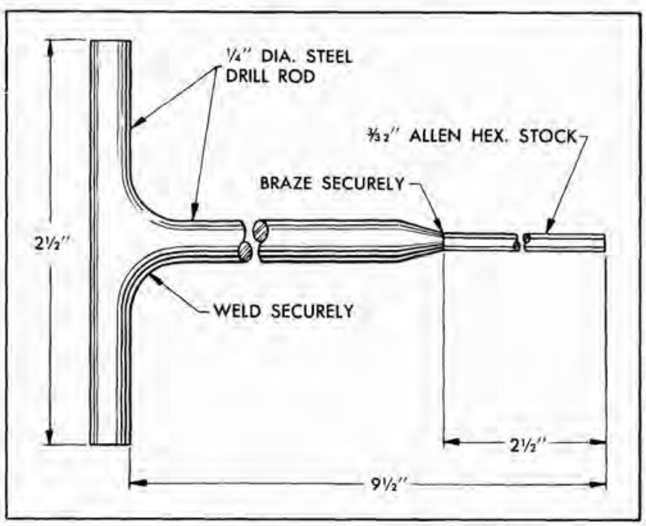



Fig. 2-15 Air Inlet Valve Link Adjusting Tool

## TEMPERATURE CONTROL BOWDEN CABLE

### *REMOVE AND REPLACE*

1. Remove blower motor.

2. Disconnect temperature control bowden cable at valve and pull cable from heater core and case assembly.

3. Disconnect temperature control cable clamp from heater front air distributor (on engine side of dash shroud).

4. Disconnect temperature control bowden cable from heater control assembly.

5. Attach a piece of wire or stout cord about four feet long to valve end of cable and pull bowden cable into passenger compartment.

6. Replace by reversing the above procedure, making sure insulated end of cable is toward control panel. (Insulation protects wires from chafing on cable housing.) Do not replace blower motor.

7. Adjust temperature control bowden cable.

8. Replace blower motor.

## AIR VALVE CONTROL CABLE

### *REMOVE AND REPLACE*

1. Disconnect air control bowden cable at heater control assembly.

2. Remove inspection hole cover from heater rear air distributor (inside passenger compartment).

3. Disconnect bowden cable from air selector cam assembly.

4. Remove air control bowden cable.

5. Replace by reversing the above procedure.

6. Adjust air control bowden cable.

## HEATER CONTROL PANEL ASSEMBLY

### *REMOVE AND REPLACE*

1. Disconnect battery.

2. Disconnect headlamp switch assembly from instrument panel.

3. Remove one stamped nut at bottom and two at top from back side of heater control assembly.

4. Move control assembly out from instrument panel and disconnect "TEMP" and "AIR" control bowden cables from heater control assembly.

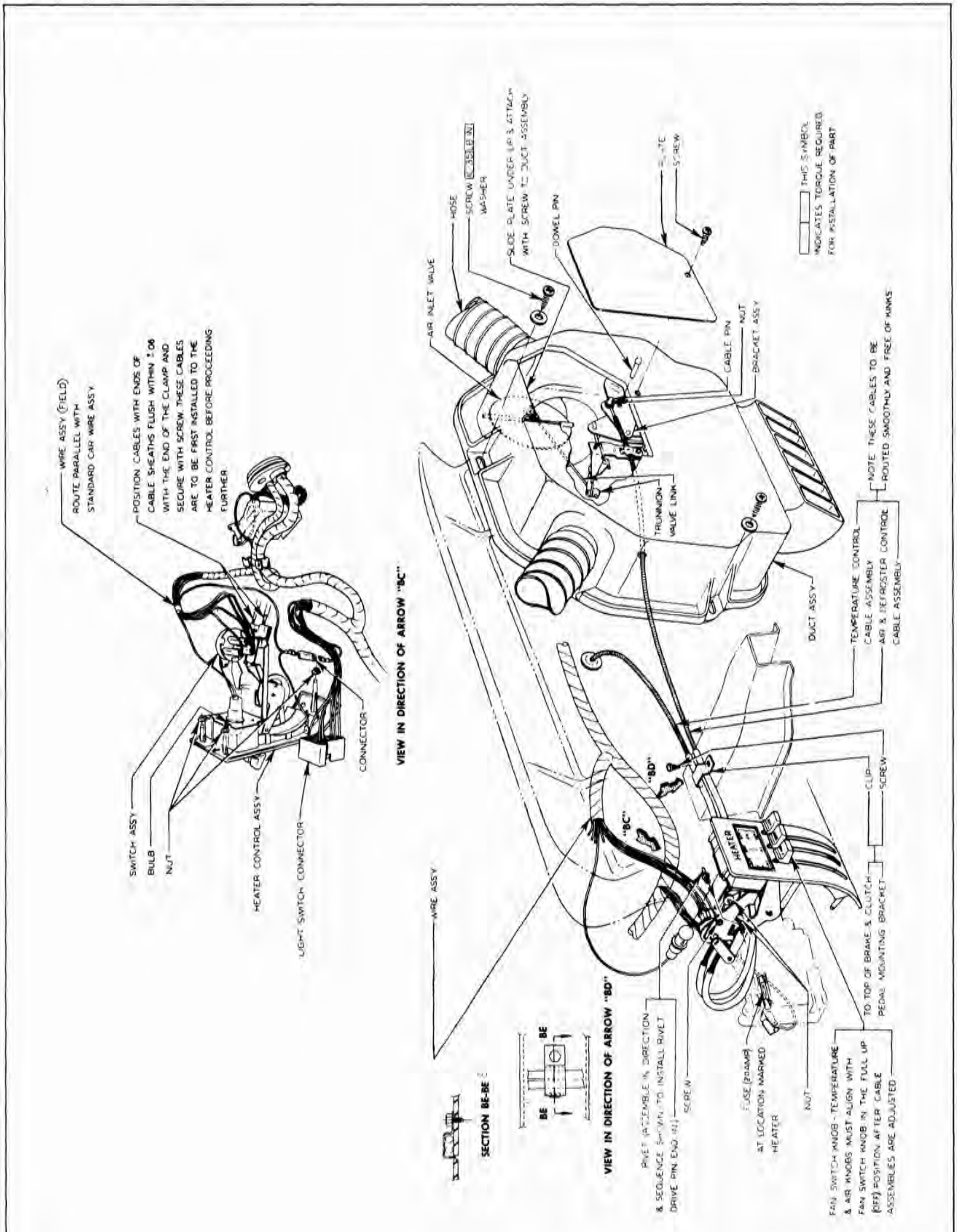



Fig. 2-16 Reference Illustration—Body Interior Details

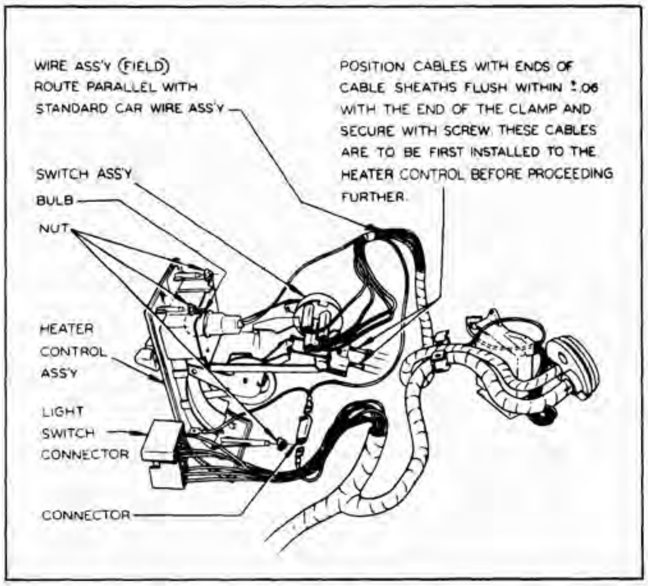



Fig. 2-17 Connections at Tempest Control Panel

5. Disconnect wires and remove control assembly.

6. Replace by reversing the above procedure (Fig. 2-17).

7. Adjust "AIR" control bowden cable.

8. Adjust "TEMP" control bowden cable.

9. Connect battery.

## HEATER FAN (BLOWER) SWITCH ASSEMBLY

### *REMOVE AND REPLACE*

1. Disconnect battery.

2. Disconnect headlamp switch assembly from instrument panel.

3. Remove heater control assembly.

4. Remove heater blower switch from control assembly (Figs. 2-18 and 2-19).

NOTE: Remove plastic "hinge" by removing round pin from center of hinge, then remove hinge.

5. Replace blower switch, making sure control lever engages in all four positions without hitting top or bottom of lever slot, and the lever does not contact depressions in left side of slot.

6. Replace control assembly.

7. Connect headlamp switch assembly.

8. Adjust "AIR" control bowden cable.

9. Adjust "TEMP" control bowden cable.

10. Connect battery.

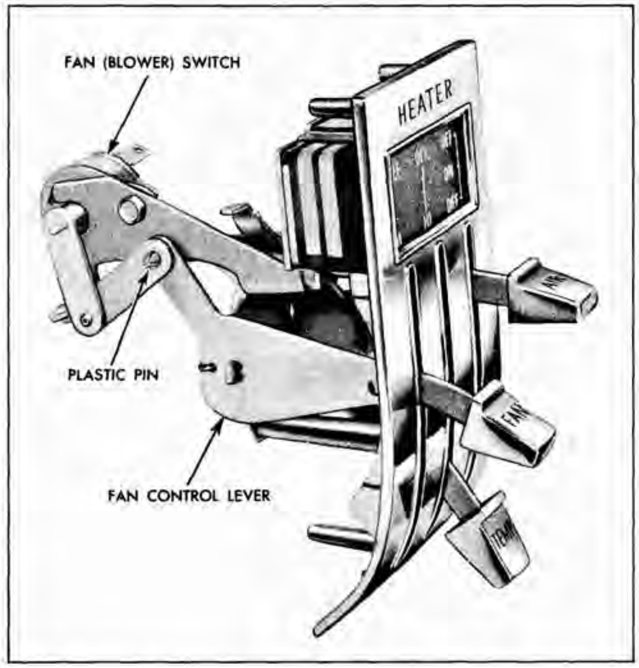



Fig. 2-18 Tempest Control Panel Fan (Blower) Linkage

## HEATER FRONT AIR DISTRIBUTOR DUCT ASSEMBLY

### *REMOVE AND REPLACE*

1. Move "AIR" control to full down position.

2. Remove inspection hole cover from the heater air outlet duct.

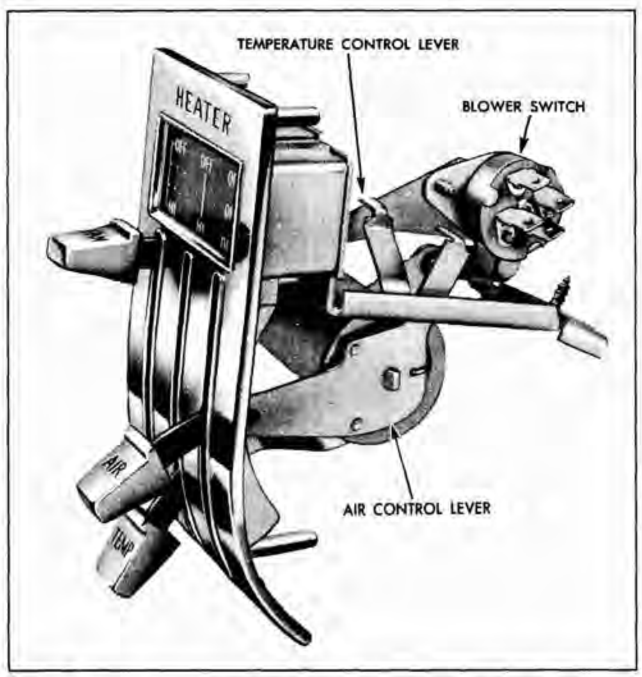



Fig. 2-19 Tempest Control Panel Control Cable Linkage

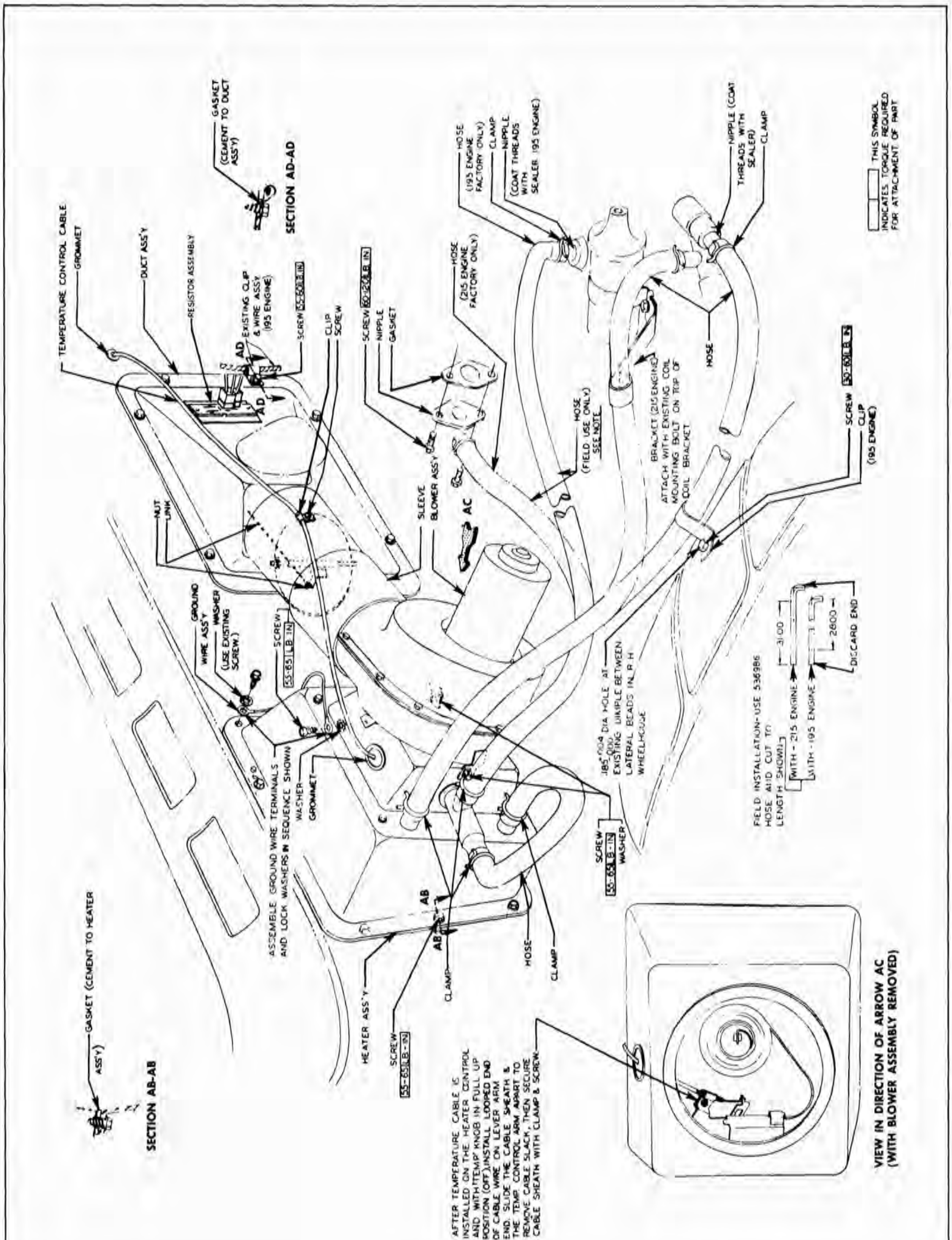



Fig. 2-20 Reference Illustration—Engine Compartment Details

3. Loosen hex socket set screw on air inlet valve link and disconnect link.

4. Remove temperature control bowden cable clip from front air distributor duct.

5. Remove screws securing front air distributor duct to dash shroud and remove duct.

6. Replace by reversing the above procedure, making sure the heater blower to front air distributor duct sleeve (rubber) is properly installed to eliminate any air leaks.

7. Adjust air inlet valve link.

## HEATER REAR AIR DISTRIBUTOR DUCT ASSEMBLY

## (AIR INLET DUCT)

### *REMOVE AND REPLACE*

1. Move "AIR" control to full down position.

2. Remove inspection hole cover.

3. Loosen hex socket set screw on air inlet valve link and disconnect link.

4. Disconnect and remove air control bowden cable from duct.

5. Disconnect defroster hoses.

6. Remove three screws retaining heater air outlet duct to dash shroud (one at each side and one at top) and remove duct.

7. Replace by reversing the above procedure.

8. Before replacing the inspection hole cover, adjust air inlet valve link so valve is closed when the air selector cam is in the full clockwise position.

9. Adjust "AIR" control bowden cable.

10. Replace inspection hole cover.

## HEATER BLOWER MOTOR

### *REMOVE AND REPLACE*

1. Disconnect hot wire to blower motor at motor.

2. Remove three blower motor housing to inlet air duct screws and remove blower motor assembly.

3. Replace by reversing the above procedure, making sure blower motor ground wire is attached at top screw.

4. Note that the blower impeller (and for the Pontiac Circ-L-Aire Conditioner) is of opposite rotation from the Pontiac heater. The proper Tempest impeller (and Circ-L-Aire Conditioner) is identified by a gold colored inlet ring. Use of the wrong impeller will cause excessive blower noise and reduced air flow.

## HEATER CORE AND/OR HEATER TEMPERATURE CONTROL VALVE

### *REMOVE AND REPLACE*

1. Drain radiator.

2. Remove heater blower assembly.

3. Disconnect water inlet hose (intake manifold to temperature control valve) at temperature control valve (Fig. 2-20).

4. Disconnect temperature control valve to heater core hose at valve.

5. Disconnect temperature control bowden cable at valve.

6. Disconnect heater water outlet hose (top hose) at core.

7. Disconnect heater water inlet hose (bottom hose) at core.

8. Remove heater core and case assembly.

9. Remove four screws (two on each side) from the front of the heater case.

10. Remove four screws retaining valve to case (insert screwdriver just below heater core outlet hose and just above heater core inlet hose).

11. Disconnect temperature control valve capillary tube from core and remove core and valve.

12. Replace by reversing the above procedure (Fig. 2-21).

13. Adjust temperature control bowden cable.

14. Fill radiator.

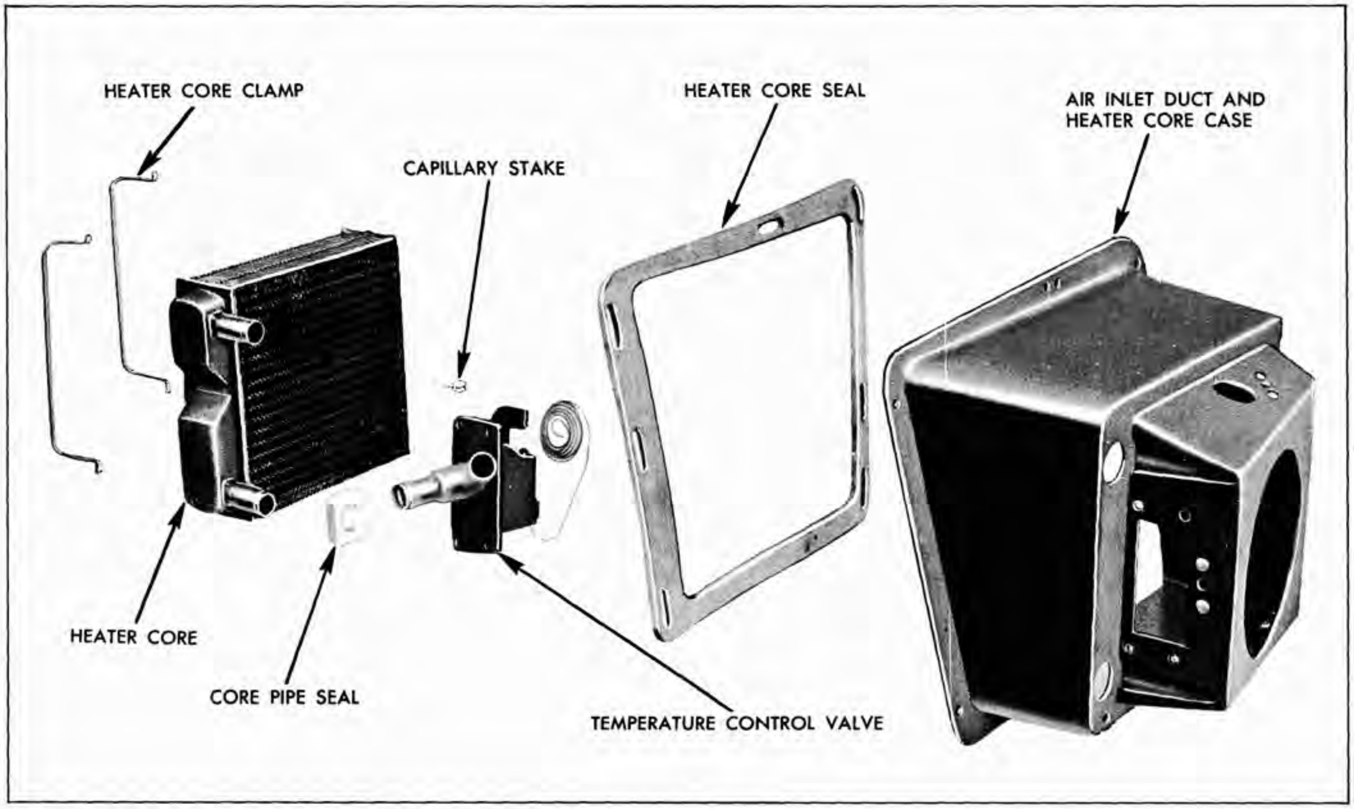



Fig. 2-21 Tempest Heater Air Inlet and Core Case Assembly—Exploded View

# TESTING AND DIAGNOSIS

## CONTENTS OF THIS SECTION



## TESTING

### *OPERATIONAL TEST*

The purpose of performing a heater operational test is to prove the heater system is operating properly.

### PRELIMINARY CHECKS

Engine Compartment

1. Check radiator for proper engine coolant level.

2. Inspect radiator core and heater hoses for leaks, at the same time inspecting for kinked or collapsed heater hoses.

3. Inspect the blower to heater front air distributor sleeve to see that it is not torn or damaged and that it is properly installed (to prevent any air leaks from engine compartment, which may have objectionable fumes or odors).

Inside Car Body

1. Check to see that all control levers operate smoothly, and they are in alignment when all are in the full up position.

2. Start engine.

3. Place "FAN" control lever in "OFF" position; blower should not operate.

4. Move "FAN" lever to the "LO" and "MED" position; blower should operate. Continue by moving lever to the "HI" position; blower should operate at a speed faster than at the "LO" and "MED" position.

5. Move "AIR" lever down slowly until the midway down position is reached; more and more air should flow through outlet as lever is depressed.

6. Move "AIR" lever down slowly until the full down position is reached, at the same time sensing the amount of air flowing from the defroster outlets. More and more air should flow through these outlets as the lever is depressed.

Should the heater control levers operate satisfactorily during the above checks, it would appear that heater controls operation is normal. If during the checks irregularities are noted or complaints on heater operation could not be noted or determined, then refer to TROUBLE DIAGNOSIS for the complaint or cause and the remedy.

## TROUBLE DIAGNOSIS

### *INSUFFICENT HEATING*

| CAUSE | REMEDY |
|---|---|
| Slow warming in car. | Incorrect operation of controls. Advise operator of proper operation of heater controls. |
| Objectionable engine or exhaust fumes in car. | Check for good seal between hood and cowl. |
| | Check for good seal between vent grille and cowl. |
| | Check for damaged and/or improper installation of sleeve between heater case and heater front air distributor duct. |
| | Locate and seal any other leaks. |

### INSUFFICIENT HEATING—Continued

| CAUSE | REMEDY |
|---|---|
| Cold drafts on floor. | Check operation and adjustment of cowl vent cables. Advise operator of proper operation of heater system. |
| Insufficient heat to rear seat. | Check for obstructions under front seat. Blower must operate. |
| Low engine coolant level. | Check radiator and fill to proper level, open water control valve wide, run engine to clear air lock. |
| Failure of engine cooling system to warm up. | Check radiator cap and engine thermostat and replace if required. |
| Kinked heater hoses. | Remove kink or replace hose. |
| Foreign material obstructing water flow in heater core. | Remove foreign material if possible, otherwise replace core. |
| Temperature control valve cable improperly adjusted. | Adjust cable. |
| Inoperative temperature control valve. | Replace valve. |
| Air valves do not open. | Check for proper installation and/or adjustment of cables. |

### INADEQUATE REMOVAL OF FOG OR ICE

| CAUSE | REMEDY |
|---|---|
| Air valve does not open. | Check for proper installation and/or adjustment of cable. |
| Defroster valve does not open fully. | Adjust air control cable. |
| Obstructions in defroster outlets at windshield. | Remove obstruction. On cars with instrument panel pads, look for and fix loose panel pad cover at defroster outlets. |
| Dinged defroster outlets. | Reshape outlet flange with pliers. The outlet should have a uniform opening, $5/16''$ wide. |
| Blower motor not connected. | Connect wire. |
| Inoperative blower motor. | Check heater fuse.<br>Replace motor.<br>Check wiring at resistor block. |
| Inoperative blower motor switch. | Replace switch. |

### TOO WARM IN CAR

| CAUSE | REMEDY |
|---|---|
| Inoperative temperature control valve. | Replace valve. |
| Incorrect operation of controls. | Advise operator of proper operation of heater system. |

***BLOWER INOPERATIVE***

| CAUSE | REMEDY |
|---|---|
| Blown fuse. | Replace fuse. |
| Inoperative motor. | Replace motor. |
| Open circuit. | Repair circuit between ignition switch, blower switch, and blower motor. |
| Inoperative blower motor switch. | Replace faulty switch. |

***MISCELLANEOUS***

| CAUSE | REMEDY |
|---|---|
| Control levers not aligned due to incorrect adjustment. | Adjust control cables. |
| Blown fuses. | Shorts in electrical system. Locate and correct short.<br>Blower wheel rubbing on case.<br>Failed blower motor. |
| Heater "gurgle". | Check engine coolant level in radiator. |

## SPECIFICATIONS

| | |
|---|---|
| **Cooling System Capacity (Engine with Heater)** | 12.6 qts. |
| **Fuse** | |
| Heater Electrical System (on fuse block) | 20 amp. |
| Heater Control Panel Lamp (on fuse block) | 4 amp. |

# TEMPEST HEATER

## (1962 LATE TYPE)

### CONTENTS OF THIS SECTION



## DESCRIPTION AND OPERATING INSTRUCTIONS

### GENERAL DESCRIPTION

Pontiac's Tempest Heating and Defroster System provides rapid warm-up sensation and even distribution of warmed air to all parts of the car. All air entering the system is taken through hood high cowl vents providing air with a minimum of dust, foreign material and undesirable fumes.

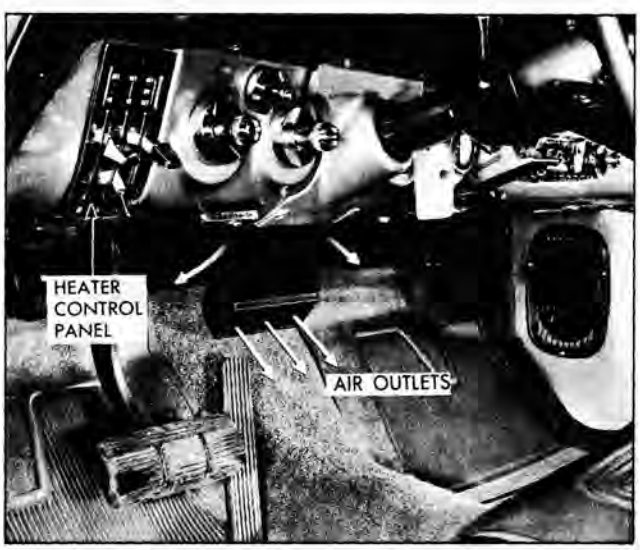



Fig. 2A-1 Air Outlets and Controls

The use of outside air exclusively provides constant and rapidly changing air inside the car, eliminating a smoke-filled interior and keeps the occupants comfortable.

The driver has fingertip control of the temperature warmed air entering the car. When heated air is desired, the blower forces air taken from the hood high cowl air inlet duct through the heater core and then through an air distributing system to the air outlets.

The design of the heater and defroster system, its valves and controls permits a method of obtaining different amounts of forced air flow for ventilation.

#### *AIR OUTLETS AND CONTROLS*

#### AIR OUTLETS

Heated air enters the interior of the car and is distributed by a center outlet grille opening at the bottom of the heater duct, which disperses air over the front floor area and is so aimed that it also directs air to the rear passenger compartment (Fig. 2A-1).

Additional outlets are provided on the right and left sides of the heater outlet air duct for additional air distribution to the driver and front seat passenger floor area.

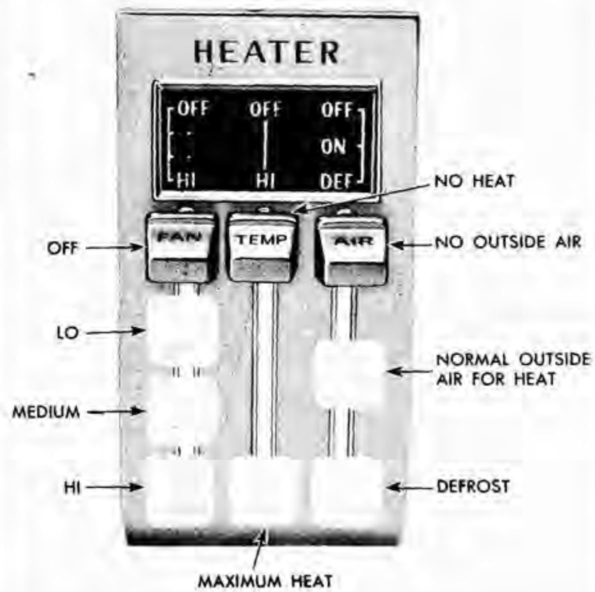



Fig. 2A-2 Tempest Heater Control Panel

## CONTROLS

The heater control panel (Fig. 2A-2) is located to the left of the steering column on the lower section of the instrument panel. The panel has three levers sliding in a vertical plane which control air flow and fan speed; one each for "FAN", "TEMP", and "AIR". When all levers are in the full up position, all valves and control units are closed and the fan blower motor is off.

### "FAN"

The fan control lever has four distinct positions—"OFF", "LO", "MED", and "HI"; "OFF" is in the full up position, "LO" and "MED" partially down, and "HI" in the full down position.

### "TEMP"

When the temperature control lever is in the full up position no heated coolant enters the heater core to provide heat. As the lever is progressively moved downward, more and more heated engine coolant is permitted to flow through the heater core. In the full down position maximum heat is obtained.

Depress the temperature control to be in the full down position during engine warm up. After the inside of the car is at the desired level adjust the "TEMP" lever to maintain this desired temperature.

### "AIR"

With the air lever in the full up position no air enters the car. As the lever is is depressed more and more air is permitted through the heater air system until maximum outside air is admitted when lever is in the midway position where a detent will be felt.

This position permits partial air flow out of the defroster nozzles while providing the majority of air flow through the heater air system.

Moving the "AIR" lever further downward from the detent position permits more and more air to be directed to the windshield until in the full down position full defrost air is obtained, with only a limited amount of air coming out of the heater outlets.

## OPERATING INSTRUCTIONS

To warm a car under various weather and driving conditions, use the following control settings after the green light indicating a "COLD" engine goes out:

### FAST WARM-UP

(CAR WHICH HAS BEEN STANDING IN COLD)

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for occupant comfort |
| Air control lever | full down until windshield is "de-iced" or "defogged", then to midway position for maximum air flow at heater outlets and partial defrost |
| Car windows | front door vent and door window open slightly to assist in de-icing or defogging, then closed or positioned to provide comfort for all occupants |

### SLOW CITY DRIVING IN COLD WEATHER

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for comfort |

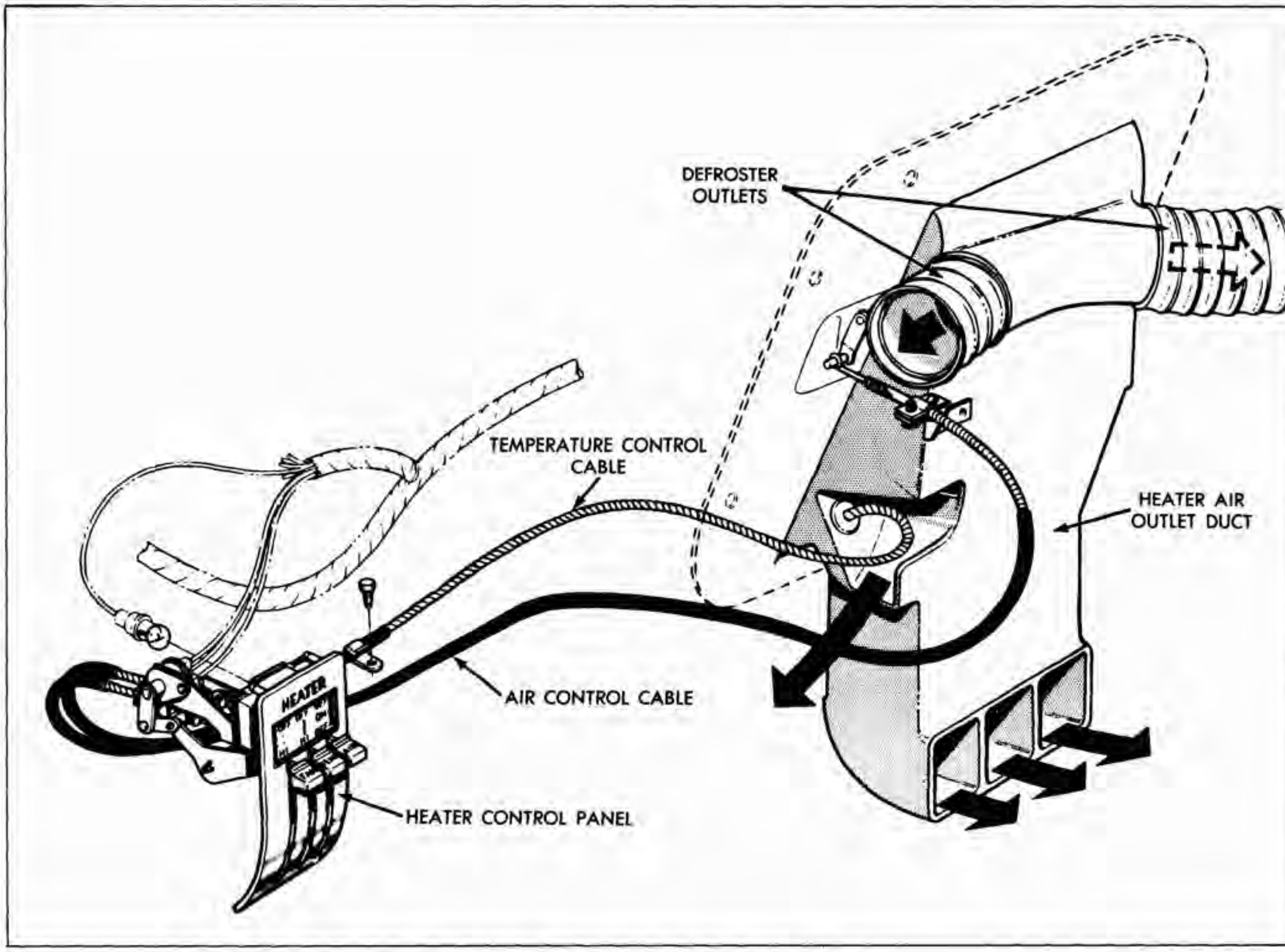



Fig. 2A-3 Tempest Heater Units Inside Car

***SLOW CITY DRIVING IN COLD WEATHER—Continued***

| CONTROL | SETTING |
|---|---|
| Air control lever | at midway position for maximum air flow and partial defrost |
| Car windows | closed |

***NORMAL COOL WEATHER HIGHWAY CRUISING***

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | position to obtain desired temperature |
| Air control lever | at midway position for maximum air flow and partial defrost |

***NORMAL COOL WEATHER HIGHWAY CRUISING—Continued***

| CONTROL | SETTING |
|---|---|
| Car windows | closed, door vent(s) may be opened to suit occupant comfort |

***COLD WEATHER HIGHWAY CRUISING***

| CONTROL | SETTING |
|---|---|
| Fan control lever | full down for high speed |
| Temperature control lever | down, for maximum heating, then adjusted for occupant comfort |
| Air control lever | at midway position for maximum air flow and partial defrost |
| Car windows | closed |

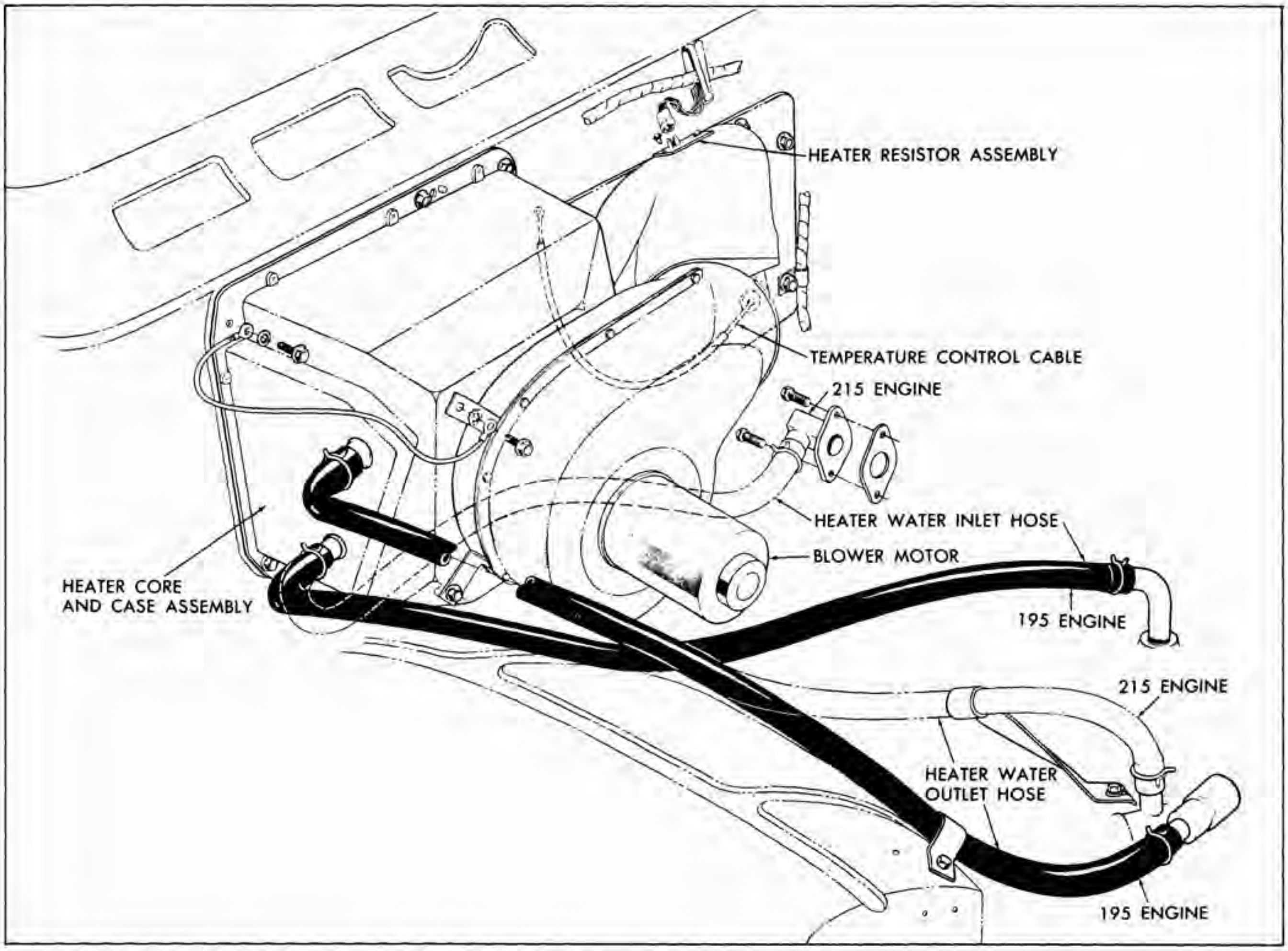



Fig. 2A-4 Tempest Heater Units in Engine Compartment

## TIPS ON USE OF HEATER AND DEFROSTER SYSTEM

### KEEPING COMFORTABLE IN EXTREMELY HUMID "MUGGY" WEATHER

When the relative humidity is extremely high causing discomfort on a day when the temperature is 55°F.-70°F., depress the air control lever to the midway position and move the temperature control lever down slightly. This will permit hot engine coolant to enter the heater core and provide minimum heating. Move the fan control lever to the low speed position.

### KEEPING COMFORTABLE IN MILD WEATHER

When the weather is cool, but the sun is very bright, as in spring or fall or at high altitudes, use both the heater and the cowl ventilators at the same time, setting the temperature control, and fan speed for desired comfort.

### CONTROLLING TEMPERATURE IN CAR

The most satisfactory method of controlling the temperature in the car is to:

1. Set air control lever down for maximum air flow (midway position).

2. Position temperature control lever down for maximum heating, then adjust to maintain the desired temperature in the car.

3. Set fan speed for your personal comfort.

### USING THE HEATING SYSTEM FOR VENTILATION

The heating system is designed so that it can also be used for ventilation when it is not necessary to warm the air. Ventilation may be obtained by placing the air control lever in the midway position for maximum air flow and the temperature control lever in the extreme up position to prevent the flow of heated coolant from entering the heater core. Select the amount of air flow desired by positioning the fan control lever at the speed desired.

# PRINCIPLES OF OPERATION

CONTENTS OF THIS SECTION



## HEATER CORE

The copper heater core is of tube and center construction and is designed to permit the engine water (coolant) to flow in a "U" path through the core (Fig. 2A-5). This core construction permits a high volume of air to pass through the core as well as a rapid heat dissipation from the water to the core surfaces which provides for rapid transfer of heat to the air.

The heater core is located on the right side center of the dash shroud in the engine compartment, with the air duct outlet in the center of the dash shroud inside the car body. Its location permits maximum heating of all air passing over the heater core.

Air passing over the hot heater core is warmed and also cools the hot engine coolant which returns to the intake side of the water pump.

## WATER FLOW

Water flow in the heater system is taken from the engine cooling system from a water passage in the engine intake manifold, via a hose to the heater core inlet (on the engine side of the dash shroud), through the heater core, via a hose to the intake side of the water pump, and back to the engine cooling system (Fig. 2A-6).

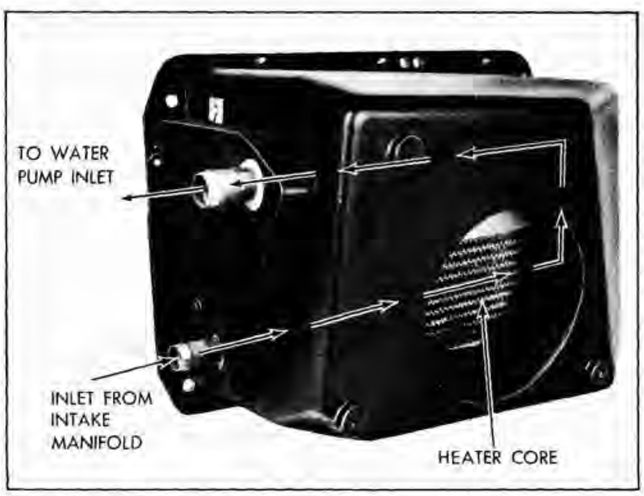



Fig. 2A-5 Flow of Engine Coolant Through Heater Core

Water entering the core from the intake manifold fills the lower half of the core and flows to the left where it enters a chamber connecting the lower half of the core with the upper half. Engine cooling system pressure (created by the water pump) forces the water into the upper half of the core and then back to the intake side of the water pump.

## AIR SYSTEM

Outside air enters through an intake grille mounted flush with the hood directly below the windshield. Air in this chamber is pulled by the blower and pulled into the heater core and case assembly (positioned on the right side of the dash in the engine compartment), where part of the air by-passes the heater core and part of the air is directed through the heater core. The amount of the by-pass air versus the amount of air flow through the heater core will depend upon the outside air temperature and the comfort or desired temperature in the car.

Heater air is distributed by a center outlet grilled opening in the heater air outlet duct which disperses air over the front floor area and is so aimed as to also direct air to the rear passenger compartment, (Fig. 2A-7). Openings in the right and left side of the heater outlet air duct are for additional air distribution to the front seat area (Fig. 2A-8).

Flexible hoses, extending from the heater air outlet duct are attached to two nozzles located along the base of the windshield for effective defrosting. A valve in the heater air outlet duct assembly (controlled at the control panel) may be positioned to direct air to the defrosters.

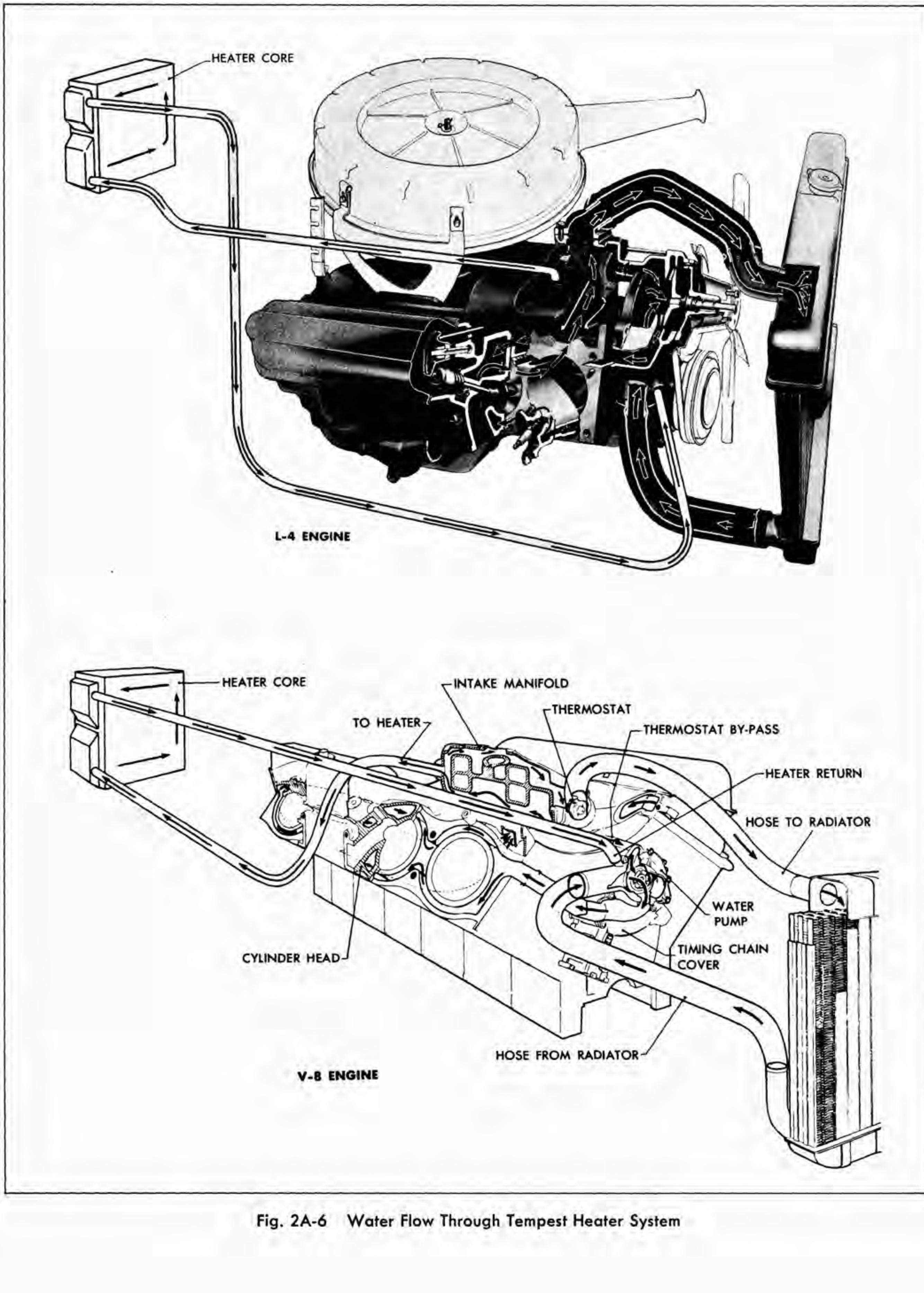



Fig. 2A-6 Water Flow Through Tempest Heater System

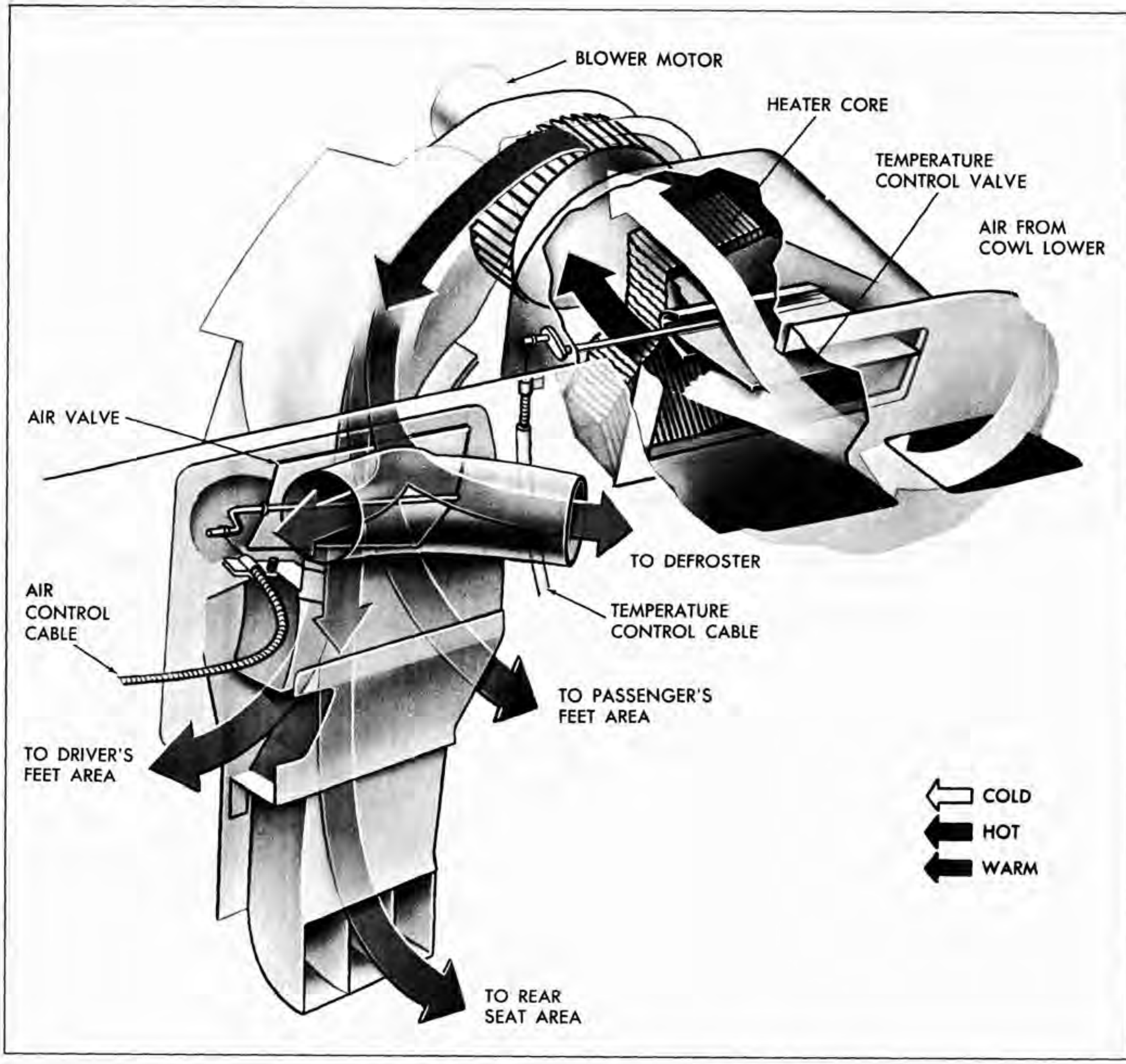



**Fig. 2A-7 Air Flow Through the Tempest Heater System**

Air flow through Pontiac's Tempest heater system is controlled by levers that slide in a vertical plane in the heater control panel which is located to the left of the steering column. These levers control and operate (1) the heater temperature control valve in the heater air inlet duct assembly located on the engine side of the dash shroud, (2) the defroster valve in the heater air outlet duct assembly (located on the passenger side of the dash shroud) and (3) the fan control switch for "OFF", "LO", "MED" and "HI" speed.

The amount of air flow through the heater air system can be varied with the "TEMP" control valve lever in the heater control panel and also with the "FAN" lever. The distribution of this air is controlled by the "AIR" control cable.

When the "TEMP" control lever is in the full up position no air flows through the heater core since the temperature control valve is closed (Fig. 2A-9) and all air by-passes the core. As the "TEMP" control lever is moved downward the temperature control valve (in the "air inlet duct"—heater core and assembly) moves upward to allow more and more air to enter the heater system. At the same time more and more air is directed through the heater core (to mix with air by-passing the core, Figs 2A-10 and

Fig. 2A-8 Air Outlets to Floor Area

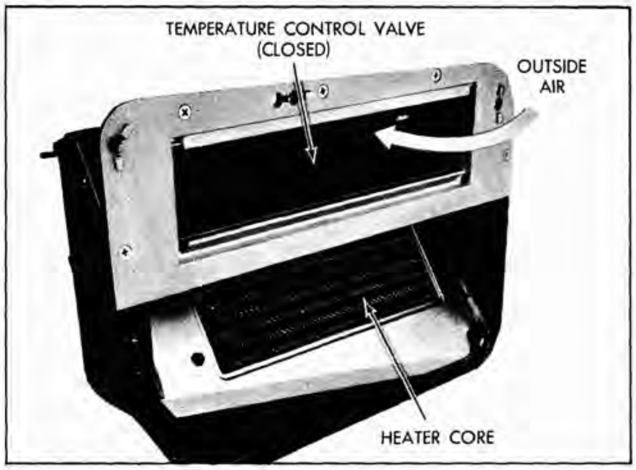



Fig. 2A-9 Temperature Control Valve Closed at Full Cold Position

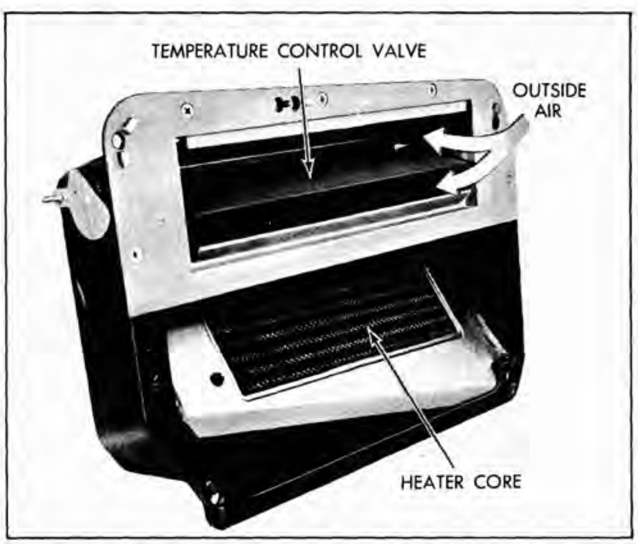



Fig. 2A-10 Temperature Control Valve at Mixing Position

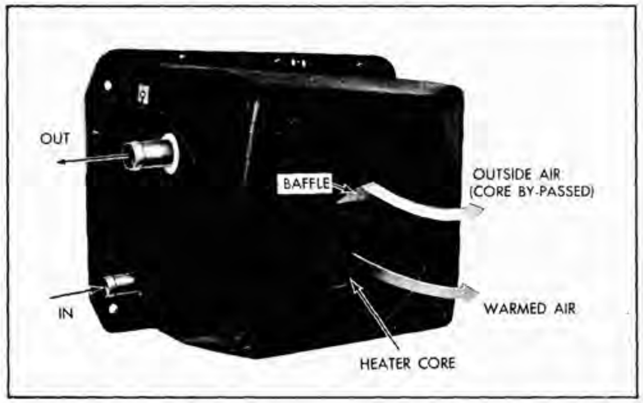



Fig. 2A-11 Air Leaving Inlet Air Duct

2A-11) until all air is directed through the heater core as shown in Fig. 2A-12 (temperature control lever is in full down position).

Since coolant flows through the heater core at all times, warmed air is allowed to mix with outside air by moving the temperature control lever which in turn moves a temperature air valve in the heater air duct; no heated air—all by-pass air with the temperature control lever in the full up position, all heated air—no by-pass air in the full down position (Figs. 2A-9 and 2A-12).

An air distribution valve is hinged to the top of the air outlet duct assembly (portion inside car) and operates to close off air flow through the air outlet duct when the "AIR" control valve is in the full up

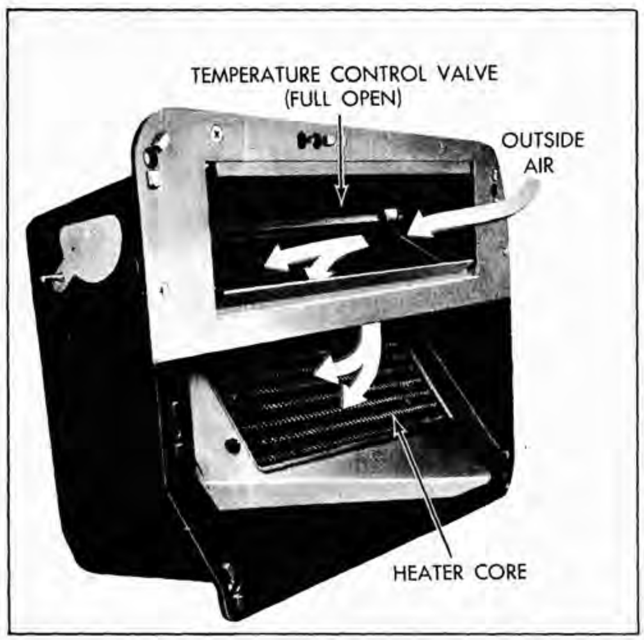
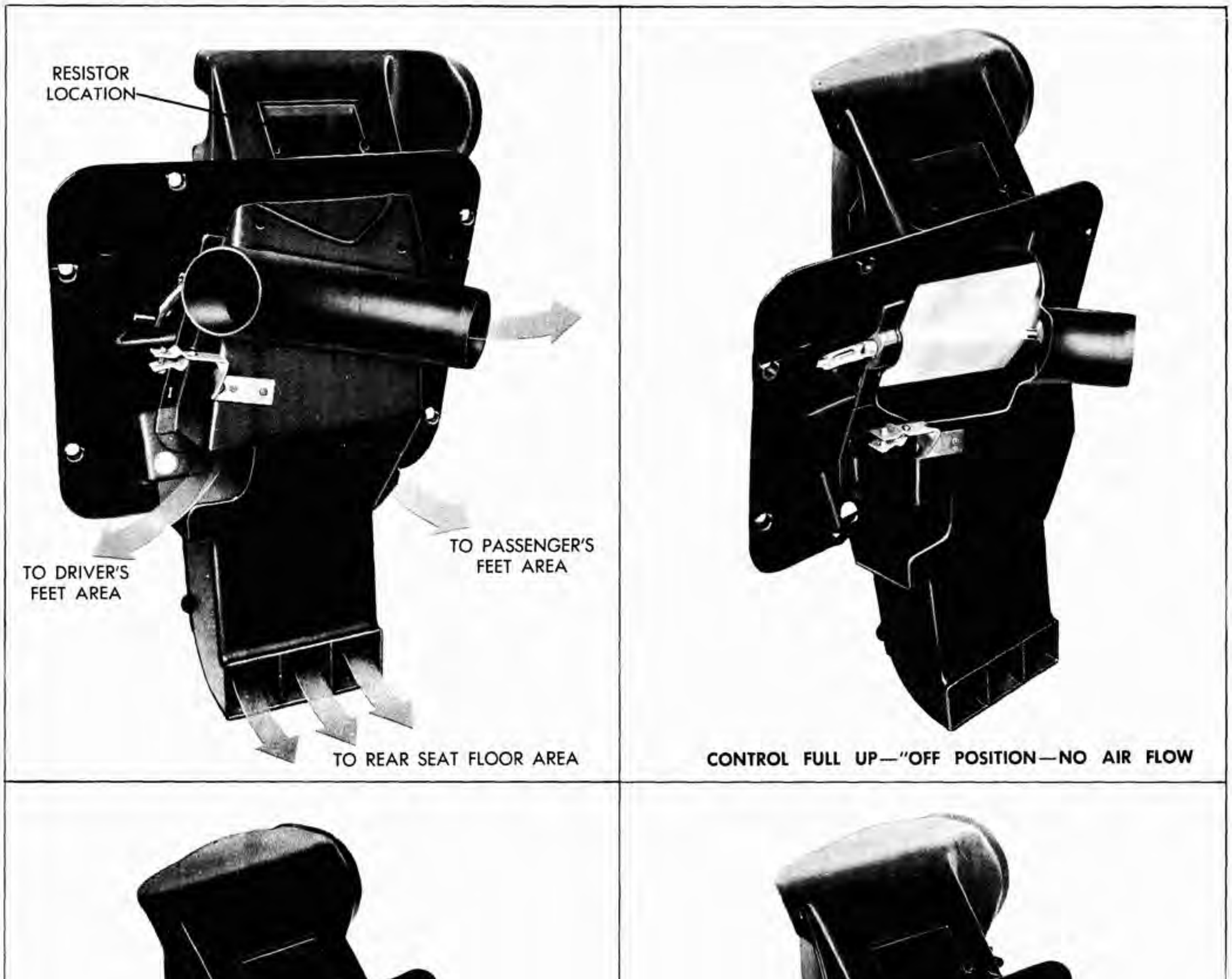



Fig. 2A-12 Temperature Control Valve at Maximum Heat Position




CONTROL FULL UP—"OFF POSITION—NO AIR FLOW

CONTROL MIDWAY—"NORMAL" POSITION—AIR TO HEATER OUTLETS—SOME TO WINDSHIELD

CONTROL FULL DOWN—"DEFROST" POSITION—MOST AIR TO WINDSHIELD

Fig. 2A-13 Position of Air Distribution Valve

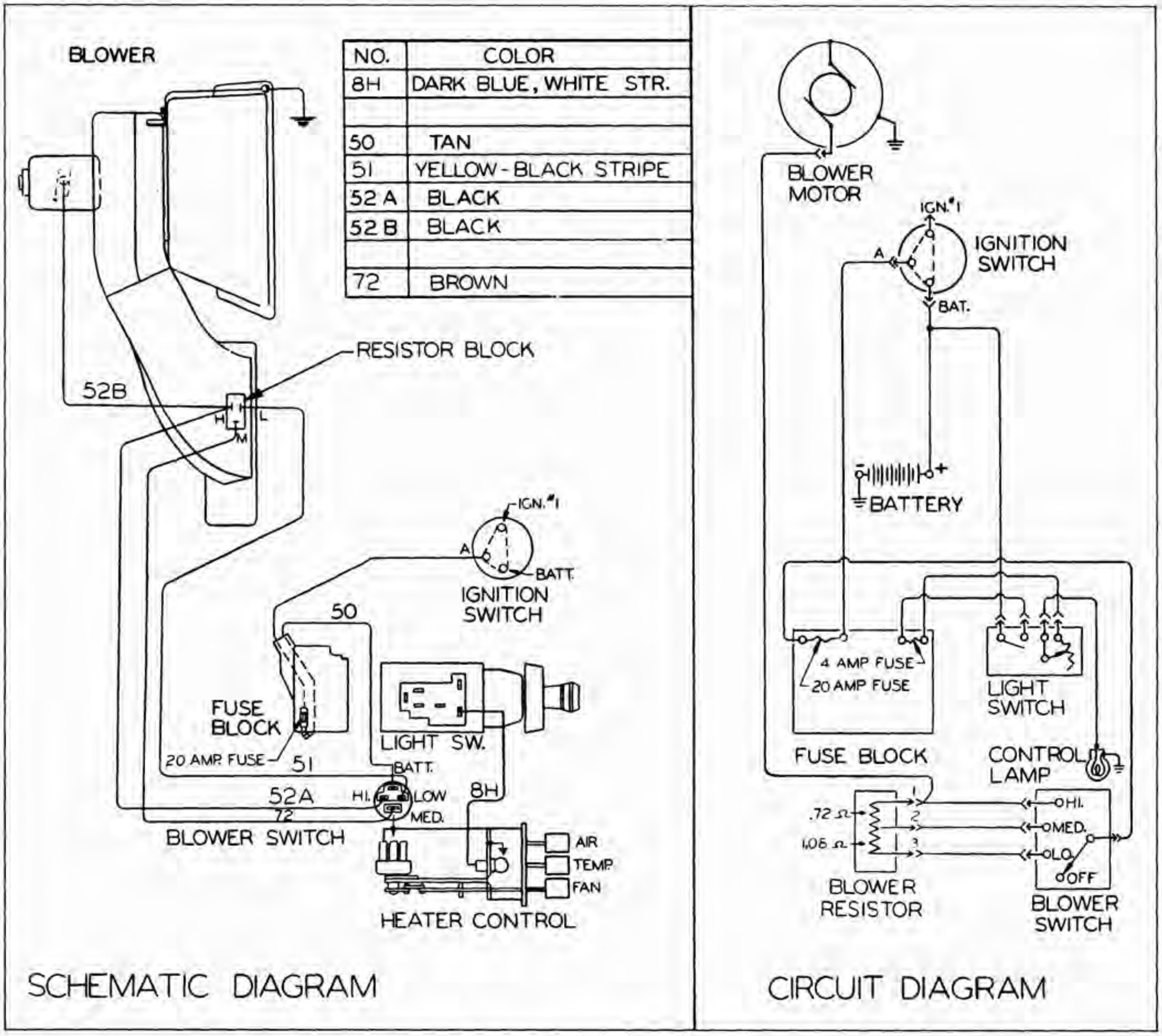



**Fig. 2A-14 Schematic and Circuit Diagrams of Tempest Heater Electrical System**

position. When the "AIR" valve is at the midway down position, most of the air is directed to the outlets with some being directed to the defroster outlets. In the full down position, the "AIR" control cable moves the valve to permit most of the air to be directed to the defroster outlets to direct maximum amount of air from the duct to the windshield whenever "de-icing" the windshield (Fig. 2A-13).

The amount of air flow through the heater air system can be varied with the "FAN" switch which is the right vertical control lever in the heater control panel. The "FAN" and "DE-ICE" switches are connected to the electrical system through the chassis wiring harness. Their purpose is explained in ELECTRICAL SYSTEM and their operation can be traced in the wiring schematic illustrations (Fig. 2A-14).

With the "FAN" lever in the full up position the blower is off. Moving the lever to the first (1/3 down) position operates a blower switch with linkage to provide for "LO" blower speed.

With the "FAN" lever in the second (2/3 down) position the blower switch will provide "MED" blower speed.

With the "FAN" lever in the full down position, "HI" blower speed is obtained to provide for maximum air flow through the system.


Fig. 2A-15 Location of Heater Resistor Assembly

## ELECTRICAL SYSTEM

The heater control panel lamp is fed from instrument panel rheostat output circuit which is protected by 4 amp. fuse in upper right corner of fuse block.

The blower circuit of the heater system receives its electrical supply from the heater terminal on the fuse block. Overload protection of the heater electrical systems is provided by a 20 amp. fuse located in the lower left corner of the fuse block.

When the ignition switch is turned to the start position, the accessory terminal of the ignition switch is cut out. This prevents operation of the accessories connected through the ignition switch while starting the engine. Thus, the starting motor receives maximum battery current while cranking the engine because there is no current to the heater electrical system.

When the "FAN" control lever is in the full up position, no current flows through the blower switch.

The heater blower switch is a four position switch that provides for "OFF" and three blower speeds; low, medium and high. The blower is fed through a single connection at its input; a black colored wire.

### *CURRENT FLOW THROUGH HEATER FAN CONTROL POSITIONS*

Four positions of the heater blower switch permit current flow to the blower as follows:

When the "FAN" control lever is in the "OFF" (full up) position, the blower switch is open and no current flows through the switch.

When the "FAN" control lever is in "LO" position, the circuit is closed to the blower. This allows current to flow from the "HTR" terminal of the fuse block through a tan colored wire to the "BATT" terminal on the blower switch, through the blower switch "LO" terminal and through a yellow wire with black stripe to the resistor assembly (located in the heater air outlet duct as shown in Fig. 2A-15). Cur-

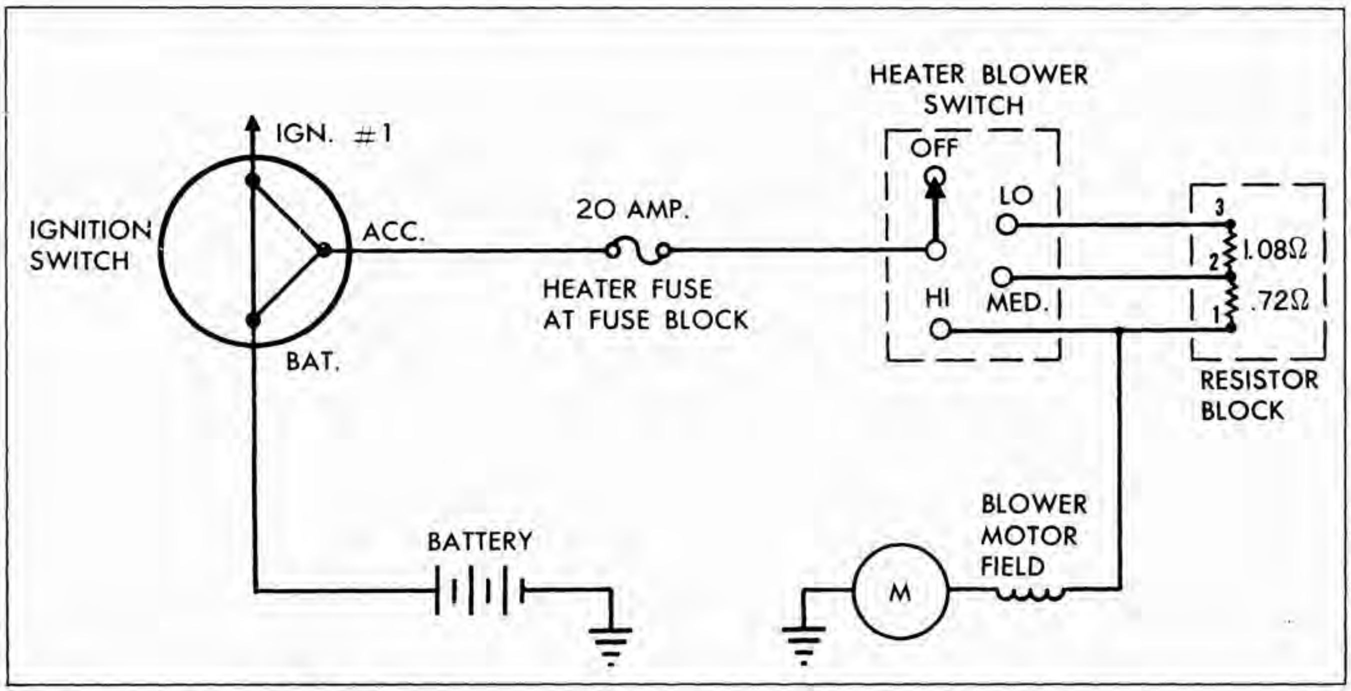



Fig. 2A-16 Simplified Circuit Diagram of Tempest Heater Electrical System

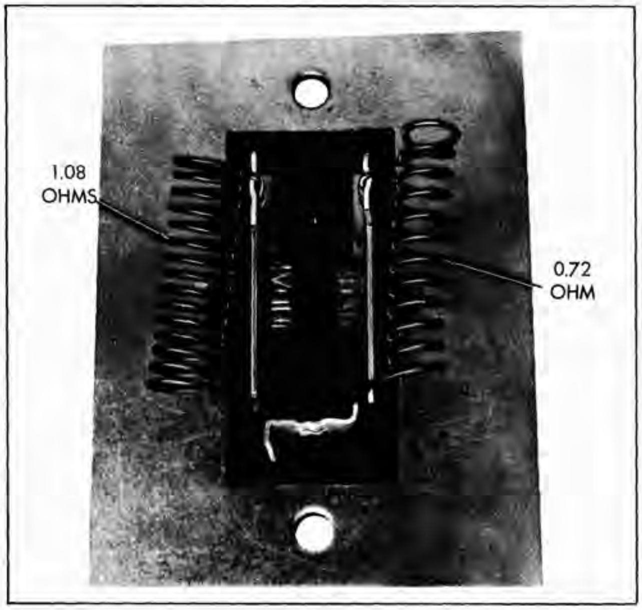



Fig. 2A-17 Tempest Heater Resistor—Resistance Value at Coils

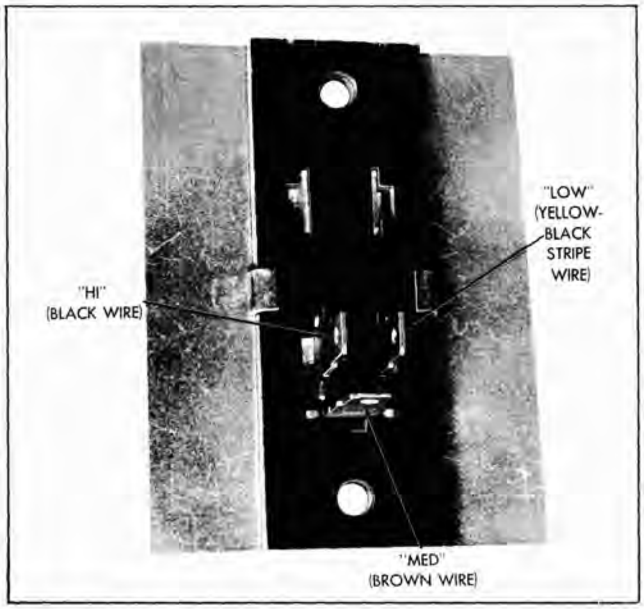



Fig. 2A-18 Tempest Heater Resistor—Terminal Identification

rent flows through all the resistors in the resistor block (1.08 ohm, and .72 ohm) then to the blower via a black wire. See Figs. 2A-14 and 2A-16.

"MED" position closes the heater blower switch which closes the circuit to the blower motor. This allows current from the "HTR" terminal on the fuse block to flow to the blower switch via a tan colored wire, through the blower switch "MED" terminal and through a brown colored wire to the resistor assembly (located in the heater outlet duct). Current flows through a .72 ohm resistor then to the blower via a black colored wire (Fig. 2A-14).

"HI" position closes the heater blower switch which closes the circuit to the blower motor. This allows current from the "HTR" terminal on the fuse block to flow to the blower switch via a tan colored wire, through the blower switch "HI" terminal and through a black wire to the resistor assembly (located in the heater air outlet duct), then through a black wire to the defroster switch and to the blower via a black wire (Fig. 2A-14).

# MINOR SERVICES AND REPAIRS

## CONTENTS OF THIS SECTION



## ADJUSTMENTS ON CAR

### *TEMPERATURE CONTROL VALVE CABLE ADJUSTMENT*

NOTE: This adjustment should be checked when insufficient heated, slightly warmed air or warmed air with "TEMP" control in "off" position, leaves the heater outlets.

1. Check to see that the temperature control valve cable housing extends no more than $\frac{1}{16}''$ beyond the cable housing clamp on the control panel assembly (Fig. 2A-19).

2. Move temperature control valve lever (at the heater control panel) making sure lever moves up against its stop ("off" position).

3. Loosen cable housing clamp screw at temperature control valve (Fig. 2A-20).

4. Slide cable housing and temperature control valve arm apart (temperature control arm will move up) to remove cable slack and secure cable housing clamp.

5. Check operation of cable.

NOTE: After adjustment, the "TEMP" lever knob must be in alignment with the "AIR" and "FAN" lever knobs, with all in the full up position.

### *AIR CONTROL CABLE ADJUSTMENT*

1. Check to see that the air cable housing does not extend any farther than $\frac{1}{16}''$ beyond the cable housing clamp on the control panel (Fig. 2A-19).

2. Move "AIR" control lever (at the heater control panel) to "OFF" position (up against its stop).

3. Loosen the bowden cable clamp in the heater air outlet duct (Fig. 2A-21).

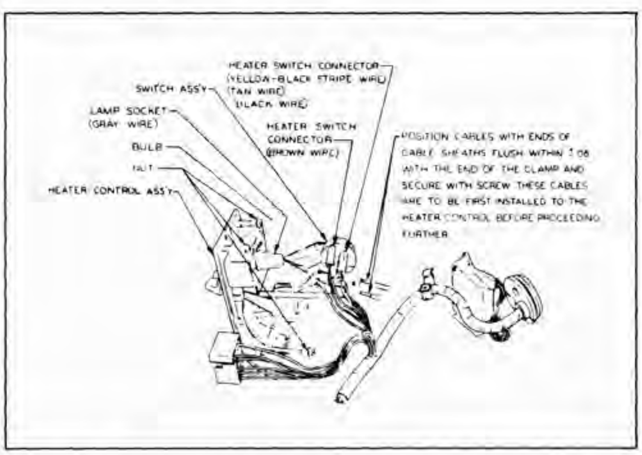



Fig. 2A-19 Control Cable Connections at Control Panel


Fig. 2A-20 Location of Temperature Control Valve Lever

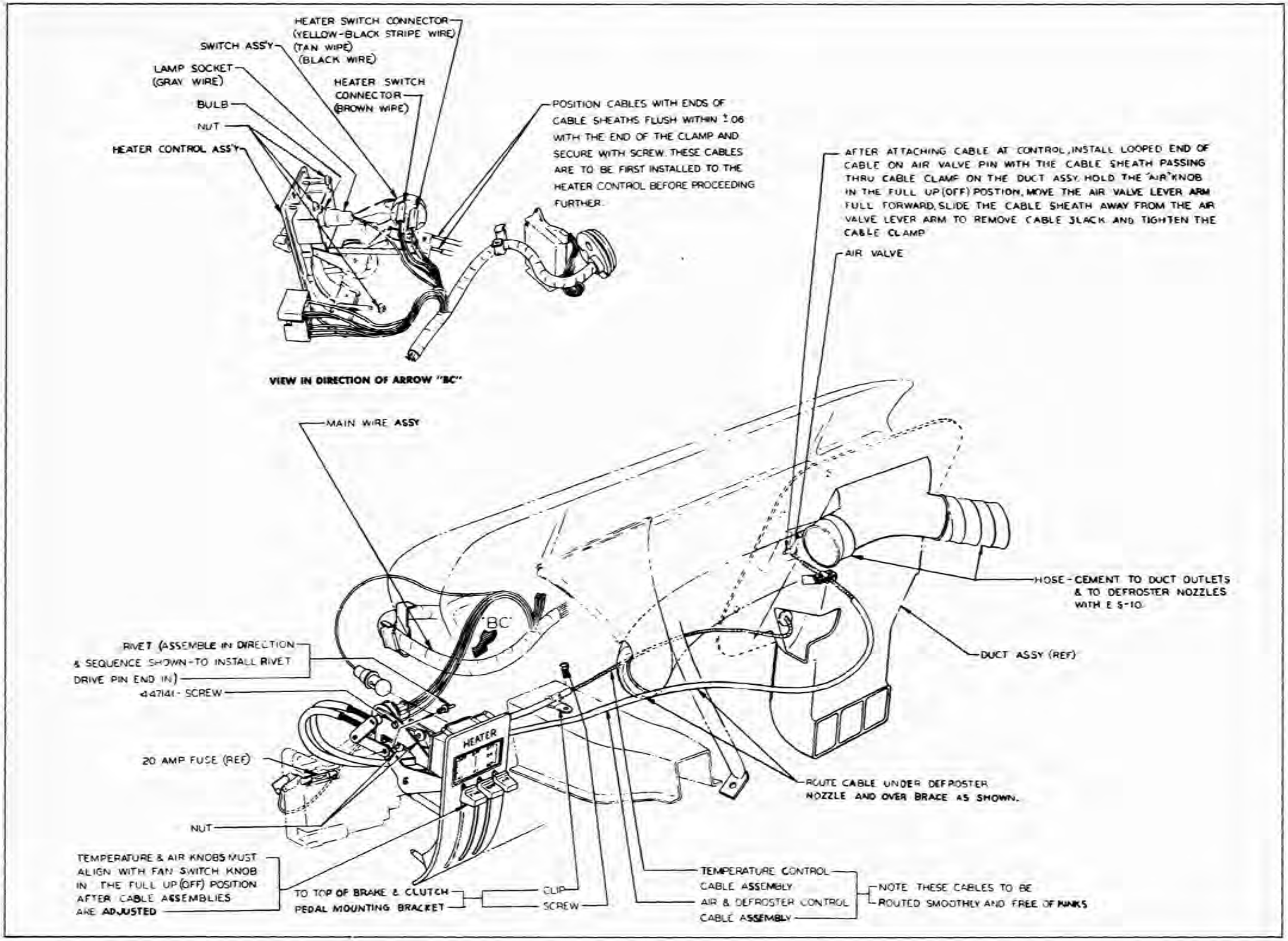



Fig. 2A-21 Reference Illustration—Body Interior Details

4. Rotate the air selector cam in the heater air outlet duct full forward.

5. Attach cable looped end on air valve pin (with cable sheath passing through cable clamp).

6. Slide cable sheath away from air valve lever arm to remove cable slack and tighten cable clamp.

7. Check operation of air valve.

NOTE: After adjustment all levers on control panel must be in alignment when all are in the full up position.

## TEMPERATURE CONTROL CABLE

### *REMOVE AND REPLACE*

1. Disconnect temperature control bowden cable at control valve.

2. Disconnect temperature control cable clamp from heater air inlet duct (on engine side of dash shroud). See Fig. 2A-20.

3. Disconnect temperature control bowden cable from heater control assembly.

4. Attach a piece of wire or stout cord about four feet long to valve end of cable and pull bowden cable into passenger compartment.

5. Replace by reversing the above procedure, making sure insulated end of cable is toward control panel. (Insulation protects wires from chafing on cable housing.) Do not replace blower motor.

6. Adjust temperature control bowden cable.

## AIR CONTROL CABLE

### *REMOVE AND REPLACE*

1. Disconnect air control bowden cable at heater control assembly.

2. Disconnect bowden cable from air distribution valve lever and clamp.

3. Remove air control bowden cable.

4. Replace by reversing the above procedure.

5. Adjust air control bowden cable.

## HEATER CONTROL PANEL ASSEMBLY

### *REMOVE AND REPLACE*

1. Disconnect battery.

2. Disconnect headlamp switch assembly from instrument panel.

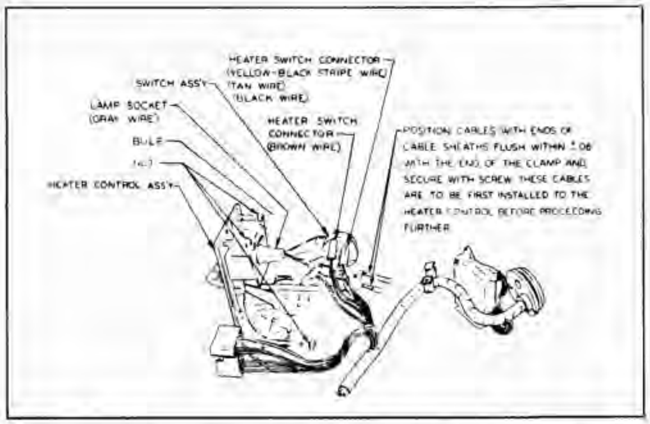



Fig. 2A-22 Connections at Tempest Control Panel

3. Remove one stamped nut at bottom and two at top from back side of heater control assembly.

4. Move control assembly out from instrument panel and disconnect "TEMP" and "AIR" control bowden cables from heater control assembly.

5. Disconnect wires and remove control assembly.

6. Replace by reversing the above procedure (Fig. 2A-22).

7. Adjust "AIR" control bowden cable.

8. Adjust "TEMP" control bowden cable.

9. Connect battery.

## HEATER FAN (BLOWER) SWITCH ASSEMBLY

### *REMOVE AND REPLACE*

1. Disconnect battery.

2. Disconnect headlamp switch assembly from instrument panel.

3. Remove heater control assembly.

4. Remove heater blower switch from control assembly (Figs. 2A-23 and 2A-24).

NOTE: Remove plastic "hinge" by removing round pin from center of hinge, then remove hinge.

5. Replace blower switch, making sure control lever engages in all four positions without hitting top or bottom of lever slot, and the lever does not contact depressions in left side of slot.

6. Replace control assembly.

7. Connect headlamp switch assembly.

8. Adjust "AIR" control bowden cable.

9. Adjust "TEMP" control bowden cable.

10. Connect battery.

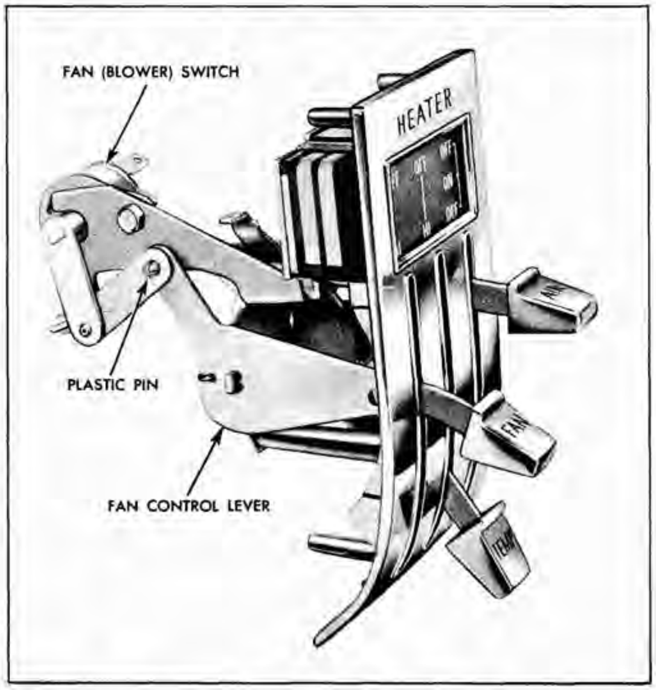



Fig. 2A-23 Tempest Control Panel Fan (Blower) Linkage

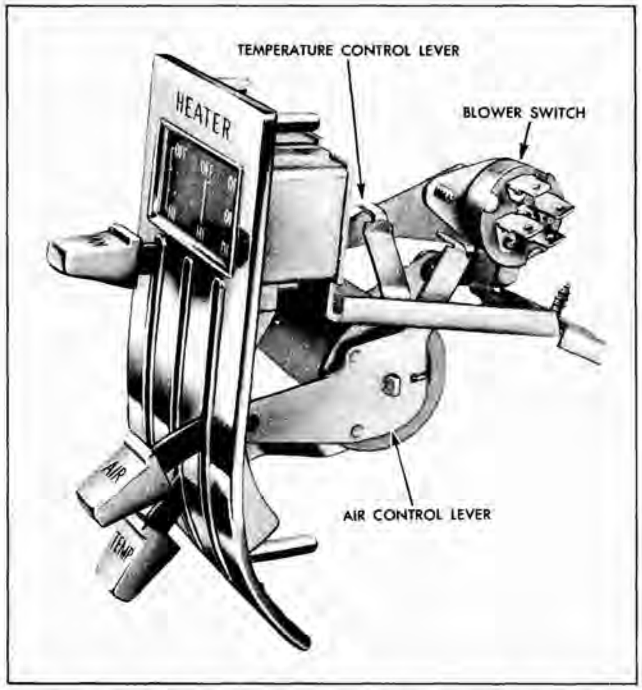



Fig. 2A-24 Tempest Control Panel Control Cable Linkage

## HEATER AIR OUTLET DUCT ASSEMBLY

### *REMOVE AND REPLACE*

1. Disconnect air valve control cable from air outlet duct.

2. Disconnect temperature control cable from air inlet duct and heater core assembly.

3. Pull temperature control cable inside car.

4. Disconnect battery.

5. Disconnect coil and bracket from dash shroud.

6. Remove blower motor assembly.

7. Remove distributor cap.

8. Remove air outlet duct to dash shroud screws and remove duct assembly.

9. Replace by reversing the above procedure.

10. Adjust temperature control cable.

11. Adjust air control cable.

## HEATER BLOWER MOTOR

### *REMOVE AND REPLACE*

1. Disconnect hot wire to blower motor at motor.

2. Remove three blower motor housing to inlet air duct screws and remove blower motor assembly.

3. Replace by reversing the above procedure, making sure blower motor ground wire is attached at top screw.

4. Note that the blower impeller (and for the Pontiac Circ-L-Aire Air Conditioner) is of opposite rotation from the Pontiac heater. The proper Tempest impeller (and Circ-L-Aire Air Conditioner) is identified by a gold colored inlet ring. Use of the wrong impeller will cause excessive blower noise and reduced air flow.

## HEATER AIR INLET DUCT, CORE AND HEATER TEMPERATURE CONTROL VALVE

### *REMOVE AND REPLACE*

1. Drain radiator.

2. Remove heater blower motor.

3. Disconnect temperature control cable at valve.

4. Disconnect heater water outlet hose (top hose) at core.

5. Disconnect heater water inlet hose (bottom hose) at core.

6. Remove heater core and inlet air duct assembly.

7. Replace by reversing the above procedure.

8. Adjust temperature control cable.

9. Fill radiator.

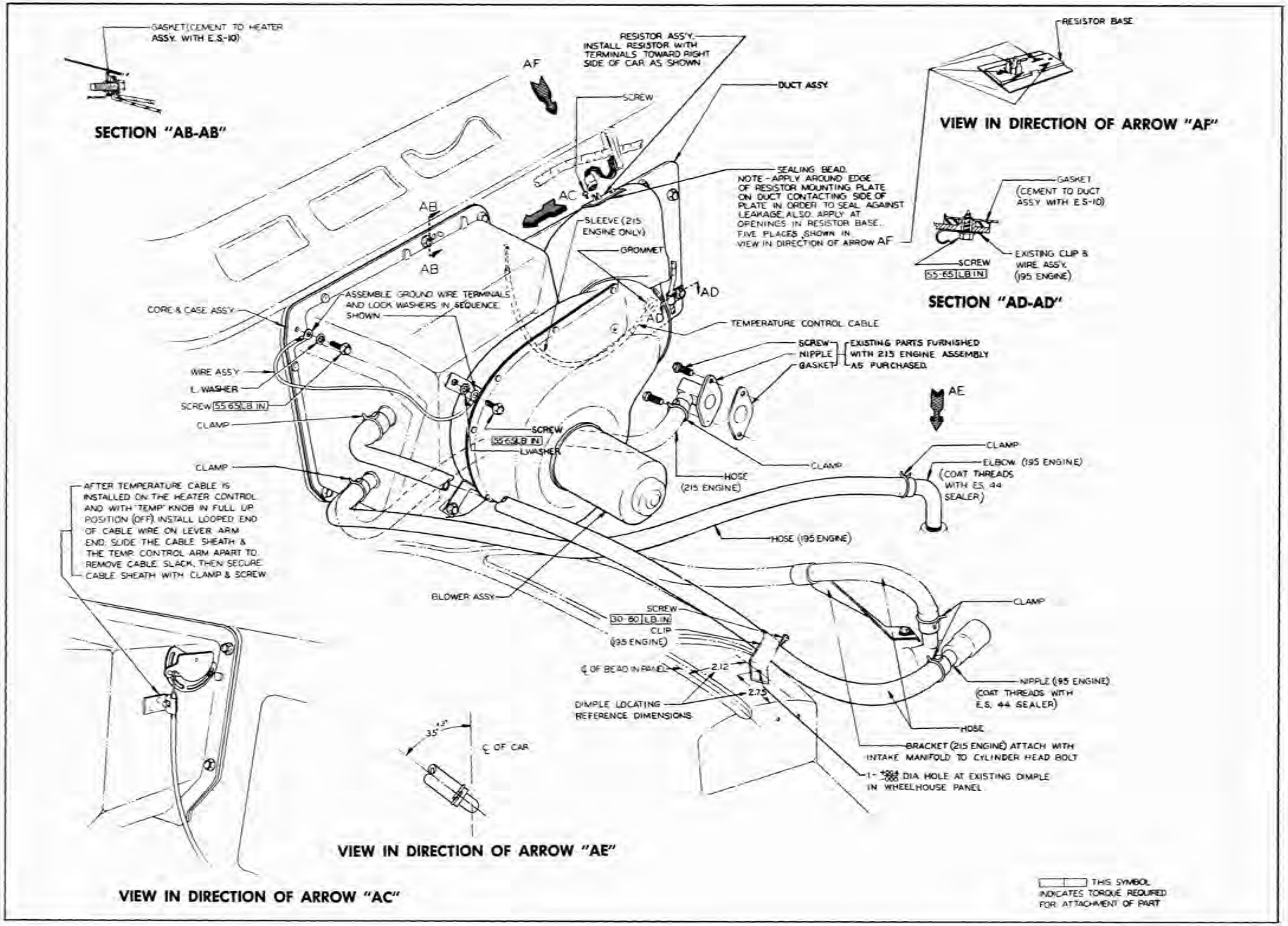



Fig. 2A-25 Reference Illustration—Engine Compartment Details

# TESTING AND DIAGNOSIS

CONTENTS OF THIS SECTION



## TESTING

### OPERATIONAL TEST

The purpose of performing a heater operational test is to prove the heater system is operating properly.

PRELIMINARY CHECKS

Engine Compartment

1. Check radiator for proper engine coolant level.

2. Inspect radiator core and heater hoses for leaks, at the same time inspecting for kinked or collapsed heater hoses.

3. Inspect the blower to heater air distributor to see that it is properly installed (to prevent any air leaks from engine compartment, which may have objectionable fumes or odors).

Inside Car Body

1. Check to see that all control levers operate smoothly, and they are in alignment when all are in the full up position.

2. Start engine.

3. Place "FAN" control lever in "OFF" position; blower should not operate.

4. Move "FAN" lever to the "LO" and "MED" position; blower should operate. Continue by moving lever to the "HI" position; blower should operate at a speed faster than at "LO" and "MED" positions.

5. Move "AIR" lever down slowly until the midway down position is reached; more and more air should flow through outlet as lever is depressed.

6. Move "AIR" lever down slowly until the full down position is reached, at the same time sensing the amount of air flowing from the defroster outlets. More and more air should flow through these outlets as the lever is depressed.

7. After engine has warmed up, move "TEMP" control lever from full up to full down position. Air at outlet should get progressively warmer.

Should the heater control levers operate satisfactorily during the above checks, it would appear that heater controls operation is normal. If during the checks irregularities are noted or complaints on heater operation could not be noted or determined, then refer to TROUBLE DIAGNOSIS for the complaint or cause and the remedy.

## TROUBLE DIAGNOSIS

### INSUFFICIENT HEATING

| CAUSE | REMEDY |
|---|---|
| Slow warming in car. | Incorrect operation of controls. Advise operator of proper operation of heater controls. |
| Objectionable engine or exhaust fumes in car. | Check for good seal between hood and cowl. |
| | Check for good seal between vent grille and cowl. |
| | Locate and seal any other air leaks. |

### INSUFFICIENT HEATING—Continued

| CAUSE | REMEDY |
|---|---|
| Cold drafts on floor. | Check operation and adjustment of cowl vent cables. Check adjustent of air valve cable. Advise operator of proper operation of heater system. |
| Insufficient heat to rear seat. | Check for obstructions under front seat. Advise owners to operate blower. |
| Low engine coolant level. | Check radiator and fill to proper level, run engine to clear air lock. |
| Failure of engine cooling system to warm up. | Check radiator cap and engine thermostat and replace if required. See Tempest Chassis Shop Manual. |
| Kinked heater hoses. | Remove kink or replace hose. |
| Foreign material obstructing water flow in heater core. | Remove foreign material if possible, otherwise replace core. |
| Temperature control valve cable improperly adjusted. | Adjust cable. |
| Inoperative temperature control valve. | Replace heater core and valve assembly. |
| Air valve does not open. | Check for proper installation and/or adjustment of "AIR" control cables. |

### INADEQUATE REMOVAL OF FOG OR ICE

| CAUSE | REMEDY |
|---|---|
| Air valve does not open. | Check for proper installation and/or adjustment of "AIR" control cable. |
| Temperature control valve does not open. | Check and adjust temperature control valve cable. |
| Defroster valve does not open fully. | Adjust air control cable. |
| Obstructions in defroster outlets at windshield. | Remove obstruction. On cars with instrument panel pads, look for and fix loose panel pad cover at defroster outlets. |
| Dinged defroster outlets. | Reshape outlet flange with pliers. The outlet should have a uniform opening, $\frac{5}{16}$" wide. |
| Blower motor not connected. | Connect wire. |
| Inoperative blower motor. | Check heater fuse. Replace motor. |
| Inoperative blower motor switch. | Replace switch. |

### TOO WARM IN CAR

| CAUSE | REMEDY |
|---|---|
| Inoperative temperature control valve adjustment. | Adjust temperature control valve cable. |
| Incorrect operation of controls. | Advise operator of proper operation of heater system. |

### BLOWER INOPERATIVE

| CAUSE | REMEDY |
|---|---|
| Blown fuse. | Replace fuse. |
| Inoperative motor. | Replace motor. |
| Open circuit. | Replace circuit between ignition switch, blower switch, and blower motor. |
| Inoperative blower motor switch. | Replace faulty switch. |

### MISCELLANEOUS

| CAUSE | REMEDY |
|---|---|
| Control levers not aligned due to incorrect adjustment. | Adjust control cables. |
| Blown fuses. | Shorts in electrical system.<br>Locate and correct short.<br>Blower wheel rubbing on case.<br>Failed blower motor. |
| Heater "gurgle". | Check engine coolant level in radiator. |

## SPECIFICATIONS

**Cooling System Capacity (Engine with Heater)** .......... 12.6 qts.

**Fuse**

Heater Electrical System (on fuse block) .......... 20 amp.

Heater Control Panel Lamp (on fuse block) .......... 4 amp.

# VENTILATING

## CONTENTS OF THIS SECTION



## GENERAL DESCRIPTION

Comfortable, draft free ventilation inside the car may be obtained by opening the front door vent windows and/or the ventilator valves in the side shroud.

The air intake for the ventilation system is located at the horizontal portion of the cowl forward of the windshield reveal molding and flush with the hood. Outside air enters the louvered intake then flows into an enclosed chamber which extends on each side of the cowl. Outside air in the chamber travels to inlets in the side cowl trim pads. Air can also be directed through heater and/or defroster outlets without being heated, provided the temperature controls are at the off position.

Control knobs mounted on the instrument panel provide individual control of the air flow through the inlets into the front passenger compartment (Figs. 3-1 and 3-2).

Contour of the air chamber is such that water in the air is deflected away from the inlet ducts, which extend into the chamber and also through the inlets in the cowl trim pads. A large volume of water, such as would be present when the car is being washed, is prevented from entering the inlet ducts by gutters on the ducts in each side of the chamber.

All cars except those equipped with Circ-L-Aire conditioning are equipped with side shroud ventilators at both sides. On Circ-L-Aire equipped cars only the left side shroud ventilator is installed. On Tempest with air conditioning, special parts are used at the right hand vent.

## ADUSTMENTS ON CAR

### *FRONT DOOR VENT WINDOWS*

Refer to the Body Shop Manual for all services and repairs for the front door vent windows.

## MINOR SERVICES AND REPAIRS

### *SHROUD TOP VENTILATOR GRILLE—REMOVE AND REPLACE*

1. Place protective coverings over hood and fenders.
2. Remove windshield wiper arm, spanner nut,


Fig. 3-1 Pontiac—Right Vent and Vent Control

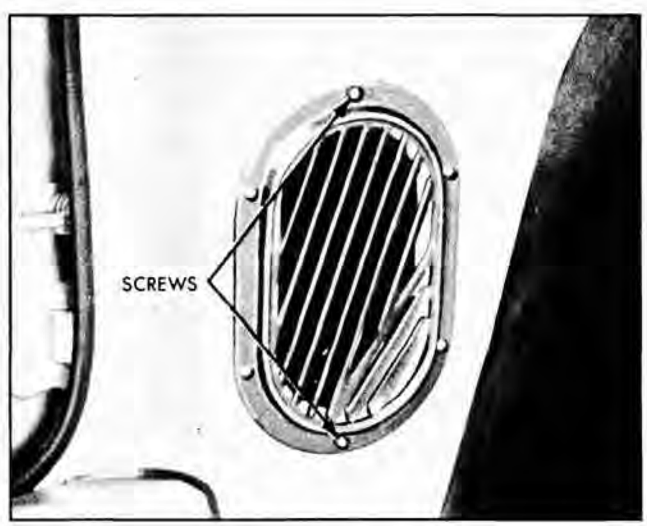



Fig. 3-2 Tempest—Right Vent

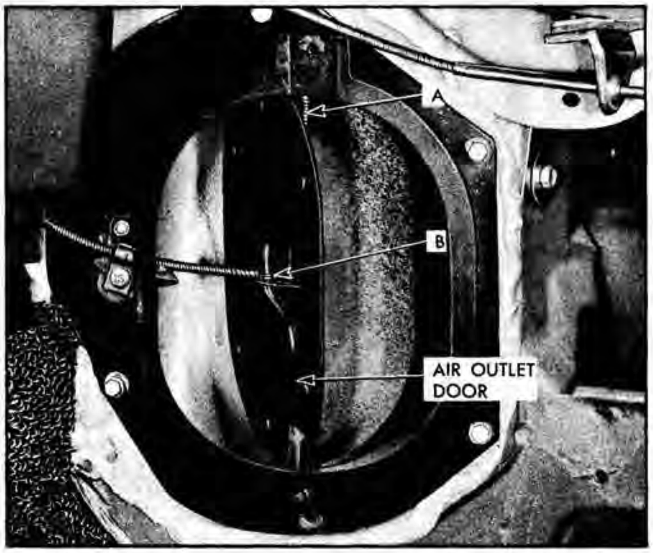



Fig. 3-3 Pontiac—Air Outlet Door

washer and escutcheon from each wiper transmission. Use tool No. J-6592-01 to remove transmission nut.

3. Raise hood and remove screws securing front edge of grille to shroud.

4. Carefully raise front edge of grille and slide grille forward (toward front of car) to disengage retaining tabs along rear edge of grille positioned between lower reveal moldings and molding attaching clips and remove grille.

NOTE: Exercise care so that grille does not contact hood.

5. On Tempest models apply medium-bodied sealer around grille retaining slots in shroud panel and around screw attaching holes.

6. Insert retaining tabs along rear edge of grille in slots in shroud panel and reverse removal procedure. Make certain windshield washer nozzle is in proper position.

NOTE: Check to see that grille does not contact hood after installation.

### SHROUD SIDE FOUNDATION—REMOVE AND REPLACE

1. Remove screw at upper and lower end of air inlet grille (Figs. 3-1 and 3-2) and bend down tabs securing foundation to floor pan.

2. Slide foundation forward to disengage rear edge

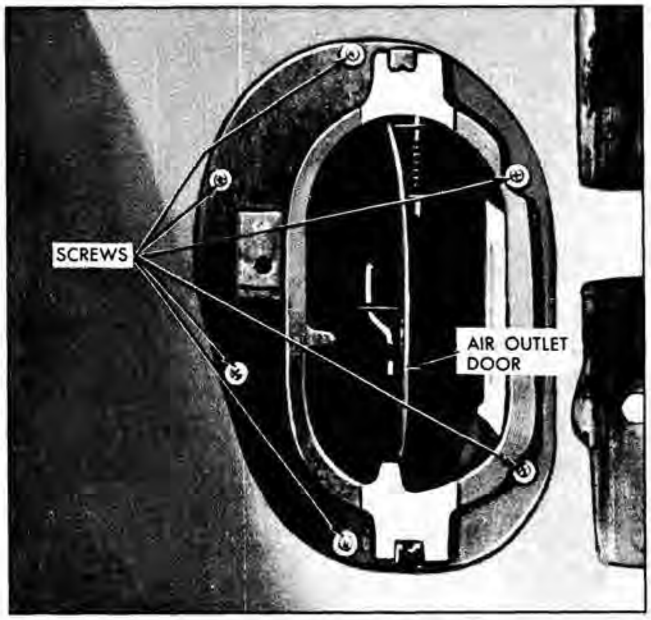



Fig. 3-4 Tempest—Air Outlet Door

from retainer and remove from body and remove foundation.

3. To install, reverse above procedure. Only the lower attaching screw is used on the left foundation.

### SHROUD SIDE DUCT VENT CONTROL CABLE—REMOVE AND REPLACE

1. Remove side foundation trim panel (kick pad). (Two screws secure this panel at top and bottom of vent grille.)

2. Loosen control cable clamp.

3. Holding the air outlet door in the closed position, slide cable housing toward rear of car so there is approximately 1/8" between the cable knob and the mounting bracket and tighten cable housing clamp.

4. Replace side foundation trim panel.

### SHROUD SIDE DUCT PANEL AIR OUTLET DOOR—REMOVE AND REPLACE

1. Remove shroud side foundation panel.

2. Remove end of control cable from pin indicated in Figs. 3-3 and 3-4.

3. Pry hinge pin downward and remove door.

4. To install, reverse above procedure.

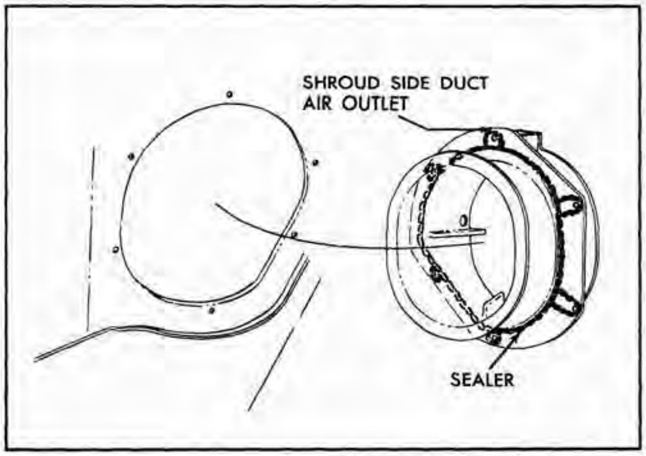



Fig. 3-5 Pontiac—Side Duct Air Outlet Sealing

***SHROUD SIDE DUCT PANEL AIR OUTLET—REMOVE AND REPLACE***

1. Remove shroud side foundation panel.

2. Remove screws securing outlet door housing to shroud panel as shown in Figs. 3-3 and 3-4 and remove housing.

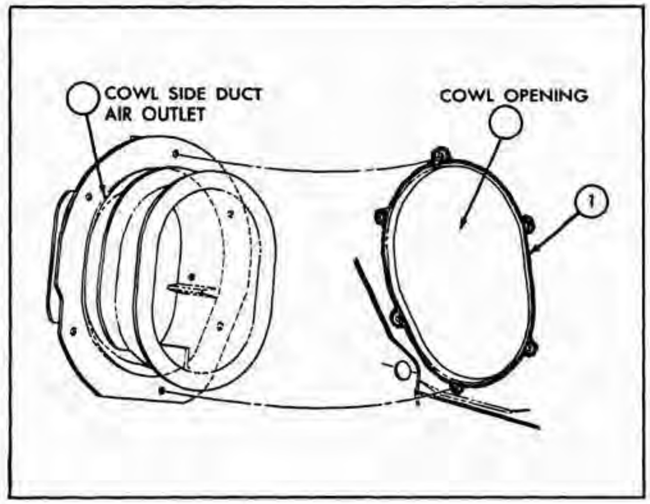



Fig. 3-6 Tempest—Side Duct Air Outlet Sealing

NOTE: Outlet is only present on left side of bodies equipped with Circ-L-Aire conditioning.

3. Apply a bead of medium-bodied sealer to areas indicated in Figs. 3-5 and 3-6 and install, reversing the above procedure.

# BASIC AIR CONDITIONING INFORMATION

CONTENTS OF THIS SECTION



## FUNDAMENTAL PRINCIPLES OF REFRIGERATION

Pontiac's air conditioning system cools the air by means of a refrigeration system which is basically the same as that used in a home refrigerator.

The principle of operation of the refrigeration system is based on a few simple laws of physics which are stated informally as follows:

1. Temperature is a measurement of the intensity of heat.

2. Heat is a form of energy. When heat is added to a substance, it usually is noticed by an increase in temperature. For example, in order to raise the temperature of water from 35°F. to 100°F., it is necessary to add a certain amount of heat.

3. When an object cools, it does not absorb cold, but rather it loses heat to a colder object or substance nearby. When a bottle containing warm liquid is placed on a cake of ice, the ice melts and the bottle and its contents become cool. Heat from the bottle and its contents is lost to the ice.

4. When a liquid boils, turning to vapor, it absorbs a great amount of heat. For instance, water boiling on a stove is absorbing a great amount of heat from the burner as it is changing to the vapor commonly called steam. Boiling is a rapid form of evaporation.

When a liquid boils, it absorbs heat without changing temperature. For example, when heat is added to water at sea level, as when heating on a stove, the temperature of the water will rise until it reaches 212°F. If the water remains on the hot stove, it will boil, but the temperature will remain at 212°F. The heat being absorbed by the water is changing it to steam rather than raising the temperature.

Refrigerant-12, the refrigerant used in Pontiac's air conditioning system, boils at 21.7°F. below zero. Thus, if it were exposed to the air at normal room temperature, it would absorb heat from the surrounding air and boil, immediately changing to a vapor.

5. When heat is removed from this water vapor, it will condense back into a liquid. For example, the steam caused by boiling water on a stove will condense into water on the underside of the cover. This is due to the cover not being as hot as the steam. The cover, therefore, takes heat from the steam, causing it to condense back to water. This same action occurs when warm air contacts any cooler substance. Heat from the air is lost to the cool substance and usually any moisture in the air condenses on the cooler substance.

6. The temperature at which substances will boil or condense is affected by pressure. If the pressure is increased, the liquid will not boil until a higher temperature is reached. Thus we can prevent the refrigerant from boiling if it is kept under high pressure. If this high pressure is suddenly released, the refrigerant will immediately boil. A similar condition has been demonstrated in modern automobiles with pressure cooling systems.

Many persons have had the experience of removing the radiator cap from a car in which the water is overheated but not boiling; the pressure is released and the solution boils over with considerable violence.

When the pressure of a vapor is increased, the temperature at which it will condense is also raised. Steam condenses at 212°F. if heat is removed from it, but it can be made to condense at a higher temperature by increasing the pressure.

7. Compressing a vapor increases its temperature. For example, when pumping air into a tire with a

hand pump, the pump will become warm due to the heating of the air as it is compressed.

8. When a liquid is heated until it is converted to a gas, then this gas is heated additionally without changing pressure, this gas is said to be superheated. For instance, in the evaporator Refrigerant-12 absorbs heat and boils at a constant temperature and pressure until it has been completely vaporized, it continues to absorb heat from the warm air passing over the evaporator without any increase in pressure. Since this heat is no longer being used to convert the refrigerant from a liquid to a gas, it will now cause the temperature of the refrigerant to rise. The refrigerant is then superheated.

## OPERATION OF A SIMPLIFIED REFRIGERATION SYSTEM

Any refrigeration system takes advantage of the principles described above. A very simple refrigeration system would have five basic parts. They are the compressor, condenser, receiver, expansion valve and evaporator. The refrigeration cycle of this simple system (Fig. 4-1) is as follows:

Refrigerant gas under low pressure is drawn into the compressor, where it is compressed to a high pressure and high temperature. (The process of compressing heats the gas.) The hot refrigerant gas is then pumped into the condenser where it cools by giving off heat to the metal of the condenser, then to the air passing over the condenser surfaces.

As the refrigerant gas cools, while passing through the condenser, it condenses into a liquid under high pressure. From the condenser, the high pressure refrigerant liquid passes into the receiver. The receiver acts as a reservoir to furnish a solid column of refrigerant liquid to the expansion valve at all times. Liquid refrigerant under high pressure passes from the receiver to the expansion valve located at the inlet of the evaporator.

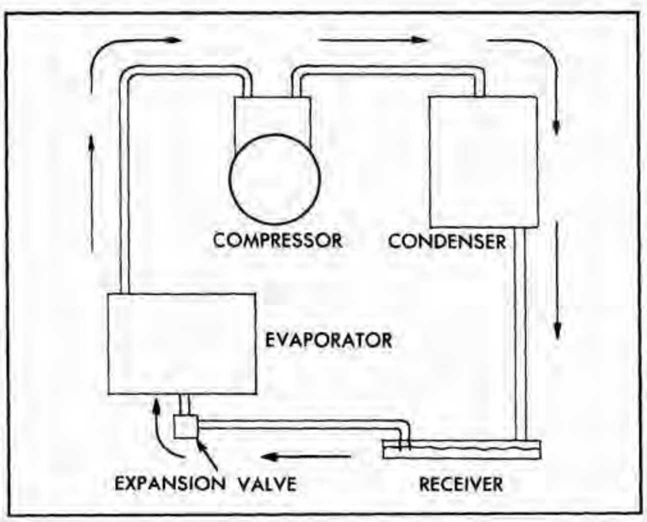



Fig. 4-1 Schematic of Simplified Refrigeration Cycle

The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the suction of the compressor. As the refrigerant enters this low pressure area, it will immediately begin to boil and its temperature will drop to that corresponding with the low pressure. For instance, if the pressure inside the evaporator is 30 psi, the temperature of the refrigerant will drop to 32°F. (Fig. 4-2) and it will begin to boil by absorbing heat from the surrounding areas. As the liquid refrigerant passes through the evaporator, it will continue to boil at 32°F. until all the liquid has changed to gas (vaporized). The flow of refrigerant is regulated by the expansion valve so that the refrigerant will remain in the evaporator long enough to completely vaporize.

From the evaporator the cool refrigerant gas is drawn back to the compressor to repeat the cycle.

### REFRIGERANT-12 PRESSURE-TEMPERATURE RELATIONSHIP

The table below indicates the pressure of Refrigerant-12 at various temperatures. For instance, a drum of Refrigerant at a temperature of 80°F. will have a pressure of 84.1 psi. If it is heated to 125°F. the pressure will increase to 167.5 psi. It also can be used conversely to determine the temperature at which Refrigerant-12 boils under various pressures. For example, at a pressure of 30.1 psi, Refrigerant boils at 32°F.

| TEMP. (°F.) | PRESSURE (PSIG) | TEMP. (°F.) | PRESSURE (PSIG) |
|---|---|---|---|
| -21.7 | 0 (atmospheric pressure) | 55 | 52.0 |
| | | 60 | 57.7 |
| -20 | 2.4 | 65 | 63.7 |
| -10 | 4.5 | 70 | 70.1 |
| - 5 | 6.8 | 75 | 76.9 |
| 0 | 9.2 | 80 | 84.1 |
| 5 | 11.8 | 85 | 91.7 |
| 10 | 14.7 | 90 | 99.6 |
| 15 | 17.7 | 95 | 108.1 |
| 20 | 21.1 | 100 | 116.9 |
| 25 | 24.6 | 105 | 126.2 |
| 30 | 28.5 | 110 | 136.0 |
| 32 | 30.1 | 115 | 146.5 |
| 35 | 32.6 | 120 | 157.1 |
| 40 | 37.0 | 125 | 167.5 |
| 45 | 41.7 | 130 | 179.0 |
| 50 | 46.7 | 140 | 204.5 |

Fig. 4-2 Pressure - Temperature Relationship of Refrigerant-12

## GENERAL INFORMATION ON REFRIGERATION SERVICE

### *REFRIGERANT-12 (DICHLORODIFLUOROMETHANE)*

Refrigerant-12 is a transparent and colorless refrigerant in both the gaseous and the liquid state. It has a boiling point of 21.7°F. below zero at atmospheric pressure; therefore, at all normal temperatures and pressures it will be a vapor. The vapor is heavier than air and resembles chloroform in odor. Refrigerant-12 is non-flammable, non-corrosive and non-toxic or irritating when *not* in contact with a live flame or fire.

### PROCUREMENT

Refrigerant-12 is shipped and stored in metal drums. It is serviced in 25 lb. drums and one pound (15 oz. net weight) cans. Consult your parts department for details about procuring refrigerant.

It will be impossible to draw all the refrigerant out of the drum. The use of warm water when charging the system will assure the extraction of a maximum amount of refrigerant from the drum. Be sure to follow the instructions under CHARGING THE SYSTEM.

### PRECAUTIONS IN HANDLING REFRIGERANT-12

1. Do not leave drum of Refrigerant-12 uncapped.

2. Do not carry drum in passenger compartment of car.

3. Do not subject drum to high temperature.

4. Do not weld or steam clean on or near system.

5. Do not fill drum completely.

6. Do not discharge vapor into area where flame is exposed.

7. Do not expose eyes to liquid.

All refrigerant drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for the same reason.

If it is ever necessary to transport or carry a drum of refrigerant in a car, keep it in the luggage compartment. If the drum is exposed to the radiant heat from the sun, the resultant increase in pressure may cause the safety plug to release or the drum to burst.

For the same reason, the refrigerant drum should never be subjected to excessive temperature when charging a system. The refrigerant drum should be heated for charging purposes by placing in 125°F. water. Never heat above 125°F. or use blowtorch, radiator or stove to heat the drum.

Welding or steam cleaning of or near any of the refrigerant lines or components of the air conditioning system could build up dangerous and damaging pressures in the system.

If you ever have the occasion to fill a small drum from a large one, never fill the drum completely. Space should always be allowed above the liquid for expansion. If the drum were completely full and the temperature was increased, tremendous hydraulic force could be developed.

Discharging large quantities of Refrigerant-12 into a room can usually be done safely as the vapor would produce no ill effects. However, this should not be done if the area contains a flame-producing device such as a gas heater or running engines. While Refrigerant-12 normally is non-poisonous, heavy concentrations of it in contact with a live flame will produce a poisonous gas. The same gas will attack all bright metal surfaces.

One of the most important cautions concerns the eyes. Any liquid Refrigerant-12 which may accidentally escape is approximately 21°F. *below* zero. If liquid refrigerant should touch the eyes, serious damage could result. Always wear goggles to protect the eyes when opening refrigerant connections.

If Refrigerant-12 liquid should strike the eye, *call a doctor immediately.*

a. DO NOT RUB THE EYE. Splash the affected area with quantities of cold water to gradually get the temperature above the freezing point.

b. The use of an antiseptic oil is helpful in providing a protective film over the eye ball to reduce the possibility of infection.

c. As soon as possible, obtain treatment from a doctor or an eye specialist.

Should liquid refrigerant come in contact with the skin, the injury should be treated the same as though the skin has been frostbitten or frozen.

### *PRECAUTIONS IN HANDLING HOSES, TUBES AND FITTINGS*

When replacing hoses, tubes or disconnecting and connecting fittings, there are several important points which should be kept in mind.

NOTE: New tubes in parts department stock have been dehydrated and sealed. They should not be opened until immediately before they are to be installed. If a delay is encountered the tubes should be capped again until they are ready to be used.

1. The tubes should be free of kinks, since kinks will cause restrictions in the flow of refrigerant and create system noise. The refrigeration capacity of the entire system can be greatly reduced by a single kink in any tube.

2. Use proper wrenches when loosening or tightening connections. This assures the proper tightening of each fitting without damaging the seal.

The special wrenches for flared fittings are similar to box end wrenches, but have an opening so that they will fit over the tubes. It is extremely important to use these wrenches on the tube fittings in order to prevent distortion of the fittings.

When loosening or tightening tube fittings, always use two wrenches. Use an open end wrench to hold the seat stationary so that the original seal will not be broken, causing a leak.

3. "O" rings and fittings must be in perfect condition. The slightest burr or foreign material may cause a leak.

4. "O" rings and fittings should be coated with refrigeration oil before they are assembled. This is extremely important in allowing the connection to be tightened evenly to the proper torque. Fittings which are not coated with refrigeration oil are almost sure to leak. Refrigeration oil is as moisture free as it can be made and therefore the container should always be capped when not in use.

5. When disconnecting any fitting or removing any plug in the refrigeration system, proceed very cautiously, regardless of gauge readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid refrigerant in the line. If pressure is noticed when fitting is loosened, allow it to bleed off very slowly.

***CAUTION: Always wear safety goggles when opening refrigerant lines.***

6. When any connection is opened it should immediately be capped to prevent the entrance of air and moisture. When tubes are laid aside while other work is being performed the utmost care should be taken to keep them absolutely clean.

## MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation of the air conditioning refrigeration system is dependent on the pressure-temperature relationship of pure Refrigerant-12. As long as the system contains pure Refrigerant-12 (plus a certain amount of compressor oil which mixes with the Refrigerant) it is considered to be chemically stable.

When foreign materials, such as dirt, air, or moisture are allowed to get into the system they will change the pressure-temperature relationship of the refrigerant. Thus, the system will no longer operate at the proper pressures and temperatures and the efficiency will decrease.

The following general practices should be observed to insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant connection, wipe away any dirt or oil at and near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be immediately capped or plugged to prevent the entrance of dirt, foreign material and moisture. It must be remembered that all air contains moisture. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly.

2. Tools should also be kept clean and dry. This includes the gauge set and replacement parts.

3. When adding oil, the container and the transfer tube through which the oil will flow should be exceptionally clean and dry due to the fact that refrigeration oil is as moisture-free as it is possible to make it. Therefore, it will quickly absorb any moisture with which it comes in contact. For this same reason the oil container should not be opened until ready for use and then it should be capped immediately after use.

4. When it is necessary to open a system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the system open any longer than is necessary.

5. Any time the system has been opened and it has been sealed again, the system must be properly evacuated.

## GAUGE SET

The gauge set shown in Fig. 4-3 is one of the most valuable of the air conditioning tools. It is used when charging, evacuating and for diagnosing trouble in the system.

The gauge at the left is known as the low pressure gauge. The face is graduated into pounds of pressure from 0 to 60 (with a cushion to 200) in 2 pound graduations, and, in the opposite direction, in inches of vacuum from 0 to 30 inches. This is the gauge that should always be used in checking pressure on the low pressure side of the system.

The gauge at the right in Fig. 4-3 is graduated from 0 to 600 pounds pressure in 10 pound graduations. This is the high pressure gauge which is used for checking pressure on the high pressure side of the system.

The connection on the left (Fig. 4-3) is for attaching the low pressure gauge line; the one on the right, the high pressure gauge line.

The center connector is common to both and is for evacuating or adding refrigerant to the system. When this connection is not required, it should be capped.

The hand shut-off valves do not have anything to do with opening or closing off pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operations, the valves must be closed. The occasions for opening both at the same time would be when evacuating and charging the system.

When the gauges are connected to the compressor gauge fittings with the refrigeration system charged, the gauge lines should always be purged. Purging is done by "cracking" each valve on the gauge set to allow the pressure of the refrigerant in the refrigeration system to force the air to escape through the center gauge line. Failure to purge lines may result in air or other contaminants entering refrigeration system.

***LEAK DETECTORS***

### LEAK DETECTOR J-6084

Leak detector J-6084 is a gas operated torch type leak detector using a replaceable cylinder. It can also be used as a blowtorch by replacing the leak detector burner unit with Utility Torch Unit J-6085.

### ASSEMBLING UNIT

1. Remove dust cap from cylinder.

2. Close valve knob on detector unit.

3. Thread detector unit onto top of fuel cylinder. Tighten finger tight.

NOTE: Do not use tool or wrench to tighten.

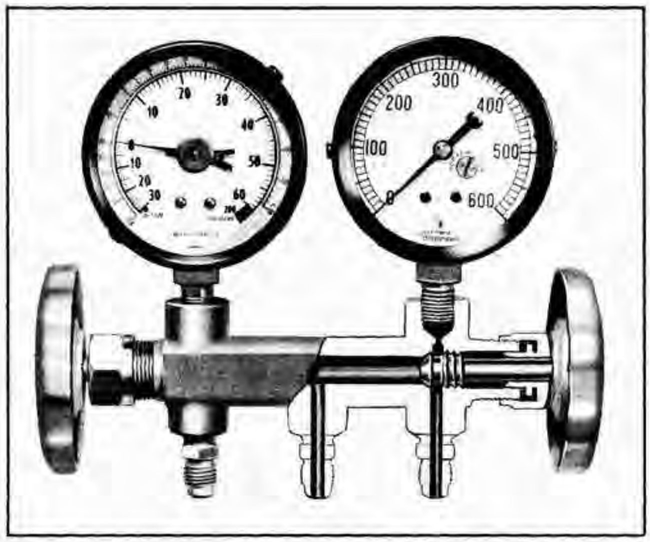


Fig. 4-3 J-5725-01 Gauge Set

4. Attach search hose assembly to detector unit (Fig. 4-4).

### LIGHTING DETECTOR J-6084

1. Open control valve until slight hiss of gas is heard, then light gas at opening in chimney.

***CAUTION: Do not use lighted detector in any place where combustible or explosive gases, dusts or vapors may be present.***

2. Adjust the flame until the desired volume is obtained. A pale blue flame approximately 3/8" above the reaction plate is best for detecting leaks.

NOTE: The reaction plate will be heated to a cherry red.

### CORRECTION FOR YELLOW FLAME

If the flame is yellow, insufficient air is being inspirated or the reaction plate is dirty. Insufficient air may be caused by:

1. Obstructed or partially collapsed suction tube.

2. Dirt or foreign substance in burner tube.

3. Dirty or partially clogged orifice.

Blowing air through the suction tube and back through the detector will usually clear dirt or foreign matter. If a yellow flame is caused by dirty reaction plate, allow the flame to burn for several minutes. This will usually burn the plate clean. If an oxide film appears on the reaction plate from continued use, it will reduce the sensitivity of the detector. This may be remedied by removing the plate and scraping the surface gently with a knife.

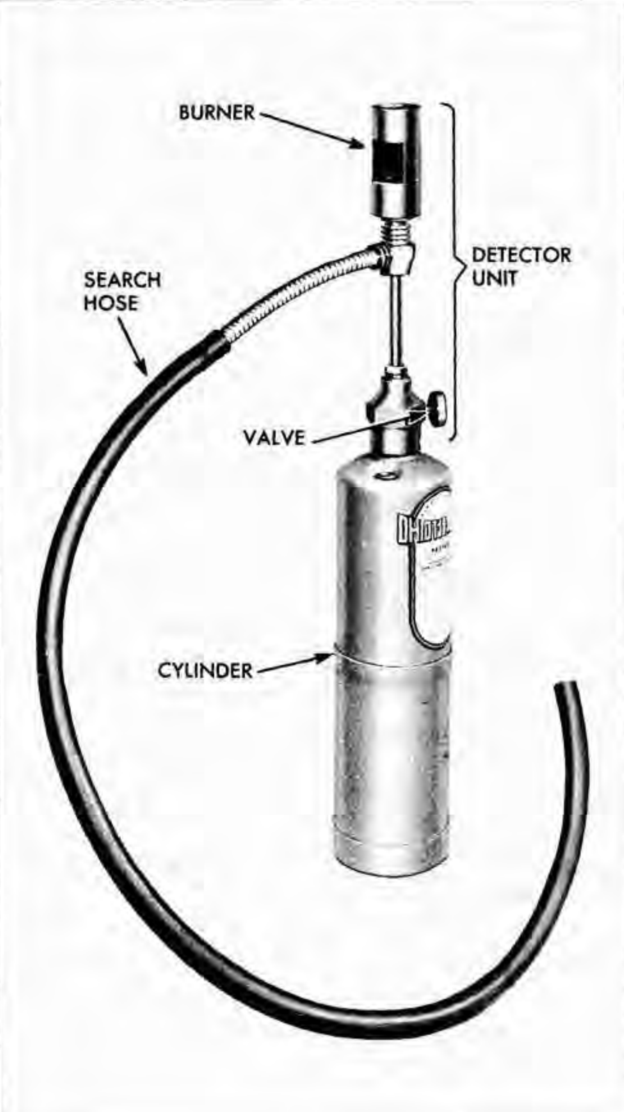



Fig. 4-4 J-6084 Leak Detector

## TO CLEAN ORIFICE

1. Never attempt to clean orifice by passing anything through the hole.

2. Unscrew burner assembly from burner tube by applying wrench to hexagon part located immediately below search hose connection. Turn to left. This will expose orifice block which is inserted into the end of the tube.

3. Remove orifice block from tube.

4. Reverse orifice block and replace against burner tube; screw burner head onto burner tube (hand tight), then open valve quickly, admitting several short blasts.

5. To reassemble: unscrew burner head, insert orifice block into burner tube, and screw burner head onto burner tube with a wrench to form a gas-tight joint.

Replacement parts can be obtained from Kent-Moore.

## CHECKING FOR REFRIGERANT LEAKS

After the leak detector flame is adjusted check for refrigerant leaks in an area having a minimum amount of air flow in the following manner:

Explore for leaks by moving end of hose or sampling tube around all connections and points where a leak may be. Check around bottom of connections, since Refrigerant-12 is heavier than air and will, therefore, be more apparent at bottom of fitting.

The color of the flame will turn to a yellow-green when a small leak is detected. Large leaks will be indicated by a change in color to brilliant blue or purple. When the suction hose is moved away from the leak the flame will clear to an almost colorless pale-blue again.

***CAUTION: Do not breathe the fumes and black smoke that are produced if the leak is a big one. They are poisonous! Any time an open flame is used near a car there is a certain amount of danger. Although the torch flame is small and well protected, it is recommended that a fire extinguisher be close at hand for any emergency that might arise.***

## LIQUID LEAK DETECTORS

There are a number of fittings and places throughout the air conditioning unit where a liquid leak detector solution may be used to pin-point leaks.

By merely applying solution to the area with the swab that is attached to the bottle cap, bubbles will form within seconds if there is a leak.

For confined areas, such as sections of the evaporator and condenser, the torch type detector is the only practical kind which should be used for determining leaks.

### *VACUUM PUMP*

A vacuum pump J-5428 (Fig. 4-5) should be used to evacuate air and moisture from the air conditioning system. All pumps are shipped fully charged with 8 ozs. oil; however, the following precautions should be observed relative to the maintenance and operation of this pump.

MAINTENANCE

***CAUTION: Do not use this pump as an air compressor.***

1. Keep all openings capped when not in use to avoid moisture being drawn into the system.

2. Oil should be changed after every 250 hours of normal operation.

To change oil, simply unscrew hex nut located on back side of pump, tilt backward and drain out oil (Fig. 4-6). Recharge with 8 ounces of vacuum pump oil Frigidaire 150 or equivalent (Fig. 4-7). If you desire to flush out the pump, use this same type clean oil. Do not use a solvent.

NOTE: Improper lubrication will shorten the life of the pump.

3. If this pump is subjected to extreme or prolonged cold, allow it to remain indoors until oil has reached approximate room temperature. Failure to warm oil will result in a blown fuse.

4. A five ampere time delay cartridge fuse has been installed in the common line to protect the windings of the compressor. The fuse will blow if an excessive load is placed on the pump. In the event the fuse is blown, replace with a five ampere time delay fuse—*do not use a substitute fuse* as it will result in damage to the starting windings.

5. If the pump is being utilized to evacuate a burnt-out system, a filter must be connected to the intake fitting to prevent any sludge from contaminating the working parts, which will result in malfunction of the pump.

6. Before using pump, remove dust cap on discharge outlet of pump.

***SERVICE STATION***

The J-8393 Deluxe Portable Air Conditioner Service Station supplies all evacuating and charging equipment assembled into a compact portable unit (Fig. 4-8).

J-8393 consists of a wheeled cart, a vacuum pump, pressure gauges, control valves, and most important, a calibrated charging cylinder capable of storing and accurately metering up to five pounds of liquid refrigerant. All necessary hoses are included and the cart is fitted with brackets for a 25 or 50 pound refrigerant cylinder, oil injector, and leak detector.

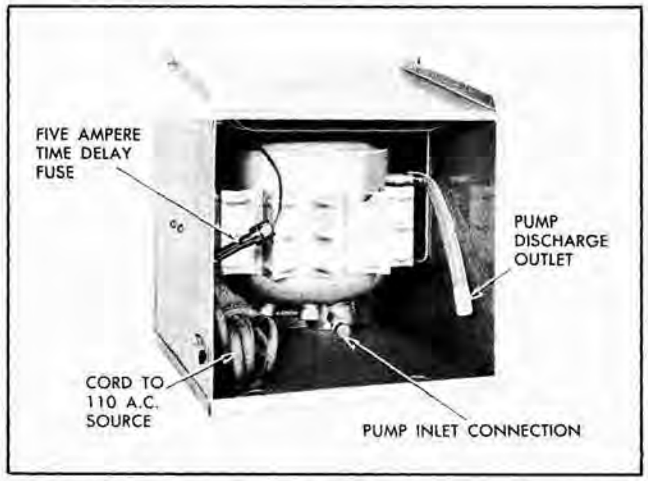



Fig. 4-5 J-5428 Vacuum Pump

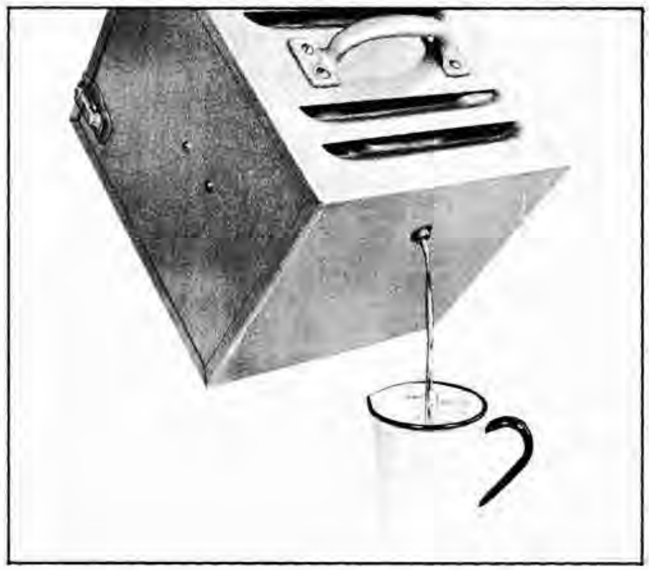


Fig. 4-6 Draining Oil from Vacuum Pump

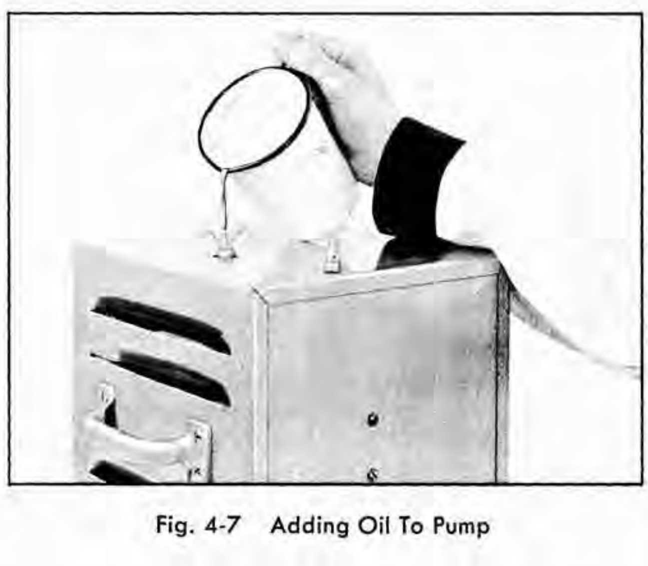


Fig. 4-7 Adding Oil To Pump

Since refrigerant is metered into the system, by volume, the correct amount will always be added to the system. This, plus the fact that the unit remains "plumbed" at all times, thereby eliminating loss of refrigerant that would be caused by purging of lines and hooking-up components, combines to enable the serviceman to economically utilize all refrigerant purchased.

The simplified lay-out of evacuating and charging equipment is designed to allow any mechanic to do a first-rate job of servicing an air conditioner. The "Station" virtually makes air conditioner servicing simply a matter of connecting two hoses and manipulating clearly labeled valves.

Dealerships that desire all features of the Deluxe Portable Air Conditioner Service Station (J-8393) may obtain same, yet avoid duplication of air conditioning tools now in their possession, simply by selecting "Station" components from those listed below:

J-8418—PORTABLE SERVICE STATION. Without vacuum pump or manifold and gauge set, otherwise same as "Deluxe" unit J-8393. Includes provisions for easy installation of the A-5428 Vacuum Pump and J-5725-01 Gauge Set.

J-8420 – CHARGING CYLINDER AND TEST PANEL (Complete), consists of J-8413 Charging Cylinder and test panel with all gauges, hoses and valves. It also includes universal upper and lower mountings for bench, wall, or portable equipment.

J-8413 – CHARGING CYLINDER AND TEST PANEL (Less J-5725-01 Manifold and Gauge Set).

J-8413 – CHARGING CYLINDER ASSEMBLY. This assembly also includes cylinder adapter fitting, inlet and bleeder valves as well as a 12" length of inlet hose.

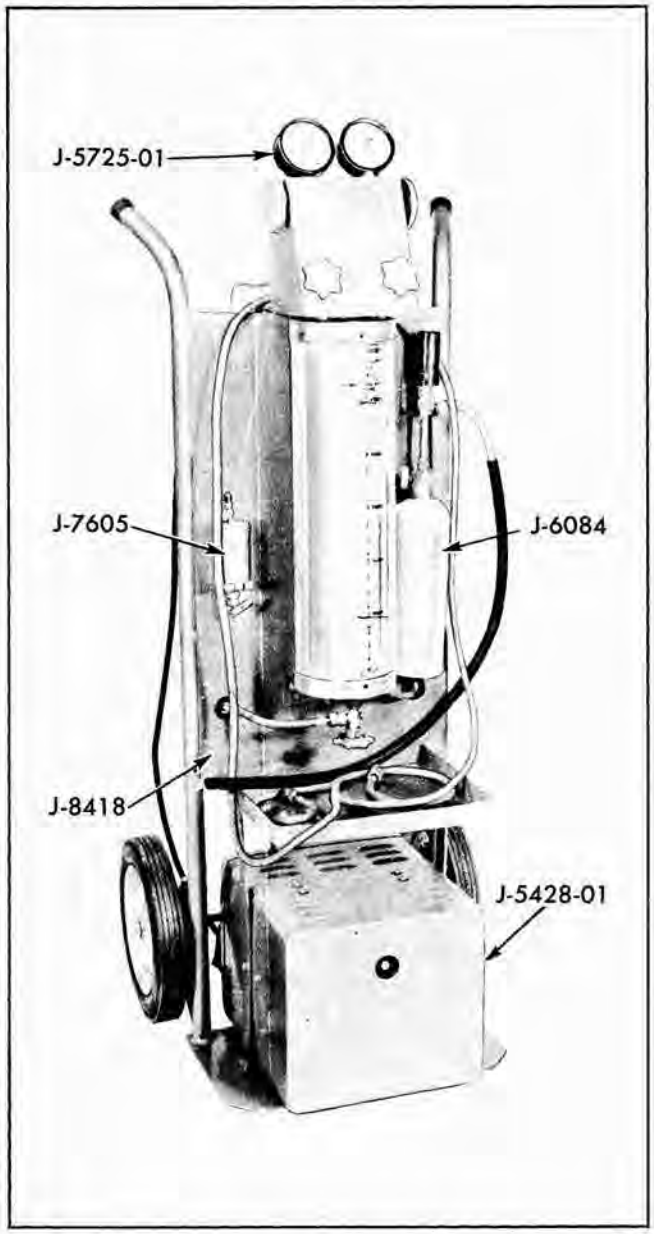



Fig. 4-8 Complete Service Station

## SPECIAL TOOLS REQUIRED TO SERVICE AIR CONDITIONING SYSTEMS

| Tool No. | Description | Tool No. | Description |
|---|---|---|---|
| J-4245 | Truarc Pliers (No. 23 Internal) | J-6084 | Leak Detector |
| J-5403 | Truarc Pliers (No. 21 Internal) | J-6271 | Fits—All Valve (one 1# can) |
| J-5418 | Charging Line (3 reg.) | J-6272-01 | 3 can Muilti-opener (three 1# cans) |
| J-5428-02 | Vacuum Pump | J-6435 | Truarc Pliers (No. 26 External) |
| J-5428-11 | 1 Qt. Oil (150 Vis. For Pump) | J-6742 | Thermometer (0-180°) |
| J-5453 | Goggles | J-8092 | Handle |
| J-5462-3 | Fiber Washer | J-8393 | Complete Charging Station |
| J-5462-4 | Drum Reducer | J-8393-50 | Bracket (for New Freon Bottle) |
| J-5725-01 | Manifold and Gauge Set | J-8413 | Charging Cylinder Assembly Only |

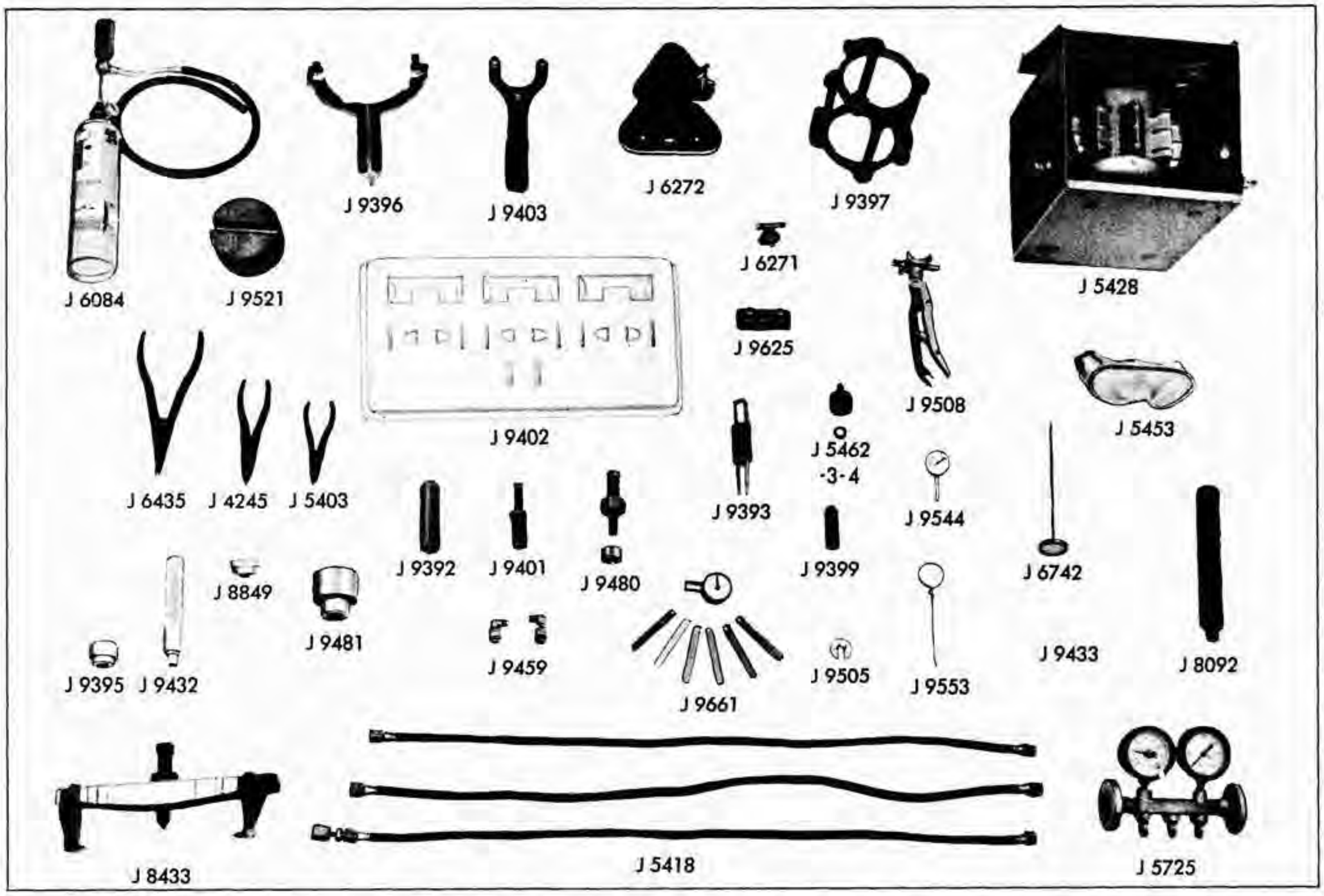



Fig. 4-9 Special Tools Required to Service Air Conditioning Installations

| Tool No. | Description |
|---|---|
| J-8418 | Charging Cylinder Less Vacuum Pump & Gauge Set |
| J-8420 | Charging Cylinder & Test Panel Assembly Complete |
| J-8421 | Charging Cylinder & Test Panel Less Gauge Set |
| J-8433 | Compressor Pulley Remover |
| J-8849 | Pulley Bearing Remover (Use with J-8092 Handle) |
| J-9392 | Compressor Shaft Seal Remover |
| J-9393 (-1 Sleeve) (-2 Clamp) | Compressor Seal Seat Remover |
| J-9395 | Pulley Puller Pilot (Use with J-8433-1 Bar & J-8433-2 short legs) |
| J-9396 | Compressor Holding Fixture |
| J-9397 (-1 base) (-2 nut) (-3 leg) | Compressing Fixture |
| J-9399 | Pulley Lock Nut Remover (9/16" special thin wall socket) |
| J-9401 (-1 body) (-2 screw) | Armature Plate & Hub Assembly Remover |
| J-9402 | Parts Tray |
| J-9403 | Armature Plate & Hub Holding Tool (Spanner) |
| J-9432 | Mainshaft Needle Bearing Installer |
| J-9433 | Suction Crossover Seal Installer |
| J-9450 | Temperature Tester (3 lead Thermocouple) |
| J-9459 (2 required) | 90° Gauge Fittings Adapter (Schrader Valve Depresser) |
| J-9480 (-1 screw) (-2 spacer) (-3 nut) | Armature Plate & Hub Assembly Installer |
| J-9481 | Compressor Pulley & Bearing Assembly Installer (Use with J-8092 Handle) |
| J-9505 | S.T.V. Adjusting Spanner |
| J-9508 | Refrigerant Hose Remover |
| J-9521 | Internal Mechanism Support Block |
| J-9544 | .0005" Dial Indicator |
| J-9553 | Shaft Seal Seat O-Ring Remover |
| J-9661 | Compressor Shoe Gauge Set |
| J-9625 | Compressor Test & Storage Plate |

# CIRC-L-AIRE CONDITIONER

CONTENTS OF THIS SECTION



## DESCRIPTION AND OPERATING INSTRUCTIONS

### GENERAL DESCRIPTION

Pontiac's Circ-L-Aire Conditioner is combined with the heater to provide a year-round air conditioning system. This permits the air blower to be used for both air conditioning and/or heater operation. All outside air entering the system is taken through hood high cowl vents, providing air free of dust, foreign material, and undesirable fumes.

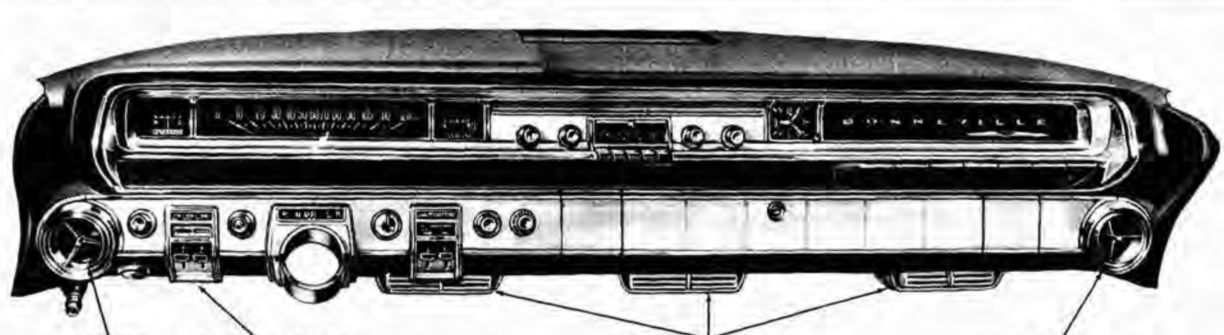



Fig. 5-1 Air Outlets and Controls

Pontiac's Circ-L-Aire Conditioning system may be operated to provide conditioned air taken from the outside or air taken from the inside of the car and recirculated. The use of outside air exclusively provides constant and rapidly changing air inside the car, eliminating a stuffy, smoke-filled interior and keeps the occupants fresh and comfortable. The use of air taken from the inside of the car and recirculated permits cooled inside air inside the car to be drawn through the cooling coils when outside air is unwanted or when greater cooling is desired.

The driver has fingertip control of the temperature of conditioned air entering the car. When air conditioning is desired, the blower forces air taken from the hood high cowl air inlet housing through the evaporator core (cooling coils), and is directed through an air distributing system to the air outlets. When heated air is desired, the blower forces air taken from the hood high cowl air inlet housing through the heater core to the heater air outlets.

During mild or rainy weather both the air conditioning system and heater system may be operated together to provide the degree of comfort desired.

The design of the air conditioning air system, its valves and controls, permits a method of obtaining many different amounts of forced air flow for ventilation. Innumerable degrees of comfort may be easily obtained by drawing air from outside or inside the car with the refrigeration system operating.

## AIR OUTLETS AND CONTROLS

### AIR OUTLETS

Refrigerated air enters the interior of the car through five outlets in the instrument panel (Fig. 5-1), and through a number of holes in the bottom and left end of the air outlet duct which directs cooled air to the passenger's and driver's legs.

An air outlet located at each end of the instrument panel can be individually controlled to provide a comfortable air flow in any direction desired by the occupants.

The center outlets (three), affixed to the lower part of the instrument panel, contain a vaned rotary valve which can be adjusted to change vertical direction of air flow.

### CONTROL PANEL PUSH BUTTONS

The control panel is located to the left of the steering column on the lower section of the instrument panel. Three push buttons across the top of the panel control air flow through the system: "OFF", "OUTSIDE" and "INSIDE" (Fig. 5-2).

This push button selector panel directs vacuum to diaphragms which, by mechanical linkage, cause air control valves to function in the following manner (all heater controls and the left-hand cowl ventilation control must be in "OFF" position for maximum air conditioning performance):

1. "OFF" button pushed in ("OUTSIDE" and "INSIDE" buttons in out position): No air flow, no cooling.

2. "OUTSIDE" button pushed in ("OFF" and "INSIDE" buttons in out position): Blower on and outside air is admitted into the car through air conditioning outlets located at each end and the center of the instrument panel.

3. "INSIDE" button pushed in ("OFF" and "OUTSIDE" buttons in out position): Blower on and air inside the car is recirculated to re-enter the interior of the car through air conditioning outlets.

NOTE: When the recirculation air valve is opened, it swings out to cover all but approximately 15% of the outside air inlet opening. This small amount of

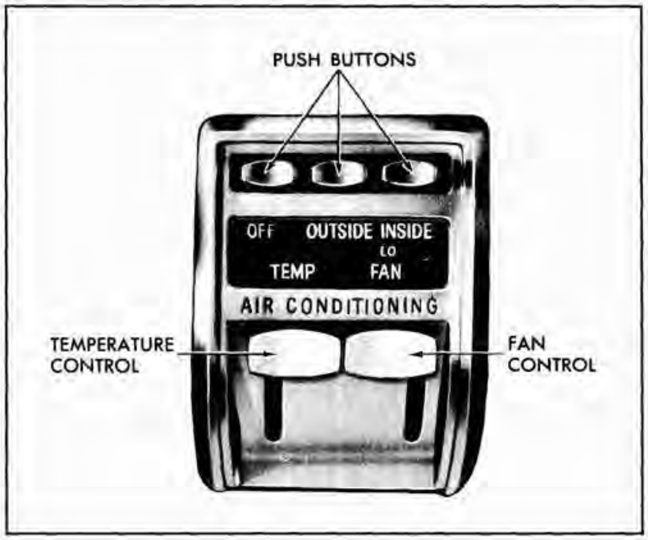



Fig. 5-2 Circ-L-Aire Conditioner Control Panel

outside air is mixed with recirculated air at all times to prevent infiltration of hot outside air through small openings in the car body, and aids in eliminating a stuffy, smoke-filled interior, thereby keeping the occupants fresh and comfortable.

## BLOWER CONTROL

The blower control lever is located in the lower left part of the control panel. A vertically sliding lever controls four blower speeds to regulate the amount of forced air movement.

When the blower control lever is in the up position, the letters "LO" appear in the "FAN" window and the blower operates at low speed. When the blower control lever is in the down position, the letters "HI" appear in the "FAN" window and the blower operates at high speed. Between the extreme up and down positions, "2" and "3" appear in the window and the blower operates at two medium speeds.

The blower always operates in one of the four speed positions whenever the air conditioner control panel push buttons labeled "OUTSIDE" or "INSIDE" are pushed in.

## TEMPERATURE CONTROL

The temperature control lever is located in the lower right part of the control panel.

A vertically sliding lever activates the air conditioning compressor and also tailors inside temperature. In the extreme up position the compressor does not operate because the compressor clutch switch is open. This feature permits forced air for ventilation without cooling the air. As the temperature control lever is depressed slightly the compressor clutch switch closes to energize the compressor clutch coil to engage the clutch.

A dial opening in the panel above the lever shows progressively increasing bands of blue color to indicate increased cooling. Maximum cooling is obtained when the lever is in the full down position.

## OPERATING INSTRUCTIONS

To cool a car under various weather and driving conditions, use the following control settings:

### *FAST COOL DOWN*

(CAR WHICH HAS BEEN STANDING IN HOT SUN)

| CONTROL | SETTING |
|---|---|
| Push button | "OUTSIDE" pushed in for two or three minutes, then "INSIDE" |
| Blower control lever | down, for high speed |
| Temperature control lever | down, for maximum cooling |
| Nozzles | position as desired |
| Center air nozzles | position as desired |
| Car windows | wide open for two or three minutes to expel hot air, then closed |

### *SLOW CITY DRIVING*

| CONTROL | SETTING |
|---|---|
| Push button | "INSIDE" pushed in |
| Blower control lever | down, for high speed |
| Temperature control lever | down, for maximum cooling |
| Nozzles | position as desired |
| Center air nozzles | position as desired |
| Car windows | closed |

NOTE: Under extreme heat conditions, additional cooling may be obtained if the car is operated with transmission control lever in drive right range.

### NORMAL WARM WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Push button | "OUTSIDE" pushed in |
| Blower control lever | up, for low speed, or in "2" or "3" speed position |
| Temperature control lever | position to obtain desired temperature at nozzles |
| Nozzles | to direct air stream along roof for indirect cooling |
| Center air nozzles | position as desired |
| Car windows | closed |

### HOT WEATHER HIGHWAY CRUISING

| CONTROL | SETTING |
|---|---|
| Push button | "OUTSIDE" pushed in or "INSIDE" pushed in if air inside car is to be recirculated |
| Blower control lever | down, for high speed |
| Temperature control lever | down for maximum cooling |
| Nozzles | position as desired |
| Center air nozzles | position as desired |
| Car windows | closed |

## TIPS ON USE OF AIR CONDITIONING SYSTEM

### KEEPING COMFORTABLE IN EXTREMELY HUMID "MUGGY" WEATHER

When the relative humidity is extremely high causing discomfort on a day when the temperature is 75°F.-80°F. depress the "INSIDE" button and move the temperature control lever down slightly. This will operate the refrigeration system and provide minimum cooling. Move the blower control lever to the up position (low speed) to recirculate inside air, thereby rapidly dehumidifying the air inside the car.

### KEEPING COMFORTABLE IN MILD WEATHER

When the weather is cool, but the sun is very bright as in spring or fall or at high altitudes, use both the heater and the air conditioner at the same time, setting the temperature controls, blower speed and nozzle positions for desired comfort.

### CONTROLLING TEMPERATURE IN CAR

The most satisfactory method of controlling the temperature in the car is to:

1. Set blower speed for your personal comfort;

2. Position temperature control lever as necessary to maintain the desired temperature in the car;

3. Depress "OUTSIDE" or "INSIDE" push button for desired source of air for cooling inside of car;

4. Use sun visors to reduce direct sun rays on front seat passengers.

NOTE: E-Z-Eye glass is a great aid in keeping cool since it reduces glare and aids in protecting passengers from much of the direct rays of the sun.

### USING THE AIR CONDITIONING SYSTEM FOR VENTILATION

The air conditioning system is designed so that it can also be used for ventilation when it is not necessary to cool the air by refrigeration. Ventilation may be obtained by placing the temperature control lever in the extreme up position, depressing the "OUTSIDE" or "INSIDE" push button, and selecting the amount of air flow desired by positioning the blower control lever to "LO", "2", "3", or "HI" speed.

## DIFFERENCES IN THE AIR CONDITIONED CAR

Pontiac models equipped with Circ-L-Aire Conditioning have been specially engineered to accommodate the extra weight, power requirements, and electrical loads of the air conditioning system.

Following is a listing of the major differences that will be found in these models. Before attempting to order these or related parts for an air conditioned equipped car, consult the latest parts information for correct part numbers.

Air Vent (at kick pad)

Only at left side.

Battery

Heavy duty to improve hot starting on factory installed cars.

Compressor Drive Belt

15/32" belt connecting compressor pulley and harmonic balancer only.

Cooling System Capacity

All Models—18.5 qts. less heater, 19.5 qts. with heater.

Engine Fuel System

Incorporates a vapor separator. The gasoline vapor separator cover has two outlets: one to the carburetor, the other outlet has a small restriction in the filter assembly cover which permits fuel vapor to return to the bottom of the fuel tank via the fuel tank gauge unit. (A ¼" dia. steel tube connects the filter cover and the tank gauge unit.)

A fuel antisurge air dome is located at fuel pump inlet.

A fuel filter is located just above fuel pump in fuel line to carburetor.

Engine Oil Level Indicator

Permits greater accessibility to engine oil dip stick.

Fan Assembly

Seven-bladed fan to give more air flow for greater cooling capacity.

Fan Clutch

Regulate fan speed, so that fan runs slowly except when hot weather requires increased fan speed for good engine cooling.

Fan Shroud

To direct air flow for greater cooling capacity at idle.

Front Springs

Heavier springs to accommodate extra weight (approximately 80 lbs. at each spring).

Generator Assembly

Heavy duty, 45 ampere generator to accommodate higher electrical loads.

Generator Regulator Assembly

Heavy duty, 45 ampere.

Generator Mounting

Special brackets to realign generator so it is driven by fan and water pump drive belt.

Harmonic Balancer

Changed to accommodate the compressor drive belt.

Ignition Switch

Incorporates a ground terminal in the switch to block out the air conditioning system when starting the car.

Radiator Assembly

Increased heat constant of core for better cooling.

Regular Fuel Engine

The heavy duty starter and battery are included on factory installed Circ-L-Aire Conditioners with regular fuel engine.

Starter

Heavy duty to improve hot starting on factory installations only.

Tires

8:50-14 tires on all sedans and coupes.

E-Z Eye Glass and Cars Painted with Light Colors

Desirable as these reflect some of sun's rays and some added cooling can be obtained.

# DESCRIPTION AND OPERATION OF THE CIRC-L-AIRE CONDITIONER

CONTENTS OF THIS SECTION



## DESCRIPTION AND OPERATION OF INDIVIDUAL UNITS

Fig. 5-3 illustrates the location of units of the Circ-L-Aire Conditioning System as combined with the Circ-L-Aire Heating System. Each of the units in the air conditioning system is described on the following pages.

## REFRIGERATION CIRCUIT IN PONTIAC'S CIRC-L-AIRE CONDITIONING SYSTEM

Cool Refrigerant-12 gas is drawn into the compressor from the evaporator and pumped from the compressor to the condenser under high pressure (Fig. 5-4). This high pressure gas being pumped to the condenser will have a high temperature as a result of

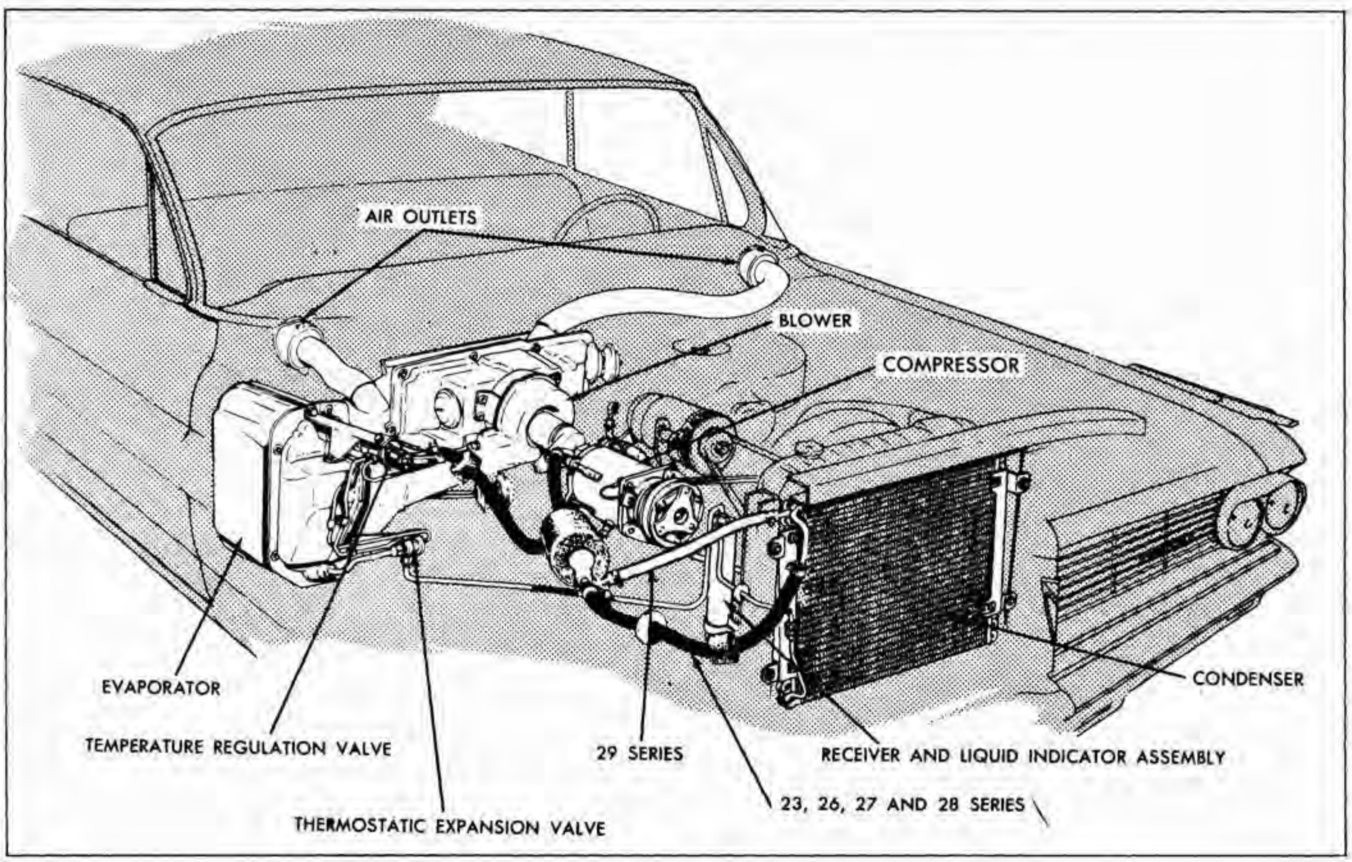



Fig. 5-3 Location of Units in the Circ-L-Aire Conditioner System

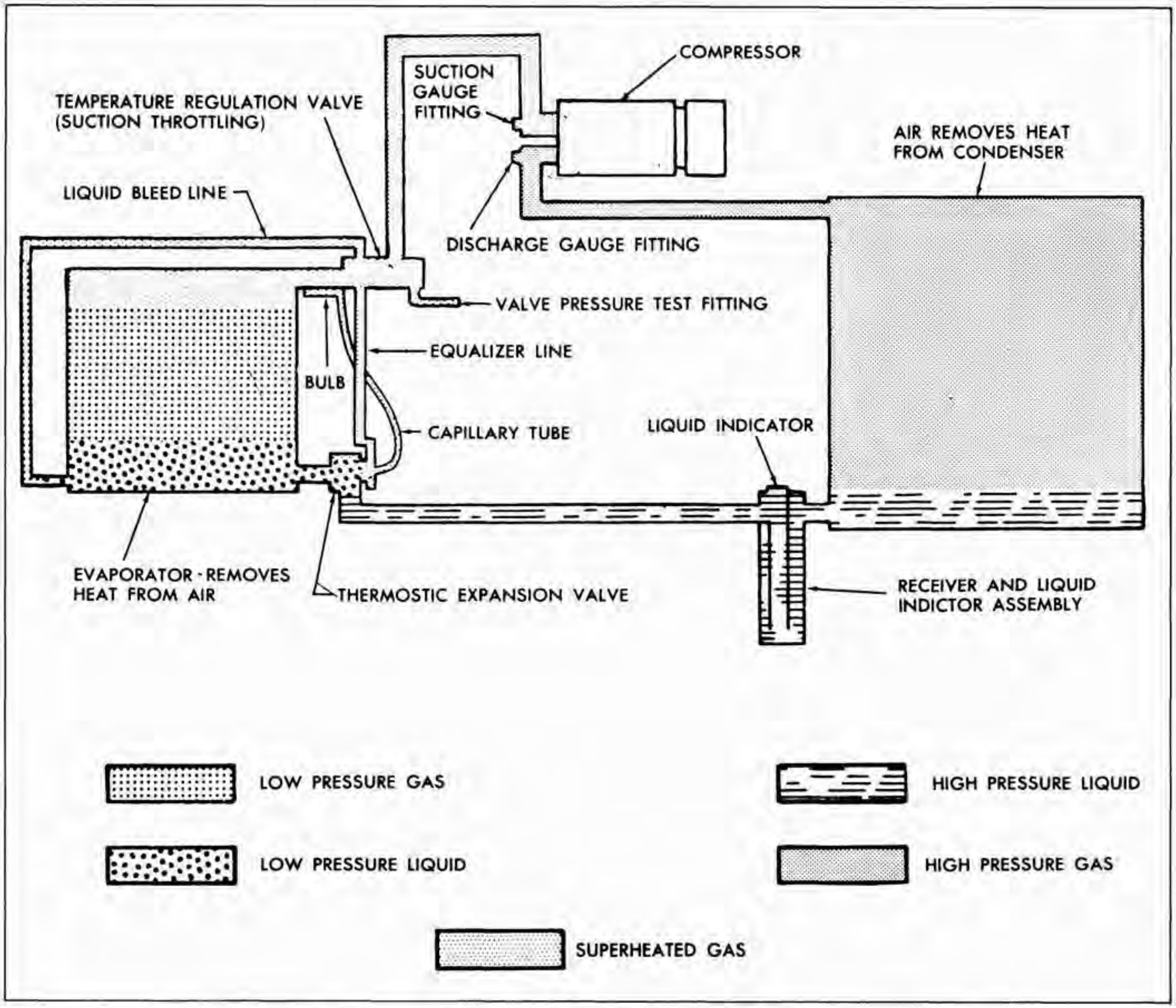



Fig. 5-4 Refrigeration Circuit for the Circ-L-Aire Conditioner System

being subjected to compression. As it passes through the condenser, the high pressure high temperature gas rejects its heat to the outside air, as the air passes over the metal surfaces of the condenser. This cooling of the gas causes it to condense into liquid refrigerant and drop to the bottom of the condenser.

The liquid refrigerant, still under high pressure, then passes from the bottom of the condenser into the receiver and liquid indicator assembly, of which the receiver portion of this assembly acts as a reservoir for the liquid refrigerant.

Liquid refrigerant from the receiver and liquid indicator assembly flows (under pressure) to the thermostatic expansion valve.

The thermostatic expansion valve meters the high pressure liquid refrigerant flow into the evaporator. Since the pressure in the evaporator is relatively low, the refrigerant immediately begins to boil. As the refrigerant passes through the evaporator, it continues to boil, drawing heat from the surface of the evaporator core, warmed by the air passing over the surfaces of evaporator core.

In addition to warm air passing over the evaporator rejecting its heat to cooler surfaces of the evaporator core, any moisture in the air condenses on the cool surfaces of the core, resulting in cool dehydrated air entering inside the car. By the time the refrigerant gas leaves the evaporator, it has completely vaporized and is slightly superheated.

Refrigerant passing through the evaporator is directed through a temperature regulation valve and then returned to the compressor where the refrigeration cycle is repeated.

The pressure in the evaporator is so controlled at its lowest pressure setting that any moisture condensing on the evaporator surface will not freeze. If pressure drops below the lowest controlled pressure setting, refrigerant and oil by-passes the evaporator core, to flow directly through the temperature regulation valve and then to the compressor.

## COMPRESSOR

### GENERAL

The compressor is of basic double action piston design. Three horizontal double acting pistons make up a six-cylinder compressor, and are mounted axially around the compressor shaft to operate in a front and rear cylinder assembly. These pistons operate in a $1\frac{1}{2}''$ bore, have a $1\frac{3}{16}''$ stroke and are actuated by a swash plate pressed on the compressor crankshaft. See Figs. 5-5 and 5-6.

Reed type suction and discharge valves are mounted in valve plates between the cylinder assembly and the head at each end of the compressor. The heads are connected with each other by gas-tight passage ways which direct refrigerant gas to a common output.

### SUCTION VALVES

A three-reed suction valve disc is assembled to both the front and rear cylinder heads. These reeds open when the pistons are on the intake portion of their stroke to allow the low pressure vapor to flow into the cylinders.

When the pistons reverse and are on the compression portion of their stroke, the reed valve closes against their seats to prevent the high pressure vapor from being forced back into the low side of the system.

### DISCHARGE VALVES

There are two discharge valve plate assemblies, each having three reeds and retainers positioned to direct the high pressure vapor from the cylinders into the outer annular cavities of the front and rear head castings. When the piston has completed its compression stroke and reverses to the suction stroke, the high pressure vapor in the discharge cavity causes the reeds to close, thus maintaining the differential of pressure between the high and low pressure areas.

### CYLINDER HEAD

Each cylinder head contains suction and discharge cavities. In addition, the rear head contains an oil pump cavity, in the center of the suction cavity, to house the oil pump gears (which are driven by the compressor mainshaft). The suction cavity is in the center and indexes with the suction reeds. The discharge cavity is around the outside and indexes with the discharge reeds.

These cavities are sealed from each other with a teflon seal molded onto the cylinder head. The discharge cavity is sealed from the outside of the compressor by an O-ring seal which rests in a chamfered relief in the cylinder head and compresses against the compressor body.

Both cylinder heads are connected with each other; the suction cavities by a flat suction crossover "cover," the discharge cavity by a tube pressed into each head. (Service discharge crossover tube assemblies are seated with O-rings and spacers.)

### OIL PUMP

An oil pump mounted at the rear of the compressor picks up oil from the bottom of the compressor oil sump and pumps it to the internal parts.

The multi-lobed oil pump gears are made of sintered iron. The inner gear is the driver and has a "D" shaped hole in the center which fits over a matching "D" flat on the rear of the mainshaft. The outer gear, which is driven, has internal gear teeth mating with the external teeth on the inner (drive) gear.

### OIL FLOW

The internal parts of the compressor are lubricated with this oil pump. Oil is picked up from the sump by the oil pump gears through the pick-up tube and into the pump cavity. From here oil is forced through the drilled hole, through the center of the mainshaft assembly and to three outlets; one at each mainshaft thrust bearing and at the compressor shaft seal assembly.

Oil from the mainshaft seal assembly drains back into the sump via a hole built in the discharge plate, a notched slot in the suction reed that indexes with a cast passage (slanted) in the front face of the front head casting, around the mainshaft and through the mainshaft front bearing, between the mainshaft and front head casting hub, to the mainshaft front thrust bearing and into the sump.

Oil directed through each mainshaft thrust bearing flows through the bearing and dumps into the sump.

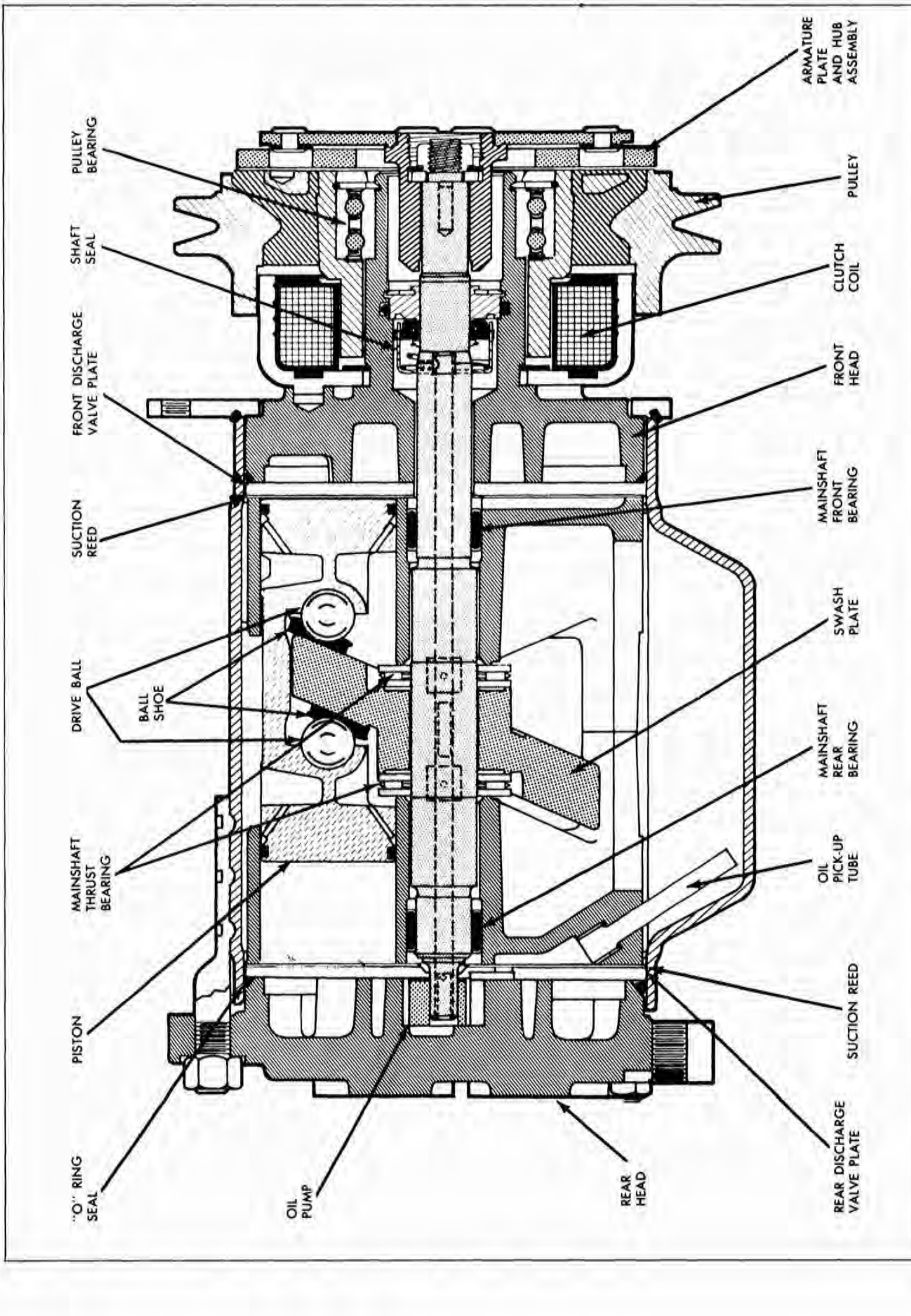
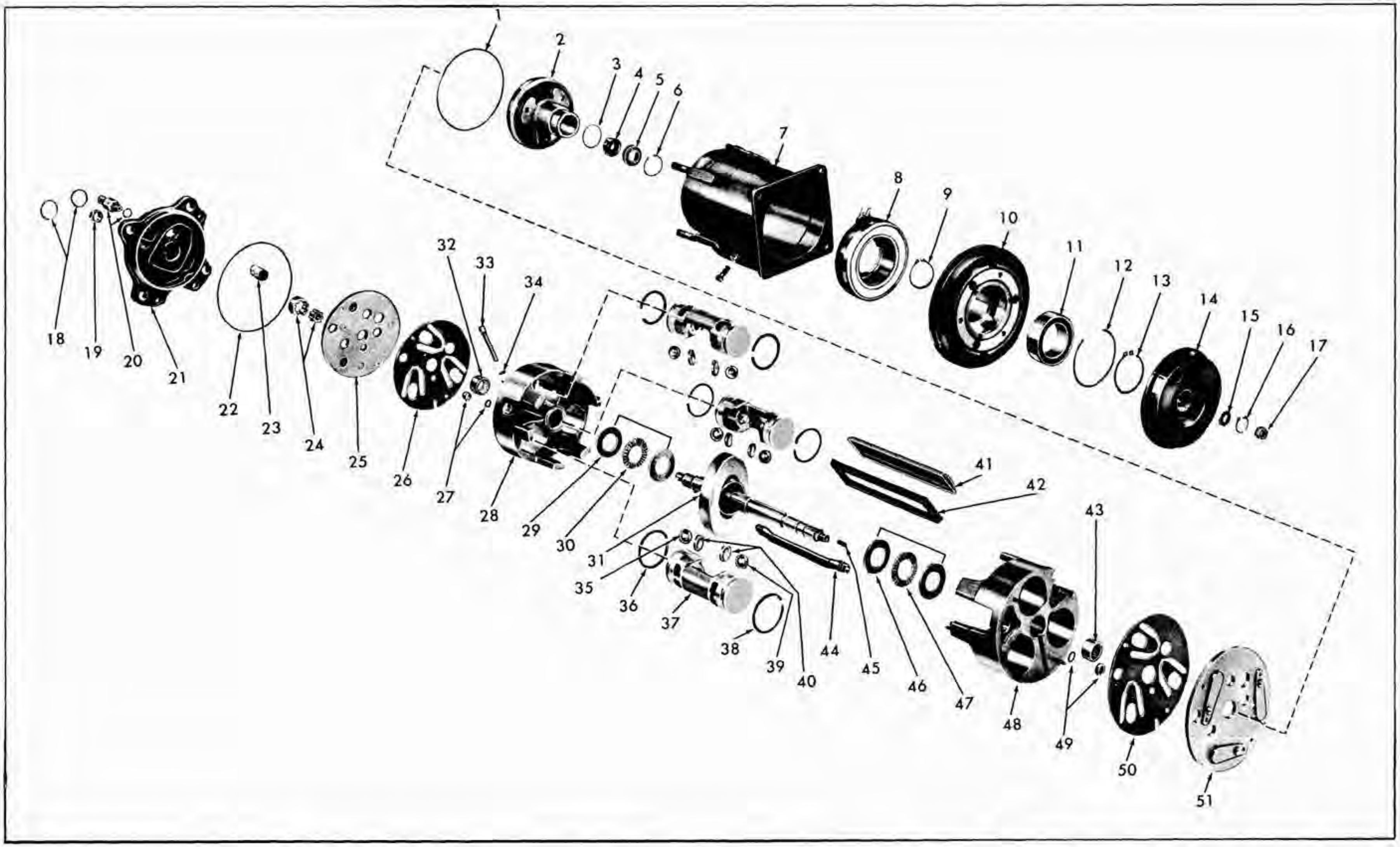



Fig. 5-5 Cross Section of Six Cylinder Compressor Assembly




1. Front Head to Shell "O" Ring
2. Front Head Assembly
3. Seal Seat "O" Ring
4. Shaft Seal Assembly
5. Shaft Seal Seat
6. Seal Seat Retainer Snap Ring
7. Compressor Shell
8. Clutch Coil
9. Clutch Coil Snap Ring
10. Pulley Assembly
11. Pulley Bearing
12. Pulley Bearing Retainer Ring
13. Pulley Brg. to Head Ring
14. Armature Plate and Hub Assembly
15. Armature Plate and Hub Spacer
16. Armature Plate and Hub to Mainshaft Spacer Retainer
17. Armature Plate and Hub Lock Nut
18. Fittings "O" Rings
19. Rear Head to Shell Locking Nut (4)
20. High Pressure Relief Valve and "O" Ring
21. Rear Head Assembly
22. Rear Head to Shell "O" Ring
23. Inlet Screen
24. Oil Pump Gears
25. Rear Discharge Plate Assembly
26. Rear Suction Reed
27. Discharge Crossover Tube Spacer and Gasket
28. Cylinder—Rear Half
29. Rear Thrust Bearing Selective Races
30. Rear Thrust Bearing
31. Swash Plate and Mainshaft Assembly
32. Mainshaft Rear Bearing
33. Oil Pick-Up Tube
34. Oil Pick-Up Tube "O" Ring
35. Piston Drive Ball (6)
36. Piston Ring (6)
37. Piston (3)
38. Piston Ring
39. Piston Drive Ball
40. Piston Ball Shoe (6)
41. Suction Crossover Cover
42. Suction Crossover Cover Gasket
43. Mainshaft Front Bearing
44. Discharge Crossover Tube
45. Armature Plate and Hub to Mainshaft Key
46. Front Thrust Bearing
47. Front Thrust Bearing Selective Races
48. Cylinder—Front Half
49. Discharge Crossover Tube Gasket and Spacer
50. Front Suction Reed
51. Front Discharge Plate Assy.

Fig. 5-6 Six Cylinder Compressor Assembly—Exploded View

The mainshaft rear bearing is lubricated from oil emitting from clearances at the oil pump gears.

Oil that travels with the refrigerant into the compressor assembly that is forced by the piston rings returns to the sump as the pistons travel on their suction stroke. The design of the piston rings is such that the scraper grooves at the side of the ring facing the inside of the compressor forces the oil through two oil return holes behind the ring groove (and extend toward the center area of the piston) to dump oil into the compressor sump.

### MAINSHAFT

The compressor mainshaft is driven by the pulley when the clutch coil is energized. It extends through the compressor front head, to the compressor rear head and drives the oil pump in the rear head pump cavities. The shaft is supported by a needle bearing located in the front half of the cylinder and a similar needle bearing in the rear half of the cylinder.

A 3/16" diameter oil hole in the shaft extends from the rear oil pump cavity to the shaft seal cavity. Four .078" (5/64") diameter holes are drilled 90° to the main oil passage. These drilled passages direct oil under pump pressure to the shaft seal surfaces, thrust bearings, and shaft roller needle bearings.

### THRUST BEARINGS AND RACES

Two flat-type thrust needle bearings are seated around the shaft and are located near the center of the compressor. These bearings have rollers placed radially in their separators. Each bearing is "sandwiched" between two steel thrust races, and this combination of three pieces is placed between the shoulders of the swash plate and the shoulders of the cylinder hubs on the front and rear halves of the cylinder.

The FRONT end combination, consisting of a needle bearing with a thrust race on each side, is selected to provide the proper piston head clearance below the top of cylinder and the underside of the suction and discharge valve plates.

The REAR end combination, consisting of a needle bearing with a thrust race on each side, is selected to obtain .0003" (low limit) to .0013" (high limit) running clearance between the hub surfaces of the swash plate and the front and rear hubs of the cylinder. This allows .001" tolerance between the high and low limits of running clearance.

### CYLINDER BLOCK

The cylinder block consists of two halves, front and rear. Three piston bores in each half are line bored as one piece during production to assure proper alignment and parallelism. After boring, the cylinder block is cut apart at the center and the faces are ground parallel to the two outer ends of the cylinder.

Alignment and register of the two halves is maintained by two cylindrical locator (squeeze) pins. It is important that the two halves of the cylinder be kept together to assure correct relationship of parts.

### PISTONS

The double end pistons are made of cast aluminum, with a "bridge" connecting each end. Each piston has a notch cast in this bridge. This notched end of the piston is positioned toward the FRONT end (pulley end) of the compressor.

Both ends of the pistons have a groove to receive a piston ring. Two oil return holes are drilled behind the ring groove and extend toward the center area of the piston to "dump" oil to the compressor oil sump. The piston rings have an oil scraper groove at one edge (toward the center of the piston) to wipe any excess oil back into the oil sump (reservoir) through the oil return holes.

A spherical cavity is located in the inside center on each side of the pistons to receive the hardened steel piston drive balls.

### SHOE DISCS

Shoe discs are made of bronze and one side is a flat surface which contacts the surface of the swash plate. The opposite side has a coined concave surface into which is assembled the piston drive ball.

These shoes are provided in .0005" thickness variations and ten sizes are available for servicing these parts. Included in these ten is a basic ZERO shoe to permit simple gauging operations.

All service shoes will be marked with the shoe size, which will also correspond to the last three digits of the piece part number.

### SWASH PLATE

An angular shaped member (swash plate) is located near the center of the compressor. The swash plate changes the rotating action of the shaft to provide a reciprocating driving force to each of the three pistons. (This driving force is applied, through the shoes and balls, to the midpoint of each of the double end pistons.) The swash plate has two angular faces ground smooth and parallel to permit smooth sliding of the shoe discs.

The plate is a .0005"-.0010" press fit onto the 3/4" diameter shaft and is positioned by a Woodruff key located in the shaft.

### SUCTION CROSS-OVER AND COVER

Since the pistons are double-acting, low pressure vapor from the cooling coil must be supplied to both ends of the compressor and pistons.

The inlet (suction) port on the rear head of the compressor is connected by a hose to the outlet side of the evaporator (cooling coil). A fine mesh suction screen is located in the low pressure inlet cavity of the rear head. Its purpose is to trap any material (larger than the mesh size) that would damage the compressor mechanism.

A flat rectangular cavity is cast into the outer face of the front and rear cylinder block halves. The edges of this cavity are machined into a "dove-tail" shape to retain a rectangular suction cross-over cover, with a neoprene gasket around its edges. This cover and gasket forms a passage for the low pressure vapor to flow from the rear head of the compressor to the front head and thus supply suction refrigerant to the pistons and cylinders at the front of the compressor.

The sides of the cover gasket seal the cover to the suction cross-over cavity and the narrow ends of the gasket form a seal with the under side of the suction and discharge valves when they are assembled to the cylinder heads.

### DISCHARGE CROSS-OVER TUBE—PRODUCTION TYPE

The double acting pistons also produce high pressure vapor at both ends of the compressor. The outlet (discharge) port for the high pressure vapor is located in the *rear* head of the compressor.

A discharge vapor tube is used to connect the front head discharge cavity to the rear head discharge cavity. This tube has cylindrical ends that are spun into holes in the front and rear cylinder head halves to provide a vapor-tight joint. The center of this tube has a flattened cross-section to provide clearance between the swash plate and tube.

When the pistons in the front end of the cylinder are on their compression stroke, the high pressure vapor is caused to flow into the discharge cavity in the front head, through the discharge tube and into the rear head discharge cavity. This vapor combines with the high pressure vapor produced by the pistons in the rear cylinder head during their compression stroke and flows out the compressor discharge port.

### DISCHARGE CROSS-OVER TUBE—SERVICE TYPE

The purpose, function, and design of the service discharge tube is the same as that for the production type tube with the exception of shouldered sleeves located in both ends of the service tube. These shoulders provide a surface for the O-rings and compression bushings. Since the production discharge tube is vapor sealed to the front and rear cylinder heads by "spinning in" the ends of the tube, equipment to perform this "spin in" operation during service operations would not be economical. Therefore, if it should be necessary to separate the cylinder halves during a service operation, a service type discharge tube should be used when reassembling the mechanism.

### PRESSURE RELIEF VALVE

The compressor is fitted with a high pressure relief valve. If the discharge pressure ever exceeds approximately 440 psi, the relief valve opens automatically to relieve the pressure and closes again when the pressure recedes.

Opening of the relief valve will be accompanied by a loud popping noise and perhaps the ejection of some oil with the refrigerant. Any condition that causes this valve to open should be corrected immediately.

### OIL TEST OUTLET

An oil test outlet is located on the under side of the compressor shell. This outlet is a screw having a hole drilled lengthwise through its center to the head which indexes with a hole drilled crosswise just above the head. This allows oil to enter the drilled holes and be emitted when the screw is loosened.

The proper method of checking oil level is outlined under CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL.

### SHELL

The shell of the compressor has a mounting flange on the front end and four threaded screws welded to the outside at the rear. An oil sump is formed into the bottom of the shell, with a baffle plate over the sump on the inside of the shell. There is an oil charging screw and gasket (which also serves as an oil test outlet) in the wall of the shell.

The compressor serial number is located on a plate on top of the compressor. This number should be included in all Product Information Reports, claims or correspondence concerning the compressor. The compressor part number is also shown on the serial number plate and bears the reference of "Model 6550109".

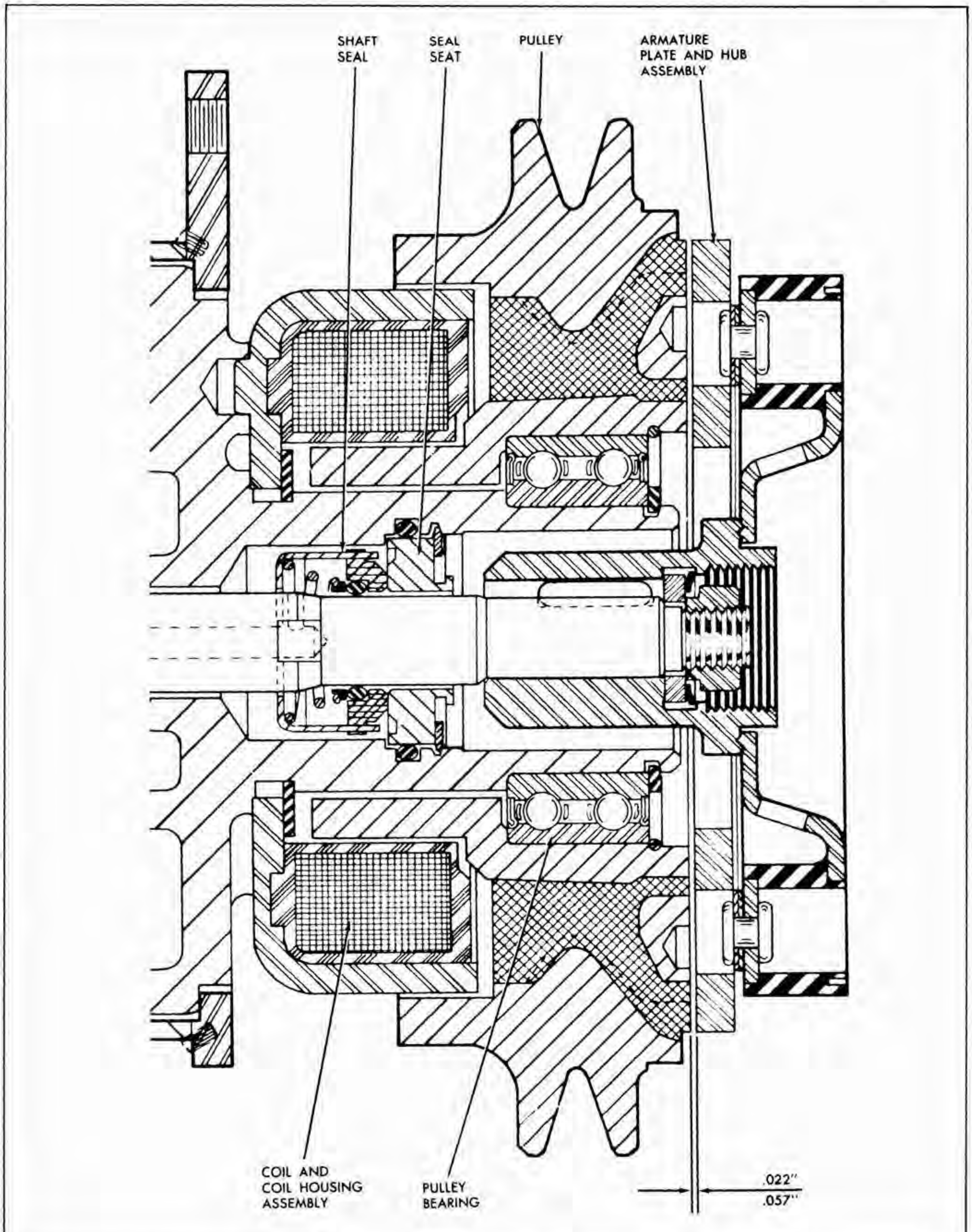



Fig. 5-7 Cross Section of Six Cylinder Clutch Assembly

## *CLUTCH AND PULLEY ASSEMBLY (See Fig. 5-7)*

The pulley assembly contains an electrically controlled magnetic clutch, permitting the compressor to operate only when refrigerated air is desired.

When the temperature control lever is in the extreme up position or when the "OFF" button is pushed in, the circuit to the compressor clutch is open and the clutch is released. The compressor shaft does not turn, although the pulley is still being turned by the compressor belt.

The armature plate is the movable member of the clutch. The plate is attached to a driven ring by driver springs, which are riveted to the armature plate and the driven ring. The driven ring is attached to the clutch hub by a rubber disc, which is bonded to both the driven ring and the clutch hub. The clutch hub is pressed onto the compressor shaft and is aligned with a square drive key located in the keyway of the compressor shaft. This hub and drive plate assembly is retained by a spacer and retainer ring (assembled to the shaft) and is held in place with a hexagonal lock nut.

The rubber disc isolates the compressor shaft from the drive pulley to prevent vibrations from being transmitted either into or out of the compressor shaft.

The pulley hub and ring assembly consists of three parts: (1) pulley rim, which contains the belt groove; (2) power element ring, and (3) pulley hub. These parts are formed into an assembly by molding a frictional material between the hub and the rim. The power element ring is embedded in the forward face of the assembly, between the outer rim and the inner hub.

A two-row ball bearing is pressed into the hub of the pulley and held in place by a retainer ring. This pulley and bearing assembly is pressed over the front head of the compressor and held in place by a retainer ring.

## *CLUTCH COIL*

The clutch actuating coil is molded into the coil housing with a potted epoxy resin; therefore, the coil and housing is replaceable only as a complete assembly. The coil has 3.85 ohms resistance at 80°F. (surrounding temperature) and should not demand more than 3.2 amperes at 12V D.C.

Three protrusions on the rear face of the coil housing fit into alignment holes in the front head of the compressor. When the coil and housing assembly is aligned and engaged with the front head (and indexed with the protrusions), it is secured in place by a retainer ring.

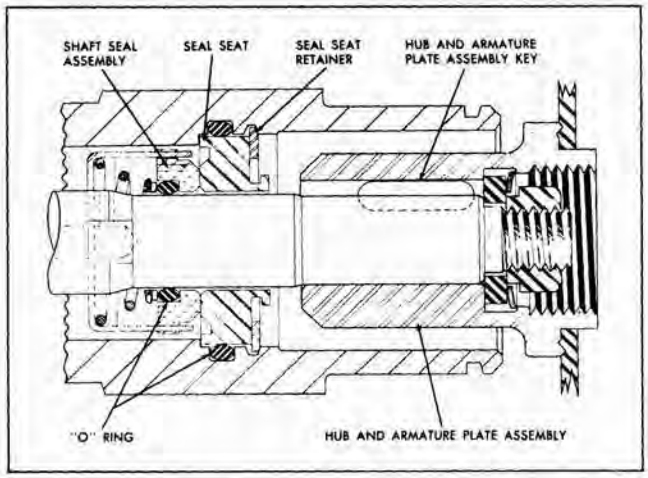



Fig. 5-8 Cross Section of Compressor Shaft Seal Area

## COMPRESSOR SHAFT SEAL

A replaceable seal is used at the front of the compressor to seal the air conditioning system from atmosphere when the compressor is operating or at rest, regardless of pressures in the compressor.

Components of the seal located in the neck of the front head of the compressor (Fig. 5-8) are the retaining ring, the small O-ring, the compressor spring-loaded shaft seal, the cast iron seal seat and the large O-ring. The seal indexes with two flats machined on the compressor shaft and turns with the compressor shaft.

A spring in the shaft seal assembly holds the seal against the seal seat, which is held stationary in the neck of the compressor front head by a retainer ring. (The tapered side of the retained ring should be assembled toward the front of the compressor.) Because of the constant pressures inside the compressor, the seal surfaces must be protected against any damage, such as scratches and nicks, (even finger markings may cause surface damage) to prevent oil and/or refrigerant leaks past this seal.

The small O-ring seals between the shaft and the seal, and the large O-ring seals between the seal seat and the compressor front head.

Service shaft seal parts are supplied in a complete kit containing all necessary replacement parts.

## COMPRESSOR OPERATION

With the "OUTSIDE" or "INSIDE" push button pushed in and the temperature control lever moved down slightly from the extreme up position, demand for cooling is met and these control settings close the electrical circuit to the compressor clutch.

Current flowing through the coil creates a magne*·* force which flows through the pulley to dra*·*

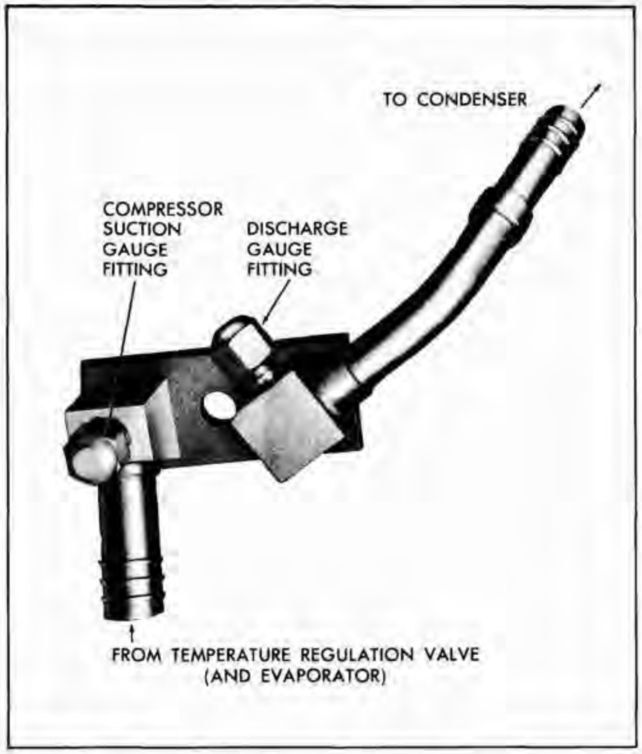



Fig. 5-9 Compressor Fittings Assembly

armature plate (forward of the pulley assembly) rearwardly toward the pulley. As the armature plate moves toward the pulley, it contacts the pulley face (which rotates freely about the compressor shaft).

The design of the clutch and coil is such that maximum magnetic holding force is obtained to magnetically lock the armature plate and pulley together as one unit. Since the clutch hub is pressed on, and keyed to, the compressor shaft, the compressor shaft will then turn with the pulley.

When the temperature lever is moved to the full up position or when the "OFF" push button is depressed, the electric circuit to the compressor clutch is opened and the magnetic pull on the clutch no longer exists. The armature plate to driven ring actuating springs will then pull the armature plate away from the pulley and the plate loses contact with the pulley. With the clutch released, the pulley rotates freely on its bearing. In this condition, the compressor shaft does not rotate.

It may be noted that if the air conditioning system was in use when the engine was turned off, the armature plate may remain in contact with the pulley, due to residual magnetism. This will cause no trouble, as the armature plate and pulley will separate as soon as the engine is started.

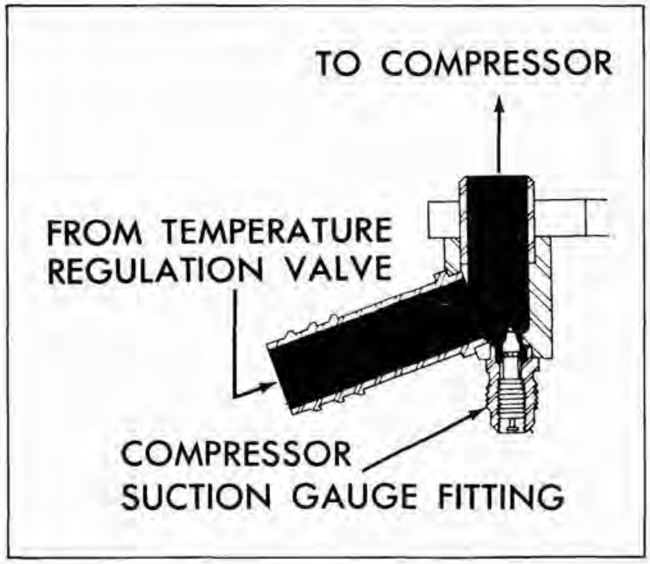



Fig. 5-10 Schematic of Suction Portion of Fittings Assembly

***COMPRESSOR FITTINGS ASSEMBLY***

The compressor fittings assembly (Fig. 5-9) contains an open passage into the compressor from the evaporator (low pressure) and an open passage from the compressor to the condenser.

A gauge fitting containing a Schrader valve is in the suction( Fig. 5-10) and discharge (Fig. 5-11) passages to permit pressure gauge readings at any time. These valves are also the means of servicing the refrigeration system whenever it is necessary to depressurize, evacuate or charge the system.

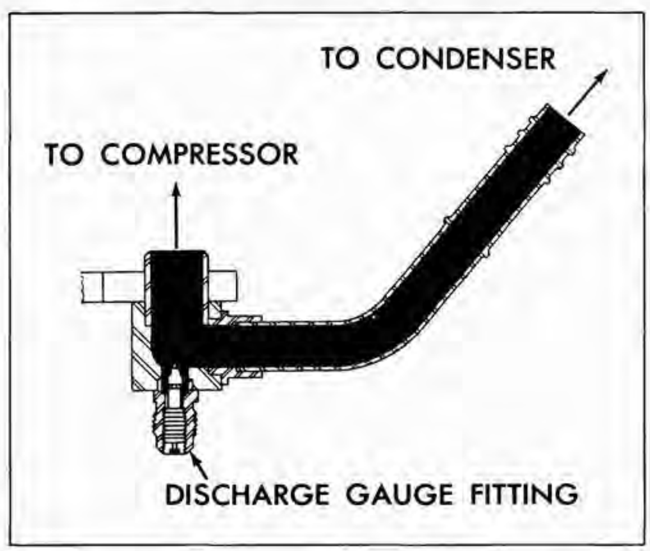



Fig. 5-11 Schematic of Discharge Portion of Fittings Assembly

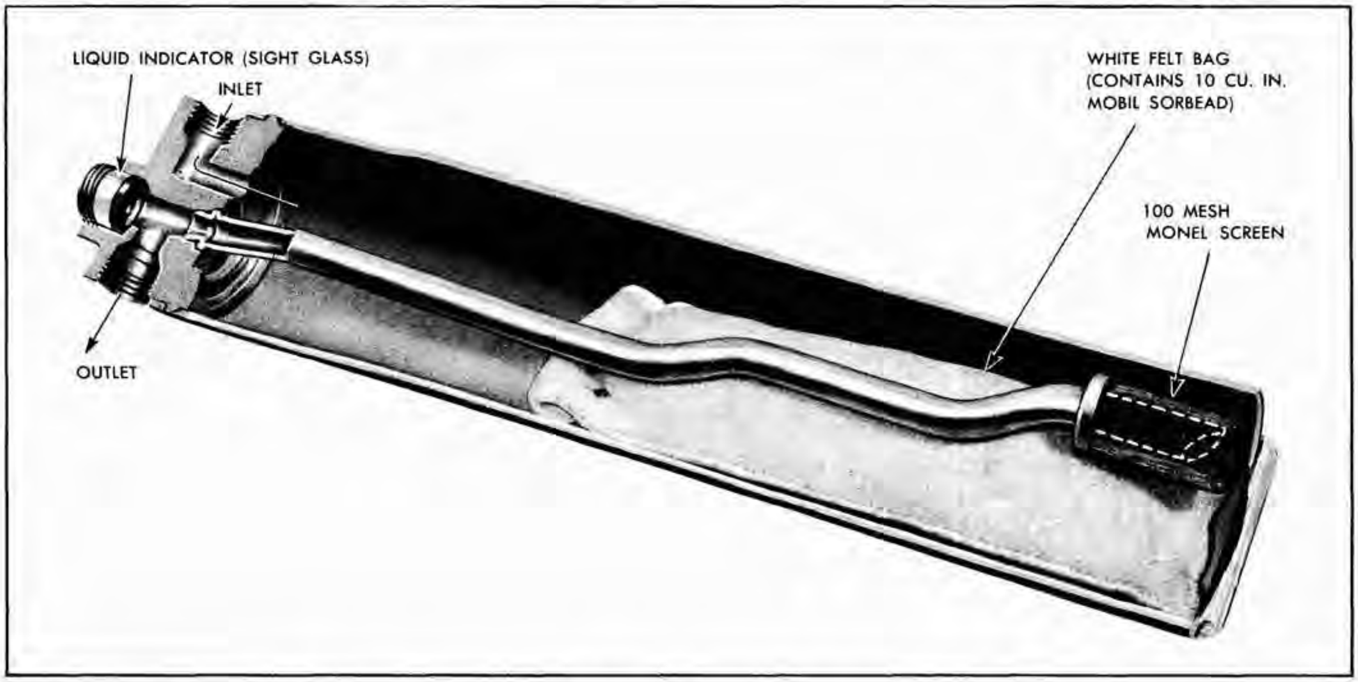



Fig. 5-12 Inside View of Receiver and Liquid Indicator Assembly

## CONDENSER

The condenser is similar to the ordinary car radiator but is designed to withstand much higher pressures. It is made up of tubes which carry the refrigerant and cooling fins which provide rapid transfer of heat. The condenser is made completely of aluminum.

The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the car and from the engine fan. Air passing over the condenser cools the hot high pressure refrigerant gas, causing it to condense into high pressure liquid refrigerant.

## RECEIVER AND LIQUID INDICATOR ASSEMBLY

The receiver and liquid indicator assembly is mounted vertically along the right rear side of the radiator support.

The purpose of the receiver part of this assembly is to insure a solid column of liquid refrigerant to the thermostatic expansion valve at all times, provided the system is properly charged.

The liquid indicator (many times referred to as a sight glass) serves no purpose in the refrigeration system except as an aid to diagnosis. It is possible to look into the interior of the indicator chamber through a glass window. The appearance of bubbles or foam beneath the sight glass (liquid indicator) above 70°F. ambient indicates air or a shortage of refrigerant in the system. Foam may be noted in the sight glass below 70°F. even when the system is free of air and properly charged. Details of these conditions are in the TROUBLE DIAGNOSIS Section.

Liquid refrigerant from the condenser enters the receiver to flow into the upper portion of the receiver which contains dessicant confined in a white felt bag that is not attached to anything but merely rests on the baffle in the lower portion of the receiver. As the refrigerant flows through an opening in the lower portion of the receiver, it is also filtered through a 100 mesh screen attached to a baffle at the bottom of the receiver. (See Fig. 5-12.)

The desiccant in this assembly is to absorb any moisture that might be present in the system after assembly. The screens trap any foreign material which may enter the system during assembly. (See Fig. 5-12.) These features of the assembly prevent obstruction to the valves or damage to the compressor.

NOTE: Markings on top of the receiver show the proper inlet and outlet fitting connections.

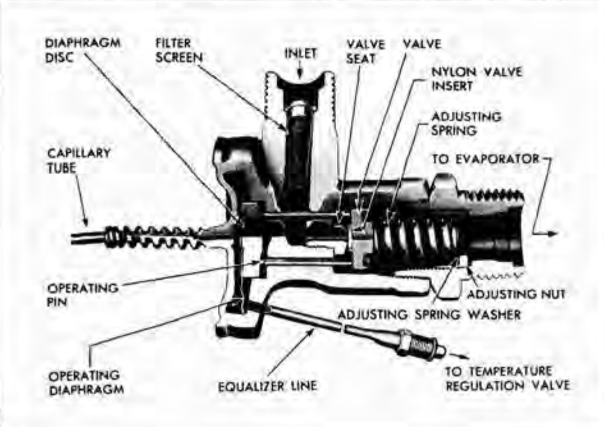



Fig. 5-13 Cross Section of Thermostatic Expansion Valve

# THERMOSTATIC EXPANSION VALVE

## DESCRIPTION

The thermostatic expansion valve (Fig. 5-13) consists of a capillary bulb and tube which is connected to an operating diaphragm (which is sealed within the valve itself) and an equalizer line which connects the valve and the low pressure return pipe.

The valve contains three operating pins (spaced approximately 120° apart), valve stationary seat, valve, valve carriage, adjusting spring and screw, an inlet which has a fine mesh screen, and an outlet connection (which attaches to the evaporator). The fine mesh screen at the inlet of the valve provides protection to the valve by preventing dirt and other foreign material from entering the valve.

While this valve is located at the inlet of the evaporator (at the bottom of the evaporator), the thermo bulb is attached to the evaporator outlet pipe (Fig. 5-14) and is insulated from temperature other than that of the evaporator outlet pipe.

The equalizer line joins the expansion valve to the temperature regulation valve so that compressor inlet pressure will register in the expansion valve. Under high load conditions this pressure is essentially the same as evaporator pressure, and the expansion valve functions in a normal manner. Under light load conditions (low ambient temperature or extreme modulation of outlet nozzle temperatures) the pressure transmitted to the expansion valve diaphragm is considerably lower than evaporator pressure. This low pressure, plus the thermo bulb reading on the evaporator outlet pipe, "tricks" the expansion valve into admitting more liquid refrigerant into the evaporator

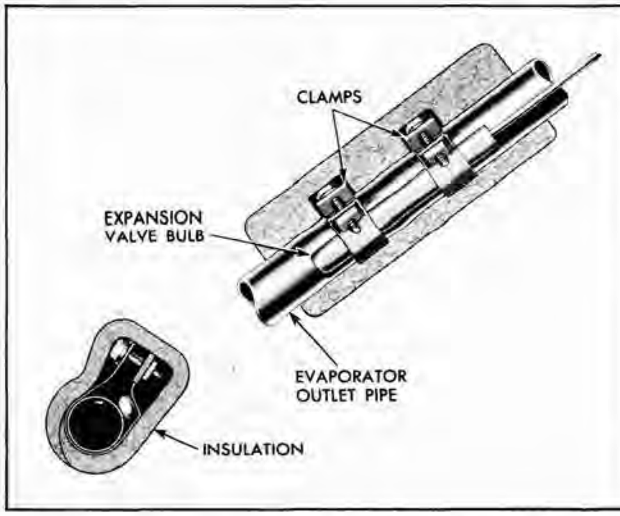



Fig. 5-14 Thermostatic Expansion Valve Bulb at Evaporator Outlet Pipe

than is required for the cooling demand. This high refrigerant flow rate insures that compressor oil will flow through the evaporator and back to the compressor, thereby keeping the compressor adequately supplied with oil, and preventing the evaporator from becoming oil-logged.

## FUNCTION

The purpose of the thermostatic expansion valve is to regulate the flow of liquid refrigerant into the evaporator automatically in accordance to the requirements of the evaporator.

This valve is the dividing point in the system between high pressure liquid refrigerant supplied from the receiver and relatively low pressure liquid and gaseous refrigerant in the evaporator. It is so designed that the temperature of the refrigerant at the evaporator outlet must have 6¾°F. of superheat before more refrigerant is allowed to enter the evaporator. Superheat is an increase in temperature of the gaseous refrigerant above the temperature at which the refrigerant vaporizes.

A capillary tube filled with carbon dioxide and the equalizer line provide the temperature regulation of the expansion valve. This capillary tube is fastened to the low pressure refrigerant pipe coming out of the evaporator so that it communicates the temperature of the refrigerant at this point to the expansion valve. If the superheat at the outlet decreases below 6¾°F., the expansion valve will automatically reduce the amount of refrigerant entering the evaporator, thus reducing the amount of cooling. If the superheat increases, the expansion valve will automatically allow more refrigerant to enter the evaporator, thus increasing the cooling.

The equalizer line joining the temperature regulation valve with the area behind the operating diaphragm acts with the capillary to measure superheat.

It is the temperature of the air passing over the evaporator core that determines the amount of refrigerant that will enter and pass through the evaporator. When the air is very warm, the heat transfer from the air to the refrigerant is great and a greater quantity of refrigerant is required to cool the air and to achieve the proper superheat on the refrigerant gas leaving the evaporator. When the air passing over the evaporator is cool, the heat transfer is small and a lesser quantity of refrigerant is required to cool the air and to achieve the proper superheat on the refrigerant gas leaving the evaporator.

A mechanical adjusting nut located within the valve is provided to regulate the amount of refrigerant flow through the valve and moves the spring seat to increase or decrease the tension on the valve carriage spring. By varying the tension on this spring, it is possible to regulate the point at which the valve begins to open or close, thereby regulating refrigerant flow into the evaporator. As this adjustment feature is inside the valve, *no external adjustment is possible.* All valves are preset at the time of manufacture.

Since the evaporator outlet pressure is proportionate to the amount of heat (superheat) picked up by the refrigerant gas in passing through the evaporator, it can be seen that adjusting spring tension which works against capillary pressure and equalizer line pressure controls the volume of refrigerant entering the evaporator as signaled by the temperature and pressure in the evaporator outlet pipe.

### OPERATION

When the air conditioning system has not been operating, all pressures within the thermostatic expansion valve assembly will have equalized at the ambient (surrounding air) temperature, thus the pressure above and below the operating diaphragm and at the inlet and outlet side of the valve will be equal (Fig. 5-13). (Pressure under the diaphragm is evaporator pressure. It reaches this area by means of clearance around the operating pins in the valve body which connects the area under the diaphragm with the evaporator pressure area.) While pressures in the expansion valve are almost equal, the addition of the valve adjusting spring pressure behind the valve will hold the valve over to close the valve orifice.

When the air conditioning system first begins to operate, the compressor will immediately begin to draw refrigerant from the evaporator, lowering the pressure in the evaporator and in the area under the operating diaphragm. As the pressure in this area decreases, the pressure above the diaphragm exerted by the carbon dioxide in the capillary tube will overcome spring pressure and push the diaphragm against the operating pins, which in turn will force the needle valve off its seat.

Refrigerant will then pass through the expansion valve into the evaporator where it will boil at a temperature corresponding to the pressure in the evaporator. This will begin cooling the air passing over the evaporator, and, also it will begin to cool the evaporator outlet pipe.

As the evaporator outlet pipe cools, the pressure of the carbon dioxide in the capillary tube (contacting this outlet pipe) decreases, exerting less force on the operating diaphragm.

The valve adjusting spring is calibrated so that the pressure of the refrigerant in the evaporator, plus the spring force, will equal the force above the operating diaphragm when the temperature of the refrigerant in the evaporator outlet is 6¾°F. above the temperature of the refrigerant entering the evaporator. In other words, the refrigerant should remain in the evaporator long enough to completely vaporize and then warm (superheat) 6¾°F.

If the temperature differential begins to go below 6¾°F. (outlet pipe becomes too cold) carbon dioxide pressure in the capillary tube and area above the diaphragm decreases, allowing the valve adjusting spring to move the needle valve toward its seat, closing off the flow of refrigerant past the needle valve.

If the temperature differential begins to go above 6¾°F. (outlet pipe too warm), the pressure in the capillary tube and area above the operating diaphragm will increase, pushing this diaphragm against the operating pins to open the needle valve further, admitting more refrigerant to the evaporator.

## EVAPORATOR

### DESIGN

The evaporator core consists of a series of plates which when joined together form the refrigerant tubes and the top and bottom tanks. Between the tubes corrugated strips of aluminum serve as air fins. This type of construction is called a channel plate type core. A 3/16" (O.D.) diameter tube extends from the bottom of the evaporator core opposite to the inlet

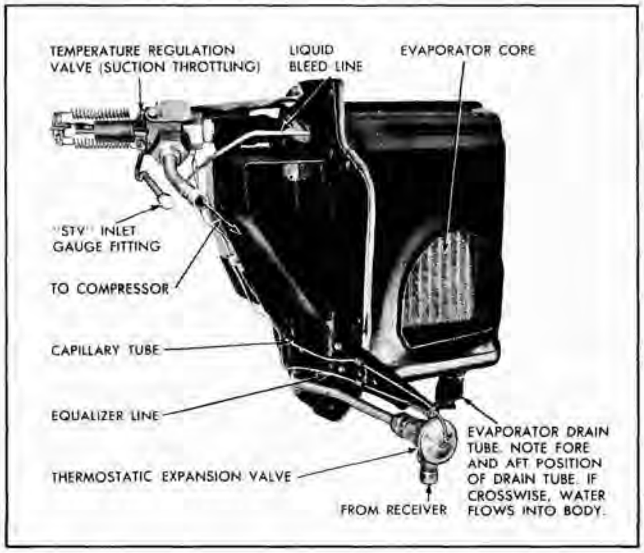



Fig. 5-15 Evaporator Assembly (With Thermostatic Expansion Valve and Temperature Regulation Valve)

end and connects to the temperature regulation valve. The nature of this design is such that the refrigerant travels a relatively short distance with little or no pressure drop resulting between the inlet and the outlet. Therefore, the inlet pressures and outlet pressures are about equal and exactly controlled to maintain the refrigerant boiling point at a temperature which cools the air passing over the evaporator to a temperature at or just above the freezing point of water.

The evaporator core with this design permits a very efficient distribution of refrigerant at the moment refrigerant enters the core. As far as operating pressures are concerned, they will vary considerably due to ambient temperature and load requirement variations. The setting of the temperature control lever, which in turn sets the temperature regulation valve (suction throttling valve), located at the evaporator outlet, will determine the amount of cooling the refrigeration system will deliver.

As the compressor operates at all times whenever refrigerated air is desired, it is the proper pre-set adjustment of the thermostatic expansion valve and the setting of the temperature regulation valve that governs the amount of refrigerant flow through the evaporator and amount of cooling which results.

### *DESCRIPTION*

The evaporator assembly consists of an evaporator core and housing. The evaporator core assembly is aluminum-brazed and allodized and is approximately $10\frac{3}{16}$" wide, $10\frac{1}{2}$" high, and $3\frac{5}{8}$" thick. The core contains 16 aluminum channeled (embossed) plate type tubes (in parallel) with cooling fins between the plates on the outside.

A $\frac{3}{16}$" O.D. tube brazed to the bottom tank connects with the temperature regulation valve.

The evaporator housing is constructed of a reinforced plastic material for strength. A self-opening rubber nozzle serves as a water drain and is located at the bottom of the housing.

### *FUNCTION*

The evaporator is actually the device which cools and dehumidifies the air before it enters the car. High pressure liquid refrigerant flows through the valve orifice in the thermostatic expansion valve into the low pressure area of the evaporator. This regulated flow of refrigerant boils immediately. Heat from the core surface is lost to the boiling and vaporizing refrigerant, which is cooler than the core, thereby cooling the core. The heat in the air passing over the evaporator loses its heat to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

Since Refrigerant-12 will boil at 21.7°F. below zero at atmospheric pressure and water freezes at 32°F., it becomes obvious that the temperature in the evaporator must be controlled so that the water collecting on the core surface will not freeze in the fins of the core and block off the air passages. In order to control the temperature, it is necessary to control pressure inside the evaporator and this is done by the temperature control valve.

To obtain maximum cooling, the refrigerant must remain in the core long enough to completely vaporize and then superheat a minimum of $6\frac{3}{4}$°F. If too much or too little refrigerant is present in the core, then maximum cooling efficiency is lost. A thermostatic expansion valve in conjunction with the temperature regulation valve is used to provide this necessary refrigerant volume control.

## TEMPERATURE REGULATION VALVE (Suction Throttling Valve)

### *DESCRIPTION*

The temperature regulation valve (suction throttling valve) Fig. 5-16, is manually controlled by means of a control cable which connects the air conditioning temperature control lever (at the control

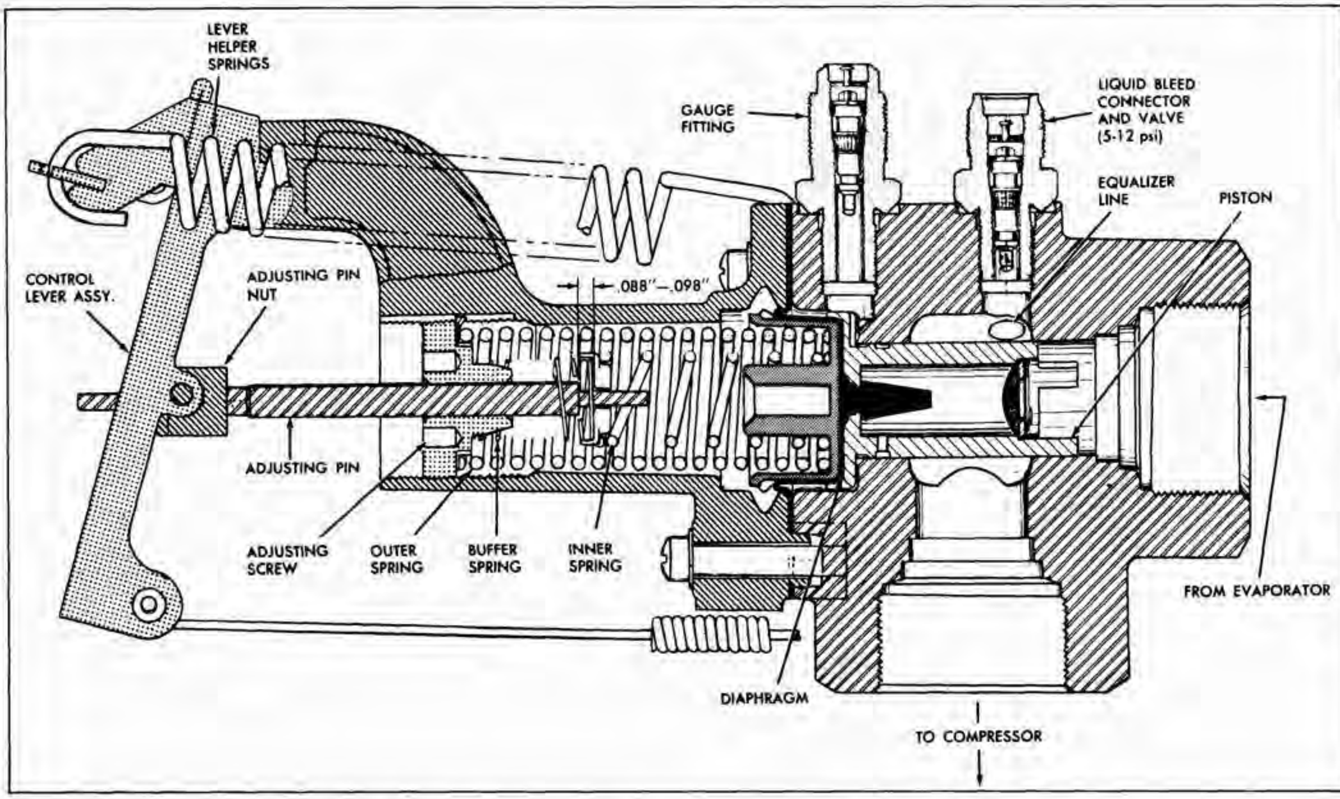



Fig. 5-16 Cross Section of the Temperature Regulation Valve

panel) to the temperature regulation valve lever. This valve is located in front of the evaporator and under the right front fender.

A lever at the end of the valve indexes with an actuating pin (in the cover assembly) in such a manner as to increase or decrease load on a spring which in turn exerts a load on the diaphragm, which is opposed by evaporator outlet pressure.

The body of the valve contains an inlet connection from the evaporator top tank outlet pipe (suction side) and an outlet connection to the compressor. Three smaller fittings receive an equalizer line from the thermostatic expansion valve, a pressure controlled Schrader type valve which connects to the liquid bleed line from the bottom of the evaporator, and a Schrader fitting to read evaporator suction pressure at this valve. A pressure control piston attached to the diaphragm permits evaporator outlet gas to pass by through the "windows" in the piston skirt to get to the compressor.

The diaphragm separates the valve body and cover and is acted upon by evaporator outlet pressure on one side and atmospheric pressure assisting spring pressure on the other.

The cover houses two springs which control pressures within the evaporator. The outer spring controls low pressure for freeze protection and the inner spring controls high pressures for warming up nozzle temperatures when desired. A buffer spring in line with the inner spring keeps the inner spring from bouncing and creating a noise condition during low pressure operation.

### FUNCTION

The function of the temperature regulation valve is to maintain a given temperature inside the car as selected by the temperature control lever and also to limit the evaporator to a minimum pressure preventing any moisture condensing on the evaporator core from freezing.

This valve automatically controls cooling and prevents evaporator freeze-up by limiting evaporator pressure to a controlled minimum.

### OPERATION

When the temperature control lever is just below the full up position, the temperature regulation valve is manually positioned at its warmest setting (temperature regulation valve lever is toward the rear of the car) thereby providing minimum cooling.

Progressive movement of the temperature control lever would progressively move the temperature regulation valve lever towards the front of the car and its "coldest" position (lever fully forward) is reached when the temperature control lever is at the extreme down position. Any further attempt to reduce the air temperature leaving the evaporator, as might result from adjusting the temperature regulation valve below its minimum setting, will only result in a momentary gain in cooling and will be followed by evaporator core icing and a resultant loss of cooling.

Low pressure refrigerant gas from the evaporator outlet enters the temperature regulation valve inlet to fill the space inside the piston and behind the diaphragm (by passing through four small holes located in the piston). Compressor suction pressure encircles the piston, and enters the equalizer line opening to the thermostatic expansion valve and also applies pressure to the bottom side of the bleed line valve (controlled to open at 5 to 12 p.s.i. differential between the pressure inside the temperature regulation valve and the pressure at the bottom of the evaporator). The Schrader valve for the evaporator suction and charging fitting is so ported that it reads evaporator suction pressure.

Whenever evaporator suction pressure is at or above the minimum pressure desired in the evaporator, suction pressure against the piston and the diaphragm will cause the piston to move the spring loaded diaphragm to permit the refrigerant gas to pass through the "windows" in the piston and on to the compressor. When the evaporator pressure drops below the pressure which provides the desired temperature in the car, the spring loaded diaphragm will force the piston to restrict (and even completely close) the gas passage from the top of the evaporator to the compressor.

Since the compressor continues to operate, pressure is reduced around the piston, at the equalizer line to the thermostatic expansion valve, and also beneath the spring loaded valve at the liquid bleed line. When the pressure differential exceeds 5 to 12 p.s.i., the liquid refrigerant and oil from the evaporator bottom tank by-passes the evaporator core to flow through the bleed valve (now open because of the 5 to 12 p.s.i. differential) and to the compressor. At the same time warm air being forced by the blower through the evaporator core provides more heat to the surface of the core and thus causes the refrigerant inside the evaporator to boil, increasing the pressure within the evaporator to such a point as to overcome atmospheric and spring pressure above the diaphragm to move the piston to allow refrigerant gas from evaporator outlet to pass through the valve. As the pressure differential at the liquid bleed valve falls below 5 to 12 p.s.i. the valve closes, preventing refrigerant and oil from by-passing the evaporator core. In this manner, evaporator pressure is controlled and yet oil and refrigerant are always being returned to the compressor to prevent the compressor from being damaged by sustained operation at vacuum conditions where no oil would normally be returned to the compressor for lubrication.

If maximum cooling in the car is not desired and the temperature control lever is pushed to the warmest setting, then the lever on the temperature regulation valve is pulled towards the rear of the car by means of a control cable. This lever movement increases the load on the inner spring. The increased inner spring load now requires a higher evaporator pressure to overcome this spring load before the piston is moved to permit warm gas from the evaporator to pass to the compressor. The increased pressure in the evaporator will increase the temperature of the air leaving the evaporator. Thus, the refrigeration cycle occurs at a higher suction pressure (which would give a higher temperature). The flow of refrigerant through the evaporator to the temperature regulation valve and compressor is dependent upon evaporator pressure and the resultant temperature of air desired.

When the evaporator pressure is greater than the opposing spring load, the piston will move to permit the gas to flow through the now "open" valve. When evaporator pressure is less than the opposing spring load, the piston will move to prevent gas from the evaporator outlet to flow through the now "closed" valve, and refrigerant and oil now will flow from the bottom tank of the evaporator to the compressor, by-passing the evaporator core, through the bleed valve.

## AIR SYSTEM

Air flow through the Circ-L-Aire conditioning system is controlled by push buttons located in the air conditioning control panel. These buttons operate a vacuum switch which appropriately applies vacuum to five vacuum operated diaphragms (Fig. 5-17) to control the position of the three air valves which direct air flow through the air conditioning system.

All air for ventilation or refrigerated air enters the interior of the car through five outlets on the instrument panel and also through a series of holes in the bottom of the air outlet duct assembly. (These holes direct cooled air to the left and right side of the front floor to cool the passengers' feet.) Nozzles located at each end of the instrument panel can be individually controlled to provide a comfortable air flow in any direction desired by the passengers.

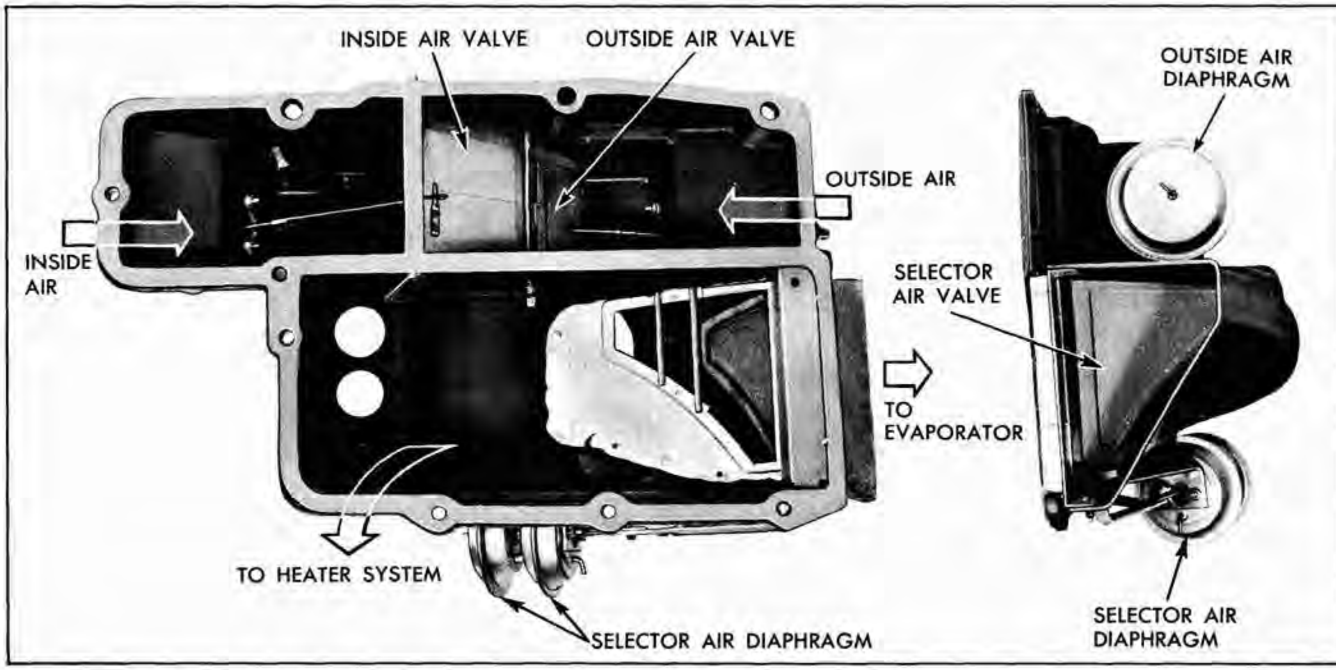



Fig. 5-17 Blower and Air Inlet Duct Assembly—Air Flow

The ball type nozzle may be rotated to direct air in any direction. It is retained in a bezel and is mounted between felt "bearings" for ease of turning. A nozzle retainer keeps the felts and nozzle tight against the bezel. See Fig. 5-18. The bezel is held tight against the instrument panel by screws (from behind the instrument panel) which secure the entire assembly from the back side of the instrument panel.

Attached to the lower center part of the instrument panel are three center outlets having vaned valves which can be rotated to change the vertical direction of air flow. A concealed opening in the left side of the center outlet directs a stream of cooled air to the driver's feet.

The design of the air conditioning air system, its valves and controls, permits a method of obtaining many different amounts of forced air flow for ventilation or refrigeration and can draw its source of air from either outside or inside the car.

## VACUUM SYSTEM

Air flow through the Circ-L-Aire conditioning system is controlled by push buttons located in the air conditioning control panel. These buttons operate a vacuum switch which appropriately applies vacuum to diaphragms that operate the air conditioning inlet air valves in the top of the blower and inlet air duct and the outlet (selector) air valve located in the lower right portion of the blower and inlet air duct assembly. The inlet air valves control air source from outside the car or inside the car (for recirculation) depending upon position of vacuum switch as positioned by the "OUTSIDE" or "INSIDE" push button.

Air flow through the heating system is controlled similarly. In this case, however, vacuum operates the inlet air (outside) valve to open the valve to outside air and also the inside air valve to close it to prevent recirculation of inside air (located in the top of the blower and inlet air duct).

Vacuum input to both the air conditioning and heater vacuum switch is through a "T" connection in the vacuum line to the distributor vacuum advance on all cars except those equipped with triple two barrel carburetors. On cars with triple two barrel

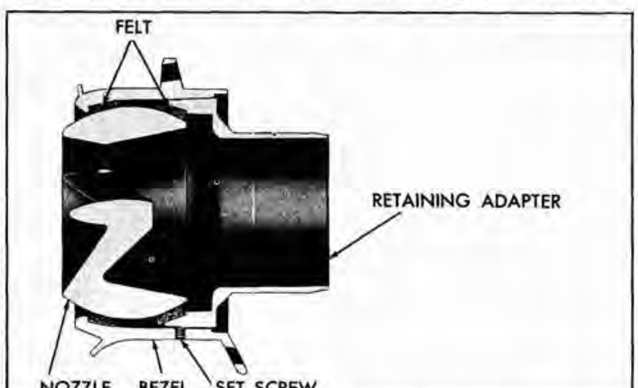



Fig. 5-18 Cross Section of Bezel and Nozzle Assembly (Right Shown)

<table>
<tr><th colspan="2">Control Setting</th><th colspan="3">Air Valve—Positions</th><th colspan="2" rowspan="2">Usages</th></tr>
<tr><th>Air Cond. Push Button</th><th>Heater Push Button</th><th>Defroster</th><th>Outside-Inside Combination</th><th>Selector</th></tr>
<tr><td>Off</td><td>Off</td><td>Heat</td><td>Full Recirculation</td><td>To Heater</td><td colspan="2">Air Conditioning and Heater off</td></tr>
<tr><td>Off</td><td>Normal</td><td>Heat</td><td>Outside</td><td>To Heater</td><td>Heat</td><td rowspan="2">Heater only</td></tr>
<tr><td>Off</td><td>De-ice</td><td>Defrost</td><td>Outside</td><td>To Heater</td><td>Defrost</td></tr>
<tr><td>Outside</td><td>Off</td><td>Heat</td><td>Outside</td><td>To Evaporator</td><td>Outside Air Cooling</td><td rowspan="2">Air Conditioning only</td></tr>
<tr><td>Inside</td><td>Off</td><td>Heat</td><td>Recirculation</td><td>To Evaporator</td><td>Maximum Cooling</td></tr>
<tr><td>Outside</td><td>Normal</td><td>Heat</td><td>Outside</td><td>To Both</td><td>Upper Level—Cool<br>Lower Level—Heat</td><td>Bright sun on cool days. Humid mornings and warm evenings</td></tr>
<tr><td>Inside</td><td>Normal</td><td>Heat</td><td>Recirculation</td><td>To Both</td><td>Upper Level—Max. Cool<br>Lower Level—Heat</td><td>Rainstorms</td></tr>
<tr><td>Outside</td><td>De-ice</td><td>Defrost</td><td>Outside</td><td>To Both</td><td colspan="2">Not Recommended</td></tr>
<tr><td>Inside</td><td>De-ice</td><td>Defrost</td><td>Recirculation</td><td>To Both</td><td colspan="2">Not Recommended</td></tr>
</table>

Fig. 5-19 Summary of Circ-L-Aire Conditioner and Circ-L-Air Heater Valve Positions Under Various Control Settings

carburetors, vacuum input to both the air conditioning and heater vacuum switch is through a tee connection fed from the carburetor vacuum source for accessories. This vacuum is applied to the No. 1 post of the air conditioner and heater vacuum switches in both input arrangements.

These vacuum switches are connected to each other through the common vacuum source and also with a vacuum hose connecting the No. 3 vacuum post on the Circ-L-Aire heater control panel vacuum switch to the No. 5 vacuum post on the air conditioning control panel vacuum switch.

Inlet and outlet (selector) air valve action is controlled by directing vacuum to one or more of five diaphragms on the blower and air duct assembly and one diaphragm on the Circ-L-Aire heater core and case assembly.

Valve action under various push button positions with air conditioning and the Circ-L-Aire heater is as follows:

### *PUSH BUTTON: AC—OFF, CIRC-L-AIRE HEATER—OFF (See Fig. 5-20)*

### VACUUM

With the engine running, vacuum is at the No. 1 post of each of the heater and air conditioning vacuum switch. No vacuum passes through the heater switch. Vacuum does pass from the No. 1 post of the air conditioning vacuum switch through the No. 2 post of the same switch where it is directed to the return travel portion of the selector air valve holding this valve in such a position to prevent the entrance of air flow to the air conditioning evaporator.

Since atmospheric pressure is on both sides of all other diaphragms, spring tension holds the inside and outside air valve in a closed position to prevent air flow through the air conditioning and heater systems.

### ELECTRICAL

In the off position, the electrical circuit is open and no current flows to the electrical units (compressor and blower).

### *PUSH BUTTONS: AC—OUTSIDE, CIRC-L-AIRE HEATER—OFF (See Fig. 5-21)*

### VACUUM

When the "OUTSIDE" button is pushed in, the rotor part of the air conditioning vacuum switch moves to direct vacuum to the No. 1 post through the switch to the No. 3 and No. 4 post of the same switch.

Vacuum from the No. 4 post is directed to the full travel portion of the inside air diaphragm which moves the inside air valve to allow outside air to enter the air inlet duct. At its full travel position, the valve is now located to prevent air inside the car from entering the air inlet duct. Vacuum is also di-

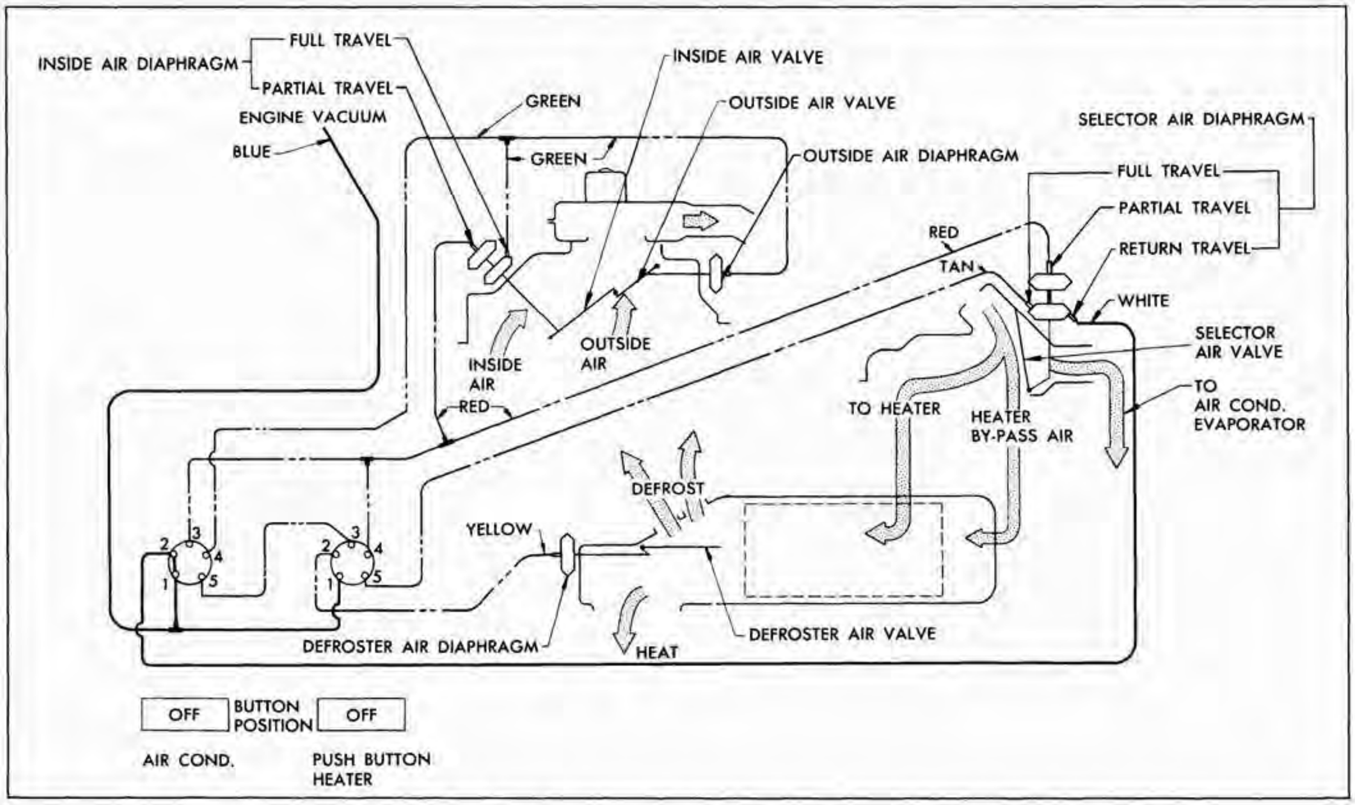



Fig. 5-20 Push Buttons: AC-OFF, Heater-OFF, No Air Flow. (Vacuum in Dark Black Lines)

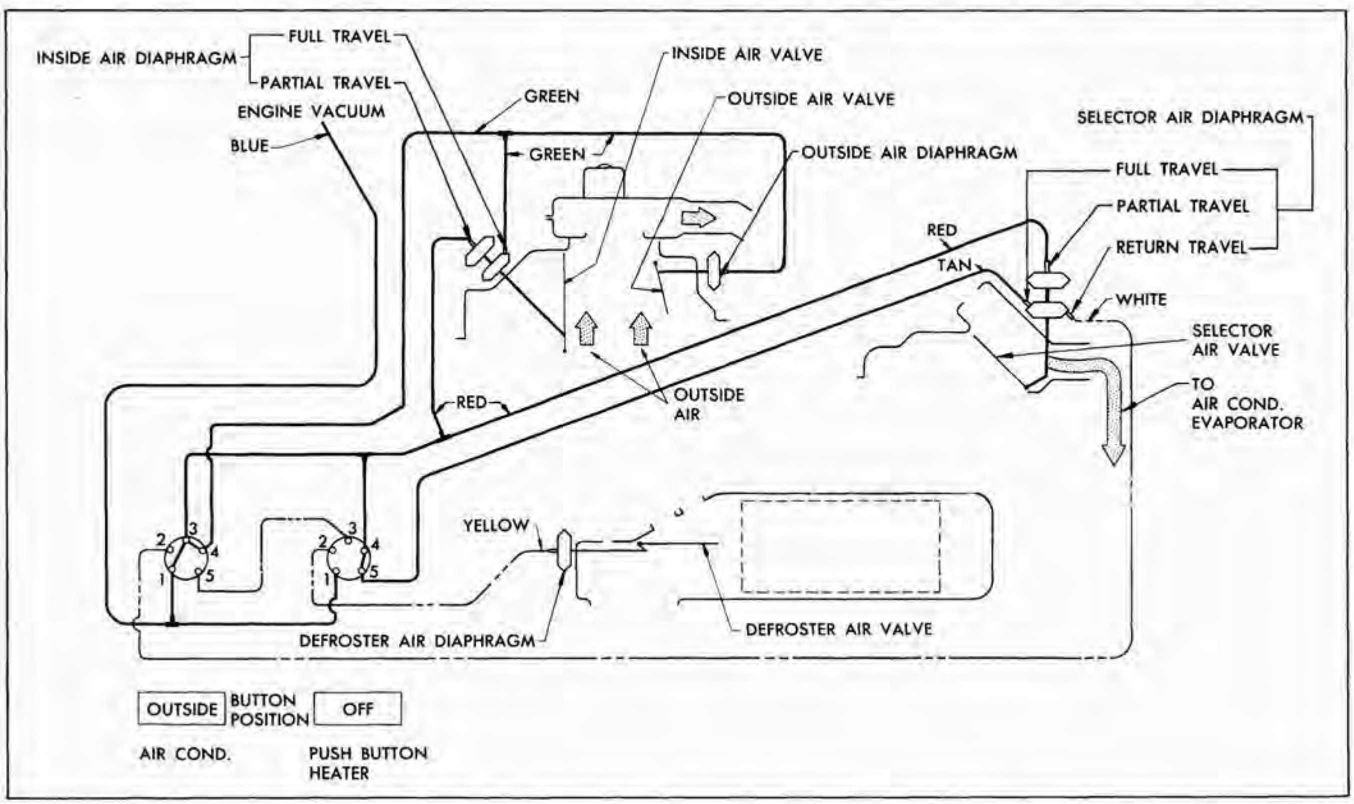



Fig. 5-21 Push Button: AC-OUTSIDE, Heater-OFF.
Air Flow through AC System—All Outside Air To Nozzels Center Outlets and Foot Cooling. (Vacuum in Dark Black Lines)

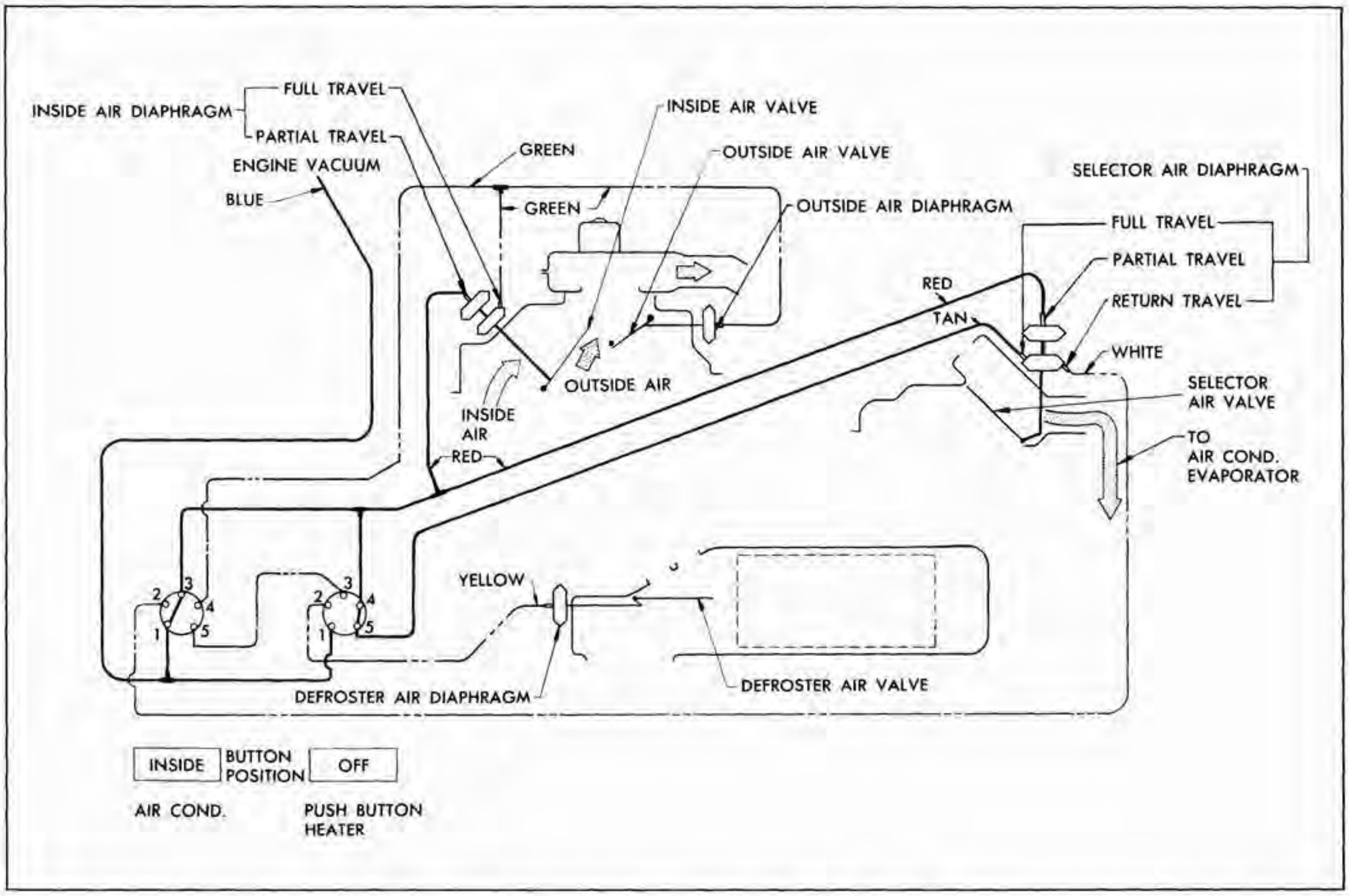



Fig. 5-22 Push Buttons: AC-INSIDE, Heater-OFF.
Air Flow through AC System—Majority of Air Recirculated to Nozzles, Center Outlets and Foot Cooling.
(Vacuum in Dark Black Lines)

rected to the outside air diaphragm to open the valve permitting outside air to enter the air inlet duct assembly.

Vacuum from the No. 3 post is directed to a "T" connector where it is applied to the partial travel portion of the inside air diaphragm and to the partial travel portion of the selector air diaphragm. Vacuum from this "T" is also applied to the No. 4 post on the heater vacuum switch. From the No. 4 post, on the heater vacuum switch, vacuum is directed through this switch to the No. 5 post and to the full travel portion of the selector air valve moving the valve to open the passage to the evaporator and close the passage to the heater system permitting all air to be directed to the evaporator, to the nozzles and to the air outlets on the instrument panel.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valve closed, and force them to swing open.

## ELECTRICAL

When the "OUTSIDE" button is pushed, the electrical circuit is closed to energize the master control relay which closes the electrical circuit to the blower and compressor clutch switches. With the blower circuit closed, the blower operates to pull air through the louvers on the top of the cowl to the inlet air assembly. The blower then forces air through the evaporator and air conditioning air outlets on the instrument panel (hoses are attached to each bezel and the air outlet duct assembly).

### *PUSH BUTTONS: AC—INSIDE, CIRC-L-AIRE HEATER—OFF (See Fig. 5-22)*

## VACUUM

Pushing the "INSIDE" button moves the rotor part of the air conditioning vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 3 post of the same switch.

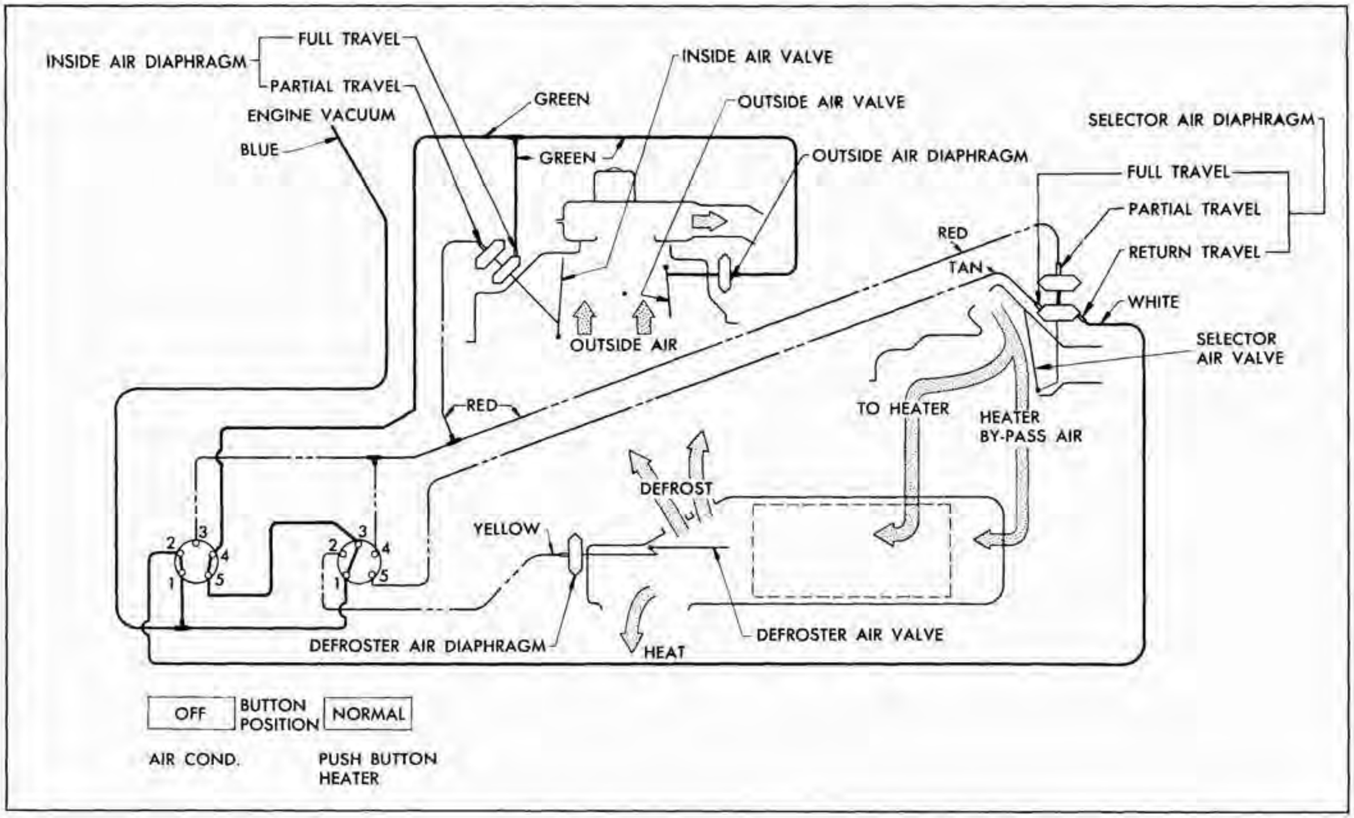



Fig. 5-23 Push Buttons: AC-OFF, Heater-NORMAL.
Air Flow Through Heater System—All Outside Air to Heater Ducts and Defroster. (Vacuum in Dark Black Lines)

Vacuum from the No. 3 post is directed to a "T" connector where it is applied to the partial travel portion of the inside air diaphragm to move the inside air valve a slight amount. Since air from the inside of the car may enter the inlet air duct unrestricted, and the slight movement of the inside valve permits some outside air to enter the air inlet duct assembly, outside air mixes with inside air in the air inlet duct.

Vacuum is also directed to the partial travel portion of the selector air valve diaphragm. Vacuum from this "T" is also directed to the No. 4 post on the heater vacuum switch. From the No. 4 post on the heater vacuum switch, vacuum is directed through the switch to the No. 5 post and to the full travel portion of the air selector air diaphragm to open the selector valve moving the valve to open the passage to the evaporator and close the passage to the heater system, permitting all air to be directed to the evaporator, to the nozzles and to the air outlets on the instrument panel.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome spring tension holding valves closed, causing them to swing open.

## ELECTRICAL

When the "INSIDE" button is pushed in, the electrical circuit is closed to energize the master relay and close the electrical circuit to the blower and compressor clutch switches. With the blower circuit closed, the blower operates to pull air from inside the car through the air recirculation opening to the air inlet housing. Some outside air (approximately 15%) is permitted to mix with this inside air to "pressurize" the inside of the car and thus prevent infiltration of hot outside air through small openings in the car body. The blower then forces this mixed air through the evaporator and on to the air conditioning outlets on the instrument panel.

### *PUSH BUTTONS: AC—OFF, CIRC-L-AIRE HEATER—NORMAL (See Fig. 5-23)*

## VACUUM

Depressing the "NORMAL" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 3 post of the same switch to the No. 5 post on the air conditioning vacuum switch through this switch to the No. 4 post and to a "T" connector which directs vacuum to the full travel portion of the inside air diaphragm. At its full travel position, the valve is now located to prevent air inside the car from entering the air inlet duct. Vacuum is also directed to the outside air diaphragm to open the valve, permitting outside air to enter the air inlet duct assembly.

Vacuum passes from the No. 1 post of the air conditioning vacuum switch through the switch to the No. 2 post where it is directed to the return travel portion of the selector air valve holding the valve in such a position to prevent entrance of air flow to the air conditioning evaporator, permitting all air to be directed to the heater system and out the heater and defroster outlets.

With vacuum on one side of the inside and outside air diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valves closed, and forces them to swing open. With vacuum on one side of the return travel portion of the selector air valve and atmospheric pressure on the other, atmospheric pressure assists valve spring pressure to assure positive sealing of the air inlet opening to the air conditioning system.

### ELECTRICAL

When the "NORMAL" button on the Circ-L-Aire heater control panel is pushed, the heater master switch closes to close the electrical circuit to the heater blower switch. The blower will not operate unless the blower control lever is in the "LO", "MED" or "HI" position. If in one of these blower speed positions, air will be pulled through the louvers on the top of the cowl into the blower and inlet air assembly. The blower then forces this air through the heater core and out the heater outlets. Some air will be directed through the defroster nozzles due to the design of the heater core case assembly.

Air will not enter the passage to the evaporator since no vacuum is directed to the return travel portion of the selector air valve diaphragm which keeps the selector air valve closed.

## *PUSH BUTTONS: AC—OFF, CIRC-L-AIRE HEATER—DE-ICE (See Fig. 5-24)*

### VACUUM

Depressing the "DE-ICE" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 2 and No. 3 posts of the same switch. Vacuum from the No. 2 post is directed to the defroster air valve diaphragm. Vacuum from the No. 3 post is directed to the No. 5 post on the air conditioning vacuum switch through this switch to the No. 4 post and to a "T" connector which directs vacuum to the full travel portion of the inside air diaphragm. At its full travel position, the valve is now located to prevent air inside the car from entering the air inlet duct. Vacuum is also directed to the outside air diaphragm to open the valve, permitting outside air to enter the air inlet duct assembly.

Vacuum passes from the No. 1 post of the air conditioning vacuum switch through the switch to the No. 2 post where it is directed to the return travel portion of the selector air valve holding the valve in such a position to prevent entrance of air flow to the air conditioning evaporator, permitting all air to be directed to the heater system and out the heater and defroster outlets.

Atmospheric pressure on one side of the defroster air valve diaphragm is sufficient to overcome spring tension holding the defroster air valve up (in the heater core and case assembly) (closed) to cause the valve to swing open (down) permitting maximum flow of heater system air to be directed to the defroster outlets. Some air will also be emitted from the heater outlet nozzle.

With vacuum on one side of the inside and outside air diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valve closed, and forces them to swing open. With vacuum on one side of the return travel portion of the selector air valve and atmospheric pressure on the other, atmospheric pressure assists valve spring pressure to assure positive sealing of the air inlet opening to the air conditioning system.

### ELECTRICAL

Pushing the "DE-ICE" button causes the Circ-L-Aire heater master switch and defroster switch to close the electrical circuit to the heater blower switch and to the blower motor (which by-passes the blower switch) regardless of the position of the blower control lever.

Air will be pulled through the louvers on the top of the cowl into the blower and air inlet assembly. The blower then forces the air through the heater core and case assembly and out the defroster nozzles. (The defroster air valve being in the down position acts as

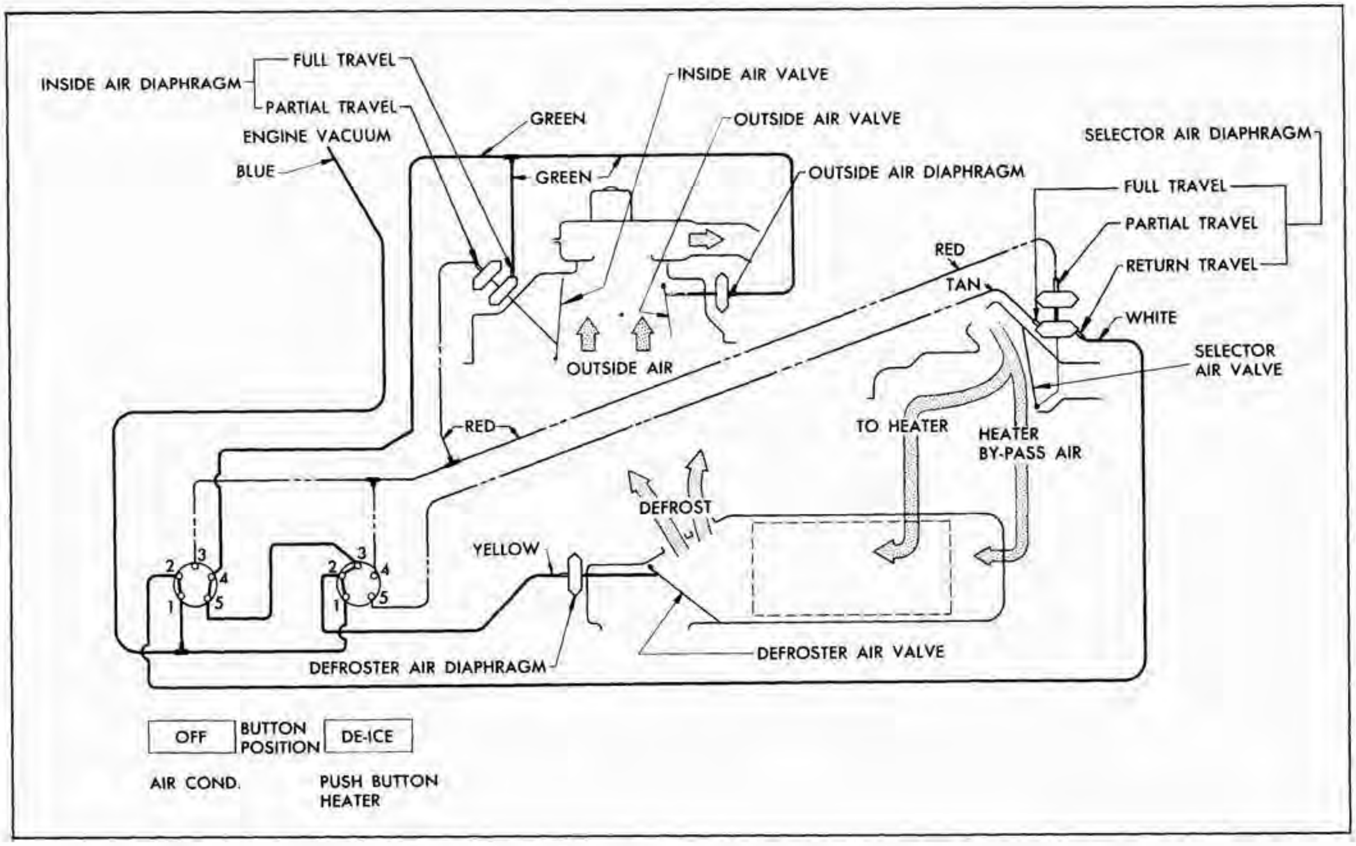



Fig. 5-24 Push Buttons: AC-OFF, Heater-DE-ICE.
Air Flow Through Heater System—All Outside Air to Defroster and Heater Ducts. (Vacuum in Dark Black Lines)

a ramp to direct the air to the defroster outlets.) Some air will be directed through the heater outlets since the defroster air valve does not completely block the heater air duct.

Air will not enter the passage to the evaporator since vacuum is directed to the return portion of the selector air valve diaphragm which keeps the selector air valve closed.

#### *PUSH BUTTONS: AC—OUTSIDE, CIRC-L-AIRE HEATER—NORMAL (See Fig. 5-25)*

### VACUUM—AC SYSTEM

When the "OUTSIDE" button is pushed in on the air conditioning control panel, the rotor part of the air conditioning vacuum switch moves to direct vacuum to the No. 1 post through the switch to the No. 3 and No. 4 post of the same switch.

Vacuum from the No. 4 post is directed to the full travel portion of the inside air diaphragm which moves the inside air valve to allow outside air to enter the air inlet duct. At its full travel position, the valve is now located to prevent air inside the car from entering the air inlet duct. Vacuum is also directed to the outside air diaphragm to open the valve, permitting outside air to enter the air inlet duct assembly.

Vacuum from the No. 3 post is directed to a "T" connector where it is applied to the partial travel portion of the inside air diaphragm and to the partial travel portion of the selector air diaphragm. The selector air valve moves to permit air to enter the evaporator and air conditioning outlets and also the heater core and heater outlets. Vacuum from this "T" is also applied to the No. 4 post on the heater vacuum switch where it ends.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valves closed, and force them to swing open.

### VACUUM—HEATER SYSTEM

Depressing the "NORMAL" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 3 post of the same switch to the No. 5 post on the air conditioning vacuum switch where it ends.

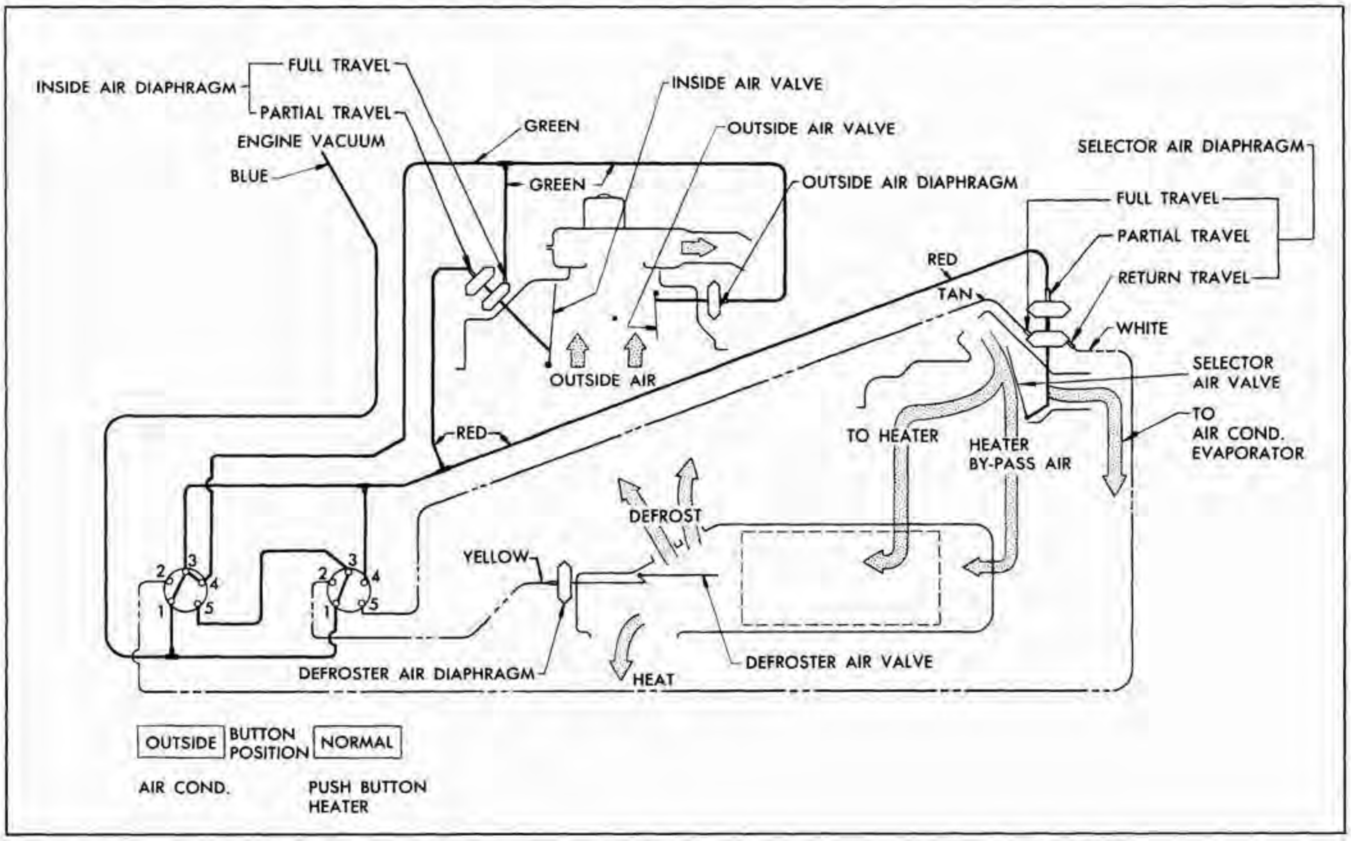



Fig. 5-25 Push Buttons: AC-OUTSIDE, Heater-NORMAL.
Air Flow Through AC and Heater Systems—All Outside Air Equally Divided Between AC and Heater Outlets.
(Vacuum in Dark Black Lines)

## ELECTRICAL—AC SYSTEM

When the "OUTSIDE" button on the air conditioning control panel is pushed in, the electrical circuit is closed to energize the master control relay which closes the electrical circuit to the blower and compressor clutch switches.

## ELECTRICAL—HEATER SYSTEM

Depressing the "NORMAL" button on the heater control panel closes the heater master switch to close the electrical circuit to the heater blower switch.

The speed of the blower will depend on the position of the blower control lever on the air conditioning and heater control panels; the fastest blower speed will depend upon the least resistance in the electrical circuit to the blower motor.

With the blower circuit closed, the blower operates to pull air through the louvers on the top of the cowl to the blower and inlet air assembly. The blower then forces air through the evaporator and the heater core and case assembly. Air from the evaporator emits from the air conditioning outlets on the instrument panel. Most of the air from the heater core and case assembly is directed to the heater outlets with a slight amount out of the defroster nozzles.

### *PUSH BUTTONS: AC—INSIDE, CIRC-L-AIRE HEATER—NORMAL (See Fig. 5-26)*

## VACUUM—AC SYSTEM

Pushing the "INSIDE" button moves the rotor part of the air conditioning vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 3 post of the same switch.

Vacuum from the No. 3 post is directed to a "T" connector where it is applied to the partial travel portion of the inside air diaphragm to move the inside air valve a slight amount. Since air from the inside of the car may enter the inlet air duct unrestricted, and the slight movement of the inside valve permits some outside air to enter the air inlet duct assembly, outside air mixes with inside air in the air inlet duct. Vacuum is also directed to the partial travel portion

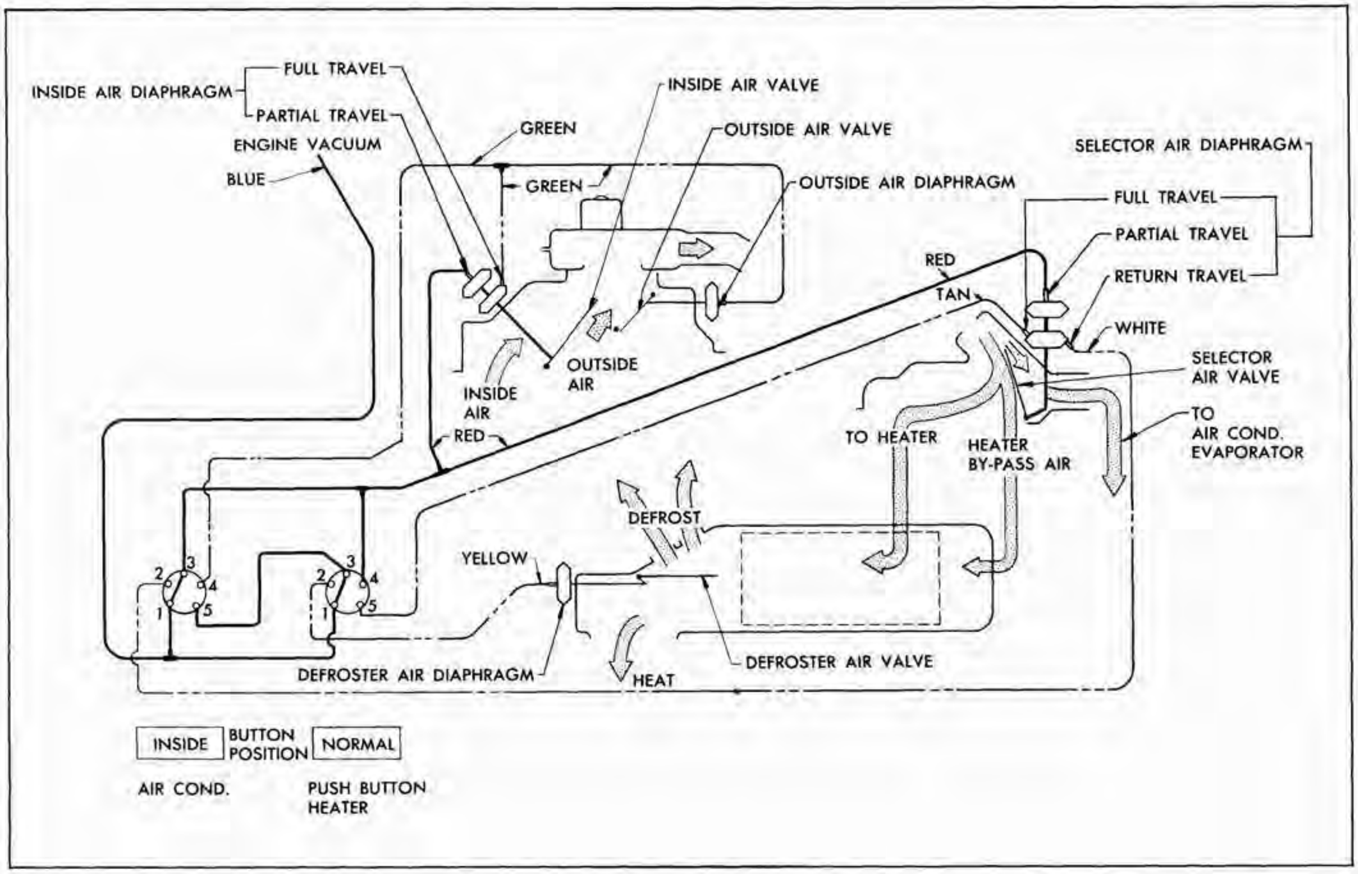



Fig. 5-26 Push Buttons: AC-INSIDE, Heater-NORMAL.
Air Flow Through AC and Heater Systems—Majority of Air Recirculated and Equally Divided Between AC and Heater Outlets. (Vacuum in Dark Black Lines)

of the selector air valve diaphragm. The selector air valve moves to permit air to enter evaporator and air conditioning outlets and also heater core and heater outlets. Vacuum from this "T" is also applied to the No. 4 post on heater vacuum switch where it ends.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valves closed, and force them to swing open.

## VACUUM–HEATER SYSTEM

Depressing the "NORMAL" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 3 post of the same switch to the No. 5 post on the air conditioning vacuum switch where it ends.

## ELECTRICAL

When the "INSIDE" button is pushed in on the air conditioning control panel the electrical circuit is closed to energize the master control relay and the electrical circuit to the blower and compressor clutch switches.

Depressing the "NORMAL" button on the heater control panel closes the heater master switch to close the electrical circuit to the heater blower switch.

The speed of the blower will depend on the position of the blower control lever on the air conditioning and heater control panels; the fastest blower speed will depend upon the least resistance in the electrical circuit to the blower motor.

With the blower motor circuit closed, the blower operates to pull air from inside the car plus a little from the outside of the car (entering through the louvers at the top of the cowl). The blower then forces the air through the evaporator and the heater core and case assembly. Air from the evaporator emits from the air conditioning outlets on the instrument panel. Most of the air from the heater core and case assembly is directed to the heater outlets with a slight amount out of the defroster nozzles.

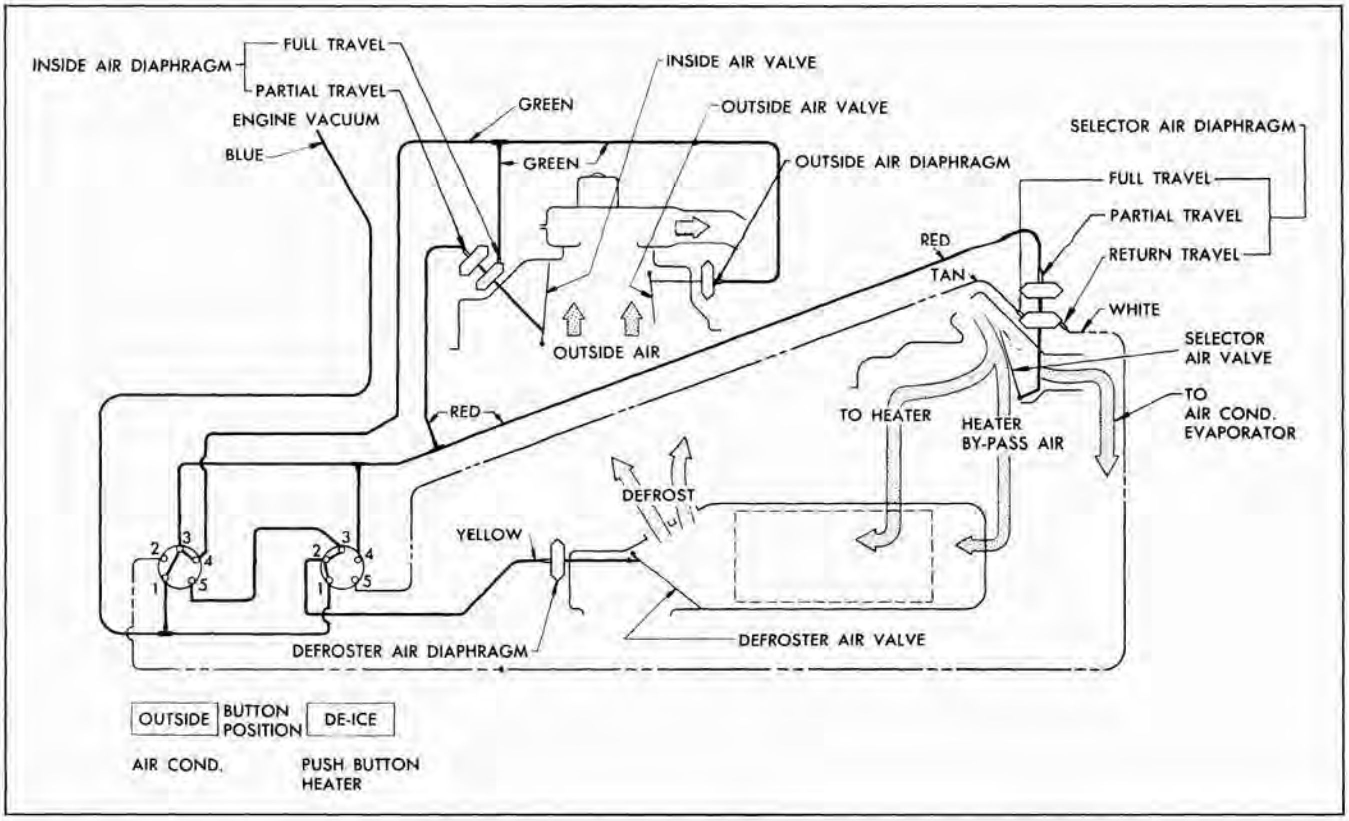



Fig. 5-27 Push Buttons: AC-OUTSIDE, Heater-DE-ICE.
Air Flow Through AC and Heater Systems—All Outside Air Equally Divided Between AC and Defroster and Heater Outlets. (Vacuum in Dark Black Lines)

***PUSH BUTTONS: AC—OUTSIDE, CIRC-L-AIRE HEATER—DE-ICE (See Fig. 5-27)***

## VACUUM—AC SYSTEM

When the "OUTSIDE" button is pushed in, the rotor part of the air conditioning vacuum switch moves to direct vacuum to the No. 1 post through the switch to the No. 3 and No. 4 post of the same switch.

Vacuum from the No. 4 post is directed to the full travel portion of the inside air diaphragm which moves the inside air valve to allow outside air to enter the air inlet duct. At its full travel position, the valve is now located to prevent air inside the car from entering the air inlet duct. Vacuum is also directed to the outside air diaphragm to open the valve, permitting outside air to enter the air inlet duct assembly.

Vacuum from the No. 3 post is directed to a "T" connector where it is applied to the partial travel portion of the inside air diaphragm and to the partial travel portion of the selector air diaphragm. The selector valve moves to permit air to enter the evaporator and air conditioning outlets and also the heater core and heater outlets. Vacuum from this "T" is also applied to the No. 4 post on the heater vacuum switch where it ends.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valves closed, and force them to swing open.

## VACUUM—HEATER SYSTEM

Depressing the "DE-ICE" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 2 and No. 3 posts of the same switch. Vacuum from the No. 2 post is directed to the defroster air valve diaphragm. Vacuum from the No. 3 post is directed to the No. 5 post on the air conditioning vacuum switch where it ends.

Atmospheric pressure on one side of the defroster air valve diaphragm is sufficient to overcome spring tension holding the defroster air valve (in the heater core and case assembly) up (closed), to cause the valve to swing open (down) permitting maximum flow of heater system air to be directed to the defroster outlets. Some air will also be emitted from the heater outlet nozzle.

### ELECTRICAL

When the "OUTSIDE" button on the air conditioning control panel is pushed in, the electrical circuit is closed to energize the master control relay which closes the electrical circuit to the blower and compressor clutch switches.

Pushing the "DE-ICE" button causes the heater master switch and defroster switch to close the electrical circuit to the heater blower switch and to the blower motor (which by-passes the blower switch) regardless of the position of the blower control lever.

The speed of the blower motor will depend on the position of the air conditioning blower control lever; the fastest blower speed will depend upon the least resistance in the electrical circuit to the blower motor.

With the blower motor circuit closed the blower operates to pull air through the louvers on the top of the cowl into the blower and inlet air assembly. The blower then forces air through the evaporator and the heater core and case assembly. Air from the evaporator emits from the air conditioning outlets on the instrument panel. Most of the air from the heater core and case assembly is directed to the defroster nozzles with a slight amount out the heater air outlets.

## *PUSH BUTTONS: AC–INSIDE, CIRC-L-AIRE HEATER–DE-ICE (See Fig. 5-28)*

### VACUUM–AC SYSTEM

Pushing the "INSIDE" button moves the rotor part of the air conditioning vacuum switch to direct vacuum from the No. 1 post through the switch to No. 3 post of the same switch.

Vacuum from the No. 3 post is directed to a "T" connection where it is applied to the partial travel portion of the inside air diaphragm to move the inside air valve a slight amount. Since air from the inside of the car may enter the inlet air duct unrestricted, and the slight movement of the inside valve permits some outside air to enter the air inlet duct assembly, outside air mixes with inside air in the air inlet duct.

Vacuum is also directed to the partial travel portion of the selector air valve diaphragm. The selector valve moves to permit air to enter the evaporator and air conditioning outlets and also the heater core and heater outlets. Vacuum from this "T" is also applied to the No. 4 post on the heater vacuum switch where it ends.

With vacuum on one side of these diaphragms and atmospheric pressure on the other, atmospheric pressure is sufficient to overcome the spring tension holding the valves closed, and force them to swing open.

### VACUUM–HEATER SYSTEM

Depressing the "DE-ICE" button on the Circ-L-Aire heater control panel moves the rotor part of the heater vacuum switch to direct vacuum from the No. 1 post through the switch to the No. 2 and No. 3 posts of the same switch. Vacuum from the No. 2 post is directed to the defroster air valve diaphragm. Vacuum from the No. 3 post is directed to the No. 5 post on the air conditioning vacuum switch where it ends.

Atmospheric pressure on one side of the defroster air valve diaphragm is sufficient to overcome spring tension holding the defroster air valve (in the heater core and case assembly) up (closed) to cause the valve to swing open (down) permitting maximum flow of heater system air to be directed to the defroster outlets. Some air will also be emitted from the heater outlet nozzle.

### ELECTRICAL

When the "INSIDE" button is pushed in on the air conditioning control panel, the electrical circuit is closed to energize the master control relay and also the electrical circuit to the blower and compressor clutch switches.

Pushing the "DE-ICE" button causes the heater master switch and defroster switch to close the electrical circuit to the heater blower switch to close an electrical circuit directly to the blower motor (which by-passes the blower switch) regardless of the position of the blower control lever.

The speed of the blower motor will depend on the position of the air conditioning blower control lever; the fastest blower speed will depend upon the least resistance in the electrical circuit to the blower motor.

With the blower motor circuit closed, the blower operates to pull air from inside the car plus a little from outside of the car (entering through louvers at the top of the cowl). The blower then forces the air through the evaporator and heater core and case assembly. Air from the evaporator emits from the air

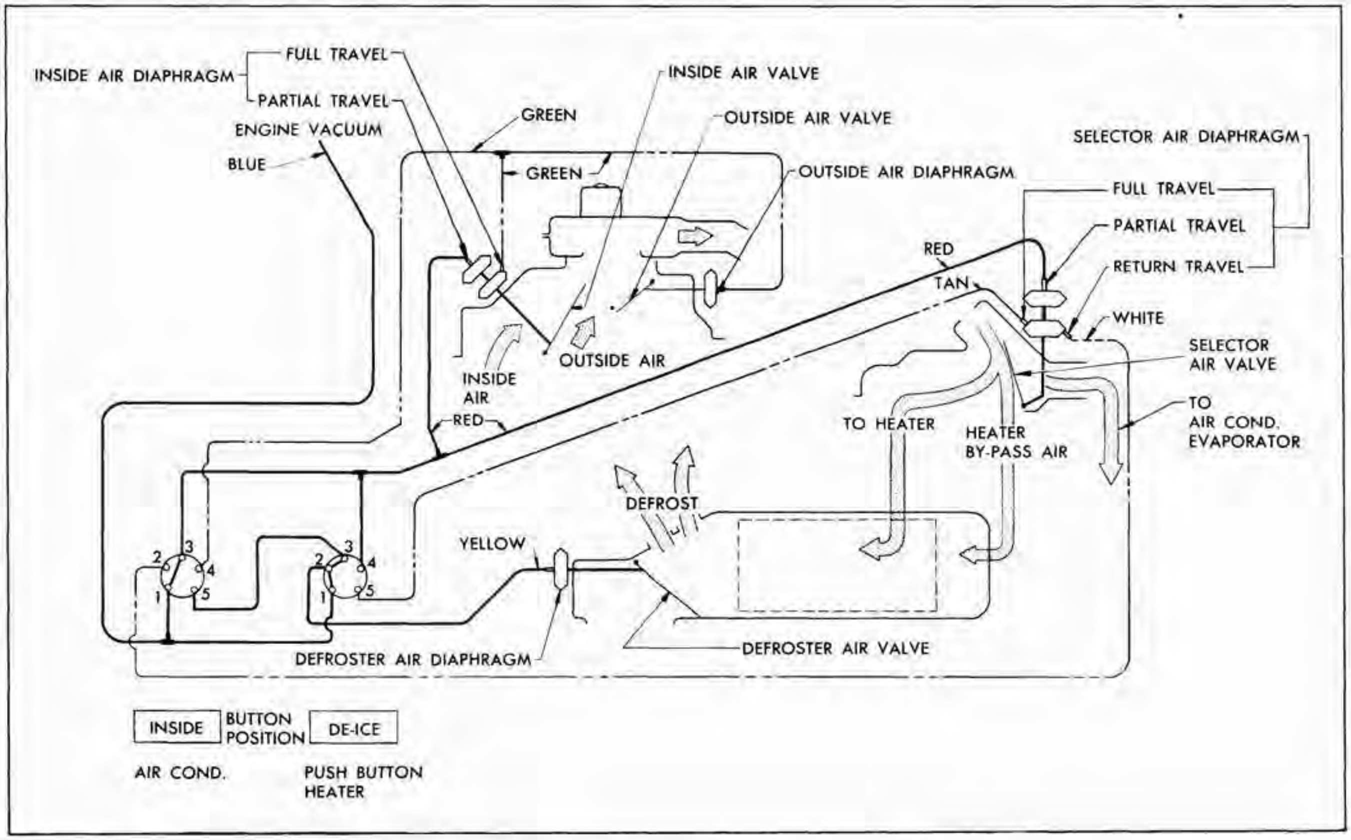



Fig. 5-28 Push Buttons: AC-INSIDE, Heater-DE-ICE.
Air Flow Through AC and Heater Systems—Majority of Air Recirculated and Equally Divided Between AC and Defroster and Heater Outlets. (Vacuum in Dark Black Lines)

conditioning outlets on the instrument panel. Most of the air from the heater core and case assembly is directed to the defroster nozzles with a slight amount out the heater outlets.

## ELECTRICAL SYSTEM

The air conditioning and heater control lamps are connected with each other by a grey wire which is fed from the instrument panel rheostat output circuit on the fuse block. The blower circuit of the Circ-L-Aire system receives its electrical supply through a master control relay mounted on the upper part of the dash shroud just left of the windshield wiper motor. Overload protection of the air conditioning electrical system is provided by a 30 ampere fuse in a fuse holder line in front of the fuse block coming out of the wiring harness at the left and connecting the "AIR COND" terminal in the fuse block.

There are six terminals on the back of the ignition switch, used on all models without Circ-L-Aire Conditioning and seven terminals on cars with Circ-L-Aire Conditioning (Fig. 5-29).

The terminal marked "BAT" is connected to the battery through the ammeter and supplies the power to the switch. The accessory terminal supplies power to the accessories when the switch is in the "ACC" or running positions. The "SOL" terminal supplies power to the solenoid to activate the starter in the start position. The terminal marked "GR" (ground) completes the test circuit for the temperature "HOT" indicator bulb when the switch is turned to the start position. These circuits are all open when the ignition switch is in the "OFF" or "START" positions.

When the ignition switch is turned to the start position, the accessory terminal of the ignition switch is cut out. At the same time, the "ground" terminal in the ignition switch is opened de-energizing the air conditioning electrical system to prevent operation of the accessories and air conditioner while starting the engine. Thus, the starting motor does not have to turn the compressor while cranking the engine. See Figs. 5-30 through 5-33.

When the "OFF" push button is depressed, the relay control and ignition relay switch is opened and no current reaches the master control relay. The

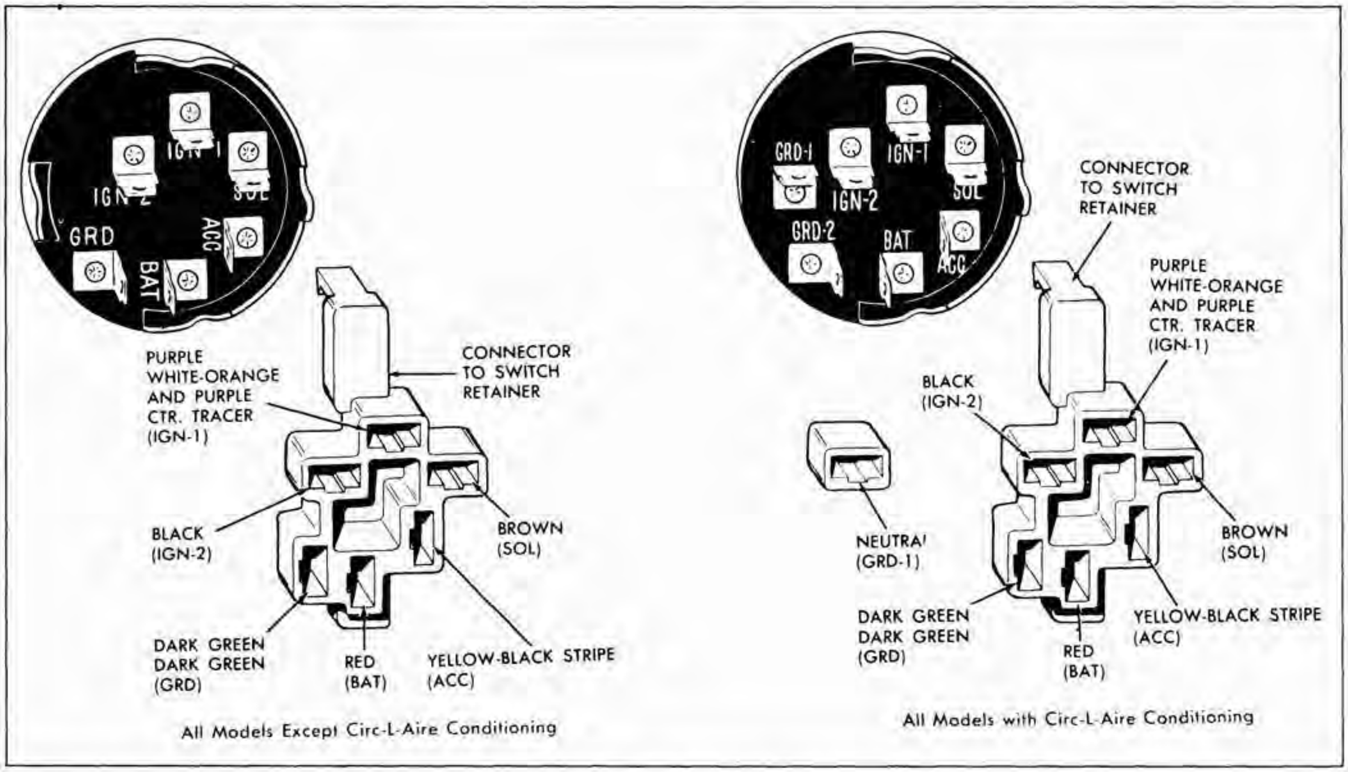



Fig. 5-29 Comparison of Back Side of Ignition and Starter Switch Assemblies

relay control switch is activated when either the "OUTSIDE" or "INSIDE" push button is depressed to energize the master control relay and the compressor clutch control switch. Current does not flow to the compressor clutch coil until the temperature control lever is moved down slightly from the full up position which closes the compressor clutch control switch. This feature allows the use of forced uncooled air for ventilation.

NOTE: The same blower is used to provide forced air for air conditioning and/or heater operation.

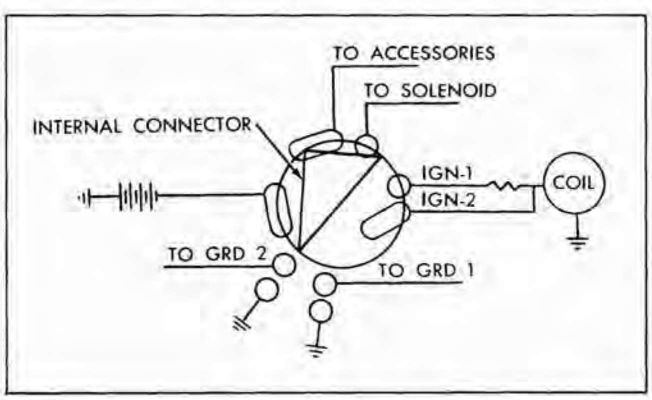



Fig. 5-30 AC Ignition Switch—Circuit Diagram "OFF" Position: No Current Flow—Switch Open

Wires for the heater blower switch and the air conditioning blower switch are contained in the same wire harness and are connected in parallel. This arrangement allows the use of the heater blower switch when the air conditioning control "OFF" button is pushed in, since the heater blower switch will then

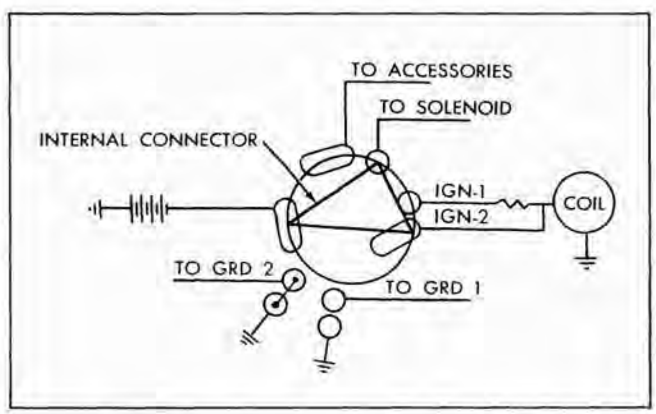



Fig. 5-31 All with Circ-L-Aire AC—Circuit Diagram "Start" Position—Contactors are shown in "IGN-2" (start) position. Current flows from the battery to and through the switch to the starter solenoid to operate engine electrical systems. No current flow through accessories circuit or Circ-L-Aire Conditioning circuit.

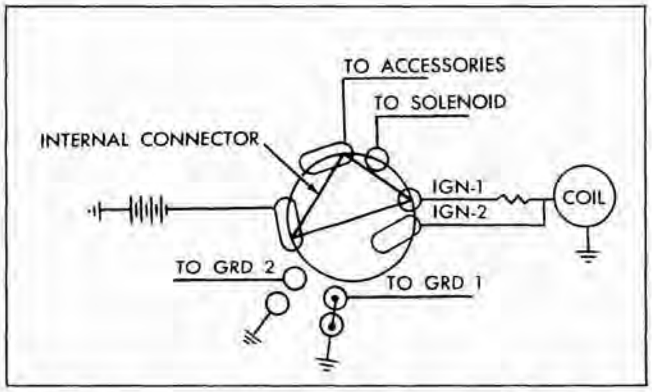



Fig. 5-32 All with Circ-L-Aire AC—Circuit Diagram "Run" Position—Contactors are shown in "IGN-1" (run) position. Current flow is from the battery to and through the switch to operate all engine electrical requirements as well as all accessories circuits.

receive its current through a 20 ampere fuse at the "HTR" terminal on the fuse block. See Figs. 5-34, 5-35 and 5-36.

The air conditioning blower switch provides for four blower speeds: "LO", "2", "3", and "HI." The heater blower switch is also a four position switch with positions of "OFF," "LO", "MED" and "HI".

The blower is fed through a single connection at its input; a black colored lead. Variable voltages to give the various blower speeds is accomplished by using resistances of different values. When the air conditioning blower control is in the "HI" position full system voltage is impressed on the black lead.

### *CURRENT FLOW AT AIR CONDITIONING CONTROL POSITIONS (HEATER OFF)*

The blower is always on when the air conditioner is operating in order to prevent the possibility of evaporator freeze-up when car is driven very slowly or if car is stopped for any length of time with the engine running.

Four positions of the air conditioning blower control provide current to the blower as follows:

### "LO" CURRENT

"LO" speed current flows from the master control relay to the air conditioning blower switch via a light blue wire at the input terminal, through the switch to the "LO" terminal and to the resistor assembly via a brown wire with a white stripe. Current continues through three resistors, (.45 ohm, .31 ohm, and .15 ohm) and to the blower motor via a black wire.

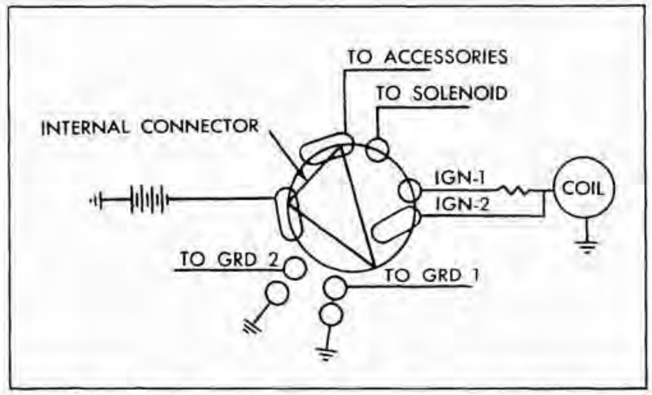



Fig. 5-33 All with Circ-L-Aire AC—Circuit Diagram "ACC." Position—Contactors are shown in "ACC" position. Current flow is from the battery to and through the switch to operate all accessories circuits except Circ-L-Aire Conditioning system. (The "GRD-1" connection inside the switch is open to prevent operation of the Circ-L-Aire Conditioning system.)

### "2" CURRENT

"2" speed current flows from the master control relay to the air conditioning blower switch via a light blue wire, through the "2" terminal of the switch and through a yellow colored wire to the resistor assembly where it flows through two resistors (.31 ohm and .15 ohm) and then to the blower motor via a black colored wire.

### "3" CURRENT

"3" speed current flows from the master control relay to the air conditioning blower switch via a light blue wire, through the "3" terminal of the switch and through a red wire with white stripe to the resistor assembly where it flows through one resistor (.15 ohm) and then to the blower motor via a black colored wire. A black colored wire connects the No. 3 terminal of this switch to the heater "DE-ICE" switch.

### "HI" CURRENT

"HI" speed current flows from the master control relay via a light blue wire to the air conditioning blower switch, through the blower switch high terminal through a black wire to the resistor assembly and to the blower motor through a black colored wire. While the current flows through the resistor assembly, there is no resistance in the circuit through the resistor.

### *TEMPERATURE CONTROL LEVER*

When the temperature control lever is moved down slightly from its full up position, the compressor

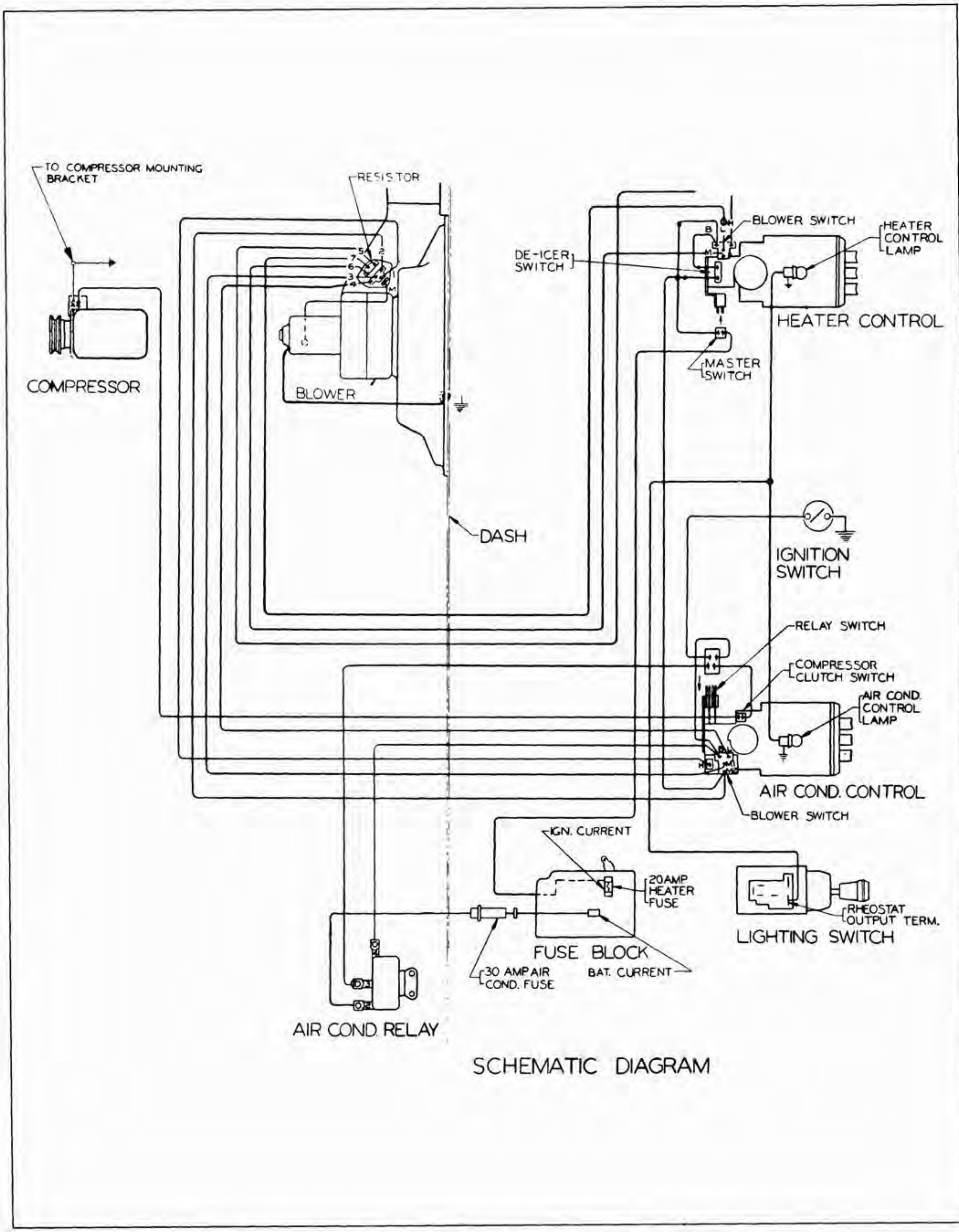
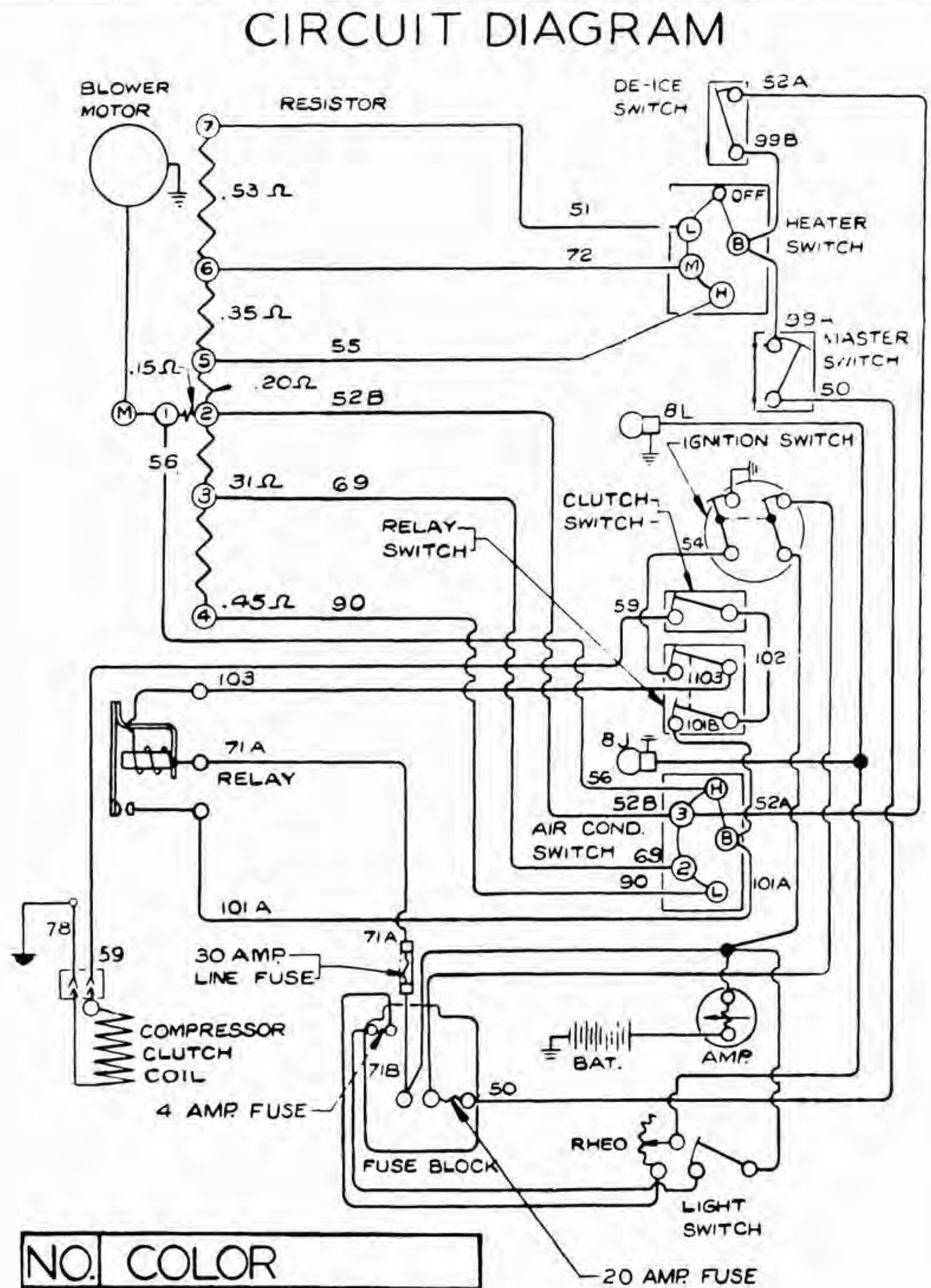



Fig. 5-34 Schematic Diagram of Circ-L-Aire Conditioner Electrical System




| NO. | COLOR | | |
|---|---|---|---|
| 8E | DK BLUE, WHITE STR. | | |
| 8J | GRAY | 71A | RED |
| | | 71B | RED |
| 50 | TAN | 72 | BROWN |
| 51 | WHITE | 78 | BLACK |
| 52A | BLACK | 90 | BROWN, WHITE STR. |
| 52B | RED, WHITE STRIPE | | |
| | | 99A | TAN, WHITE STRIPE |
| 54 | WHITE | 99B | TAN, WHITE STRIPE |
| 55 | RED | | |
| 56 | BLACK | | |
| | | 101A | LIGHT BLUE |
| | | 101B | RED |
| 59 | BLACK | 102 | YELLOW |
| | | 103 | GRAY |
| 69 | YELLOW | | |

Fig. 5-35 Circuit Diagram of Circ-L-Aire Conditioner Electrical System

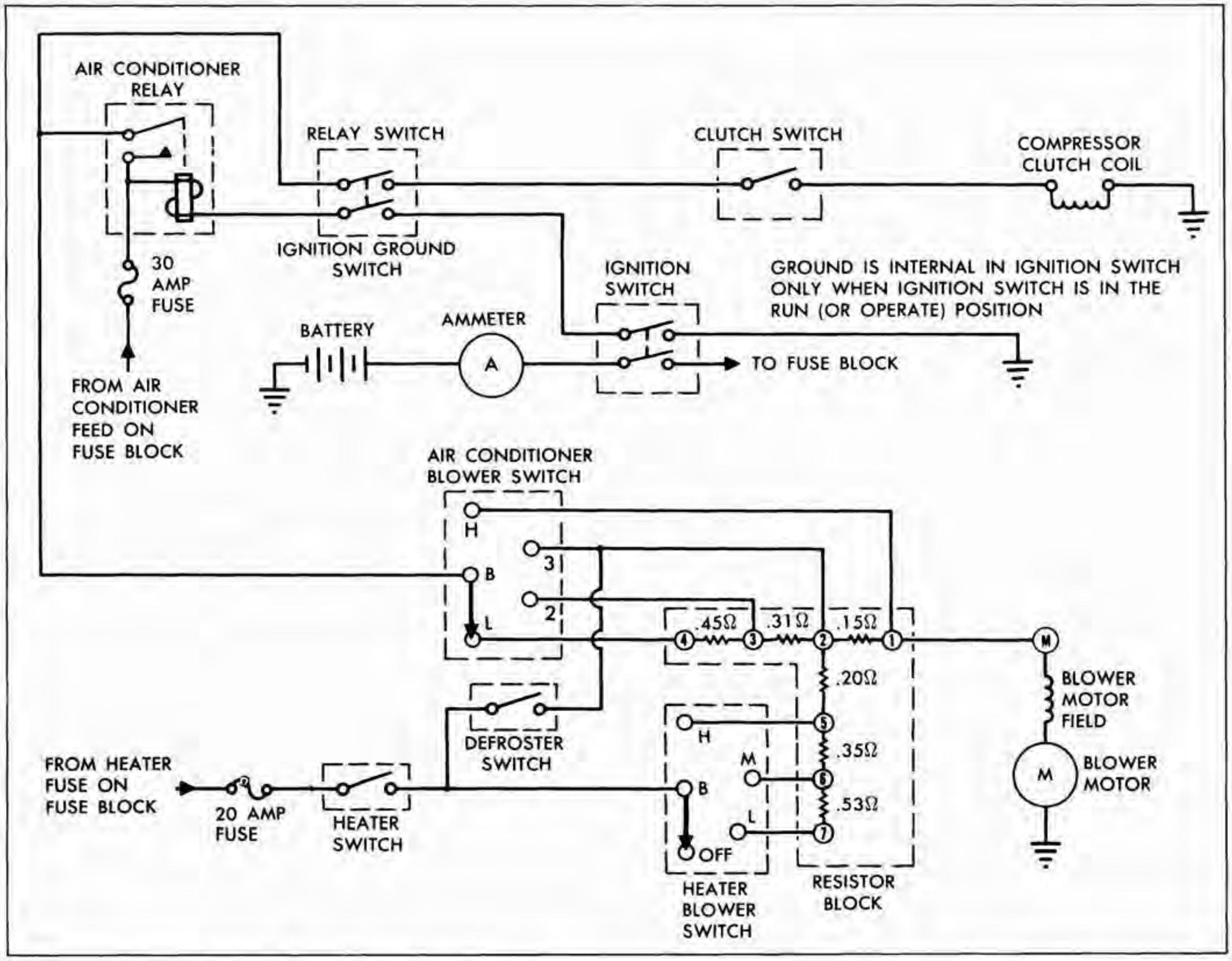



Fig. 5-36 Simplified Circuit Diagram of The Circ-L-Aire Conditioner Electrical System

clutch control switch closes, permitting current to flow via a black wire to the compressor clutch coil to energize the coil. Current will continue to flow through the clutch coil until the temperature control lever is placed in the full up position or the "OFF" button is depressed.

## *CURRENT FLOW AT HEATER CONTROL POSITIONS (AC OFF)*

### "OFF" PUSH BUTTON DEPRESSED ON CIRC-L-AIRE HEATER

In the "OFF" position, the heater master switch is open and prevents the flow of current.

### "NORMAL" PUSH BUTTON DEPRESSED ON CIRC-L-AIRE HEATER

With the "NORMAL" push button depressed, the master switch is closed, permitting current to flow to the heater blower control switch, which in turn permits current flow to the blower as follows:

### "FAN" CONTROL LEVER IN "OFF" POSITION

"OFF" position places the heater blower switch to prevent the flow of current through the switch.

### "FAN" CONTROL LEVER IN "LO" SPEED POSITION

The "FAN" control lever at "LO" provides for low speed current to flow from the fuse block (HTR terminal) to the heater master switch via a tan colored wire. Current flows through the switch, via a tan colored wire with a white stripe to the heater blower switch, through this switch to the resistor assembly via a white colored wire, through four resistor coils in the resistor assembly (totaling 1.23 ohms) to the blower motor via a black wire.

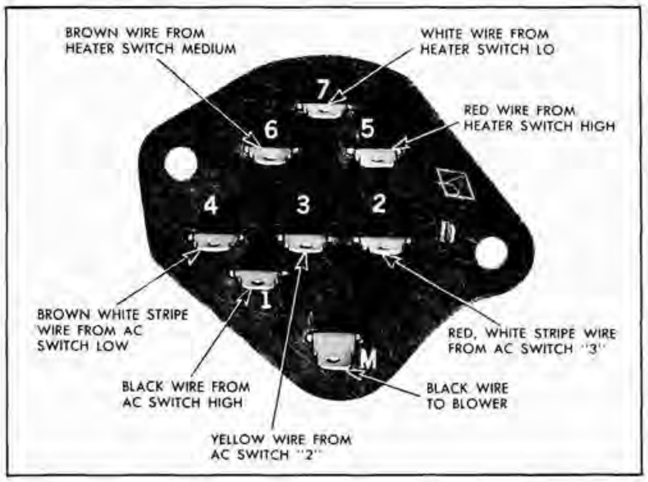



Fig. 5-37 Identification of Terminals on Resistor Assembly

"FAN" CONTROL LEVER IN
"MED" SPEED POSITION

The "FAN" control lever at "MED" provides for low speed current to flow from the fuse block (HTR terminal) to the heater master switch via a tan colored wire. Current flows through the switch, via a tan colored wire with white stripe to the heater blower switch, through this switch to the resistor assembly via a brown colored wire, through three resistor coils in the resistor assembly (totaling 0.70 ohms) to the blower motor via a black wire.

"FAN" CONTROL LEVER IN
"HI" SPEED POSITION

The "FAN" control lever at "HI" provides for "HI" speed current to flow from the fuse block (HTR terminal) to the heater switch via a tan colored wire.

Current flows through the switch via a tan colored wire with a white stripe to the heater blower switch, through this switch to the resistor assembly via a red colored wire, through two resistor coils in the resistor assembly (totaling 0.35 ohms) to the blower motor via a black colored wire.

"DE-ICE" PUSH BUTTON DEPRESSED ON
CIRC-L-AIRE HEATER

When the "DE-ICE" button is pushed in the heater master switch closes to supply current to the defroster switch.

Current flows from the fuse block (HTR terminal) to the heater master switch via a tan colored wire. Current flows through this switch through a tan colored wire having a white stripe to the current input side of the heater blower switch and then to the defroster switch through a tan colored wire having a white stripe, through the defroster switch to the air conditioning blower motor switch "3" terminal (a double connector) via a black colored wire, to the resistor assembly via a red colored wire having a white stripe, through one coil of the resistor assembly (having a value of 0.15 ohms) and to the blower motor via a black colored wire.

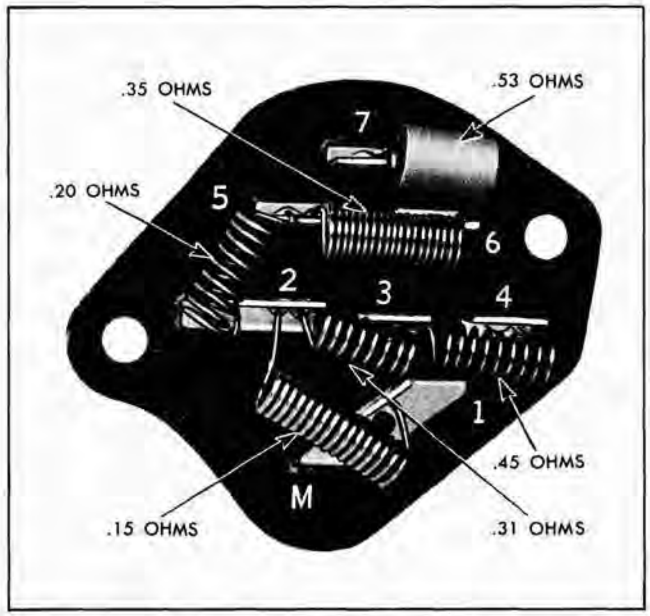



Fig. 5-38 Resistance Values of Resistor Assembly Coils

The "DE-ICE" current flow has less resistance than either the heater blower "LO", "MED" or "HI" speed positions. The blower will operate at "DE-ICE" speed regardless of the position of the heater blower control lever, providing the "DE-ICE" button is depressed.

## THERMOSTATIC CONTROLLED ENGINE FAN FLUID CLUTCH

A thermostatically controlled engine fan fluid clutch is used on Circ-L-Aire conditioned equipped cars and operates only when additional air flow is required to reduce radiator coolant temperatures.

This clutch is of simple functional design and is made of light weight metal filled with silicone oil and is hermetically sealed. The finned (rear) housing contains a hub assembly (secured to the housing bearing) which attaches to the engine water pump (Fig. 5-39). Four bosses with tapped holes (in the rear face) provide for attachment of the engine fan. The front surface of the housing has six deep circular grooves which index with six matching bosses on the rear face of a floating clutch. A separator plate

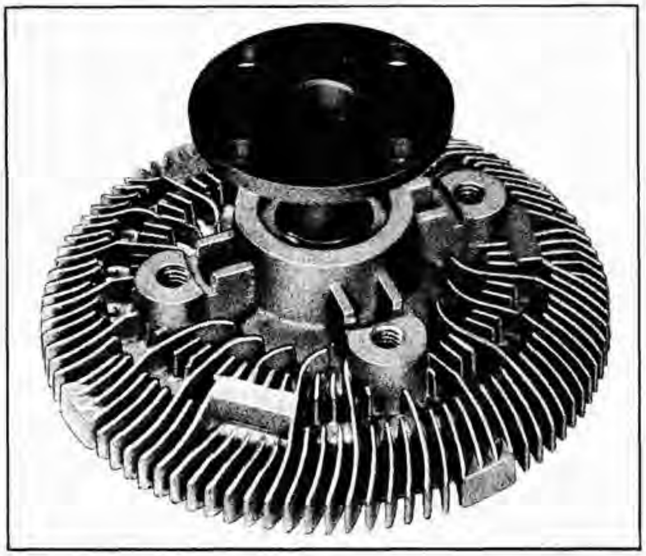


Fig. 5-39 Fan Fluid Clutch Assembly

and front cover (with thermostatic coil control) complete the clutch assembly.

During periods of operation when radiator discharge air temperature is low (below approximately 150°F), the fan clutch limits the fan speed to 800-1400 r.p.m. In this position, the clutch is disengaged since a small oil pump driven by the separator plate forces the silicone oil into the reservoir between the separator plate and the front cover assembly. In this position also, the passage from this cavity to the clutch area is closed by the coil spring leaf valve.

As operating conditions produce a high radiator discharge air temperature (above approximately 150°F), the temperature sensitive bi-metal coil tightens to move the leaf valve (attached to the coil) which opens a port in the separator plate allowing flow of silicone oil into the clutch chamber to engage clutch providing a maximum fan speed of approximately 2200 r.p.m.

The clutch coil is calibrated so that at road load with an ambient temperature of approximately 90°F, the clutch is just at a point of shift between high and low fan speed.

No attempt should be made to disturb the calibration of the engine fan clutch assembly as each assembly is individually calibrated at the time of manufacture.

# INSPECTION AND PERIODIC SERVICE

CONTENTS OF THIS SECTION



## NEW CAR PRE-DELIVERY INSPECTION

1. Check compressor belt tension to 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

2. Check all hose and air duct connections for tightness.

3. Operate system and check for correct operation in all control positions.

NOTE: This step and step 5 can be done in conjunction with the pre-delivery road test.

4. Check for refrigerant leaks (Fig. 5-40) and observe the refrigerant passing through the liquid indicator with system operating to see if there is any evidence of bubbles (above 70°F. ambient).

NOTE: This check can be made immediately after the pre-delivery road test provided the system was operated during the road test.

a. If a refrigerant leak is detected, correct leak. If necessary to replace parts, evacuate and charge system after new parts are installed.

Fig. 5-40 Checking for Refrigerant Leaks

b. If a refrigerant leak is detected and the leak can be corrected without changing parts, bleed system slowly through discharge fitting valve until bubbles appear in the liquid indicator with the temperature control lever at the full cold position. Depress "OUTSIDE" or "INSIDE" button. Place blower on "HI" and temperature control lever down to full cold. Add one pound of Refrigerant-12. See ADDING REFRIGERANT-12.

c. If bubbles are visible in the liquid indicator (above 70°F. ambient) and no leaks are evident, it indicates partial or complete plug in a line or a lack of refrigerant in the system. Correct condition. Add refrigerant until the liquid indicator clears, then add another one pound of refrigerant.

5. Check ambient air temperature and air temperature at outlets on instrument panel in accordance with the operational test procedure. Temperature should correspond to those in the SYSTEM PRESSURES AND TEMPERATURE chart.

6. Check and adjust engine idle—540-560 RPM with air conditioning off. (Hydra-Matic transmission in Drive range, Synchro-Mesh transmission in Neutral.)

## 2000 MILE INSPECTION

1. Inspect all connections for presence of oil on any of the refrigerant system parts which could indicate a refrigerant leak. If oil is evident, check for leaks and repair as necessary.

a. If a refrigerant leak is detected, correct leak. If necessary to replace parts, evacuate and charge system after new parts are installed.

b. If a refrigerant leak is detected and leak can be corrected without changing parts, bleed system slowly through discharge fitting valve until bubbles appear in liquid indicator. Add one pound of refrigerant. See ADDING REFRIGERANT-12.

c. If bubbles are visible in the liquid indicator (above 70°F. ambient) with the temperature control lever at the full cold position and no leaks are evident, it indicates partial or complete plug in a line or a lack of refrigerant in the system. Correct condition. Depress "OUTSIDE" or "INSIDE" button. Place blower on "HI" and temperature control lever down for full cold. Add refrigerant until the liquid indicator clears, then add another one pound of refrigerant.

2. Check compressor belt tension. If below 70 lbs. adjust to 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

3. Check hose and air duct connections for tightness.

4. Operate system for ten minutes at 1500 RPM with temperature control lever at full down and blower control lever down for high speed. Liquid indicator should be clear (above 70°F. ambient).

If bubbles are visible when temperature control lever is at the full cold position it indicates a lack of refrigerant in the system. Correct as necessary and charge system as explained in step one above.

NOTE: This check can be made immediately after the regular road test which is part of the 2000 Mile Inspection, provided the system is operated during the road test.

## PERIODIC SERVICE

### EVERY 2000 MILES

1. Inspect condenser and radiator cores to be sure they are not plugged with leaves or other foreign materials. Be sure to check between the condenser and radiator cores as well as the outer surfaces.

2. Check to insure that the evaporator drain is open.

### TWICE A YEAR OR EVERY 10,000 MILES

Twice a year or every 10,000 miles make a complete maintenance schedule test of the system.

1. Clean out front of condenser to remove all obstruction, such as leaves, bugs, dirt, etc. Be sure that the space between the condenser and radiator is also free of this material.

2. Check to insure that the evaporator drain is open.

3. Check and adjust the temperature regulator valve cable.

4. Inspect compressor drive belt. Check and adjust belt tension.

5. Check to see that the air distributor hoses are connected.

6. Check electrical circuit for proper operation of relays, compressor clutch and blower control switches.

7. Adjust engine idle to 540-560 RPM, with air conditioning "OFF" (Hydra-Matic transmission in Drive range, Synchro-Mesh transmission in Neutral).

8. Check all vacuum connections to diaphragm operating valves.

9. Perform operation test.

## ADJUSTMENTS ON CAR

### COMPRESSOR BELT

NOTE: Check compressor belt tension, adjust if looseness is indicated by slipping or tension is below 70 lbs. on Borroughs Belt Tension Gauge. Adjust as follows:

1. Loosen compressor front and rear mounting plate adjusting slot bolts, compressor front and rear pivot bolts and compressor rear bracket adjusting strap bolt.

2. Using a ½" square socket drive in the hole of the compressor front plate, swing air conditioning compressor outward to obtain a belt tension of 100-105 lbs. using the Borroughs Belt Tension Gauge.

3. Tighten compressor rear mounting plate adjusting slot bolt, and front adjusting bolts. Tighten pivot bolts.

### TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT

The purpose of this adjustment is to insure that the air conditioner refrigeration system will give maximum cooling performance when required.

1. Place temperature control lever in the full cold (down) position.

2. Disconnect the Bowden cable loop from the temperature regulation valve lever.

3. Pull the Bowden cable loop as far forward (toward front of car) as possible.

4. Move the temperature regulation valve lever forward (toward front of car).

5. Slide Bowden cable sheath until eye of Bowden

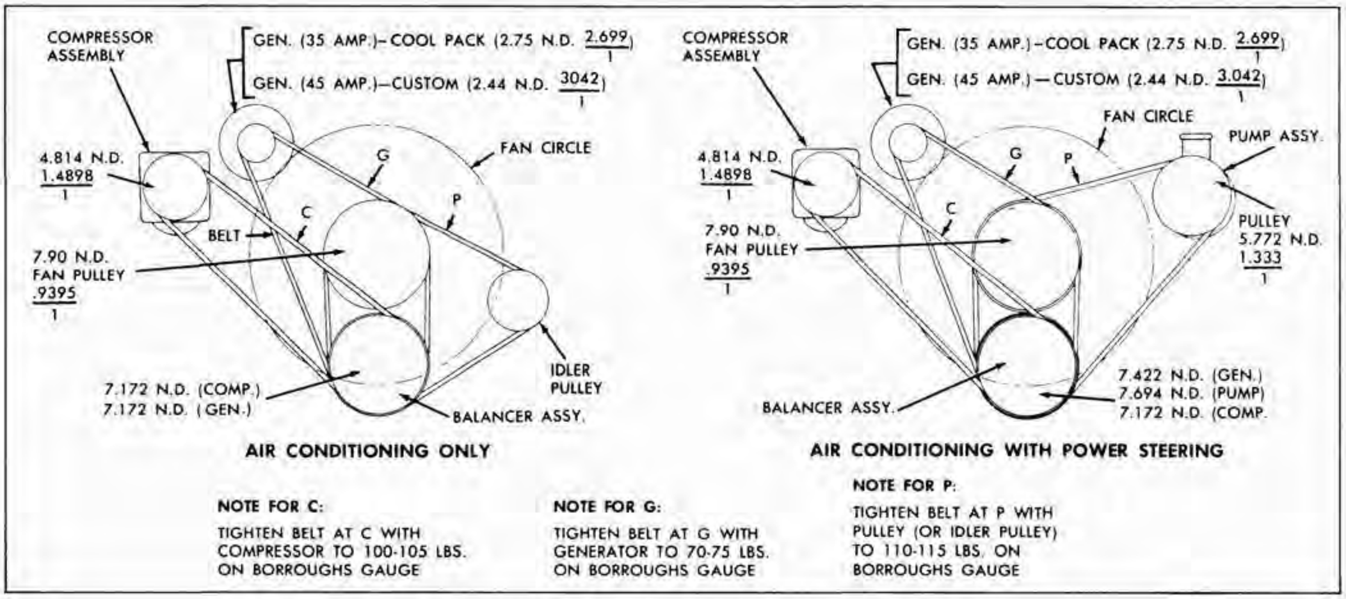



Fig. 5-41 Engine Drive Belt Combinations

cable aligns with temperature regulation valve lever pin.

6. Tighten Bowden cable housing clamp.

7. Install Bowden cable loop on temperature regulation valve cam lever pin.

### *TEMPERATURE REGULATION VALVE ADJUSTMENT*

The purpose of this adjustment is to provide evaporator core freeze protection with maximum cooling efficiency.

NOTE: It is essential that the temperature regulation valve control cable be properly adjusted prior to conducting this check.

1. Check calibration of suction gauge and connect low pressure side of the manifold gauge set J-5725 or J-5725-01 using J-5420 Schrader valve adapter to the Schrader valve located in the temperature regulation valve assembly.

2. Connect the high pressure side of the gauge set using J-6163 Schrader valve adapter (90°) to the Schrader valve located in the discharge side of the compressor fitting (gauge) assembly.

3. Push temperature control lever full down for maximum cooling. (See TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT.)

4. Depress "INSIDE" button and position blower on "HI".

5. Close car doors and windows.

6. Place auxiliary fan (at least 20" in diameter) in front of condenser.

7. Start engine and slowly increase speed to run at 1500 R.P.M.

8. After ten minutes, observe low pressure gauge and adjust temperature regulation valve only if reading (on suction gauge) is not to the specification for the ambient temperature.

NOTE: If adjustment of temperature regulation valve is necessary, proceed as follows: *DO NOT* adjust actuating pin which is threaded in nylon adjusting nut. This nut does *not* have any effect on freeze control pressure.

a. Install J-9505 into two holes in cold setting adjusting screw.

b. Obtain proper pressure reading on the suction gauge by turning adjusting tool clockwise to increase pressure or counterclockwise to decrease pressure.

NOTE: It is important that changes be made in small increments, with time allowed for the pressure to stabilize.

c. Install and adjust temperature valve control cable at temperature regulation valve so that valve cable loop aligns with the lever pin with the temperature set for maximum cold.

(See TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT.)

### CLUTCH CONTROL SWITCH ADJUSTMENT

The purpose of this adjustment is to insure an open circuit to the compressor clutch coil when the temperature control lever is in the full up position.

This switch may be adjusted without removing the air conditioning control assembly.

Adjust clutch control switch to insure an open circuit to the compressor clutch coil when the temperature control lever is in the full up position. The switch should close electrical circuit to compressor coil when the temperature control lever is moved downward 1/4" from the full up position.

# MINOR SERVICES AND REPAIRS—MECHANICAL

CONTENTS OF THIS SECTION



The following services and repairs concern parts of the air conditioning system which can be serviced without opening the refrigeration system. Before attempting any repairs which require opening refrigerant connections, see MINOR SERVICES AND REPAIRS—REFRIGERATION.

## TEMPERATURE REGULATION VALVE CONTROL CABLE

### *REMOVE AND REPLACE*

1. Disconnect temperature regulation valve control cable at temperature regulation valve and detach cable from clamp at each shroud.

2. Disconnect cable at air conditioning control panel assembly.

3. Attach a stout piece of cord or wire (approximately 6 feet long) to the control panel end of the cable and remove cable leaving end of cord on engine side of dash.

4. Detach cable from cord (or wire) and attach new cable to cord. Before installation, inspect the new cable to be sure that it is free of kinks, and that the cable "eyes" are centered with the cable.

5. Pull cable through dash and attach to control panel so cable housing extends through the cable clamp and ¼" beyond (Fig. 5-42).

6. Attach control cable to temperature regulation valve, and secure clamps.

7. Adjust temperature regulation valve control cable.

## BLOWER SWITCH

### *REMOVE AND REPLACE*

The blower switch may be replaced without removing the air conditioning control panel assembly.

1. Disconnect wire connector at blower switch.

2. Remove blower switch lever plastic rivet. Push the plastic center pin out of the plastic rivet and then the rivet can be pushed out of the switch lever.

3. Remove blower switch and switch lever arm as an assembly by removing the two switch attaching screws (Fig. 5-43).

4. Attach the new blower switch to the control assembly with the two screws finger tight.

5. Replace plastic hinge rivet by inserting the rivet and then the plastic center pin.

6. With the blower control lever in the full up position in the control panel, move switch body to engage the "LO" detent and tighten blower switch mounting screws.

## CLUTCH CONTROL SWITCH

### *REMOVE AND REPLACE*

The clutch control switch may be replaced without removing the air conditioning control panel assembly.

1. Disconnect wires at clutch control switch.

2. Remove clutch control switch by removing two switch attaching screws (¼") (Fig. 5-44).

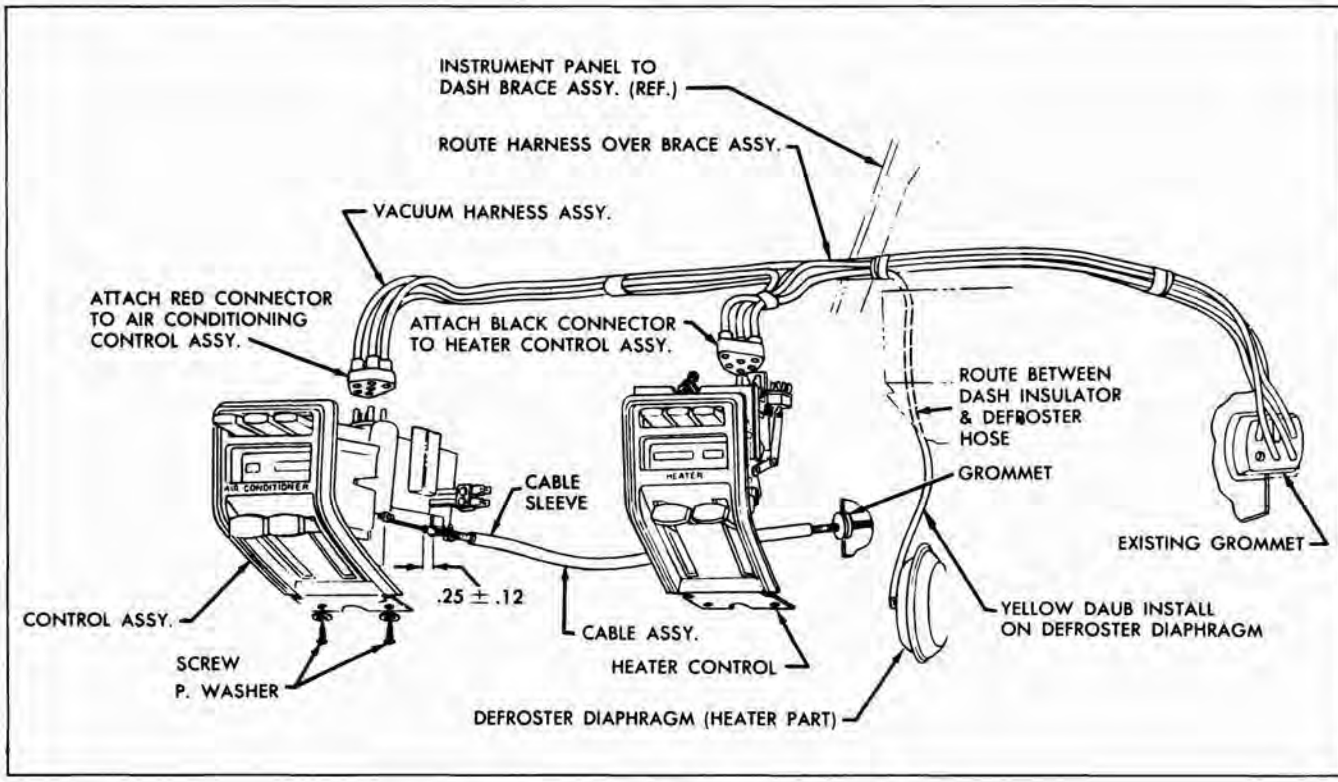



Fig. 5-42 Installation of Cables at Control Panel

3. Replace switch and attach wires.

**NOTE:** The sliding switch release bar should be in front of (towards engine) the switch release lever (plastic end).

4. Adjust the clutch control switch to insure an open circuit to the compressor clutch coil when the temperature control lever is in the full up position. The switch should close the electrical circuit to the compressor coil when the temperature control lever is moved downward 1/4" from the full up position.

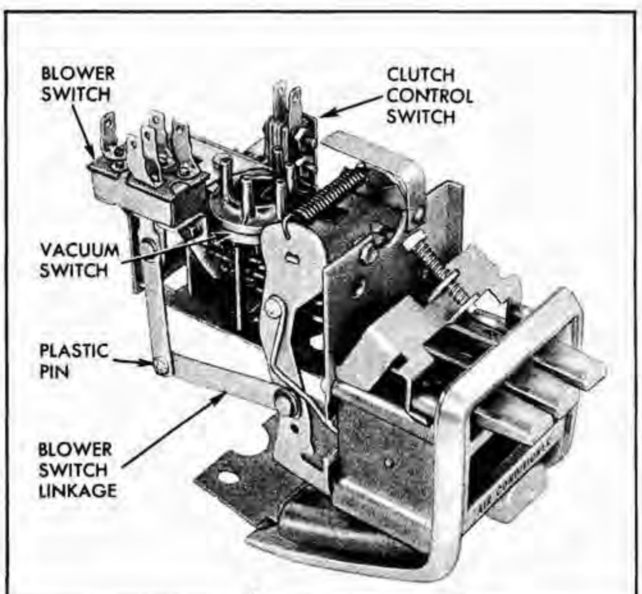



Fig. 5-43 Control Panel Blower Switch and Linkage

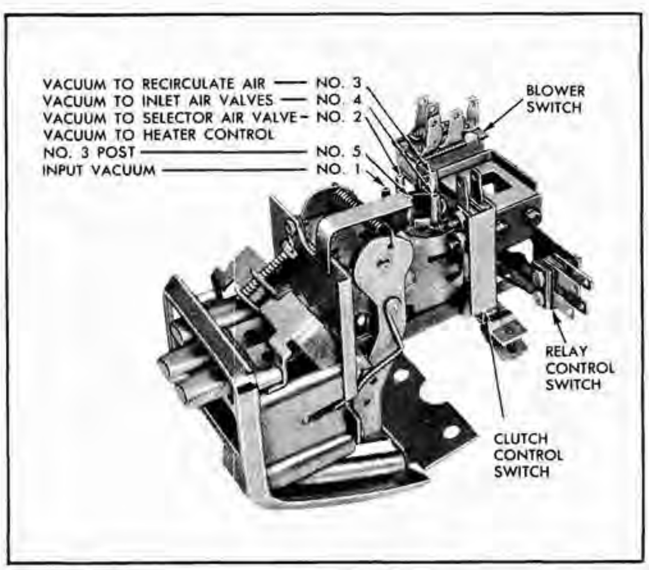



Fig. 5-44 Location of Clutch and Relay Control Switches

## RELAY CONTROL SWITCH

### *REMOVE AND REPLACE*

The relay control switch may be removed without removing the air conditioning control panel assembly.

1. Disconnect wire connector at switch.

2. Remove relay control switch (Fig. 5-44).

3. Replace relay control switch so plastic portion of switch makes good contact with the "OFF" sliding bar when either the "OUTSIDE" or "INSIDE" button is depressed. Plastic ends of switch should *not* contact front portion of control assembly but rather extend through "window" in the front (towards engine) of the control assembly.

## AIR CONDITIONING CONTROL PANEL ASSEMBLY

### *REMOVE AND REPLACE TO SERVICE ASSEMBLY*

1. Disconnect battery.

2. Disconnect wire connectors from control assembly.

3. Disconnect temperature valve control cable.

4. Remove two control panel to instrument panel lower attaching screws.

5. Loosen control panel to instrument panel upper screw (from back side of instrument panel).

6. Pull control panel out of instrument panel far enough to disconnect vacuum hoses, temperature regulation valve control cable and wires.

7. Disconnect vacuum hose connector and remove control assembly.

8. Service assembly as necessary, free up sliding levers, etc.

9. Replace by reversing the above procedure.

10. Adjust temperature regulation valve control cable.

11. Connect battery.

## VACUUM SWITCH

### *REMOVE AND REPLACE*

1. Remove control panel assembly.

2. Remove vacuum switch.

3. Replace by reversing the above procedure, using new vacuum switch and switch felt retainer (in service switch package).

4. Adjust temperature regulation valve control cable.

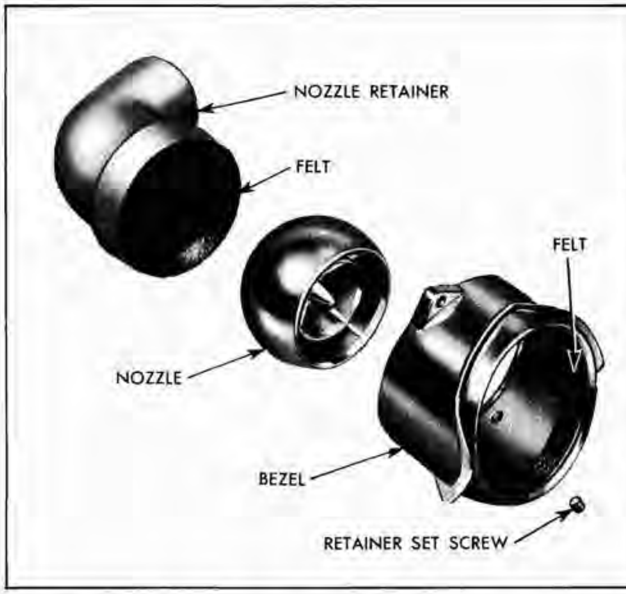



Fig. 5-45 Bezel and Nozzle Assembly—Exploded View

## BEZEL AND NOZZLE ASSEMBLY

### *REMOVE AND REPLACE*

The bezel and nozzle assembly consists of a bezel, nozzle front bearing felt, nozzle, nozzle rear bearing felt and a nozzle retainer (Fig. 5-45). This assembly fits to the instrument panel from the passenger side and is retained by two screws; one at the bottom and one at the top (from the back side of the instrument panel).

RIGHT OR LEFT SIDE

1. Disconnect air distributor to right nozzle hose.

2. Remove bezel to instrument panel lower screw.

3. Loosen nozzle adapter to instrument panel screw (at top of bezel) from back side of instrument panel.

NOTE: Turn adapter at left nozzle to gain access to the upper screw.

4. Remove bezel and nozzle assembly from instrument panel by rolling bottom of bezel out. The hose is cemented to the left nozzle retainer.

5. Replace by reversing the above procedure.

## BEZEL AND NOZZLE ASSEMBLY—OVERHAUL

1. Remove bezel and nozzle assembly.

2. Unscrew nozzle retainer screw from bottom of bezel.

3. Replace by reversing the above procedure.


Fig. 5-46 Location of Circ-L-Aire Conditioner Resistor Assembly

## BLOWER ASSEMBLY

***REMOVE AND REPLACE TO SERVICE***

1. Disconnect wires from resistor on blower motor housing (Fig. 5-46).

2. Disconnect blower motor ground wire at dash shroud.

3. Remove blower impeller housing to air inlet duct screws and remove blower assembly.

4. Replace by reversing the above procedure.

5. Note that the blower impeller is of opposite rotation from the Pontiac heater. The proper air conditioning impeller (and Tempest heater) is identified by a gold colored inlet ring. Use of the wrong impeller will cause excessive blower noise and reduced air flow.

## BLOWER AND AIR INLET DUCT ASSEMBLY

***REMOVE AND REPLACE***

1. Drain radiator.

2. Remove air cleaner.

3. Disconnect coil bracket at dash shroud and move out of way.

4. Remove blower assembly.

5. Disconnect wires from resistor block and vacuum hoses at diaphragms. (Remove hose and wire clips at top of air duct assembly.)

6. Remove wheel and tire assembly.

7. Remove rear portion of right front fender skirt on cars so equipped. On early models, remove entire skirt.

8. Remove screws from adapter between air duct assembly and evaporator.

9. Remove screws and nuts holding air duct assembly to dash.

10. Rotate inboard side of air duct assembly towards right fender as necessary to clear heater pipes and then move the assembly towards engine to disengage from the adapter between air duct assembly and the evaporator.

11. Disconnect heater hoses and remove air inlet duct assembly.

12. Replace by reversing the above procedure, making sure all parts are properly sealed and vacuum hoses are properly connected. Be sure that heater hoses are connected to the heater core at the proper angle so they are not kinked inside the air inlet duct attached to the dash.

NOTE: Connect the vacuum hoses to the control diaphragms as shown in Fig. 5-47.

## OUTSIDE AIR DIAPHRAGM

***REMOVE AND REPLACE***

1. Disconnect wire connectors from resistor and remove blower assembly.

2. Disconnect vacuum hoses and remove air inlet duct assembly.

3. Remove outside air diaphragm assembly.

4. Check air valve to be sure it is properly adjusted and that valve moves fully open.

5. Replace by reversing the above procedure, making sure all vacuum hoses are properly connected (Fig. 5-47) and that wire connectors to resistor are installed.

## INSIDE AIR DIAPHRAGM ASSEMBLY

***REMOVE AND REPLACE***

1. Disconnect wire connectors from resistor and remove blower assembly.

2. Unhook diaphragm assembly.

3. Remove two stamped nuts from inside air inlet duct assembly and remove diaphragm assembly.

4. Replace diaphragm assembly. It may be necessary to hold diaphragm lever against the diaphragm next to the air duct assembly to hook onto the lever arm.

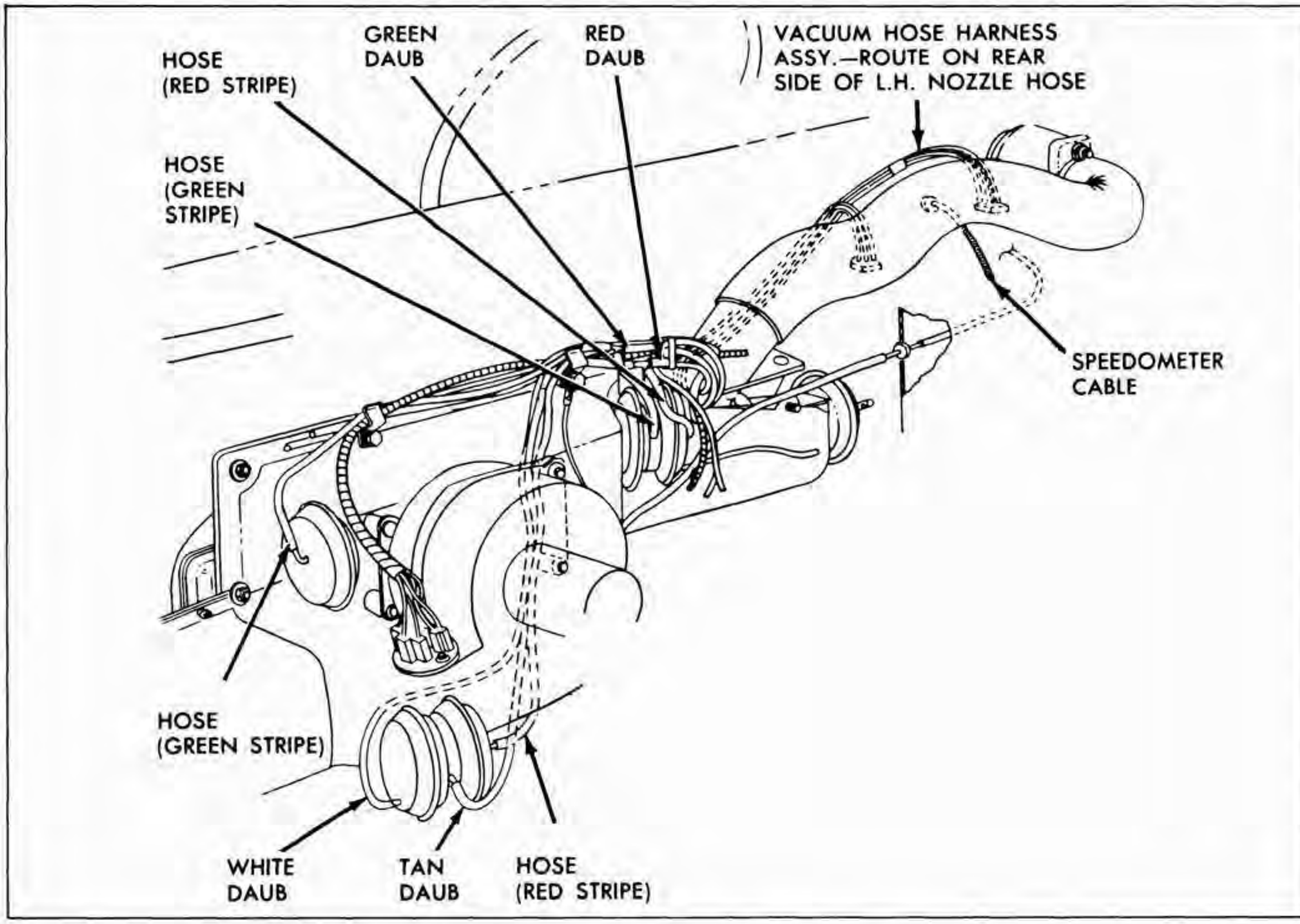



Fig. 5-47 Vacuum Hose Connections at Control Diaphragms

5. Check operation diaphragms. When the diaphragm closest to the duct is operated, the air door should go wide open. When the other diaphragm is operated, the air door should move only 1/4" from its closed position.

6. Replace blower motor assembly.

7. Attach vacuum hoses to diaphragms (Fig. 5-47) and wires to resistor.

## SELECTOR AIR DIAPHRAGMS

### *REMOVE AND REPLACE*

1. Disconnect wire connectors at resistor assembly and remove blower motor assembly.

2. Disconnect vacuum hoses from diaphragms and remove two stamped nuts retaining diaphragms to duct.

3. Replace by reversing above procedure, making sure vacuum hoses are properly connected (Fig. 5-48).

4. Check operation of diaphragms by operating controls and observing that the selector valve seals tightly at both ends of its travel.

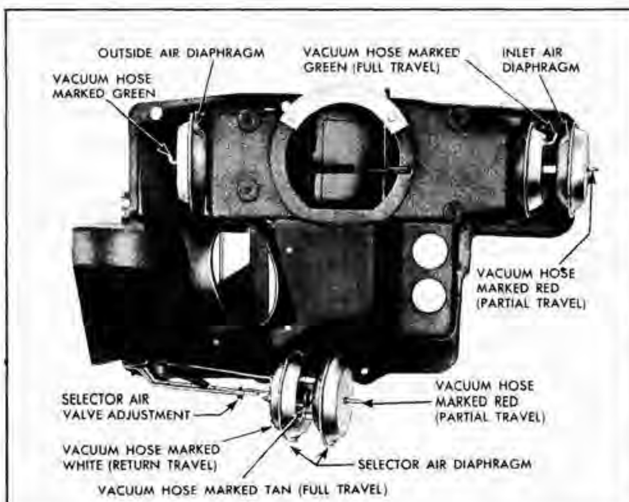



Fig. 5-48 Identification of Diaphragms and Vacuum Hose Connections

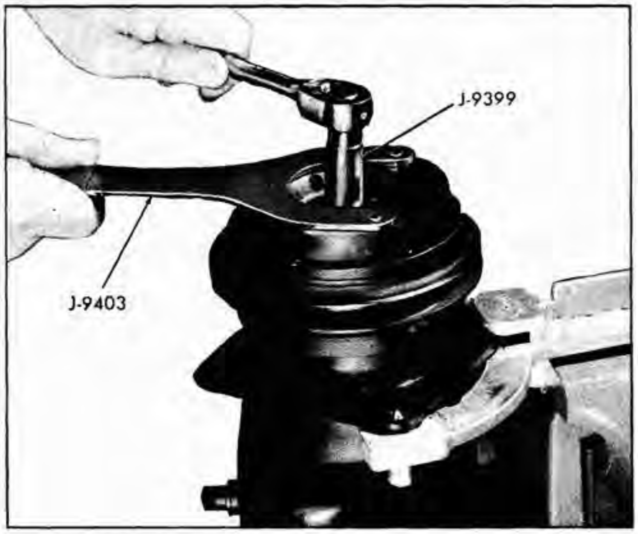



Fig. 5-49 Removing Hub and Drive Plate Lock Nut

## COMPRESSOR HUB AND DRIVE PLATE ASSEMBLY

### *REMOVE AND REPLACE*

### *REMOVE*

1. Hold the clutch hub with J-9403 wrench and using J-9399 (special thin wall $9/16''$ socket) remove hub and drive plate assembly lock nut from shaft (Fig. 5-49).

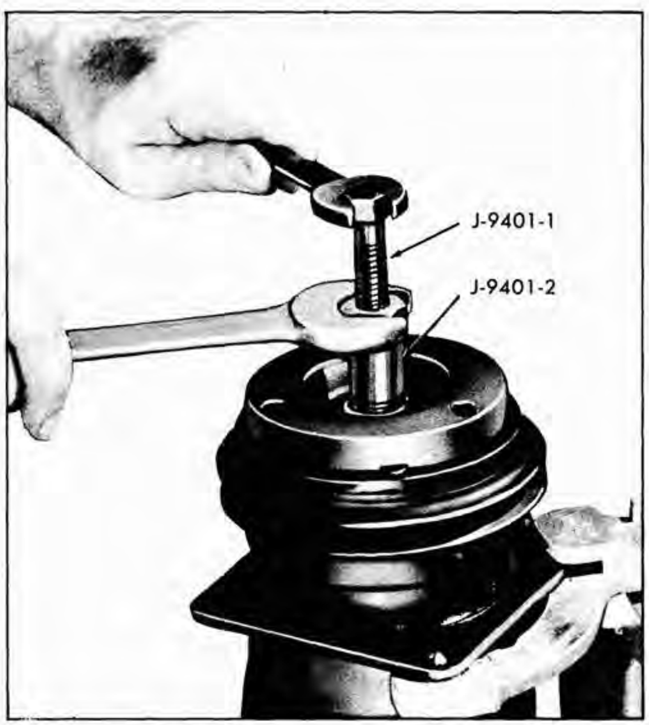



Fig. 5-50 Removing Hub and Drive Plate Assembly

Fig. 5-51 Removing Hub Retainer and Spacer

2. Screw threaded hub puller J-9401 into the hub. Holding body of tool with a wrench, tighten the center screw to remove hub and drive plate assembly (Fig. 5-50). Remove J-9401 puller.

3. Remove hub and drive plate assembly retainer ring, using J-5403 (No. 21 Truarc pliers). Remove spacer. (Fig. 5-51).

4. Remove hub and drive plate assembly key from shaft.

### *REPLACE*

1. Insert square drive key into hub of drive plate so it projects approximately $3/16''$ out of end of keyway (Fig. 5-52). Wedge into keyway with blunt tool.

2. Line up key in hub with keyway in shaft.

***CAUTION: To avoid internal damage to the compressor, DO NOT drive or pound on the hub of the drive plate assembly or on the end of the shaft. If proper tools to remove and replace clutch parts are not used, it is possible to disturb the position of the swash plate (keyed to the main shaft) and result in compressor damage.***

3. Position hub and drive plate assembly into compressor front end casting.

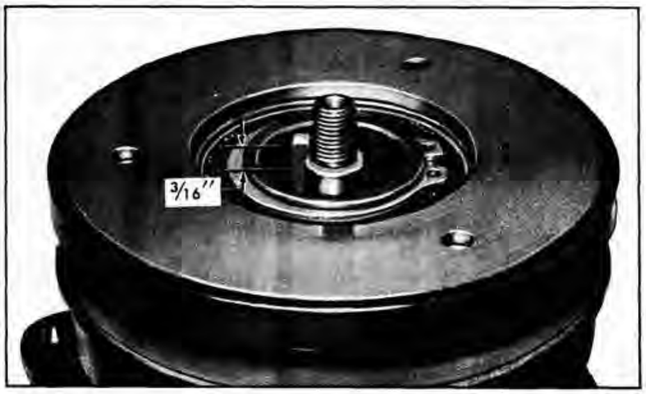



Fig. 5-52 Proper Position of Hub Drive Key

4. Place the J-9480-2 "free" spacer on hub and drive plate assembly and screw J-9480 drive plate installing tool on threaded end of compressor shaft approximately three full turns (to prevent tool from forcing key out of keyway).

***CAUTION: Make certain key in hub remains in place when pressing hub on shaft.***

5. Using a wrench on end of tool body and another wrench on the hex nut, tighten nut to press the hub of the drive plate assembly onto the shaft approximately 1/4".

6. Remove tool and look into armature plate hub to make certain key remains in place.

7. Install J-9480 and press until there is approximately .002"-.057" (1/32"-1/16") space between the frictional faces on the pulley and drive plate (Fig. 5-53).

8. Remove J-9480 assembly.

9. Install hub spacer washer.

10. Install hub and drive plate assembly retainer ring with flat side of ring facing spacer, using J-5403 (No. 21 Truarc pliers). J-9399 can be used to "snap" the retainer ring in place.

11. Install a new armature plate and hub lock nut, using J-9399 (special thin wall 9/16" socket). Tighten to 14-16 lb. ft. torque. The air gap between the friction faces of the pulley and drive plate should now be between .002" to .057" (1/32" to 1/16") clearance.

12. Operate engine and refrigeration system with suction pressure of at least 30 p.s.i.g. and the discharge pressure at least 150 p.s.i.g. Cycle clutch (by turning air conditioning off and on) at least twenty times at approximately one second intervals to "seat" or "run-in" mating parts of the clutch.


Fig. 5-53 Installing Hub and Drive Plate Assembly

## COMPRESSOR PULLEY AND/OR BEARING ASSEMBLY

### *REMOVE AND REPLACE*

#### *REMOVE*

1. Remove hub and drive plate assembly.

2. Remove pulley assembly retainer ring using J-6435 (No. 26 Truarc pliers) (Fig. 5-54).

3. Place J-9395 puller pilot over compressor shaft and remove pulley assembly using J-8433 pulley puller.

4. Remove puller and J-9395 puller pilot.

5. Remove pulley bearing wire retainer ring with an awl or a small screwdriver (Fig. 5-55).

6. Remove ball bearing assembly using J-8849 and J-8092 handle to press out bearing.

#### *REPLACE*

If the existing pulley and drive plate and hub assembly are to be reused, clean the drive faces on each part with trichlorethylene, alcohol or similar solvent. If these parts show evidence of warpage, due to overheating, they should be replaced.

1. When replacing a new ball bearing assembly into the pulley, use J-9481 pulley bearing installer (Fig. 5-56).

Fig. 5-54 Removing Pulley and Bearing Assembly Retainer Ring

2. Replace the pulley assembly wire retainer ring in pulley.

3. Press or tap the pulley and bearing assembly on the neck of the compressor using J-9481 (Fig. 5-57).

4. The pulley should rotate freely.

5. Install pulley snap ring retainer using J-6435 (No. 26 Truarc pliers). Assure installation of snap ring by tapping with J-9481.

6. Replace hub and drive plate assembly making sure to use the proper tools to replace this assembly. *DO NOT* drive or pound on the hub assembly.

## COMPRESSOR CLUTCH COIL AND HOUSING ASSEMBLY

### *REMOVE AND REPLACE*

### REMOVE

1. Remove hub and drive plate assembly.

2. Remove pulley and bearing assembly.

3. Remove electrical connection plug from the terminals on coil.

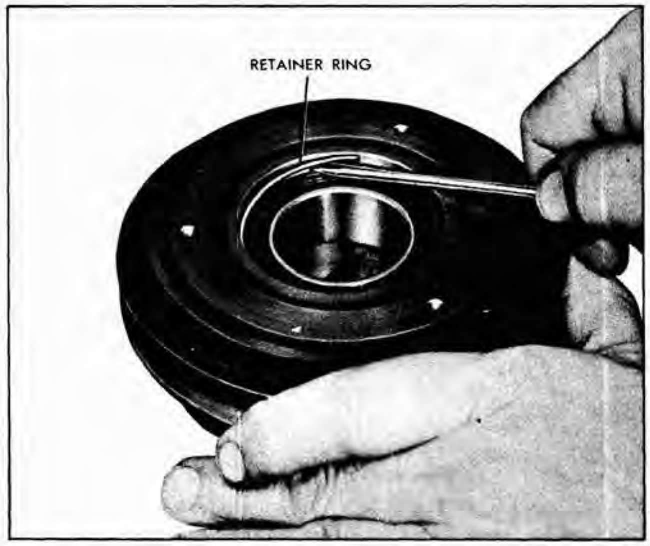



Fig. 5-55 Removing Pulley Bearing Retainer Ring


Fig. 5-56 Installing Pulley Bearing

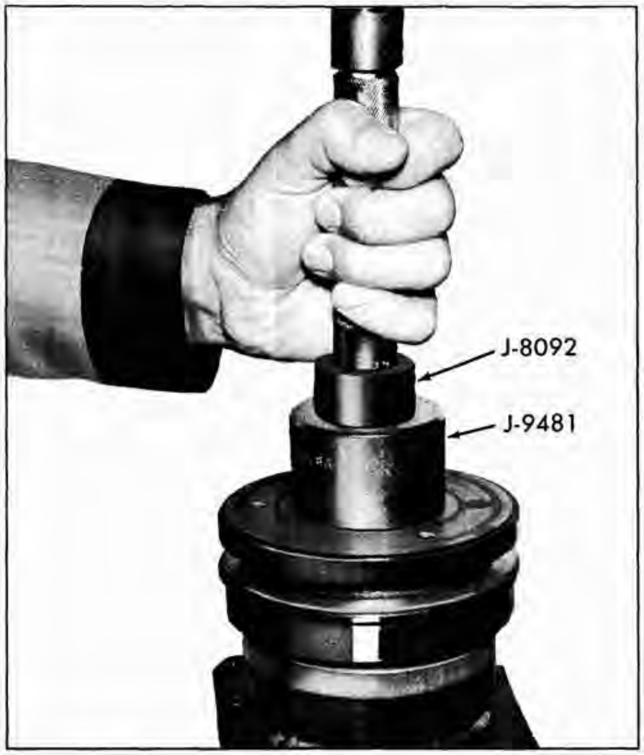



Fig. 5-57 Installing Pulley Assembly

4. Note position of electrical terminals and scribe location of coil housing terminals on compressor body.

5. Use J-6435 (No. 26 Truarc pliers) and remove coil housing retainer ring (Fig. 5-58).

6. Remove the coil housing assembly.

### *REPLACE*

1. Position clutch coil on compressor front head casting so electrical terminals are in their proper location as previously scribed on compressor body.

NOTE: Make certain coil is properly seated on dowels.

2. Replace the coil retainer ring with flat side of ring facing coil, using J-6435 (No. 26 Truarc pliers).

3. Connect electrical connection.

4. Replace pulley and bearing assembly.

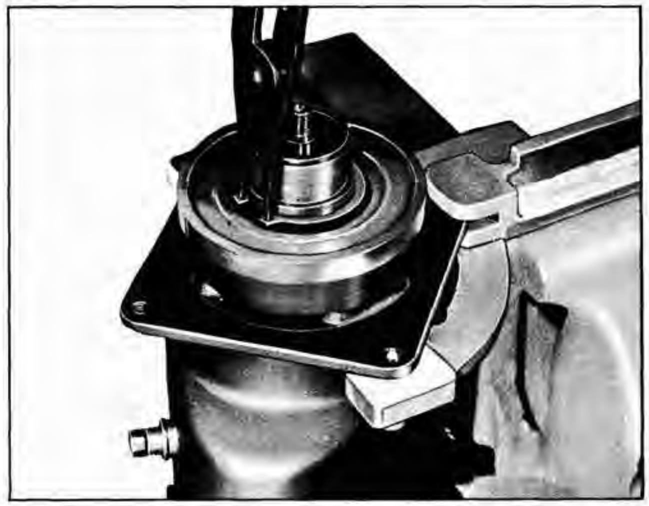


Fig. 5-58 Removing Coil Housing Retainer Ring

5. Replace hub and drive plate assembly making sure the proper tools are used to replace this assembly. *DO NOT* drive or pound on the hub assembly.

## REMOVE COMPRESSOR ASSEMBLY TO SERVICE ENGINE

1. Disconnect compressor clutch coil ground wire at compressor and wire connector at coil.

2. Remove compressor drive belt.

3. Remove compressor rear brace to cylinder head brace bolt at compressor mounting bracket.

4. Remove compressor front plate to mounting bracket upper bolts and lower adjusting bolt.

5. Remove compressor rear plate to mounting bracket lower adjusting bolt.

6. Pad fender and fender skirt and place compressor near top of fender skirt, securing compressor to right fender brace (with wire, rope or similar means).

***CAUTION: Do not kink any hoses or place excessive tension on the hose.***

7. Replace by reversing the above procedure.

8. Tighten compressor belt to give 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

# MINOR SERVICES AND REPAIRS—REFRIGERATION

## CONTENTS OF THIS SECTION



## PRECAUTIONARY SERVICE MEASURES

Before any service is attempted which requires the opening of refrigeration pipes or units, the person doing the work should be thoroughly familiar with GENERAL INFORMATION ON REFRIGERATION SERVICE. Also, he should follow very carefully the instructions given on the following pages for the unit being serviced.

The major reasons behind these measures are for safety and to prevent dirt and moisture from getting into the system. Dirt contaminant is apt to cause leaky valves or wear in the compressor, and moisture will freeze into ice at the expansion valve and freeze the valve stem.

The presence of moisture can also cause the formation of hydrochloric or hydrofluoric acids in the system.

### PRE-ASSEMBLY

1. All sub-assemblies are shipped, sealed and dehydrated. They are to remain sealed until just prior to making connections.

2. All sub-assemblies should be at room temperature before uncapping. (This prevents condensation of moisture from the air that enters into the system.)

3. If for any reason the caps are removed, but the connections are not made, then the tubes and other parts should not remain unsealed for more than 15 minutes. Reseal connections if period is to be longer. This applies particularly to partially built-up systems that will be left overnight.

4. Compressors are shipped with 11 oz. of Frigidaire 525 Viscosity oil and charged with a mixture of Refrigerant-12 and dry nitrogen to provide an internal pressure at slightly above atmospheric pressure.

### ASSEMBLY

1. All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak.

2. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with alcohol. Do not use chlorinated solvents such as trichloroethylene for a cleaning agent, as they are contaminants. If dirt, grease or moisture gets inside the pipes and cannot be removed, the pipe is to be replaced.

3. Sealing caps should be removed from sub-assemblies just prior to making connections for final assembly.

4. Use a small amount of clean refrigeration oil (525 or 1000 viscosity) on all tube and hose joints,

and dip the O-ring gasket in this oil before assembling the joint, as this oil will help in making a leak-proof joint.

When tightening joints, use another wrench to hold the stationary part of the connection, so that a solid feel can be attained, which will indicate proper assembly.

***CAUTION: Tighten all tubing connections as shown in Fig. 5-59. Insufficient torque when tightening can result in loose joints and excessive torque when tightening can result in deformed joint parts, either condition can result in refrigerant leakage.***

5. Do not connect the receiver and liquid indicator assembly until all other sealed sub-assemblies have been connected. This is necessary to insure optimum dehydration and maximum moisture protection of the refrigeration system.

### CAUTION—LIQUID INDICATOR

Under normal conditions, the liquid indicator will show clear with about 3.25 pounds of refrigerant in the system. However, the air conditioner will not produce its best performance until 4.0 pounds of refrigerant are in the system. Do not overcharge with refrigerant, as this will result in extremely high head pressures and the compressor safety valve will "blow".

## DEPRESSURIZING THE SYSTEM

Any time the system is to be opened, it must first be depressurized. Depressurize the system as follows:

1. Remove caps from suction and discharge valve gauge fittings on compressor.

2. With both valves on the manifold gauge set J-5725-01 closed (clockwise), attach manifold to compressor using J-5420 Schrader valve adapter at the suction gauge fitting and J-6163 Schrader valve adapter at the discharge gauge fitting.

3. Crack open the high pressure valve on manifold gauge set to allow slow escape of refrigerant from the system through the manifold gauge set and out the center fitting and hose. (Place end of hose in clean container.) If oil drips from the hose into the container, refrigerant is escaping too rapidly.

4. When hissing ceases (indicating all refrigerant has escaped) close high pressure valve on manifold gauge set by turning valve clockwise.

| Metal Tube Outside Diameter | Thread and Fitting Side | Steel Tubing Torque Lb.-Ft. | Aluminum or Copper Tubing Torque Lb.-Ft. | Nominal Torque Wrench Span |
|---|---|---|---|---|
| 1/4 | 7/16 | 10-15 | 5-7 | 5/8 |
| 3/8 | 5/8 | 30-35 | 11-13 | 3/4 |
| 1/2 | 3/4 | 30-35 | 11-13 | 7/8 |
| 5/8 | 7/8 | 30-35 | 18-21 | 1 1/16 |
| 3/4 | 1 1/16 | 30-35 | 23-28 | 1 1/4 |

**If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification.**

Fig. 5-59 Pipe and Hose Connection Torque Chart

## EVACUATING THE SYSTEM

When the refrigeration system is depressurized and opened for service, some air will enter the lines regardless of how quickly the openings are capped. In order to remove this air and as much as possible of the moisture it contains, the complete system must be "evacuated". Evacuating is merely the process of removing all air from the system, thereby creating a vacuum in the system.

***CAUTION: Under no circumstances should alcohol be used in the system in an attempt to remove moisture, regardless of the successful use of alcohol in other refrigeration systems.***

### PREPARATIONS FOR EVACUATING COMPLETE SYSTEM

Due to the arrangement of the compressor fittings assembly, the system may be evacuated through the manifold gauge set, using the following procedure to catch any oil which may be lost:

1. Check the low pressure gauge for proper calibration, with the gauge disconnected from the refrigeration system. Be sure that the pointer on the gauge indicates to the center of "O". Tap the gauge a few times lightly to be sure pointer is not sticking. If necessary, calibrate as follows:

a. Remove the cover from the gauge.

b. Holding gauge pointer adjusting screw firmly with one hand, carefully force pointer in the proper direction in the proper amount to position the pointer through the center of the "O" position. Tap gauge a few times to be sure pointer on gauge is not sticking. Replace gauge cover.

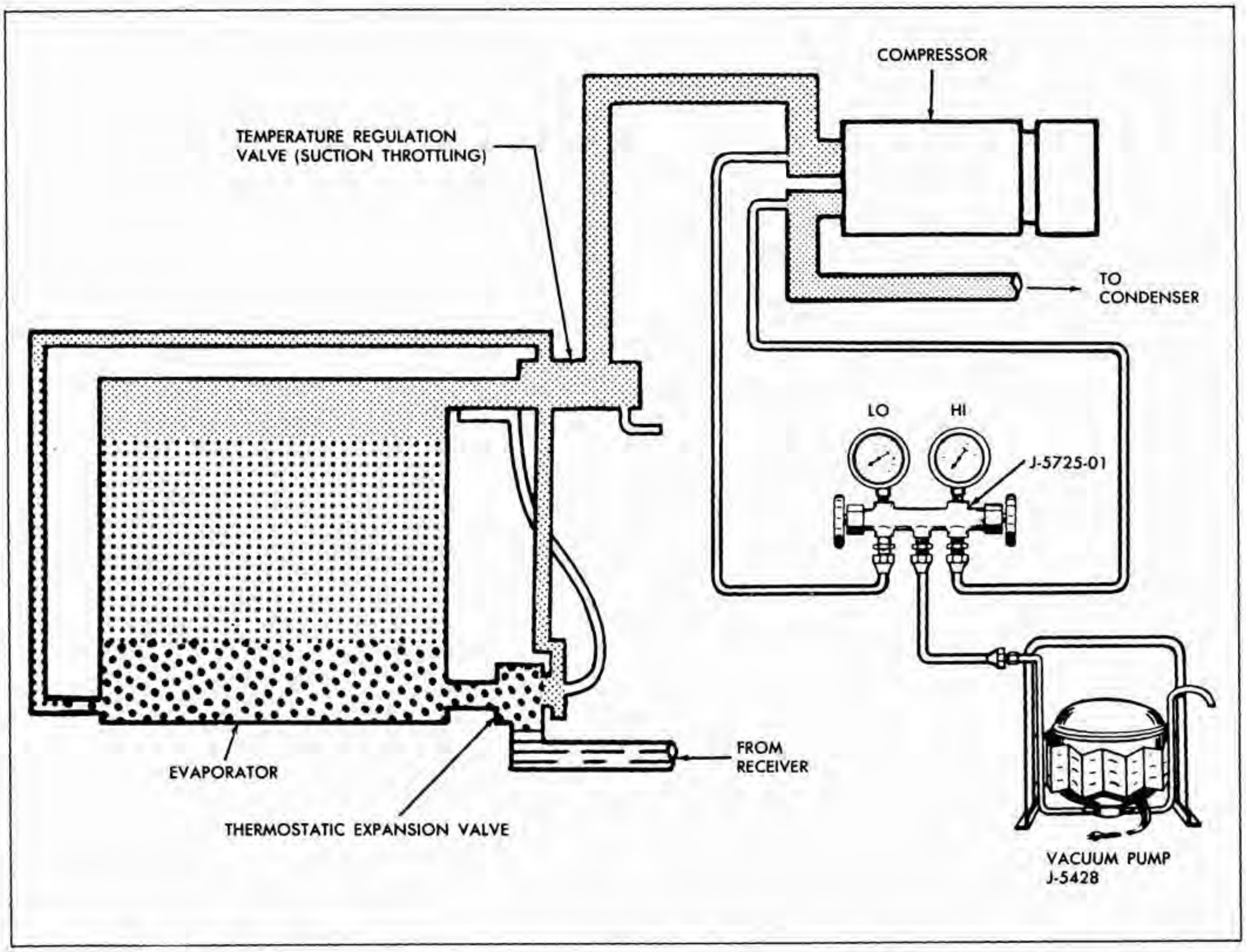



Fig. 5-60 Schematic Showing Connections and Tools for Evacuating the Refrigeration System

2. If gauge set is not already connected to the compressor, connect as follows (Fig. 5-60).

a. Close hand shut-off valves on gauge set by turning clockwise.

b. Remove caps from gauge fittings on compressor suction and discharge fittings.

c. Attach Schrader valve adapter J-5420 to end of hose from low pressure gauge and connect this adapter fitted hose to the suction gauge fitting.

d. Attach Schrader valve adapter J-6163 to end of hose from high pressure gauge and connect this adapter fitted hose to the discharge gauge fitting.

3. Attach a flexible gauge hose to the center fitting of the gauge set and attach the other end of this hose to the vacuum pump J-5428 or J-5428-01 (Fig. 5-60).

4. The system can now be evacuated.

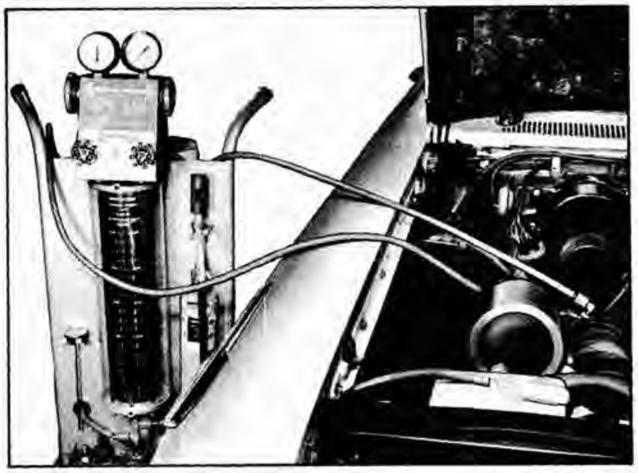


Fig. 5-61 Evacuating the Refrigerant System with J-8393

### *EVACUATING COMPLETE SYSTEM*

1. Turn hand shut-off valve on low pressure gauge of gauge set to the full clockwise position.

2. Slowly turn valve on high pressure gauge counterclockwise from the full clockwise position letting any pressure build up escape completely. Close high pressure valve.

3. Check oil level in vacuum pump and add Frigidaire 150 viscosity oil or eqivalent, if necessary, to bring to proper level. *Make sure* dust cap on discharge side of vacuum pump has been removed.

4. Start the vacuum pump and slowly open the low and high pressure sides of the manifold gauge set to avoid forcing oil out of the refrigeration system and the pump. Pressure is now being reduced on both sides of the refrigeration system.

NOTE: If oil is blown from the vacuum pump, it should be refilled to the proper level with Frigidaire 150 viscosity oil or equivalent under BASIC AIR CONDITIONING INFORMATION.

5. Observe low pressure gauge and operate vacuum pump until gauge shows 26-28" vacuum. Continue to run pump for ten additional minutes.

NOTE: In all evacuating procedures the specification of 26-28 inches of vacuum is used. This evacuation can only be attained at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specification should be lowered by one inch of mercury vacuum. For example: at 5000 feet elevation only 21 to 23 inches of vacuum can normally be obtained.

If vacuum cannot be pulled to the minimum specification for the respective altitude, it indicates a leak in the system, gauge connections or a defective vacuum pump. In this case, it will be necessary to check for leaks as outlined below, after a small amount of Refrigerant-12 has been added to the low side of the system.

a. Turn the hand shut-off valves at the low and high pressure gauge of the gauge set to the full clockwise position with the vacuum pump operating, then stop pump.

b. Connect flexible line from center fitting of the gauge set to refrigerant drum (drum should be at room temperature).

NOTE: It may be necessary to use reducer J-5462-4 with washer J-5462-3 and fitting J-5462-9 to attach flexible hose to refrigerant drum.

c. Open shut-off valve on drum and loosen flexible line fitting at center fitting at gauge set so that refrigerant will purge all air from line. Tighten flexible fitting when certain all air has been purged from line.

d. Open suction valve on gauge set. This will allow refrigerant to pass from the drum into the system. When pressure stops rising, close suction valve on gauge set and valve at refrigerant drum (as refrigerant drum is at room temperature, only a small refrigerant charge will enter the system).

e. Using leak detector J-6084, check all fittings in the system, compressor shaft seal and on the gauge set for evidence of leakage. When general area of leak has been found with the test torch, a liquid leak detector may be helpful in locating the exact point of leakage. After leak has been corrected, evacuate the system again.

6. Turn the hand shut-off valves at the low and high pressure gauge of the gauge set to the full clockwise position with the vacuum pump operating, then stop pump. Carefully check low pressure gauge to see that vacuum remains constant. If vacuum reduces, it indicates a leak in the system or gauge connections. See "NOTE" in step 5 above for method of locating leak.

## CHARGING THE SYSTEM

The system should be charged only after being evacuated as outlined in EVACUATING THE SYSTEM.

### *REFRIGERANT DRUM METHOD*

1. Connect center flexible line of gauge set to refrigerant drum.

NOTE: It may be necessary to use reducer J-5462-4 with washer J-5462-3 and fitting J-5462-9 to attach flexible line to refrigerant drum.

2. Place refrigerant drum in a pail of water which has been heated to a maximum of 125°F.

***CAUTION: Do not allow temperature of water to exceed 125°F. High temperature will cause excessive pressure and possible softening of the fusible safety plugs in the refrigerant drum. It may not be necessary to use hot water if a large drum is used (over approximately 100 lbs.).***

3. Place refrigerant drum (in pail of water) on

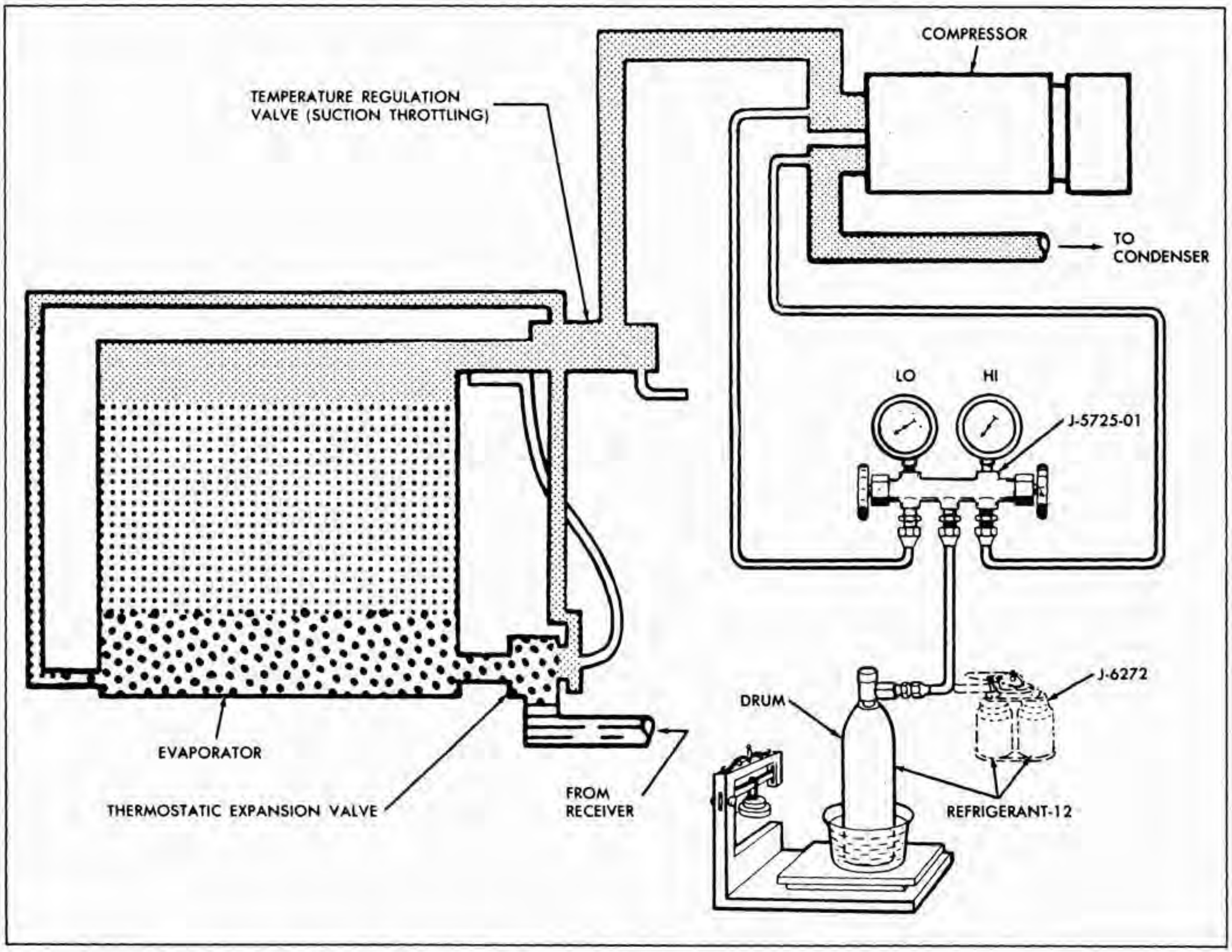



Fig. 5-62 Schematic Showing Connections and Tools for Charging the Refrigeration System

scales (bathroom or commercial, preferably commercial), Fig. 5-62.

***CAUTION: Do not turn refrigerant drum upside down as this would allow liquid refrigerant to enter compressor which may cause damage.***

4. If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and "crack" valve on refrigerant drum to blow air from line. Retighten line at center fitting and record exact weight of refrigerant tank in water on the scales.

5. Open valve on refrigerant drum and both valves on gauge set to allow refrigerant to flow into the system. Continue charging until the scales show that 4.0 pounds of refrigerant have been transferred from refrigerant drum to the system.

NOTE: If full charge cannot be attained, close both valves on gauge set, start engine, and position temperature control lever to full down position. Open low pressure valve on gauge set slowly and leave open until full charge of 4.0 pounds of Refrigerant-12 is taken in.

***CAUTION: Observe high pressure gauge while charging with compressor running. Shut off engine if pressure exceeds 350 psi. A large fan placed in front of the car will help reduce excessively high head pressure.***

6. Close both valves on gauge set (high pressure valve will already be closed if charging was completed by running compressor) and close valve on refrigerant drum.

NOTE: If the engine was used to complete the Refrigerant-12 charge into the system, close valve on refrigerant drum to permit compressor to draw any refrigerant left in the line from the drum to the center fitting of the gauge set, then close the low pressure valve on the gauge set.

7. Operate engine at 1500 RPM with temperature control lever at full down position and blower control down for high speed. After ten minutes of operation, observe appearance of refrigerant in liquid indicator. If bubbles are observed, open low pressure gauge valve and valve on refrigerant drum to allow more refrigerant to enter system. Close valve when liquid indicator clears up.

NOTE: If air inlet temperature is below 70°F. when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Air inlet temperature must be 70°F. or above to make an accurate check. In no case should the system be charged with more than 4.0 lbs. of refrigerant.

8. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

9. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on compressor fittings.

NOTE: A considerable amount of refrigerant will collect in the high pressure line, since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure gauge fitting at the compressor with a shop cloth before disconnecting the Schrader valve from the gauge fitting, to prevent damage or injury to personnel.

10. Using leak detector J-6084, check complete system for leaks, as explained under LEAK DETECTORS.

***REFRIGERANT-12 DISPOSABLE CAN METHOD***

After having depressurized, repaired (if necessary), and evacuated the refrigeration system, the system may be charged as follows when using Refrigerant-12 disposable cans:

1. Obtain four "one" pound cans of Refrigerant-12. (Actually the net weight of refrigerant is 15 ozs. per can.)

2. Mount three cans in J-6272 No. 3 Multi-opener or attach J-6271 Fitz-All Valve (single can opener valve) on one can.

***CAUTION: MAKE SURE OUTLET VALVE ON OPENER IS CLOSED (CLOCKWISE) BEFORE INSTALLING OPENER.***

a. If the J-6272 No. 3 Multi-opener is used, raise locking lever, position three cans of refrigerant and force the locking lever down to secure cans and at the same time puncture the top of the can to make it ready for charging.

b. If the J-6271 Fitz-All Valve is used, back off the valve from the can top retainer, slip the valve on to the can and turn the valve into the retainer until tight. *DO NOT* open outlet valve during this operation as turning the valve into the retainer punctures the top of the can to make it ready for charging.

3. Connect center flexible line of gauge set to the fitting on a can opener valve.

NOTE: If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and "crack" valve at can opener (for a second or two) to force air from the line. Retighten line at center fitting.

4. Open valve on No. 3 Multi-opener (or on single can) and also low pressure and high pressure valves on manifold gauge set. Leave can valve open until all refrigerant has entered the refrigeration system. Close valve on can.

a. If the system is charged using single cans and the J-6271 valve, disconnect valve from can, leaving valve closed to flexible line to the center fitting of the manifold gauge set. Install valve on a new and full disposable can of Refrigerant-12, and repeat until four "one pound" cans of refrigerant have been used to charge the system. The system requires 4.0 pounds of refrigerant to have a proper charge. Since the "can" only contains 15 ozs. of refrigerant, four cans will charge the system with four ozs. less than the maximum refrigerant charge of 4.0 pounds.

b. If the system is charged using the 3 can Multi-opener, J-6272, close the valve of the opener after all cans are empty. Release the locking lever and discard the three empty cans. If this tool will be used to complete the charge with one additional can to bring the required refrigerant charge to 4.0 pounds, then leave two of the cans emptied in position, locate the one full can and lock the lever into place. (These empty cans balance the assembly and prevents the loss of refrigerant out the open "series" passage.)

NOTE: Align the pierced hole in the empty cans with the punch in the cover of the tool.

If the J-6271 Fitz-All Valve for single cans is available, complete charging as explained in 4a. above.

5. Close valves on manifold gauge set.

6. Operate engine at 1500 RPM with temperature control lever at full down position and blower control down for high speed.

NOTE: If air inlet temperature at the condenser is below 70°F. when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Air inlet temperature must be 70°F. or above to make an accurate check. In no case should the system be charged with more than 4.0 lbs. of refrigerant.

7. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

8. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on compressor fittings.

NOTE: A considerable amount of refrigerant will collect in the high pressure line, since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure fitting at the compressor with a shop cloth before disconnecting the Schrader valve from the gauge fitting to prevent damage or injury to personnel.

9. Using leak detector J-6084, check complete system for leaks as explained under LEAK DETECTORS.

### SERVICE STATION METHOD

#### INSTALLING J-8393

1. Be certain compressor hand shut-off valves are closed to gauge fittings (counterclockwise).

2. Be certain all valves on charging station are closed.

3. Connect high pressure gauge line (with J-6163 attached) to compressor high pressure gauge fitting.

4. Turn high pressure hand shut-off valve one turn clockwise, and high pressure control (2) one turn counterclockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line to low pressure gauge fitting on compressor. (Place J-6163 adapter on hose, then attach adapter to gauge fitting.)

#### FILLING CHARGING CYLINDER

1. Open control valve on refrigerant container.

2. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

3. Bleed charging cylinder top valve (behind control panel) only as required to allow refrigerant to enter cylinder. When refrigerant reaches desired charge level (4.0 lbs.), close valve at bottom of charging cylinder and be certain cylinder bleed valve is closed securely.

NOTE: While filling the cylinder, it will be necessary to close the bleed valve periodically to allow boiling to subside so that refrigerant level in the charging cylinder can be accurately read.

### CHARGING THE SYSTEM, USING J-8393

1. With charging station installed as previously described, remove low pressure gauge line at compressor.

2. Crack open high (No. 2) and low (No. 1) pressure control valves on station, and allow refrigerant gas to purge from system. Purge slow enough so that oil does not escape from system along with refrigerant.

3. When refrigerant flow nearly stops, connect low pressure gauge line to compressor.

4. Turn on vacuum pump and open vacuum control valve (No. 3).

5. With system purged as above, run pump until 26-28 inches of vacuum is obtained. Continue to run pump for 15 minutes after the system reaches 26-28 inches vacuum.

NOTE: In all evacuating procedures, the specification of 26-28 inches of mercury vacuum is used. These figures are only attainable at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specifications should be lowered by 1 inch. Example: at 5000 ft. elevation, only 21 to 23 inches vacuum can normally be obtained.

6. If 26-28 inches vacuum (corrected to sea level) cannot be obtained, close vacuum control valve (No. 3) and shut off vacuum pump. Open refrigerant control valve (No. 4) and allow some refrigerant to enter system. Locate and repair all leaks.

7. After evacuating for 15 minutes, add ½ pound of refrigerant to system as described in step 6 above. Purge this ½ pound and re-evacuate for 15 minutes. This second evacuation is to be certain that as much contamination is removed from the system as possible.

8. Only after evacuating as above, system is ready for charging. Note reading on sight glass of charging

cylinder. If it does not contain a sufficient amount for a full charge, fill to the proper level.

9. Close low-pressure valve on charging station. Fully open station refrigerant control valve (No. 4) and allow all liquid refrigerant to enter system. When full charge of refrigerant has entered system (4.0 lbs.), turn off refrigerant control valve (No. 4) and close both hand shut-off valves.

10. If full charge of refrigerant will not enter system, close high pressure control and refrigerant control valves. Start engine and run at slow idle with compressor operating. Crack refrigerant control valve (No. 4) and low pressure control on station. Watch low side guage and keep guage below 50 psi by regulating refrigerant control valve. Closing valve will lower pressure. This is to prevent liquid refrigerant from reaching the compressor while the compressor is operating. When required charge has entered system, close refrigerant control valve and close low pressure control.

11. System is now charged and should be performance tested before removing gauges.

## ADDING REFRIGERANT-12

The following procedure should be used in adding small amounts of refrigerant that may have been lost by leaks, or while opening system for servicing the compressor. Before adding refrigerant to replace that lost by leaks, check compressor oil level and add oil if necessary. See ADDING OIL.

NOTE: This procedure will only apply if the air inlet temperature is *above* 70°F. at the condenser.

1. Remove caps from compressor suction and discharge fitting gauge fittings. Attach gauge set to gauge fittings, making sure Schrader adapter J-5420 is between low pressure gauge hose and suction gauge fitting, and J-6163 is between high pressure gauge hose and discharge gauge fitting.

2. Start engine, move air conditioning temperature control lever to full down position, blower lever down for high speed. Operate for ten minutes at 1500 RPM to stabilize system.

3. Observe the refrigerant through the glass cover of the liquid indicator with the system operating, to see if there are any bubbles evident.

a. If no bubbles are evident, then bleed system slowly through the discharge valve until bubbles appear in the liquid indicator. Add one pound of refrigerant as explained under CHARGING THE SYSTEM.

b. If bubbles are visible in the liquid indicator with the temperature control lever at the full cold position and the blower at "HI" speed, it indicates partial or complete plug in a line, or a shortage of refrigerant, or both. Correct condition. Add refrigerant as explained below until the sight glass clears, then add another one pound of refrigerant.

4. Attach flexible hose from center fitting of gauge set loosely to refrigerant drum or on disposable can valves. Open high and low pressure valves on the gauge set slightly to purge pressure gauge lines of air. Tighten fitting of refrigerant drum or can, when satisfied that all air has been removed from gauge lines. Close (clockwise) both hand shut-off valves of gauge set.

5. Partially charge system.

a. Refrigerant-12 Drum Method.

(1) Place pail containing hot water that does not have a temperature exceeding 125°F. on scales, place refrigerant drum in pail containing water, note weight, and only open low pressure valve on gauge set.

(2) Start engine, move temperature control lever to full down position, and place blower lever down for high speed. Operate engine for ten minutes at 1500 RPM to stabilize system.

(3) With compressor operating, slowly open valve on refrigerant drum and allow refrigerant to flow into system (through manifold gauge set) until liquid indicator clears up and immediately shut off valve at gauge set or on refrigerant drum. Check weight of refrigerant drum and pail of water. Then slowly open valve on gauge set (or refrigerant drum) and add one more pound of refrigerant. Note total amount of refrigerant added.

b. Refrigerant-12 Disposable Can Method (15 oz. per can).

(1) Make sure the outlet valve on the J-6271 Fitz-All Valve is fully clockwise and attach the J-6271 to a "one pound" can of refrigerant as follows: back off the valve from the top of the retainer, slip the valve onto the can and turn the valve into the retainer until tight. DO NOT accidently open outlet valve during this operation as turning the valve into the retainer punctures the top of the can to make it ready for charging.

(2) Connect center flexible line of gauge set to the fitting on the valve (Fig. 5-63).

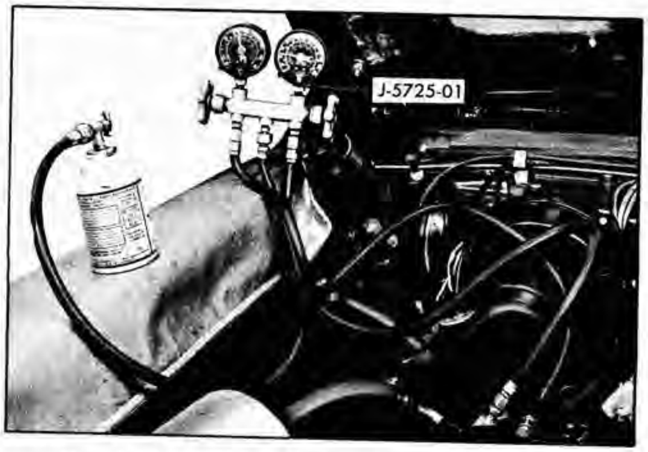



Fig. 5-63 Adding Refrigerant-12—Disposable Can Method

(3) Start engine, move temperature control lever to full down position and place blower lever down for high speed. Operate engine for ten minutes at 1500 RPM to stabilize system.

(4) With compressor operating slowly, open valve on refrigerant can and allow refrigerant to flow into system (through manifold gauge set) until liquid indicator clears up and immediately shut off valve at gauge set and on refrigerant can. Check weight of can and valve assembly and record.

(5) Add an additional one pound of refrigerant by adding refrigerant from the can just weighed until can is empty. Attach another can and add refrigerant until can and valve assembly weighs the same as recorded.

6. Close valves at refrigerant drum or can.

7. Test for leaks and make operational check of system as outlined under OPERATIONAL TEST.

## CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL

The design and configuration of the six cylinder axial compressor requires a radical departure from oil checking methods, as has been the practice on the five cylinder axial compressor. It is, therefore, very necessary that these procedures be adhered to for adequate oil supply for the compressor.

The refrigeration system with the six cylinder axial compressor requires 11 fluid ozs. of 525 viscosity oil. After the system has been operated, oil circulates throughout the system with the refrigerant. Hence, while the system is running, oil is leaving the compressor with the high pressure gas and is returning to the compressor with the suction gas.

To enhance return of oil to the compressor, under partially depleted refrigerant charge conditions on the Circ-L-Aire system, an oil bleed line from the bottom of the evaporator to the suction line at the temperature regulation valve (suction throttling valve) has been provided. The core in the bleed line fitting at the temperature regulation valve has a special low force spring in it which allows the core to open at 5 to 12 psi pressure difference. It is important that this core *not* be replaced with a standard tire core.

NOTE: The oil level in the compressor should *not* be checked as a matter of course, such as is done in the car engine crankcase.

In general, the compressor oil level should be questioned only in cases where there is evidence of a major loss of system oil such as:

a. Broken hose or severe hose fitting leak.

b. Oil sprayed in copious amounts under the hood due to a badly leaking compressor seal(s).

c. Collision damage to refrigeration system components.

### REPLACING REFRIGERATION SYSTEM COMPONENTS OTHER THAN COMPRESSOR

When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor. The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* the following amount for the refrigeration system component being changed.

a. Evaporator—3 fluid ozs.

b. Condenser—1 fluid oz.

c. Receiver liquid indicator assembly—1 fluid oz.

Neglect any fluid oil coating loss in case of line change.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid

ozs. of clean oil, *plus* the amount shown above for the respective component replacements.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

## REMOVING MALFUNCTIONING COMPRESSOR AND INSTALLING NEW COMPRESSOR

*The compressor removed must be closed immediately.*

If the system has been or can be operated for more than two minutes, circulation of oil from the compressor to other components of the system will require adjustment of the oil charge in the new compressor as explained above, under REPLACING COMPONENTS OTHER THAN COMPRESSOR.

After draining and measuring the oil from the crankcase and head of the compressor removed, the amount that has migrated to other parts of the system can be determined by subtracting the amount drained from the original oil charge of 11 fluid ozs. The amount of oil *equal to this loss* shall be drained from the new compressor assembly before it is installed.

### REPLACING AN OPERABLE COMPRESSOR

After idling compressor (on car) to be replaced for 10 minutes at 1000-1500 engine r.p.m., at maximum refrigeration and blower at high speed: *DO NOT* add any more oil to the compressor than is necessary or maximum cooling will be reduced.

1. Compressor replaced with service compressor assembly.

a. Remove compressor and place in a horizontal position with drain plug downward, drain compressor, measure quantity of oil drained and then discard it.

b. Drain oil from replacement compressor and save it.

c. (1) If amount of oil drained in "a" is *more* than 4 ozs., place into the new compressor the same amount of oil drained from the replaced compressor.

(2) If amount of oil drained in "a" is *less* than 4 ozs., place 6 ozs. of oil in the replacement compressor.

d. Install compressor.

2. Compressor replaced with a field repaired (overhauled) compressor.

a. Proceed as in section 1 above, and then add one extra oz. of oil. (More oil is retained in a drained compressor than one that has been rebuilt.)

### REPLACING AN INOPERATIVE COMPRESSOR

In the case when it is not possible to idle the compressor to be replaced to effect oil return to it the following will apply. DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove compressor from car, drain and measure the oil.

2. If amount drained in "1" above is *more* than 1½ fluid ozs., subtract this amount drained from the original oil charge of 11 ozs. to obtain "oil loss". Take the new compressor assembly and drain from it the amount of "oil loss" above; provided the refrigeration system shows no evidence of a major leak, indicating that little or no oil has been lost from the system. (Minor leak indicating very slow leakage.)

3. If the amount drained in "1" above is *less* than 1½ ozs. of oil and/or system appears to have lost an excessive amount of oil then:

a. Disconnect the thermostatic expansion valve outlet connection (evaporator inlet).

b. Plug suction line connection at suction throttle valve outlet.

c. Disconnect oil bleed line at suction throttle valve, using care not to damage line.

d. Connect a cylinder of Refrigerant-12 regulated to not exceed 125 p.s.i. to this oil bleed fitting, to force any retained oil from the evaporator out the evaporator inlet fitting. (Reverse flush the evaporator.) Catch any oil reverse flushed in this manner. If oil flushed from the system appears clean, install new compressor with 6-7 ounces of oil.

4. If oil drained in "1" above contains any foreign material such as chips, or there is evidence of moisture in the system, replace the receiver-liquid-indicator assembly and flush all component parts, or replace if necessary. After flushing refrigeration system in this manner, the full oil charge should be left in the new service compressor or 11 ozs. installed in an overhauled or repaired compressor.

### COMPRESSOR REMOVAL

1. Connect the high and low pressure gauge lines from the gauge set to the respective connections on the old compressor on the car. Be sure valves on gauge set are fully clockwise to close gauge set to

center fitting, that a J-5420 or J-6163 Schrader adapter is between low pressure hose and suction gauge fitting, and also at the discharge gauge fitting.

2. Remove the flare nut from center connection on gauge manifold or the plug in the gauge line attached to the center connection. Wrap the line at the outlet with a cloth to protect persons and car surfaces from oil or refrigerant.

3. Slowly depressurize refrigeration system.

4. While system is depressurizing remove clutch assembly and coil from old compressor as outlined under COMPRESSOR CLUTCH, COIL AND SEAL REPLACEMENT. If parts are not oil soaked and are in good condtion, lay them aside on a clean surface as they may be installed on the new compressor.

5. After the system is *completely* depressurized, very slowly loosen screw which retains compressor fittings assembly to compressor. As screw is being loosened, work fittings assembly back and forth to break seal and carefully bleed off any remaining pressure.

***CAUTION: High pressure may still exist at the discharge fitting. If this pressure is released too rapidly there will be a considerable discharge of refrigerant and oil.***

6. When all pressure has been relieved, remove screw and remove fittings assembly and O-ring seals.

7. *Immediately cover compressor openings.* A simple way is with a plate (similar to the one on new compressor) which can be attached with fittings assembly screw, using the O-rings to provide a seal.

8. Disconnect compressor clutch coil wire and remove compressor mounting plates to bracket bolts, front and rear.

9. If there is any possibility that broken parts from the compressor got into the discharge line or the condenser, all refrigeration system parts should be cleaned and a new receiver and liquid indicator assembly should be installed.

10. Drain all oil from compressor just removed in a clean dry container and replace compressor drain plug screw. Measure amount of oil drained. See CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL.

#### COMPRESSOR REPLACEMENT

NOTE: Before installing a new compressor, rotate compressor shaft four or five times. This permits proper lubrication of compressor seal over all its surface. Before compressor clutch is mounted to the new compressor, wipe the front face of the compressor thoroughly with a clean dry cloth and, if necessary, clean front of compressor with a solvent to remove any excess oil. Cleaning compressor in this manner will prevent any oil from being thrown onto the clutch surfaces which would cause slippage and eventual clutch failure.

1. Stamp refrigerant charge of the refrigerant system on new compressor in space on plate provided for this information.

NOTE: Follow procedure for replacing oil in new compressor explained under REMOVING MALFUNCTIONING COMPRESSOR AND INSTALLING NEW COMPRESSOR.

2. Install new compressor on car, leaving compressor fittings opening cover plate on the compressor.

3. Remove cover plate over compressor openings very slowly to bleed off pressure.

***CAUTION: New compressors are charged with a mixture of nitrogen and Refrigerant-12 and 11 fluid ozs. of Frigidaire 525 viscosity oil. If the cover is removed too rapidly, the oil will be blown out violently with the sudden release of pressure.***

4. Install coil and clutch parts if not already installed.

5. Evacuate, charge and perform OPERATIONAL TEST.

### COMPRESSOR SHAFT SEAL ASSEMBLY

#### REMOVE AND REPLACE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor *if oil was sprayed in copious amounts due to leaks or broken shaft seal.*

The amount of oil to put back into the compressor is found as follows: DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.


Fig. 5-64 Removing Shaft Seal Retainer

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, plus the amount shown above for the respective component replacements.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE SHAFT SEAL*

1. Depressurize refrigeration system.

2. Remove hub and drive plate assembly, and shaft key.

3. Remove shaft seal seat retaining ring, using J-4245 (No. 23 Truarc pliers) (Fig. 5-64).

4. Remove shaft seal seat, using J-9393-1 and 2 to grasp flange on seal seat (Fig. 5-65). Pull straight out at end of tool to remove seal seat.

5. Engage tabs on compressor shaft seal assembly with locking tangs on J-9392 seal installer and remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft (Fig. 5-66).

6. Remove O-ring from interior of front head casting bore using J-9553. (A wire with a hook formed on the end may be used. This hook may be made in a manner as shown in Fig. 5-67.)

7. Replace shaft seal assembly by reversing above procedure, making sure shaft seal retainer ring is positioned in the first *full* groove to properly retain the seal seat. The metal looking groove can be seen from the shaft end is a *land* and not a groove.

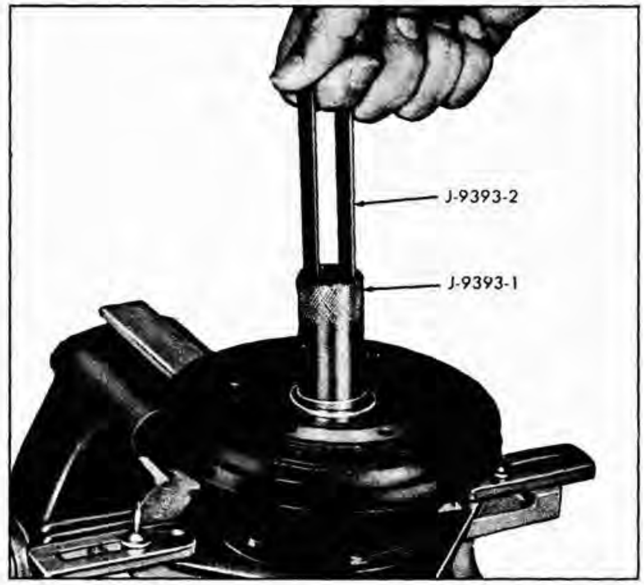



Fig. 5-65 Removing Shaft Seal Seat

NOTE: Immerse shaft seal in clean compressor oil before installing. This will help to prevent shaft shoulder cutting O-ring.

8. Evacuate and charge refrigeration system.

9. Perform operational test.


Fig. 5-66 Removing Shaft Seal Assembly

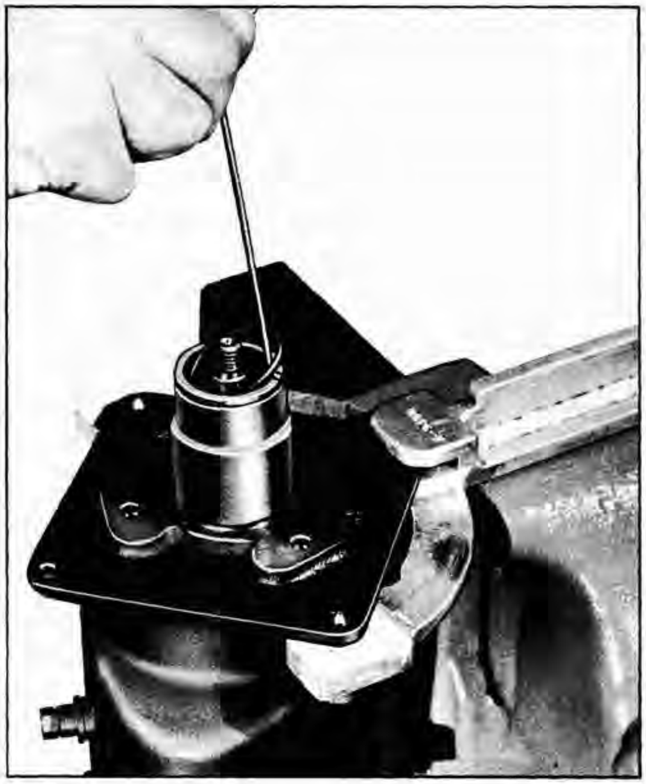


Fig. 5-67 Removing O-Ring Seal

## COMPRESSOR ASSEMBLY—OVERHAUL

### *INTRODUCTION*

These operations are based on the use of recommended service tools and on condition that an adequate stock of service parts to select from is available. Service parts should include.

1. Standard size piston drive balls.

2. Shoe discs—total of 10 sizes, including the ZERO shoe.

3. Thrust races—total of 14 sizes, including the ZERO race.

4. Pistons—both standard head and re-expansion heads.

5. Main shaft—needle bearings.

6. Thrust bearings.

7. Compressor shaft, swash plate and Woodruff key assembly.

8. Service cylinder assembly—front, rear halves, with main bearing in place and halves dowel-pinned together.

9. Major interior mechanism assembly.

10. Suction reed valve—front, rear.

11. Discharge valve assembly—front, rear.

12. Gasket kit—service containing all gaskets, seals, O-rings, etc. This is to be used each time a compressor is re-built after a teardown.

13. Shaft seal kit.

14. Nuts—head to shell and shaft.

15. Ring—retainers.

16. Cylinder locator pins.

17. Valve and head locator pins.

18. Service type—discharge crossover tube kit.

A clean work bench, orderliness of the work area and a place for all parts being removed and replaced is of great importance. Any attempt to use makeshift or inadequate equipment may result in damage and/or improper operation of the compressor.

## PRESERVATION AND PACKAGING SERVICE PARTS

All parts required for servicing will be protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the mechanism assembly just as they are removed from the service package.

In addition, some parts will be identified on the piece part to denote its size or dimension. This will apply to the piston shoe discs and the shaft thrust races.

To provide suitable and adequate quantities and grouping of parts for servicing the compressor, kits are available which will contain these necessary parts. The gasket kit should be used whenever it is necessary to overhaul or rebuild the entire compressor internal mechanism, or when replacing some individual internal part.

### *OVERHAUL COMPRESSOR*

Anytime a major overhaul or rebuilding operation is to be performed on this compressor, obtain and install compressor gasket kit. This kit includes all of the necessary O-rings and gaskets. Obtain also, an ample supply of piston rings.

1. Remove drive plate and hub assembly.

2. Remove pulley and bearing assembly.

3. Remove clutch coil and coil housing assembly.

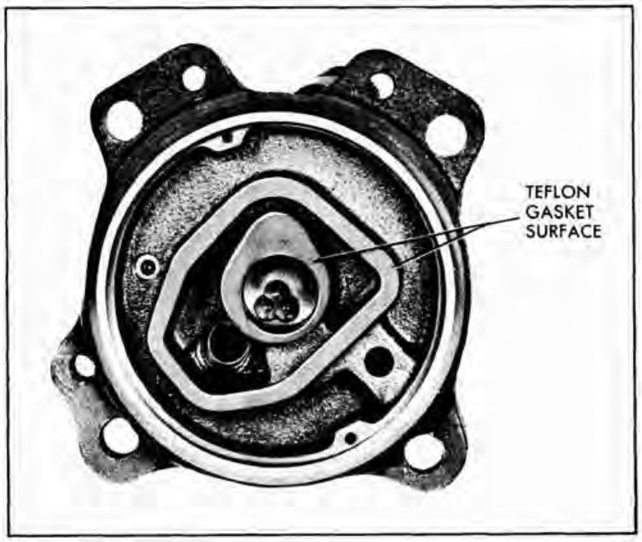



Fig. 5-68 Teflon Seal on Head Casting Web

4. Remove compressor assembly, leaving fittings assembly attached to refrigerant lines. Keep compressor horizontal at all times. Placing the compressor on either end will allow oil from the compressor sump to enter the head.

5. Seal compressor fittings opening and openings in compressor rear head.

6. Thoroughly clean exterior of compressor assembly and blow dry with compressed dry air.

7. Place compressor assembly on clean, dry work bench.

NOTE: Under *NO* circumstances should compressor be placed on the pulley end.

## COMPRESSOR REAR HEAD

### *REMOVE*

1. Remove compressor oil plug, tilt compressor and drain oil into *clean* dry container. It may be possible to get only 4 to 6 ozs. of oil from the compressor at this time.

2. Attach J-9396 holding fixture to compressor and mount in vise.

3. Remove compressor pressure relief valve.

4. Remove four lock nuts from threaded studs welded to compressor shell and remove rear head.

NOTE: Some oil may drain when the head is removed.

5. Examine teflon surface on the rear head casting webs. If any damage is observed, the head should be replaced (Fig. 5-68).

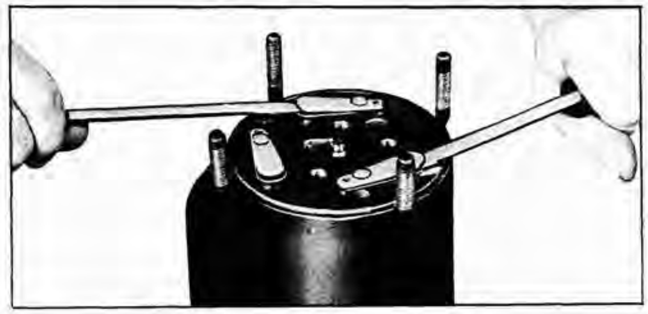


Fig. 5-69 Removing Discharge Valve Plate

6. Remove suction screen and examine for damage or contamination. Clean or replace as necessary.

7. Remove oil pump gears noting how they are mated (end to end) and inspect for damage. Replace both gears if one or both show damage. Keep gears mated as they were when removed.

8. Remove rear head to compressor shell O-ring seal and inspect for damage, cuts, nicks or imperfections. A damaged seal may be the cause of a refrigerant leak. In any event, this O-ring seal must be replaced with a new one.

9. Carefully remove rear discharge valve plate assembly by prying up on assembly (Fig. 5-69) and examine discharge valve reeds and seats. Replace entire assembly if excessively scored or if any one of the three reeds is broken or seats are damaged.

10. Carefully remove rear suction reed and examine for any damage. Replace if necessary (Fig. 5-70).

## COMPRESSOR MAJOR INTERIOR MECHANISM

### *REMOVE, INSPECT AND CHECK*

1. Remove shaft seal seat retaining ring, using J-4245 (No. 23 Truarc pliers).

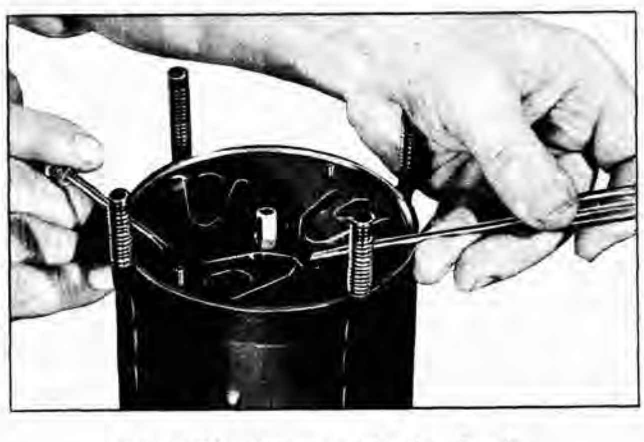


Fig. 5-70 Removing Suction Reed

Fig. 5-71 Removing Oil Inlet Tube

2. Remove shaft seal seat, using J-9393-1 and 2 to grasp flange on seal seat. Pull straight out at end of tool to remove seal seat.

3. Engage tabs on compressor shaft seal assembly with locking tangs on J-9392 seal installer and remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft.

4. Remove O-ring from interior of front head casting bore. (A wire with a hook formed on the end may be used. This hook may be made in a manner as shown in Fig. 5-67.)

5. Remove oil inlet tube and O-ring, using a wire with a hook formed in one end (Fig. 5-71).

6. Push on front end of compressor shaft to remove mechanism from rear of shell. DO NOT hammer on end of compressor shaft or use undue force to remove the compressor internal mechanism. This assembly will slide out easily.

NOTE: Some oil will drain from compressor when mechanism assembly is removed.

7. Remove compressor front head casting assembly from compressor shell. Examine teflon sealing surface for damage and/or deep scratches. Replace if necessary.

8. Remove compressor front head casting to shell O-ring seal and inspect for damage, cuts, nicks or imperfections. A damaged seal may be the cause of a refrigerant leak. In any event, this O-ring must be replaced with a new one.

9. Remove the front discharge reed plate and suction reed and examine for damage.

10. Examine mechanism for any obvious damage. Turn compressor shaft and check for smoothness of operation as well as for any scratches in bores, etc.

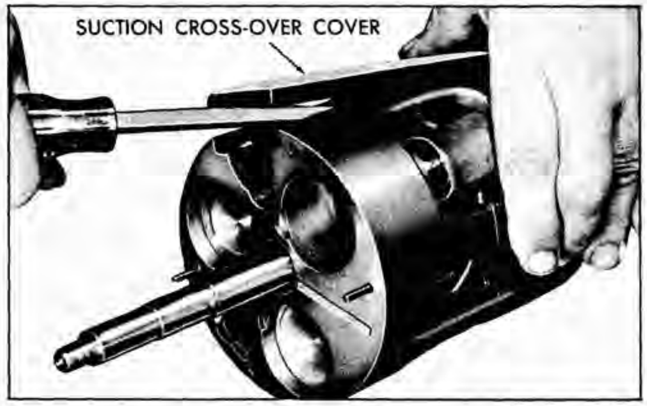



Fig. 5-72 Removing Suction Crossover Cover

NOTE: If mechanism has sustained major damage, due possibly to loss of refrigerant and/or oil, it may be necessary to use the service interior mechanism or the service cylinder assembly rather than replace individual parts.

11. Remove suction crossover plate as shown in Fig. 5-72 and discard gasket.

## COMPRESSOR INTERIOR MECHANISM

### *DISASSEMBLE*

(Obtain clean J-9402 assembly parts tray to retain compressor parts during disassembly.)

1. Number pistons (1, 2 and 3) and their bores so parts can be replaced in their original locations (Fig. 5-73).

2. Turn compressor shaft to position swash plate towards front of compressor in area of discharge crossover tube. Using J-9492, drive discharge crossover tube out of rear head assembly toward *front* of compressor or use a wooden block as shown in Fig. 5-74. *DO NOT* drive toward rear of compressor as discharge crossover tube may damage swash plate.

3. Separate front and rear cylinder assemblies being careful not to damage any parts during separation.

4. Remove rear half cylinder from pistons.

5. Drive discharge crossover pipe from front head, using J-9492.

6. Push on compressor shaft and carefully remove pistons, piston rings, shoes and balls; one assembly at a time. Place parts in the J-9402 tray to keep parts together (Fig. 5-75). The front end of the piston has an identifying notch in the casting web (Fig. 5-76).

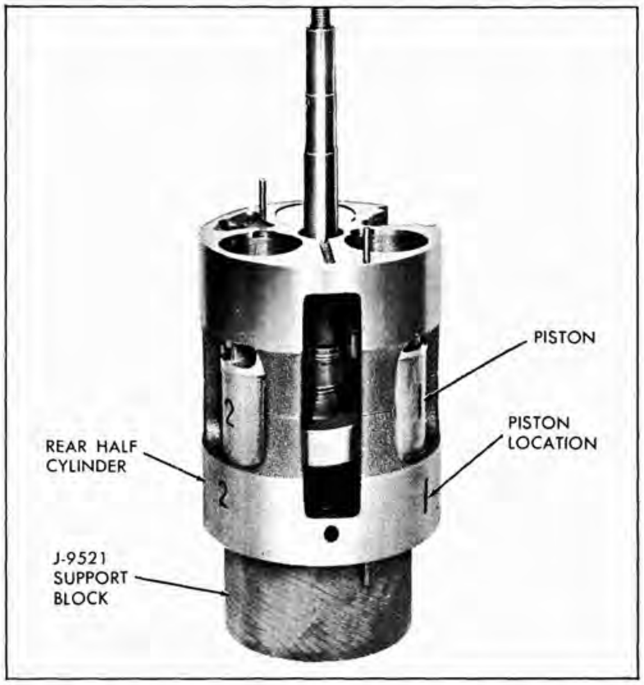



Fig. 5-73 Pistons and Cylinder Bores Numbered

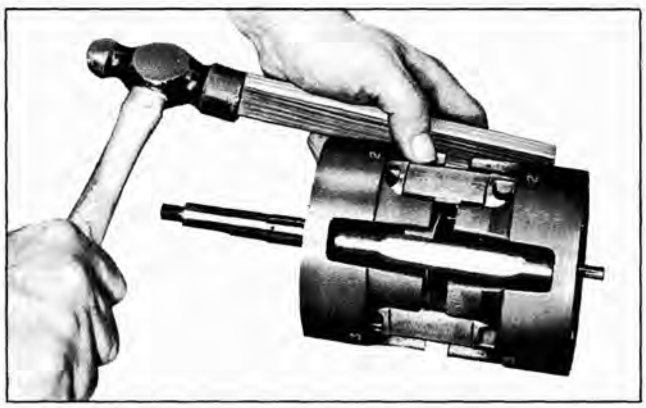


Fig. 5-74 Separating Cylinder Halves

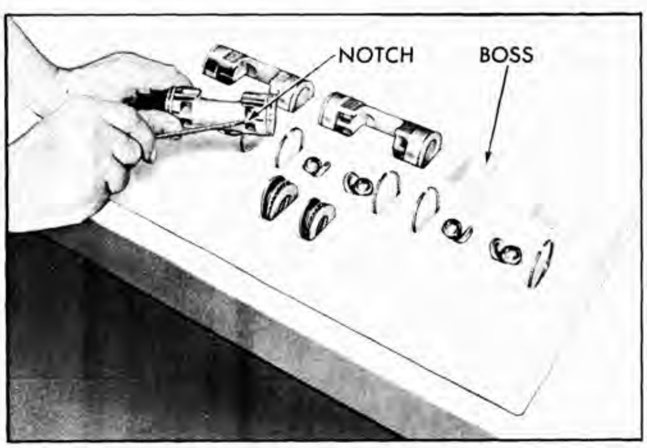



Fig. 5-75 Compressor Parts in Tray

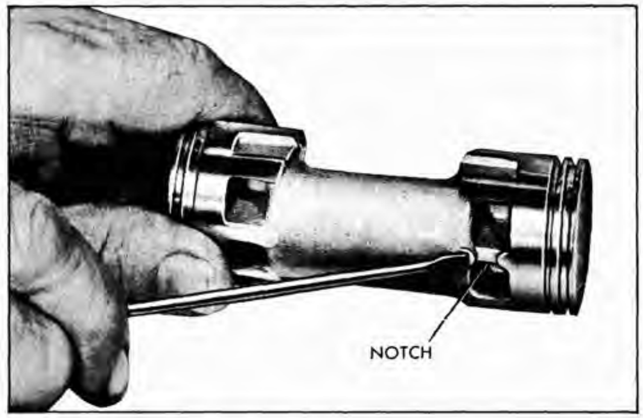



Fig. 5-76 Identification of Front End of Piston

7. Remove all piston shoe discs, examine for indication of failure or probable cause of failure, then discard *all* shoe discs.

8. Examine piston balls and, if satisfactory for reuse, put aside in assembly tray in compartment associated with proper end of piston.

9. Remove rear combination of thrust races and thrust bearing. Discard all three pieces (**Fig.** 5-77).

10. Push on shaft to remove shaft from front half cylinder.

11. Remove front combination of thrust races and thrust bearing. Discard all three pieces.

12. Examine swash plate surfaces for excessive scoring or damage. If satisfactory, reuse. If necessary, replace main shaft and swash plate assembly.

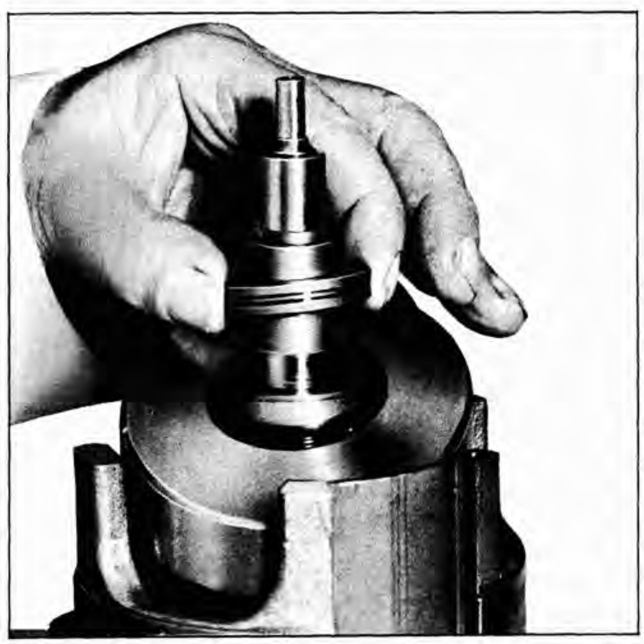
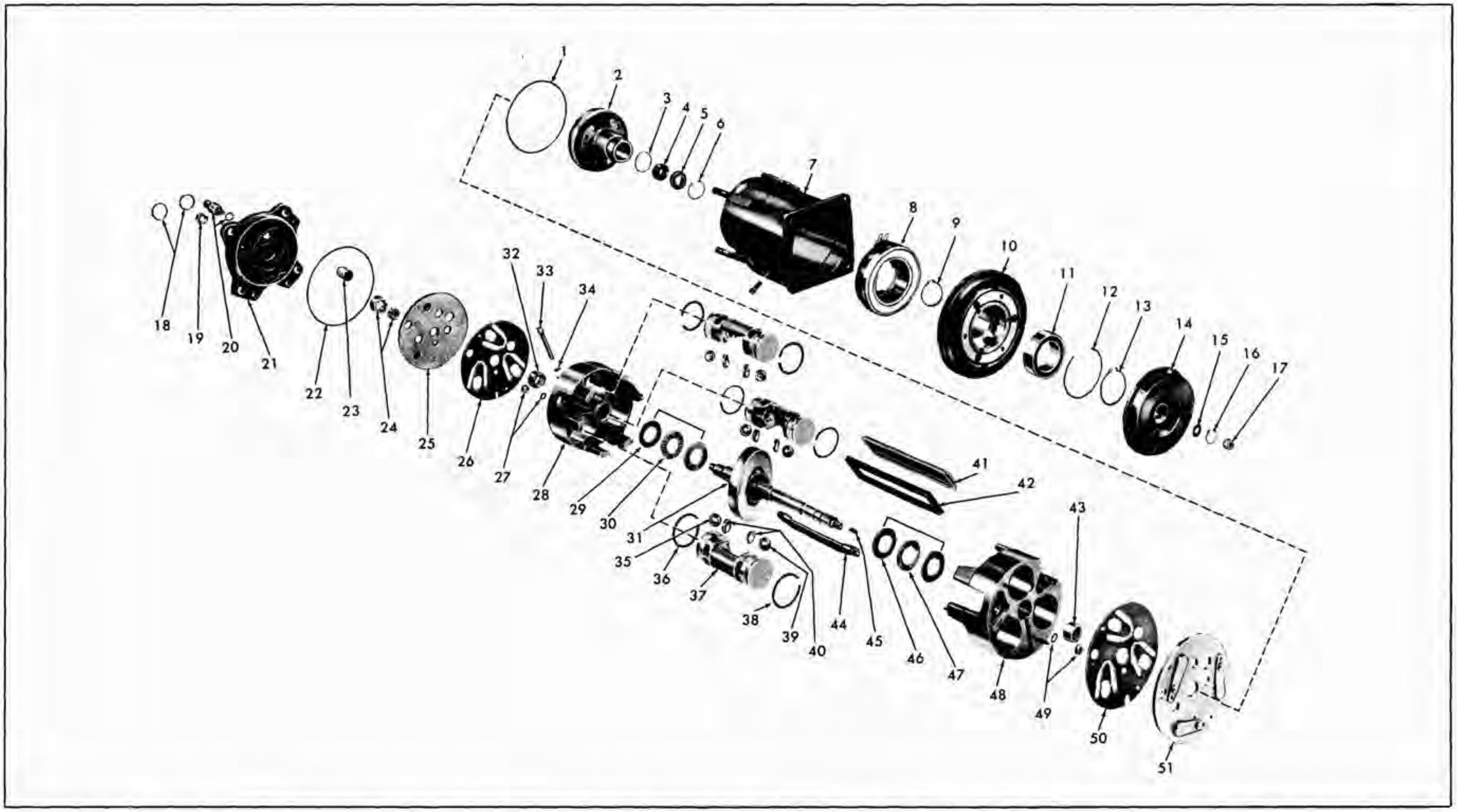


Fig. 5-77 Removing Rear Thrust Races and Bearing



1. Front Head to Shell "O" Ring
2. Front Head Assembly
3. Seal Seat "O" Ring
4. Shaft Seal Assembly
5. Shaft Seal Seat
6. Seal Seat Retainer Snap Ring
7. Compressor Shell
8. Clutch Coil
9. Clutch Coil Snap Ring
10. Pulley Assembly
11. Pulley Bearing
12. Pulley Bearing Retainer Ring
13. Pulley Brg. to Head Ring
14. Armature Plate and Hub Assembly
15. Armature Plate and Hub Spacer
16. Armature Plate and Hub to Mainshaft Spacer Retainer
17. Armature Plate and Hub Lock Nut
18. Fittings "O" Rings
19. Rear Head to Shell Locking Nut (4)
20. High Pressure Relief Valve and "O" Ring
21. Rear Head Assembly
22. Rear Head to Shell "O" Ring
23. Inlet Screen
24. Oil Pump Gears
25. Rear Discharge Plate Assembly
26. Rear Suction Reed
27. Discharge Crossover Tube Spacer and Gasket
28. Cylinder—Rear Half
29. Rear Thrust Bearing Selective Races
30. Rear Thrust Bearing
31. Swash Plate and Mainshaft Assembly
32. Mainshaft Rear Bearing
33. Oil Pick-Up Tube
34. Oil Pick-Up Tube "O" Ring
35. Piston Drive Ball (6)
36. Piston Ring (6)
37. Piston (3)
38. Piston Ring
39. Piston Drive Ball
40. Piston Ball Shoe (6)
41. Suction Crossover Cover
42. Suction Crossover Cover Gasket
43. Mainshaft Front Bearing
44. Discharge Crossover Tube
45. Armature Plate and Hub to Mainshaft Key
46. Front Thrust Bearing Selective Races
47. Front Thrust Bearing
48. Cylinder—Front Half
49. Discharge Crossover Tube Gasket and Spacer
50. Front Suction Reed
51. Front Discharge Plate Assy.

Fig. 5-78 Six Cylinder Compressor Assembly—Exploded View

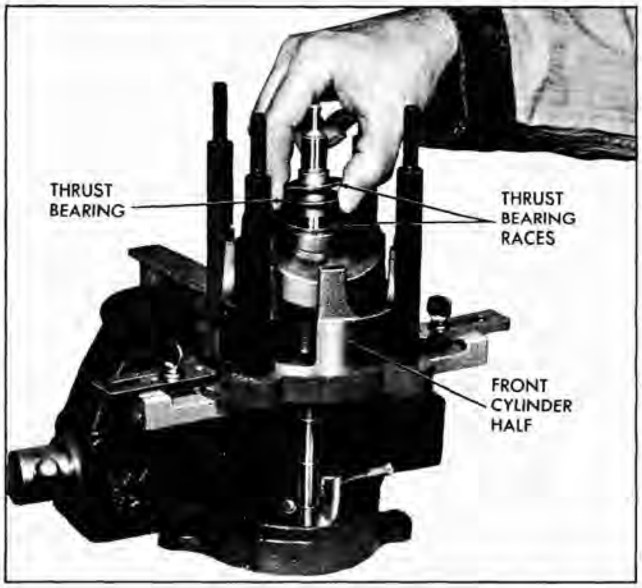



Fig. 5-79 Mainshaft Thrust Bearing Installed

13. Wash all parts to be reused in a tank of clean trichlorethylene, alcohol or similar solvent. Blow dry all parts using a source of clean, dry air.

14. Examine the front and rear cylinder halves and replace if cylinder bores are deeply scored or damaged.

NOTE: The service cylinder assembly will contain a front and rear half doweled together. This assembly will also include two main bearings; one main bearing pressed into the proper location in the front half and the other in its proper location in the rear half.

15. Check main shaft bearings for roughness and replace as necessary. Use J-9432 to replace bearings.

## COMPRESSOR INTERNAL MECHANISM

### GAUGING FOR NEW PARTS

Obtain the parts discussed in the introduction of this section.

NOTE: If thrust bearings and races are to be replaced, use parts as outlined below; otherwise use existing bearings and races.

1. Secure four ZERO thrust races, three ZERO shoe discs and two new thrust bearings.

2. Stack a ZERO thrust race, a new needle thrust bearing and a second ZERO thrust race. Assemble this "sandwich" of parts to FRONT end of compressor main shaft.

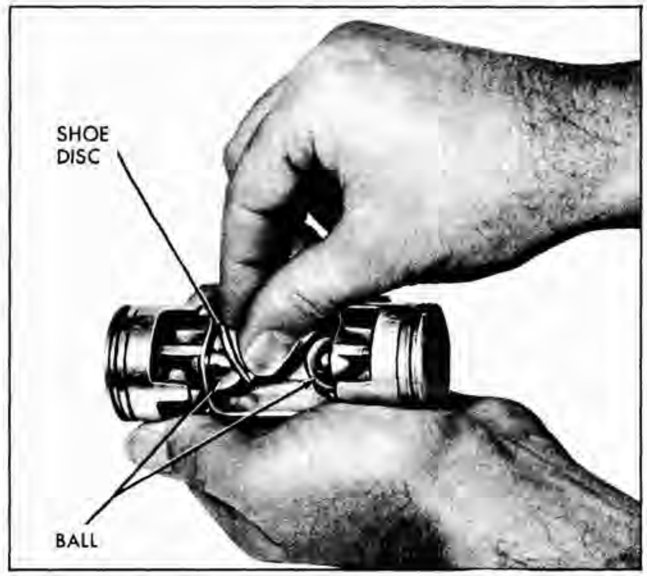



Fig. 5-80 Zero Shoe and Ball at Front of Piston

3. Place FRONT half of cylinder on J-9397 compressing fixture. Insert threaded end of shaft (with front bearing assembly) through front main bearing and allow thrust race assembly to rest on hub of cylinder.

4. Stack a ZERO thrust race, a new thrust bearing and a second ZERO thrust washer. Assemble this "sandwich" of parts to REAR of compressor main shaft so it rests on hub of swash plate (Fig. 5-79).

5. Apply a light coat of clean refrigerant oil to ball pockets of each of three pistons.

6. Place balls in piston pockets.

7. Apply a light coat of clean refrigerant oil to cavity of three new ZERO shoe discs.

8. Place a ZERO shoe over each ball in FRONT end of piston. Front end of piston has an identifying notch in casting web (Fig. 5-80).

9. Place a ball only in rear ball pocket of each of three pistons (Fig. 5-80).

NOTE: Do not assemble any piston rings at this time.

10. Rotate shaft and swash plate until high point of swash plate is over piston cylinder bore, which had been identified as No. 1. Insert front end of No. 1 piston (notched end) in cylinder bore (toward the front of compressor) and at same time, place front ball and shoe and rear ball only over swash plate (Fig. 5-81).

NOTE: It may be necessary to lift shaft assembly to aid in installing pistons. Hold front thrust bear-

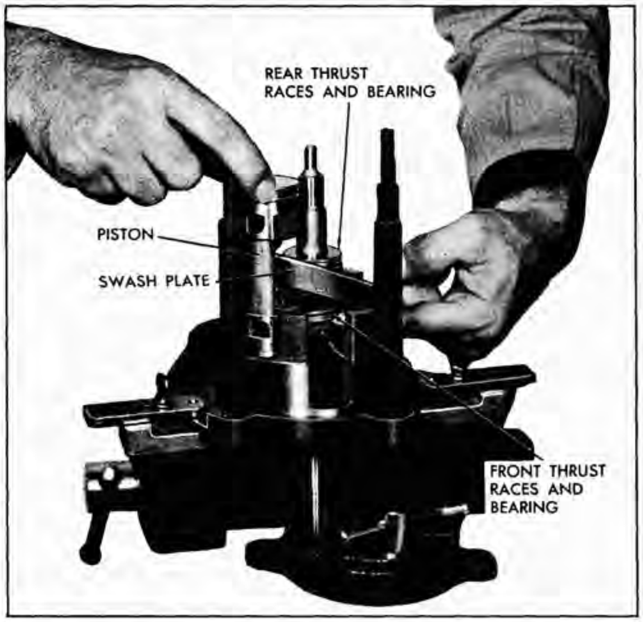



Fig. 5-81 Installing Piston with Balls and Front Shoe Only

ing pack tightly against swash plate hub while lifting shaft (Fig. 5-81).

11. Repeat this operation for No. 2 and No. 3 pistons. Balls and shoes must adhere to piston during this assembly.

12. Align rear head casting with bores, suction passage, discharge crossover holes, dowel pins, etc. Tap

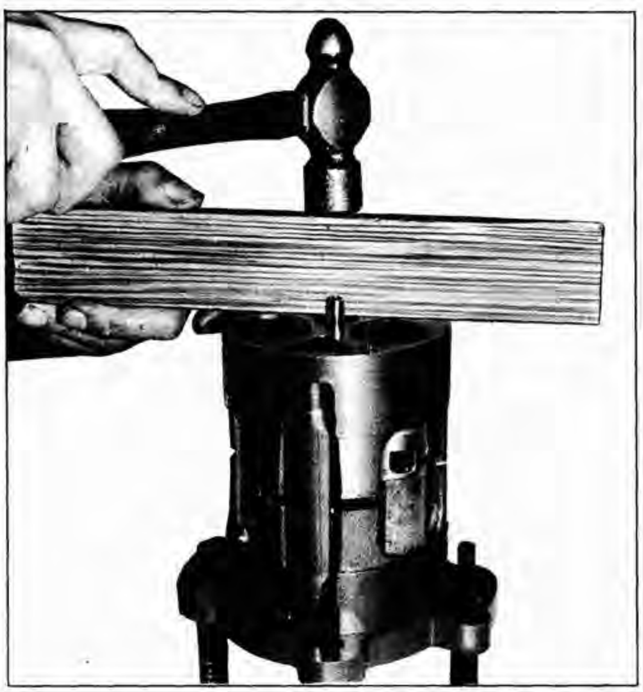


Fig. 5-82 Installing Rear Head on Front Head

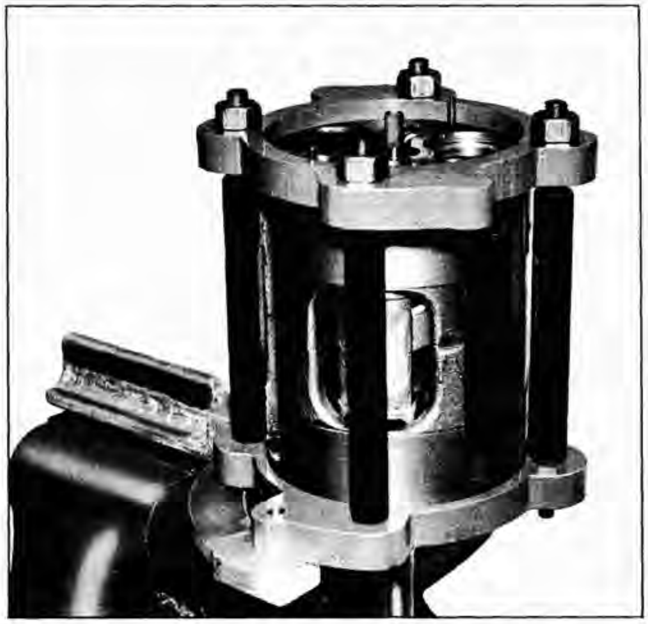


Fig. 5-83 Internal Mechanism in Compressing Fixture

into place, using a hard wood or plastic block and mallet (Fig. 5-82).

13. Place cylinder assembly in J-9397 compressing fixture with front of compressor shaft pointing down, positioning discharge tube opening between fixture bolts. This will permit access for the feeler gauge. Assemble fixture head ring and nuts to the cage, tighten nuts evenly to 25 lb. ft. torque (Fig. 5-83).

14. Use a leaf type feeler gauge to check clearance between **REAR** ball and swash plate for each piston as follows:

a. Use J-9661 gauge set selecting a suitable feeler gauge leaf until the result is a 4 to 8 oz. pull on the scale between ball and swash plate (Fig. 5-84). If the pull is just less than 4 ozs. add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 8 ozs. then subtract .0005" from the thickness of the feeler stock. Select a shoe accordingly.

b. Rotate the shaft aproximately 120° and make a second check with feeler gauge between *same* ball and plate.

c. Rotate shaft again approximately 120° and repeat check with feeler gauge between these same parts.

d. From this total of three checks between the same ball and swash plate at 120° increments on swash plate for each piston, use the minimum gauge reading to select a numbered shoe to correspond to

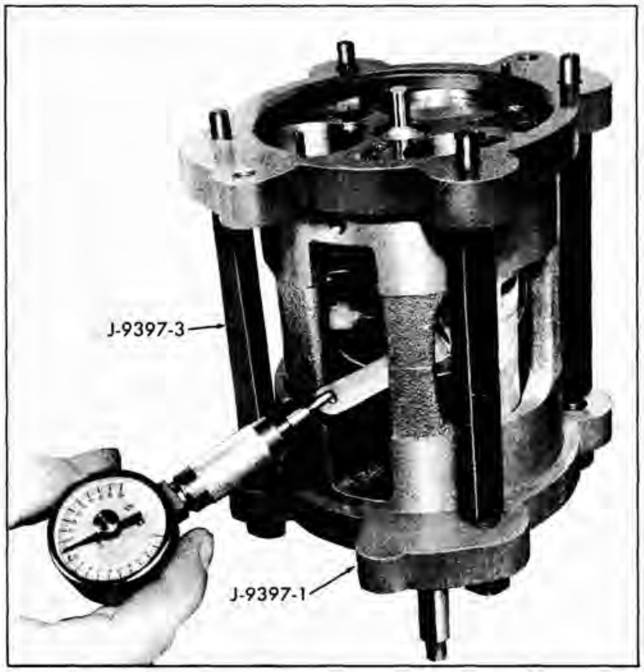



Fig. 5-84 Measuring for Proper Shoe

this reading (Fig. 5-85).

NOTE: A selection will be made from shoe packages shown in Fig. 5-85 which will provide a .0005" to .0010" total clearance between shoes and the swash plate at the *tightest* point throughout its 360° rotation. The reading or resultant reading will correspond to the last three numbers of the part number of the part to be used.

Once proper selection of shoes has been made, it is imperative that the matched combination of shoe to ball and spherical cavity in the piston be kept intact during disassembly after gauging operation and final reassembly of mechanism. An assembly parts tray (J-9402) with individual compartments for each component of the mechanism will keep parts in their proper relationship.

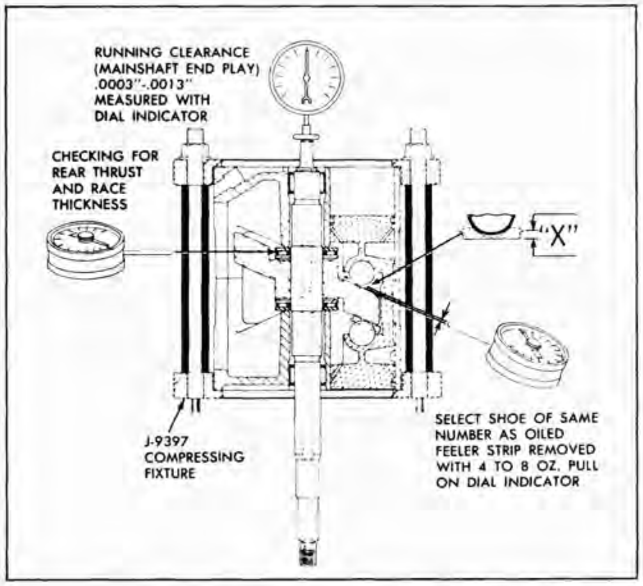
e. Mark piston number (1, 2 or 3) on shoe package.

f. Place shoes in J-9402 assembly tray in compartment corresponding to piston number and rear ball pocket position.

g. Repeat in detail same gauging procedure explained above for each of the other two pistons.

15. The next gauging operation is to determine space between REAR thrust bearing and upper or outer-rear thrust race. Check compressor shaft end play as follows (Fig. 5-86):

a. Mount dial indicator to read clearance at end of compressor shaft.




| SHOE DISC | | THRUST BEARING RACE | |
|---|---|---|---|
| PART NUMBER | IDENTIFICATION STAMP | PART NUMBER | IDENTIFICATION STAMP |
| 6557000 | 0 | 6556000 | 0 |
| 6556175 | 17½ | 6556055 | 5½ |
| 6556180 | 18 | 6556060 | 6 |
| 6556185 | 18½ | 6556065 | 6½ |
| 6556190 | 19 | 6556070 | 7 |
| 6556195 | 19½ | 6556075 | 7½ |
| 6556200 | 20 | 6556080 | 8 |
| 6556205 | 20½ | 6556085 | 8½ |
| 6556210 | 21 | 6556090 | 9 |
| 6556215 | 21½ | 6556095 | 9½ |
| 6556220 | 22 | 6556100 | 10 |
| | | 6556105 | 10½ |
| | | 6556110 | 11 |
| | | 6556115 | 11½ |
| | | 6556120 | 12 |

Fig. 5-85 Summary of Measurements and Table of Available Service Shoes and Thrust Races

Fig. 5-86 Checking Compressor Mainshaft End Play

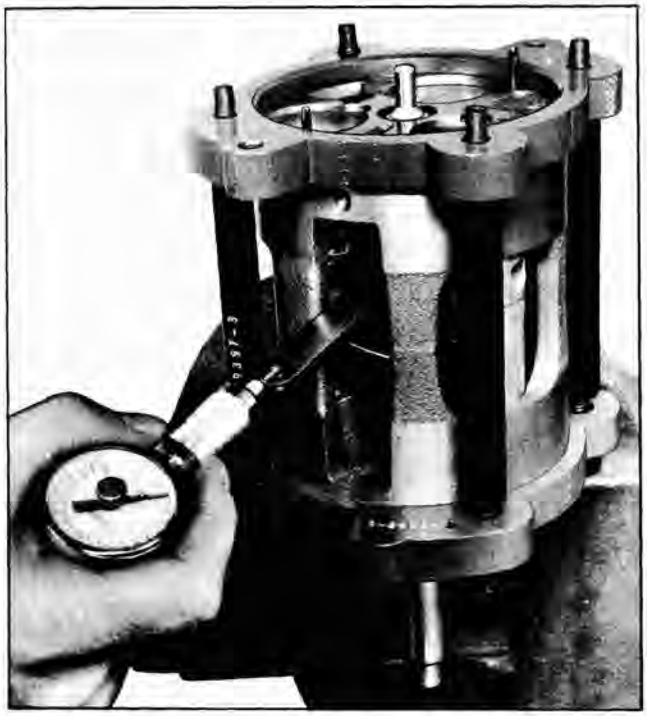


Fig. 5-87 Measuring for Proper Thrust Race

b. Move compressor shaft along its longitudinal axis and measure end play.

NOTE: Apply full hand force at end of mainshaft a few times *before* reading clearance. This will help squeeze the oil out from between mating parts.

c. An alternate method of selecting a proper race is to use J-9661 gauge set selecting a suitable feeler gauge leaf until the result is a 4 to 8 oz. pull on the scale between the rear thrust bearing and upper (or outer rear) thrust race (Fig. 5-87). If the pull is just less than 4 ozs. add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 8 ozs., then subtract .0005" from the thickness of the feeler stock. Select a race accordingly.

d. Select from stock a numbered thrust race that corresponds to dial indicator reading (Fig. 5-85).

NOTE: Thrust races are made of steel and ground to a fixed thickness. A total of fourteen thrust races are available for field service. They will have increments of .0005" thickness to provide the required clearances.

The thrust races will be identified on the part by their thickness, and the number on thrust race will correspond to the last three digits of the piece part number.

If an improper selection of thrust races or shoes is made and the tolerance is GREATER than the maximum clearance, noisy operation of the compressor will result. If the tolerance is LESS than the minimum clearance it is quite likely that the mechanism assembly will be too tight. This may result in galling and seizure of parts.

Therefore, it is very important that care be used during gauging operations and the proper selection of parts be made. Once selection has been made, be sure that they are assembled into the correct position in the mechanism.

e. Mark the package "REAR" thrust race or place it in the J-9402 assembly parts tray corresponding to this position.

16. Loosen and remove nuts and ring from J-9397 compressing fixture.

17. Separate cylinder halves, (it may be necessary to use a fiber block and mallet).

18. Remove rear half cylinder.

19. Carefully remove one piston at a time from swash plate and front half cylinder. Do not lose relationship or position of front ball and shoe and *rear ball only*. Transfer each piston, balls and shoe assembly to its proper place in the J-9402 assembly tray.

20. Remove REAR outer ZERO thrust race from shaft and *replace* it with *numbered thrust race*, determined in step No. 15. Apply a LIGHT smear of petrolatum to thrust races to aid in holding them in place during assembly.

NOTE: This ZERO thrust race may be put aside for re-use in additional gauging and/or rebuild operations.

21. Apply a light smear of petrolatum to numbered shoes and place them over correct ball in rear of piston.

## COMPRESSOR INTERNAL MECHANISM

### *ASSEMBLE (WITH NEW PARTS)*

Be sure to install all new seals, gaskets and O-rings. These are all included in the compressor gasket kit.

1. Assemble a piston ring, scraper groove toward the center of piston, to each end of three pistons.

2. Place front half cylinder on J-9397 compressing fixture with compressor main shaft (threaded end) projecting downward through the fixture. Rotate swash plate so high point is above cylinder bore No. 1. With open end of ring towards center of com-

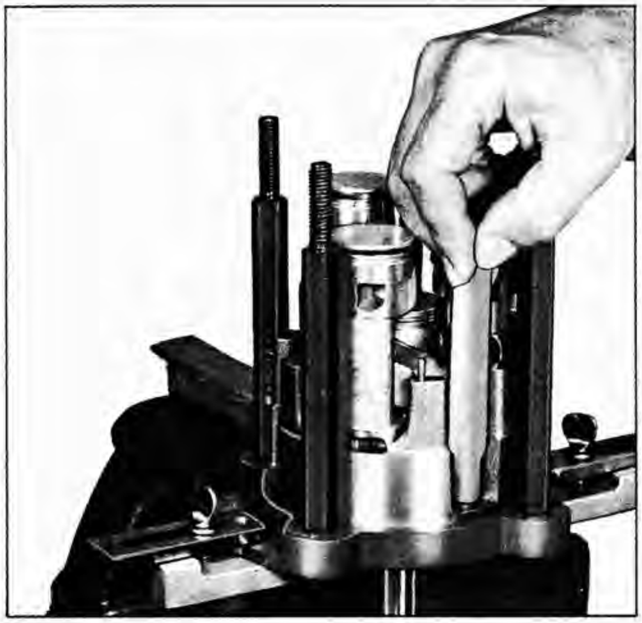


Fig. 5-88 Installing Service Discharge Crossover Tube

pressor, carefully assemble No. 1 piston (complete with ball and a ZERO shoe on FRONT end and ball and numbered shoe on REAR end) over swash plate. Compress and enter piston ring into front half cylinder. Repeat this operation for pistons No. 2 and No. 3.

3. Assemble one end of *service* discharge cross-over tube into hole in front cylinder (Fig. 5-88).

4. Rotate shaft to position pistons in a "stair step" arrangement. Place rear half cylinder over shaft and start pistons into cylinder bores.

5. Invert cylinder on fixture to complete assembly as follows:

a. Compress piston ring on each piston so as to permit its entrance into cylinder.

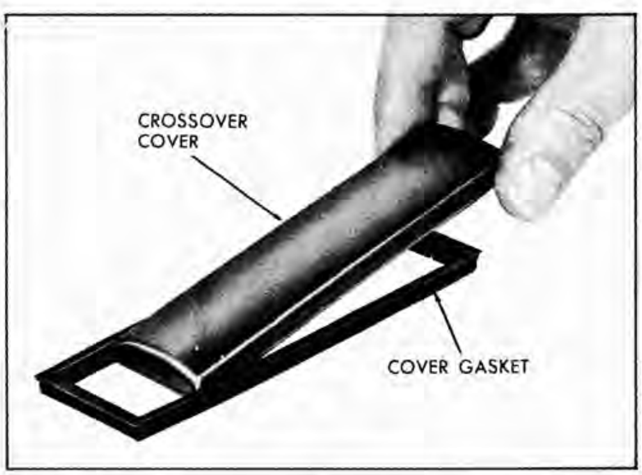



Fig. 5-89 Assembly of Crossover Cover and Seal

b. When all three pistons and rings are in their respective cylinders, align end of the discharge crossover tube with hole in rear half cylinder, making sure flattened portion of this tube faces *inside* of compressor (for swash plate clearance).

c. When satisfied that all parts are in proper alignment, tap with a fiber block and mallet to 'seat' rear cylinder over locating dowel pins.

6. Generously lubricate all moving parts with clean Frigidaire 525 viscosity oil. Check for free rotation of mechanism.

7. Check operation and smoothness of piston travel before proceeding with remainder of assembly. If any improper operation is observed during this check, the mechanism may have to be regauged. Complete assembly when correct operation is obtained.

8. Assemble a new rectangular gasket to suction crossover cover so wide portion side of seal is at bottom (against cylinder halves) and retained by cover (Fig. 5-89).

a. Coat gasket with clean 525 viscosity Frigidaire oil.

b. Start one side of gasket and cover into "dovetail" slot in the cylinder.

c. Use J-9433 suction crossover cover seal installer as a "shoehorn", by placing it between the gasket on opposite side and the "dovetail" slot (Fig. 5-90).

d. Center cover and gasket with ends of cylinder faces.

e. Press down on cover to snap into place.

f. Remove J-9433 suction crossover cover seal installer with a pair of vise grip pliers by pulling straight out (the long way).

g. Examine cover and gasket to be sure cover is properly seated.

9. Place internal mechanism in J-9397 compressing fixture if cylinder head dowel pins are to be replaced.

10. Replace two dowel pins in front cylinder if previously removed.

NOTE: A rod drilled 1/4" deep to O.D. of dowel pins will aid in installing pins.

11. Remove internal mechanism from J-9397 fixture.

## COMPRESSOR INTERNAL MECHANISM

### *REPLACE*

1. Install service discharge crossover pipe front O-ring and spacer (Fig. 5-91).

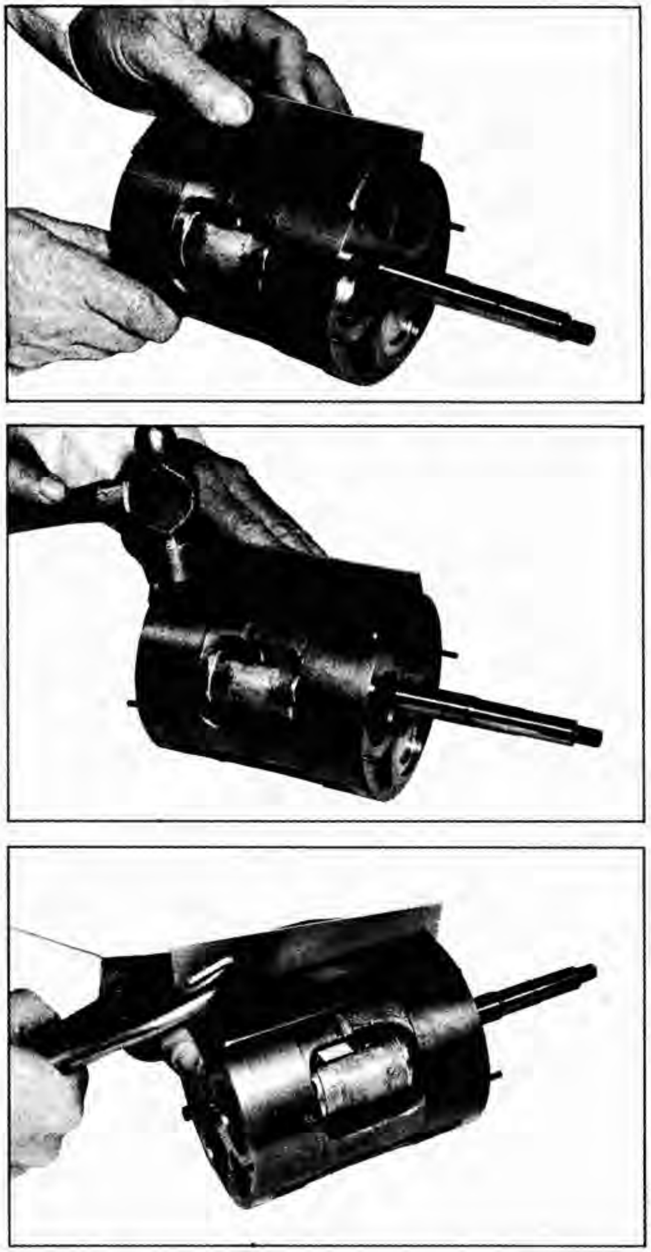


Fig. 5-90 Installing Suction Crossover Cover and Seal

2. Assemble suction reed valve to front end of cylinder. Align dowel pin holes, suction ports and oil return slot.

3. Assemble front discharge valve plate, aligning holes with dowel pins and proper openings in head.

NOTE: The front discharge valve plate has a large diameter hole in the center (Fig. 5-92).

4. Remove oil charging screw from compressor shell, inspect for damage, dirt or contamination, clean and replace.

5. Coat teflon gasket surfaces on webs of compressor front head casting with clean 525 viscosity Frigidaire oil.

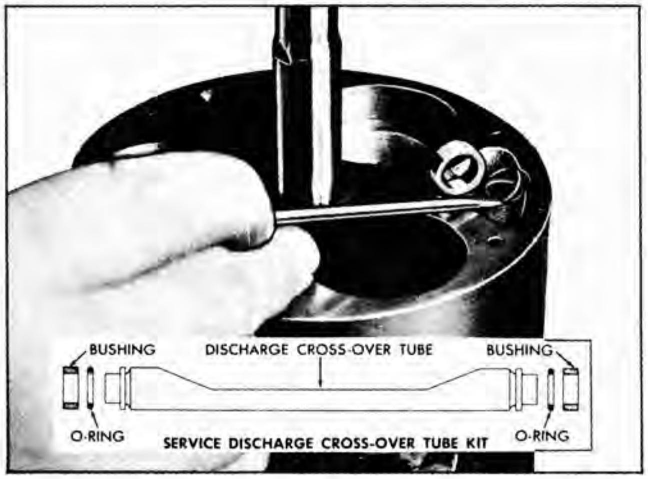



Fig. 5-91 Installing Service Discharge Crossover Parts

6. Examine location of dowel pins and contour of webs (mark dowel location). Rotate so as to position it properly over discharge reed retainers. Use care to avoid damaging teflon gasket surfaces. When in proper alignment, seat on compressor front head casting with light mallet taps (Fig. 5-93).

7. If previously removed, place compressor shell with J-9396 holding fixture in vise so shell is up.

NOTE: Examine corners of oil baffle to be sure they do not damage O-rings on reassembly. Tap corners at oil baffle down carefully with small ball pean hammer.

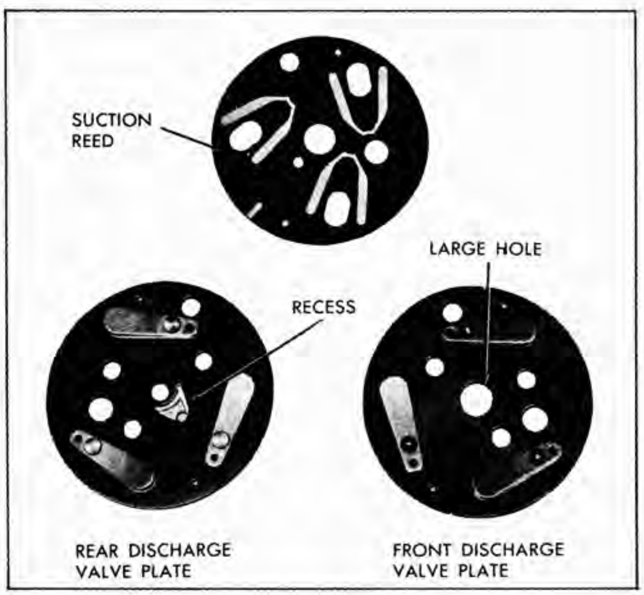



Fig. 5-92 Identification of Front and Rear Discharge Valve Plate

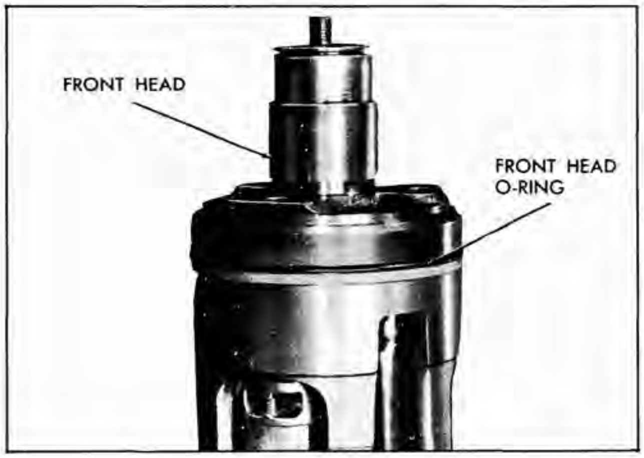



Fig. 5-93 Front Head Casting Installed

Fig. 5-95 Installing Oil Intake (Pick-up) Tube

8. Apply an ample amount of clean 525 viscosity Frigidaire oil around angle groove at the lower edge of casting. Coat large diameter head to shell O-ring and assemble O-ring on shoulder of shell (at front) (Fig. 5-92).

9. Coat the inside machined surfaces of shell with clean 525 viscosity Frigidaire oil. Line up oil sump with oil intake tube hole and slide mechanism into shell. Maintain this alignment when lowering mechanism into place (Fig. 5-94).

10. Place an O-ring on the oil pick-up tube, apply oil to cavity and O-ring. Insert tube and O-ring (Fig. 5-95), rotating compressor mechanism as necessary and align tube with hole in the shell baffle. Be sure O-ring and intake tube are properly seated.

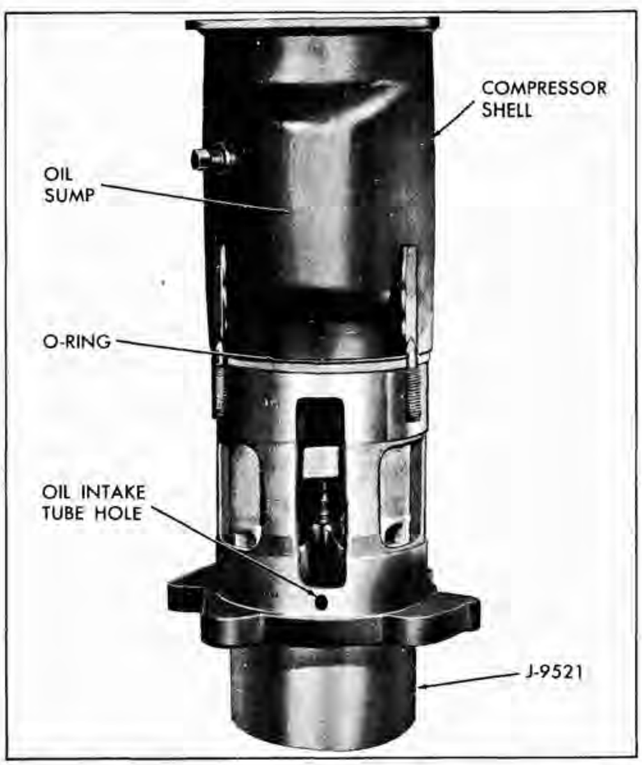



Fig. 5-94 Installing Mechanism Assembly

11. Replace split dowel pins (in rear cylinder) if previously removed.

NOTE: A rod drilled $\frac{1}{4}''$ deep to O.D. of dowel pins will aid in installing these pins.

12. Install service discharge crossover pipe rear O-ring and spacer.

13. Position rear suction reed valve to align with dowel pins, reed tips, and ports in head.

14. Position rear discharge valve assembly to align with dowel pins and ports and slide it into place over pins.

15. Position rear head casting to align with dowel pins. Rotate mechanism assembly back and forth by hand, if necessary, to permit this alignment and assure proper seating of front head cylinder assembly. Remove rear head from this trial assembly.

16. Assemble inner oil pump gear over "D" shaped flat on shaft. Place outer oil pump gear over inner oil pump gear.

NOTE: Before attempting the final assembly of the rear head casting, position outer gear as follows:

a. Observe position of oil sump in shell.

b. Locate approximate center line of this sump.

c. While facing center line of this sump and viewing from the back of compressor, move *outer* pump gear to **LEFT** until it is at approximately 90° (at 9 o'clock position) from center line of oil sump (Fig. 5-96).


Fig. 5-96 Positioning Oil Pump Outer Gear

## COMPRESSOR REAR HEAD ASSEMBLY

### *REPLACE*

1. Generously oil valve plate around outer edge where large O-ring will be placed. Oil valve reeds, oil pump gears, and area where teflon gasket will contact valve plate.

2. Coat new head-to-shell O-ring with oil and place it on valve plate in contact with shell.

3. Replace suction screen in rear head.

4. Assemble rear head to compressor shell, using care not to damage teflon gasket (Fig. 5-97).

5. Assemble new nuts to threaded shell studs. Tighten 25-28 lb. ft. torque.

6. Replace pressure relief valve, if removed, using new copper washer.

7. Invert compressor and compressor holding fixture in vise. Place shaft seal seat O-ring seal in *second full* groove inside neck of compressor front head casting.

8. Using J-9392 seal assembly holding tool, install shaft seal assembly over the "D" flats on shaft. Push seal over flats until seal seats. Turn tool counterclockwise to disengage tool from seal and remove tool.

9. Oil interior of shaft seal cavity, shaft and seal, using *clean* Frigidaire 525 viscosity oil.

10. Grip shaft seal seat with J-9393-1 and 2 shaft seal seat assembly tool. Push it into place so as to not disturb the O-ring in the *second* groove and to also affect a seal with this O-ring.

Fig. 5-97 Installing Rear Head

11. Replace seal seat retainer (snap ring) so flat surface of ring contacts seal seat, using J-9393-1 to snap retainer in place (Fig. 5-98).

***CAUTION: DO NOT apply any more force to J-9393-1 than is necessary to seat retainer. Excessive force may crack or chip carbon nose of shaft seal.***

12. Install J-9625 on rear end of compressor and attach gauge manifold assembly.

13. Charge with one pound Refrigerant-12 through the *DISCHARGE* side only.

14. Check for leaks. If pressure is immediately noted on the suction gauge, it indicates an internal leak (*inside* the compressor) which could be seal leak at front or rear head, at discharge crossover pipe, or broken piston ring(s).

15. Depressurize and correct any leaks as necessary.


Fig. 5-98 Seating Seal Seat Retainer

16. Replace same amount of *clean* 525 compressor oil as drained from the compressor prior and during compressor overhaul. Add oil through oil test screw opening.

17. Remove J-9625.

18. Install compressor clutch coil and coil housing assembly.

19. Install compressor pulley and bearing assembly.

20. Install compressor clutch hub and plate assembly.

21. Evacuate and charge refrigeration system.

22. Perform operational test.

## LEAKING SEALS, HOSES OR LINES

### REMOVE AND REPLACE

When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor if oil was sprayed in copious amounts due to severe leaks or broken lines. The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Depressurize refrigeration system.

2. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

3. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

Neglect any fluid oil coating loss in case of line change.

4. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.

5. Replace leaking seal, hose, or line.

6. Replace compressor and system components.

7. Evacuate, charge and perform operational test.

## CONDENSER ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, compressor must also be removed and oil drained from compressor if oil was sprayed in copious amounts due to leaks or collision damage to condenser.

The amount of oil to put back into compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* one fluid oz. for the condenser.

3. If oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, *plus* one fluid ounce for condenser.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### REMOVE AND REPLACE CONDENSER

1. Depressurize the refrigeration system.

2. Remove right and left headlamp doors.

3. Remove right and left headlamp assemblies.

4. Remove upper grille bar.

5. Remove compressor discharge hose clamp.

6. Remove hose from condenser inlet using J-9508. Plug openings.

7. Disconnect connection at condenser outlet and plug openings.

8. Remove battery and battery tray.

9. Disconnect right and left horns and remove condenser.

10. Replace condenser by reversing the above procedure, using a new rubber O-ring seal well lubricated with clean compressor oil at each connection.

11. Evacuate and charge system.

12. Perform operational test.

## RECEIVER AND LIQUID INDICATOR ASSEMBLY

NOTE: When refrigeration system components other than compressor are replaced, the compressor must also be removed and oil drained from compressor if oil was sprayed in copious amounts due to leaks or collision damage to receiver.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* one fluid oz. for the receiver and liquid indicator.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, *plus* one fluid ounce for the receiver and liquid indicator.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

#### *REMOVE AND REPLACE RECEIVER ASSEMBLY*

1. Depressurize the system.

2. Disconnect inlet and outlet connections of receiver at liquid indicator assembly and plug openings.

3. Loosen receiver and liquid indicator assembly clamp screw and remove assembly.

4. Replace the receiver and liquid indicator assembly by reversing the above procedures, using new rubber O-ring seals, well lubricated with clean compressor oil, at each connection.

5. Evacuate complete system.

6. Charge complete system.

7. Perform operational test.

## THERMOSTATIC EXPANSION VALVE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leaks or collision damage to valve.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

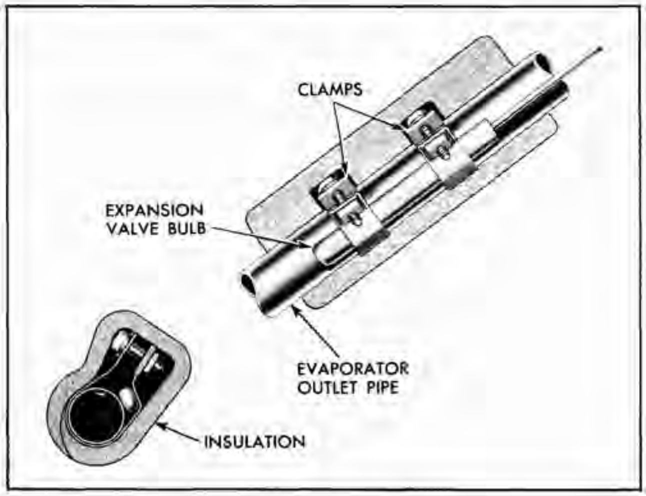



Fig. 5-99 Thermostatic Expansion Valve Bulb at Evaporator Outlet Pipe

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

#### *REMOVE AND REPLACE VALVE*

1. Depressurize the system.

2. Hoist front end of car.

3. Remove right front wheel and tire assembly.

4. Remove right front headlamp assembly.

5. Disconnect front fender at lower rear.

6. Remove right front fender rear half skirt. On early models remove right fender and skirt assembly.

7. Disconnect thermostatic expansion valve capillary tube bulb at evaporator outlet pipe (Fig. 5-99).

8. Disconnect thermostatic expansion valve equalizer line at temperature regulation valve (Fig. 5-100).

9. Disconnect thermostatic expansion valve inlet connection carefully, as some pressure may still exist, and plug openings.

10. Remove thermostatic expansion valve, noting amount of oil that drains from evaporator, and plug openings.

11. Replace by reversing the above procedure, using new rubber O-ring seals, well lubricated with clean compressor oil, at each fitting connection.

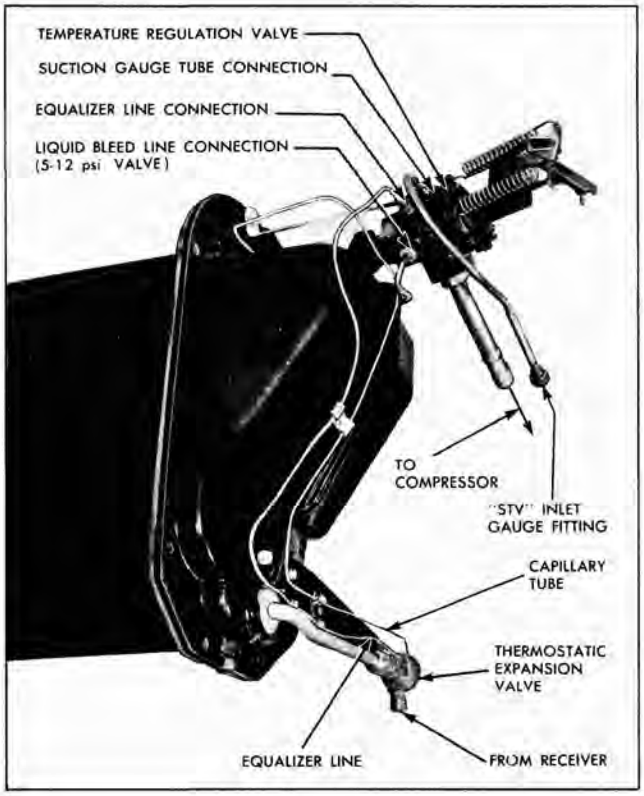



Fig. 5-100 Equalizer Line at Temperature Regulation Valve

12. Evacuate and charge system.

13. Perform operational test.

## EVAPORATOR CORE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leaks or collision damage to core.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle. measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* three fluid ozs. for the evaporator.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, *plus* the three ozs. for the evaporator.

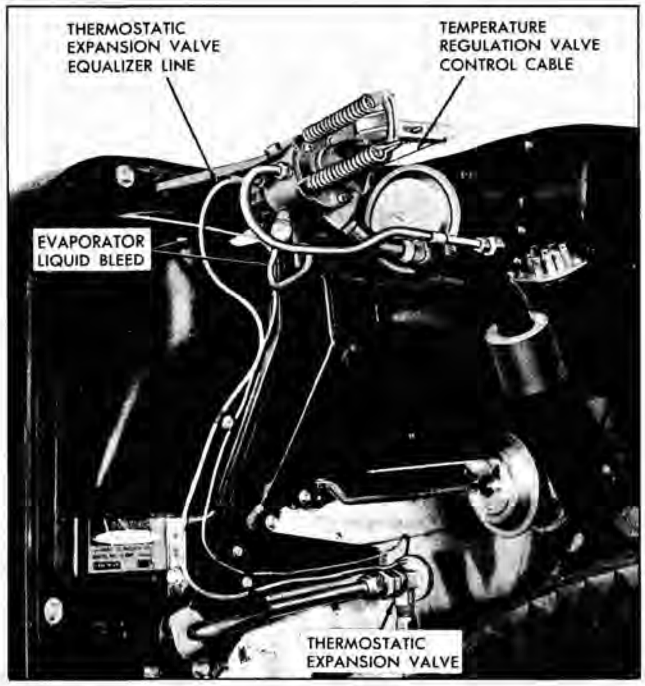



Fig. 5-101 Evaporator Assembly on Dash Shroud

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE EVAPORATOR CORE*

1. Depressurize the system.

2. Hoist front of car.

3. Remove right front wheel and tire assembly.

4. Remove right front headlamp assembly.

5. Remove right front fender and fender skirt assembly on early models and rear half fender skirt only on late models.

6. Disconnect connection at thermostat expansion valve inlet and plug openings (Fig. 5-101).

7. Remove temperature regulation valve bracket.

8. Disconnect thermostatic expansion valve equalizer line at temperature regulation valve and plug openings.

9. Disconnect evaporator liquid line connection at temperature regulation valve. Plug openings.

10. Remove adapter connecting blower and air duct assembly to evaporator assembly.

11. Disconnect temperature regulation valve from evaporator. Plug openings.

12. Loosen blower and air inlet duct assembly as

necessary to provide clearance for removal of evaporator.

13. Remove evaporator to cold air duct adapter attaching screws, remove adapter, and remove evaporator assembly.

14. Disconnect thermostatic expansion valve capillary bulb at evaporator outlet.

15. Remove thermostatic expansion valve, noting amount of oil that drains from evaporator, and plug all openings.

16. Remove evaporator core housings.

17. Remove right kick pad.

18. Remove air outlet duct assembly.

19. Replace evaporator by reversing the above procedure, making sure new rubber O-ring seals, well lubricated with clean compressor oil, are at each fitting connection.

a. Make sure that the blower to evaporator adapter is properly sealed.

b. Make sure that the evaporator to cold air duct adapter and the cold air duct are properly sealed.

c. Make sure the temperature regulation valve is properly positioned and aligned to permit replacement of the valve bracket.

d. Make sure that the air outlet duct is properly sealed to the evaporator and to the cowl side panel.

20. Evacuate and charge system.

21. Check and adjust the temperature control cable.

22. Perform operational test.

## TEMPERATURE REGULATION VALVE (SUCTION THROTTLING VALVE)

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leaks or collision damage to valve.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### REMOVE AND REPLACE VALVE

1. Depressurize the refrigeration system.

2. Hoist front of car.

3. Remove right front wheel and tire assembly.

4. Remove right front headlamp assembly.

5. Remove right front fender and fender skirt assembly on early models and rear half fender skirt only on late models.

6. Remove temperature regulation valve bracket.

7. Disconnect thermostatic expansion valve equalizer line at the temperature regulation valve (Fig. 5-100). Plug openings.

8. Disconnect evaporator liquid line connection at the temperature regulation valve. Plug openings.

9. Remove valve gauge fitting tube from valve and plug openings.

10. Disconnect valve control cables.

11. Disconnect temperature regulation valve from evaporator outlet and remove valve.

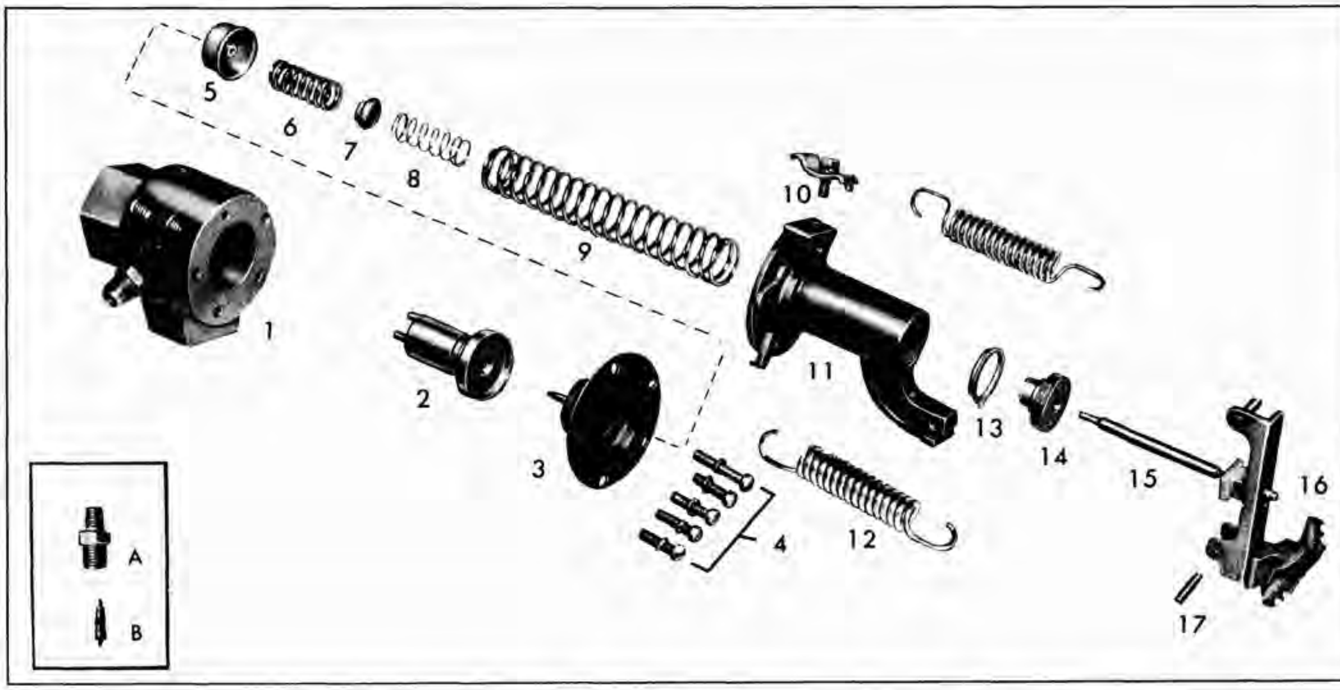
12. Replace the temperature regulation valve by reversing the above procedures, using new rubber O-ring seals, well lubricated with compressor oil, at each connection. Make sure the valve is properly positioned and aligned to permit replacement of the valve bracket.

13. Adjust temperature regulation valve control cable.

14. Evacuate complete system.

15. Charge complete system.

16. Perform operational test.




1. Valve Body
1A. Liquid Bleed Line Fitting
1B. Liquid Bleed Line Valve
2. Piston
3. Diaphragm
4. Cover to Body Screws
5. Inner Spring Seat and Retainer
6. Inner Spring
7. Inner Spring Center Retainer
8. Buffer Spring
9. Outer Spring
10. Cable Clamp and Screw
11. Diaphragm Cover
12. Helper Springs
13. Outer Spring Retainer
14. Freeze Protection Adjusting Screw
15. Actuating Pin and Nut
16. Lever Assembly
17. Lever to Cover Pin

Fig. 5-102 Temperature Regulation Valve—Exploded View

## TEMPERATURE REGULATION VALVE—OVERHAUL (See Fig. 5-102)

### *DISASSEMBLE*

1. Remove temperature regulation valve assembly. Plug all lines connecting to valve.

2. Remove valve lever helper springs.

3. Remove lever axis pin. Remove lever and adjusting pin assembly.

NOTE: Do not disturb the adjusting pin nut (plastic) on pin.

4. Scribe line on diaphragm cover and valve body for guide during reassembly.

5. Note depth of valve adjusting screw. Unscrew screw slowly (under spring tension) using J-9505.

6. Remove outer spring seat (under adjusting screw), outer spring, buffer spring, buffer spring seat and inner spring.

7. Remove screws from diaphragm cover to valve body and remove cover.

8. Remove diaphragm and piston assembly.

9. Remove cup retainer (inner and outer springs seat) from diaphragm.

10. Carefully remove diaphragm from piston. Pull on diaphragm, stretching diaphragm retainer (extending in piston) until it releases from piston.

***CAUTION: Use care when handling diaphragm to prevent damage to rubber and fabric surfaces. Examine diaphragm for cuts, tears, etc. If damaged; replace diaphragm.***

11. Screen and retainer in evaporator end of piston should *not* be removed from piston. Examine screen for any foreign material or contamination and clean with tri-chlorethylene.

12. Remove liquid bleed line Schrader core and examine for damage.

### CLEANING AND INSPECTION

NOTE: After cleaning and inspection, lay all parts on a clean dry surface. Use lint-free towels during this procedure.

1. Thoroughly clean valve body with tri-chlorethylene. Be sure all metal chips are removed from tapped holes (for diaphragm cover).

2. Blow all passages in valve body dry with refrigerant.

3. Clean all internal parts with tri-chlorethylene and blow dry with refrigerant.

4. Examine *all* parts for scratching or scoring and replace parts as necessary.

5. Examine valve body bore and piston surfaces for any imperfections, foreign material, or obvious damage that would cause the piston to hang up or prevent free operation of the piston. Replace valve body if bores are damaged or connection ports have been cross threaded.

NOTE: DO NOT attempt to scrape, stone, or dress any deep scratches, as this may result in improper valve performance.

### ASSEMBLE

1. Install liquid bleed line Schrader valve core. This is a special valve core, so do not try to replace with a tire valve core.

2. Apply a light coat of clean compressor oil on diaphragm retainer tab and install diaphragm on piston by inserting tab in hole at top of piston. Press down with a rotating motion until tab is seated in piston.

3. Apply a light coat of clean compressor oil on piston and also in valve body bore and install piston and diaphragm assembly.

4. Install spring retainer cup in diaphragm.

5. Position diaphragm cover on valve body, (aligning marks scribed prior to disassembly) making certain holes in valve body, diaphragm, and diaphragm cover align. Start all screws but do not tighten.

6. Push on screened end of piston so piston moves to the full open position (against diaphragm cover). This positions diaphragm so it doesn't become pinched under cover. Now press against spring retainer cup until piston is against shoulder of valve body (fully closed) and tighten screws to 20-25 in. lb. torque.

7. Install inner spring, buffer spring seat and buffer spring.

8. Install outer spring and outer spring retainer, aligning retainer with slot in spring cavity.

9. Place adjusting nut on spring and turn to depth noted before removal.

10. Slide control lever onto the adjusting pin nut and install this assembly, securing with the lever axis pin.

11. Place valve on evaporator inlet end and measure the distrance from the top of the adjusting pin with the lever in the "free fall" position and with the lever full up against the stop. This distance should be .088" to .098". Adjust by turning pin. This is the clearance between the shoulder at the bottom of the adjusting pin and the buffer spring seat (Fig. 5-103).

12. Replace lever helper springs.

13. Replace temperature regulation valve.

14. Adjust temperature regulation valve control cable.

15. Evacuate and charge refrigeration system.

16. Perform operational test and adjust temperature regulation valve.

## COLLISION SERVICE

The severity and circumstances of the collision will determine the extent of repair work required. Good judgment must be used in deciding what steps are necessary to put the system back into operation.

Each part of the system must be carefully inspected. No attempt should be made to straighten kinked tubes or repair any bent or broken units. Check especially for cracks at soldered connections.

### REFRIGERATION SYSTEM OPEN TO ATMOSPHERE

Broken tubes or units will allow air, moisture and dirt to enter. These parts should be sealed as soon as possible until such time as they are replaced.

If the system is open for more than 15 or 20 minutes (depending on humidity), the receiver and liquid indicator assembly will absorb an excessive amount of moisture and should be replaced, and each component of the system should be cleaned with dry nitrogen and flushed with liquid refrigerant to remove dirt and moisture.

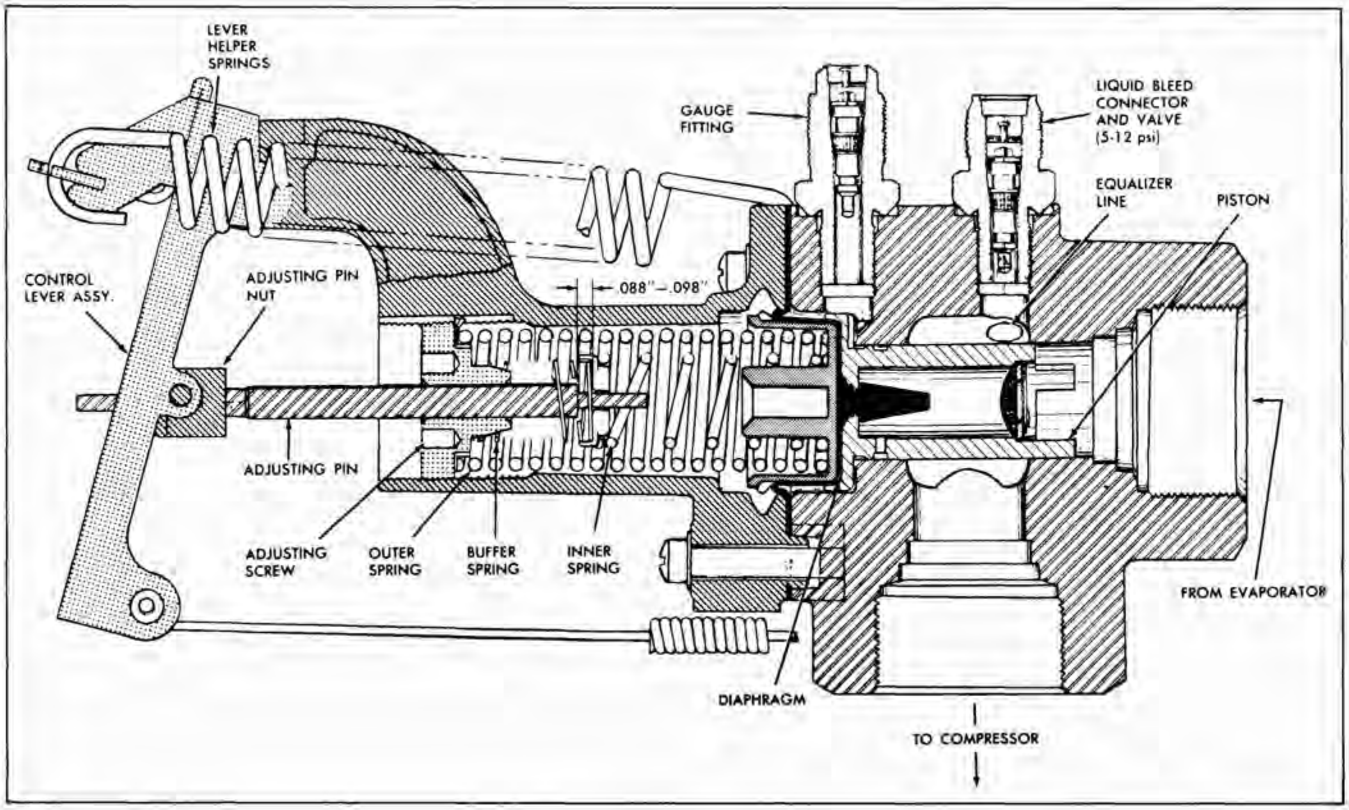



Fig. 5-103 Cross Section of Temperature Regulation Valve

### FLUSHING SYSTEM

Flushing can be accomplished by connecting a refrigerant drum to the unit to be flushed and then turning the drum upside down and opening the drum shut-off valve to pour refrigerant through the unit. The unit should be supported so that the refrigerant passing through it will be directed into an area where −21.7°F. will do no damage.

***CAUTION: Remember that when liquid refrigerant is poured from the drum into an area where atmospheric pressure exists, its temperature will immediately drop to −21.7°F.***

In order to keep the expansion valve open when flushing the evaporator, the expansion valve bulb must be detached from the evaporator outlet tube.

### INSPECTING COMPRESSOR

If there is no visible evidence of damage, rotate compressor shaft to test for normal reaction. A quick check for broken reed valves is to turn compressor shaft (using box end wrench on compressor shaft nut) and check for resistance when turning the shaft. An irregular resistance force will be felt as each of the pistons goes over top center for each revolution of the crankshaft. If this pattern is not felt, it indicates one or more broken compressor reed valves and the compressor must be repaired.

Inspect oil for foreign material which would indicate internal damage to the compressor. If no foreign matter is found in oil, compressor can be used. Flush entire refrigeration system with refrigerant, drain oil from compressor and pour in 11 oz. avoirdupois of new Frigidaire 525 viscosity oil.

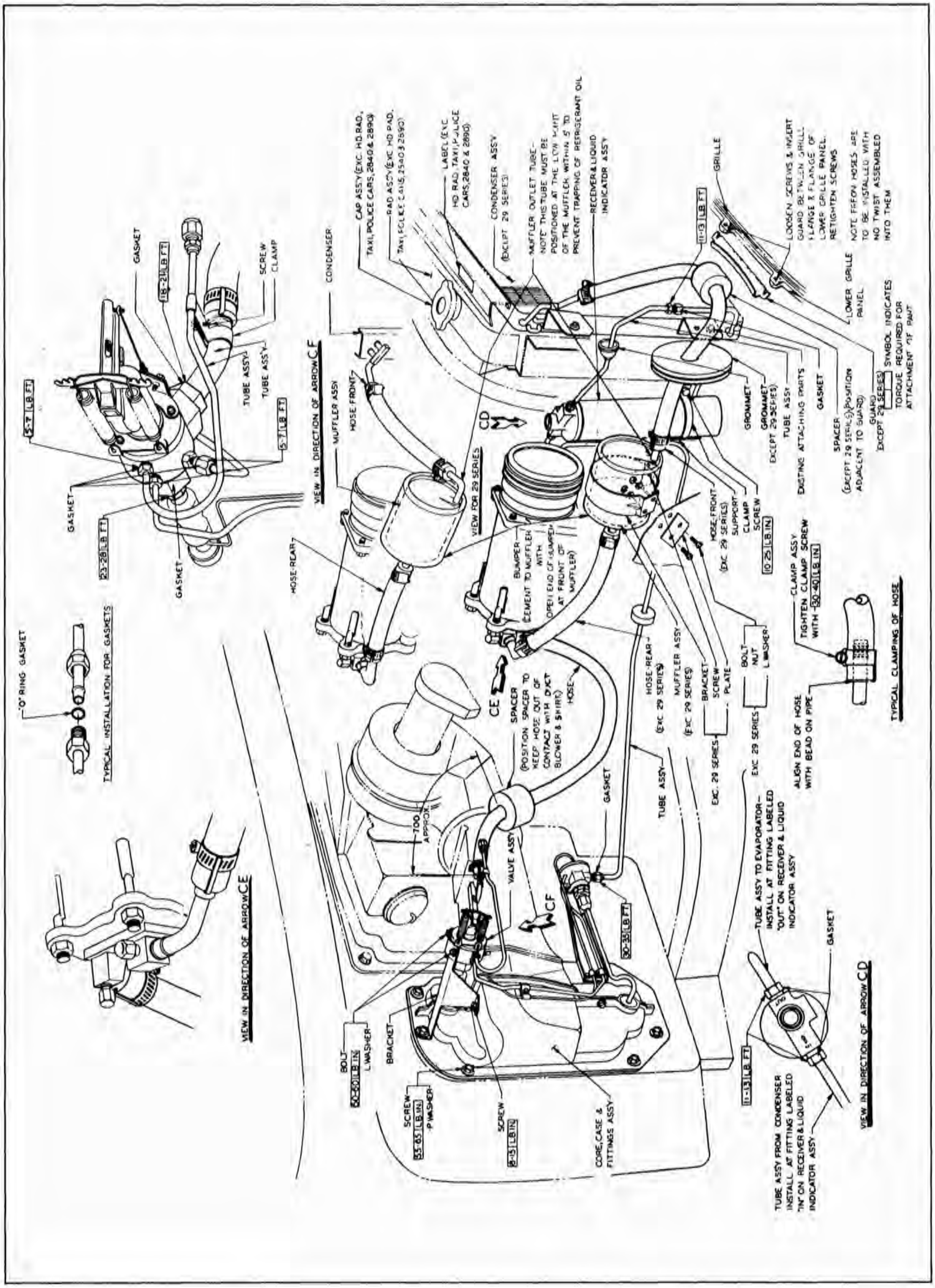



Fig. 5-104 Reference Illustration—Circ-L-Aire Conditioner Refrigeration System

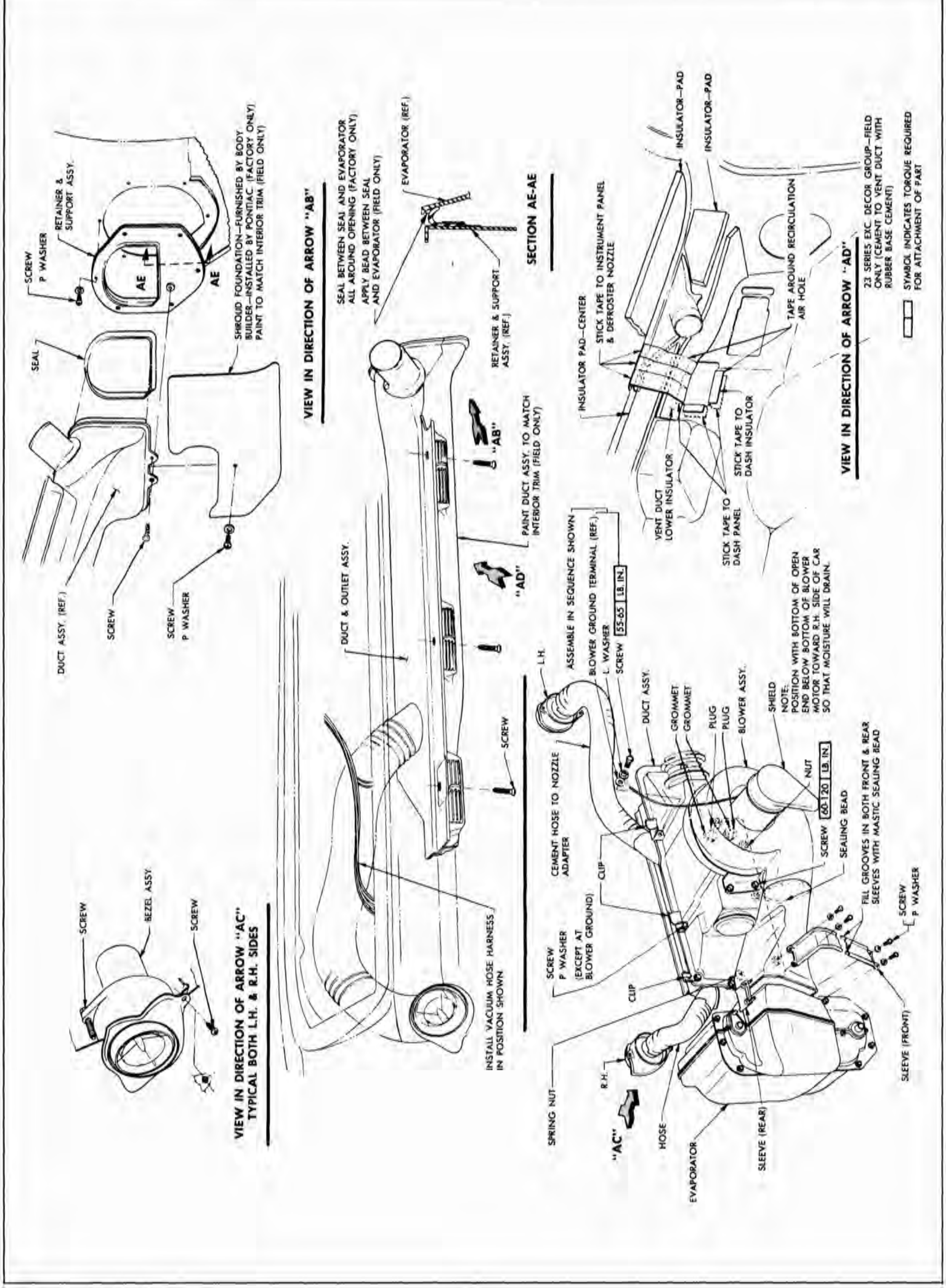



Fig. 5-105 Reference Illustration—Circ-L-Aire Conditioner Air System

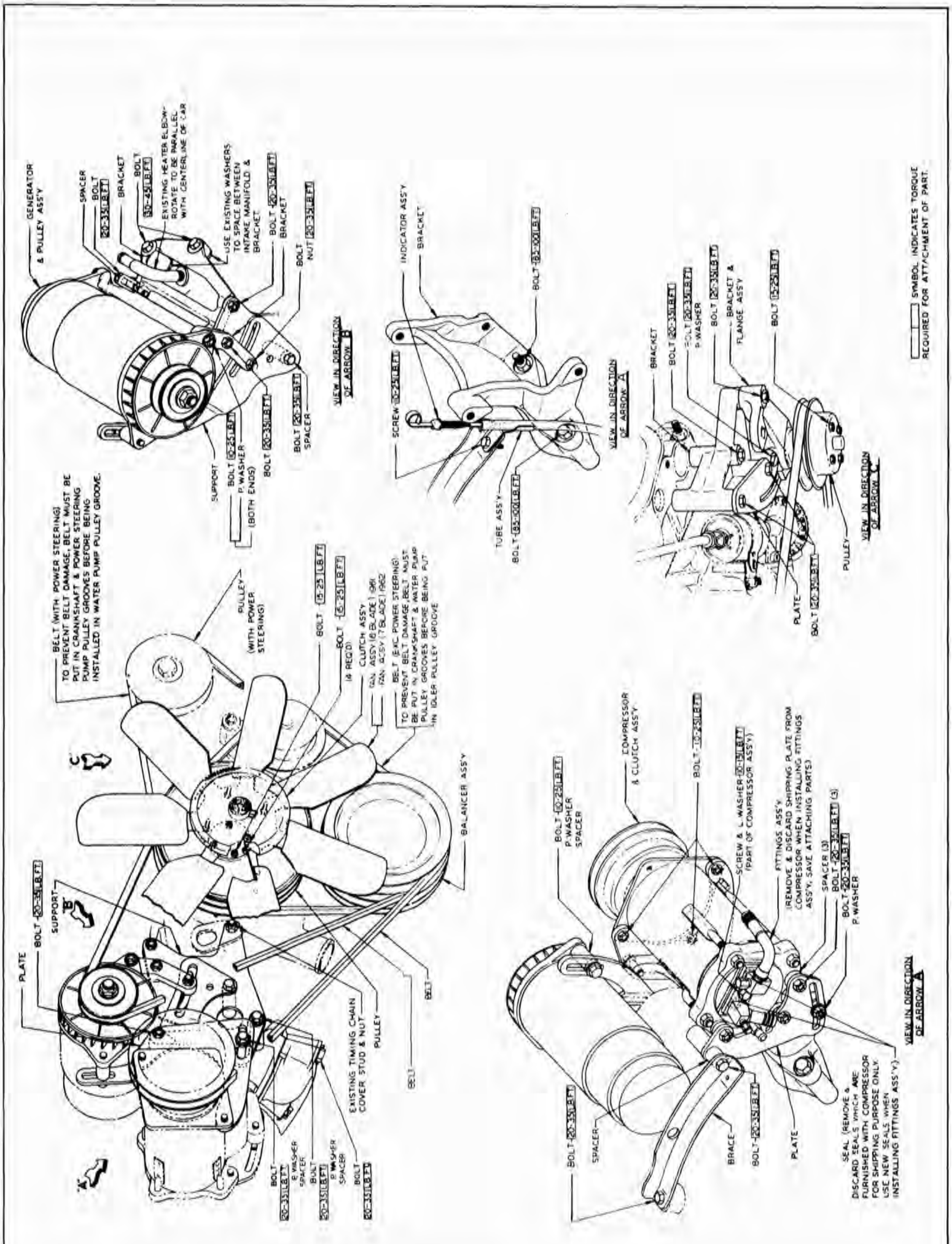



Fig. 5-106 Reference Illustration—Circ-L-Aire Conditioner Engine Parts


Fig. 5-107 Reference Illustration—Circ-L-Aire Conditioner Electrical Parts

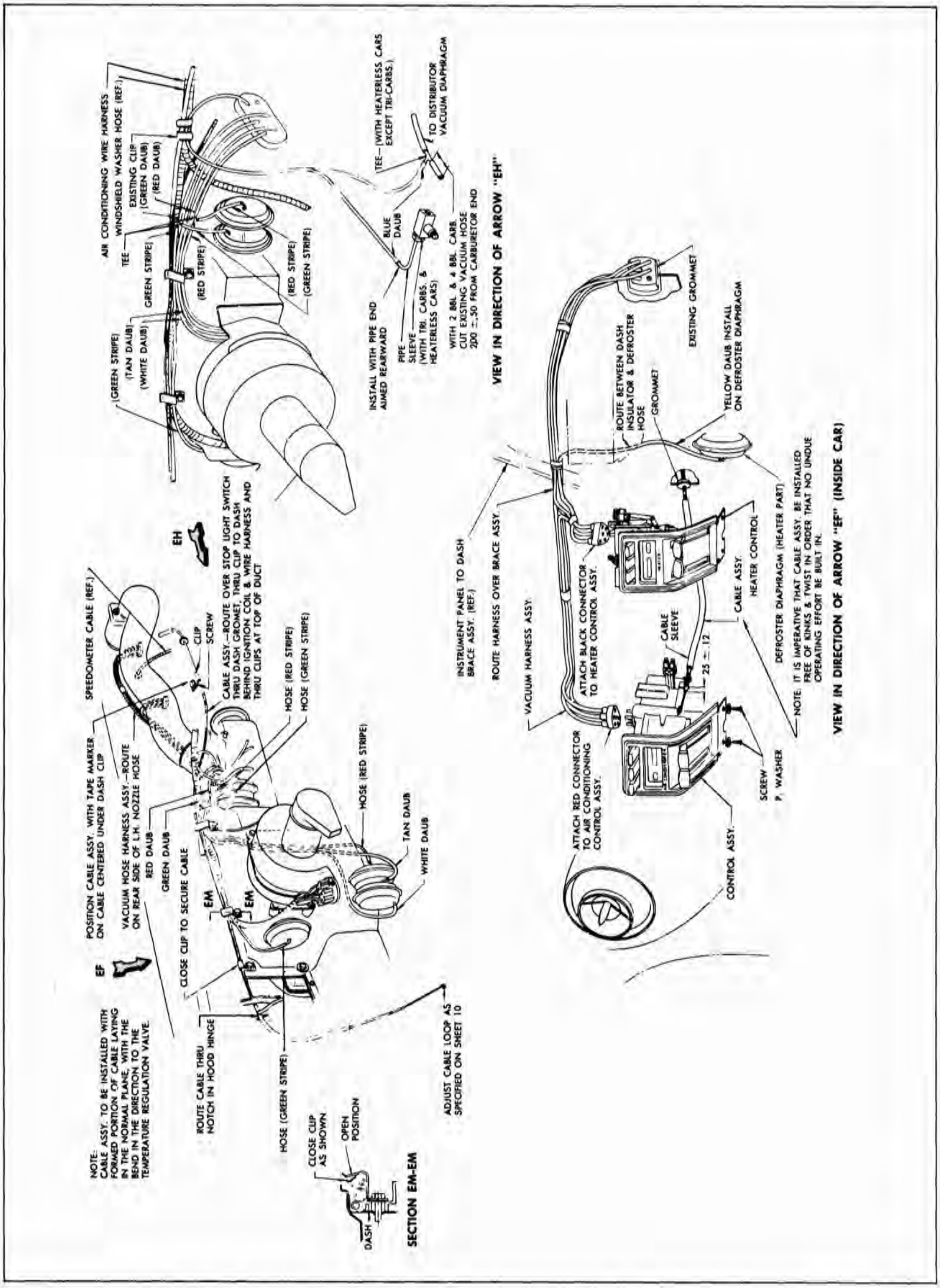



Fig. 5-108 Reference Illustration—Circ-L-Aire Conditioner Controls

# TESTING AND DIAGNOSIS

**CONTENTS OF THIS SECTION**



## TESTING

The purpose of performing an operational test is to prove that the air conditioning electrical system, air system, vacuum system and refrigeration system are operating properly and efficiently. Results of the test are as follows:

1. Operation of the air conditioner blower at all four speeds and engagement of the compressor clutch would indicate that the electrical circuits are functioning properly.

2. A clear sight glass would indicate a properly charged refrigeration system.

3. Proper evaporator pressure, as controlled by the temperature regulation valve, would provide the proper "freeze protection" for the evaporator.

4. Proper nozzle temperatures would indicate a system free from warm air leaks.

Check and correct all air and refrigerant leaks in the air conditioning system as well as operation of vacuum operated air valves.

Check for proper compressor oil level during the repair of refrigerant leaks, *before* conducting an operational test.

### PRELIMINARY CHECKS

1. Check compressor belt for proper tension; if below 70 lbs. adjust to 100-105 lbs. on Borroughs Belt Tension Gauge.

2. Check all refrigeration lines for leaks, kinks, or other restrictions.

3. Check all air hoses for leaks or restrictions. Air restriction may indicate a plugged (or partially so) evaporator core.

4. Check outer surfaces of radiator and condenser cores to be sure they are not plugged with dirt, leaves or other foreign material. Be sure to check between the condenser and radiator as well as the outer surfaces.

5. Connect engine tachometer.

6. Start engine and operate at 1500 rpm with "OUTSIDE" button depressed, temperature control lever full down for maximum cooling and blower speed on "HI". Check heater controls to be certain all are in the off position. After ten minutes of engine operation, observe for bubbling at the sight glass (above 70°F. ambient). If the system is low on refrigerant, refer to ADDING REFRIGERANT-12 for proper charging procedure.

7. Under the same conditions as in step 6 above, pull the temperature control lever to the full up position. This should disengage the compressor clutch. If clutch does not disengage, disconnect the clutch wire at the compressor.

a. If clutch disengages, the clutch control switch should be checked for proper operation and/or maladjustment.

b. If clutch does not disengage, malfunction is at the clutch.

8. Gradually push temperature lever down until the clutch engages (this should occur at approximately ¼" downward travel) and observe clutch engagement action which should be without slip. If clutch slips, check clutch for proper adjustment, short in clutch coil, or leaking compressor shaft seal.

9. Change blower speed to "3", "2", and then "LO", and observe for decreases in air flow.

10. With blower on "HI", check for air leakage at defroster nozzles and heater outlet. Depress "INSIDE" button and repeat. Leakage at these points,

either with the "OUTSIDE" or "INSIDE" button depressed, indicates malfunctioning of the selector air valve or improper vacuum hose harness hook-up.

11. Turn ignition key to "OFF" position.

The air conditioning refrigeration system should be checked for proper operating temperatures and pressures as follows:

### INSTRUMENTATION AND TEST CONDITIONS

1. Place car in a shaded area (not under sun).

2. Remove caps from compressor gauge fittings.

3. Check calibration of suction gauge and connect low pressure side of manifold gauge set J-5725 or J-5725-01 using J-5420 Schrader valve adapter to the Schrader valve located in the temperature regulation valve.

4. Connect the high pressure side of the gauge set using J-6163 Schrader valve adapter (90°) to the Schrader valve located in the discharge side of the compressor fittings assembly.

5. Purge gauge lines by cracking gauge set low and high pressure hand shut-off valves.

6. Connect engine tachometer.

7. Push temperature control lever full down for maximum cooling. In this position the valve lever cam should just contact the nylon plunger. (See TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT.)

8. Depress "INSIDE" button and position blower on "HI".

9. Locate a calibrated thermometer one inch (1″) inside *left* nozzle so sensing element does not contact nozzle hose or metal parts.

10. Check heater controls to be certain all are in the off position.

11. Close car doors and windows.

12. Place auxiliary fan (at least 20″ in diameter) approximately 25″ in front of the air conditioning condenser.

13. Suspend a calibrated thermometer 2″ ahead of condenser in auxiliary fan air blast.

### OPERATIONAL TEST PROCEDURE

NOTE: Before proceeding be sure instruments and test conditions are as explained above.

1. Start engine, increase slowly to 1500 rpm and run for ten minutes at this speed. (Place synchro-mesh transmission in neutral and parking brake on or Hydra-Matic transmission in the "PARK" position and parking brake on.)

2. Observe low pressure gauge and adjust temperature regulation valve only if reading is not within specifications.

a. Check and adjust temperature control cable.

NOTE: If adjustment of temperature regulation valve is necessary, proceed as follows: DO NOT adjust actuating pin which is threaded in nylon nut. This adjustment does *NOT* have any effect on freeze control pressure.

b. Install J-9505 into two holes in (cold setting) adjusting screw.

c. Check CHART I–OPERATIONAL TEST data and obtain proper psi reading on the suction gauge by turning adjusting tool clockwise to increase pressure or counterclockwise to decrease pressure.

NOTE: It is important that changes be made in small increments, with time allowed for the pressure to stabilize.

3. Run engine at 1500 rpm for at least 10 minutes or until refrigeration system stabilizes.

4. At the end of this time, record the following:

a. Ambient air at condenser.

b. Compressor discharge pressure.

c. Pressure at temperature regulation valve.

d. Left nozzle temperature.

Compare above with system pressures and temperature shown on the OPERATIONAL TEST CHART.

If not within the limits shown, refer to TROUBLE DIAGNOSIS for possible cause of substandard performance. Reference should be made in the order listed, with head pressure first, if not within operational test chart limits, then suction pressure, and finally left nozzle temperature.

5. When all adjustments or repairs have been made, make another operational test of the system.

**TEST CONDITIONS**

| | |
|---|---|
| Heater Control | Completely "off"—All Levers fully raised |
| Heater Temperature Lever | Fully raised for no heat |
| Heater Fan Switch | "OFF" |
| Hood | "Raised" |
| Doors, Windows, Ventipanes and Shroud Air Vents | "Closed" |
| Air Conditioner Control Push Button | On "INSIDE" |
| Air Conditioner Fan Switch | On "HI" |
| Air Conditioner Temperature Lever | Fully depressed for maximum cooling |
| Engine Speed | 1500 RPM |
| Ball Nozzles and Air Outlets | Open |

Test where sun load is not a factor; also an auxiliary fan must be placed in front of condenser.

**TEST READINGS**

| | | | | | |
|---|---|---|---|---|---|
| Ambient Air in Degrees F. (In aux. fan air blast 2" ahead of condenser.) | 70 | 80 | 90 | 100 | 110 |
| Average Compressor Head—PSI (12 PSI range is normal) | 138-158 | 153-176 | 173-196 | 202-230 | 237-262 |
| Average Freon Test Tube (at Temperature Regulation Valve) Pressure must be within ±1 PSI | 28½ | 28½ | 28½ | 28½ | 29 |
| Left Nozzle Temperature—Degrees F. | 35-38 | 35-38 | 35-39 | 36-40 | 37-41 |
| CAUTION: Sensing element must not contact nozzle, plastic elbow or metal parts. | | | | | |

Chart I Circ-L-Aire Conditioner Operational Test Data

## TROUBLE DIAGNOSIS

***INSUFFICENT COOLING***

| COMPLAINT OR CAUSE | REMEDY |
|---|---|
| Nozzle temperature too high. | See NOZZLE TEMPERATURE TOO HIGH and also SUCTION PRESSURE TOO HIGH. |
| | Check blower operation. |
| | Check for obstructions, proper routing and proper connection of the air distribution hoses. |
| Insufficient air flow. | Flush evaporator core. If evaporator is iced, de-ice and check adjustment of temperature regulation valve. |
| | Air leaks in air system. |
| Heater temperature control valve *not off* in the "OFF" position. | Adjust heater temperature control cable and/or temperature control valve (air mix valve). |
| Ventilator and/or heater air valve or controls not in the "OFF" position. | Advise owner on proper operation of air conditioning system. |

***INSUFFICIENT COOLING—Continued***

| COMPLAINT OR CAUSE | REMEDY |
|---|---|
| Nozzle temperature varies too much. | A 7°F. frequent variation at nozzle during operational check indicates temperature regulation valve is "hunting" excessively and the valve should be overhauled. |
| Erratic cooling. | Temperature regulation valve piston sticking; if stuck closed, no cooling due to lack of flow of refrigerant through the evaporator core; if stuck open no controlled cooling and car may get too cold—evaporator may freeze. Replace valve. |

***COMPRESSOR DISCHARGE PRESSURE TOO HIGH***

| CAUSE | REMEDY |
|---|---|
| Engine overheated. | See Shop Manual. |
| Overcharge of refrigerant or air in system. | Systems with excess discharge pressures should be *slowly* depressurized at the receiver inlet connection, observing the behavior of the high pressure gauge indicator.<br><br>1. If discharge pressure drops rapidly, it indicates air (with the possibility of moisture) in the system. When pressure drop levels but still indicates in excess of specifications shown in the OPERATIONAL TEST CHART, slowly bleed system until bubbles appear in the sight glass and stop. Add refrigerant until bubbles clear, then add one (1) pound of refrigerant. Recheck operational pressures. If discharge pressure still remains above specifioations and the suction pressure is slightly above normal, then a restriction exists in the high pressure side of the system.<br><br>2. If discharge pressure drops slowly, it indicates excessive refrigerant. If pressures drop to specifications and sight glass remains clear, stop depressurizing and recheck operational pressures. If pressures are satisfactory, depressurize until bubbles appear in the sight glass, stop depressurizing, then add one (1) pound of refrigerant. Recheck operational pressures.<br><br>3. If discharge pressure remains high after depressurizing the system, continue depressurizing until bubbles appear in the sight glass. If suction pressures also remain high, then the temperature regulation valve may require adjustment, as well as a possibility of a restriction in the high pressure side of the refrigeration system. The system will have high pressure control more frequently under this condition. See also TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |

### COMPRESSOR DISCHARGE PRESSURE TOO HIGH—Continued

| CAUSE | REMEDY |
|---|---|
| Restriction in condenser, receiver-liquid indicator, or any high pressure line. | Remove parts, inspect, and clean or replace. |
| Condenser air flow blocked. | Clean condenser and radiator core surfaces as well as the space between the condenser and radiator. |
| Temperature regulation valve inlet pressure too high. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |

### COMPRESSOR DISCHARGE PRESSURE TOO LOW

| CAUSE | REMEDY |
|---|---|
| Insufficient refrigerant. | Check for presence of bubbles or foam in liquid indicator. If bubbles or foam are noted, add refrigerant until sight glass clears, then add an additional one lb. Adding refrigerant in excess of 1/4 lb. beyond the charge specification would indicate a leak in the system.<br>NOTE: It is not unusual for bubbles to occur on minimum cooling and "LO" blower in mild weather even with a fully charged system (Below 70° ambient). |
| Defective compressor and/or broken compressor reed valves. | Overhaul compressor. |
| Plug in refrigerant system. | Remove high pressure line to condenser at compressor and suction hose from evaporator at the temperature regulation valve; also disconnect union in high pressure line between condenser and expansion valve. It should be possible to blow air through both ends of union; if not, investigate for plug in line through which air cannot be blown. If none of the refrigerant lines are plugged see TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW. |
| Temperature regulation valve inlet pressure too low. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW. |

### TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH

| CAUSE | REMEDY |
|---|---|
| Thermostatic expansion valve capillary tube bulb not tight to evaporator tube. | Remove insulation and check clamps for tightness and foreign material between bulb and evaporator tube. |
| Thermostatic expansion valve inoperative. | Immerse capillary tube bulb alternately in hot and cold water. If suction pressure does not change, replace thermostatic valve. |

### TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH—Continued

| CAUSE | REMEDY |
|---|---|
| Temperature regulation valve improperly adjusted or inoperative. | Conduct temperature regulation valve check. If temperature regulation valve inlet pressure cannot be brought down to proper specification, overhaul temperature regulation valve. |

### TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW

| CAUSE | REMEDY |
|---|---|
| Temperature regulation valve improperly adjusted or inoperative. | Conduct temperature regulation valve check. If compressor suction pressure cannot be raised to proper specification, repair temperature regulation valve. |
| | Force temperature regulation valve lever fully rearward to full warm position, and return. If temperature regulation valve inlet pressure in now O.K., diaphragm was not in position. If pressure is still too high and compressor suction pressure is below 15-20 psi, temperature regulation valve is stuck shut, and should be repaired. |
| Thermostatic expansion valve capillary tube broken, inlet screen plugged, or valve otherwise failed. | Conduct temperature regulation valve c'ıeck. If temperature regulation valve inlet pressure cannot be raised to proper specification, remove thermostatic expansion valve. If inlet screen is not plugged, replace valve. If screen is plugged, it should be cleaned, the valve back flushed with Refrigerant-12 and reinstalled. |
| Temperature regulator valve bleed line Schrader valve stuck open. | Remove Schrader valve and inspect. Replace as necessary using *only special valve* as prescribed. |
| Restriction in system tubes or hoses. | Replace kinked tube or restricted hose. |

### NOZZLE OUTLET TEMPERATURE TOO HIGH

NOTE: When owner complains of not enough cooling and operational test shows that system is functioning properly, check fit of rear of hood to cowl seal. An air leak at this point will result in hot engine compartment air passing directly into the cowl air intake.

| CAUSE | REMEDY |
|---|---|
| Warm air leaks. | Locate and correct as necessary. |
| Heater temperature control valve *not off* in "OFF" position. | Adjust heater temperature control cable and/or temperature control valve (air mix valve). |
| Heater air control *not* in "OFF" position. | Advise owner of proper control settings. |
| Poor seal—evaporator core to evaporator outlet case. | Correct sealing at evaporator core to evaporator outlet case. |
| Defective or missing evaporator drain hose. | Replace drain hose. |
| Air hoses not properly connected. | Inspect and connect air hoses. |

***NOZZLE OUTLET TEMPERATURE TOO HIGH—Continued***

| CAUSE | REMEDY |
|---|---|
| Vacuum control hoses not connected properly. | Check for proper vacuum hoses and for proper connections. |
| Insufficient refrigerant. | If bubbles appear in the liquid indicator (above 70° F.) with blower on "HI", "Inside" button depressed, and temperature control lever in full cold position, add refrigerant until bubbles disappear and then add one lb. additional. If there are no bubbles in the liquid indicator, add one lb. of refrigerant and recheck nozzle temperatures. If nozzle temperature does not change, bleed off refrigerant until bubbles do appear, then add one lb. of refrigerant. Recheck and compare with operational test data. |
| Thermostatic expansion valve improperly adjusted. | Replace valve. |
| Temperature regulation valve improperly adjusted. | Adjust temperature regulation valve. |
| Evaporator core freezes. | Check for proper connections at temperature regulation valve and/or adjust valve. |
| | Replace thermostatic expansion valve. |

***NOZZLE OUTLET TEMPERATURE TOO LOW***

| CAUSE | REMEDY |
|---|---|
| Inoperative or improperly adjusted thermostatic expansion valve. | Replace valve. |
| Temperature regulation valve improperly adjusted. | Adjust temperature regulation valve. |
| Insufficient air flow from nozzles. | Check for blocked evaporator, improperly installed air outlet housing to nozzle hoses and inoperative blower. |

See INSUFFICIENT COOLING.

***MISCELLANEOUS***

| TROUBLE | REMEDY |
|---|---|
| Hissing or wheezing noise when moving temperature control to warmer position. | Temperature regulation valve operating. This is normal condition when moving temperature control from cold to warmer position. |
| Icing at compressor and/or temperature regulation valve. | Normal condition. |
| Noise from compressor when moving temperature control lever from minimum cooling to maximum cooling (60°-70°F. at approximately 1200 engine rpm). | Normal condition. Noise sounds like engine detonation but lasts for only an instant; caused by liquid refrigerant passing through compressor. |
| Temperature of air from nozzle too cold. | Temperature regulation valve piston stuck in open position. Replace valve. |
| | Temperature regulation valve requires adjustment or valve piston is stuck open. If latter, replace valve. |

## SPECIFICATIONS

**Current flow at Circ-L-Aire and heater blower control positions**

NOTE: Heater control in OFF position, at room temperature–70°F, all windows closed.

| AIR CONDITIONING CONTROL SETTING | RELAY VOLTAGE | BLOWER SPEED | BLOWER VOLTAGE | BLOWER AMPERES | RESISTOR VOLTAGE |
|---|---|---|---|---|---|
| INSIDE HI | 12.2 | 2940 | 11.5 | 16.3 | – |
| INSIDE HI | 13.5 | 3120 | 12.7 | 17.75 | – |
| INSIDE HI | 14.5 | 3240 | 13.65 | 19.0 | – |
| INSIDE MED. 3 | 12.2 | 2610 | 9.6 | 14.0 | 2.01 |
| INSIDE MED. 3 | 13.5 | 2790 | 10.7 | 15.25 | 2.19 |
| INSIDE MED. 3 | 14.5 | 2910 | 11.5 | 16.3 | 2.32 |
| INSIDE MED. 2 | 12.2 | 2010 | 6.5 | 10.25 | 5.15 |
| INSIDE MED. 2 | 13.5 | 2160 | 7.3 | 11.2 | 5.65 |
| INSIDE MED. 2 | 14.5 | 2250 | 7.9 | 11.9 | 6.0 |
| INSIDE LO | 12.2 | 1560 | 4.75 | 7.9 | 7.05 |
| INSIDE LO | 13.5 | 1680 | 5.3 | 8.7 | 6.6 |
| INSIDE LO | 14.5 | 1800 | 5.7 | 9.8 | 8.3 |
| OUTSIDE HI | 12.2 | 2910 | 11.5 | 16.25 | – |
| OUTSIDE HI | 13.5 | 3150 | 12.75 | 17.8 | – |
| OUTSIDE HI | 14.5 | 3270 | 13.7 | 19.0 | – |
| OUTSIDE MED. 3 | 12.2 | 2550 | 9.55 | 14.1 | 2.02 |
| OUTSIDE MED. 3 | 13.5 | 2730 | 10.6 | 15.4 | 2.22 |
| OUTSIDE MED. 3 | 14.5 | 2880 | 11.4 | 16.4 | 2.38 |
| OUTSIDE MED. 2 | 12.2 | 1980 | 6.6 | 10.3 | 5.2 |
| OUTSIDE MED. 2 | 13.5 | 2130 | 7.25 | 11.25 | 5.7 |
| OUTSIDE MED. 2 | 14.5 | 2220 | 7.85 | 12.0 | 6.05 |
| OUTSIDE LO | 12.2 | 1530 | 4.6 | 7.9 | 7.2 |
| OUTSIDE LO | 13.5 | 1620 | 5.1 | 8.8 | 7.95 |
| OUTSIDE LO | 14.5 | 1740 | 5.6 | 9.4 | 8.45 |

NOTE: Air Conditioning Control was in OFF position. *Voltage at Regulator–80°F Ambient.

| HEATER CONTROL SETTING | INPUT VOLTAGE* | BLOWER SPEED | BLOWER VOLTAGE | BLOWER AMPERES | RESISTOR VOLTAGE |
|---|---|---|---|---|---|
| DE ICE | 12.2 | 2595 | 8.95 | 12.7 | 1.72 |
| DE ICE | 13.5 | 2790 | 9.9 | 13.8 | 1.87 |
| DE ICE | 14.5 | 2925 | 10.7 | 14.8 | 2.2 |
| NORMAL HI | 12.2 | 2115 | 6.45 | 9.9 | 4.3 |
| NORMAL HI | 13.5 | 2280 | 7.25 | 10.9 | 4.65 |
| NORMAL HI | 14.5 | 2400 | 7.8 | 11.7 | 4.95 |
| NORMAL MED. | 12.2 | 1890 | 5.4 | 8.75 | 5.6 |
| NORMAL MED. | 13.5 | 2040 | 6.0 | 9.6 | 6.1 |
| NORMAL MED. | 14.5 | 2130 | 6.5 | 10.2 | 6.5 |
| NORMAL LO | 12.2 | 1440 | 3.75 | 7.0 | 7.35 |
| NORMAL LO | 13.5 | 1575 | 4.25 | 7.7 | 8.1 |
| NORMAL LO | 14.5 | 1680 | 4.65 | 8.3 | 8.6 |

**Compressor**

| | |
|---|---|
| Armature plate and hub assembly | .0002"-.0007" press fit to shaft |
| Armature plate to pulley clearance | .022"-.057" (air gap) |
| Mainshaft assembly end play | .0003"-.0013" |
| Oil charge (new) | 11 fluid ozs. |
| Oil Type | Frigidaire 525 visc. |
| Piston shoe clearance | .0005"-.0010" |
| Pulley Diameter | (nominal) 4.814" (approximately 4 13/16") |
| Rear head to shell nuts | 19-23 lb. ft. torque |
| Service Compressor Oil Charge | 11 oz. Frigidaire 525 oil |

**Compressor Belt**

| | |
|---|---|
| Size | 15/32" |
| Tension | 100-105 lbs. indicated on Borroughs Belt Tension Gauge |

**Compressor Coil**

| | |
|---|---|
| Current (maximum demand) | 3.2 amps. at 12 v. |
| Resistance | 3.85 ohms at 80°F. |

| | |
|---|---|
| **Compressor to Engine Ratio** | 1.4898 to 1 |
| **Cooling System Capacity** | with heater 19.5 qts. |
| **Engine Idle Speed**—Air Conditioner off (Hydra-Matic Transmission in Drive) | 540-560 RPM |
| (Synchro-Mesh Transmission in Neutral) | 540-560 RPM |
| **Fan** | 7 blades |
| **Refrigerant-12 Capacity** | 4.0 lbs. |

**Fuse**

| | |
|---|---|
| In line in front of fuse block | 30 amp. |
| At battery terminal of generator regulator (engine electrical system) | 60 amp. |
| At heater terminal in fuse block | 20 amp. |

**Generator**

| | |
|---|---|
| Model | 1102220 |
| Brush Tension | 28 oz. |
| Cold Output | 45 amps., 14 volts at 2520 gen. rpm or 1025 eng. rpm |
| Field Current (12V at 80°F.) | 2.66-2.86 amps. |
| Generator to engine drive ratio | 3.042 to 1 |

**Generator Regulator**

Model ........ 1119623
(Includes 1119600 regulator and 1945171—60 amp. fuse assembly.)

Cutout Relay

Air Gap ........ .020″
Point Opening ........ .020″
Closing Voltage ........ 11.8-13.0 Volts

Voltage Regulator

Air Gap ........ .067″
Upper Contact Opening ........ .016″
Normal Range ........ 13.8-14.6 Volts
Lower Contact Setting ........ 0.1-0.3 Volts lower than the normal range

Current Regulator

Air Gap ........ .057″
Allowable limits at 125°F. ........ 36-40 amps.

**Radiator Cap** ........ 15 lbs.

**Hose and Tubing Connections Torque Chart**

| Metal Tube Outside Diameter | Thread and Fitting Size | Steel Tubing Torque Lb.-Ft. | Aluminum or Copper Tubing Torque Lb.-Ft. | Nominal Torque Wrench Span |
|---|---|---|---|---|
| 1/4 | 7/16 | 10-15 | 5-7 | 5/8 |
| 3/8 | 5/8 | 30-35 | 11-13 | 3/4 |
| 1/2 | 3/4 | 30-35 | 11-13 | 7/8 |
| 5/8 | 7/8 | 30-35 | 18-21 | 1 1/16 |
| 3/4 | 1 1/16 | 30-35 | 23-28 | 1 1/4 |

If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification.

Use steel torques only when both ends of connection are steel.

# COOL PACK CONDITIONER

## CONTENTS OF THIS SECTION



# DESCRIPTION AND OPERATING INSTRUCTIONS

## GENERAL DESCRIPTION

### *PONTIAC*

Pontiac's Cool Pack Conditioner can be operated at any time the engine is running. This feature permits its use any time for circulating inside air for added ventilation, cooling or dehumidifying. All air entering the system is inside air which is recirculated, providing air free of undesirable automobile exhaust fumes or odors.

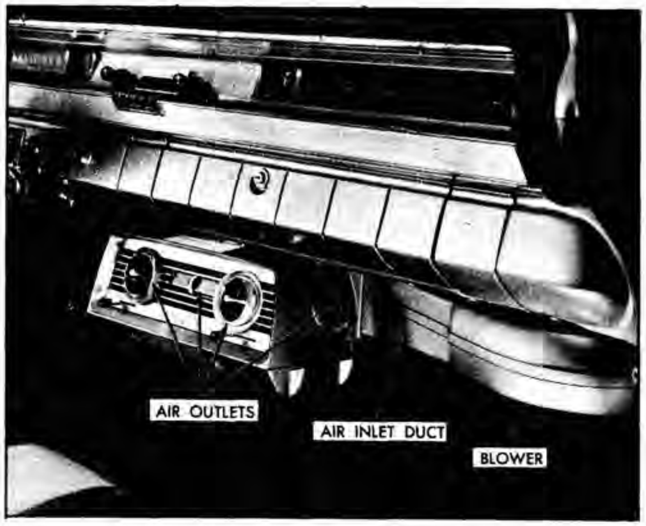



Fig. 6-1 Pontiac Cool Pack Conditioner Air Outlets

The cooling unit is suspended from the center of the instrument panel providing minimum vibration and an efficient location for distributing cooled air with a minimum of space requirement for this type air conditioning.

The driver has fingertip control of the temperature of conditioned air in the car. When air conditioning is desired, the Cool Pack blower forces air taken from over the right front passenger's feet through the cooling unit core and then through the air outlets.

Pontiac's refrigeration portion of the Cool Pack Conditioning system is efficiently and completely contained within the engine compartment and under the instrument panel.

### *TEMPEST*

The Tempest unit is very similar to the one in the Pontiac. The major difference is that the right hand cowl vent grille is replaced by a blower air inlet duct. By pulling out the right hand cowl vent control and when at normal highway speeds, a percentage of outside air may be used for removal of smoke or odors from the car.

## *AIR OUTLETS AND CONTROLS*

### AIR OUTLETS

Refrigerated air enters the interior of the car through five discharge outlets; two revolvable, louvered registers on the sides of the evaporator, designed to rotate 360°; through two ball nozzle outlets which can be adjusted to direct air flow in any direction, and through a vaned rotary valve which can be adjusted to change vertical direction of air flow.

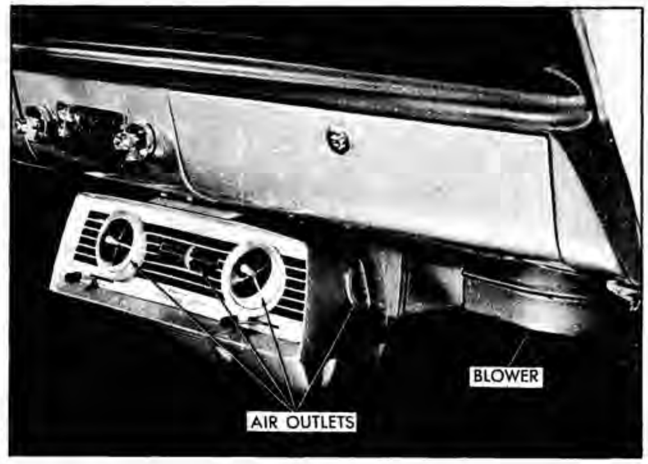



Fig. 6-2 Tempest Cool Pack Conditioner Air Outlets

The outlets located on each side of the evaporator case are for foot cooling of passenger and driver.

### CONTROLS

The controls are located at the front of the evaporator case assembly: a "FAN" (blower) control lever at the lower left and a temperature control lever at the lower right (Fig. 6-3).

### BLOWER CONTROL

A "FAN" control lever slides in a horizontal plane and controls three blower speeds to regulate the amount of forced air movement.

When the blower control is at the full left position, the blower is "OFF" with no current flowing to the blower or Refrigeration Compressor clutch. Moving the blower control progressively to the right supplies current to the blower to operate at "LO", "MED", and "HI" speed respectively and provides a path for current to the compressor clutch.

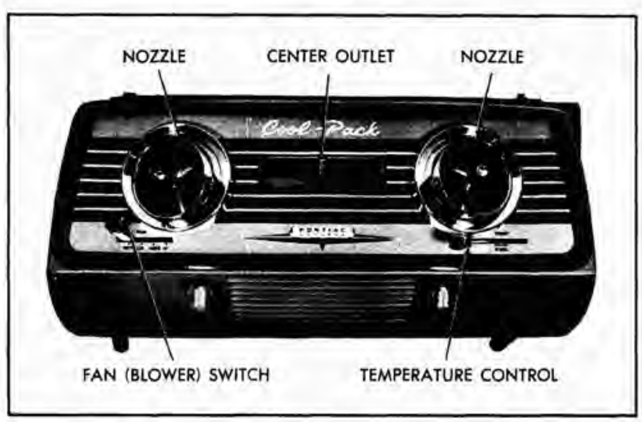



Fig. 6-3 Cool Pack Conditioner Controls

The Cool Pack blower circuit is so wired that when the air conditioner is on, the heater blower circuit is open.

TEMPERATURE CONTROL

The temperature control (located at the lower right corner) slides in a horizontal plane to provide for varying levels of cooling.

This control is attached to a temperature regulation valve which controls evaporator pressure. Minimum cooling is provided with the temperature control at the full left position. Moving this control from full left to the right progressively increases the amount of cooling. Maximum cooling is obtained when the control lever is at the extreme right position (as shown by the direction of the arrow).

## OPERATING INSTRUCTIONS

To cool a car under various weather and driving conditions, use the following control settings:

***FAST COOL DOWN***

(CAR WHICH HAS BEEN STANDING IN HOT SUN)

| CONTROL | SETTING |
|---|---|
| Blower control | High speed. |
| Temperature control | Maximum cooling (full right). |
| Nozzles | Position as desired. |
| Car windows | Wide open for two or three minutes to expel hot air, then closed. |

***SLOW CITY DRIVING***

| CONTROL | SETTING |
|---|---|
| Blower control | High speed. |
| Temperature control | Maximum cooling (full right). |
| Nozzles | Position as desired. |
| Car windows | Closed. |

***NORMAL WARM WEATHER HIGHWAY CRUISING***

| CONTROL | SETTING |
|---|---|
| Blower control | Low speed, or medium speed. |
| Temperature control | Position to obtain desired temperature at nozzles. |

***NORMAL WARM WEATHER HIGHWAY CRUISING—Continued***

| CONTROL | SETTING |
|---|---|
| Nozzles | To direct air stream for indirect cooling. |
| Car windows | Closed. |

***HOT WEATHER HIGHWAY CRUISING***

| CONTROL | SETTING |
|---|---|
| Blower control | High speed. |
| Temperature control | Maximum cooling. |
| Nozzles | Position as desired. |
| Car windows | Closed. |

## TIPS ON USE OF COOL PACK CONDITIONING SYSTEM

***KEEPING COMFORTABLE IN EXTREMELY HUMID 'MUGGY' WEATHER***

When the relative humidity is extremely high, causing discomfort on a day when the temperature is 75-80°F., position the temperature control at the full left position. This will operate the refrigeration system at minimum cooling. Move the blower control lever to the "LO" speed. Recirculating inside air, in this manner, rapidly dehumidifies the air inside the car.

***KEEPING COMFORTABLE IN MILD WEATHER***

When the weather is cool, but the sun is very bright, as in spring or fall or at high altitudes, use the air conditioner, setting the temperature controls, blower speed, and nozzle positions for low range operation to give the desired comfort.

***CONTROLLING TEMPERATURE IN CAR***

The most satisfactory method of controlling the temperature in the car is to:

1. Set blower speed for your personal comfort.

2. Position temperature control as necessary to maintain the desired temperature in the car.

3. Use sun visors to reduce direct sun rays on front seat passengers.

NOTE: E-Z-Eye glass is a great aid in keeping cool since it aids in protecting passengers from much of the direct rays of the sun.

# DESCRIPTION AND OPERATION OF THE COOL PACK CONDITIONER

CONTENTS OF THIS SECTION



## REFRIGERATION CIRCUIT IN THE COOL PACK CONDITIONER

Cool Refrigerant-12 gas is drawn into the compressor from the evaporator and pumped from the compressor to the condenser under high pressure (Fig. 6-4). This high pressure gas being pumped to the condenser will also have a high temperature as a result of being subjected to the process of compression. As it passes through the condenser, the high pressure high temperature gas rejects its heat to the outside air as the air passes over the metal surfaces of the condenser. This cooling of the gas causes it to condense into liquid refrigerant.

The liquid refrigerant, still under high pressure, then passes from the bottom of the condenser into the receiver and liquid indicator assembly, of which the receiver portion of this assembly acts as a reservoir for the liquid refrigerant.

Liquid refrigerant from the receiver and liquid indicator assembly flows to the thermostatic expansion valve.

This high pressure liquid refrigerant flows through the orifice in the thermostatic expansion valve into the low pressure area of the evaporator. Since the pressure in the evaporator is relatively low, the refrigerant immediately begins to boil. As the refrigerant passes through the evaporator, it continues to boil, drawing heat from the surface of the evaporator core warmed by the air passing over its surfaces.

In addition to the warm air passing over the evaporator rejecting its heat to the cooler surfaces of the evaporator core, any moisture in the air condenses on the cool surfaces of the core, resulting in cool dehydrated air entering the car. By the time the refrigerant gas leaves the evaporator, it has completely vaporized and is slightly superheated.

Refrigerant passing through the evaporator is directed through a temperature regulating valve and then returned to the compressor where the refrigeration cycle is repeated.

The pressure in the evaporator is so controlled (by the temperature regulation valve) at its lowest pressure setting that any moisture condensing on the evaporator surface will not freeze.

## DESCRIPTION AND OPERATION OF INDIVIDUAL UNITS

Figs. 6-5 and 6-6 illustrate the location of units of the Cool Pack Conditioning system. Each of the units in the air conditioning system is described on the following pages.

## COMPRESSOR

The purpose, design and function of the Cool Pack compressor used on the Pontiac, Tempest 195 engine and Tempest 215 engine is the same as explained for the Circ-L-Aire Conditioner with the following exceptions.

| Model Application | Model No. | Pulley Nominal Diameter |
|---|---|---|
| Pontiac | 6550119 | 5.737" or approx 5¾" |
| Tempest | | |
| 195 Engine | 6550114 | 6.774" or approx 6¾" |
| 215 Engine | 6550115 | 4.814" or approx 4$^{13}/_{16}$" |

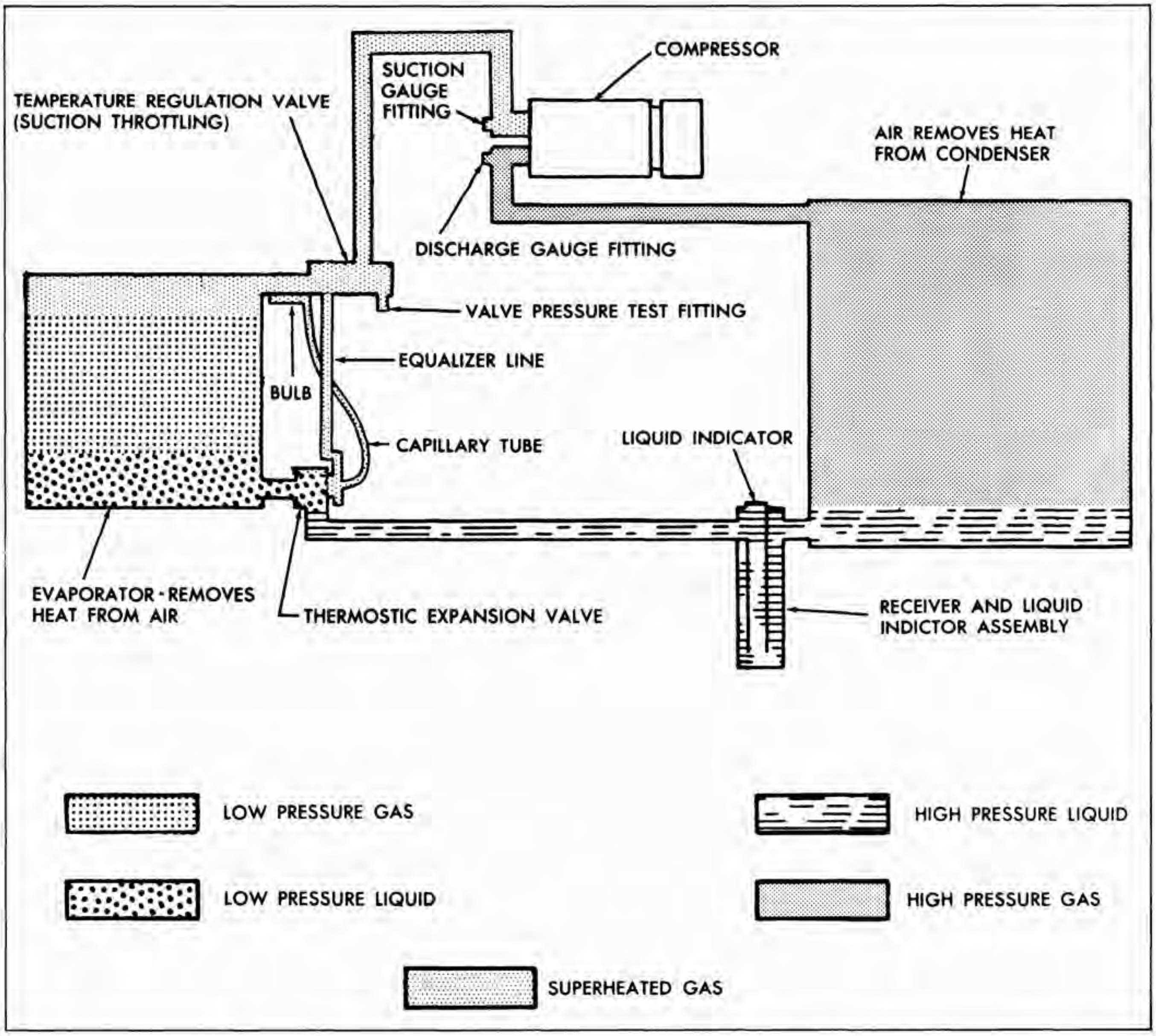



Fig. 6-4 Schematic Diagram of the Cool Pack Refrigeration System

## PISTONS

The pistons have a counter-bore of one inch diameter by .093" deep in each head and at both ends of the piston. This counter-bore reduces the compression ratio of the compressor and reduces the effective cubic inch displacement from 12.6 cu. in. (Circ-L-Aire compressor) to approximately 10.8 cu. in. (for Cool Pack compressors).

### *COMPRESSOR OPERATION*

When the blower control lever is moved to the "LO", "MED", or "HI" blower position, the electrical circuit is closed to the blower and also the compressor clutch coil.

Current flowing through the coil creates a magnetic force which flows through the pulley to draw the armature plate (forward of the pulley assembly) rearwardly toward the pulley. As the armature plate moves toward the pulley, it contacts the pulley face (which rotates freely about the compressor shaft).

The design of the clutch and coil is such that maximum magnetic holding force is obtained to magnetically lock the armature plate and pulley together as one unit. Since the clutch hub is pressed on, and keyed to, the compressor shaft, the compressor shaft will then turn with the pulley. The compresor continues to operate until the blower control is moved to the "OFF" position. In this position the electric

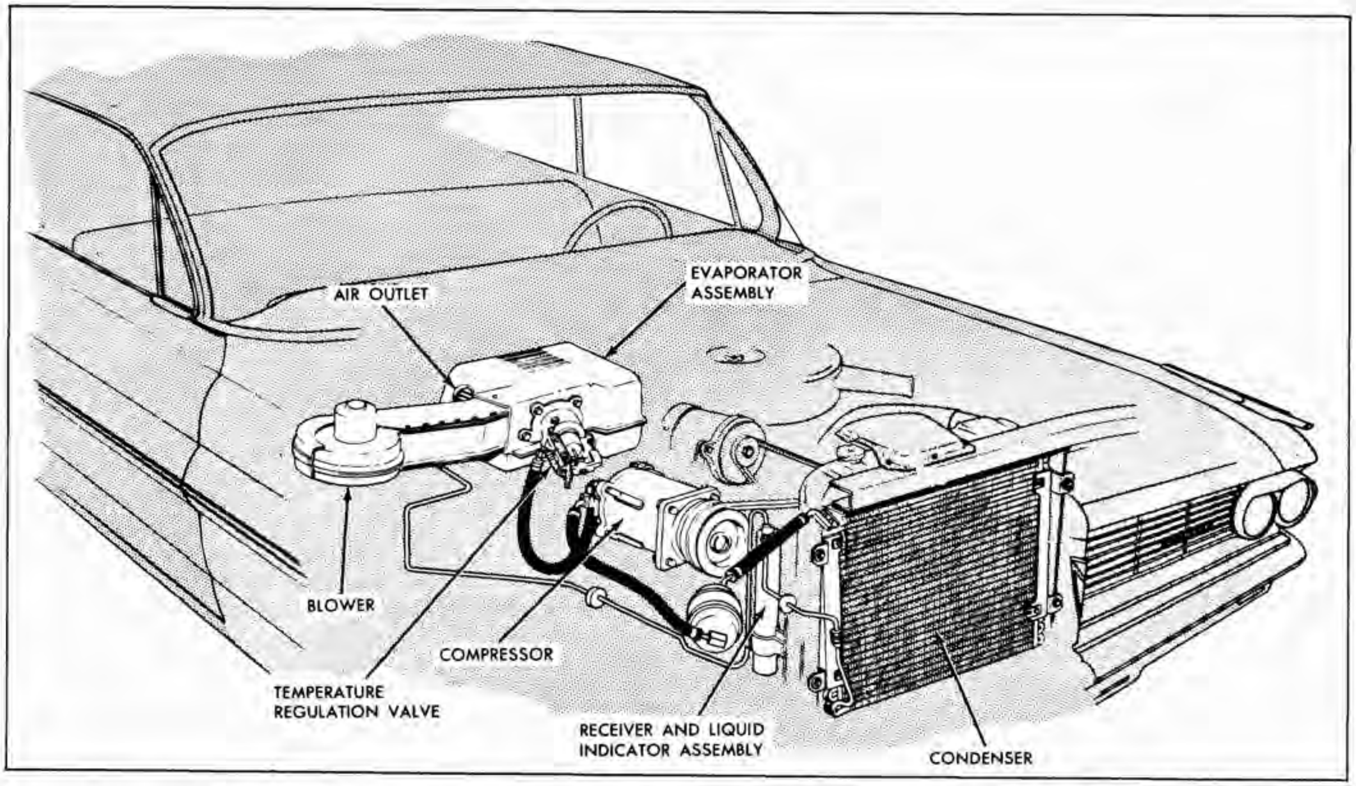



Fig. 6-5 Location of Units in the Pontiac Cool Pack Conditioner System

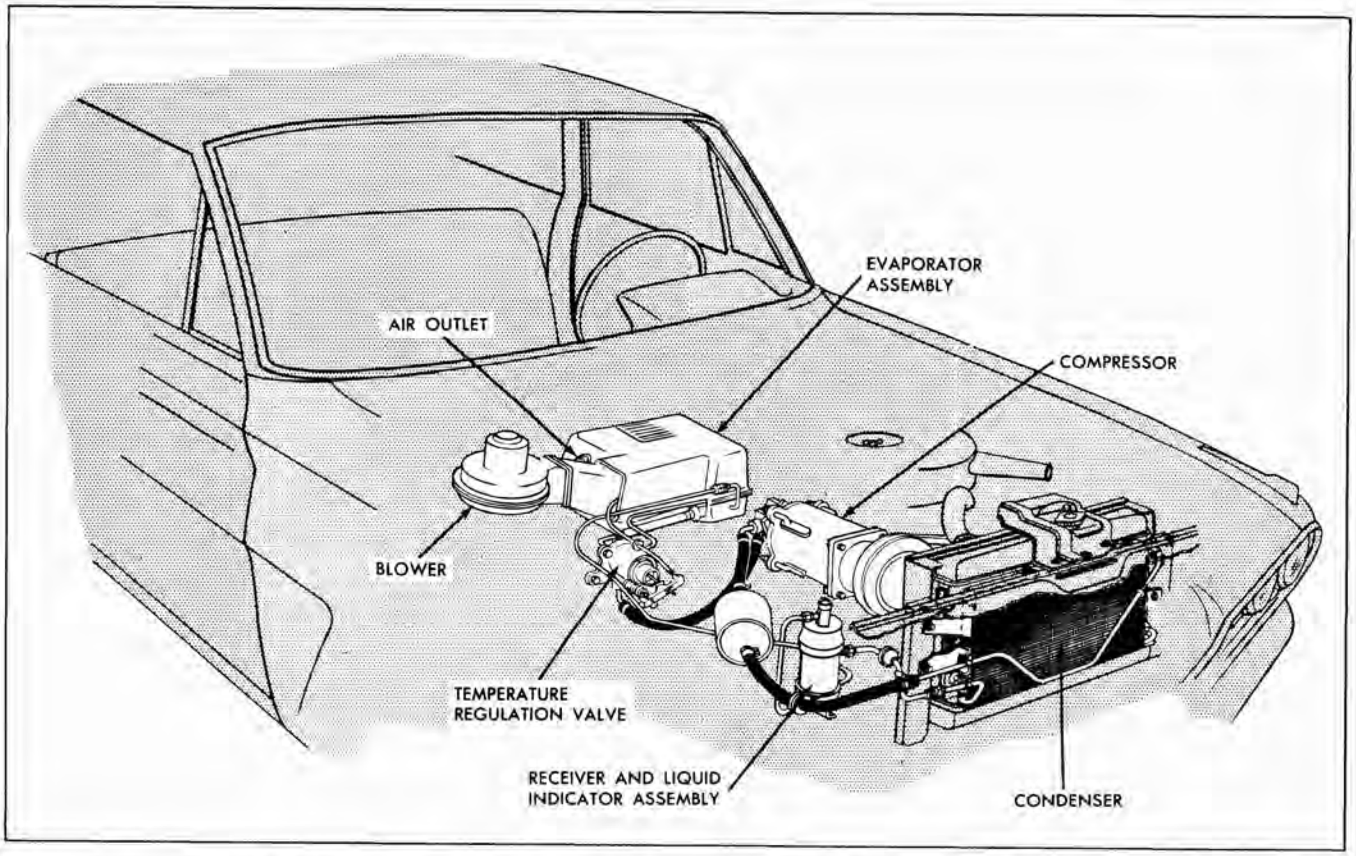



Fig. 6-6 Location of Units in the Tempest Cool Pack Conditioner System

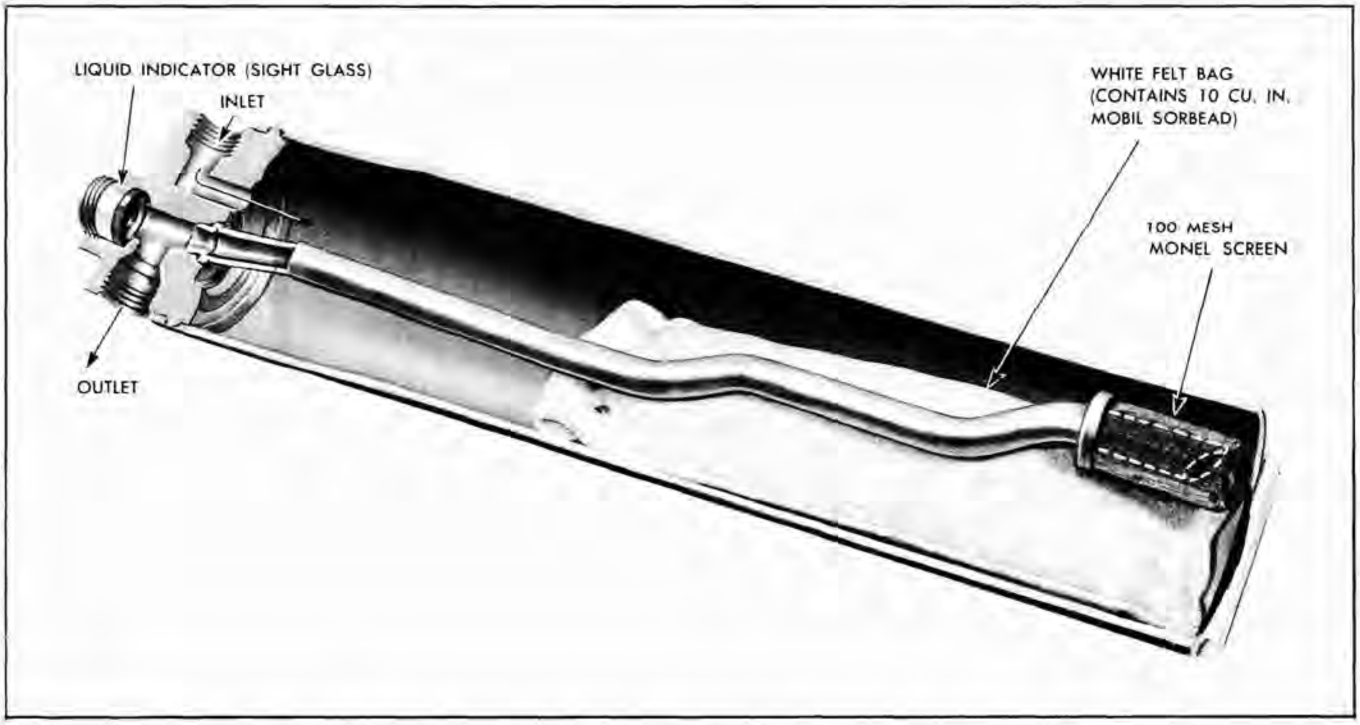



Fig. 6-7 Cross Section of Pontiac Receiver and Liquid Indicator Assembly

circuit to the compressor clutch is opened and the magnetic pull on the clutch no longer exists. The armature plate to driven ring actuating springs will then pull the armature plate away from the pulley and the plate loses contact with the pulley. With the clutch released, the pulley rotates freely on its bearing. In this condition, the compressor shaft does not rotate.

It may be noted that if the air conditioning system was in use when the engine was turned off, the armature plate may remain in contact with the pulley, due to residual magnetism. This will cause no trouble, as the armature plate and pulley will separate as soon as the engine is started.

## CONDENSER

The condenser is similar to the ordinary car radiator but is designed to withstand much higher pressures. It is made up of tubes which carry the refrigerant and cooling fins which provide rapid transfer of heat. All parts of the condenser are made of aluminum.

The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the car and from the engine fan. Air passing over the condenser cools the hot high pressure refrigerant gas, causing it to condense into high pressure liquid refrigerant.

## RECEIVER AND LIQUID INDICATOR ASSEMBLY

The receiver and liquid indicator assembly is mounted vertically behind the radiator right baffle assembly.

The purpose of the receiver part of this assembly is to insure a solid column of liquid refrigerant to the thermostatic expansion valve at all times, provided the system is properly charged.

The liquid indicator (many times referred to as a sight glass) serves no purpose in the refrigeration system except as an aid to diagnosis. It is possible to look into the interior of the receiver chamber through a glass window. The appearance of bubbles or foam beneath the sight glass (liquid indicator) above 70°F. ambient indicates air or a shortage of refrigerant in the system. Foam may be noted in the sight glass below 70°F. ambient even with a system free of air and properly charged. Details of these conditions are in the TROUBLE DIAGNOSIS section.

Liquid refrigerant from the condenser enters the receiver and flows into the upper portion of the receiver, which contains desiccant confined into a 60 mesh screen sack on the Tempest models and in a white felt bag in Pontiac models. The felt bag is not attached to anything but merely rests on the baffle in the lower portion of the receiver. As the refrigerant flows through an opening in the lower portion of the

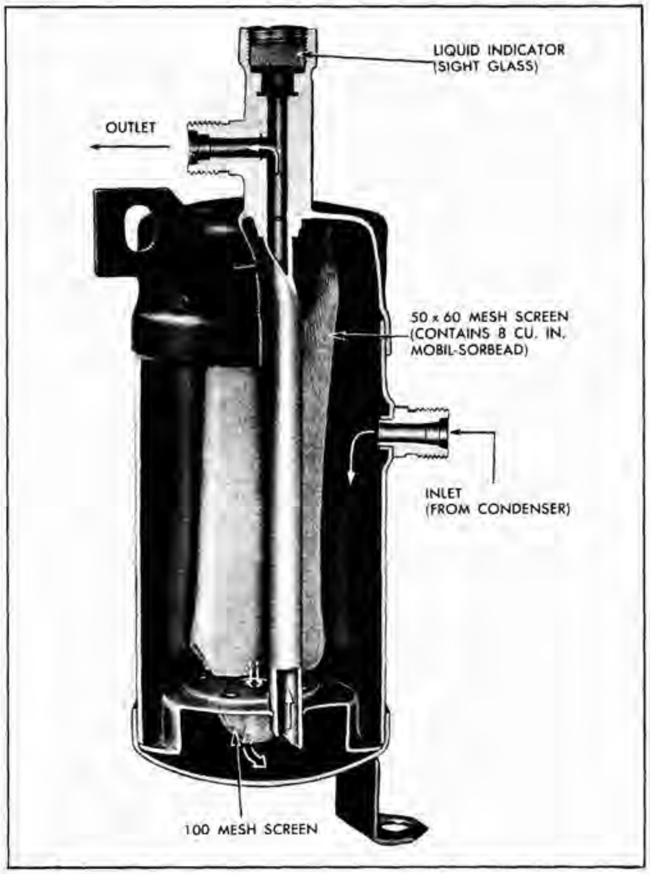



Fig. 6-8 Cross Section of Tempest Receiver and Liquid Indicator Assembly

receiver, it is also filtered through a 100 mesh screen attached to a baffle at the bottom of the receiver.

The desiccant in this assembly absorbs any moisture that might be present in the system after assembly. The screen traps any foreign material which may enter the system during assembly. These features of the assembly prevent obstruction to the valves or damage to the compressor.

## THERMOSTATIC EXPANSION VALVE

### DESCRIPTION

The thermostatic expansion valve (Fig. 6-9) consists of a capillary bulb and tube which is connected to an operating diaphragm (which is sealed within the valve itself) and an equalizer line which connects the valve and the low pressure side of the temperature regulation valve.

The valve contains three operating pins (spaced approximately 120° apart), valve stationary seat, valve, valve carriage, adjusting spring and screw,

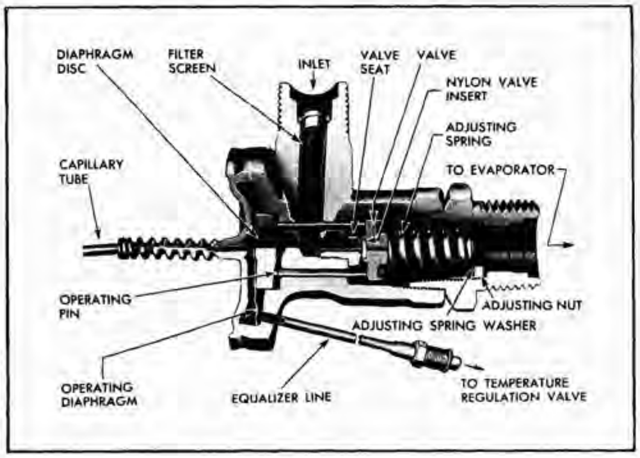



Fig. 6-9 Cross Section of Thermostatic Expansion Valve

an inlet which has a fine mesh screen, and an outlet connection (which attaches to the evaporator). The fine mesh screen at the inlet of the valve provides protection to the valve by preventing dirt and other foreign material from entering the valve.

While this valve is located at the inlet of the evaporator (at the upper left front of the evaporator), the thermo bulb is attached to the evaporator outlet pipe (at the lower left corner, Fig. 6-10).

The equalizer line joins the expansion valve to the temperature regulation valve so that compressor suction pressure will register in the expansion valve. This is necessary to insure oil returning to the compressor in mild weather.

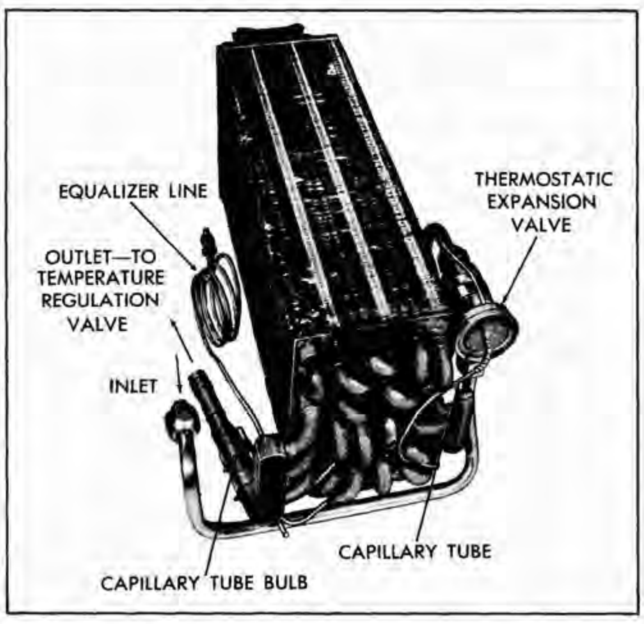



Fig. 6-10 Thermostatic Expansion Valve Bulb at Evaporator Outlet Pipe

### FUNCTION

The purpose of the thermostatic expansion valve is to regulate the flow of liquid refrigerant into the evaporator automatically in accordance to the requirements of the evaporator.

This valve is the dividing point in the system between high pressure liquid refrigerant supplied from the receiver and relatively low pressure liquid and gaseous refrigerant in the evaporator. It is so designed that the temperature of the refrigerant at the evaporator outlet must have 6°F. of superheat before more refrigerant is allowed to enter the evaporator. Superheat is an increase in temperature of the gaseous refrigerant above the temperature at which the refrigerant vaporizes.

A capillary tube filled with carbon dioxide and the equalizer line provide the temperature regulation of the expansion valve. This capillary tube is fastened to the low pressure refrigerant pipe coming out of the evaporator so that it communicates the temperature of the refrigerant at this point to the expansion valve. If the superheat at the outlet decreases below 6°F., the expansion valve will automatically reduce the amount of refrigerant entering the evaporator, thus reducing the amount of cooling. If the superheat increases, the expansion valve will automatically allow more refrigerant to enter the evaporator, thus increasing the cooling.

The equalizer line joining the low pressure side of the temperature regulation valve with the area behind the operating diaphragm acts with the capillary to measure superheat.

It is the temperature of the air passing over the evaporator core that determines the amount of refrigerant that will enter and pass through the evaporator. When the air is very warm, the heat transfer from the air to the refrigerant is great and a greater quantity of refrigerant is required to cool the air and to achieve the proper superheat of the refrigerant gas leaving the evaporator. When the air passing over the evaporator is cool, the heat transfer is small and a lesser quantity of refrigerant is required to cool the air and to achieve the proper superheat on the refrigerant gas leaving the evaporator.

A mechanical adjusting nut located within the valve is provided to regulate the amount of refrigerant flow through the valve and moves the spring seat to increase or decrease the tension on the valve carriage spring. By varying the tension on this spring, it is possible to regulate the point at which the valve begins to open or close, thereby regulating refrigerant flow into the evaporator. As this adjustment feature is inside the valve, *no external adjustment is possible.* All valves are preset at the time of manufacture.

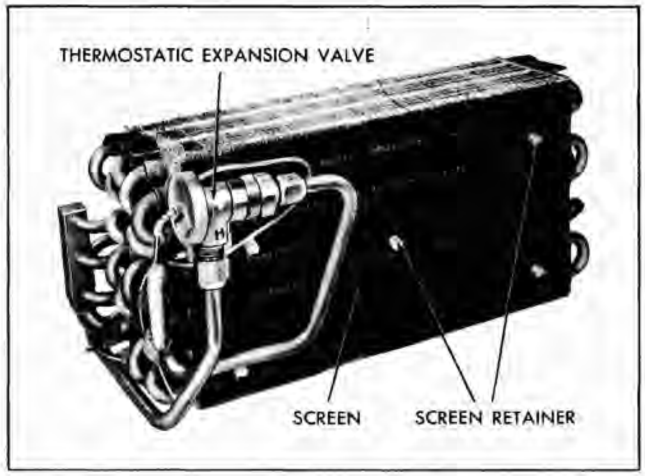



Fig. 6-11 Thermostatic Expansion Valve at Evaporator

Since the evaporator outlet pressure is proportionate to the amount of heat (superheat) picked up by the refrigerant gas in passing through the evaporator, it can be seen that adjusting spring tension which works against capillary pressure and equalizer line pressure controls the volume of refrigerant entering the evaporator as signaled by the temperature of the evaporator outlet pipe and the pressure at the temperature regulation valve.

### OPERATION

When the air conditioning system has not been operating, all pressures within the thermostatic expansion valve assembly will have equalized at the ambient (surrounding air) temperature, thus the pressure above and below the operating diaphragm and at the inlet and outlet side of the valve will be equal (Fig. 6-9). (Pressure under the diaphragm is evaporator pressure. It reaches this area by means of clearance around the operating pins in the valve body which connects the area under the diaphragm with the evaporator pressure area.) While pressures in the expansion valve are almost equal, the addition of the valve adjusting spring pressure behind the valve will hold the valve over to close the valve orifice.

When the air conditioning system first begins to operate, the compressor will immediately begin to draw refrigerant from the low pressure lines, equalizer tube and evaporator, lowering the pressure in the evaporator and in the area under the operating diaphragm. As the pressure in this area decreases, the pressure above the diaphragm exerted by the carbon dioxide in the capillary tube will overcome spring pressure and push the diaphragm against the operating pins, which in turn will force the valve off its seat.

Refrigerant will then pass through the expansion valve into the evaporator where it will boil at a temperature corresponding to the pressure in the evaporator. This will begin cooling the air passing over the evaporator, and also, it will begin to cool the evaporator outlet pipe.

As the evaporator outlet pipe cools, the pressure of the carbon dioxide in the capillary tube (contacting this outlet pipe) decreases, exerting less force on the operating diaphragm.

The valve adjusting spring is calibrated so that the pressure of the refrigerant in the evaporator outlet pipe and equalizer line to the valve plus the spring force, will equal the force above the operating diaphragm when the temperature of the refrigerant in the evaporator outlet is 6°F. above the temperature of the refrigerant entering the evaporator. In other words, the refrigerant should remain in the evaporator long enough to completely vaporize and then warm (superheat) 6°F.

If the temperature differential begins to go below 6°F. (outlet pipe becoming too cold) carbon dioxide pressure in the capillary tube and area above the diaphragm decreases, allowing the valve adjusting spring to move the valve towards its seat closing off the flow of refrigerant past the valve.

If the temperature differential begins to go above 6°F. (outlet pipe too warm), the pressure in the capillary tube and area above the operating diaphragm will increase, pushing this diaphragm against the operating pins to open the valve further admitting more refrigerant to the evaporator.

## EVAPORATOR

### DESCRIPTION

The evaporator assembly consists of the evaporator core, thermostatic expansion valve, temperature control lever, resistor assembly, and blower control switch. All these parts are enclosed in an evaporator housing assembly which contains a condensate drain pan.

The housing, constructed of plastic, incorporates five outlets; two plastic, removable, louvered registers designed to rotate 360° (at the ends of the evaporator housing), two nozzle outlets which can be adjusted to direct air flow in any direction, and a vaned rotary valve which can be adjusted to change vertical direction of air flow. The outlets located on each side of the evaporator case are for cooling of passenger and driver floor areas.

Two drain holes in the condensate drain pan (one on each side) direct condensate to tubes extending through the floor pan.

The evaporator core is aluminum tube and fin, serpentine construction. The inlet separates into two sections to make up twenty tubes in parallel (interconnected at both ends) with a two tube outlet connected to a common outlet pipe (to temperature regulation valve). The core and case assembly is approximately 16" wide, 7" high and 3½" thick.

The only service required on the unit is periodic flushing of the *outside of the core* with water to keep the outside core surface clean.

### FUNCTION

The evaporator is actually the device which cools and dehumidifies the air. High pressure liquid refrigerant flows through the orifice in the thermostatic expansion valve into the low pressure area of the evaporator. The low pressure area reduces the boiling point of refrigerant and this regulated flow of refrigerant boils immediately. Heat from the core surface is lost to the boiling and vaporizing refrigerant which is cooler than the core, thereby cooling the core. The air passing over the evaporator loses its heat to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water, through drain tubes and onto the road.

Since Refrigerant-12 will boil at 21.7°F. below zero at atmospheric pressure while water freezes at 32°F., it becomes obvious that the temperature in the evaporator must be controlled so that the water collecting on the core surface will not freeze in the fins of the core and block off the air passages. In order to control the temperature, it is necessary to control the amount of refrigerant entering the core and the pressure inside the evaporator.

To obtain maximum cooling, the refrigerant must remain in the core long enough to completely vaporize and then superheat a minimum of 6°F. If too much or too little refrigerant is present in the core, then maximum cooling efficiency is lost. A thermostatic expansion valve in conjunction with the temperature regulation valve is used to provide this necessary refrigerant volume and evaporator pressure control.

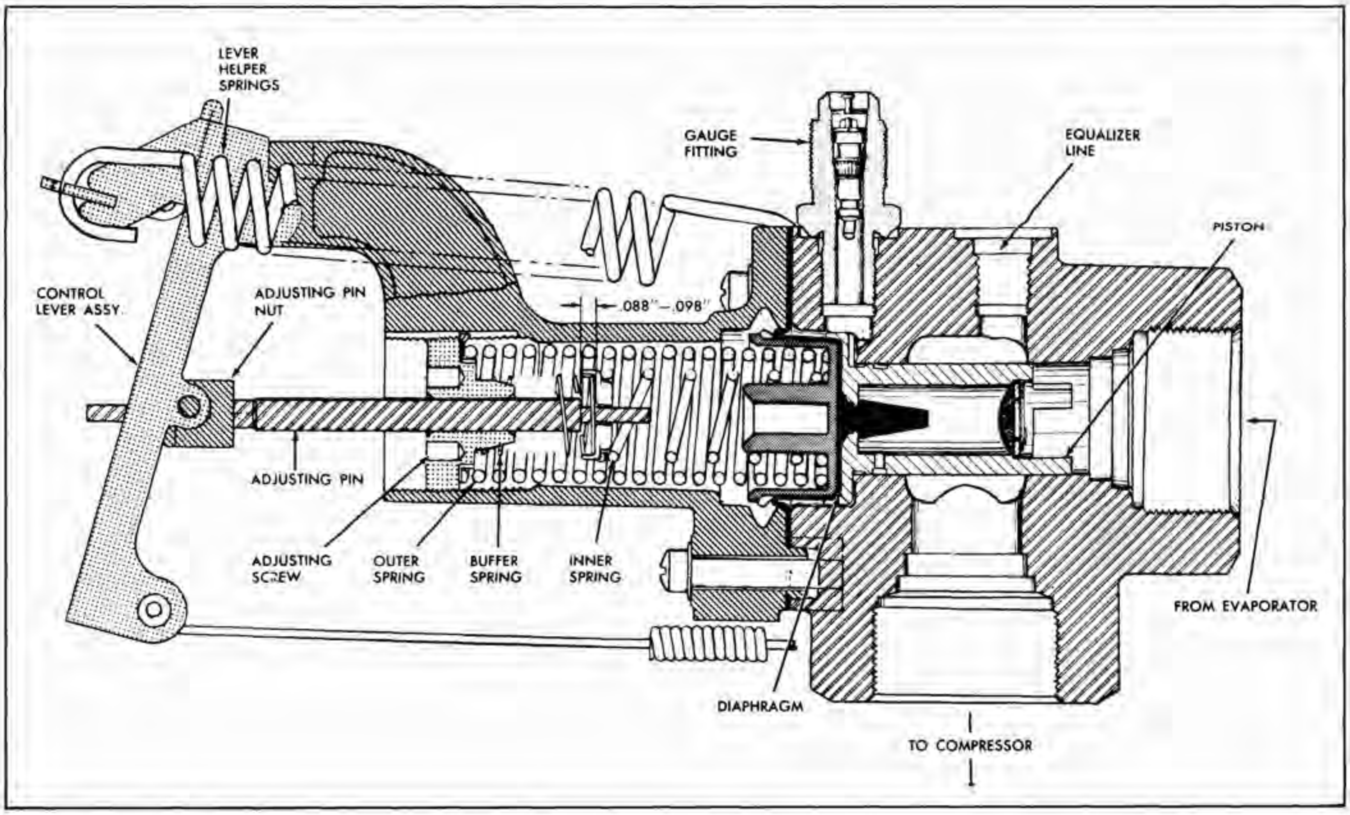



Fig. 6-12 Cross Section of Temperature Regulation Valve

The tube and fin coils used in the evaporator are very long. This length, in combination with the relatively small inner diameter, causes the pressure of the refrigerant to decrease as it passes through the coils.

Because of this pressure drop, the pressure at the core inlet is greater than the pressure at the outlet. Also, the outlet pressure is allowed to fall below 30 psi (the pressure at which refrigerant will boil at 32°F.), without the danger of water freezing on the core surface since the blower is always on when the air conditioner is being operated. This low pressure control is posisble since the drop in inlet pressure, caused by the length of the tubes, is gradual with only a very small portion of the tube end maintaining pressures below 30 psi. The average temperature of entire evaporator core is at or above 32°F. as long as there is air flow through the core.

## TEMPERATURE REGULATION VALVE (Suction Throttling Valve)

### DESCRIPTION

The temperature regulation valve (suction throttling valve) Fig. 5-12, is manually adjusted by means of a control cable which connects the air conditioning temperature control lever (at the control panel) to the temperature regulation valve lever. This valve is located on the engine side of the dash shroud (Figs. 6-13 and 6-14).

A lever at the end of the valve indexes with an actuating pin (in the cover assembly) in such a manner as to increase or decrease load on a spring which in turn exerts a load on the diaphragm, which is opposed by evaporator outlet pressure.

The body of the valve contains an inlet connection from the evaporator top tank outlet pipe (suction side) and an outlet connection to the compressor. Two smaller fittings receive an equalizer line from the thermostatic expansion valve, and a Schrader fitting to read evaporator suction pressure at this valve. A pressure control piston attached to the diaphragm permits evaporator outlet gas to pass through the "windows" in the piston skirt to get to the compressor.

The diaphragm separates the valve body and cover and is acted upon by evaporator outlet pressure on one side and atmospheric pressure assisting spring pressure on the other.

The cover houses springs which control pressures within the evaporator. The outer spring controls low pressure for freeze protection and the inner spring

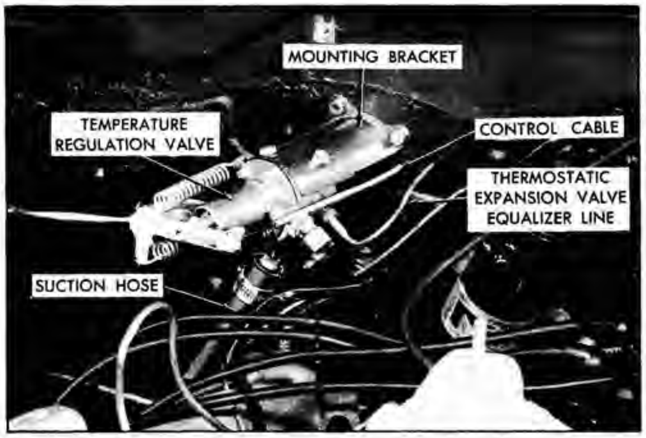



Fig. 6-13 Temperature Regulation Valve Location on Pontiac

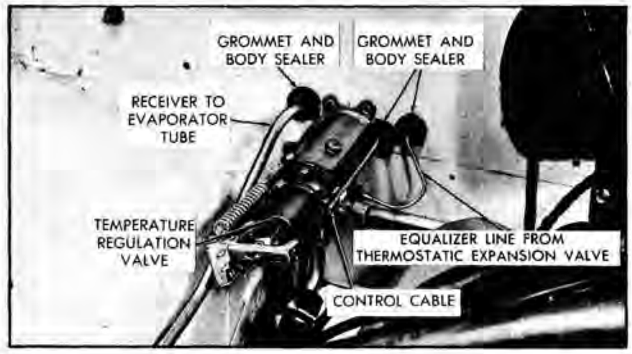



Fig. 6-14 Temperature Regulation Valve Location on Tempest

controls high pressures for warming up nozzle temperatures when desired. A buffer spring in line with the inner spring keeps the inner spring from bouncing and creating a noise condition during low pressure operation.

### FUNCTION

The function of the temperature regulation valve is to maintain a given temperature inside the car as selected by the temperature control lever and also to limit the evaporator to a minimum pressure, preventing any moisture condensing on the evaporator core from freezing.

The valve automatically controls cooling and prevents evaporator freeze-up by limiting evaporator pressure to a controlled minimum.

### OPERATION

When the temperature control lever is at the full left position, the temperature regulation valve is manually positioned at its warmest setting (temperature regulation valve lever is toward the rear of the car) thereby providing minimum cooling.

Progressive movement of the temperature control lever would progressively move the temperature regulation valve lever towards the front of the car and its "coldest" position (lever fully forward) is reached when the temperature control lever is at the extreme right position. Any further attempt to reduce the air temperature leaving the evaporator, as might result from adjusting the temperature regulation valve below its minimum setting, will only result in a momentary gain in cooling, and will be followed by evaporator core icing and resultant loss of cooling.

Low pressure refrigerant gas from the evaporator outlet enters the temperature regulation valve inlet to fill the space inside the piston and behind the diaphragm (by passing through four small holes located in the piston). Compressor suction pressure encircles the piston, and enters the equalizer line opening to the thermostatic expansion valve. The Schrader valve for the evaporator suction and charging fitting is so ported that it reads evaporator suction pressure.

Whenever evaporator suction pressure is at or above the minimum pressure desired in the evaporator, suction pressure against the piston and the diaphragm will cause the piston to move the spring loaded diaphragm to permit the refrigerant gas to pass through the "windows" in the piston and on to the compressor. When the evaporator pressure drops below the pressure which provides the desired temperature in the car, the spring loaded diaphragm will force the piston to restrict (and even completely close) the gas passage from the top of the evaporator to the compressor.

Since the compressor continues to operate, pressure is reduced around the piston, at the equalizer line to the thermostatic expansion valve. At the same time warm air being forced by the blower through the evaporator core provides more heat to the surface of the core and thus causes the refrigerant inside the evaporator to boil, increasing the pressure within the evaporator to such a point as to overcome atmospheric and spring pressure above the diaphragm to move the piston to allow refrigerant gas from evaporator outlet to pass through the valve. In this manner, evaporator pressure is controlled and yet oil and refrigerant are always being returned to the compressor to prevent the compressor from being damaged by sustained operation at or near vacuum conditions, where no oil would normally be returned to the compressor for lubrication.

If maximum cooling in the car is not desired and the temperature control lever is pushed to the

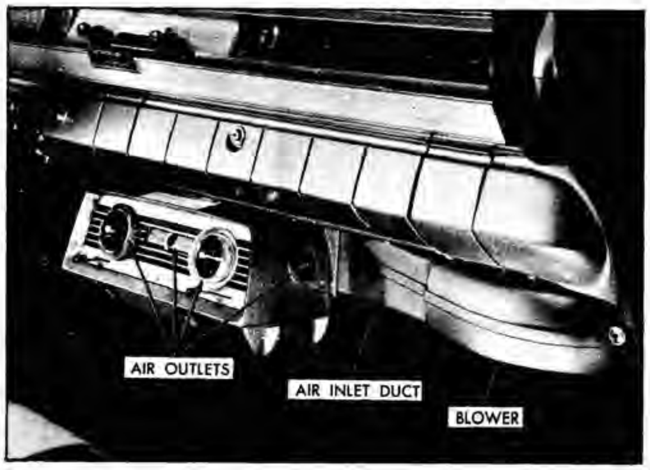



Fig. 6-15 Component Parts of Pontiac Cool Pack Air System

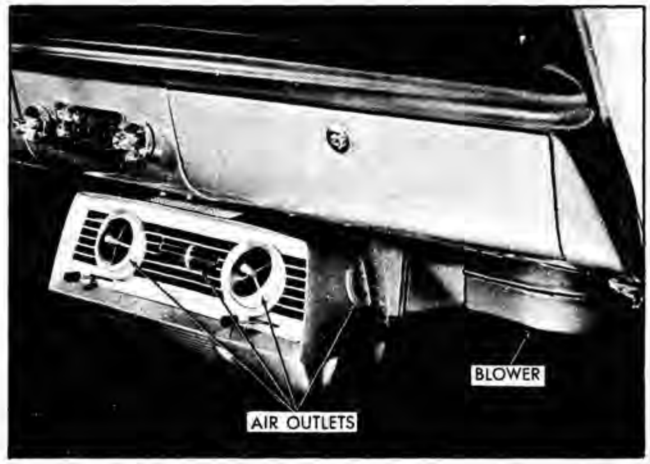



Fig. 6-16 Component Parts of Tempest Cool Pack Air System

warmest setting, then the lever on the temperature regulation valve is pulled towards the rear of the car by means of a control cable. This lever movement increases the load on the inner spring. The increased inner spring load now requires a higher evaporator pressure to overcome this spring load before the piston is moved to permit warm gas from the evaporator to pass to the compressor. The increased pressure in the evaporator will increase the temperature of the air leaving the evaporator. Thus, the refrigeration cycle occurs at a higher suction pressure (which would give a higher temperature). The flow of refrigerant through the evaporator to the temperature regulation valve and compressor is dependent upon evaporator pressure and the resultant temperature of air desired.

When evaporator pressure is less than the opposing spring load, the piston will move to prevent gas from the evaporator outlet to flow through the now "closed" valve. When the evaporator pressure is greater than the opposing spring load, the piston will move to permit the gas to flow through the now "open" valve.

## AIR SYSTEM

Since the Cool Pack Conditioner has its evaporator and blower inside the car, air inside of the car is pulled from over the right front passenger's feet and forced through the air duct and evaporator assembly to be cooled. This arrangement operates to process 100% inside air or "recirculation" at all times.

With the Tempest, when at normal highway speeds, a percentage of outside air may be added by pulling out the right hand cowl vent control knob. This will help remove smoke or odors from the car.

When the blower switch is at the "OFF" position, no air is forced through the evaporator and no current flows through the electrical circuit.

Moving the blower control switch to "LO", "MED", or "HI" closes the electrical circuit to the compressor clutch and to the blower to force air through the evaporator for cooling, where the air escapes through five outlets in the evaporator case assembly.

## ELECTRICAL SYSTEM

The blower circuit of this air conditioner receives its electrical supply directly from the heater terminal on the fuse block via the main wire assembly. Overload protection is provided by the 20 amp fuse at the fuse block.

When the ignition switch is turned to the start position, the accessory terminal of the ignition switch is cut out. This prevents operation of the accessories connected through the ignition switch while starting the engine. Thus, the starting motor does not have to turn the compressor while cranking the engine because there is no current to the air conditioning electrical system.

Wires for the *heater* blower switch and *air conditioning* blower switch are contained in separate wire harnesses; and are connected in parallel. This arrangement allows use of the *heater* blower switch only when the Cool Pack blower control is in "OFF" position. The *heater* blower switch will then receive its current through the "OFF" terminal on the Cool Pack blower switch. (See Figs. 6-17 and 6-19.)

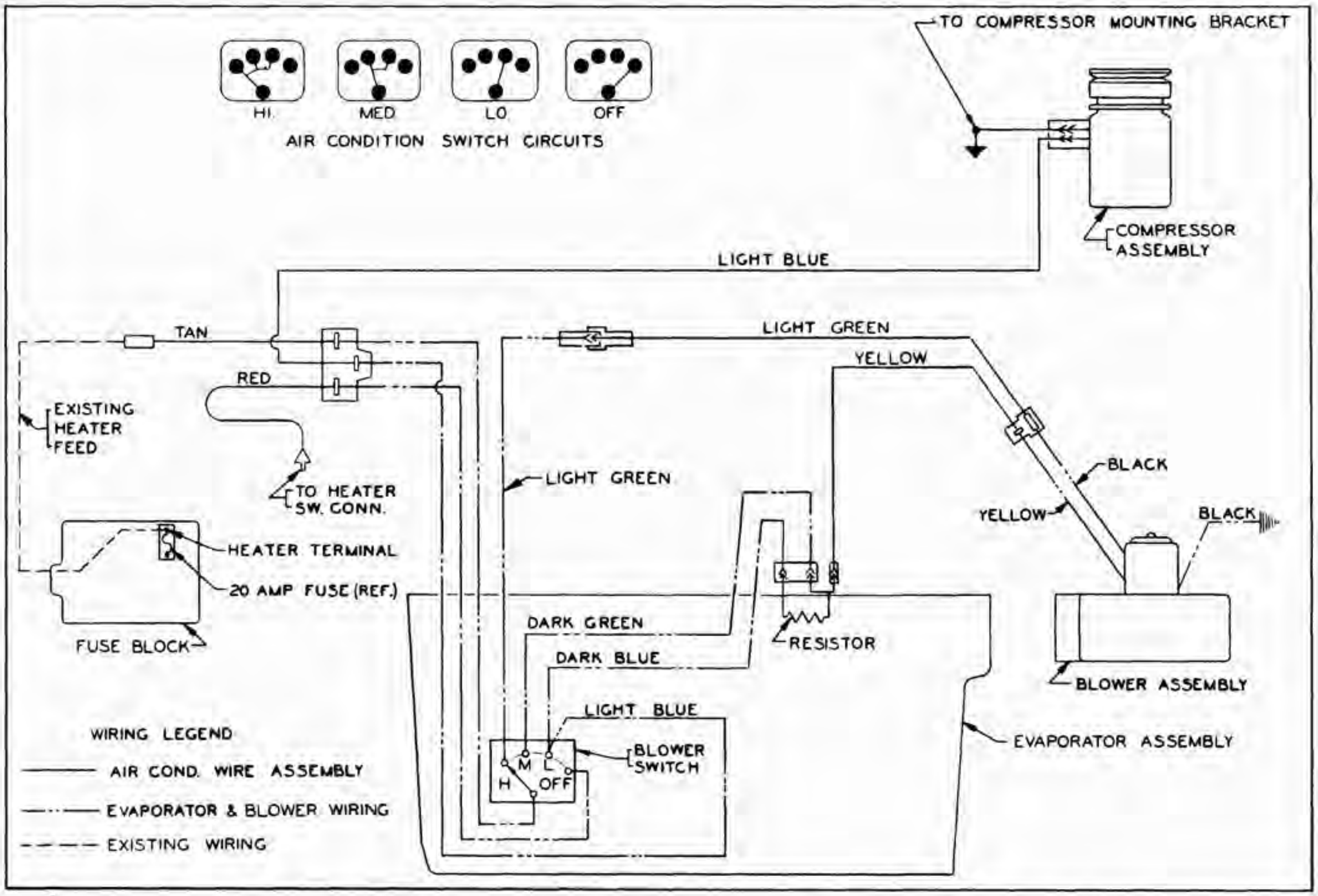



Fig. 6-17 Schematic Diagram of Pontiac Cool Pack Conditioner Electrical System

The Cool Pack conditioner blower switch is a four position switch and provides for three blower speeds: "OFF", "LO", "MED" and "HI". Cool Pack blower is fed through two connections at its input; a black colored wire and a yellow colored wire which carries current as directed by "HI" blower switch position, and the yellow colored wire only which carries "LO", and "MED" speed current as directed by the respective blower switch positions.

### CURRENT FLOW AT THE COOL PACK CONTROL POSITIONS

Four positions of the Cool Pack blower control provide current to the blower as follows:

"OFF" no current flow to the Cool Pack but closes the circuit to the car heater control panel.

"LO" speed current flows from the fuse block via the main wire harness and a tan colored wire in the Cool Pack wire harness to the blower switch. In this position the heater blower circuit is open. From here, current is separated, one path flows to the compressor coil via a light blue colored wire to the compressor clutch. Current also flows through a dark blue wire to the resistor block (located at the lower back side of the evaporator case), through the resistor block and a yellow colored wire to the blower.

"MED" speed current flows from the fuse block via the main wire harness and a tan wire in Cool Pack wire harness to the blower switch. In this position

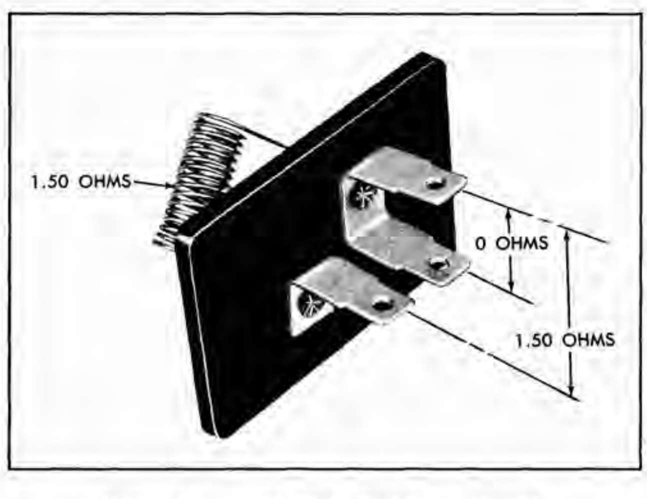



Fig. 6-18 Cool Pack Resistor Assembly

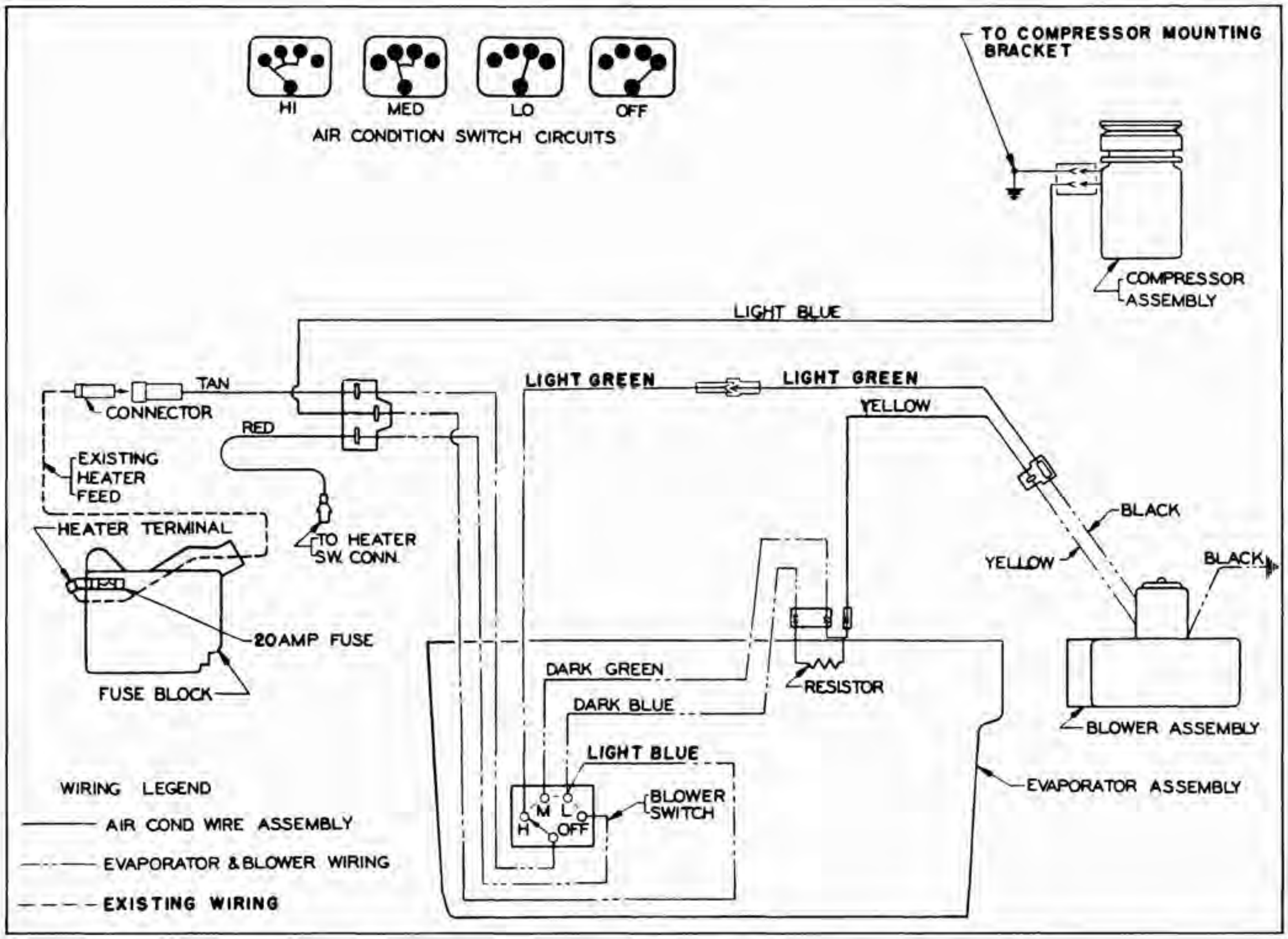



Fig. 6-19 Schematic Diagram of Tempest Cool Pack Condition Electrical System

the heater circuit is open. (In the "MED" position, the "MED" and "LO" switch terminals are connected mechanically inside the switch–which also directs current to the compressor clutch.) From here, current flows to the "LO" terminal, through a dark blue wire to the resistor block terminal. Current also flows from the "MED" blower switch terminal through a dark green colored wire to a terminal on the resistor block (to by pass the resistor) and continues to the blower via a yellow wire.

"HI" speed current flows from the fuse block via the main wire harness and a tan wire in the Cool Pack wire harness to the blower switch. In this position the heater circuit is open. (In the "HI" position, the "HI", "MED" and "LO" switch terminals are connected mechanically inside the switch.) From here current is divided to flow as follows: to the "LO" terminal through a dark blue wire to the resistor block terminal and also to the compressor clutch coil; to the "MED" terminal through a dark green wire to a terminal on the resistor block (to by pass the resistor) and continues to the blower via a yellow wire; from the "HI" blower switch terminal via a light green wire to a black wire to the blower.

### CURRENT FLOW THROUGH HEATER AND DEFROSTER CONTROL POSITIONS

Current flow through heater and defroster control positions cannot be obtained until the Cool Pack blower switch is in the "OFF" position.

With the Cool Pack blower switch in the "OFF" position current flows from the fuse block via the main wire harness and a tan wire in the air conditioning wire harness to the blower switch input terminal. From here, current flows through the switch to the "OFF" terminal, then via a red wire to the heater master switch connector and to the other electrical components.

Current flow through the heater and defroster switch positions is explained under the HEATER section.

# INSPECTION AND PERIODIC SERVICE

CONTENTS OF THIS SECTION



## NEW CAR PRE-DELIVERY INSPECTION

1. Check compressor belt tension to give 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

2. Operate system and check for correct operation in all control positions.

NOTE: This step and step 5 can be done in conjunction with the pre-delivery road test.

3. Check for refrigerant leaks (Fig. 6-20) and observe the refrigerant passing through the liquid indicator with system operating to see if there is any evidence of bubbles.

NOTE: This check can be made immediately after the pre-delivery road test provided the system was operated during the road test.

a. If a refrigerant leak is detected, correct leak. If necessary to replace parts, evacuate and charge system after new parts are installed.

b. If a refrigerant leak is detected and the leak can be corrected without discharging system or changing parts, bleed system slowly through discharge valve until bubbles appear in the liquid indicator (above 70°F. ambient). Add one-half pound of refrigerant. See ADDING REFRIGERANT-12.

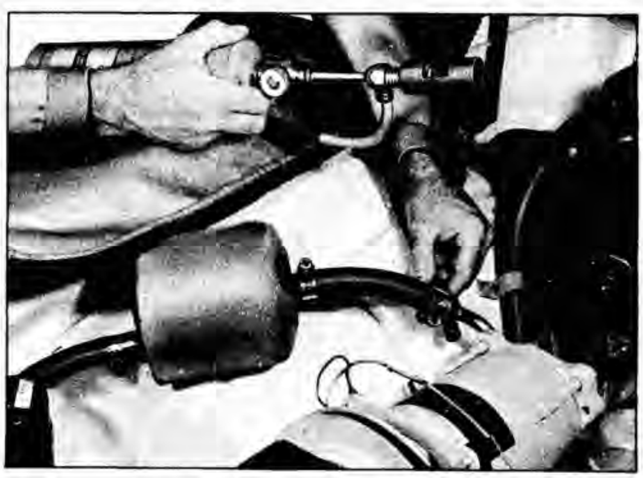


Fig. 6-20 Searching for Leaks

c. If bubbles are visible in the liquid indicator (above 70°F. ambient) with the blower on "HI", the temperature control to the full cold position, and no leaks are evident, it indicates partial or complete plug in a line or a lack of refrigerant in the system. Correct condition. Add refrigerant until the liquid indicator clears, then add another one-half pound of refrigerant.

4. Check ambient air temperature and air temperature at outlets on evaporator assembly in accordance with operational test procedure.

5. Check and adjust engine idle with air conditioning off (Hydra-Matic or Auto-Matic transmission in drive range, synchro-mesh transmission in neutral).

| | |
|---|---|
| Pontiac (all)—Hydra-Matic | 540-560 rpm. |
| Synchro-mesh | 540-560 rpm. |
| Tempest (1 bbl and 4 bbl)— | |
| Auto-Matic (in Drive) | 630-650 rpm. |
| Synchro-mesh | 680-700 rpm. |

## 2,000 MILE INSPECTION

1. Inspect all connections for presence of oil on any of the refrigeration system parts which could indicate a refrigeration leak. If oil is evident, check for leaks and repair as necessary.

a. If a refrigerant leak is detected, correct leak. If necessary to replace parts, evacuate and charge system after new parts are installed.

b. If a refrigerant leak is detected and the leak can be corrected without discharging system or changing parts, bleed system slowly through discharge fitting valve until bubbles appear in the liquid indicator

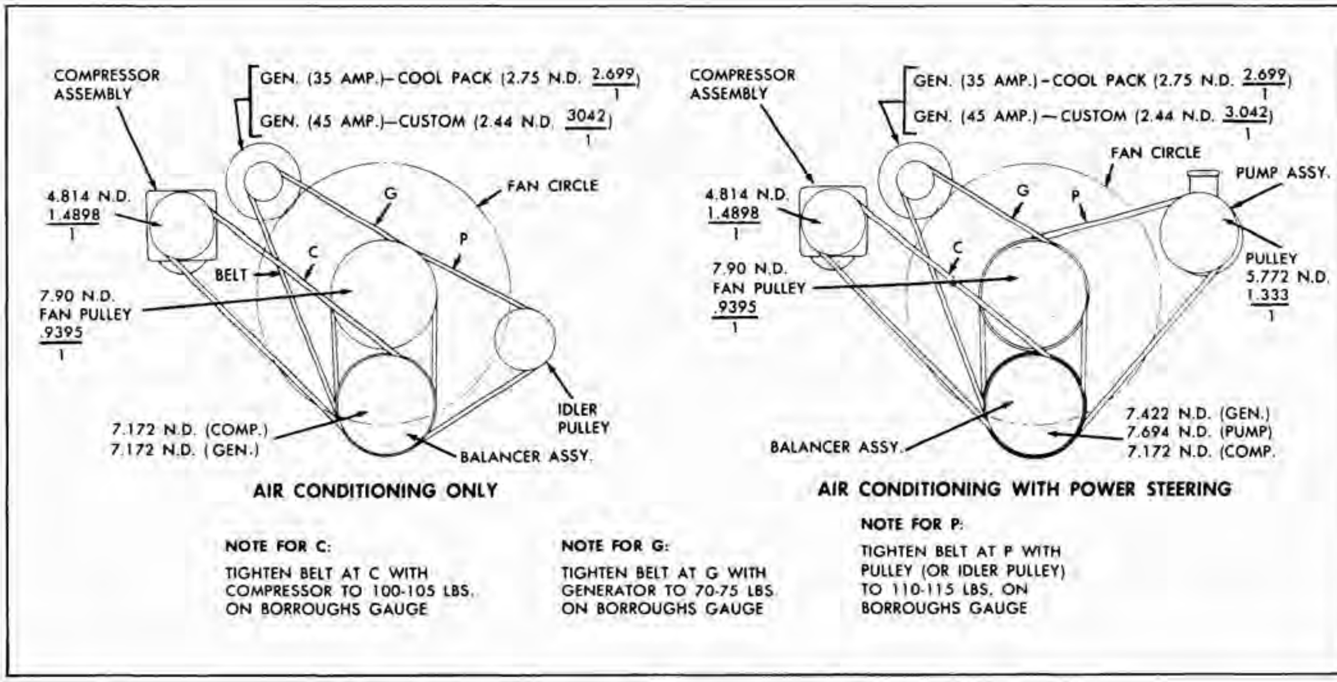



Fig. 6-21 Pontiac Engine Drive Belt Combinations

(above 70°F. ambient). Add one-half pound of refrigerant. See ADDING REFRIGERANT-12.

c. If bubbles are visible in the liquid indicator (above 70°F. ambient) and no leaks are evident, it indicates partial or complete plug in a line or a lack of refrigerant in the system. Correct condition. Place blower on "HI" and temperature control for full cold. Add refrigerant until the liquid indicator clears, then add another one-pound of refrigerant.

2. Adjust compressor belt tension to give 100-105 lbs. indicated on the Borroughs Belt Tension Gage.

3. Operate system for ten minutes at 1500 rpm with temperature control at full cold and blower control on "HI" speed. Liquid indicator should be clear.

If bubbles are visible (above 70°F. ambient) when temperature control is at full cold position, it indicates lack of refrigerant in the system. Correct as necessary and charge system as explained in step one above.

NOTE: This check can be made immediately after the regular road test which is part of the 2000 Mile Inspection, provided the system is operated during the road test.

## PERIODIC SERVICE

### *EVERY 2,000 MILES*

1. Inspect condenser and radiator cores to be sure they are not plugged with leaves or other foreign material. Be sure to check between the condenser and radiator cores as well as the outer surfaces.

2. Check to see if evaporator core is clean and free of foreign material. If not, carefully remove any material obstructing air flow through the core.

3. Check to insure that the evaporator drains are open.

### *TWICE A YEAR OR EVERY 10,000 MILES*

Twice a year or every 10,000 miles make a complete maintenance schedule test of the system.

1. Clean out front of condenser to remove all obstruction, such as leaves, bugs, dirt, etc. Be sure that the space between the condenser and radiator is also free of this material.

2. Check to ensure that the evaporator drains are open.

3. Inspect compressor drive belt. Check and adjust belt tension.

4. Check to see that the air nozzles operate freely.

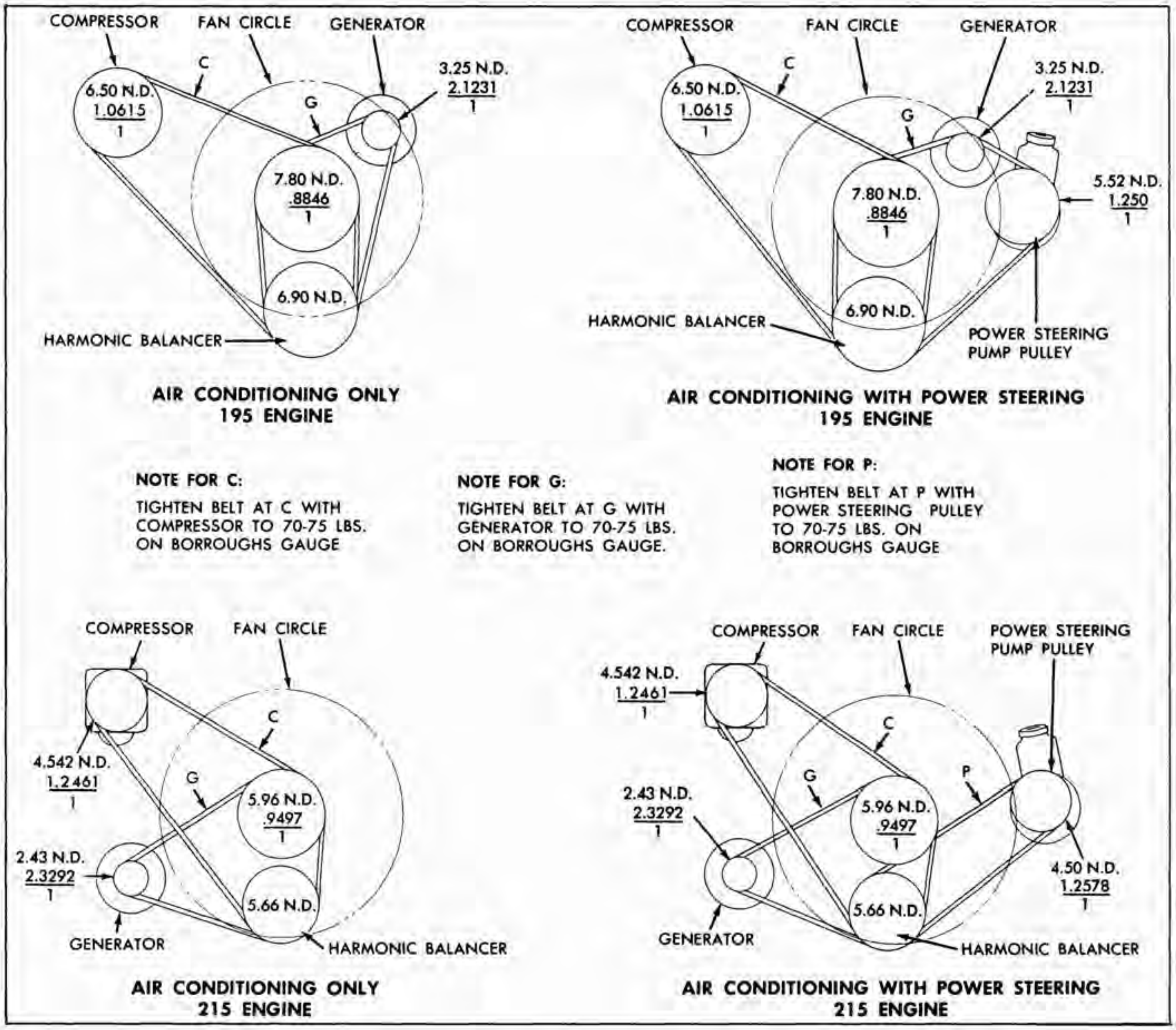



Fig. 6-22 Tempest Engine Drive Belt Combinations

5. Check electrical circuit for proper operation of compressor clutch and blower control switch, and heater blower.

6. Adjust engine idle with air conditioning off. (Hydra-Matic or Auto-Matic transmission in drive range, synchro-mesh transmission in neutral.)

| | |
|---|---|
| Pontiac (all)—Hydra-Matic | 540-560 rpm. |
| Synchro-mesh | 540-560 rpm. |
| Tempest (1 bbl and 4 bbl)— | |
| Auto-Matic | 630-650 rpm. |
| Synchro-mesh | 680-700 rpm. |

7. Perform operational test.

## ADJUSTMENTS ON CAR

### *COMPRESSOR BELT*

Check compressor belt tension. Adjust if looseness is indicated by slipping or tension is below 70 lbs. on Borroughs Belt Tension Gauge. Adjust as follows:

1. Loosen front and rear compressor mounting plate (at adjusting slot) bolts and front and rear compressor pivot bolts. On Pontiac, loosen bolt at rear brace.

2. Install Borroughs Belt Tension Gauge on compressor belt.

3. Using a ½" square drive or socket in the hole of the compressor front plate. Move air conditioning compressor to obtain 100-105 lbs. on the Borroughs Belt Tension Gauge.

4. Retain the proper tension and tighten front and rear adjusting slot bolts and pivot bolts. Tighten rear brace bolt on Pontiac.

5. Remove Borroughs Belt Tension Gauge.

## TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT

The purpose of this adjustment is to insure that the air conditioner refrigeration system will give maximum cooling performance when required.

1. Place temperature control cable in the full cold (right) position.

2. Disconnect the bowden cable loop from the temperature regulation valve lever.

3. Pull the bowden cable loop as far forward (toward front of car) as possible.

4. Move the temperature regulation valve lever forward (toward front of car) and hold in this position.

5. If cable loop does not align with the temperature regulation valve cam lever pin, adjust the bowden cable at the temperature regulation valve and position bowden cable housing as required.

6. Tighten bowden cable housing clamp.

7. Install bowden cable loop on temperature regulation valve cam lever pin and connect spring.

## TEMPERATURE REGULATION VALVE ADJUSTMENT

The purpose of this adjustment is to provide evaporator core freeze protection with maximum cooling efficiency.

NOTE: It is essential that the temperature regulation valve control bowden cable be properly adjusted prior to conducting this check.

1. Check calibration of suction gauge and connect low pressure side of the manifold gauge set J-5725 or J-5725-01 using J-5420 Schrader valve adapter to the Schrader valve located in the temperature regulation valve assembly.

2. Connect the high pressure side of the gauge set using J-6163 Schrader valve adapter (90°) to the Schrader valve located in the discharge side of the compressor fitting (gauge) assembly.

3. Push temperature control lever full over for maximum cooling. (See TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT.)

4. Position blower control lever on "HI".

5. Close car doors and windows.

6. Place an auxiliary fan (at least 20" in diameter) in front of condenser.

7. Start engine and slowly increase speed to run 1500 rpm.

8. After ten minutes, observe low pressure gauge and adjust temperature regulation valve only if reading (on suction gauge) is not to the specification for the ambient temperature.

9. Observe low pressure gauge and adjust *only* if not within the limits shown for the TEMPERATURE REGULATION VALVE TEST READINGS.

NOTE: If adjustment of temperature regulation valve is necessary, proceed as follows: *DO NOT* adjust actuating pin which is threaded in nylon adjusting nut. This nut does not have any effect on freeze control pressure.

a. Install J-9505 into two holes in cold setting adjusting screw.

b. Obtain proper pressure reading on the suction gauge by turning adjusting tool clockwise to increase pressure or counterclockwise to decrease pressure.

NOTE: It is important that changes be made in small increments, with time allowed for the pressure to stabilize.

c. Install and adjust temperature valve control cable at temperature regulation valve so that valve cable loop aligns with the lever pin with the valve set for maximum cold. (See TEMPERATURE REGULATION VALVE CONTROL CABLE ADJUSTMENT.)

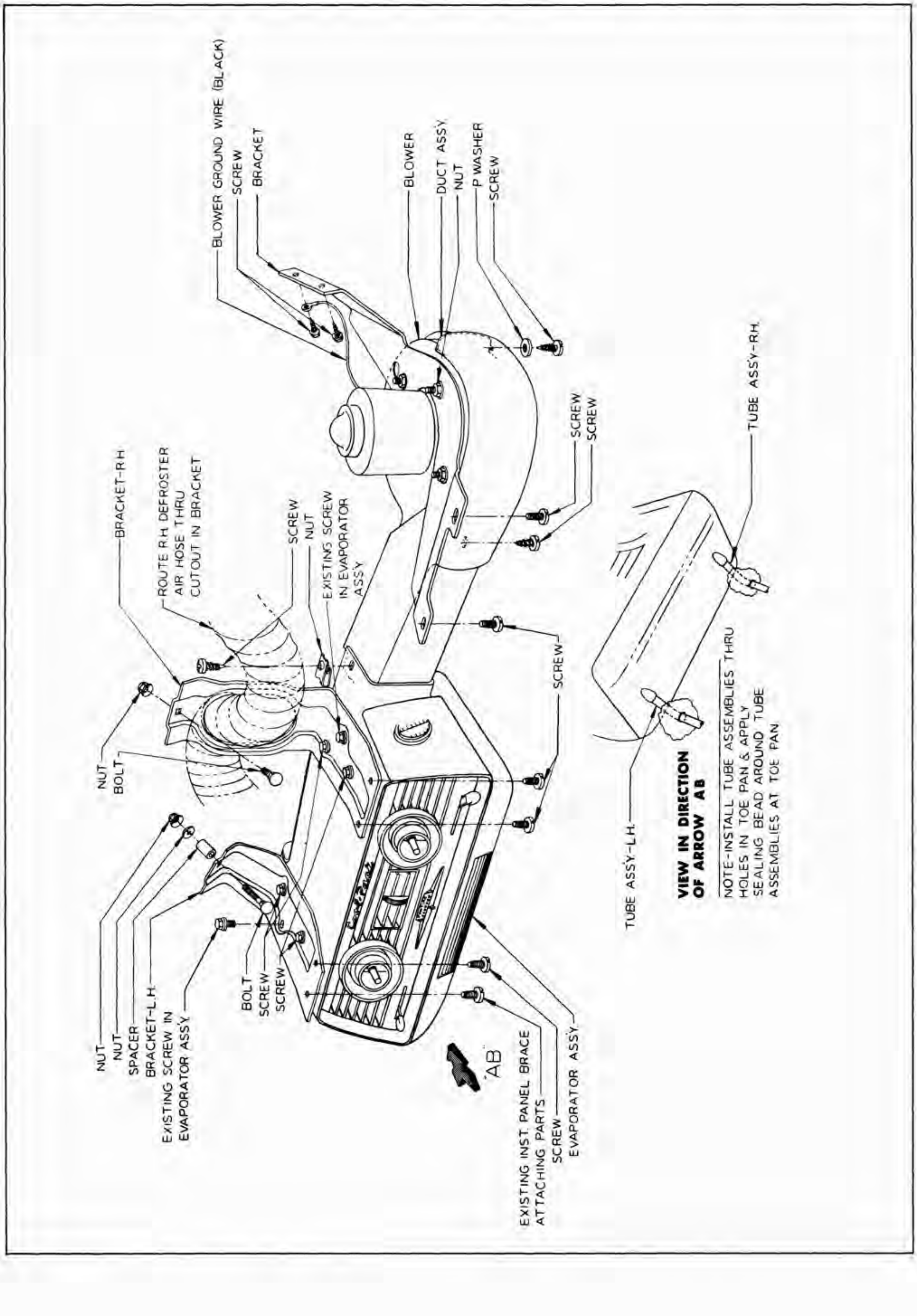



Fig. 6-23 Installation of Pontiac Cool Pack Body Interior Parts

# PONTIAC MINOR SERVICES AND REPAIRS—MECHANICAL

CONTENTS OF THIS SECTION



The following services and repairs concern parts of the air conditioning system which can be serviced without opening the refrigeration system. Before attempting any repairs which require opening refrigerant connections, see MINOR SERVICE AND REPAIRS—REFRIGERATION.

## BLOWER ASSEMBLY AND/OR BLOWER TO EVAPORATOR DUCT

***REMOVE AND REPLACE (See Fig. 6-23)***

1. Remove glove box.

2. Remove blower and mounting bracket from right cowl inner panel and instrument panel flange as an assembly. The blower to evaporator duct comes off at the same time.

3. Disconnect wires to blower motor and remove blower motor.

4. Replace by reversing the above procedure.

## AIR OUTLETS

***REMOVE AND REPLACE***

SIDE OUTLETS

Since side outlets are retained by a wire spring, move the assembly outward and down. This will permit access to the wire which can be easily moved to remove the outlet assembly.

Replace by reversing the above procedure.

FRONT NOZZLES AND/OR CENTER OUTLET

1. Remove "FAN" and "TEMP" control lever knobs.

2. Remove six screws from face of Cool Pack grille assembly. Note that the two upper center screws are longer than the other four screws.

3. Remove grille to gain access to nozzles and center outlet (Fig. 6-24).

4. Replace by reversing the above procedure, making sure long grille screws are installed at upper center holes.

## TEMPERATURE REGULATION VALVE CONTROL CABLE

***REMOVE AND REPLACE***

1. Remove blower and duct assembly.

2. Remove evaporator right side grille and disconnect cable at air conditioning control lever assembly (Fig. 6-25).

3. Loosen cable clamp screws at side of evaporator.

4. Disconnect temperature regulation valve control cable at temperature regulation valve.

5. Attach a stout piece of cord or wire (approximately 6 feet long) to the control lever end of the

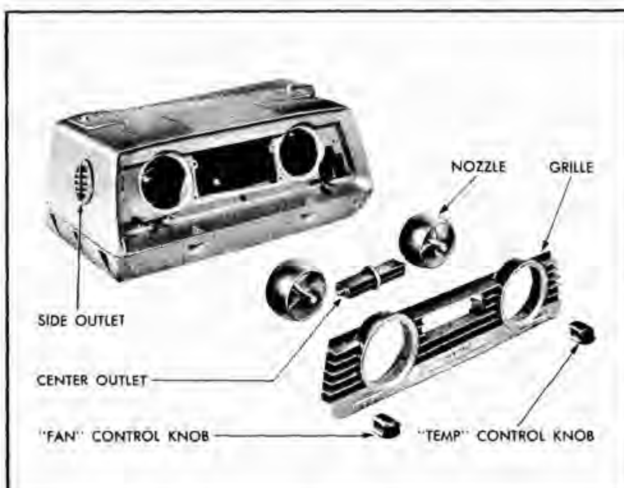



Fig. 6-24 Grille and Nozzles—Exploded View

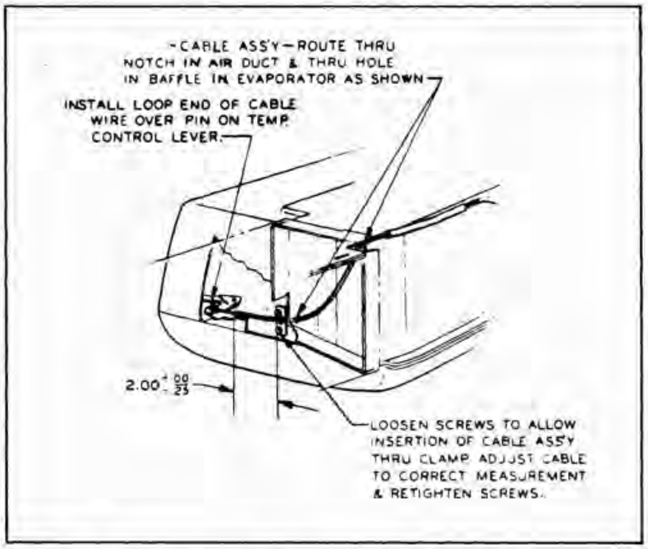



Fig. 6-25 Pontiac Temperature Control Cable Hook-up at Evaporator Housing

cable and remove cable leaving end of cord in engine side of dash.

6. Detach cable from cord (or wire) and attach new cable to cord. Before installation, inspect the new cable to be sure that it is free of kinks, and that the cable "eyes" are centered with the cable.

7. Pull cable through dash and attach to control lever so cable housing extends through the cable clamp and 2″ beyond (Fig. 6-25). Secure clamp.

8. Attach control cable to temperature regulation valve, adjust cable and secure clamps.

9. Replace blower and duct assembly.

## REMOVING COMPRESSOR TO SERVICE ENGINE

1. Disconnect compressor clutch coil ground wire at compressor and wire connector at coil.

2. Remove compressor belt.

3. Remove compressor rear brace to cylinder head brace bolt at compressor mounting bracket.

4. Remove compressor front plate to mounting bracket upper bolt and lower adjusting bolt.

5. Remove compressor rear plate to mounting bracket lower adjusting bolt.

6. Pad fender and fender skirt and place compressor near top of fender skirt, securing compressor to right fender brace (with wire, rope, or similar means).

***CAUTION: Do not kink any hoses or place excessive tension on the hoses.***

7. Replace by reversing the above procedure.

8. Tighten compressor belt to 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

# TEMPEST MINOR SERVICES AND REPAIRS—MECHANICAL

CONTENTS OF THIS SECTION



The following services and repairs concern parts of the air conditioning system which can be serviced without opening the refrigeration system. Before attempting any repairs which require opening refrigerant connections, see MINOR SERVICE AND REPAIRS—REFRIGERATION.

## RESISTOR ASSEMBLY

### REMOVE AND REPLACE

1. Remove eleven screws retaining evaporator lower housing to upper evaporator housing and then lower pan.
2. Disconnect wires at resistor and remove resistor.
3. Replace by reversing the above.

## BLOWER SWITCH

### REMOVE AND REPLACE

1. Remove "FAN" and "TEMP" control lever knobs.
2. Remove six screws from face of Cool Pack grille assembly. Note that the two upper center screws are longer than the other four screws.
3. Disconnect evaporator drain hoses.
4. Remove eleven screws retaining evaporator lower housing to upper evaporator housing and then lower pan.
5. Remove two screws retaining blower switch to evaporator housing and remove switch assembly (Fig. 6-26).
6. Disconnect wires at resistor assembly (Fig. 6-27) and wire harness.
7. Replace by reversing the above procedure, making sure long grille screws are at upper center holes.

## TEMPERATURE CONTROL LEVER

### REMOVE AND REPLACE

1. Remove "FAN" and "TEMP" control lever knobs.
2. Remove six screws from face of Cool Pack grille assembly. Note that the two upper center screws are longer than the other four screws.
3. Disconnect evaporator drain hoses.
4. Remove eleven screws retaining evaporator lower housing to upper evaporator housing and then lower pan.
5. Remove two screws retaining temperature control lever to evaporator housing.
6. Disconnect temperature control cable from lever and remove lever assembly.

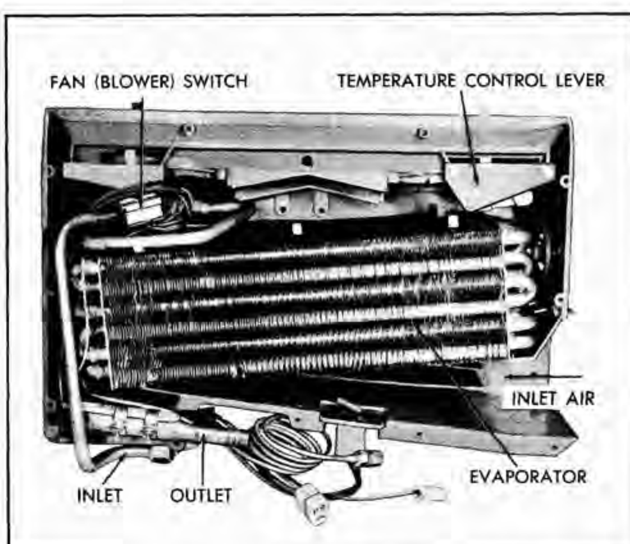



Fig. 6-26 Viewing Evaporator with Lower Pan Removed

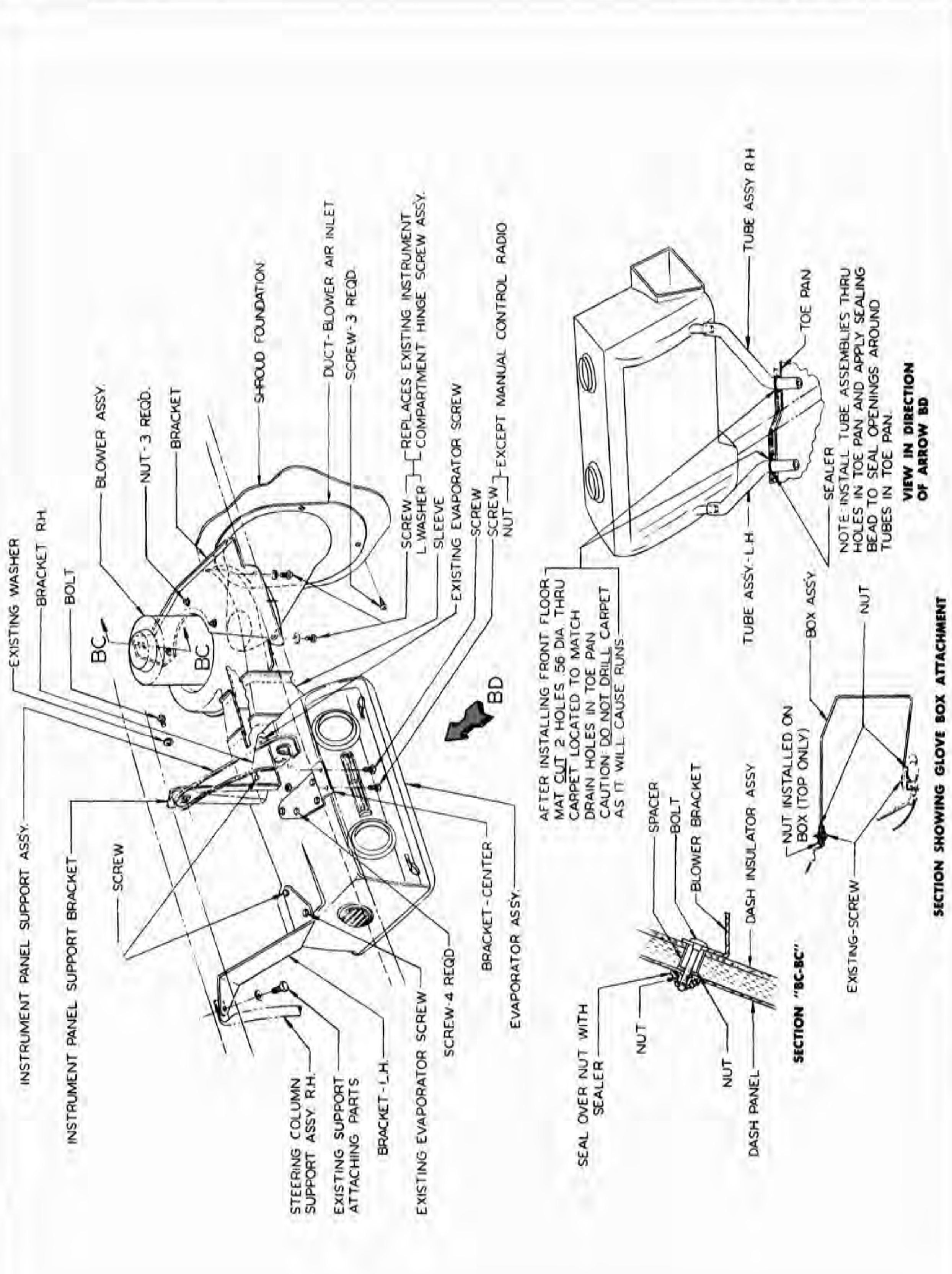



Fig. 6-27 Installation of Tempest Cool Pack Body Interior Parts

7. Replace by reversing the above procedure, making sure long grille screws are at upper center holes.

8. Adjust temperature control cable.

## BLOWER ASSEMBLY

***REMOVE AND REPLACE (See Fig. 6-27)***

1. Remove glove box.

2. Remove right vent air duct.

3. Remove three blower to blower bracket nuts. One nut is behind the blower.

4. Lower blower, disconnect blower wires and remove blower assembly.

5. Attach blower ground wire to dash shroud.

6. Attach blower to evaporator sleeve so long side of sleeve for evaporator is toward engine.

7. Holding blower in position, secure with three nuts.

8. Connect blower wires.

9. Replace right side air duct.

10. Replace glove box.

## AIR OUTLETS

***REMOVE AND REPLACE***

### SIDE OUTLETS

Since side outlets are retained by a wire spring, move the assembly outward and down. This will permit access to the wire which can be easily moved to remove the outlet assembly.

Replace by reversing the above procedure.

### FRONT NOZZLES AND/OR CENTER OUTLET

1. Remove "FAN" and "TEMP" control lever knobs.

2. Remove six screws from face of Cool Pack grille assembly. Note that the two upper center screws are longer than the other four screws.

3. Remove grille to gain access to nozzles and center outlet (Fig. 6-28).

4. Replace by reversing the above procedure, making sure long grille screws are installed at upper center holes.

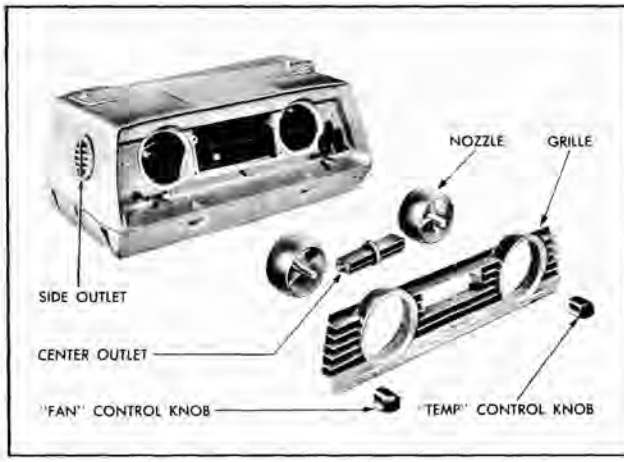



Fig. 6-28 Grille and Nozzles—Exploded View

## TEMPERATURE REGULATION VALVE CONTROL CABLE

***REMOVE AND REPLACE***

1. Remove blower and duct assembly.

2. Remove evaporator right side grille and disconnect cable at temperature control lever assembly (Fig. 6-29).

3. Loosen cable clamp at side of evaporator.

4. Disconnect temperature regulation valve control cable at temperature regulation valve.

5. Attach a stout piece of cord (or wire) approximately 6 feet long to the control lever end of the cable and remove cable leaving end of cord in engine side of dash.

6. Detach cable from cord and attach new cable to cord. Before installation inspect new cable to be sure that it is free of kinks and that the cable "eyes" are centered with the cable.

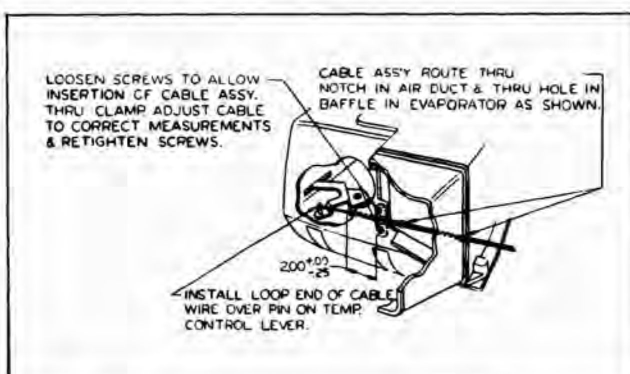



Fig. 6-29 Tempest Temperature Control Cable Hook-up at Evaporator Housing

| Metal Tube Outside Diameter | Thread and Fitting Side | Steel Tubing Torque Lb.-Ft. | Aluminum or Copper Tubing Torque Lb.-Ft. | Nominal Torque Wrench Span |
|---|---|---|---|---|
| 1/4 | 7/16 | 10-15 | 5-7 | 5/8 |
| 3/8 | 5/8 | 30-35 | 11-13 | 3/4 |
| 1/2 | 3/4 | 30-35 | 11-13 | 7/8 |
| 5/8 | 7/8 | 30-35 | 18-21 | 1 1/16 |
| 3/4 | 1 1/16 | 30-35 | 23-28 | 1 1/4 |

**If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification.**

Fig. 6-30 Pipe and Hose Connection Torque Chart

7. Pull cable through dash and attach to control lever so cable housing extends through cable clamp and 2" beyond (Fig. 6-29). Secure clamp.

8. Attach control cable to temperature regulation valve, adjust cable and secure clamp.

9. Replace blower and duct assembly.

## REMOVE COMPRESSOR TO SERVICE ENGINE

1. Disconnect compressor clutch coil ground wire at compressor and wire connector at coil.

2. Remove front and rear compressor mounting plate to compressor bolts (pivot and adjusting).

3. Remove compressor belt.

4. Pad fender and fender skirt and place compressor near top of fender skirt, securing compressor to right fender brace or hood hinge. (Use wire, rope, or similar means.)

***CAUTION: Do not kink any hoses or place excessive tension on the hoses.***

5. Replace by reversing the above procedure.

6. Tighten compressor belt to 100-105 lbs. on Borroughs Belt Tension Gauge.

# MINOR SERVICES AND REPAIRS—REFRIGERATION

CONTENTS OF THIS SECTION



## PRECAUTIONARY SERVICE MEASURES

Before any service is attempted which requires the opening of refrigeration pipes or units, the person doing the work should be thoroughly familiar with GENERAL INFORMATION ON REFRIGERATION SERVICE. Also, he should follow very carefully the instructions given on the following pages for the unit being serviced.

The major reasons behind these measures are to prevent dirt and moisture from getting into the system. Dirt contaminant is apt to cause leaky valves or wear in the compressor, and moisture will freeze into ice at the expansion valve and freeze the valve.

### PRE-ASSEMBLY

1. All sub-assemblies are shipped sealed and dehydrated and are to remain sealed until just prior to making connections.

2. All sub-assemblies should be at room temperature before uncapping. (This prevents condensation of moisture from air that enters into the system.)

3. If for any reason the caps are removed, but connections are not made, then hoses and other parts should not remain unsealed for more than 15 minutes. Reseal connections if period is to be longer.

4. Service compressors are shipped with 11 oz. of Frigidaire 525 Viscosity oil and charged with a mixture of Refrigerant-12 and dry nitrogen to provide an internal pressure at slightly above atmospheric pressure.

### ASSEMBLY

1. All precautions should be taken to prevent damage to fittings or connections. Even minute damage to the connection could cause it to leak.

2. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with alcohol. Do not use chlorinated solvents such as trichloroethylene for a cleaning agent as they are contaminants. If dirt, grease or moisture gets inside the pipes and cannot be removed, the pipe is to be replaced.

3. Sealing caps should be removed from sub-assemblies just prior to making connections for final assembly.

4. Use a small amount of clean refrigeration oil (525 or 1000 viscosity) on all tube and hose joints,

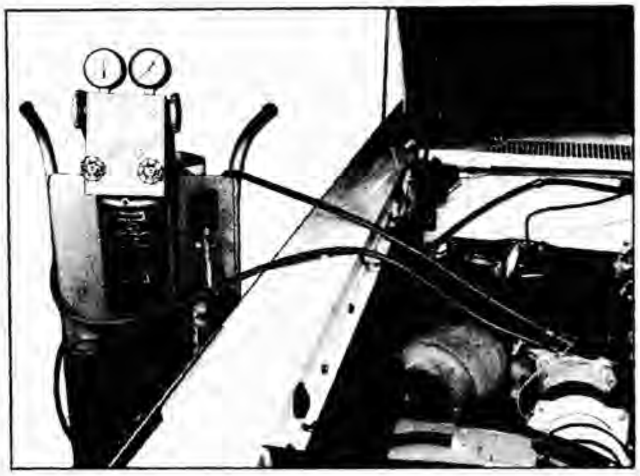


Fig. 6-31 Evacuating System with J-8393 (Pontiac Shown)

and dip the O-ring gasket in this oil before assembling the joint, as this oil will help in making a leak-proof joint. When tightening joints, use another wrench to hold the stationary part of the connection so that a solid feel can be attained, which will indicate proper assembly.

***CAUTION:*** ***Tighten all tubing connections with the proper torque (Fig. 6-30). Insufficient torque when tightening can result in loose joints and excessive torque when tightening can result in distorted joint parts. Either condition can result in refrigerant leakage.***

5. Do not connect receiver and liquid indicator assembly until all other sealed sub-assemblies have been connected. This is necessary to insure optimum dehydration and maximum moisture protection of the refrigerant system.

#### CAUTION—LIQUID INDICATOR

Under normal conditions, the liquid indicator will show clear with about 2.0 to 2.5 pounds of refrigerant in the system. However, the air conditioner will not produce its best performance until 3.25 lbs. of refrigerant are in the Pontiac system and 3.0 lbs. in the Tempest system. *Do not overcharge with refrigerant* as this will result in extremely high head pressures and the compressor safety valve will "blow".

## DEPRESSURIZING THE SYSTEM

Anytime the system is to be opened, it must first be depressurized. Depressurize the system as follows:

1. Remove caps from suction and discharge valve gauge fittings on compressor.

2. With both valves on the manifold gauge set J-5725-01 closed (clockwise), attach manifold to compressor using J-5420 Schrader valve adapter at the suction gauge fitting and J-6163 Schrader valve adapter at the discharge gauge fitting.

3. Crack open the high pressure valve on manifold gauge set to allow slow escape of refrigerant from the system through the manifold gauge set and out the center fitting and hose. (Place end of hose in clean container.) If oil drips from the hose into the container, refrigerant is escaping too rapidly.

4. When hissing ceases (indicating all refrigerant has escaped) close high pressure valve on manifold gauge set by turning valve clockwise.

## EVACUATING THE SYSTEM

When the refrigeration system is depressurized and opened for service, some air will enter the lines regardless of how quickly the openings are capped. In order to remove this air and as much as possible of the moisture it contains, the complete system must be "evacuated". Evacuating is merely the process of removing all air from the system, thereby creating a vacuum in the system.

***CAUTION: Under no circumstances should alcohol be used in the system in an attempt to remove moisture regardless of the successful use of alcohol in other refrigeration systems.***

#### PREPARATIONS FOR EVACUATING COMPLETE SYSTEM

Due to the arrangement of the compressor fittings assembly, the system may be evacuated through the manifold gauge set using the following procedure.

1. Check low pressure gauge for proper calibration with the gauge disconnected from the refrigeration system. Be sure that the pointer on the gauge indicates to the center of "O". Tap the gauge a few times lightly to be sure pointer is not sticking. If necessary, calibrate as follows:

a. Remove the cover from the gauge.

b. Holding gauge pointer adjusting screw firmly with one hand, carefully force pointer in the proper direction in the proper amount to position the pointer through the center of the "O" position. Tap gauge lightly a few times to be sure pointer on gauge is not sticking. Replace gauge cover.

2. If gauge set is not already connected to the compressor, connect gauge set to compressor as follows:

a. Close hand shut-off valves on gauge set by turning clockwise.

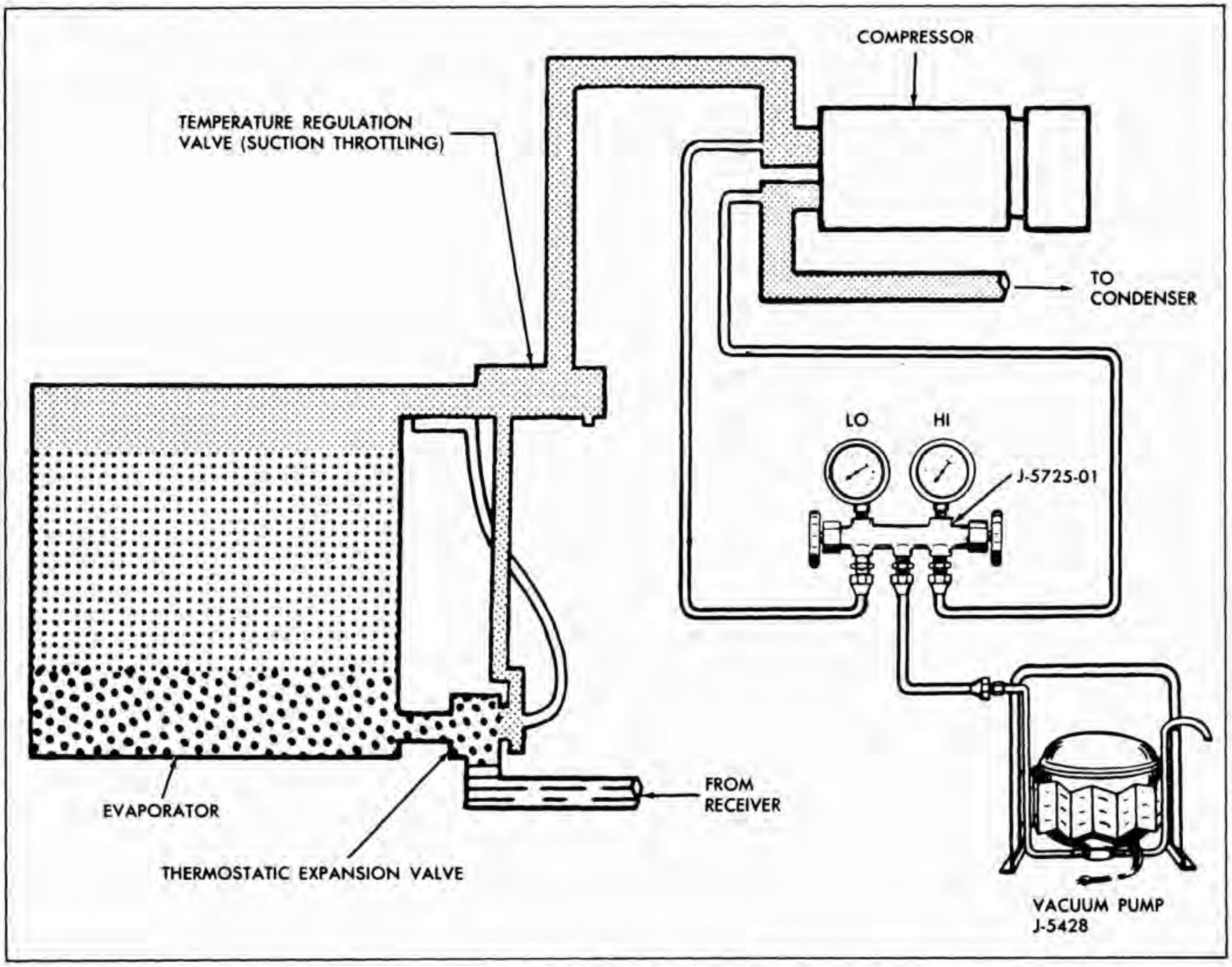



Fig. 6-32 Schematic Showing Connections and Tools for Evacuating Refrigeration System

b. Remove caps from gauge fittings on compressor suction and discharge valves.

c. Attach Schrader valve adapter J-5420 to end of hose from low pressure gauge and connect this adapter fitted hose to the discharge valve gauge.

d. Attach Schrader valve adapter J-6163 to end of hose from high pressure gauge and connect this adapter fitted hose to the discharge valve gauge fitting.

3. Attach a flexible gauge hose to the center fitting of the gauge set and attach the other end of this hose to the vacuum pump J-5428. (See Fig. 6-32).

4. The system can now be evacuated as follows:

## EVACUATING COMPLETE SYSTEM

1. Turn hand shut-off valve on low pressure gauge of gauge set to the full clockwise position.

2. Slowly turn valve on high pressure gauge counterclockwise from the full clockwise position letting any pressure build up escape completely. Close high pressure valve.

3. Check oil level in vacuum pump and add Frigidaire 150 viscosity oil if necessary, to bring to proper level. *Make sure* dust cap on discharge side of vacuum pump has been removed.

4. Start the vacuum pump and *slowly* open the low and high pressure sides of the manifold gauge set to avoid forcing oil out of the refrigeration system and the pump. Pressure is now being reduced on both sides of the refrigeration system.

NOTE: If oil is blown from the pump, it should be refilled to proper level with Frigidaire 150 viscosity oil as indicated under BASIC AIR CONDITIONING INFORMATION.

5. Observe low pressure gauge and operate vacuum pump until gauge shows 26-28" vacuum. Continue to run pump for ten additional minutes.

NOTE: In all evacuating procedures the specification of 26-28" of vacuum is used. This evacuation can only be attained at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specification should be lowered by one inch of mercury vacuum. For example, the specification for altitudes of 5000 feet elevation would only be 21-23" of vacuum.

If vacuum cannot be pulled to minimum specification for the specified altitude, it indicates a leak in the system, gauge connections or a defective vacuum pump. In this case, it will be necessary to check for leaks as outlined below after a small amount of refrigerant has been added to the low side of the system.

a. Turn the hand shut-off valves at the high pressure gauge and suction gauge of the gauge set to the full clockwise position with the vacuum pump operating, then stop pump.

b. Connect flexible line from center fitting of gauge set to refrigerant drum (drum should be at room temperature).

NOTE: It may be necessary to use reducer J-5462-4 with sealing washer J-5462-3 and fitting J-5462-9 to attach flexible hose to refrigerant drum.

c. Open shut-off valve on drum and loosen flexible line fitting at center fitting on gauge set so that refrigerant will purge all air from line. Tighten flexible fitting when certain all air has been purged from line.

d. Open suction valve on gauge set. This will allow refrigerant to pass from the drum into the system. When pressure stops rising, close suction valve on gauge set and valve at refrigerant drum. (As refrigerant drum is at room temperature, only a small refrigerant charge will enter the system.)

e. Using leak detector J-6084, check all fittings in the system, compressor shaft seal and on the gauge set for evidence of leakage. When general area of leak has been found with the test torch, a liquid leak detector may be helpful in locating the exact point of leakage. After leak has been corrected, evacuate the system again.

6. Turn hand shut-off valve at high pressure gauge of gauge set to full clockwise position with vacuum pump operating, then stop pump. Carefully check low pressure gauge to see that vacuum remains constant. If vacuum reduces, it indicates a leak in system or gauge connections. See "a" through "e" in step 5 above for method of locating leak.

## CHARGING THE SYSTEM

The system should be charged only after being evacuated as outlined in EVACUATING THE SYSTEM.

### REFRIGERANT-12 DRUM METHOD

1. Connect center flexible line of gauge set to refrigerant drum.

NOTE: It may be necessary to use reducer J-5462-4 with sealing washer J-5462-3 and fitting J-5462-9 to attach flexible line to refrigerant drum. (See Fig. 6-33).

2. Place refrigerant drum in a pail of water which has been heated to a maximum of 125°F.

***CAUTION: Do not allow temperature of water to exceed 125°F. High temperature will cause excessive pressure and possible softening of the fusible safety plugs in the refrigerant drum. It may not be necessary to use hot water if a large drum is used (over approximately 100 lbs.).***

3. Place refrigerant drum (in pail of water) on scales (bathroom or commercial, preferably commercial) as shown in Fig. 6-33.

***CAUTION: Do not turn refrigerant drum upside down as this would allow liquid refrigerant to enter compressor, which may cause damage.***

4. If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and "crack" valve on refrigerant drum to evacuate air from line. Retighten line at center fitting and record exact weight of refrigerant tank in water on the scales.

5. Open valve on refrigerant drum and both valves on gauge set to allow refrigerant to flow into the system. Continue charging until the scales show that 3.25 lbs. for Pontiac and 3.0 lbs. for Tempest of refrigerant have been transferred from refrigerant drum to the system.

NOTE: If full charge cannot be attained, close both valves on gauge set, start engine, turn air conditioner blower on "HI", and position temperature control to full cold position. Open low pressure valve on gauge set slowly and leave open until full charge of refrigerant is taken in.

***CAUTION: Observe high pressure gauge while charging with compressor running. Shut off engine***

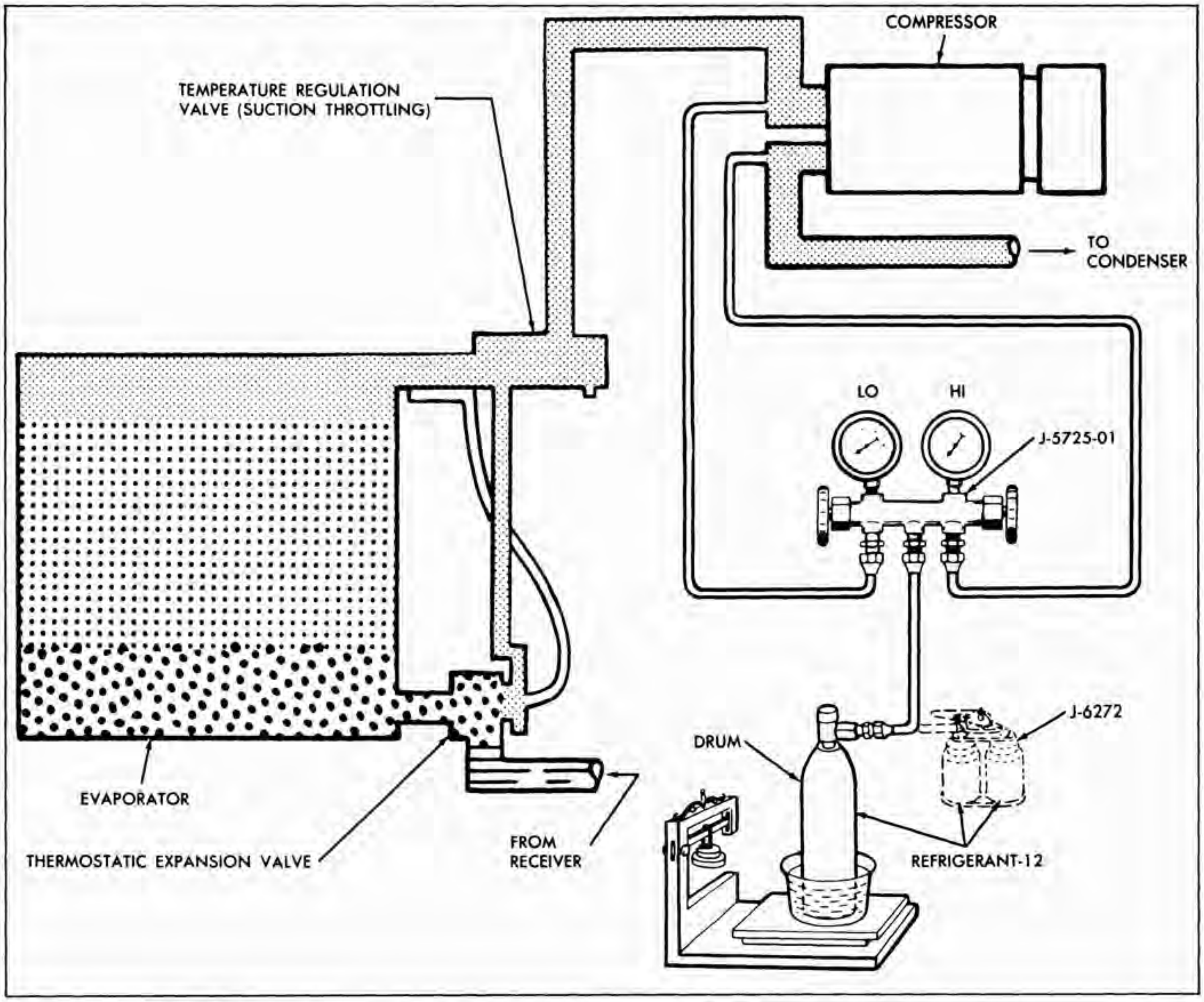



Fig. 6-33 Schematic Showing Connections and Tools for Charging Refrigeration System

***if pressure exceeds 350 psi. A large fan placed in front of the car will help reduce excessively high head pressure.***

6. Close both valves on gauge set (high pressure valve will already be closed if charging was completed by running compressor) and close valve on refrigerant drum.

NOTE: If the engine was used to complete the refrigerant charge into the system, close valve on refrigerant drum to permit compressor to draw any refrigerant left in the line from the drum to the center fitting of the gauge set, then close the low pressure valve on the gauge set.

7. Operate engine at 1500 rpm with temperature control at full cold position and blower control on "HI" speed. After ten minutes of operation, observe appearance of refrigerant in liquid indicator. If bubbles are observed, open low pressure gauge valve and valve on refrigerant drum to allow more refrigerant to enter system. Close valve when liquid indicator clears up.

NOTE: If ambient air temperature is below 70°F. when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Ambient air temperature must be 70°F. or above to make an accurate check. In no case should the system be charged with more refrigerant than 3.25 lbs. for Pontiac and 3.0 lbs. for Tempest.

8. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

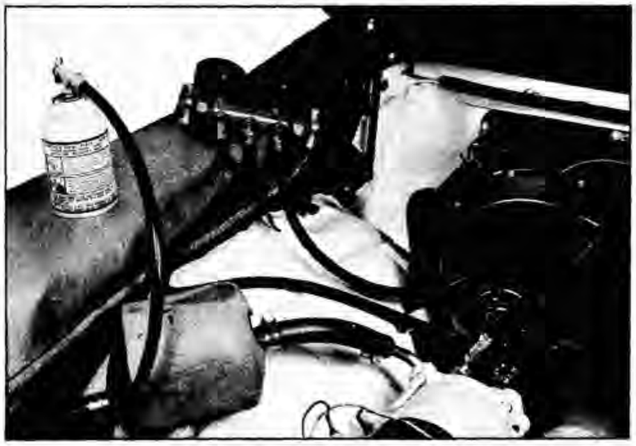


Fig. 6-34 Charging the System—Pontiac Shown (Disposable Single Can Method)

9. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on valves.

NOTE: A considerable amount of refrigerant will collect in the high pressure line since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure gauge fitting at the compressor with a shop cloth before disconnecting the Schrader valve from the gauge fitting to prevent damage or injury to personnel.

10. Using leak detector J-6084, check complete system for leaks, as explained under LEAK DETECTORS.

#### REFRIGERANT-12 DISPOSABLE CAN METHOD

After having depressurized, repaired (if necessary), and evacuated the refrigeration system, the system may be charged as follows when using Refrigerant-12 disposable cans:

1. Obtain four one pound cans of Refrigerant-12 for Pontiac and three one pound cans for Tempest. (Actually the net weight of refrigerant is 15 ozs. per can.)

2. Mount three cans in J-6272 No. 3 Multi-opener or attach J-6271 Fitz-All Valve (single can opener valve) on one can.

***CAUTION: MAKE SURE OUTLET VALVE ON OPENER IS CLOSED (CLOCKWISE) BEFORE INSTALLING OPENER.***

a. If the J-6272 No. 3 Multi-opener is used, raise locking lever, position three cans of refrigerant and force the locking lever down to secure cans and at the same time puncture the top of the can to make it ready for charging.

b. If the J-6271 Fitz-All Valve is used, back off the valve from the can top retainer, slip the valve onto the can and turn the valve into the retainer until tight. Do not open outlet valve during this operation as turning the valve into the retainer punctures the top of the can to make it ready for charging.

3. Connect center flexible line of gauge set to the fitting on a can opener valve. (See Fig. 6-34).

NOTE: If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and "crack" valve at can opener (for a second or two) to force air from the line. Retighten line at center fitting.

4. Open valve on No. 3 Multi-opener (or on single can) and also low pressure and high pressure valves on manifold gauge set. Leave can valve open until all refrigerant has entered the refrigeration system. Close valve on can.

a. If the system is charged using single cans and the J-6271 valve, disconnect valve from can leaving valve closed to flexible line to the center fitting of the manifold gauge set. Install valve on a new and full disposable can of Refrigerant-12 and repeat until three and one-half of the four "one pound" cans of refrigerant have been used to charge the system for Pontiac and only three one pound cans for Tempest. Since the "can" only contains 15 ozs. of refrigerant, three cans will charge the Tempest system with three ozs. less than the required refrigerant charge of 3.0 pounds.

b. If the system is charged using the 3 can Multi-opener J-6272, close the valve on the opener after all cans are empty. This will charge a Tempest system. For Pontiac, release the locking lever and discard the three empty cans. If this tool will be used to complete the charge with one additional can to bring the required refrigerant charge to 3.25 lbs. for Pontiac, then leave two of the cans just emptied in position, locate the one full can and lock the lever into place. (The empty cans balance the assembly and prevent the loss of refrigerant out the open "series" passage. Allow approximately one half of the contents of the fourth can to enter the system.)

NOTE: Align the pierced hole in the empty cans with the punch in the cover of the tool.

c. If the J-6271 Fitz-All Valve for single cans is available, complete charging as explained in 4a above.

5. Close valves on manifold gauge set.

6. Operate engine at 1500 rpm with temperature control at full cold position and blower control on "HI" speed. After ten minutes of operation, observe appearance of refrigerant in liquid indicator.

NOTE: If ambient air temperature is below 70°F. when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Ambient air temperature must be 70°F. or above to make an accurate check. In no case should the system be charged with more than the specified amount of refrigerant.

7. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

8. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on valves.

NOTE: A considerable amount of refrigerant will collect in the high pressure line since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure fitting at compressor with a shop cloth before disconnecting Schrader valve from gauge fitting to prevent damage or injury to personnel.

9. Using leak detector J-6084, check complete system for leaks as explained under LEAK DETECTORS.

### *SERVICE STATION METHOD*

### INSTALLING J-8393

1. Be certain compressor hand shut-off valves are closed to gauge fittings (counterclockwise).

2. Be certain all valves on charging station are closed.

3. Connect high pressure gauge line (with J-6163 attached) to compressor high pressure gauge fitting.

4. Turn high pressure hand shut-off valve one turn clockwise, and high pressure control (2) one turn counterclockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line to low pressure gauge fitting on compressor. (Place J-6163 adapter on hose, then attach adapter to gauge fitting.)

### FILLING CHARGING CYLINDER

1. Open control valve on refrigerant container.

2. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

3. Bleed charging cylinder top valve (behind control panel) only as required to allow refrigerant to enter cylinder. When refrigerant reaches desired charge level (3.25 lbs. for Pontiac and 3.0 lbs. for Tempest), close valve at bottom of charging cylinder and be certain cylinder bleed valve is closed securely.

NOTE: While filling the cylinder, it will be necessary to close the bleed valve periodically to allow boiling to subside so that refrigerant level in the charging cylinder can be accurately read.

### CHARGING THE SYSTEM

1. Turn on vacuum pump and open vacuum control valve (3).

2. With refrigeration system purged of refrigerant, run pump until 26-28 inches of vacuum is obtained. Continue to run pump for 15 minutes after the system reaches 26-28 inches vacuum.

NOTE: In all evacuating procedures, the specification of 26-28 inches of Mercury vacuum is used. These figures are only attainable at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specifications should be lowered by 1 inch. Example: at 5000 ft elevation, only 21 to 23 inches vacuum can normally be obtained.

3. If 26-28 inches vacuum (corrected to sea level) cannot be obtained, close vacuum control valve (3) and shut off vacuum pump. Open refrigerant control valve (4) and allow ½ pound of refrigerant to enter system. Locate and repair all leaks.

4. After evacuating for 15 minutes, add ½ pound of refrigerant to system as described above. Purge this ½ pound and re-evacuate for 5 minutes. This second evacuation is to be certain that as much contamination is removed from the system as possible.

5. After evacuating as above, system is ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount for a full charge, fill to the proper level.

6. Close low-pressure valve (1). Fully open refrigerant control valve (4) and allow all liquid refrigerant to enter system. When full charge of refrig-

erant has entered system (3.25 lbs. for Pontiac and 3.0 lbs. for Tempest), turn off refrigerant control valve (4) and close both hand shut-off valves.

7. If full charge of refrigerant will not enter system, close high pressure control and refrigerant control valve (4). Start engine and run at slow idle with compressor operating. Crack refrigerant control valve (4) and low pressure control (1). Watch low side gauge and keep gauge below 50 psi by regulating refrigerant control valve (4). Closing valve will lower pressure. This is to prevent liquid refrigerant from reaching the compressor while the compressor is operating. When required charge has entered system, close refrigerant control valve (4) and close low pressure control (1).

8. System is now charged and should be performance tested before removing gauges.

## ADDING REFRIGERANT

The following procedure should be used in adding small amounts of refrigerant that may have been lost by leaks, or while opening system for servicing the compressor. Before adding refrigerant to replace that lost by leaks, check compressor oil level and add oil if necessary. See ADDING OIL.

NOTE: This procedure will only apply if the air inlet temperature is above 70°F. at the condenser.

1. Remove caps from compressor suction and discharge valve gauge fittings. Attach gauge set to gauge fittings making sure Schrader adapter J-5420 is between low pressure gauge hose and suction valve gauge fitting, and J-6163 is between high pressure gauge hose and discharge valve gauge fitting.

2. Start engine, move air conditioning temperature control to full cold and position blower on "HI" speed. Operate for ten minutes at 1500 rpm to stabilize system.

3. Observe the refrigerant through the glass cover of the liquid indicator with the system operating to see if there are any bubbles evident.

a. If no bubbles are seen, then bleed system slowly through the discharge valve until bubbles appear in the liquid indicator. Add one-half pound of refrigerant as explained under CHARGING THE SYSTEM.

b. If bubbles are visible in the liquid indicator, with the temperature control at the full cold position and the blower on "HI" speed, it indicates partial or complete plug in a line or a shortage of refrigerant or both. Correct condition. Add refrigerant until the sight glass clears, then add another one-half pound of refrigerant as explained below.

4. Attach flexible hose from center fitting of gauge set loosely to refrigerant drum or on disposable can valves. Open high and low pressure valves on the gauge set slightly to purge pressure gauge lines of air. Tighten fitting of refrigerant drum, or can, when satisfied that all air has been removed from gauge lines. Close (clockwise) both hand shut-off valves of gauge set.

5. Partially charge system as follows:

a. Refrigerant-12 Drum Method

(1) Place pail containing hot water that does not have a temperature exceeding 125°F. on scales, place refrigerant drum in pail containing water, note weight, and open only low pressure valve on gauge set.

(2) Start engine, move temperature control to full cold position and place blower on "HI" speed. Operate engine for ten minutes at 1500 rpm to stabilize system.

(3) With compressor operating, open valve on refrigerant drum slowly and allow refrigerant to flow into system (through suction side of gauge set) until liquid indicator clears up and immediately shut off valve at gauge set or on refrigerant drum. Check weight of refrigerant drum and pail of water. Then open suction valve on gauge set (or refrigerant drum) slowly and add one-half pound of refrigerant. Note total amount of refrigerant added.

b. Refrigerant-12 Disposable Can Method

(1) Make sure the outlet valve on the J-6271 Fitz-All Valve is fully clockwise and attach the J-6271 to a "one pound" can of refrigerant as follows: back off the valve from the top of the retainer, slip the valve onto the can and turn the valve into the retainer until tight. *Do not* open outlet valve during this operation as turning the valve into the retainer punctures the top of the can to make it ready for charging.

(2) Connect center flexible line of gauge set to the fitting of the valve (Fig. 6-34).

(3) Start engine, move temperature control to full cold position and place blower knob on "HI" speed. Operate engine for ten minutes at 1500 rpm to stabilize system.

(4) With compressor operating, open valve on refrigerant can slowly and allow refrigerant to flow into system (through suction side of gauge set) until liquid indicator clears up and immediately shut off valve at gauge set and on refrigerant can. Check weight of can and valve assembly and record, then add one-half pound refrigerant. It may be necessary to attach another can to obtain the additional one-half pound refrigerant.

c. Service Station Method

1. Installing J-8393.

(a) Be certain compressor hand shut-off valves are closed to gauge fittings (counterclockwise).

(b) Be certain all valves on charging station are closed.

(c) Connect high pressure gauge line (with J-6163 attached) to compressor high pressure gauge fitting.

(d) Turn high pressure hand shut-off valve one turn clockwise, and high pressure control (2) one turn counterclockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line to low pressure gauge fitting on compressor. (Place J-6163 adapter on hose, then attach adapter to gauge fitting.)

2. Filling charging cylinder.

(a) Open control valve on refrigerant container.

(b) Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

(c) Bleed charging cylinder top valve (behind control panel) only as required to allow refrigerant to enter cylinder. When refrigerant reaches full level of 5 pounds, close valve at bottom of charging cylinder and be certain cylinder bleed valve is closed securely.

NOTE: While filling the cylinder, it will be necessary to close the bleed valve periodically to allow boiling to subside so that refrigerant level in the charging cylinder can be accurately read.

3. Partial charging.

(a) With charging station installed as previously described, remove low pressure gauge line at compressor.

(b) Crack open high (2) and low (1) pressure control valves, and allow refrigerant gas to purge from system. Purge slow enough so that oil does not escape from system along with refrigerant.

(c) Start engine, move temperature control to full cold position and place blower knob on "HI" speed. Operate engine for ten minutes at 1500 rpm to stabilize system.

(d) With compressor operating, open refrigerant control valve (4) slowly and allow refrigerant to flow into system (through suction side of gauge set) until liquid indicator clears up and immediately shut off valve (4) at gauge set. Then open valve (4) slowly and add one-half pound of refrigerant. Note total amount of refrigerant added.

6. Close all valves (refrigerant drum or can and gauge set).

7. Test for leaks and make operational check of system as outlined under OPERATIONAL TEST.

## CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL

The design and configuration of the six cylinder axial compressor requires a radical departure from oil checking methods, as has been the practice on the five cylinder axial compressor. It is, therefore, very necessary that these procedures be adhered to for adequate oil supply for the compressor.

The refrigeration system with the six cylinder axial compressor requires 11 fluid ozs. of 525 viscosity oil. After the system has been operated, oil circulates throughout the system with the refrigerant. Hence, while the system is running, oil is leaving the compressor with the high pressure gas and is returning to the compressor with the suction gas.

NOTE: The oil level in the compressor should *not* be checked as a matter of course, such as is done in the car engine crankcase.

In general, the compressor oil level should be questioned only in cases where there is evidence of a major loss of system oil such as:

a. Broken hose or severe hose fitting leak.

b. Oil sprayed in copious amounts under the hood due to a badly leaking compressor seal(s).

c. Collision damage to refrigeration system components.

### REPLACING REFRIGERATION SYSTEM COMPONENTS OTHER THAN COMPRESSOR

When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor. The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* the following amount for the refrigeration system component being changed.

a. Evaporator—2 fluid ozs.

b. Condenser—1 fluid oz.

c. Receiver liquid indicator assembly—1 fluid oz.

Neglect any fluid oil coating loss in case of line change.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, *plus* the amount shown above for the respective component replacements.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

## REMOVING MALFUNCTIONING COMPRESSOR AND INSTALLING NEW COMPRESSOR

The compressor removed must be closed immediately.

If the system has been or can be operated for more than two minutes, circulation of oil from the compressor to other components of the system will require adjustment of the oil charge in the new compressor as explained above, under REPLACING COMPONENTS OTHER THAN COMPRESSOR.

After draining and measuring the oil from the crankcase and head of the compressor removed, the amount that has migrated to other parts of the system can be determined by subtracting the amount drained from the original oil charge of 11 fluid ozs. The amount of oil *equal to this loss* shall be drained from the new compressor assembly before it is installed.

### REPLACING AN OPERABLE COMPRESSOR

After idling compressor (on car) to be replaced for 10 minutes at 1000-1500 engine r.p.m., at maximum refrigeration and blower on high speed: *DO NOT* add any more oil to the compressor than is necessary or maximum cooling will be reduced.

1. Compressor replaced with a service compressor assembly.

a. Remove compressor and place in a horizontal position with drain plug downward, drain compressor, measure quantity of oil drained and then discard it.

b. Drain oil from replacement compressor and save it.

c. (1) If amount of oil drained in "a" is *more* than 4 ozs. place into the new compressor the same amount of oil as drained from the replaced compressor.

(2) If amount of oil drained in "a" is *less* than 4 ozs., place 6 ozs. of oil in the replacement compressor.

d. Install compressor.

2. Compressor replaced with a field repaired (overhauled) compressor.

a. Proceed as in section 1 above, and then add one extra oz. of oil. (More oil is retained in a drained compressor than one that has been rebuilt.)

### REPLACING AN INOPERATIVE COMPRESSOR

In the case where it is not possible to idle the compressor to be replaced to effect oil return to it, the following will apply. DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove compressor from car, drain and measure the oil.

2. If amount drained in "1" above is *more* than 1½ fluid ozs., subtract this amount drained from the original oil charge of 11 ozs. to obtain "oil loss". Take the new compressor assembly and drain from it the amount of "oil loss" above; provided the refrigeration system shows no evidence of a major leak, indicating that little or no oil has been lost from the system. (Minor leak indicating very slow leakage.)

3. If the amount drained in "1" above is *less* than 1½ ozs. of oil and/or system appears to have lost an excessive amount of oil then:

a. Disconnect the thermostatic expansion valve outlet connection (evaporator inlet).

b. Plug suction line connection at suction throttle valve outlet.

c. Disconnect oil bleed line at suction throttle valve, using care not to damage the line.

d. Connect a cylinder of Refrigerant-12 regulated to not exceed 125 p.s.i. to this oil bleed fitting, to force any retained oil from the evaporator out the evaporator inlet fitting. (Reverse flush the evaporator.) Catch any oil reverse flushed in this manner. If oil flushed from the system appears clean, install new compressor with 6-7 ounces of oil.

4. If oil drained in "1" above contains any foreign material such as chips, or there is evidence of moisture in the system, replace the receiver-liquid-indicator assembly and flush all component parts, or replace if necessary. After flushing refrigeration system in this manner, the full oil charge should be left in the new service compressor or 11 ozs. installed in an overhauled or repaired compressor.

### *COMPRESSOR REMOVAL*

1. Connect the high and low pressure gauge lines from the gauge set to the respective connections on the old compressor on the car. Be sure valves on gauge set are fully clockwise to close gauge set to center fitting, that J-5420 or J-6163 Schrader adapter is between low pressure hose and suction valve gauge fitting and also at the discharge gauge fitting.

2. Remove the flare nut from center connection on gauge manifold or the plug in the gauge line attached to the center connection. Wrap the line at the outlet with a cloth to protect persons and car surfaces from oil or refrigerant.

3. Slowly depressurize refrigeration system.

4. While system is depressurizing remove clutch assembly and coil from old compressor as outlined (under COMPRESSOR SEAL REPLACEMENT). If parts are in good condition and not oil soaked, lay them aside on a clean surface as they may be installed on the new compressor.

5. After the system is *competely* depressurized, very slowly loosen screw which retains compressor fittings assembly to compressor. As screw is being loosened, work fittings assembly back and forth to break seal and carefully bleed off any remaining pressure.

***CAUTION: High pressure may still exist at the discharge valve. If this pressure is released too rapidly there will be a considerable discharge of refrigerant and oil.***

6. When all pressure has been relieved, remove fittings assembly and O-ring seals.

7. Immediately cover compressor openings. A simple way is with a plate (similar to the one on the new compressor) which can be attached with the valve body screw using the O-rings to provide a seal.

8. Disconnect compressor clutch coil wire and remove compressor mounting plates to bracket bolts (front and rear.)

9. If there is any possibility that broken parts from the compressor got into the discharge line or the condenser, all refrigeration system parts should be cleaned and a new receiver and liquid indicator assembly should be installed.

10. Drain all oil from the compressor just removed in a clean dry container and replace compressor drain plug screw. Measure amount of oil drained. See CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL.

### *COMPRESSOR REPLACEMENT*

NOTE: Before installing a new compressor, rotate the compressor shaft four or five times. This permits proper lubrication of the compressor seal over all its surface. Before the compressor clutch is mounted to the new compressor, wipe the front face of the compressor thoroughly with a clean dry cloth and, if necessary, clean front of compressor with a solvent to remove any excess oil. The cleaning of the compressor in this manner will prevent any oil from being thrown onto the clutch surface, which would cause slippage and eventual clutch failure.

1. Stamp refrigerant charge of the refrigerant system (3.25 lbs. for Pontiac and 3.0 lbs. for Tempest) on new compressor in space on plate provided for this information.

NOTE: Follow procedure for replacing oil in new compressor as explained under REMOVING MALFUNCTIONING COMPRESSOR AND INSTALLING NEW COMPRESSOR.

2. Install new compressor on car leaving compressor fittings opening cover plate on the compressor.

3. Remove cover plate over compressor openings very slowly to bleed off any pressure that may still be in the compressor.

***CAUTION: New compressors are charged with a mixture of nitrogen and refrigerant and 11 fluid ozs. of Frigidaire 525 viscosity oil. If the cover is removed too rapidly, the oil will be blown out violently with the sudden release of pressure.***

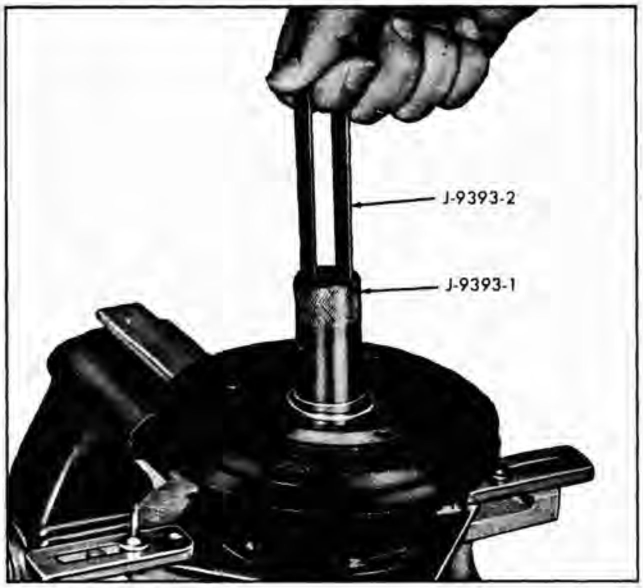



Fig. 6-35 Removing Shaft Seal Seat

4. Install coil and clutch parts on new compressor if not already installed.

5. Evacuate, charge and perform OPERATIONAL TEST.

## COMPRESSOR SHAFT SEAL ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leaking or broken shaft seal. The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, plus the amount shown above for the respective component replacements.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.


Fig. 6-36 Removing Shaft Seal Assembly

### *REMOVE AND REPLACE*

1. Depressurize refrigeration system.

2. Remove hub and drive plate assembly, and shaft key.

3. Remove shaft seal seat retaining ring, using J-4245 (No. 23 Truarc pliers).

4. Remove shaft seal seat, using J-9393-1 and 2 to grasp flange on seal seat (Fig. 6-35). Pull straight out at end of tool to remove seal seat.

5. Engage tabs on compressor shaft seal assembly with locking tangs on J-9392 seal installer and remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft (Fig. 6-36).

6. Remove O-ring from interior of front head casting bore using J-9553. (A wire with a hook formed on the end may be used. This hook may be made in a manner as shown in Fig. 6-37).

7. Replace shaft seal assembly by reversing above procedure, making sure shaft seal retainer ring is positioned in the first *full* groove to properly retain the seal seat. The metal locking grove that can be seen from the shaft end is a *land* and not a groove.

NOTE: Immerse shaft seal in clean compressor oil before installing. This will help to prevent shaft shoulder cutting O-ring.

Fig. 6-37 Removing O-Ring Seal

8. Evacuate and charge refrigeration system.

9. Check oil level and add compressor oil as necessary.

10. Perform operational test.

## COMPRESSOR ASSEMBLY

### OVERHAUL

The procedure for completely overhauling the compressor assembly used on the Cool Pack Conditioner is exactly the same as that for the compressor used on Circ-L-Aire conditioner systems, therefore, refer to the Circ-L-Aire Conditioner Section for this service operation.

## PONTIAC CONDENSER ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leak or collision damage to condenser.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* one fluid ounce for the condenser.

3. If oil quantity drained from compressor is *less* than 4 ozs., replace into compressor 6 fluid ozs. of clean oil, *plus* one fluid ounce for condenser.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### REMOVE AND REPLACE CONDENSER

1. Depressurize the refrigeration system.

2. Remove right and left headlamp doors.

3. Remove right and left headlamp assemblies.

4. Remove upper grille bar.

5. Remove compressor discharge hose clamp.

6. Remove hose from condenser inlet using J-9508. Plug openings.

7. Disconnect connection at condenser outlet and plug openings (Fig 6-38).

8. Remove battery and battery tray.

9. Disconnect right and left horns and remove condenser.

10. Replace condenser by reversing the above procedure, using a new rubber O-ring seal well lubricated with clean compressor oil at each connection.

11. Evacuate and charge system.

12. Check compressor oil level and add oil as necessary.

13. Perform operational test.

## PONTIAC RECEIVER AND LIQUID INDICATOR ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leak or collision damage to receiver.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

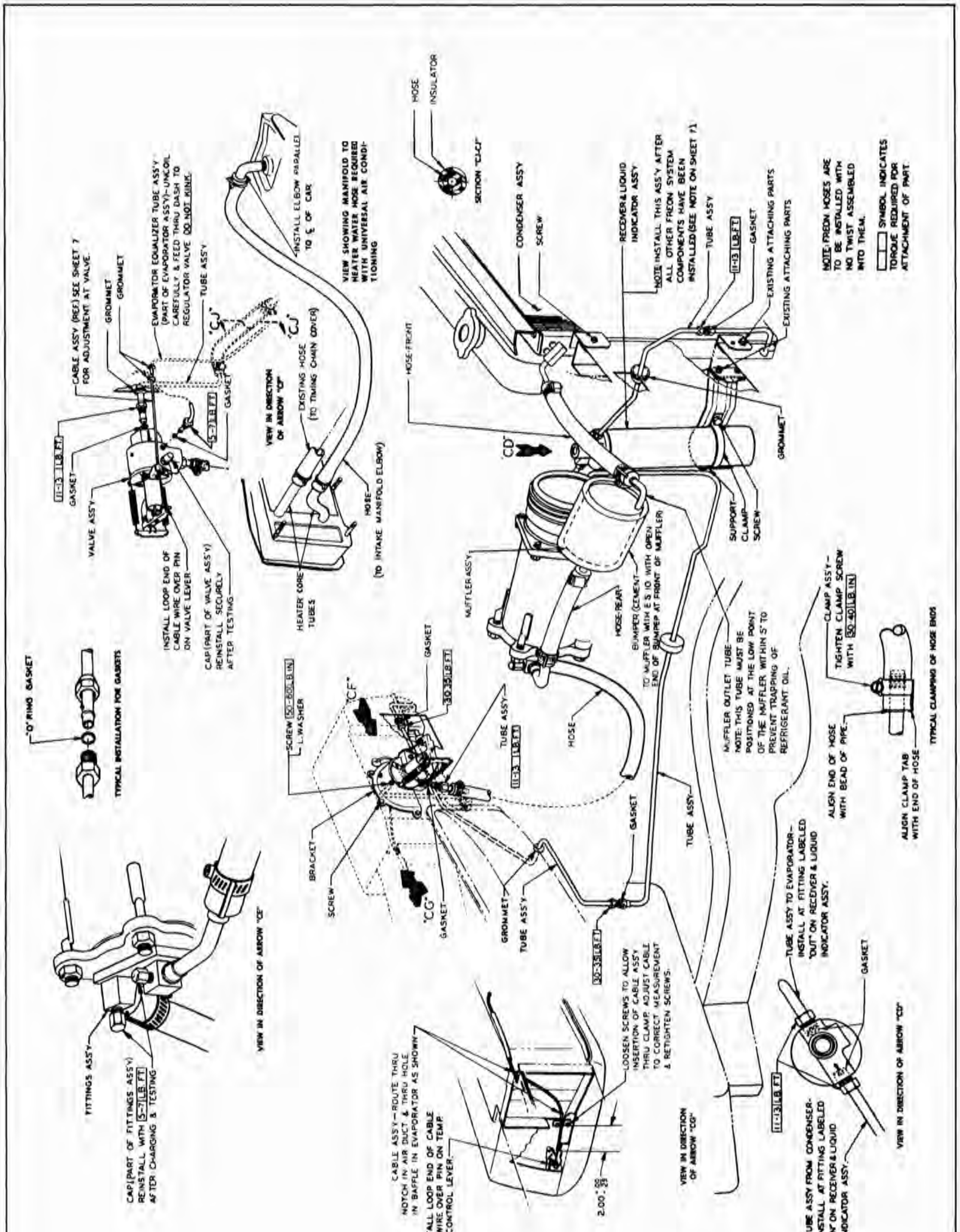



Fig. 6-38 Reference Illustration—Pontiac Cool Pack Refrigeration System

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is *more* than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, *plus* one fluid ounce for the reciever and liquid indicator assembly.

3. If the oil quantity drained from the compressor is *less* than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil *plus* one fluid ounce for the receiver and liquid indicator.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE RECEIVER*

1. Depressurize the system.

2. Disconnect the inlet and outlet connection at the receiver and liquid indicator assembly and plug all openings.

3. Loosen receiver and liquid indicator assembly clamp screw and remove assembly.

4. Replace the receiver and liquid indicator assembly by reversing the above procedure, using new rubber O-ring seals well lubricated with clean compressor oil at each connection.

5. Evacuate complete system.

6. Charge complete system.

7. Perform operational test.

## PONTIAC RESISTOR ASSEMBLY

### *REMOVE AND REPLACE*

1. Depressurize refrigerant system.

2. Remove glove box.

3. Disconnect evaporator drain hose at evaporator.

4. Disconnect evaporator case from mounting brackets.

5. Disconnect air inlet duct at evaporator.

6. Loosen temperature control cable clamps at right side of evaporator, disconnect cable and remove cable from evaporator.

7. Disconnect receiver to evaporator pipe at evaporator.

8. Disconnect evaporator to temperature regulation valve tube at hose (below heater core and case) using J-9508.

9. Disconnect wires at rear of evaporator.

10. Remove eleven screws retaining evaporator lower housing to upper housing.

11. Remove resistor assembly.

12. Replace by reversing the above procedure.

13. Evacuate and charge refrigeration system.

14. Check and adjust temperature control cable.

15. Perform operational test.

## PONTIAC BLOWER SWITCH

### *REMOVE AND REPLACE*

1. Repressurize refrigerant system.

2. Remove glove box.

3. Disconnect evaporator drain hose at evaporator.

4. Disconnect evaporator case from mounting brackets.

5. Disconnect air inlet duct at evaporator.

6. Loosen temperature control cable clamps at right side of evaporator, disconnect cable and remove cable from evaporator.

7. Disconnect receiver to evaporator pipe at evaporator.

8. Disconnect evaporator to temperature regulation valve tube at hose (below heater core and case) using J-9508.

9. Disconnect wires at rear of evaporator.

10. Remove eleven screws retaining evaporator lower housing to upper housing.

11. Remove blower control switch control lever knob.

12. Remove two screws retaining blower switch to upper housing.

13. Disconnect wires at blower switch.

14. Replace by reversing the above procedure.

15. Evacuate and charge refrigeration system.

16. Check and adjust temperature control cable.

17. Perform operational test.

## PONTIAC AND TEMPEST LEAKING SEALS, HOSES OR LINES

### *REMOVE AND REPLACE*

When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in copious amounts due to broken lines or seals.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs., of clean oil.

4. Replace leaking seal, hose, or line.

5. Replace compressor and system components.

6. Evacuate, charge and perform operational test.

## PONTIAC OR TEMPEST THERMOSTATIC EXPANSION VALVE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in copious amounts due to leaking seals or collision damage to valve.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.

4. Replace compressor and system components.

5. Evacuate, charge, and perform operational test.

### *REMOVE AND REPLACE VALVE*

1. Depressurize refrigerant system.

2. Remove glove box.

3. Disconnect evaporator drain hose at evaporator.

4. Disconnect evaporator case from mounting brackets.

5. Disconnect air inlet duct at evaporator.

6. Loosen temperature control cable clamp at right side of evaporator, disconnect cable and remove cable from evaporator.

7. Disconnect receiver to evaporator pipe at evaporator.

8. a. On Pontiac, disconnect evaporator to temperature regulation valve tube at hose (below heater core and case) using J-9508.

b. On Tempest, disconnect evaporator to temperature regulation valve tube using J-9508 (on passenger side of dash shroud).

9. Disconnect wires at rear of evaporator.

10. Remove eleven screws retaining evaporator lower housing to upper housing.

11. Remove two screws from evaporator housing.

12. Remove evaporator core and thermostatic expansion valve as an assembly.

13. Disconnect evaporator inlet pipe at the thermostatic expansion valve and plug openings.

14. Disconnect thermostatic expansion valve capillary tube bulb and equalizer line at evaporator outlet pipe and plug all openings (Fig. 6-39).

15. Remove thermostatic expansion valve, drain any oil from evaporator noting amount, and plug openings.

16. Replace by reversing the above procedure, making sure new rubber O-ring seals, well lubricated with clean compressor oil, are at each thermostatic expansion valve connection.

17. Evacuate and charge system.

18. Check and adjust temperature control cable.

19. Perform operational test.

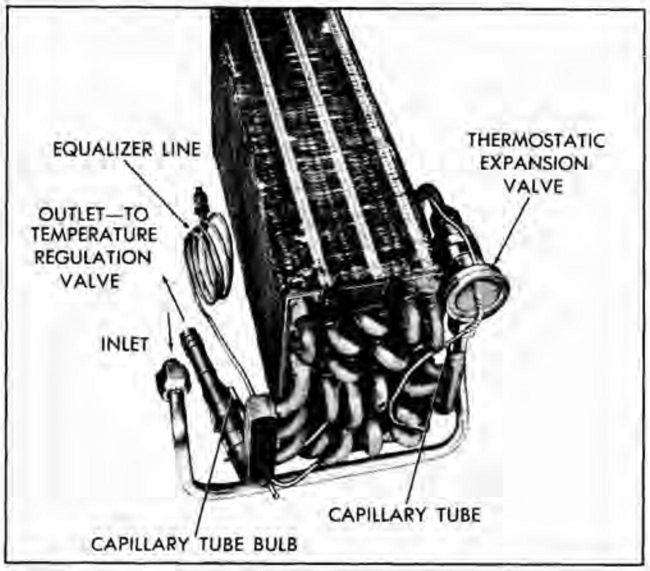



Fig. 6-39 Thermostatic Expansion Valve at Evaporator Outlet Pipe

## PONTIAC OR TEMPEST EVAPORATOR CORE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in copious amounts due to severe leaks or collision damage to evaporator.

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, ***plus*** two fluid ounces of oil for the evaporator core.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, ***plus*** two fluid ounces of oil for the evaporator core.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE EVAPORATOR CORE*

1. Depressurize refrigerant system.

2. Remove glove box.

3. Disconnect evaporator drain hose at evaporator.

4. Disconnect evaporator case from mounting brackets.

5. Disconnect air inlet duct at evaporator.

6. Loosen temperature control cable clamp at right side of evaporator, disconnect cable and remove cable from evaporator.

7. Disconnect receiver to evaporator pipe at evaporator.

8. a. On Pontiac, disconnect evaporator to temperature regulation valve tube at hose (below heater core and case) using J-9508.

b. On Tempest, disconnect evaporator to temperature regulation valve tube using J-9508 (on passenger side of dash shroud).

9. Disconnect wires at rear of evaporator.

10. Remove eleven screws retaining evaporator lower housing to upper housing.

11. Remove evaporator core and thermostatic expansion valve as an assembly.

12. Disconnect pipe at the thermostatic expansion valve and plug openings.

13. Remove evaporator to compressor hose from its end on the evaporator fitting using J-9508 and plug openings.

14. Disconnect thermostatic expansion valve capillary tube bulb and equalizer line at evaporator outlet pipe, drain any oil from evaporator noting amount, and plug openings.

15. Remove thermostatic expansion valve, drain any oil from evaporator noting amount, and plug openings.

16. Replace evaporator core by reversing the above procedure, making sure new rubber O-ring seals, well lubricated with clean compressor oil, are at each thermostatic expansion valve connection.

NOTE: Attach evaporator to compressor hose at evaporator core, making sure hose clamp is properly positioned.

17. Evacuate and charge system.

18. Check and adjust temperature control cable.

19. Perform operational test.

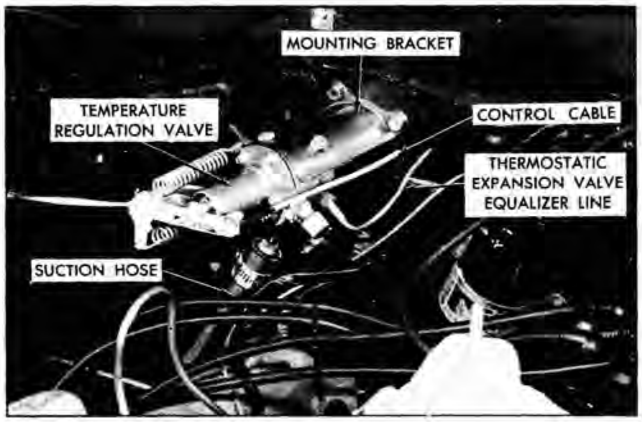



Fig. 6-40 Location of Temperature Regulation Valve—Pontiac

## PONTIAC AND TEMPEST TEMPERATURE REGULATION VALVE

### *REMOVE AND REPLACE*

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor *if oil was sprayed in copious amounts due to leaks or collision damage to valve.*

The amount of oil to put back into the compressor is found as follows: DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE*

1. Depressurize refrigerant system.

2. Disconnect temperature control cable at temperature regulation valve (Figs. 6-40 and 6-41).

3. Disconnect thermostatic expansion valve equalizer tube at temperature regulation valve. Seal openings.

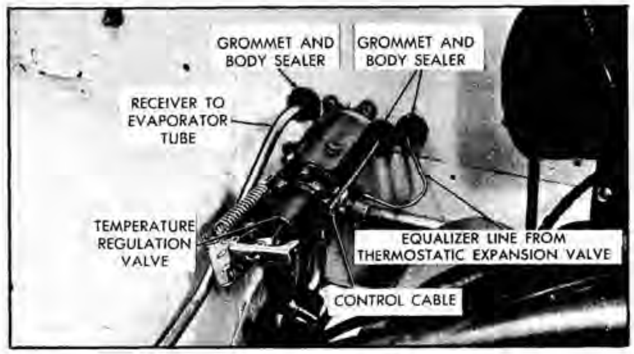



Fig. 6-41 Location of Temperature Regulation Valve—Tempest

4. Disconnect temperature regulation valve to compressor hose at valve. Seal openings.

5. Remove temperature regulation valve bracket.

6. Pull temperature regulation valve into engine compartment far enough to disconnect evaporator to temperature regulation valve tube at valve. Seal openings.

7. Replace by reversing the above procedure.

8. Evacuate and charge refrigeration system.

9. Check and adjust temperature control cable.

10. Perform operational test.

## PONTIAC AND TEMPEST TEMPERATURE REGULATION VALVE

### *OVERHAUL (See Fig. 6-42)*

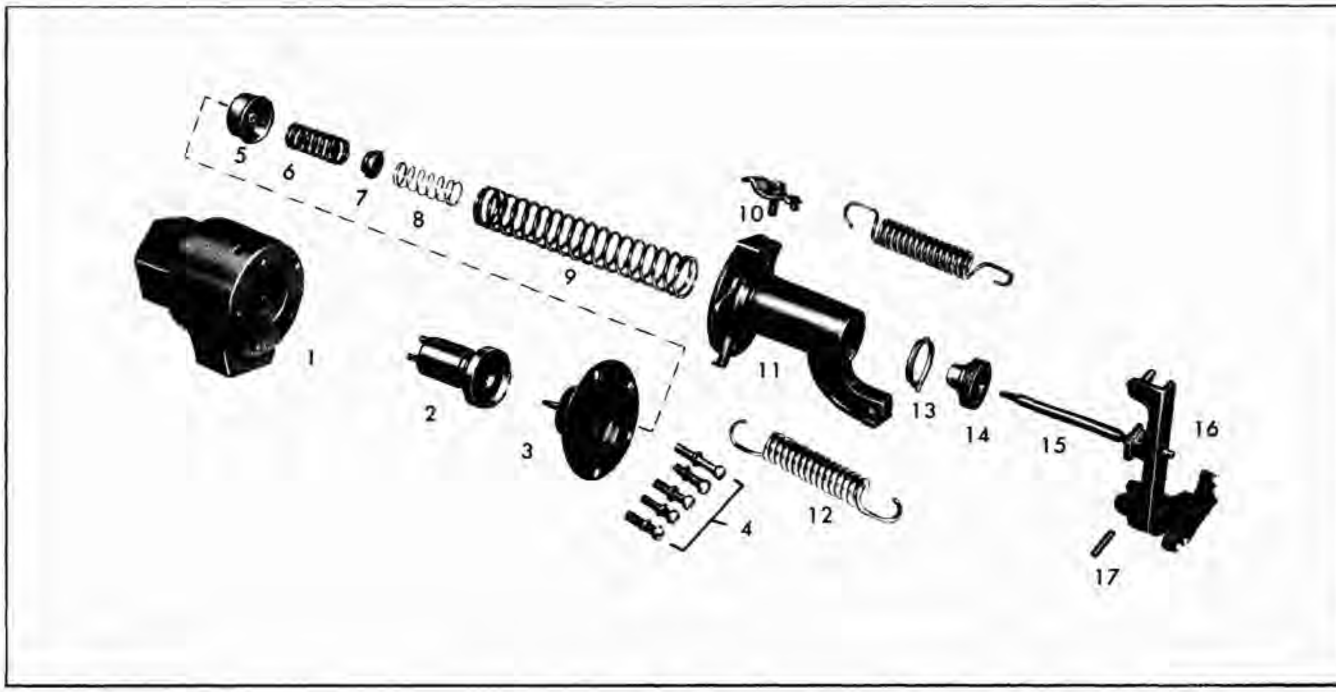
NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor *if oil was sprayed in copious amounts or collision damage to valve.*

The amount of oil to put back into the compressor is found as follows: DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in any empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil.




1. Valve Body
2. Piston
3. Diaphragm
4. Cover to Body Screws
5. Inner Spring Seat and Retainer
6. Inner Spring
7. Inner Spring Center Retainer
8. Buffer Spring
9. Outer Spring
10. Cable Clamp and Screw
11. Diaphragm Cover
12. Helper Springs
13. Outer Spring Retainer
14. Freeze Protection Adjusting Screw
15. Actuating Pin and Nut
16. Lever Assembly
17. Lever to Cover Pin

Fig. 6-42 Temperature Regulation Valve—Exploded View

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *DISASSEMBLE*

1. Remove temperature regulation valve assembly. Plug all lines connecting to valve.

2. Remove valve lever helper springs.

3. Remove lever axis pin. Remove lever and adjusting pin assembly.

NOTE: Do not disturb the adjusting pin nut (plastic) on pin.

4. Scribe line on diaphragm cover and valve body for guide during reassembly.

5. Note depth of valve adjusting screw. Unscrew screw slowly (under spring tension) using J-9505.

6. Remove outer spring seat (under adjusting screw), outer spring, buffer spring, buffer spring seat and inner spring.

7. Remove screws from diaphragm cover to valve body and remove cover.

8. Remove diaphragm and piston assembly.

9. Remove cup retainer (inner and outer springs seat) from diaphragm.

10. Carefully remove diaphragm from piston. Pull on diaphragm stretching diaphragm retainer (extending in piston) until it releases from piston.

***CAUTION: Use care when handling diaphragm to prevent damage to rubber and fabric surfaces. Examine diaphragm for cuts, tears, etc. If damaged; replace diaphragm.***

11. Screen and retainer in evaporator end of piston should *not* be removed from piston. Examine screen for any foreign material or contamination and clean with tri-chlorethylene.

12. Remove pressure gauge fitting core and examine for damage.

### CLEANING AND INSPECTION

NOTE: After cleaning and inspection, lay all parts on a clean dry surface. Use lint free towels during this procedure.

1. Thoroughly clean valve body with tri-chlorethylene. Be sure all metal chips are removed from tapped holes (for diaphragm cover).

2. Blow all passages in valve body dry with refrigerant.

3. Clean all internal parts with tri-chlorethylene and blow dry with refrigerant.

4. Examine *all* parts for scratching or scoring and replace parts as necessary.

5. Examine valve body bore and piston surfaces for any imperfections, foreign material, or obvious damage that would cause the piston to hang up or prevent free operation of the piston. Replace valve body if bores are damaged or connection ports have been cross threaded.

NOTE: DO NOT attempt to scrape, stone, or dress any deep scratches, as this may result in improper valve performance.

### ASSEMBLE

1. Install pressure gauge fitting valve core.

2. Apply a light coat of clean compressor oil on diaphragm tab retainer and install diaphragm on piston by inserting tab in hole at top of piston. Press down with a rotating motion until tab is seated in piston.

3. Apply a light coat of clean compressor oil on piston and also in valve body bore and install piston and diaphragm assembly.

4. Install spring retainer cup in diaphragm.

5. Position diaphragm cover on valve body (aligning marks scribed prior to disassembly) making certain holes in valve body, diaphragm and diaphragm cover align. Start all screws but do not tighten.

6. Push on screened end of piston so piston moves to full open position (against diaphragm cover). This positions diaphragm so it doesn't become pinched under cover. Press against spring retainer cup until piston is against shoulder of valve body (fully closed) and tighten screws to 20-25 in. lb. torque.

7. Install inner spring, buffer spring seat and buffer spring.

8. Install outer spring and outer spring retainer aligning retainer with slot in spring cavity.

9. Place adjusting nut on spring and turn to depth noted before removal.

10. Slide control lever onto adjusting pin nut and install this assembly securing with the lever axis pin.

11. Place valve on evaporator inlet end and measure the distance from the top of the adjusting pin with the lever in the "free fall" position and with the lever full up against the stop. This distance should be .088" to .098". Adjust by turning pin. This is the clearance between the shoulder at the bottom of the adjusting pin and the buffer spring seat (Fig. 6-43).

12. Replace lever helped springs.

13. Replace temperature regulation valve.

14. Adjust temperature regulation valve control cable.

15. Evacuate and charge refrigeration system.

16. Perform operational test and adjust temperature regulation valve.

## TEMPEST CONDENSER ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor *if oil was sprayed in copious amounts or because of collision damage to condenser.*

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, ***plus*** one fluid ounce of oil for the condenser assembly.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, ***plus*** one fluid ounce of oil for the condenser assembly.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### REMOVE AND REPLACE

1. Depressurize refrigeration system.

2. Remove battery.

3. Remove right and left headlamp doors.

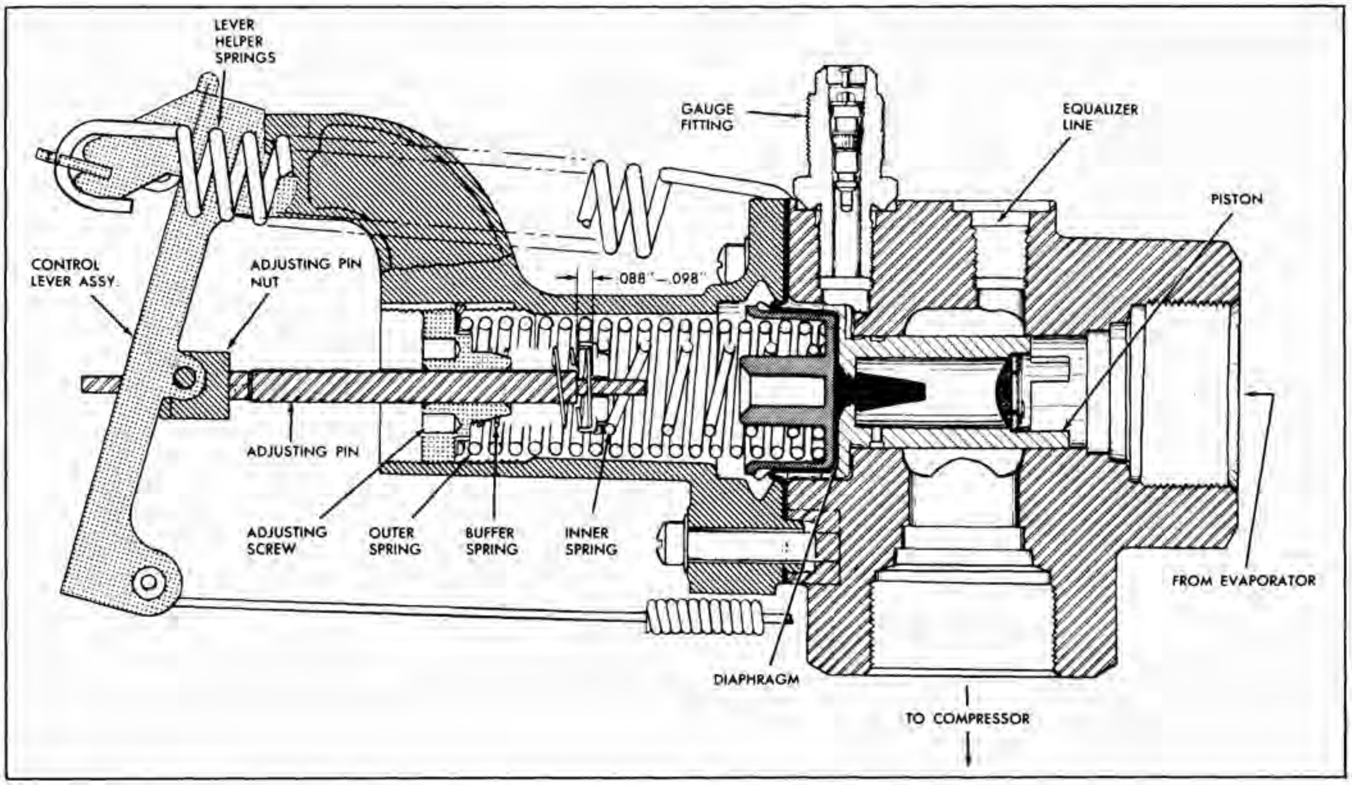



Fig. 6-43 Cross Section of Temperature Regulation Valve

4. Remove radiator grille assembly.

5. Remove hood latch bracket.

6. Remove front fender and radiator brace assembly.

7. Disconnect inlet and outlet connections of the condenser assembly and plug openings.

8. Remove inlet pipe to condenser clamp at right side of condenser.

9. Remove condenser attaching bolts and remove condenser (Fig. 6-44).

10. Repalce by reversing the above procedure, using new rubber O-ring seals well lubricated with refrigeration oil at each condenser connection.

11. Evacuate and charge refrigeration system.

12. Perform operational test.

## TEMPEST RECEIVER AND LIQUID INDICATOR ASSEMBLY

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor *if oil was sprayed in copious amounts or because of collision damage to the receiver.*

The amount of oil to put back into the compressor is found as follows: *DO NOT* add any more oil than is necessary or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained plus one fluid ounce of oil for the receiver and liquid indicator assembly.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 6 fluid ozs. of clean oil, plus one fluid ounce of oil for the receiver and liquid indicator assembly.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

### *REMOVE AND REPLACE RECEIVER*

1. Depressurize the refrigeration system.

2. Disconnect inlet and outlet connections at the receiver and liquid indicator assembly and plug openings.

3. Remove receiver and liquid indicator assembly.

4. Replace receiver by reversing the above procedure, using new rubber O-ring seals well lubricated with clean compressor oil at each connection.

5. Evacuate and charge refrigeration system.

6. Perform operational test.

## COLLISION SERVICE

The severity and circumstances of the collision will determine the extent of repair work required. Good judgment must be used in deciding what steps are necessary to put the system back into operation.

Each part of the system must be carefully inspected. No attempt should be made to straighten kinked tubes or repair any bent or broken units. Check especially for cracks at soldered connections.

### REFRIGERATION SYSTEM OPEN TO ATMOSPHERE

Broken tubes or units will allow air, moisture, and dirt to enter. These parts should be sealed as soon as possible until such time as they are replaced.

If the system is open for more than 15 or 20 minutes (depending on humidity), the receiver and liquid indicator assembly will absorb an excessive amount of moisture and should be replaced, and each component of the system should be cleaned with dry nitrogen and flushed with liquid Refrigerant-12 to remove dirt and moisture.

### FLUSHING SYSTEM

Flushing can be accomplished by connecting a refrigerant drum to the unit to be flushed, and then turning the drum upside down and opening the drum shut-off valve to pour refrigerant through the unit. The unit should be supported so that the refrigerant passing through it will be directed into an area where a temperture of $-21.7^{\circ}$F. will do no damage.

***CAUTION: Remember that when liquid refrigerant is poured from the drum into an area where atmospheric pressure exists, its temperature will immediately drop to $-21.7^{\circ}$F.***

In order to keep the expansion valve open when flushing the evaporator, the expansion valve bulb must be detached from the evaporator outlet tube.

### INSPECTING COMPRESSOR

If there is no visible evidence of damage, rotate compressor shaft to test for normal reaction. A quick check for broken reed valves is to turn compressor shaft (using box end wrench on compressor shaft nut) and check for resistance when turning the shaft. An irregular resistance force will be felt as each of the pistons goes over top center for each revolution of the crankshaft. If this pattern is not felt, it indicates one or more broken compressor reed valves and the compressor must be repaired.

Inspect oil for foreign material which would indicate internal damage to the compressor. If no foreign matter is found in oil, compressor can be used. Flush entire refrigeration system with refrigerant, drain oil from compressor and pour in 11 oz. avoirdupois of new Frigidaire 525 viscosity oil.

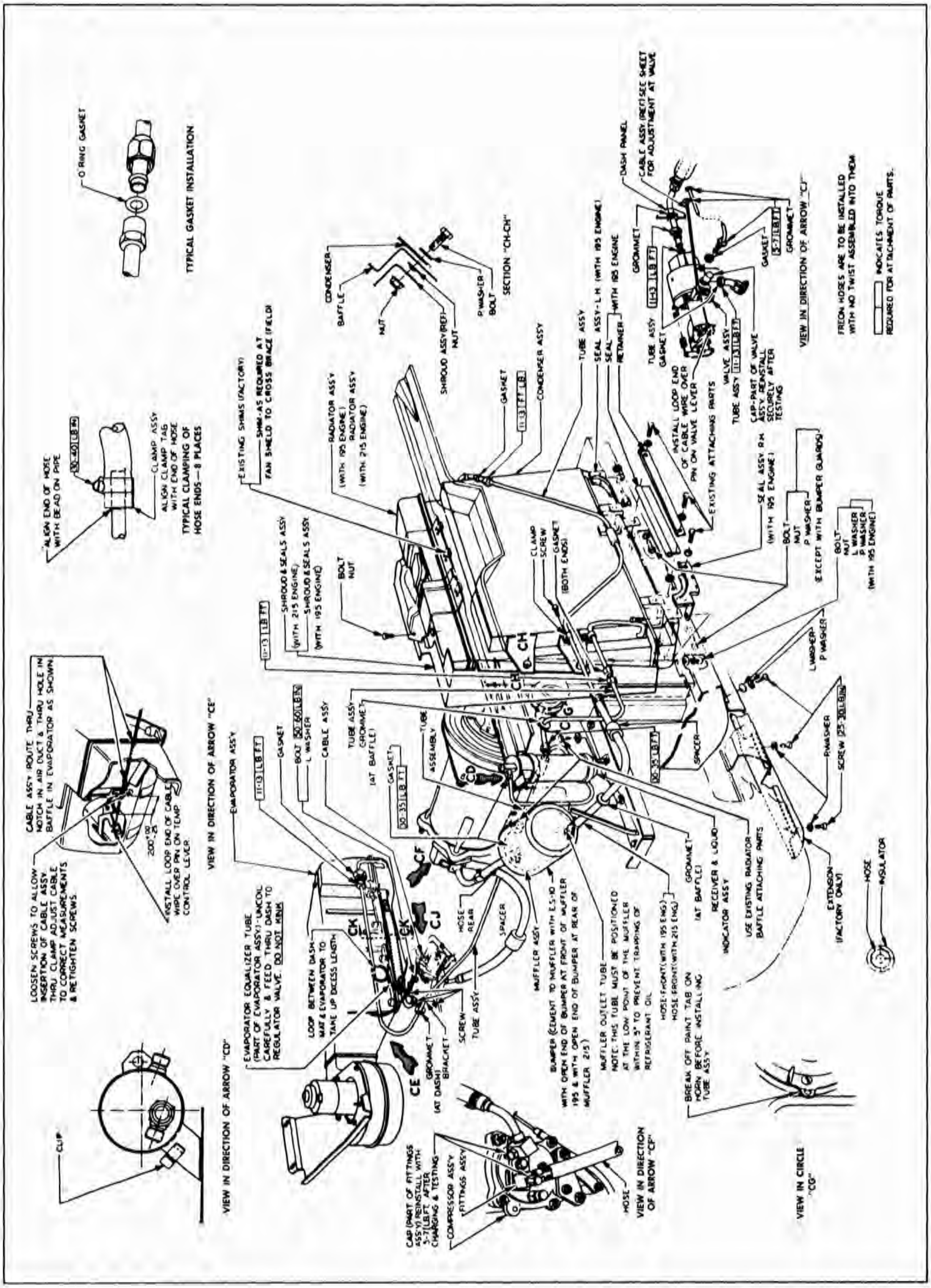



Fig. 6-44 Reference Illustration—Tempest Cool Pack Refrigeration System

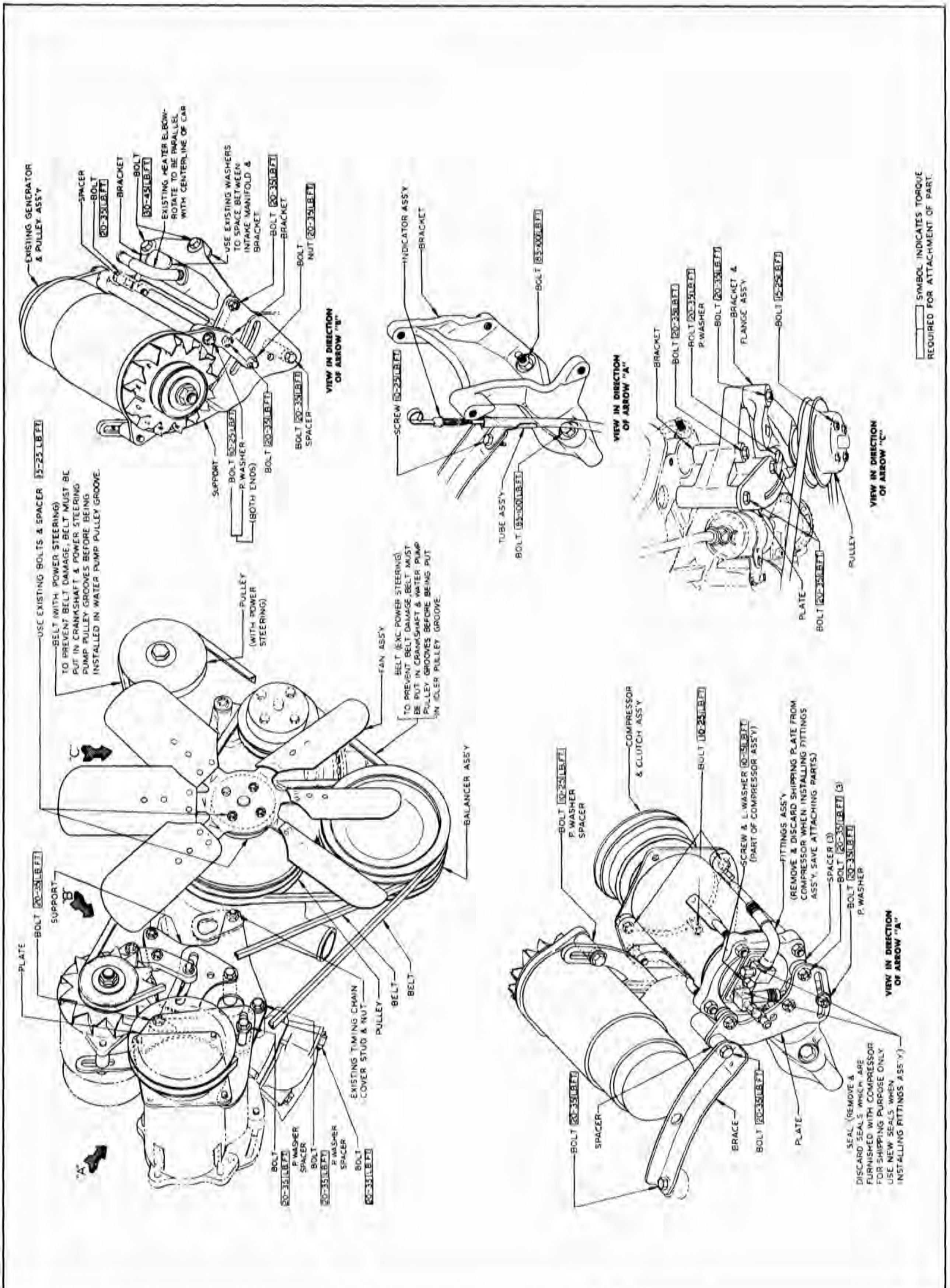



**Fig. 6-45 Reference Illustration—Pontiac Cool Pack Engine Compartment**

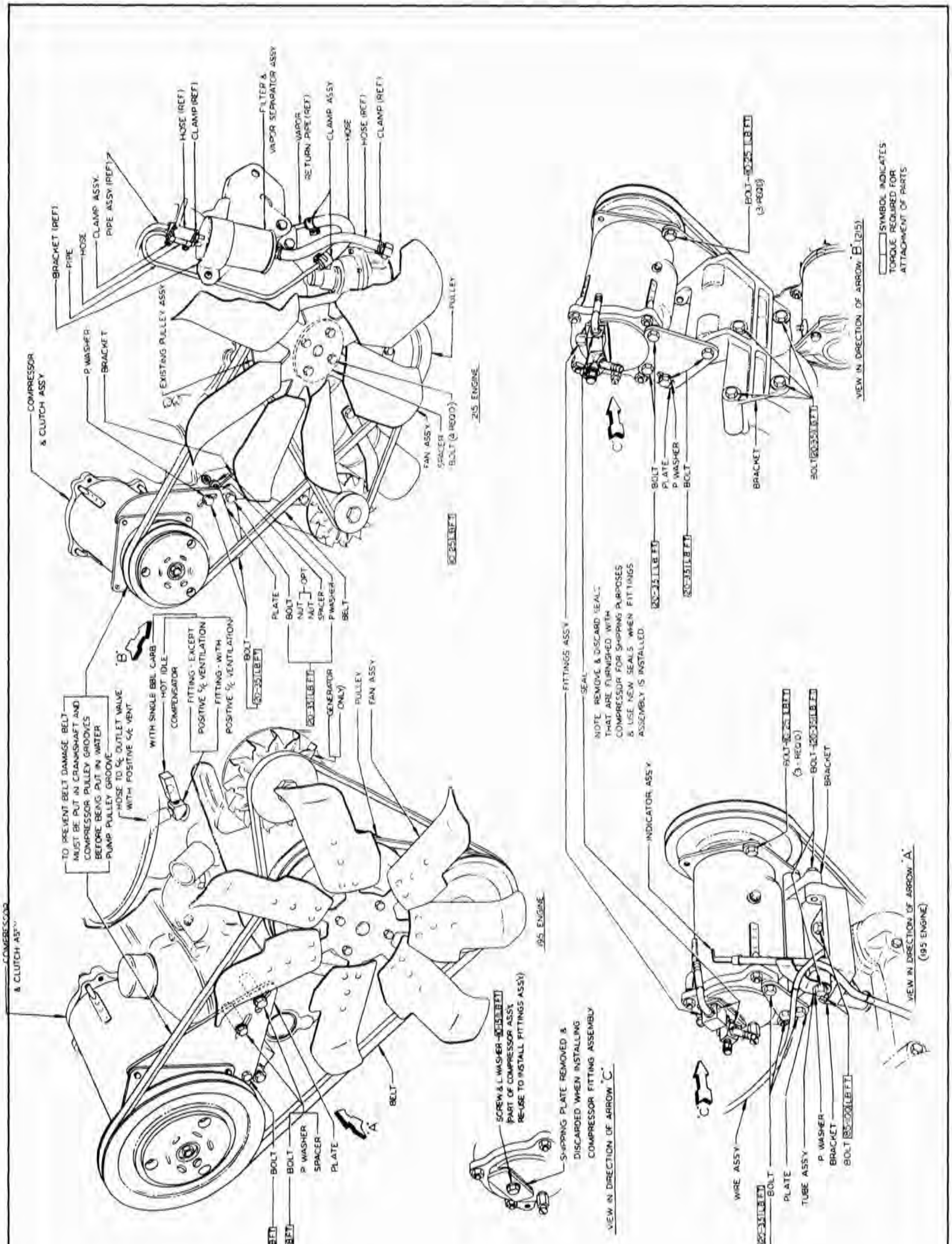



Fig. 6-46 Reference Illustration—Tempest Cool Pack Engine Compartment

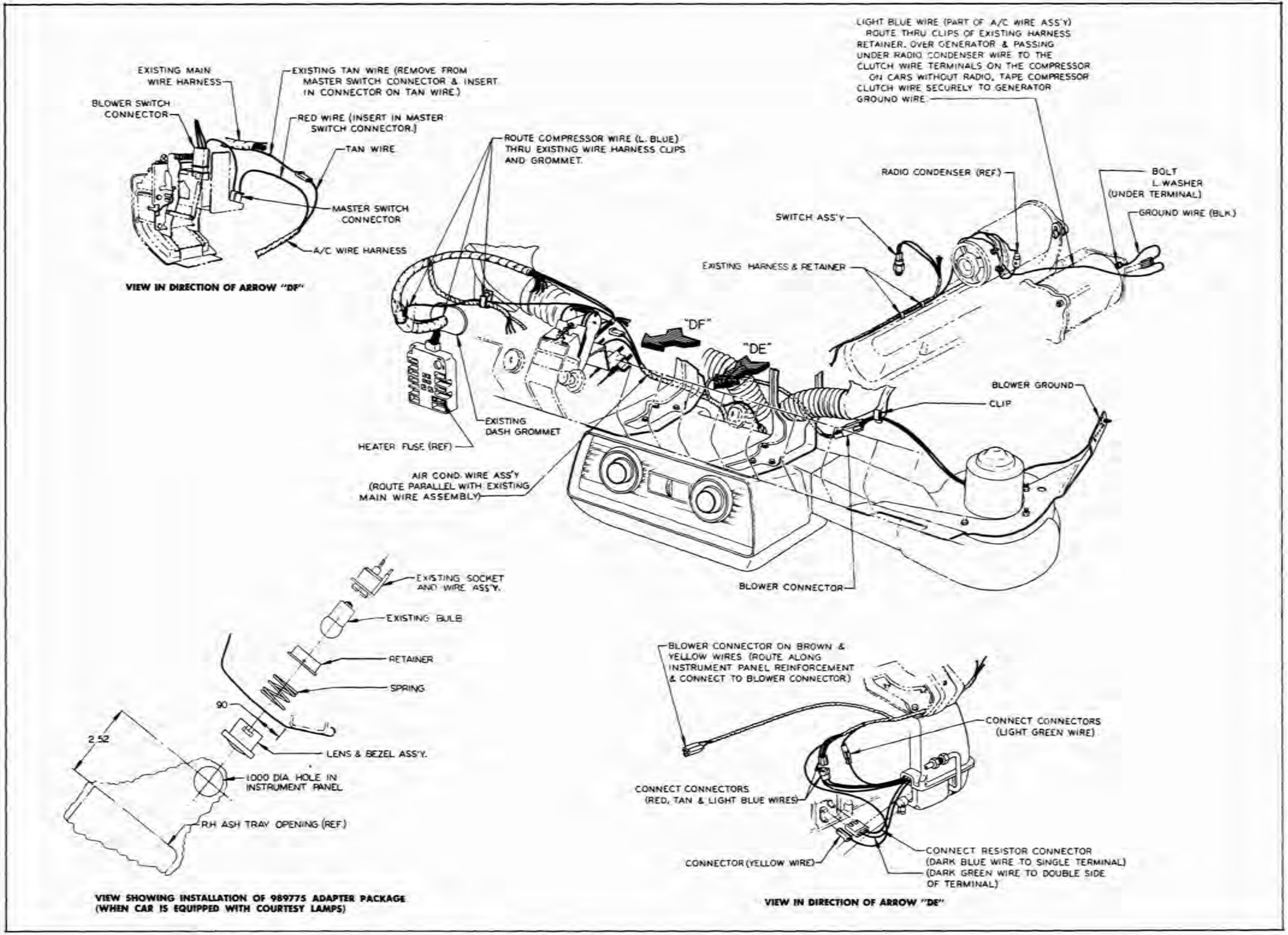



Fig. 6-47 Reference Illustration—Pontiac Cool Pack Electrical Parts

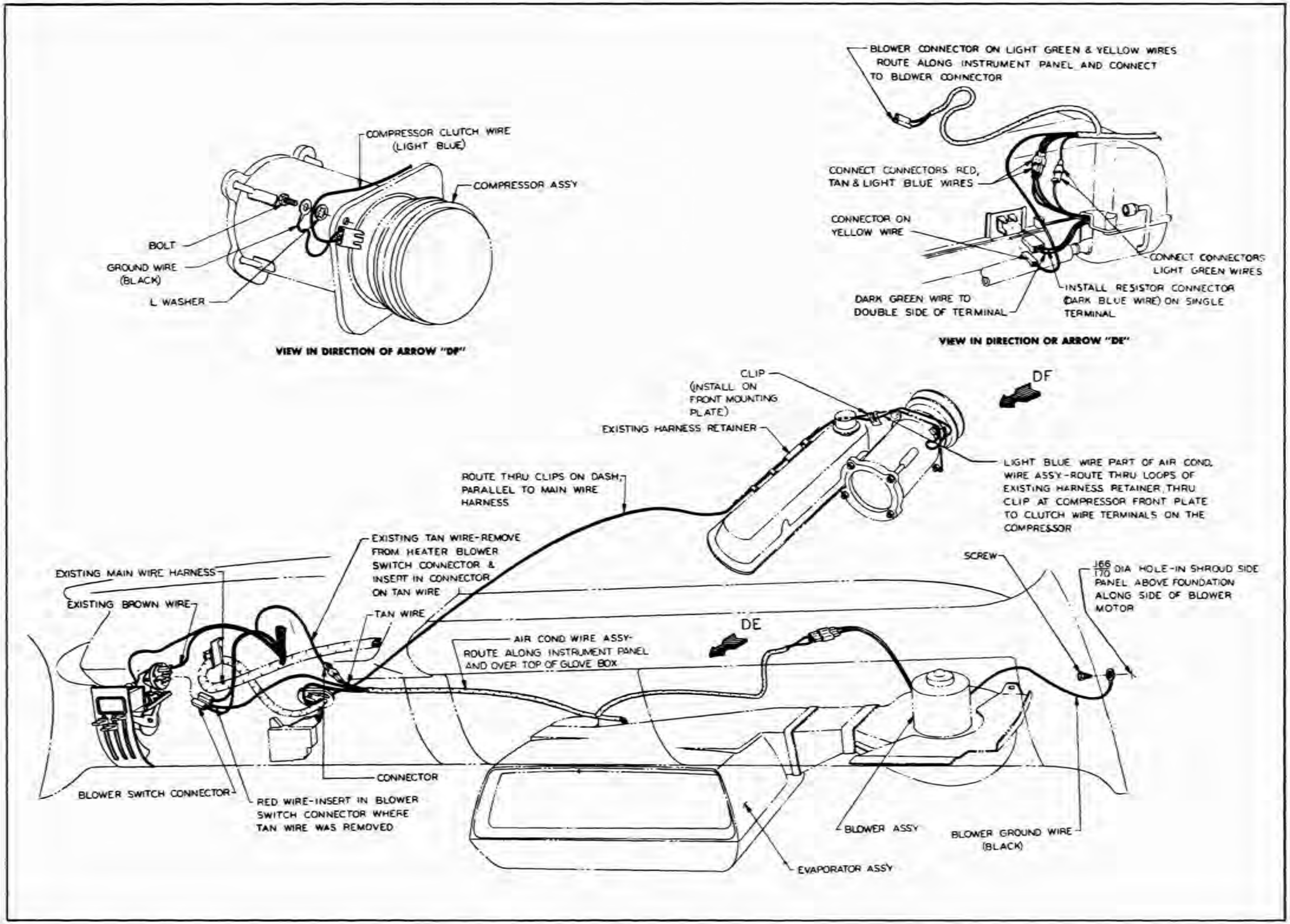



Fig. 6-48 Reference Illustration—Tempest Cool Pack Electrical Parts

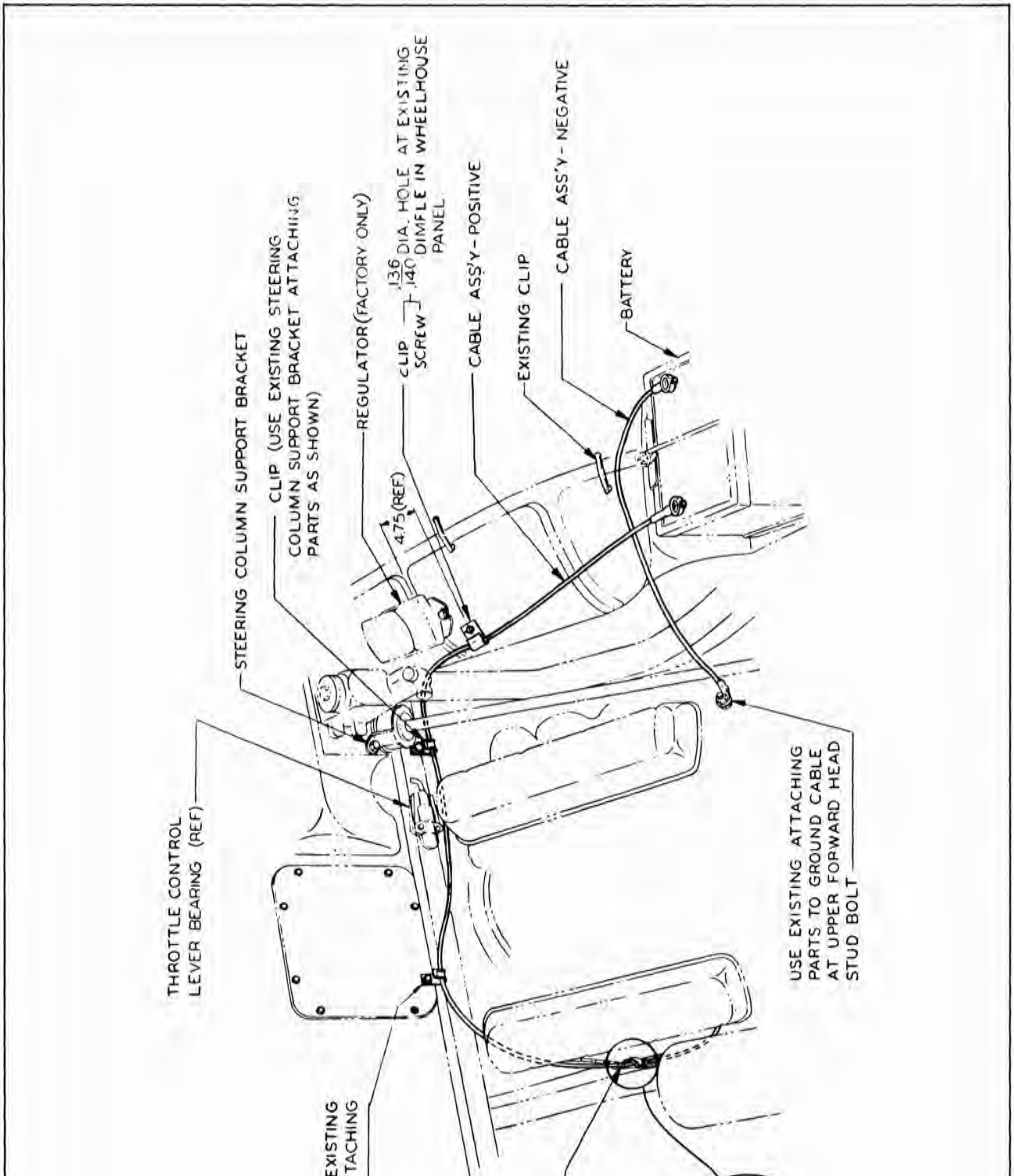



Fig. 6-49 Reference Illustration—Tempest V-8 Battery Cable Routing

# TESTING AND DIAGNOSIS

CONTENTS OF THIS SECTION



## TESTING

The purpose of performing an operational test is to prove that the air conditioning electrical system, air system, and refrigeration system are operating properly and efficiently. Results of the test are as follows:

1. Operation of the blower at all three speeds, and engagement of the compressor clutch would indicate that the electrical circuits are functioning properly.

2. A clear sight glass would indicate a properly charged refrigeration system.

3. Proper evaporator pressure, as controlled by the temperature regulation valve, would provide the proper "freeze protection" for the evaporator.

Check and correct all refrigerant leaks in the air conditioning system.

Check for proper compressor oil level during the repair of refrigerant leaks, *before* conducting an operational test.

### PRELIMINARY CHECKS

1. Check compressor belt for proper tension; if below 70 lbs. adjust to 100-105 lbs. on the Borroughs Belt Tension Gauge.

2. Check all refrigerant lines for leaks, kinks, or other restrictions.

3. Check surfaces of radiator and condenser cores to be sure they are not plugged with dirt, leaves or other foreign material. Be sure to check between the condenser and radiator as well as the outer surfaces.

4. Connect engine tachometer.

5. Start engine and operate at 1500 rpm. Move temperature control to right for maximum cooling and blower speed on "HI". Check heater controls to be certain all are in off position. After ten minutes of engine operation, observe for bubbling at the sight glass (above 70°F. ambient). If the system is low on refrigerant, refer to ADDING REFRIGERANT for proper charging procedure.

6. Under the same conditions as in step 5 above, turn the blower to the "OFF" position. This should disengage the compressor clutch. If clutch does not disengage, disconnect the clutch wire at the compressor.

a. If clutch disengages, the clutch control switch (blower switch) should be checked for proper connection.

b. If clutch does not disengage, malfunction is at the clutch.

7. Observe clutch engagement action which should be without slip. If clutch slippage occurs, check clutch for proper adjustment, short in clutch coil, leaking compressor shaft seal (which might indicate oil on the clutch surfaces), and oil on clutch surface.

8. Change blower speed to medium, and then "LO", and observe for decreases in air flow.

9. Set air conditioner blower switch to "OFF" position and check heater blower motor operation. Heater blower motor should operate. If heater blower does not operate, check for proper connection to air conditioning blower switch.

10. Place heater controls to "OFF" position.

11. Turn ignition key to "OFF" position.

The air conditioning refrigeration system should be checked for proper operating temperatures and pressures as follows:

### INSTRUMENTATION AND TEST CONDITIONS

1. Move car to a shaded area (not under sun).

2. Remove caps from compressor gauge fittings.

3. Check calibration of suction gauge and connect

low pressure side of the manifold gauge set J-5725 or J-5725-01 using J-5420 or J-6163 Schrader valve adapter to the Schrader valve located in the temperature regulation valve.

4. Connect the high pressure side of that gauge set using J-6163 Schrader valve adapter (90°) to the Schrader valve located in the discharge side of the compressor fittings assembly.

5. Purge gauge lines by cracking gauge set low and high pressure hand shut-off valves.

6. Connect engine tachometer.

7. Move temperature control for maximum cooling; place blower on "HI" speed.

8. Rotate main outlets to aim air straight out. Aim side outlets to direct air towards toe pan. Open center valve.

9. Locate a calibrated thermometer in center of right main outlet.

NOTE: Use caution that sensing bulb does not touch metal.

10. Check heater control to be certain all controls are in "OFF" position.

11. Close car doors and windows, and cowl side vents.

12. Place auxiliary fan (at least 20" in diameter) approximately 25" in front of the air conditioning condenser.

13. Suspend a calibrated thermometer 2" ahead of condenser in auxiliary fan air blast.

### OPERATIONAL TEST PROCEDURE

NOTE: Before proceeding be sure instruments and test conditions are as explained above.

1. Place transmission in "neutral" with parking brake on.

2. Start engine and set temperature control for maximum cooling and blower knob for "HI" blower speed.

3. Set engine speed at 1500 rpm and allow engine to run for ten minutes, observing pressure gauges.

NOTE: If at any time during test compressor head pressure exceeds 375 psi, discontinue test and check the following:

a. Engine cooling system.

b. Restricted receiver and liquid indicator assembly.

c. Air in refrigeration system indicated by bubbles in the sight glass or overcharge of Refrigerant-12.

d. Quantity of auxiliary fan air on radiator and condenser.

e. Defective or improperly adjusted temperature control valve.

4. At the end of this time (ten minutes stabilization period), record the following:

a. Ambinet air at condenser, pressure at temperature regulation valve and compressor discharge pressure.

b. Right nozzle temperature.

5. If nozzle temperature and pressure are not within the limits in the OPERATIONAL TEST CHART, it may be necessary to adjust the temperature regulation valve. (See TEMPERATURE REGULATION VALVE ADJUSTMENT.)

Compare above with system pressures and temperatures shown on the OPERATIONAL TEST CHART.

If not within the limits shown, refer to TROUBLE DIAGNOSIS for possible cause of substandard performance. Reference should be made in the order listed with discharge pressure first, if not within OPERATIONAL TEST CHART limits, then suction pressure and finally outlet temperature.

6. When all adjustments or repairs have been made, make another operational test of the system.

## TROUBLE DIAGNOSIS

### INSUFFICIENT COOLING

| CAUSE | REMEDY |
|---|---|
| Outlet temperature too high. | See OUTLET TEMPERATURE TOO HIGH and also SUCTION PRESSURE TOO HIGH.<br>Check blower operation. Check for obstructions at blower screen or in air duct assembly.<br>Right cowl vent open or opened to excess. |

**TEST CONDITIONS**

Heater Control ............ Completely "Off"—All levers fully raised
Heater Temperature Lever ............ Fully raised for no heat
Heater Fan Switch ............ "Off"
Hood ............ "Raised"
Doors, Windows, Ventipanes, and Shroud Air Vents ............ "Closed"
Air Conditioning Fan Control ............ On "Hi"
Air Conditioning Temperature Control ............ Set for Maximum Cooling
Engine Speed ............ 1500 RPM
Ball Nozzles and Center Outlet ............ Open

Test where sun load is not a factor; also an auxiliary fan must be placed in front of condenser.

| TEST READINGS | | | | | |
|---|---|---|---|---|---|
| Ambient Air in Degrees F. (In Aux. Fan Air Blast 2″ ahead of Condenser) | 70 | 80 | 90 | 100 | 110 |
| Average Compressor Head PSI (12 PSI Range is Normal) | 108-135 | 128-155 | 148-175 | 172-200 | 197-224 |
| Average Refrigerant Test Fitting (At Temperature Regulation Valve) Pressure must be within ± 1 PSI | 23 | 23 | 23 | 23 | 23½ |
| Right Nozzle Temperature - Degrees F. | 32½-36½ | 33-37 | 33½-37½ | 34-38 | 34½-38½ |
| CAUTION: Sensing element must not contact nozzle, plastic, or metal parts. | | | | | |

## CHART I—PONTIAC COOL PACK OPERATIONAL TEST DATA

### *INSUFFICIENT COOLING—Continued*

| CAUSE | REMEDY |
|---|---|
| Insufficient air flow. | Clean evaporator core. If evaporator is iced, de-ice and check adjustment of temperature regulation valve. |
| Heater temperature control valve *not off* in the "OFF" position. | Adjust heater temperature control cable and/or replace heater temperature control valve (on Tempest early type heater only). Adjust heater "mix" valve (temperature control) on Pontiac and Tempest late type heaters. |
| Heater air valve or controls not in the "OFF" position. | Advise owner on proper operation of air conditioning system. |
| Erratic cooling. | Temperature regulation valve piston sticking; if sticks closed, no cooling due to lack of flow of refrigerant through the evaporator core; if sticks open no controlled cooling and car may get too cold—evaporator may freeze. Replace valve. |

## TEST CONDITIONS

Heater Control .......... Completely "OFF"—All levers fully raised.
Heater Temp. Lever .......... Fully raised for no heat.
Heater Fan Switch .......... "OFF"
Hood .......... Raised
Doors, Windows, Ventipanes, and Shroud Air Vents .......... Closed
Air Conditioner Fan Switch .......... On "HI"
Air Conditioner Temperture Lever .......... Set for Maximum Cooling
Engine Speed .......... 1500 RPM
Ball Nozzles and Center Outlet .......... Open

Test where sun load is not a factor; also an auxiliary fan must be placed in front of condenser.

**TEST READINGS**

| | | | | | |
|---|---|---|---|---|---|
| Ambient Air in Degrees F. (In Auxiliary Fan Air Blast 2" ahead of Condenser) | 70 | 80 | 90 | 100 | 110 |
| Average Compressor Head PSI (12 PSI Range is Normal) | 122-147 | 142-170 | 164-192 | 192-224 | 225-255 |
| Average Refrigerant Test Fitting (At Temperature Regulation Valve) Pressure—PSI—must be within ± 1 PSI | 23 | 23 | 23 | 23 | 23-½ |
| Right Nozzle Temperature—Degrees F. | 29-33 | 29-½ 33-½ | 30-40 | 30-½ 34-½ | 31-35 |
| CAUTION: Sensing element must not contact nozzle, plastic elbow, or metal parts. | | | | | |

## CHART II—TEMPEST COOL PACK OPERATIONAL TEST DATA

### *COMPRESSOR DISCHARGE PRESSURE TOO HIGH*

| CAUSE | REMEDY |
|---|---|
| Engine overheated. | See Shop Manual. |
| Overcharge of refrigerant or air in system. | Systems with excess discharge pressures should be slowly depressurized at the condenser inlet connection on Tempest models and at receiver inlet on Pontiac models, observing the behavior of the high pressure gauge indicator.<br><br>1. If discharge pressure drops rapidly, it indicates air (with possibility of moisture) in the system. When pressure drop levels but still indicates in excess of specifications shown in the OPERATIONAL TEST CHART, slowly bleed system until bubbles appear in the sight glass and stop. Add refrigerant until bubbles clear, then add one-half pound of |

## COMPRESSOR DISCHARGE PRESSURE TOO HIGH—Continued

| CAUSE | REMEDY |
|---|---|
| Overcharge of refrigerant or air in system—continued | refrigerant. Recheck operational pressures. If system pressures still remain above specifications and the suction pressure is slightly above normal, then a restriction exists in the high pressure side of the system.<br><br>2. If discharge pressure drops slowly, it indicates excessive refrigerant. If pressures drop to specifications and sight glass remains clear, stop depressurizing and recheck operational pressures. If pressures are satisfactory, depressurize until bubbles appear in the sight glass, stop depressurizing, then add one-half pound refrigerant. Recheck operational pressures.<br><br>3. If discharge pressure remains high after depressurizing the system, continue depressurizing until bubbles appear in the sight glass. If suction pressures also remain high, then the temperature regulation valve may require adjustment, as well as a possibility of a restriction in the high pressure side of the refrigeration system. See also TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |
| Restriction in condenser, receiver-liquid indicator, or any high pressure line. | Remove parts, inspect, and clean or replace. |
| Condenser air flow blocked. | Clean condenser and radiator core surfaces as well as the space between the condenser and radiator. |
| Temperature regulation valve inlet pressure too high. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |

## COMPRESSOR DISCHARGE PRESSURE TOO LOW

| CAUSE | REMEDY |
|---|---|
| Insufficient refrigerant. | Check for presence of bubbles or foam in liquid indicator. If bubbles or foam are noted (after ten minutes of operation) refrigerant should be added until sight glass clears, then add an additional ½ lb. Adding refrigerant which exceeds ¼ lb. beyond the specification indicates a leak in the system.<br><br>NOTE: It is not unusual for bubbles to occur on minimum cooling and "LO" blower in mild weather even with a fully charged system (below 70° ambient). |
| Low temperature regulation valve inlet pressure. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW. |

### COMPRESSOR DISCHARGE PRESSURE TOO LOW—Continued

| CAUSE | REMEDY |
|---|---|
| Defective compressor (broken compressor reed valves). | Overhaul compressor. |
| Plug in refrigeration system. | 1. Disconnect fittings assembly and attached hoses from the compressor; disconnect receiver and liquid indicator inlet and outlet tubes. Seal the compressor ports and receiver fittings.<br>2. Check ends of lines for shipping plugs or torn off pieces of these plugs left in at assembly.<br>3. Blow dry nitrogen, Refrigerant-12, or dry air through lines to determine if lines or condenser are plugged. CAUTION: If done at a dealership, first bleed air hose of all moisture.<br>4. If plug in the system has not been found, disconnect temperature regulation valve.<br>5. Blow through thermostatic expansion valve and evaporator to check for plugged evaporator.<br>6. Inspect temperature regulation valve for proper operation. Insert $^9/_{16}$" square ended rod in inlet end of valve and depress piston. If unable to depress piston, valve is failed. Replace valve. NOTE: Caution should be used that rod does not damage screen. |

### TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH

| CAUSE | REMEDY |
|---|---|
| Temperature regulation valve cold setting incorrect. | See temperature regulation valve adjustment. |
| Temperature regulation valve warm setting incorrect. | With temperature regulation valve lever in maximum cold position, nylon adjusting nut should be free of contacting ears on lever. If not, rotate actuating pin clockwise until there is no load between nylon nut and lever. |
| Temperature regulation valve stuck shut. | Force temperature regulation valve lever fully rearward to full warm position and return. If temperature regulation valve inlet pressure is now O.K., diaphragm was not in position. If pressure is still too high and compressor suction pressure is below 15-20 psi, temperature regulation valve is stuck shut, and should be repaired. |
| Thermostatic expansion valve capillary tube bulb to evaporator tube. | Inspect for clearance between tube and bulb. If gap exists, move bulb to establish contact and reclamp. |

***TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH—Continued***

| CAUSE | REMEDY |
|---|---|
| Thermostatic expansion valve inoperative. | To check for an inoperative thermostatic expansion valve after the bulb has been checked for tightness on the evaporator outlet tube, remove the bulb from the tube. Immerse bulb in a container of ice water and check the suction pressure. Then immerse the bulb in container of warm water and check the suction pressure. If the suction pressure does not change, thermostatic valve assembly should be replaced.<br><br>Remove thermostatic expansion valve and inspect screen for foreign objects, if present, there is possibility seat is being held open. Install new thermostatic expansion valve; if condition is corrected, discard the valve removed. |
| Evaporator core freezing. | Adjust temperature regulaton valve. |

***TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW***

| CAUSE | REMEDY |
|---|---|
| Temperture regulation valve cold setting incorrect. | See Temperature Regulation Valve Adjustment. |
| Temperature regulation valve stuck open. | Move temperature regulation valve lever to warm position. If inlet pressure does not rise, valve is stuck open. Also indicated by less than 3 to 4 PSI pressure differential between compressor suction pressure and temperature regulation valve inlet pressure. |
| Thermostatic expansion valve capillary tube broken, inlet screen plugged, or valve otherwise failed. | Remove thermostatic expansion valve and inspect. Install new thermostatic expansion valve; if condition is corrected, discard the valve removed. |
| Restriction in system hoses or tubes. | Inspect and replace restricted hose or kinked tube. |

***NOZZLE OUTLET TEMPERATURE TOO WARM***

| CAUSE | REMEDY |
|---|---|
| Poor seal - evaporator core to evaporator inlet case. | Correct sealing. |
| Heater air control not in "OFF" position. | Place controls and left vent in "OFF" position and recheck. |
| Insufficient refrigerant. | See COMPRESSOR DISCHARGE PRESSURE TOO LOW. |
| Temperature regulation valve faulty. | SEE TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |

**NOZZLE OUTLET TEMPERATURE TOO WARM—Continued**

| CAUSE | REMEDY |
|---|---|
| Thermostatic expansion valve faulty. | SEE TEMPERATURE REGULATION VALVE INLET PRESSURE TOO HIGH. |
| Evaporator core freezing. | Adjust temperature regulation valve. |

**NOZZLE OUTLET TEMPERATURE TOO COLD**

| CAUSE | REMEDY |
|---|---|
| Insufficient air flow from nozzles. | Check for blocked or iced evaporator, defective blower motor or switch. |
| Temperature regulation valve faulty. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW. |
| Thermostatic expansion valve faulty. | See TEMPERATURE REGULATION VALVE INLET PRESSURE TOO LOW. |
| Insufficient air flow from nozzles. | Check for blocked evaporator or defective blower. |
| | Check switch operation and wiring. |
| See INSUFFICIENT COOLING. | |

## SPECIFICATIONS

Only those specifications which are different from cars not equipped with air conditioning are shown.

Blower Switch Positions (Pontiac and Tempest Cool Pack)

NOTE: Data for conditions of car windows open, engine not running, and ambient temperature of 70°F.

| Voltage at Regulator | Switch Position | Motor Amperes | Motor Volts | Impeller R.P.M. |
|---|---|---|---|---|
| 12.2 | High | 8.4 | 11.05 | 2361 |
| 13.5 | High | 9.1 | 12.25 | 2517 |
| 14.5 | High | 9.75 | 13.2 | 2631 |
| 12.2 | Med. | 4.7 | 11.45 | 1869 |
| 13.5 | Med. | 5.05 | 12.7 | 1980 |
| 14.5 | Med. | 5.35 | 13.15 | 2079 |
| 12.2 | Low | 3.1 | 6.9 | 1293 |
| 13.5 | Low | 3.35 | 7.7 | 1404 |
| 14.5 | Low | 3.6 | 8.3 | 1488 |

Compressor

Armature plate and hub assembly .... .0002"-.0007" press fit to shaft
Armature plate to pulley clearance .... .057"-.022" (air gap)
Mainshaft assembly end play .... .0003"-.0013"
Oil charge (new) .... 11 fluid ozs.
Oil Type .... Frigidaire 525 visc.
Piston shoe clearance .... .0005"-.0010"
Pulley Diameter (Nominal) .... Pontiac .... 5.737" or approx. 5¾"
Tempest 195 .... 6.774" or approx. 6¾"
Tempest 215 .... 4.814" or approx. 4 13/16"
Rear head to shell nuts .... 19-23 lb.-ft. torque
Service Compressor Oil charge .... 11 oz. Frigidaire 525 oil

Compressor Belt

Size .... 15/32"
Tension .... 100-105 lbs. indicated on Borroughs Belt Tension Gauge

Compressor Coil

Current (maximum demand) .... 3.20 amps
Resistance .... 3.85 ohms at 80°F.

Compressor to Engine Ratio .... Pontiac—1.489 to 1
Tempest L4—1.0615 to 1
Tempest V-8—1.2461 to 1

Cooling System Capacity .... Pontiac with heater 19.5 qts.
Tempest with heater 12.6 qts.

## SPECIFICATIONS

Engine Idle Speed with Air Conditioner off. (Automatic trans. in Drive range) Pontiac All: HM–540-560 RPM
(Synchro-Mesh trans. in Neutral) SM–540-560 RPM

Tempest: 4 bbl Auto–630-650
SM–680-700

Fan ........ Pontiac 6 blades
Tempest 7 blades

Fuse

In orange colored line in front of fuse block ........ 7.5 amps

Heater fuse in fuse block ........ 20 amps

Radiator Cap ........ Pontiac and Tempest–15 lbs.

Refrigerant-12 Capacity ........ Pontiac 3.25 lbs.
Tempest 3.0 lbs.

**Hose and Tubing Connections Torque Chart**

| Metal Tube Outside Diameter | Thread and Fitting Side | Steel Tubing Torque Lb-Ft. | Aluminum or Copper Tubing Torque Lb-Ft. | Nominal Torque Wrench Span |
|---|---|---|---|---|
| 1/4 | 7/16 | 10-15 | 5-7 | 5/8 |
| 3/8 | 5/8 | 30-35 | 11-13 | 3/4 |
| 1/2 | 3/4 | 30-35 | 11-13 | 7/8 |
| 5/8 | 7/8 | 30-35 | 18-21 | 1 1/16 |
| 3/4 | 1 1/16 | 30-35 | 23-28 | 1 1/4 |

If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification.

Use steel torques **only** when **both** ends of connection are steel.

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