SECTION A

HEATER—AIR CONDITIONER SYSTEM

ALL SERIES

CONTENTS

DIVISION I
SPECIFICATIONS AND ADJUSTMENTS

13-1 SPECIFICATIONS

a. Tightening Specifications

Part	Location	Torque Lb. Ft.
Nut	Drive Plate Nut to Compressor Shaft	15
Nut	Rear Head to Shell.	21
Cap	Schrader Service Valve	5

b. Compressor Specifications

Type.	Six Cylinder Axial Opposed
Make.	Frigidaire
Effective Displacement (cu. in.).	12.6
Oil	525 Viscosity
Oil Content (New)	10-1/2 fl. oz.
Air Gap Between Clutch Drive Plate and Pulley	0.022 to 0.057 inch
Clutch Type.	Magnetic
Belt Tension.	100 lbs.

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.

Figure 13-1 Pipe and Hose Connection Torque Chart

c. General Specifications

Thermostat Opening Temperature	
L-6	190°
V-8 (All)	195°
Capacity of Cooling System with Air Conditioner (Quarts)	
L-6	13.0
V-8, 350 cu. in..	13.5
V-8, 400 cu. in..	16.7
V-8, 430 cu. in..	17.0
Type of Refrigerant	Refrigerant 12
Refrigerant Capacity (Fully Charged)	
43-44000 Series	3-3/4 lbs.
45-46-48-49000 Series	4-1/4 lbs.

13-2 ADJUSTMENT OF TEMPERATURE WHEEL AND TEMPERATURE DOOR

The control cable should be adjusted when the recommended 1/16 to 1/8 inch of indicator is not visible when the TEMPERATURE wheel is in the "COOL" position. This adjustment should also be made when the air conditioner-heater assembly has been removed or when the temperature door does not properly regulate the mixing of, or blocking off of heated air.

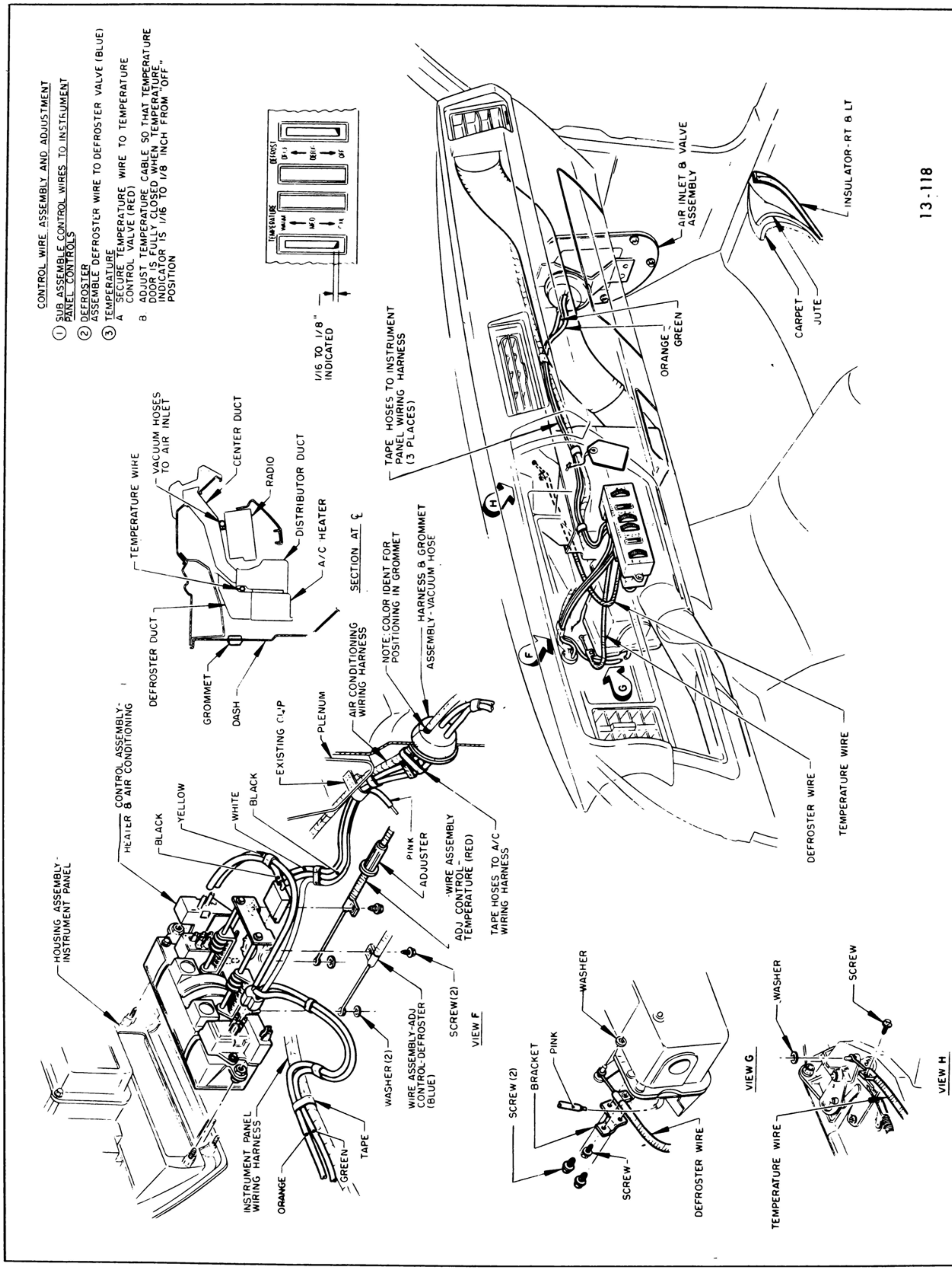


Figure 13-2 43-44000 Series Control Wire and Vacuum Hose Installation

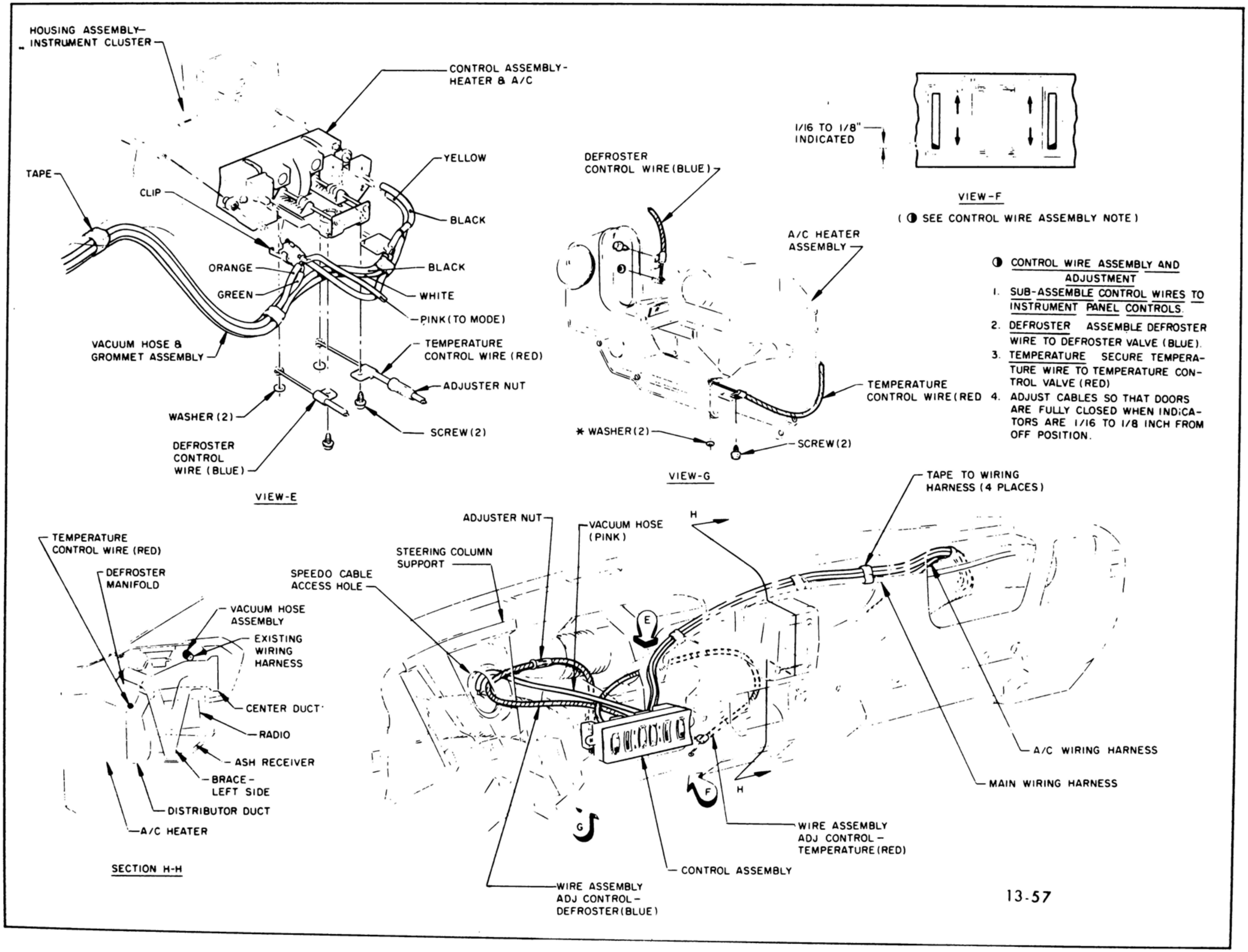
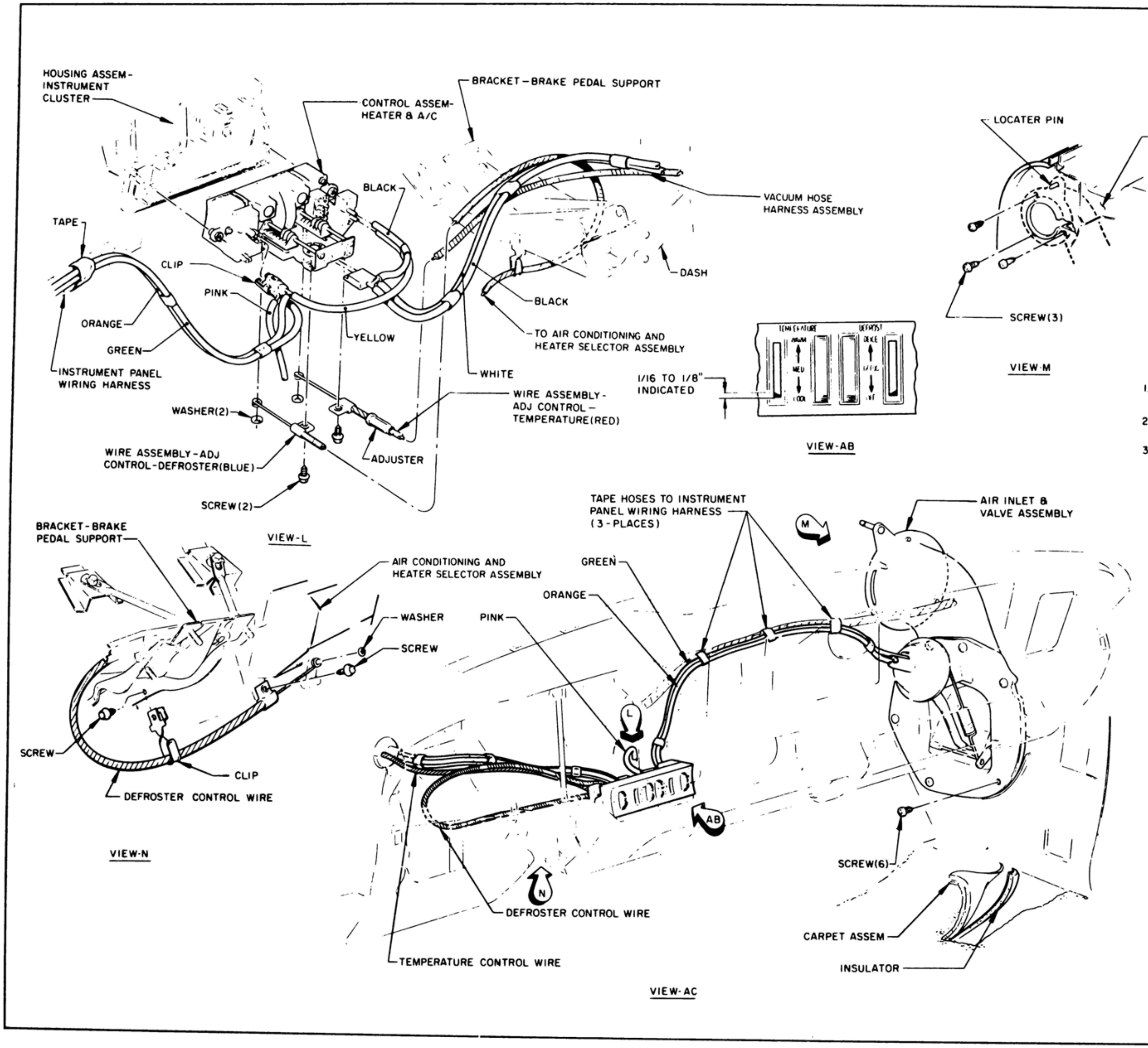


Figure 13-3 45-46-48000 Series Control Wire and Vacuum Hose Installation



CONTROL WIRE ASSEMBLY AND ADJUSTMENT

1. SUB-ASSEMBLE CONTROL WIRES TO INSTRUMENT PANEL CONTROLS.
2. DEFROSTER — ASSEMBLE DEFROSTER WIRE TO DEFROSTER VALVE (BLUE).
3. TEMPERATURE
   A. SECURE TEMPERATURE WIRE TO TEMPERATURE CONTROL VALVE (RED).
   B. ADJUST TEMPERATURE CABLE SO THAT TEMPERATURE DOOR IS FULLY CLOSED WHEN TEMPERATURE INDICATOR IS 1/16 TO 1/8 INCH FROM OFF POSITION.

CONTROLS MUST BE 100% INSPECTED FOR CORRECT OPERATION AND FREE MOVEMENT.

Figure 13-4 49000 Series Control Wire and Vacuum Hose Installation

To adjust, position the TEMPERATURE wheel to the "COOL" position and rotate the control cable adjuster nut until approximately 1/16 to 1/8 inch of indicator is showing. 43-44000 Series see Figure 13-2, 45-46-48000 Series see Figure 13-3, 49000 Series see Figure 13-4.

13-3 ADJUSTMENT OF OUTSIDE AIR INLET DOOR

The linkage between the outside air inlet door and the vacuum diaphragm on the air inlet and valve assembly may be adjusted to insure full closing of the air door.

To adjust, remove shroud side foundation. Remove vacuum hoses and loosen linkage and allow spring to close door fully, then resecure linkage, install hoses and install shroud side foundation.

DIVISION II

DESCRIPTION AND OPERATION

13-8 GENERAL DESCRIPTION OF SYSTEM

The heater-air conditioner system is a series type unit in which the cooling unit and heating unit are so arranged that the air flows through both units. With an arrangement of this type it is possible to simultaneously control both the air conditioning and heating of the air in the car. Thus the air may be cooled, heated or both cooled and reheated.

The following description of the heater-air conditioner system is divided into five areas: (1) a description of the route air takes as it flows through the system during various modes of operation, (2) how the doors (which regulate the flow of air) operate and the sequence in which they operate, (3) the theory behind obtaining hot air from the system, (4) the theory of how the system cools the air, and (5) a description of the function and purpose of each component in the air conditioning refrigeration circuit.

13-9 DESCRIPTION OF AIR FLOW THRU SYSTEM

The following description of the route the air takes as it flows thru the system during varius modes of operation is divided into four parts; air flow during air conditioning mode of operation, air flow during heating mode, air flow during defrosting mode and air flow during simultaneous air conditioning and reheating modes of operation.

a. Air Flow During Air Conditioning Mode of Operation

During normal mode of operatin of the air conditioner, the FAN wheel (see Figure 13-5) is set at any of the four positions away from the "OFF" position. The TEMPERATURE and DEFROST wheels will be positioned fully down to "COOL" and "OFF" respectively. The SELECTOR wheel will be positioned to "A/C".

Under these conditions the air flows into the system thru the opening in front of the windshield into the plenum chamber. Moving of the FAN wheel to one of the four positions away from the "OFF" position opens the main vacuum switch and applies vacuum to recirculated air port of the outside-recirculated air door diaphragm causing it to partially open. Placing of the SELECTOR wheel at "A/C" position applies vacuum to outside air port of outside-recirculated air door diaphragm. When vacuum is applied to both ports of the diaphragm the air door fully opens. 43-44000 Series see Figure 13-6, 45-46-48000 Series see Figure 13-10, 49000 Series see Figure 13-14.

The air now flows from the plenum chamber into the blower air inlet assembly. From here the air flows to the evaporator-blower assembly. Because the TEMPERATURE wheel is fully downward, the temperature door is closed blocking air flow thru the heater core. Consequently the cooled air flows past the normally open heater-air conditioner mode door and out to the air conditioner outlets. The above described air flow also applies to "VENT" mode of operation, the only difference being that the compressor does not operate in "VENT".

During recirculate mode of operation the SELECTOR wheel is in "REC" position. The air flow is the same as in "A/C" except that no vacuum is applied to outside air port of the outsiderecirculated air door diaphragm. The effect of this is to cause the air door to only partially open thereby causing the system to draw some of its air supply from inside the car. 43-44000 Series see Figure 13-7, 45-46-48000 Series see Figure 13-11, 49000 Series see Figure 13-15. This has an added cooling effect because the already cooled air from inside the car can now be recirculated and further cooled.

b. Air Flow During Heater Mode of Operation

For operation of the heater portion of the system the controls are set as follows:

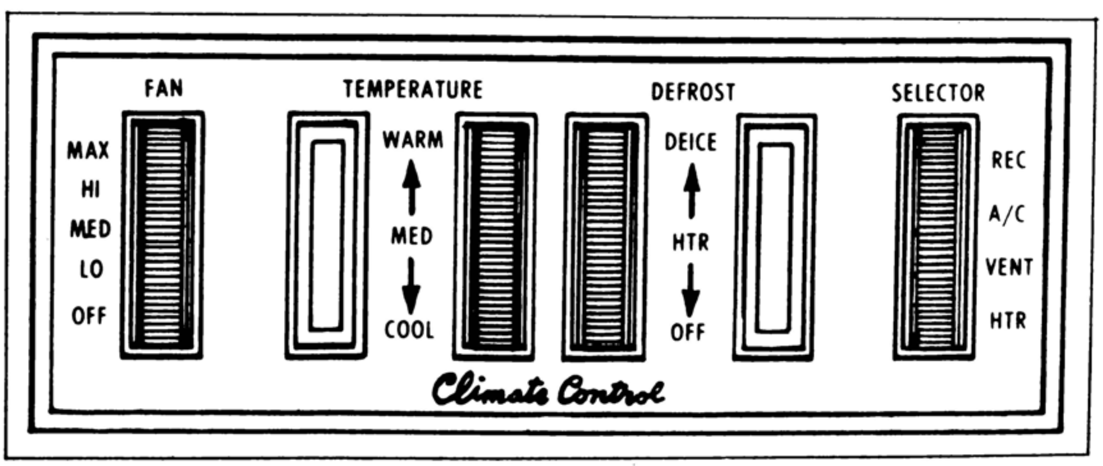


Figure 13-5 Instrument Panel Control Assembly

FAN wheel in one of four positions away from "OFF" position, TEMPERATURE wheel positioned to "WARM", DEFROST wheel positioned to "OFF", and SELECTOR wheel positioned to "HTR". The FAN wheel, being away from the "OFF" position, permits vacuum to flow to the recirculated air port of the outside-recirculated diaphragm thereby causing the air door to partially open. The SELECTOR wheel being positioned to "HTR" position permits vacuum to flow to the outside air port of the outside-recirculated air door diaphragm thereby causing the air door open to its full extent. In addition vacuum is also applied to the heater-air conditioner mode door diaphragm. The effect of this is that the diaphragm pulls its related air door closed. 43-44000 Series see Figure 13-8, 45-46-48000 Series see Figure 13-12, 49000 Series see Figure 13-16.

The outside air flows as before into the plenum chamber, down into the blower and air inlet assembly thru the evaporator core, and then into the heater assembly. At this point the air flow divides (according to the opening of the temperature door) and some of it flows thru the heater core and then remixes with the non-heated air. The heater-air conditioner mode door being closed, blocks the air flow to the air conditioner outlets and therby forces it out the heater outlets.

c. Air Flow For Defroster Mode of Operation

The air flow and position of the controls is very similar to the conditions of the system during heater mode of operation with the exception that the DEFROST wheel is now positioned as required to "DEFOG" or "DEICE". This has the effect of tilting the defroster door to deflect some or most of the air to the defroster outlets. The position of the defroster door is controlled by a control cable.

d. Air Flow For Both Air Conditioning and Heater Mode of Operation

When both the air conditioner and the heater are operated simutaneously to cool, dry and then reheat the air, the controls are set as follows: FAN wheel in one of four positions away from "OFF" position, TEMPERATURE wheel positioned as desired toward "WARM", DEFROST wheel positioned as required, and SELECTOR wheel positioned to "A/C". The effect of this setting of the controls will be to position the air doors to allow air flow through both evaporator and heater core. 43-44000 Series see Figure 13-9, 45-46-48000 Series see Figure 13-13, 49000 Series see Figure 13-17.

The air flow is from the plenum chamber, into the blower and air inlet assembly, and then thru the evaporator core. The air at this point divides according to the opening of the temperature door and some of it flows thru the hot heater core. Then the heated air remixes with the cooled air and is channeled to the air conditioner outlets.

Vacuum is applied to both ports of the outside-recirculated air door diaphragm to cause the air door to fully open permitting only outside (no recirculated) air into the system.

13-10 OPERATION OF INSTRUMENT PANEL CONTROLS

All the controls for regulation of the heater-air conditioner system are located on the instrument panel control assembly. See Figure 13-5. They operate the system as follows:

a. FAN Switch Wheel

This wheel operates the heater-air conditioner blower switch. When this wheel is moved from one extreme to the other, four positions will be felt. Moving from "OFF", the 1st detent will provide low blower speed. The second, third and fourth detents respectively provide medium, high and maximum blower speeds.

The FAN wheel is mechanically linked to the master vacuum switch. Whenever the FAN wheel is away from "OFF" position, vacuum is applied to recirculated port of the outside-recirculated air door diaphragm via this vacuum switch and the door is partially opened.

b. TEMPERATURE Wheel

When this wheel is positioned fully downward, no vacuum is applied to the diaphragm of the water valve. Movement of the wheel upward applies vacuum to the diaphragm of the water valve and coolant from the engine is circulated thru the heater core. In addition, movement of the wheel upward opens the temperature door via a control cable. Regardless of the position of the SELECTOR wheel (REC, A/C VENT or HTR)the air flow will be warmed in proportion with TEMPERATURE wheel position.

NOTE:

Cars equipped with the L-6 engine are not equipped with a water valve. Therefore, water will flow through the heater core at all times.

c. DEFROST Wheel

This wheel is connected to the defroster door via a control cable. As the DEFROST wheel is moved upward more air will be directed to the defroster outlets provided the system is operating in "HTR" mode of operation.

d. SELECTOR Wheel

This wheel operates the outside-recirculated air door and the heater-air conditioner mode door vacuum switch. This switch applies vacuum to the outside-recirculated air door diaphragm and the heater-air conditioner mode door diaphragm. In addition, the wheel is mechanically linked to the compressor clutch switch. Movement of the wheel actuates these components in the following sequence.

"REC" - In this position the compressor clutch switch is

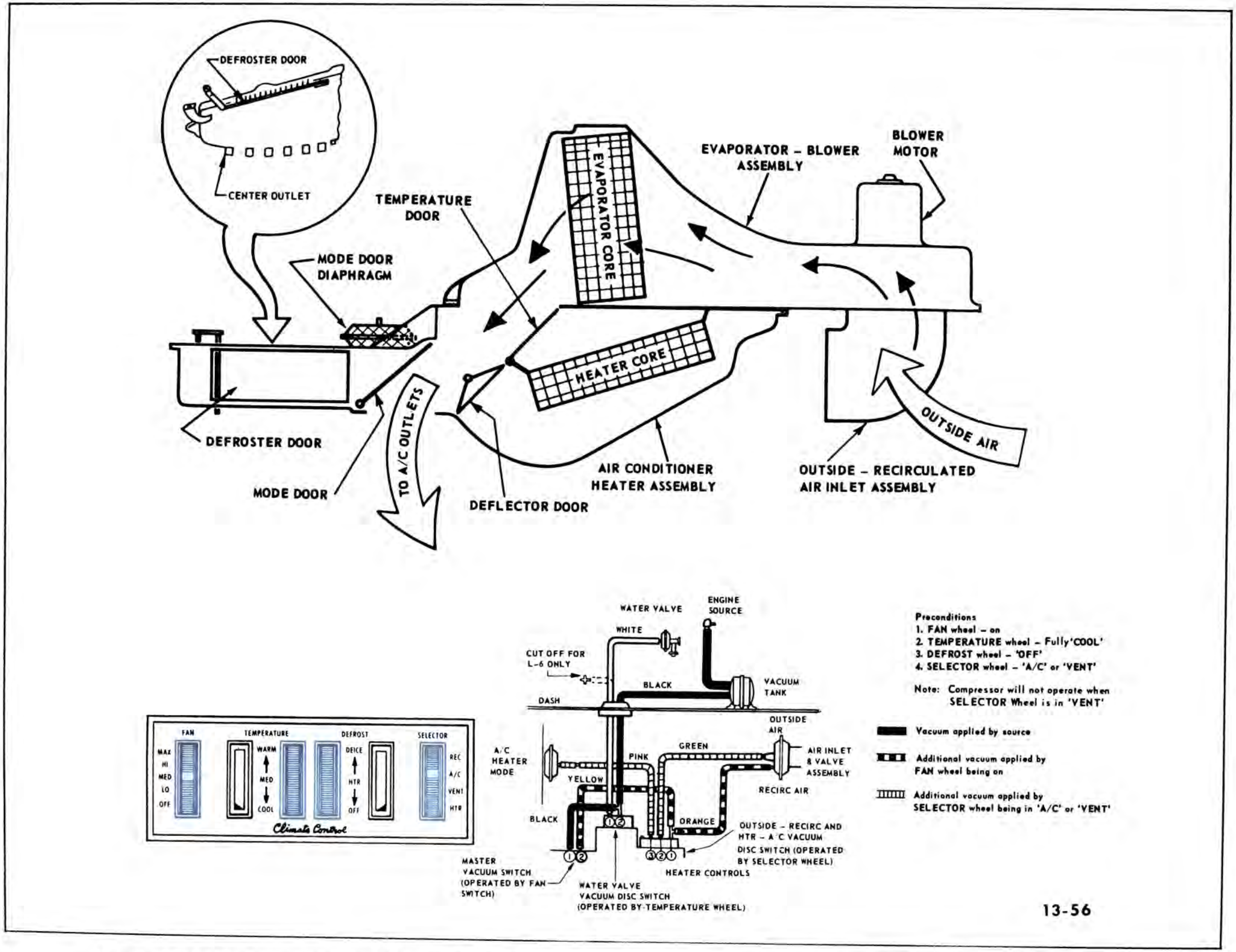


Figure 13-6 43-44000 Series Control Position, Vacuum Circuits, and Air Flow During VENT or A/C Mode

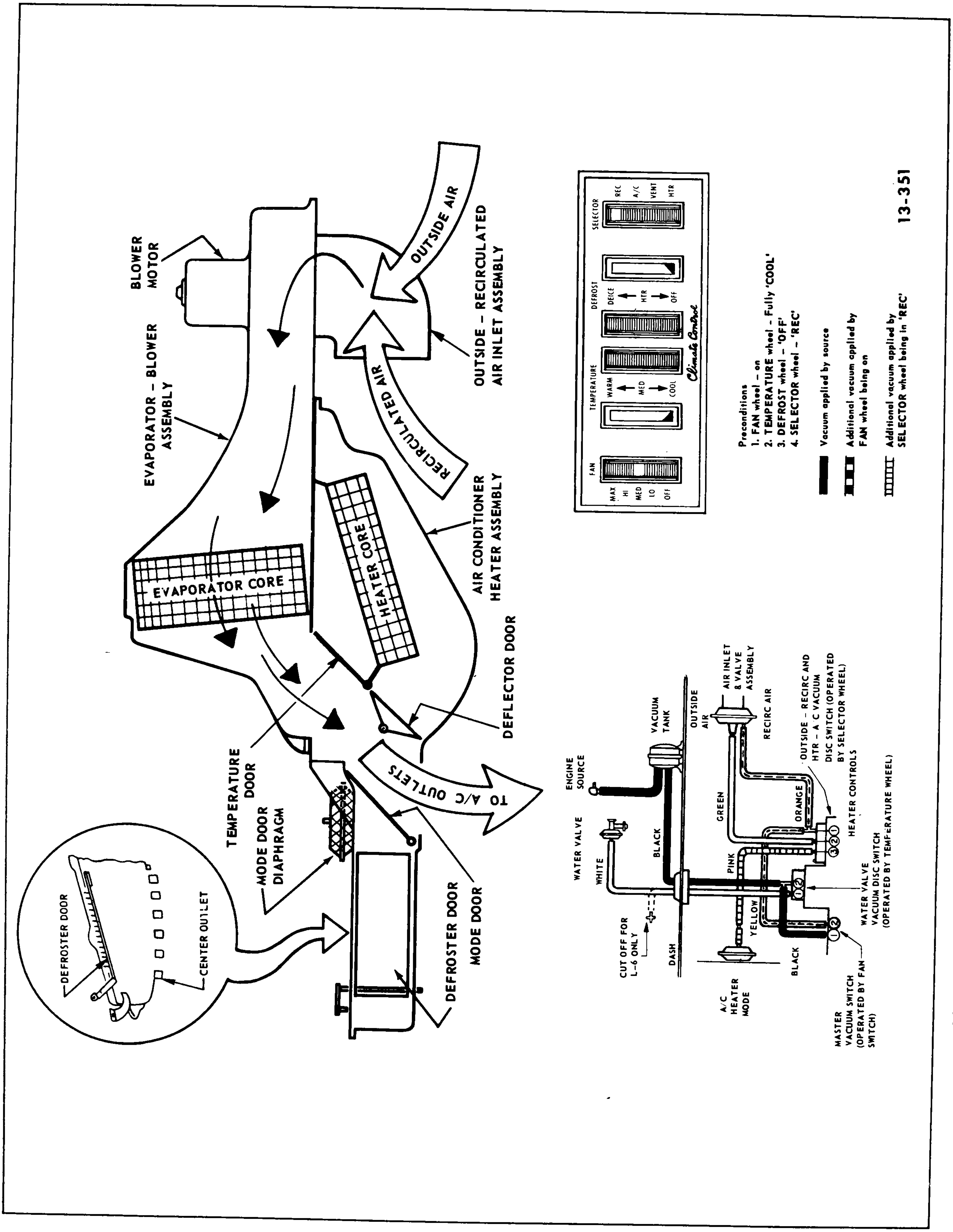


Figure 13-7 43-44000 Series Control Position, Vacuum Circuits, and Air Flow During REC Mode

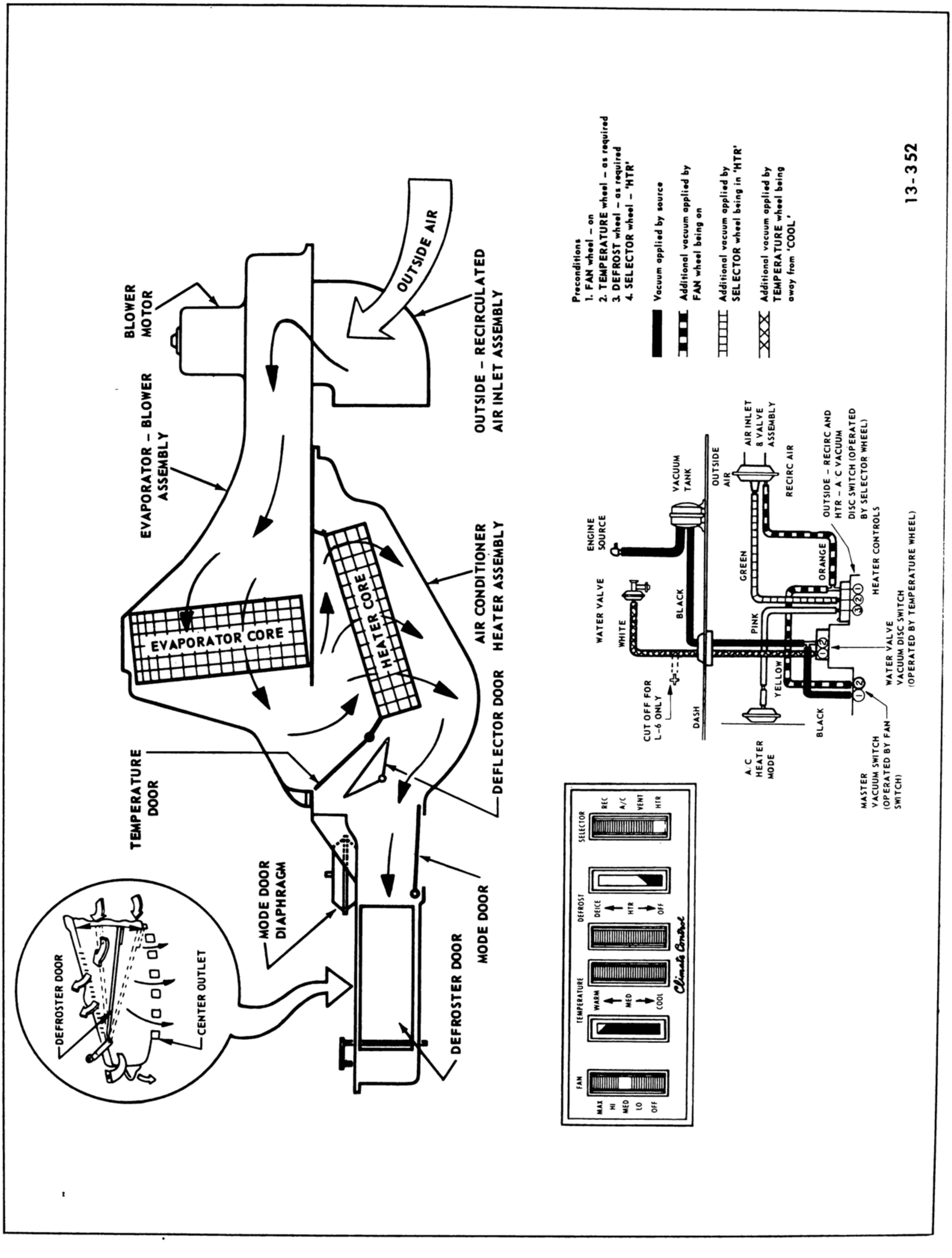


Figure 13-8 43-44000 Series Control Position, Vacuum Circuits, and Air Flow During HTR Mode

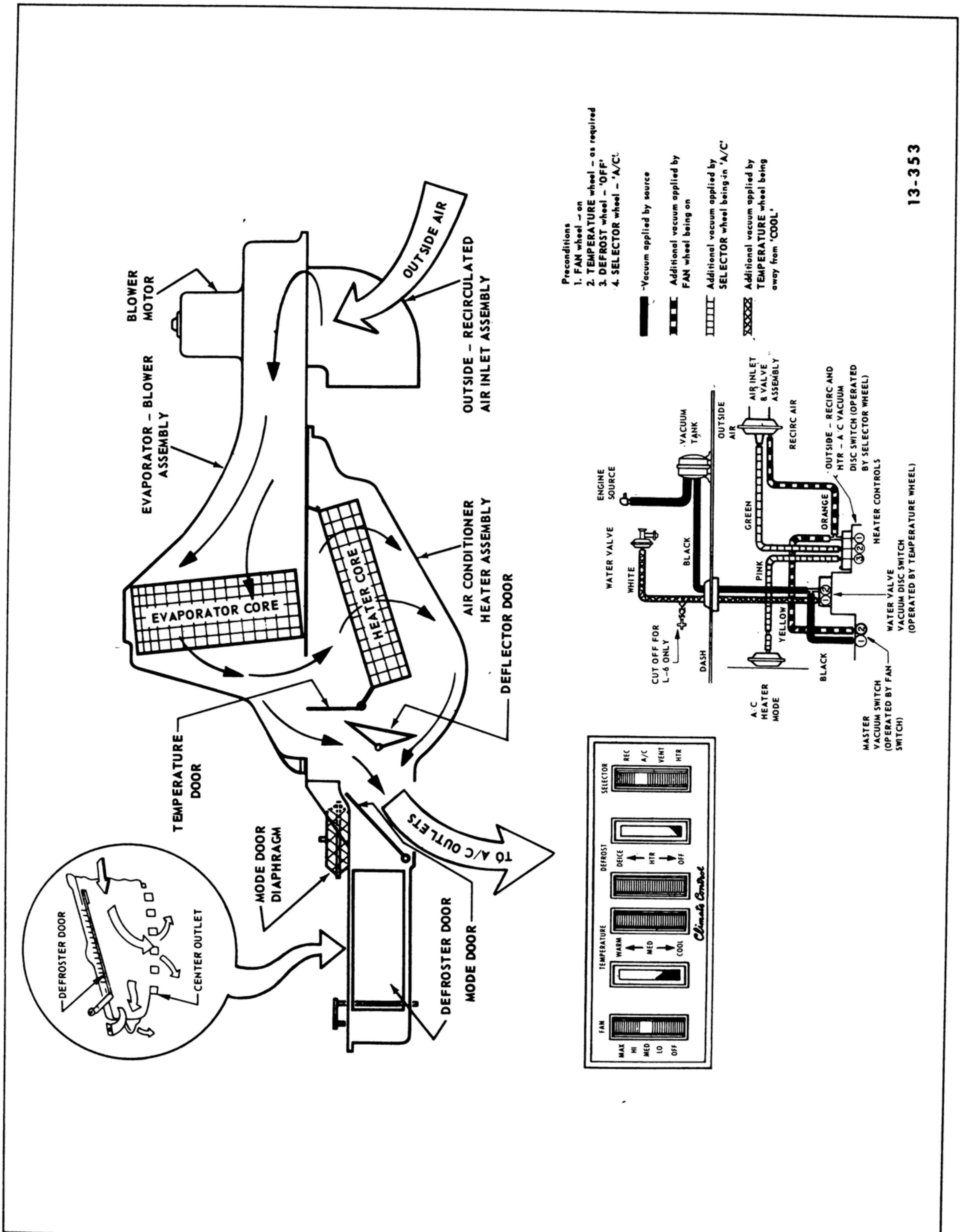


Figure 13-9 43-44000 Series Control Position, Vacuum Circuits, and Air Flow with Heater and Air Conditioner On

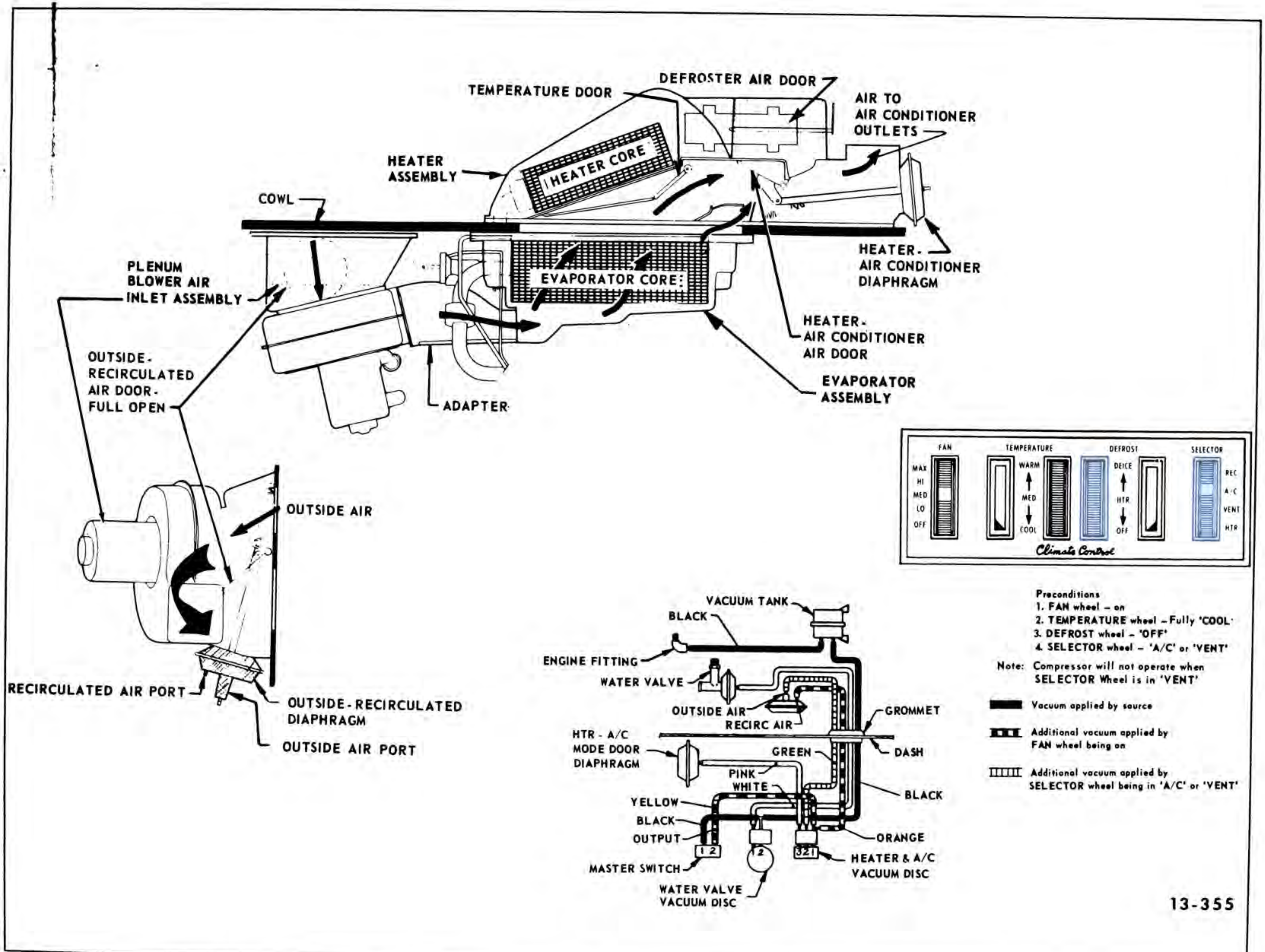


Figure 13-10 45-46-48000 Series Control Position, Vacuum Circuits, and Air Flow During VENT or A/C Mode

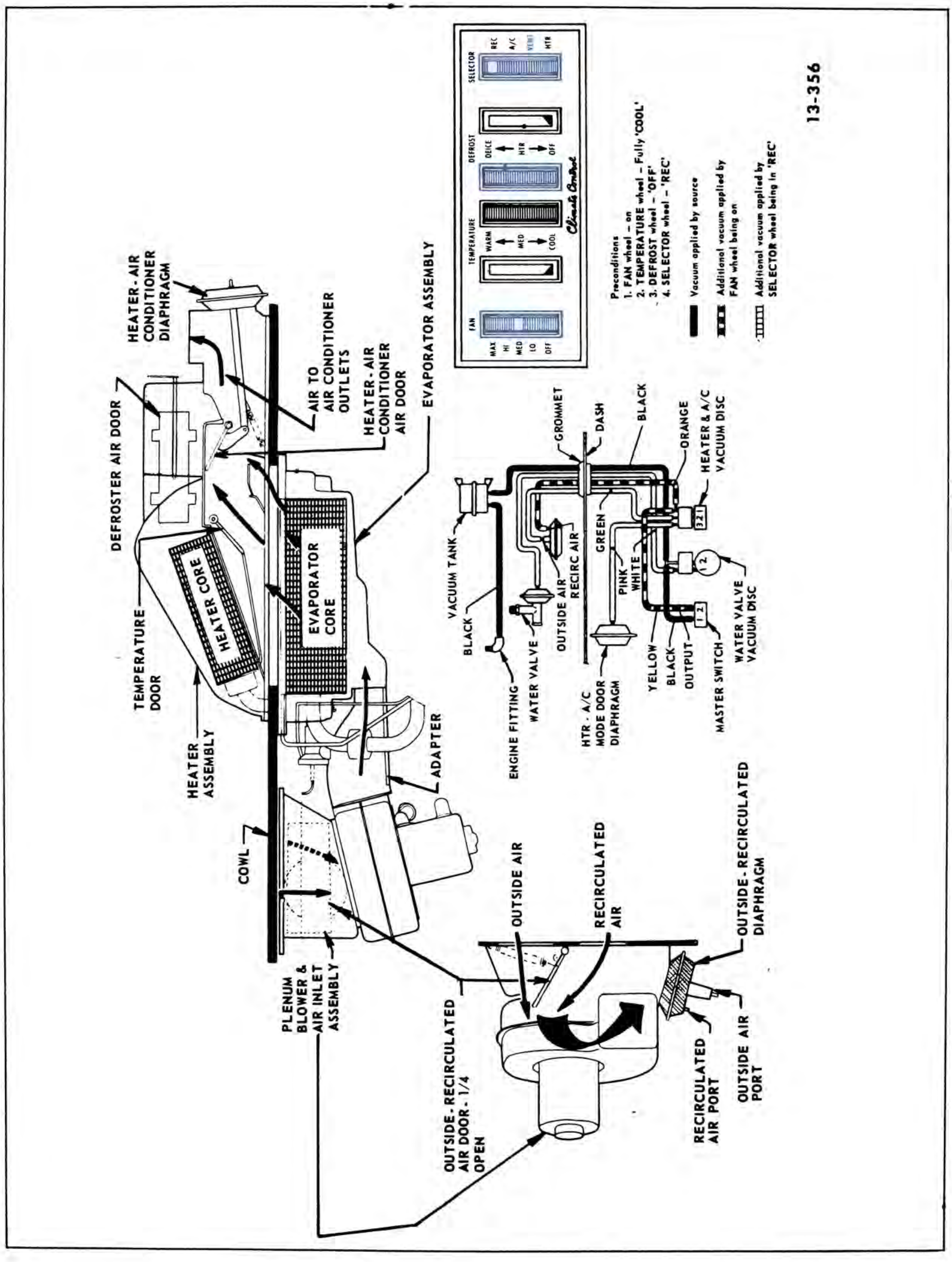


Figure 13-11 45-46-48000 Series Control Position, Vacuum Circuits, and Air Flow During REC Mode

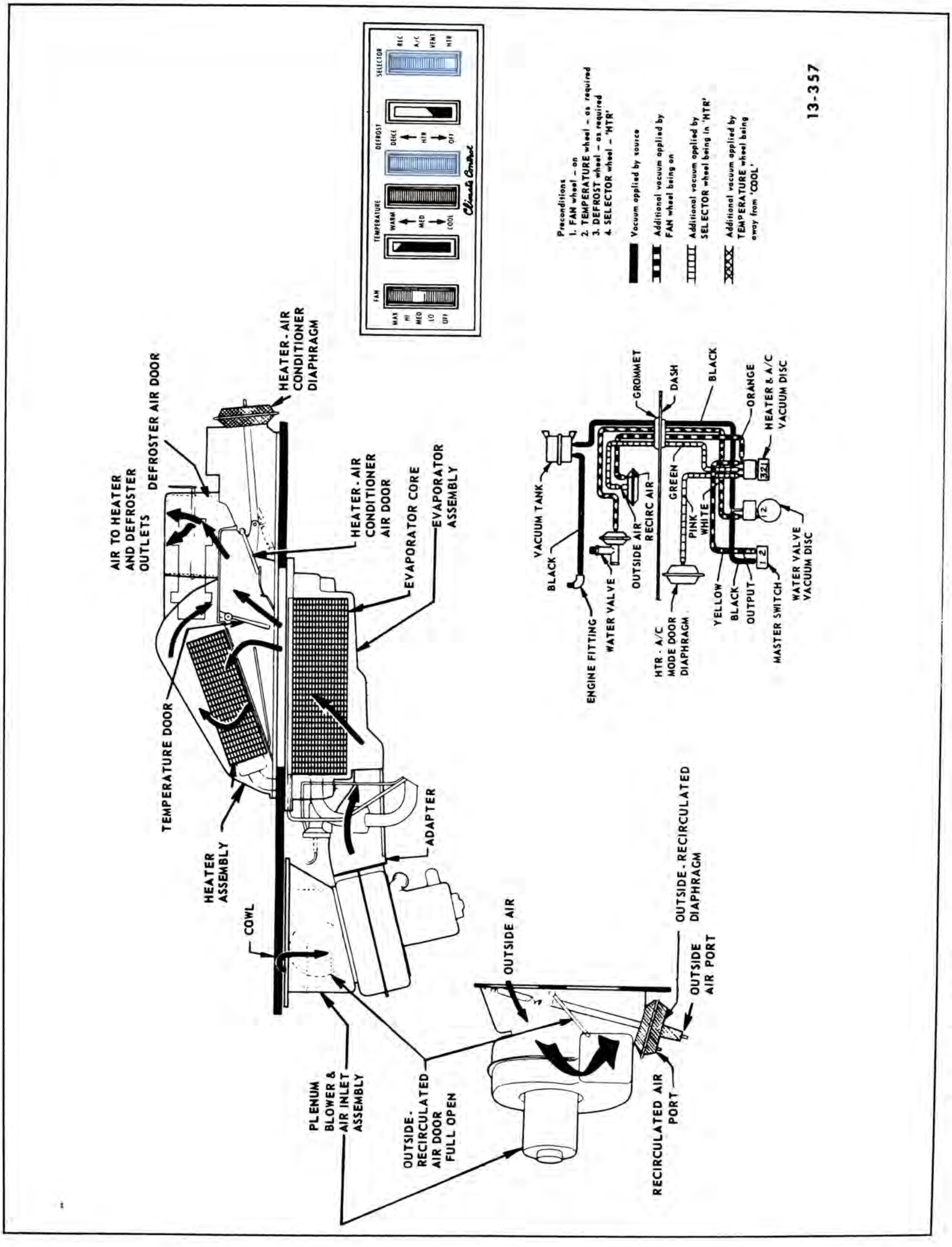


Figure 13-12 45-46-48000 Series Control Position, Vacuum Circuits, and Air Flow During HTR Mode

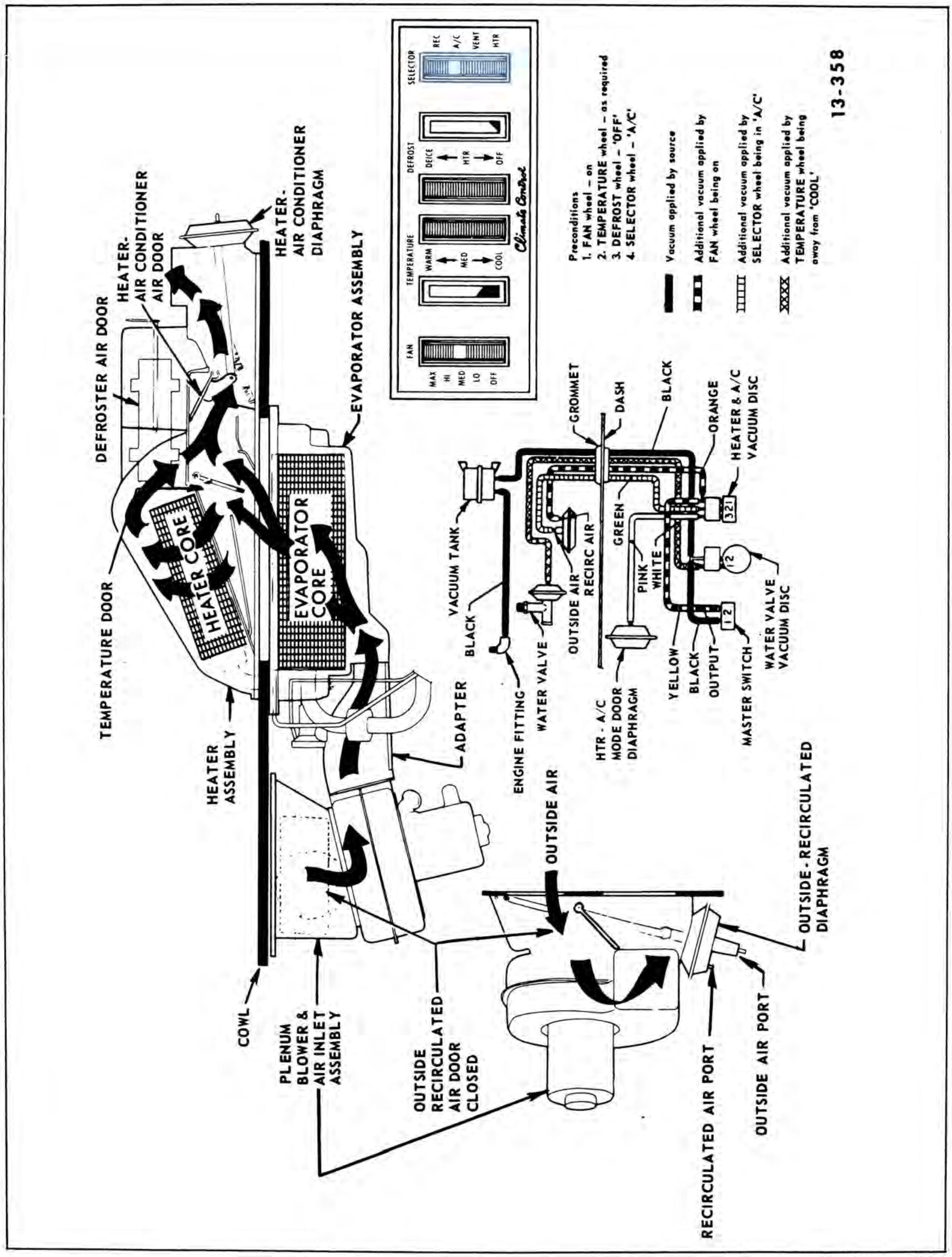


Figure 13-13 45-46-48000 Series Control Position, Vacuum Circuits, and Air Flow with Heater and Air Conditioner On

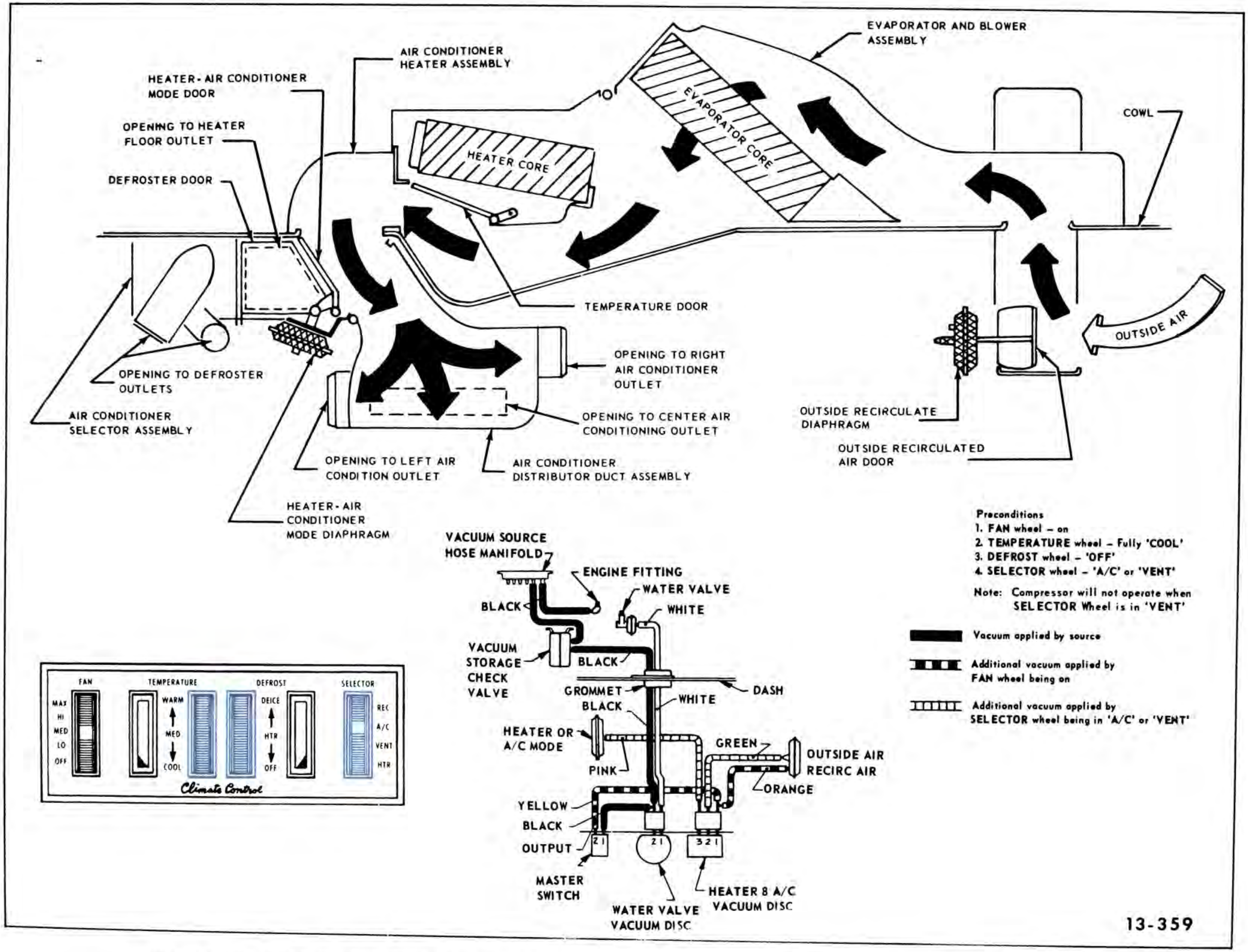


Figure 13-14 49000 Series Control Position, Vacuum Circuits, and Air Flow During VENT or A/C Mode

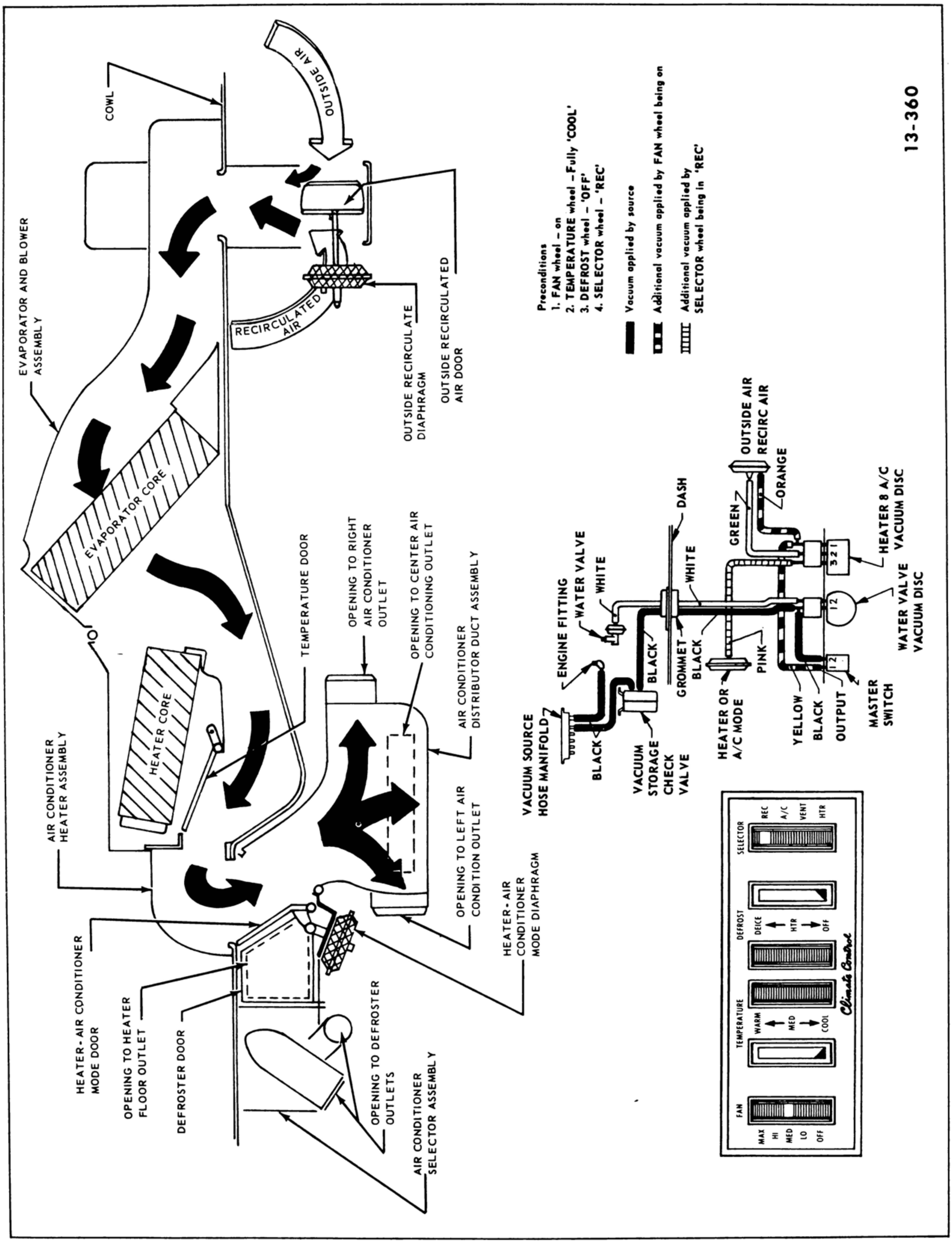


Figure 13-15 49000 Series Control Position, Vacuum Circuits, and Air Flow During REC Mode

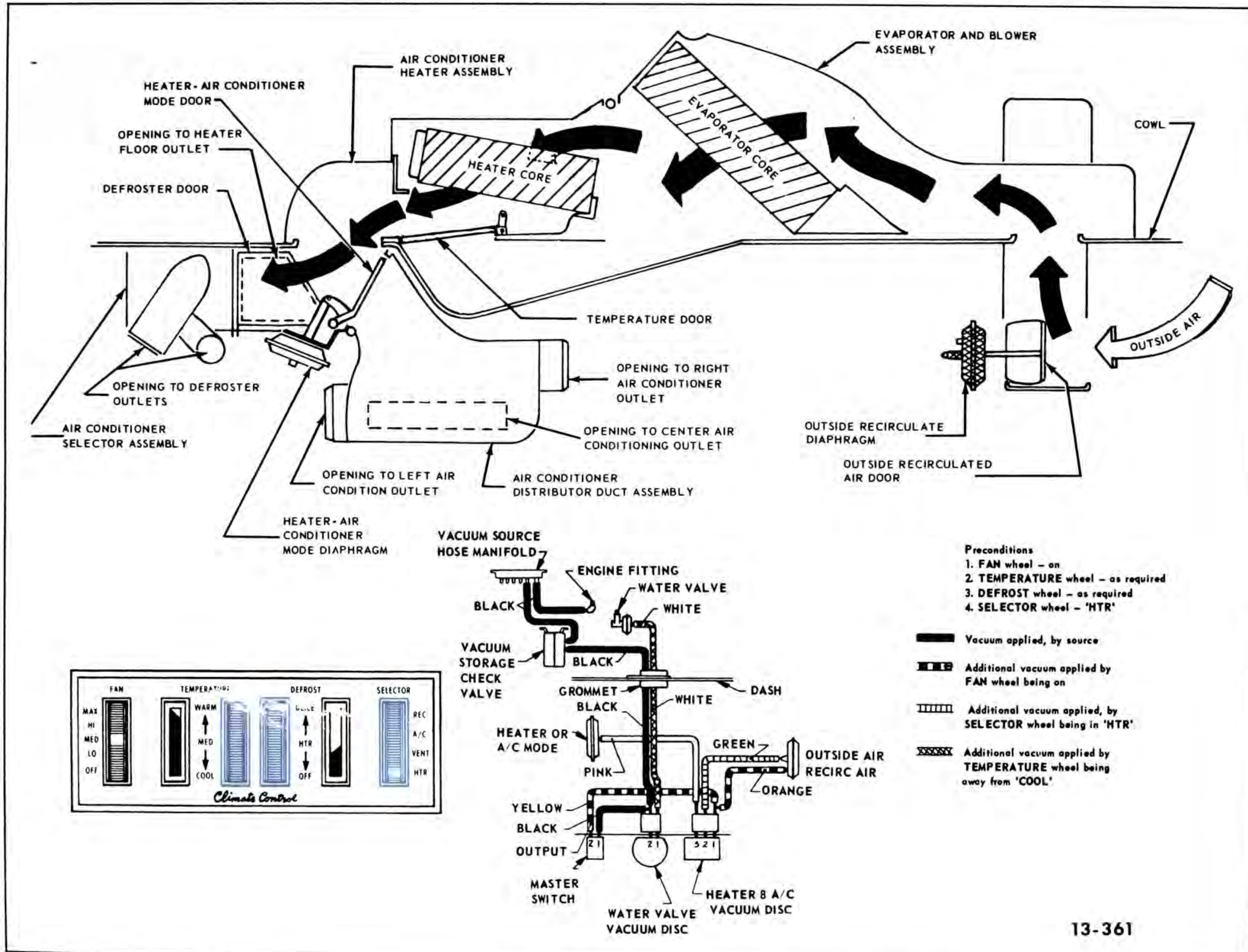


Figure 13-16 49000 Series Control Position, Vacuum Circuits, and Air Flow During HTR Mode

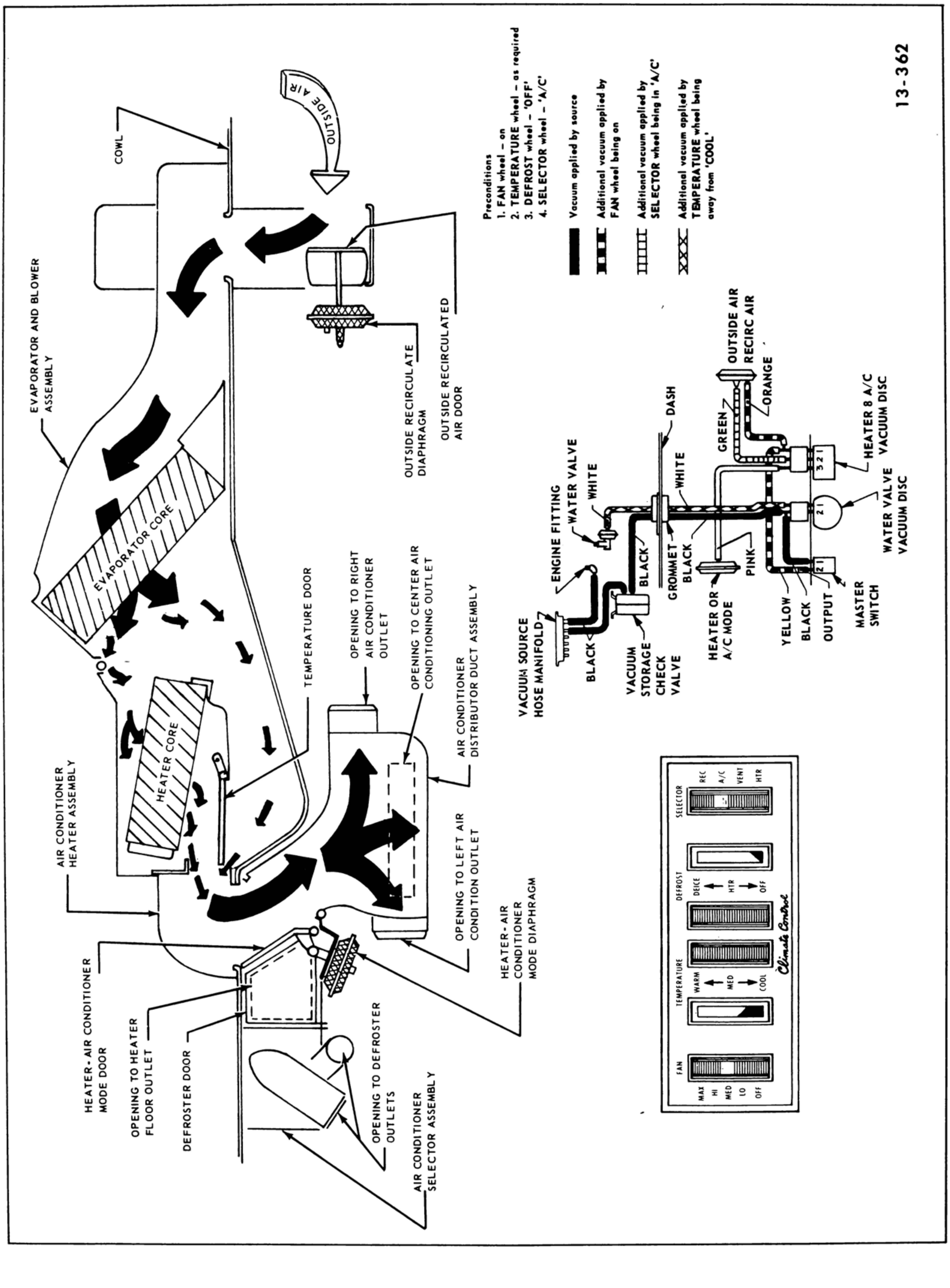


Figure 13-17 49000 Series Control Position, Vacuum Circuits, and Air Flow with Heater and Air Conditioner On

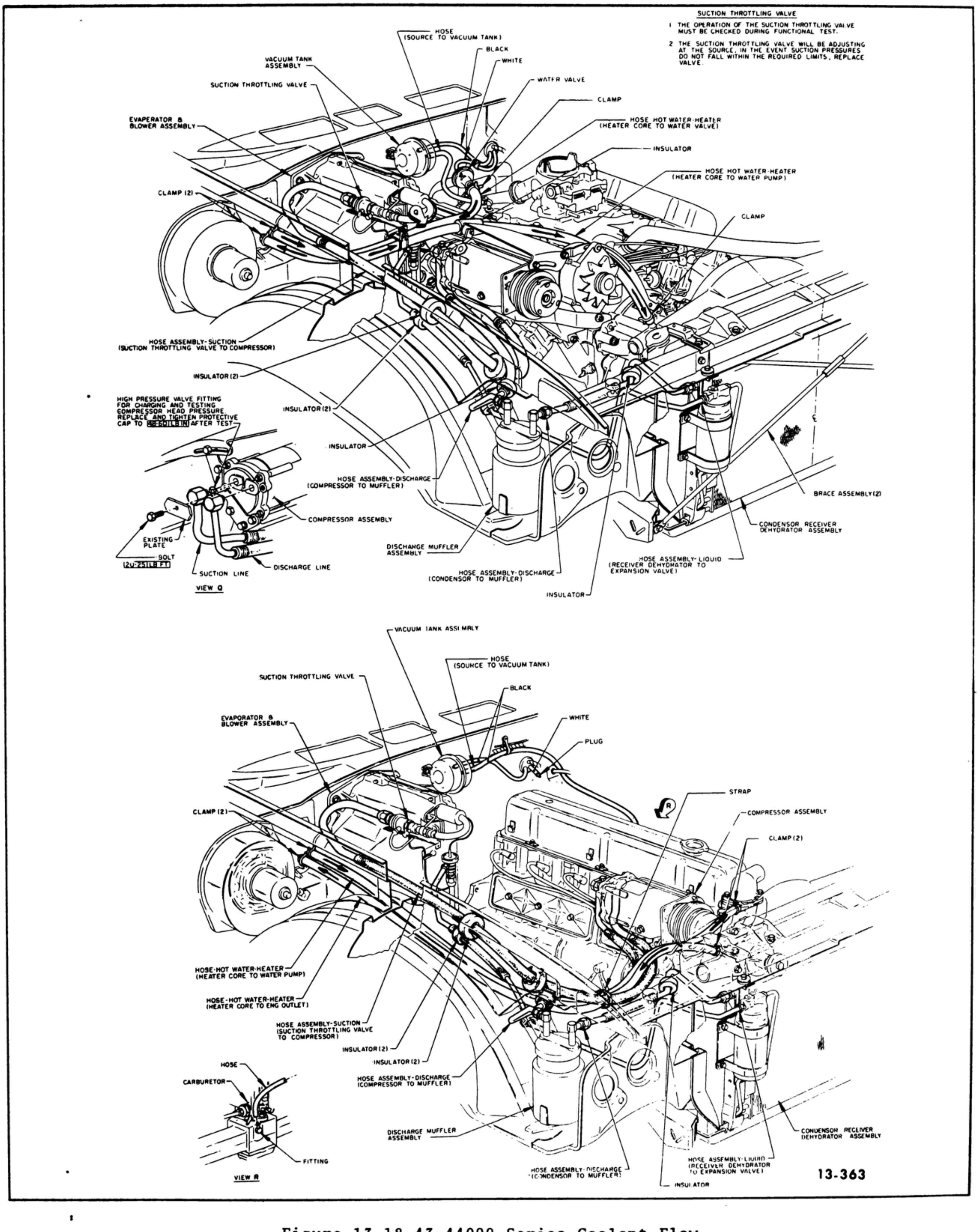


Figure 13-18 43-44000 Series Coolant Flow

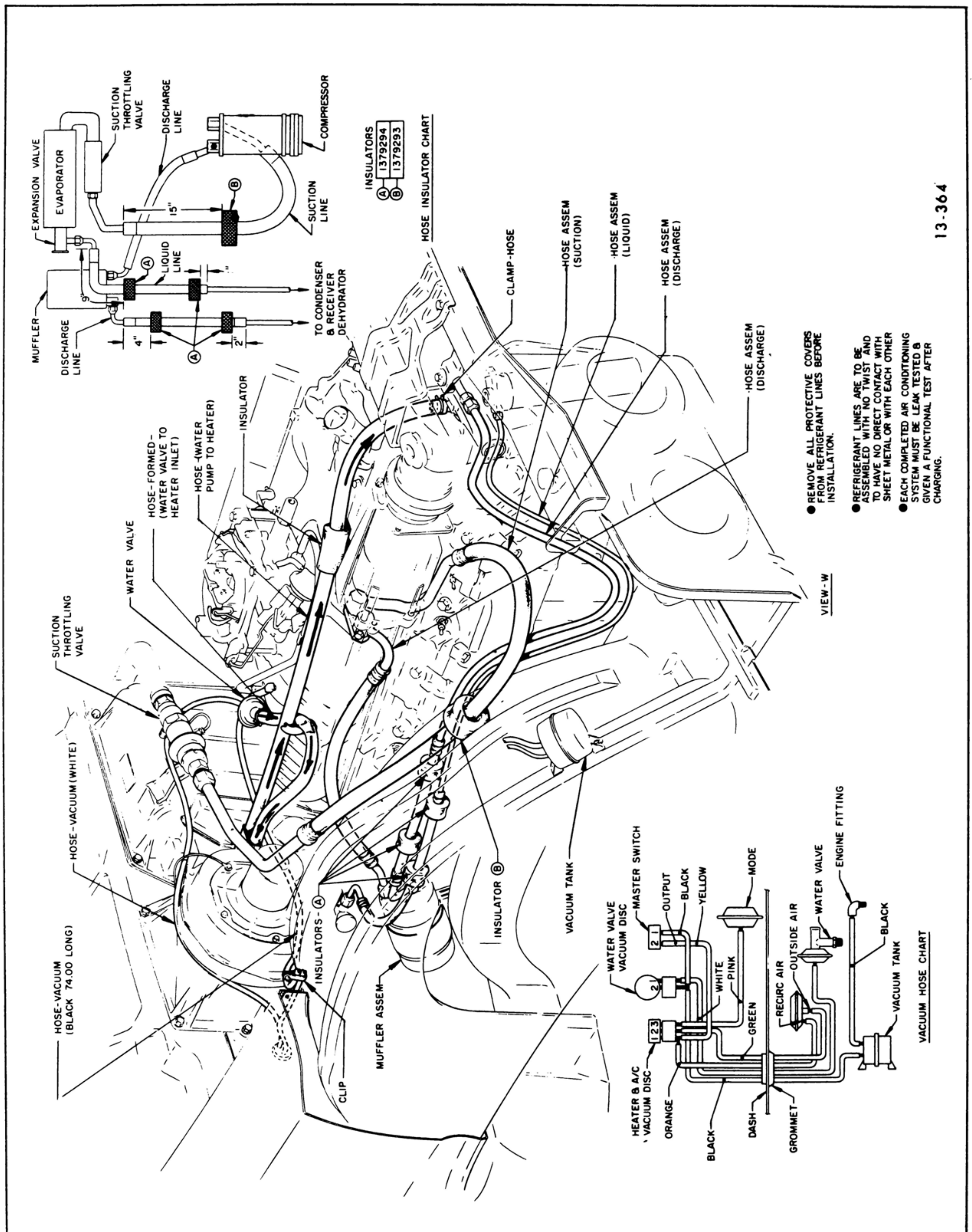


Figure 13-19 45-46-48000 Series Coolant Flow

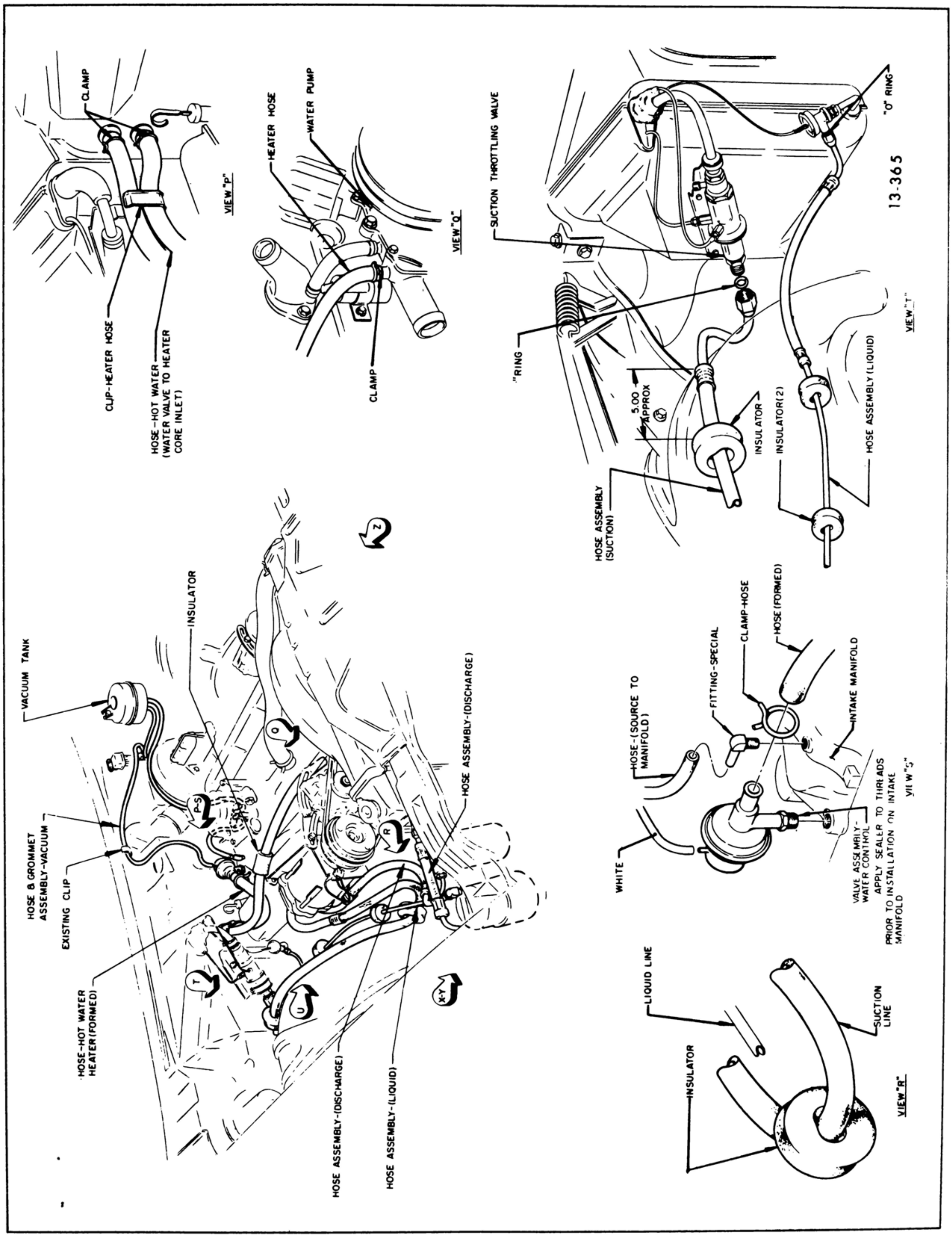


Figure 13-20 49000 Series Coolant Flow

closed completing half the circuit to the compressor clutch (the FAN switch must also be closed before the compressor clutch will be energized).

"A/C" - This position maintains the clutch compressor switch closed and applies vacuum to the outside air port of the outside-recirculated air door diaphragm. With vacuum applied to both ports of this vacuum diaphragm, (vacuum is also being applied by the FAN wheel being on) the outside-recirculated air door opens completely thereby drawing on only outside air and blocking off the recirculated air supply.

"VENT" - In this position the compressor clutch control switch is open thereby disrupting half the electrical circuit of the compressor clutch. If the FAN switch was closed and the air conditioning system operating, the compressor would thus be shut off. Vacuum is maintained at both the outside air and recirculated air ports of the outside-recirculated air door diaphragm. The VENT position is provided to afford the driver with uncooled outside air from the air conditioner outlets.

"HTR" - In this position the clutch control switch remains open and vacuum remains applied to both ports of the outside-recirculated air door diaphragm. In addition vacuum is applied to the heater-air conditioner mode door diaphragm. The door changes position and blocks off air flow to air conditioner outlets and directs air flow to heater outlets.

13-11 OPERATION OF HEATER PORTION OF SYSTEM

Engine heat is transmitted to the heater core by flow of coolant through the core. The flow of coolant or water through the heater core is shown in Figure 13-18 for 43-44000 Series, Figure 13-19 for 45-46-48000 Series, or Figure 13-20 for 49000 Series. Coolant enters the lower port of the heater core and exits from the upper port. A vacuum operated water valve (all engines except L-6) which is regulated by the position of the TEMPERATURE wheel, controls the flow of coolant to the heater core. When the TEMPERATURE wheel is fully down the water valve has no vacuum applied to it - hence is closed. When the TEMPERATURE wheel is moved approximately 1/4 inch upward from the "COOL" position, the water valve has vacuum applied to it permitting flow of coolant. The water valve will remain fully open for the remainder of the upward travel of the TEMPERATURE wheel.

13-12 OPERATION OF AIR CONDITIONER PORTION OF SYSTEM

The state of the refrigerant at the inlet port of the compressor is a low pressure gas. The compressor compresses the gas into a high pressure, high temperature gas (See Figure 13-26). Because of the increase in pressure, the heat in the gas has been concentrated and therefore is increased above the ambient (outside air) temperature. This heat in excess above the ambient temperature tends to dissipate itself. A condenser is utilized in the refrigeration circuit to provide a means whereby the heat of the refrigerant can be easily dissipated. The high pressure, high temperature (hot) gas flows through the condenser and is cooled to a high pressure liquid as it gives up its heat. From the condenser the high pressure liquid flows to the receiver-dehydrator and then to the expansion valve where the pressure is reduced and the liquid is allowed to expand in the evaporator. When the pressure is reduced the refrigerant will successively transform itself from a high pressure liquid to a low pressure liquid, and then to a low pressure gas. As the low pressure liquid expands and becomes a low pressure gas it absorbs heat. To satisfy the

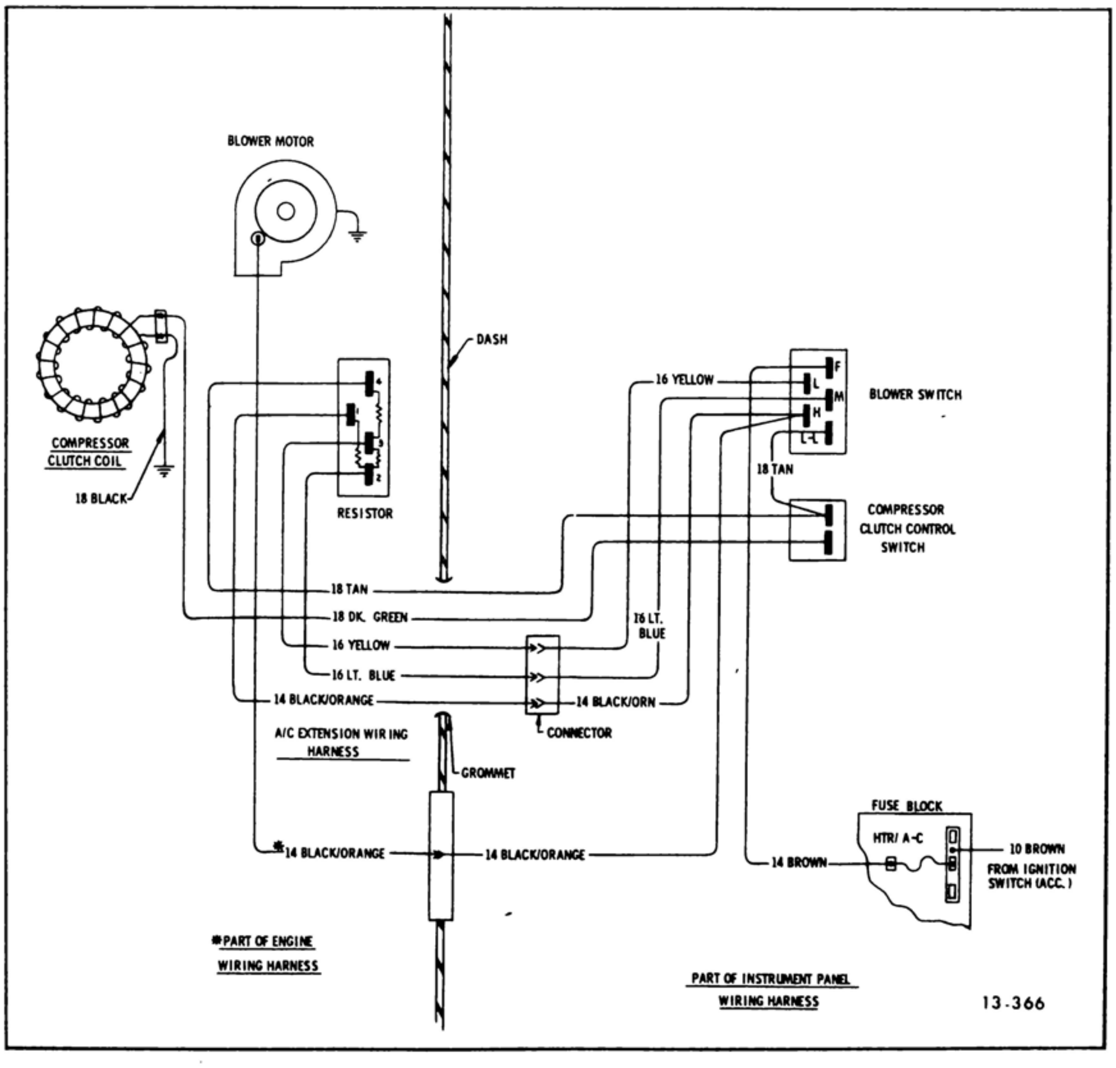


Figure 13-23 43-44000 Series Heater-Air Conditioner Wiring Diagrams

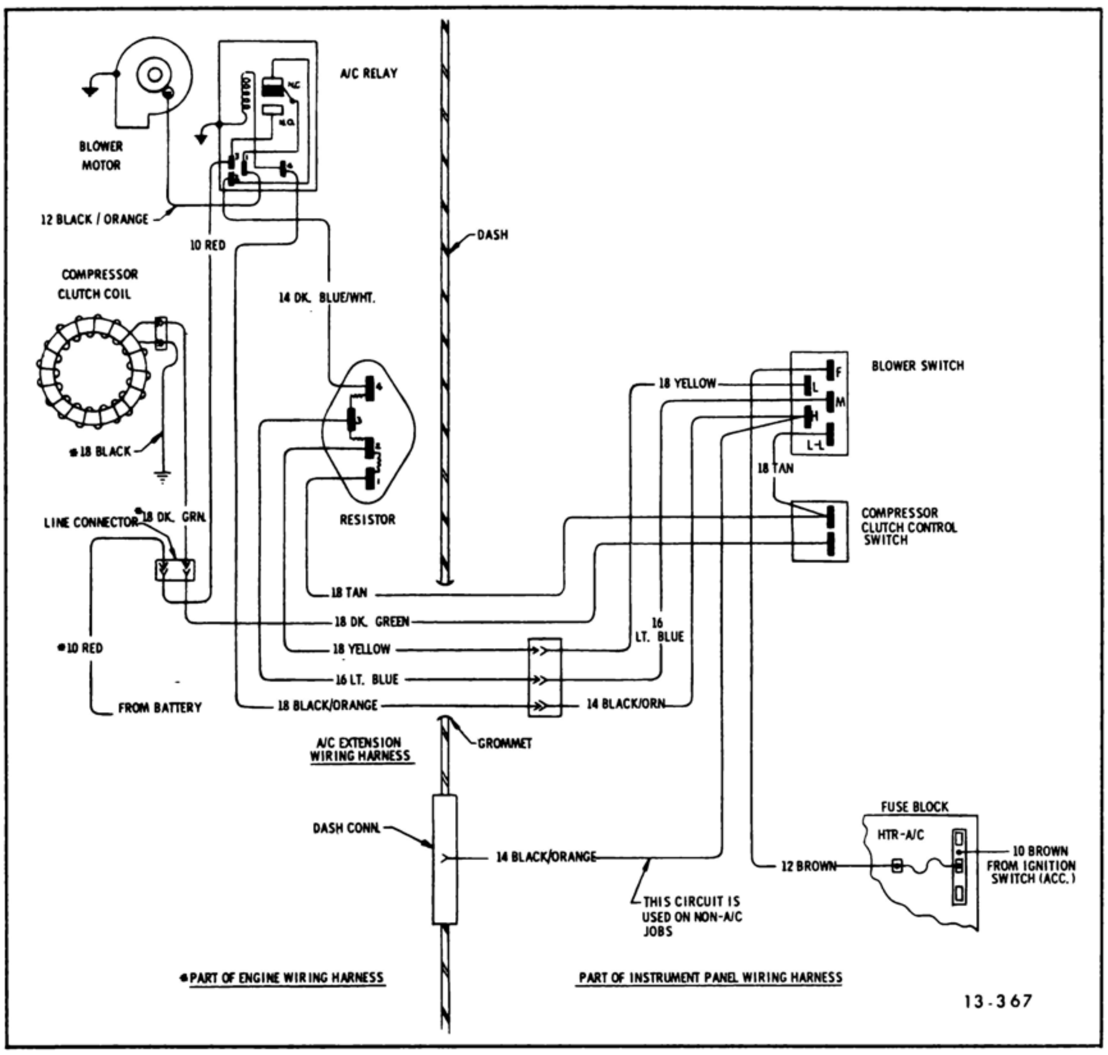


Figure 13-24 45-46-48000 Series Heater-Air Conditioner Wiring Diagrams

refrigerant demand for heat, the air passing over the evaporator gives up heat to the evaporator and in doing so, is cooled.

The low pressure gas returns to the inlet port of the compressor (the original starting point) where the cycle just described repeats itself. Although the foregoing description holds true in actual system operation, it should be qualified insofar as whenever the compressor is running, a portion of the refrigerant remains in a liquid state and consequently there is a certain amount of continuous liquid flow of refrigerant and oil throughout the system at all times during the refrigerating cycle.

13-13 DESCRIPTION OF AIR CONDITIONING COMPONENTS

a. Compressor

The compressor is located on right side of the engine compartment. The purpose of the unit is to draw the low pressure gas from the evaporator and compress this gas into a high temperature, high pressure gas. This action will result in the refrigerant having a higher temperature than the surrounding air.

The compressor is of basic double action piston design. Three horizontal double acting pistons make up a six cylinder compressor (see Figure 13-27). The pistons operate in 1-1/2 inch bore and have a 1-1/8 inch stroke. A swash plate keyed to the shaft drives the pistons. The shaft is belt driven through a magnetic clutch and pulley arrangement. An oil pump mounted at the rear of the compressor picks up oil from the bottom of the compressor and lubricates the bearings and other internal parts of the compressor.

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

1. Suction Valve Reed Discs and Discharge Valve Plates - The two suction valve reed discs and two discharge valve plates (see Figure 13-28) operate in a similar but opposite manner. The discs are composed of three reeds and function to open when the pistons are on the intake portion of their stroke (downstroke), and close on the compression stroke. The reeds allow low pressure gas to enter the cylinder heads. The discharge valve plates also have three reeds, however, they function to open when the pistons are on the compression portion of their stroke (upstroke), and close on the intake stroke. High pressure gas exits from the cylinder head discharge port. Three retainers riveted directly above the reeds on the valve plate serve to limit the opening of the reeds on the compression stroke.

2. Front and Rear Heads - The front and rear heads (Figure 13-29) serve to channel the refrigerant into and out of the cylinder heads. The front head is divided into two separate passages and the rear head is divided into three separate passages. The outer passage on both the front and rear heads channels high pressure gas to the discharge valve reeds. The middle passage on both front and rear heads channels low pressure gas to the suction valve plate reeds. The inner passage on the rear head houses the oil pump inner and outer rotors. A teflon sealing material is bonded to the sealing surfaces separating the passages in the rear head. "O" rings are used to affect a seal between the mating surfaces of the heads and the shell. The front head suction and discharge passages are connected to the suction and discharge passages of the rear head by a discharge tube

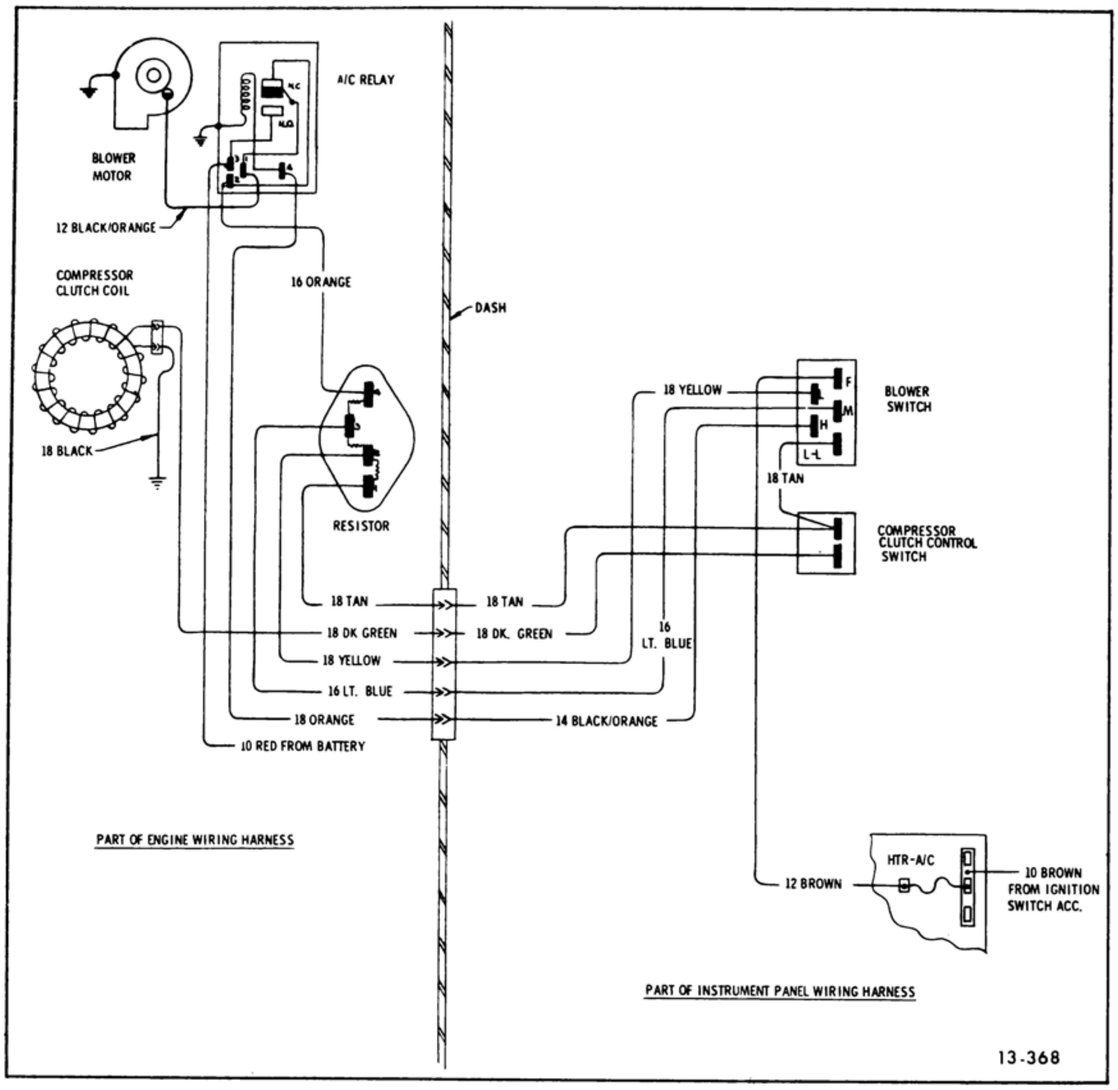


Figure 13-25 49000 Series Heater-Air Conditioner Wiring Diagrams

and suction passage in the body of the cylinder assembly. A screen located in the suction port of the rear head prevents foreign material from entering the circuit.

3. Oil Pump - An internal tooth outer rotor and external tooth inner rotor comprise the oil pump. The pump works on the principle of a rotary type pump. Oil is drawn up from oil reservoir in underside of shell through the oil inlet tube (see Figure 13-30) and circulated through the system via a 3/16 inch diameter oil passage through the shaft center and also four 5/64 inch diameter holes drilled perpendicular to the shaft. The inner rotor is driven by the shaft.

4. Shaft and Swash Plate Assembly - The shaft and swash plate assembly (see Figure 13-27) consists of an elliptical plate positioned obliquely to the shaft. As the plate and shaft rotate, the surface of the plate moves to and fro lengthwise relative to the centerline of the shaft. This reciprocating motion is transmitted to the pistons which contact the surface of the swash plate. A woodruff key locks the swash plate onto the shaft. The swash plate and shaft are serviced as an assembly. The shaft is driven by a pulley when the magnetic clutch is energized. A needle thrust bearing and a mainshaft bearing support the shaft horizontally and vertically.

5. Needle Thrust Bearing and Races - Two needle thrust bearings, each "sandwiched" between two races are located on either side of the swash plate hub. The front needle thrust bearing and races provide 0.010" to 0.015" clearance between the top of the pistons and the rear side of the front suction valve reed disc (see Figure 13-31). The rear needle thrust bearings and races provide 0.0005" to 0.0015" clearance between the hub of the swash plate and the rear hub of the rear cylinder. Races of various thicknesses are provided for service replacement to achieve required clearances when rebuilding units.

6. Cylinder Assembly and Pistons - The cylinder assembly (front cylinder and rear cylinder) is serviced only as a matched set. Alignment of the two halves is maintained by two dowel (locater) pins.

The double ended pistons are made of cast aluminum. There are two grooves on each end of the piston. The outer grooves will receive a piston ring. The inner grooves act as oil scraper grooves to collect any excess oil. Two oil return holes are drilled into the scraper grooves and allow oil to drain back into the reservoir.

7. Shoe Discs - The shoe discs are made of bronze and act as a bearing between the ball and the swash plate. An oil circulation hole is provided through the center of each shoe for lubrication purposes. These shoes are of various thicknesses and are provided in 0.0005 inch increments. Ten sizes are available for service replacement. A basic "zero" shoe size is available for preliminary gauging procedures when rebuilding a cylinder assembly.

8. Suction Passage Cover - The suction passage cover fits over a suction passage (see Figure 13-32) in the body of the cylinder assembly. Low pressure vapor flows from the suction port through the suction passage in the cylinder assembly, and into the suction cavity of the front head.

9. Discharge Tube - The discharge tube is used to connect the discharge cavity in the front head with the discharge port in the rear head. High pressure vapor discharge is channeled via the

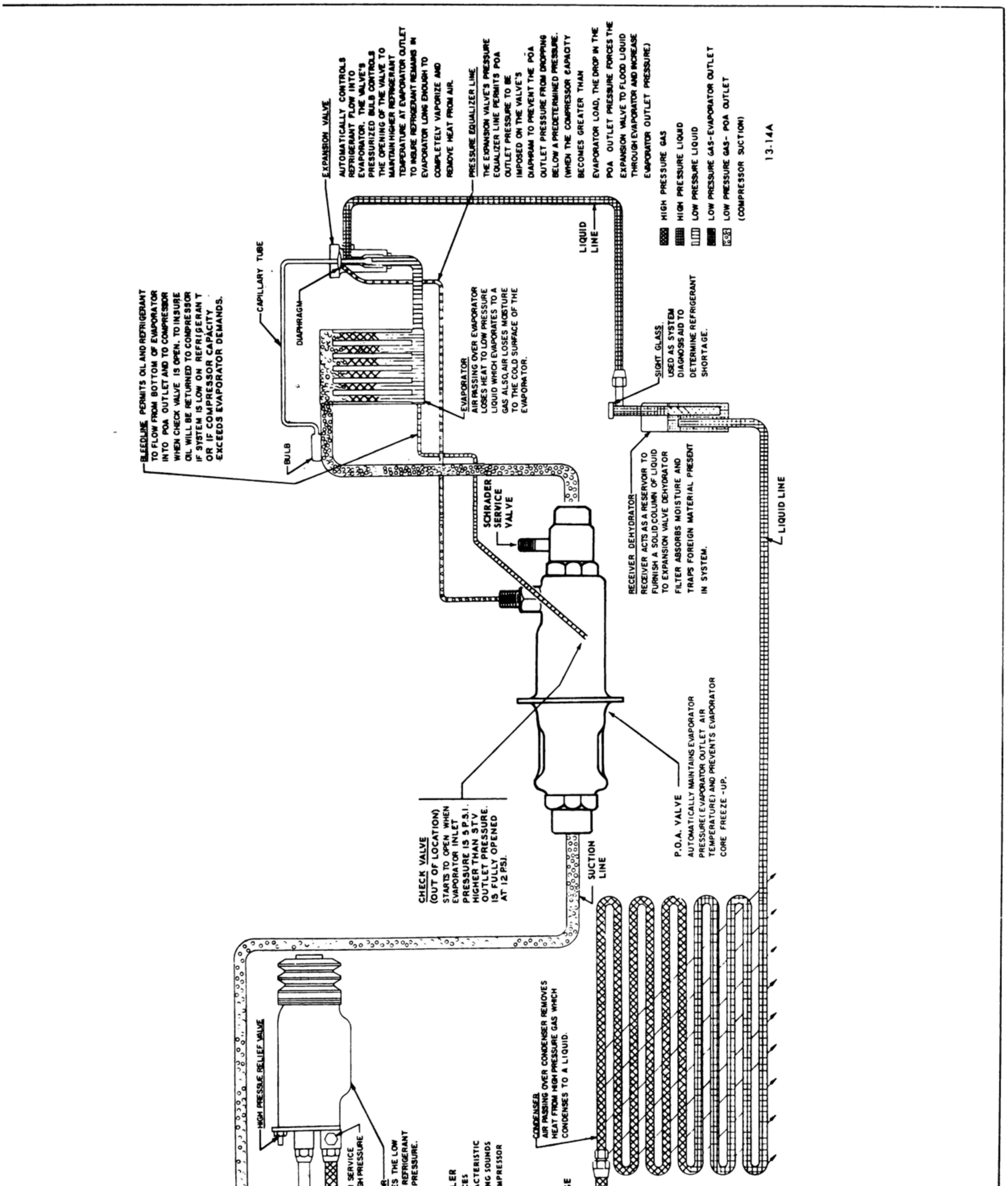


Figure 13-26 Air Conditioner Refrigeration Circuit

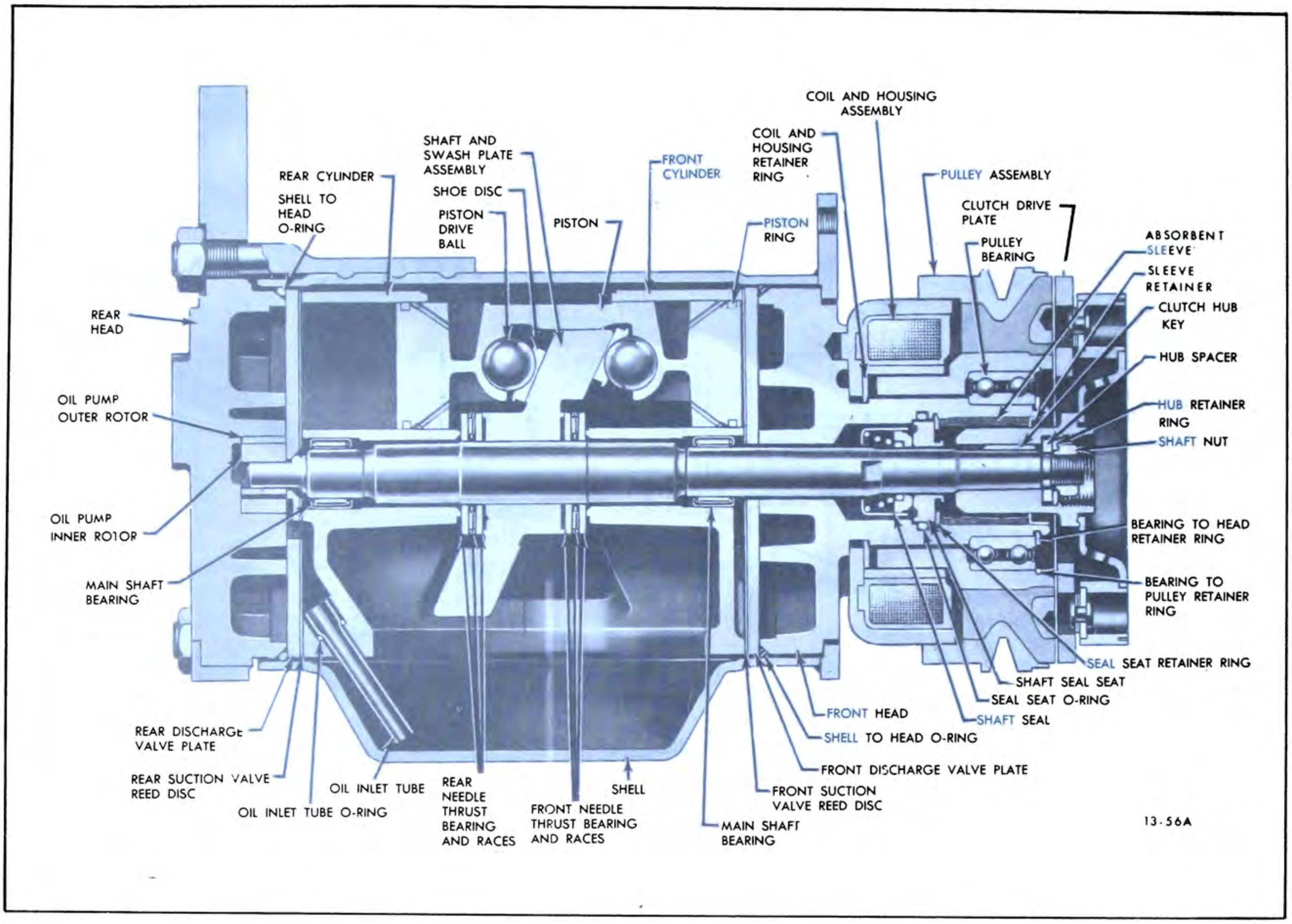


Figure 13-27 Compressor (Section View)

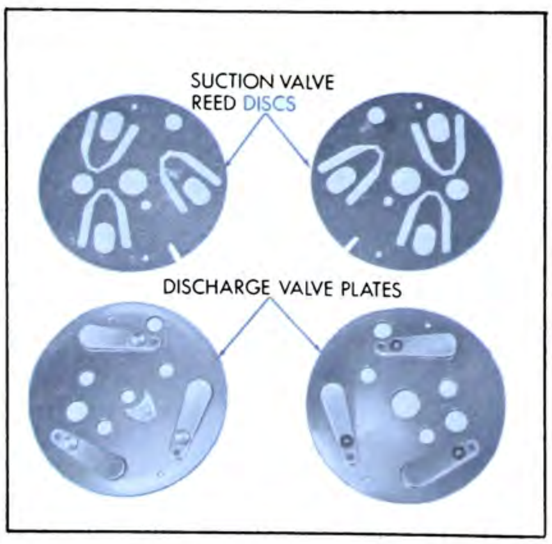


Figure 13-28 Compressor Suction Valve Reed Discs and Discharge Valve Plates

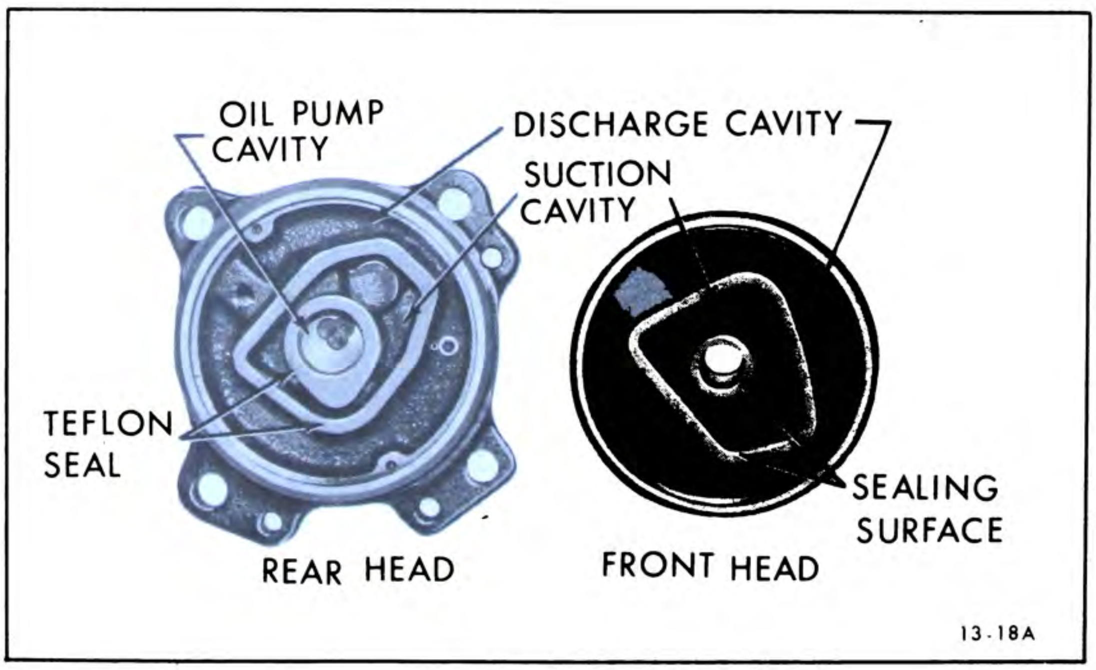


Figure 13-29 Compressor Front and Rear Heads

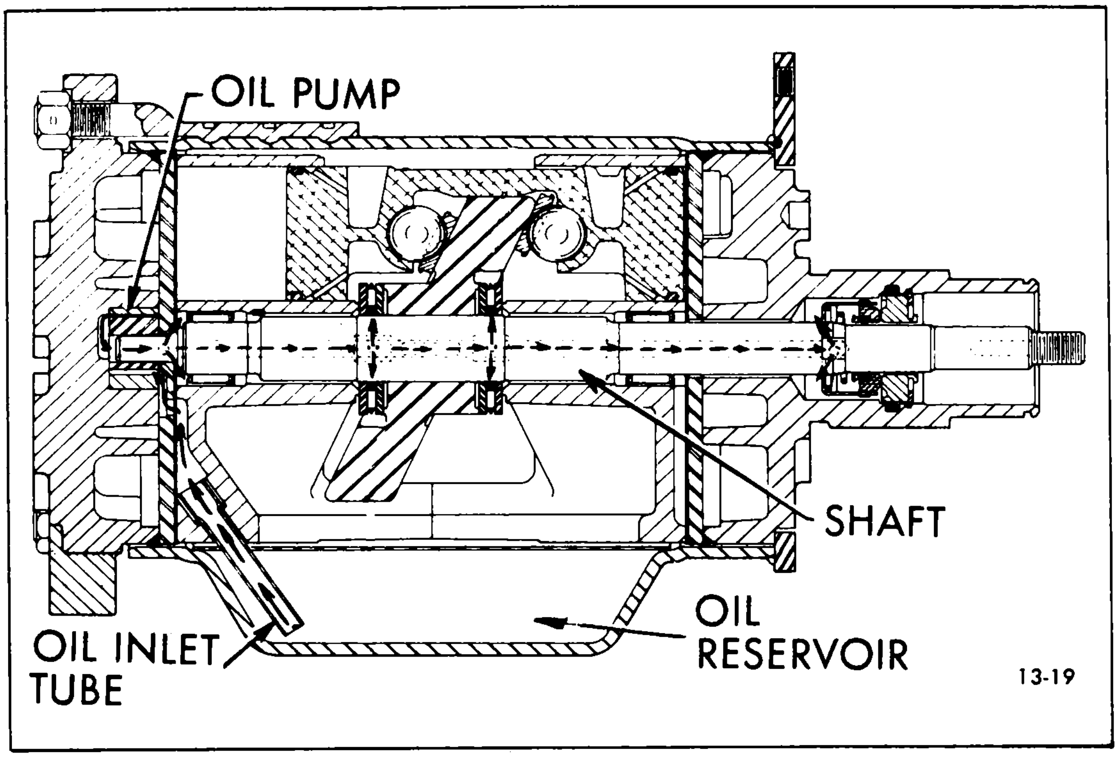


Figure 13-30 Compressor Oil Flow

tube to the discharge port. A slightly modified discharge tube is provided to be used as a service replacement (see Figure 13-33). The service replacement tube has a reduced end and a built up shoulder to accommodate an "O" ring and bushing. These added parts achieve the necessary sealing of the high pressure vapor within the compressor.

10. Pressure Relief Valve - The purpose of the pressure relief valve is to prevent the discharge pressure from exceeding 440 psi. Opening of the pressure relief valve will be accompanied by a loud popping noise and the ejection of some refrigerant from the valve. If the pressure relief valve is actuated due to excessive pressures in the compressor, the cause of the malfunction should be corrected immediately. The pressure relief valve is located on the rear head of the compressor.

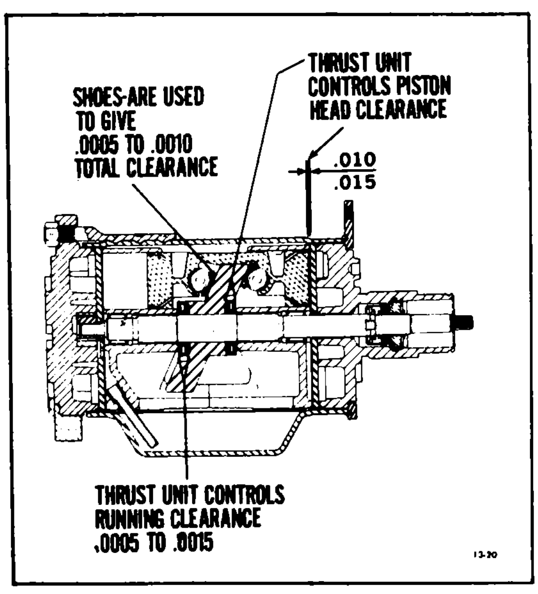


Figure 13-31 Compressor Needle Thrust Bearings and Races

11. Shell and Oil Drain Screw - The shell of the compressor contains a reservoir which furnishes a continuous supply of oil to the moving parts of the compressor. A baffle

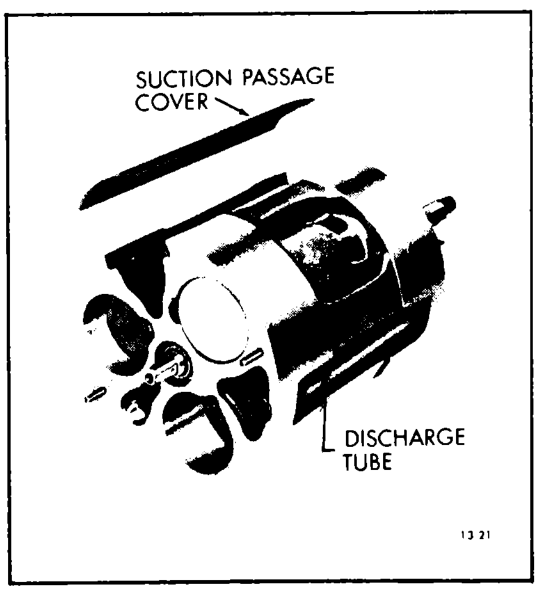


Figure 13-32 Suction Passage and Discharge Tube

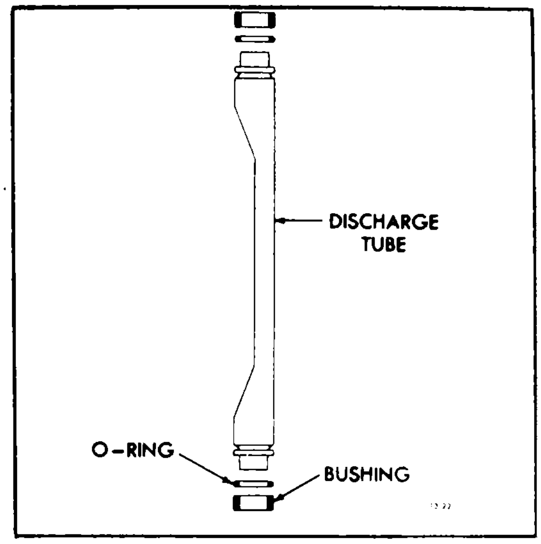


Figure 13-33 Service Replacement Discharge Tube

plate covers the reservoir and is tack-welded to the inside of the shell. In addition an oil drain screw and gasket are located on the side of the reservoir and are provided for draining or adding of oil to system. To add oil, compressor must be removed from car. The necessity to add oil should only be required when the system has ruptured violently and oil has been lost along with refrigerant. Under controlled conditions or slow leak conditions it is possible to loose only a small amount of oil with the refrigerant gas. The serial number, part or model number, and rating of the compressor is stamped on name plates located on top of shell.

12. Magnetic Clutch and Pulley Assembly - The magnetic clutch and pulley assembly (see Figure 13-34) together transmit power from the engine crankshaft to the compressor. The magnetic clutch is actuated when the air conditioning clutch compressor switch and the fan switch located on the instrument panel control assembly are closed. When the switches are closed, the coil sets up a magnetic field and attracts the armature plate (movable element of the clutch driven plate). The armature plate portion of the clutch driven plate moves forward and contacts the friction surface of the pulley assembly, thereby mechanically linking the compressor to the engine. The compressor will operate

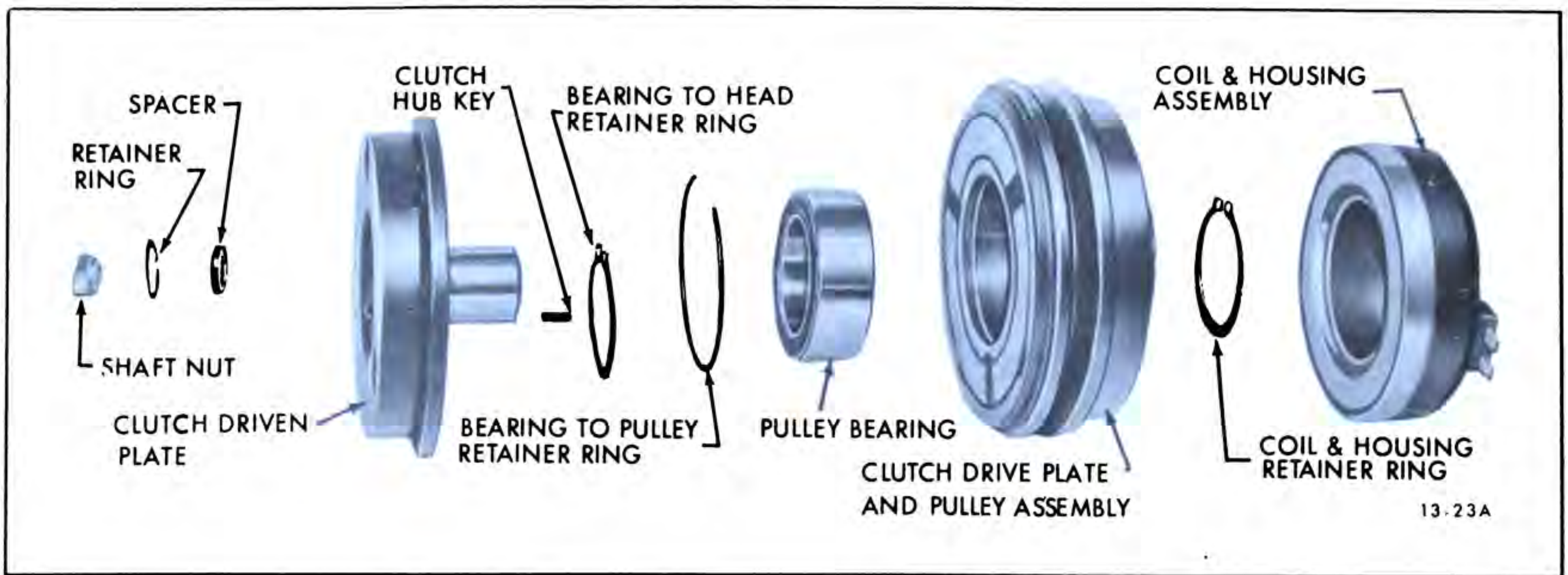


Figure 13-34 Magnetic Clutch and Pulley Assembly

continuously whenever the air conditioner clutch compressor switch and the fan switch are closed. When one or both of the switches are open the armature plate will be released due to spring tension and move away from the pulley assembly. This allows the pulley to rotate without driving the shaft. It should be noted that if the air conditioner system was in use when the engine was turned off, the armature plate may remain in contact with the pulley due to residual magnetism. When the engine is started the armature plate will separate from the pulley assembly. The coil is rated at 3.85 ohms (85°F.) and will draw 3.2 amperes at 12 volts d.c.

b. Muffler

A muffler is located on the discharge line side of the compressor. The muffler acts to reduce the characteristic pumping sound of the compressor. To further reduce compressor noise transfer through the body to the passenger compartment, a sheet of soft rubber insulation is wrapped around the outside of the muffler.

c. Condenser

The condenser which is made of aluminum is located in front of the radiator so that it receives a high volume of air flow. Air passing over the condenser absorbs the heat from the high pressure gas and causes the refrigerant to condense into a high pressure liquid.

d. Receiver—Dehydrator

The receiver-dehydrator is located on the right front side of the engine compartment. The purpose of the receiver-dehydrator is twofold: the unit insures a solid column of liquid refrigerant to the expansion valve at all times, and also absorbs any mositure in the system that might be present. A bag of desiccant (moisture absorbing material) is provided to absorb moisture. A sight glass (see Figure 13-35) permits visual checking of the refrigerant flow for bubbles or foam. The appearance of bubbles or foam above an ambient temperature of 70°F. indicates air in the line or an inadequate refrigerant charge. Bubbles or foam appearing at ambient temperatures below 70°F. do not necessarily indicate air or an inadequate charge and may appear even when the system is operating properly. A filter screen in the unit prevents foreign material from entering the remainder of the system.

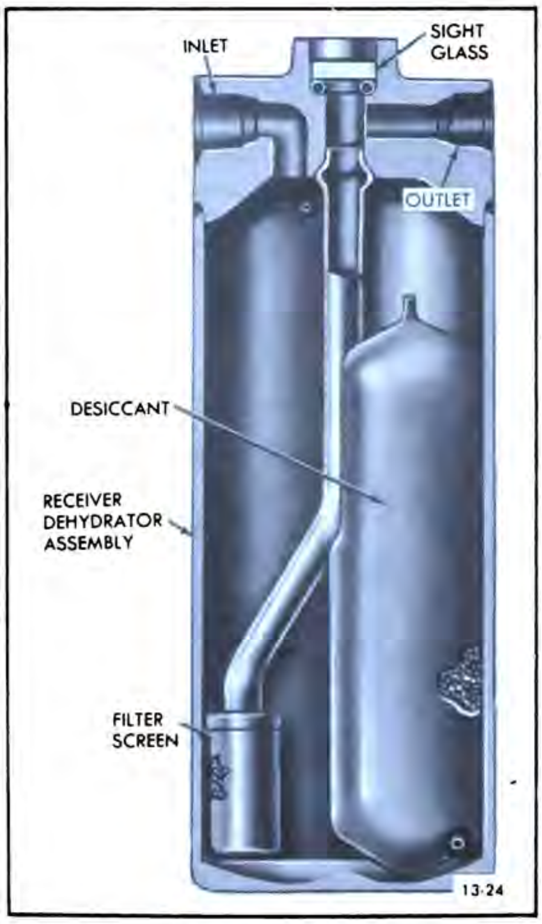


Figure 13-35 Receiver - Dehydrator Assembly

e. Expansion Valve

The expansion valve is located at the rear of the engine compartment on the passenger side of the car. It is held secure by a bracket which is attached to the plenum blower assembly. The function of the expansion valve is to automatically regulate the flow of refrigerant into the evaporator. The expansion valve is the dividing point in the system between the high and low pressure liquid refrigerant. A temperature sensing bulb is connected by a capillary tube to the expansion valve (see Figure

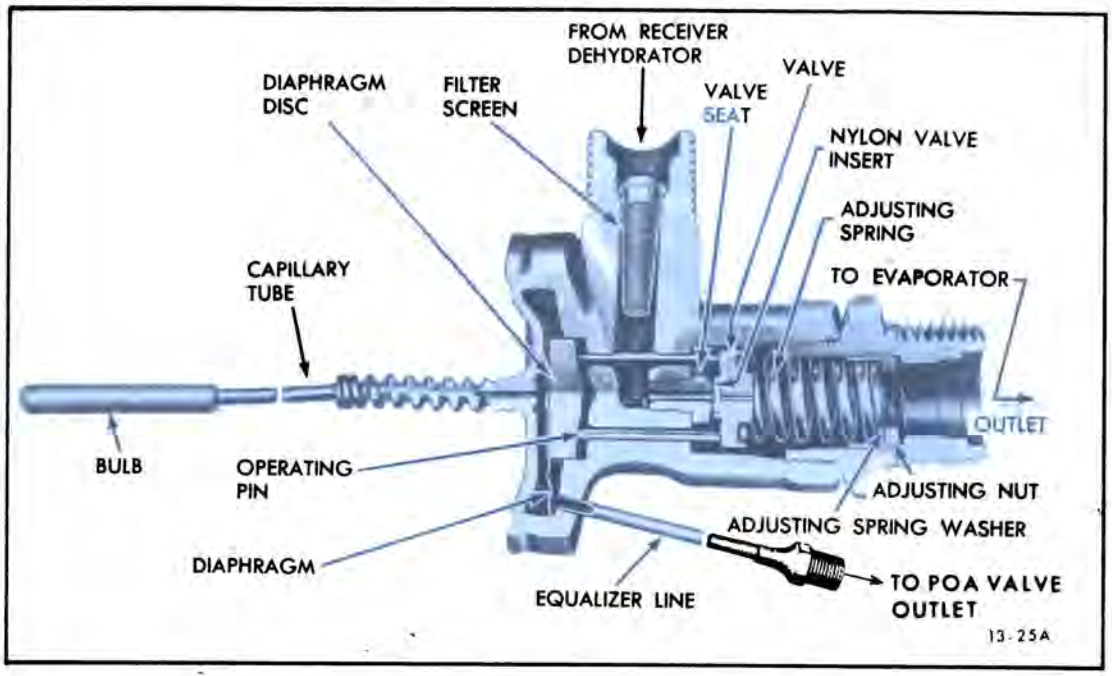


Figure 13-36 Expansion Valve

13-36). The temperature sensing bulb (clamped to the outlet pipe on the evaporator) measures the temperature of the evaporator outlet pipe and transmits the temperature variations to the expansion valve (see Figure 13-26). The capillary tube and bulb are filled with carbon dioxide and sealed to one side of the expansion valve diaphragm.

An increase in temperature will cause the carbon dioxide in the bulb and capillary tube to expand, overcoming the spring pressure and pushing the diaphragm against the operating pins (see Figure 13-36). This in turn will force the valve off its seat. When the refrigerant low pressure gas flowing through the outlet pipe of the evaporator becomes more than 6° higher or warmer than the temperature at which it originially began to vaporize or boil, then the expansion valve will automatically allow more refrigerant to enter evaporator. If the temperature of the low pressure gas decreases more than 6° below the temperature at which it originally began to vaporize or boil, then the expansion valve will automatically reduce the flow of refrigerant. Thus, an increase or decrease in the flow of refrigerant through the evaporator will result in an increase or decrease in the cooling by the evaporator. The temperature, humidity and volume of the air passing over the evaporator affects the rate of absorption of heat by the evaporator. As the ambient temperature varies, the frequency which the temperature bulb calls for more or less refrigerant will increase or decrease. 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 maintain the temperature at the evaporator pipe at the predetermined value. Conversely, cool days will result in less heat transfer and thereby require lesser quantities of refrigerant to maintain the predetermined temperature of the evaporator outlet pipe.

An equalizer line connects the expansion valve to the suction throttling valve. The equalizer line is used primarily to prevent prolonged and constant operation of the compressor under conditions where it is not receiving enough refrigerant. This operation is undesirable due to the resultant noise factor, and also due to the possibility of subjecting the compressor to reduced oil return. The equalizer line functions to permit the outlet pressure of the POA valve to be imposed on the diaphragm of the expansion valve. When the outlet pressure of the suction throttling valve drops below a predetermined pressure, this decrease in pressure is also transmitted to the diaphragm of the expansion valve, via the equalizer line. The expansion valve is caused to open and flood refrigerant through the evaporator, thereby resulting in an increase in the evaporator pressure. This action only occurs during times when the compressor capacity becomes greater than the evaporator output with the resultant drop in POA suction throttling valve outlet pressure.

f. Evaporator

The function of the evaporator is to cool and dehumidify the air flow before it enters the passenger compartment. The evaporator assembly consists of an aluminum core enclosed in a reinforced plastic housing. A water drain port is located in the bottom of the housing. Two refrigerant lines are connected to the side of the evaporator core: one at the bottom and one at the top. The expansion valve is attached to the lower (inlet) pipe, and the suction throttling valve is attached to the upper (outlet) pipe. The temperature sensing bulb of the expanding valve is clamped to the outlet pipe of the evaporator core. The high pressure liquid refrigerant, after it is metered through the expansion valve, passes into the evaporator core where it is allowed to expand under reduced pressure. As a result of the reduced pressure the refrigerant begins to expand and return to the original gaseous state. To accomplish this transformation it begins to boil.

The boiling action of the refrigerant demands heat. To satisfy the demand for heat, the air passing over the core gives up heat to the evaporator and is subsequently cooled.

g. P.O.A. Valve

The pilot operated absolute suction throttling valve (POA valve) regulates the pressure inside the evaporator and thereby affects the air temperature at the instrument

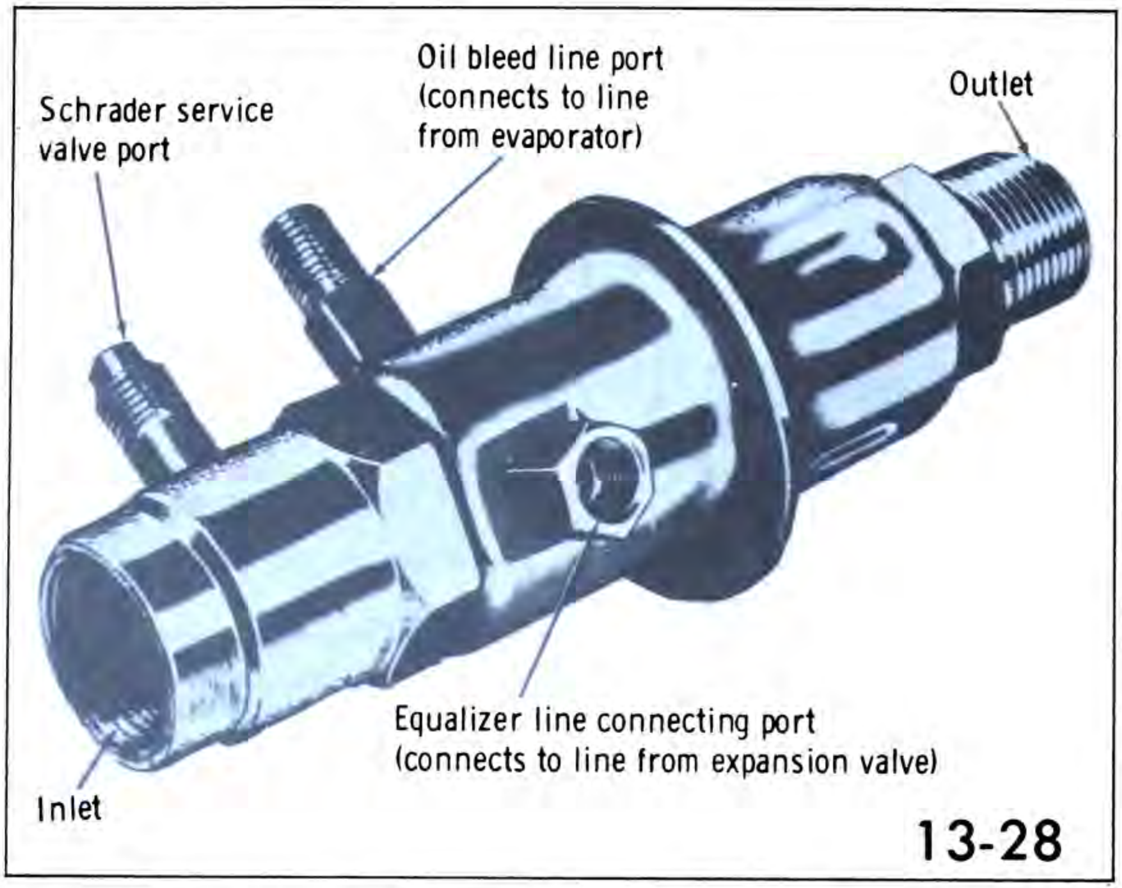


Figure 13-37 Pilot Operated Absolute Suction Throttling Valve (POA Valve)

panel outlets (See Figure 13-37). The POA valve has a sealed inner chamber which controls the pressure regulating mechanism of the valve independently of the exterior atmospheric pressure. This design insures that the valve does not change its calibration as the system is operated in various altitudes. It should be remembered; however, that any gage used to check the valve pressure will not be free from the effect of atmospheric pressure. For this reason it might appear that it is the pressure within the valve that is changing. Actually the reverse is true. The pressure within the valve remains unaffected by atmospheric variations, while the gage used to read these pressures is affected by atmospheric pressure. The table shown in Figure 13-38 indicates the gage pressure that should be obtained at various altitudes. If readings are obtained other than these, it is likely that the valve is malfunctioning. The POA valve cannot be disassembled or adjusted. If it is determined that the valve is malfunctioning, it should be replaced.

h. Fan Drive 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 800-1600 RPM. Under these conditions the clutch is disengaged since a small oil pump gear driven by the separator plate forces the silicone oil into the reservoir between the separator plate and the front cover assembly. Under these conditions 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 bimetal coil tightens to move the leak valve (attached to the coil) which opens a port in the separator plate. Silicone oil flows into the clutch chamber engaging the clutch and providing a maximum fan speed of approximately 2350 RPM.

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.

DIVISION III

SERVICE PROCEDURES

SERVICING REFRIGERANT CHARGED COMPONENTS

13-14 GENERAL SERVICE INFORMATION AND SAFETY PRECAUTIONS

a. General Information

All subassemblies are shipped sealed and dehydrated. They

ALTITUDE OF LOCAL (FT)	GAGE PRESSURE (PSI)	ALTITUDE OF LOCAL	GAGE PRESSURE (PSI)
0 (Sea Level)	28.5	6000	31.4
1000	29.0	7000	31.8
2000	29.5	8000	32.3
3000	30.0	9000	32.7
4000	30.5	10,000	33.2
5000	31.0		
Allowable tolerance of POA valve is ± 1 psi			13-29

Figure 13-38 Table of Altitude Corrected Gage Pressure for Evaluating POA Valve Performance

are to remain sealed until just prior to making connections, and should be at room temperature before uncapping. This prevents condensation of moisture from air that enters the system.

All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak. Any fittings with grease or dirt on them should be wiped clean with a cloth dipped in alcohol.

Do not clean fitting or hoses with solvents because they are contaminants. If dirt, grease or moisture gets inside the pipes or hoses and cannot be removed, the pipe or hose is to be replaced. Use a small amount of clean refrigeration oil on all tube and hose connecting joints, and lubricate the "O" ring gasket with this oil before assembling the joint. The oil will help in effecting a leak-proof joint and assist the "O" ring to slip into the proper location without being cut or damaged. Always use new "O" rings.

When tightening joints, use a second wrench to hold the stationary part of the connection to prevent twisting and to prevent hose kinking. Kinked hoses are apt to transmit noise and vibration. Tighten all connections in accordance with recommended torques (see Figure 13-1).

Do not connect receiver-dehydrator assembly until all other connections have been made. This is necessary to insure maximum moisture removal from system.

It is important that air conditioning hoses do not rest on or contact body or chassis sheet metal except where necessary. Because of the high frequency at which the compressor operates, the passenger compartment is susceptible to transfer of noise.

b. Safety Precautions

The following safety precautions should always be followed when servicing refrigerant charged components:

1. Do not leave refrigerant-12 cylinder uncapped.

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

3. Do not subject cylinder to high temperatures.

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

5. Do not fill cylinder completely.

6. Do not discharge vapor into area where flame is exposed or directly into engine air intake.

7. Do not expose eyes to liquid - WEAR SAFETY GOGGLES whenever discharging, charging or leak testing system.

13-15 DISCHARGING SYSTEM

Removal of any part in the refrigerant circuit will require discharging of the entire system.

1. Remove protective cap from the Schrader valve located on the POA valve and Schrader valve located on discharge port of compressor.

2. Install Adapters (J-5420) onto each Schrader valve, see Figure 13-50 and connect a Gage Charging Line (J-5418) between each adapter and the outer connecting ports of the Manifold and Gage Set (J-5725-01). Both valves of manifold and gage set must be closed.

3. Hold a large size rag over center port of manifold and gage set and slowly open both valves on manifold and gage set until refrigerant starts to flow without discharging refrigerant oil.

NOTE:

Do not open valves too fast as oil will be blown out of system.

13-16 ADDING OIL TO THE SYSTEM

The oil in the refrigeration system does not remain in the compressor during system operation, but circulates throughout the system. The compressor is initially charged with 10-1/2 oz. of 525 viscosity oil. After system has been in operation the oil content in the compressor will vary depending on the engine RPM and air conditioning load.

At higher engine RPM's a lesser amount of oil will be retained in the compressor reservoir. It is important that the total system oil content does not vary from a total of 10-1/2 oz. Excessive oil content will reduce cooling capacity. Inadequate oil content may result in damage to compressor moving parts.

The refrigeration system will

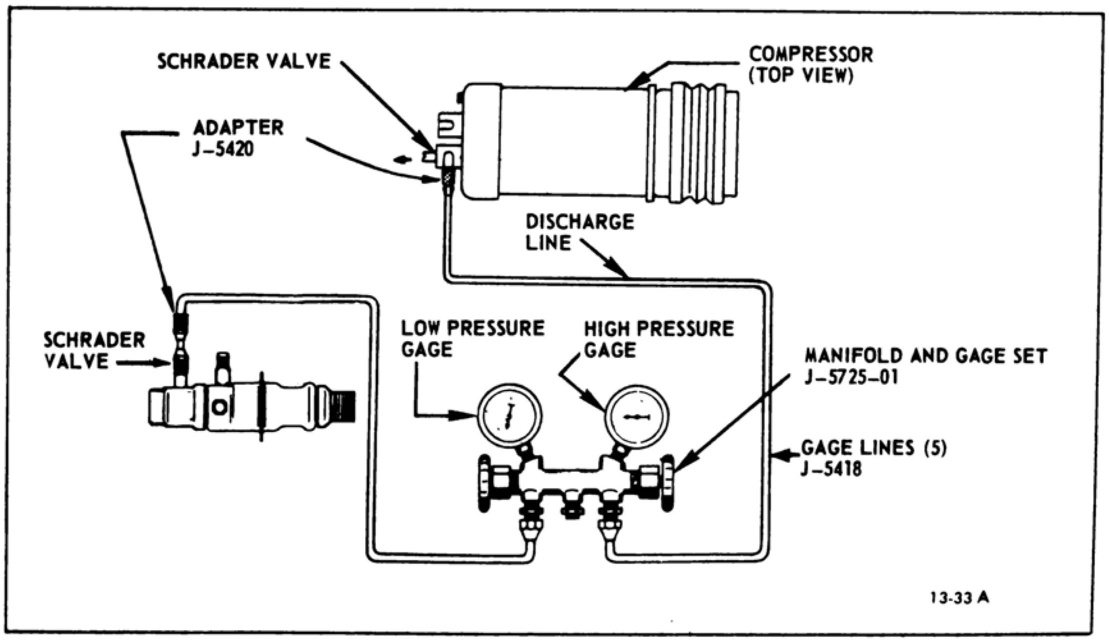


Figure 13-50 Set-Up for Discharging System

not require adding of oil unless there is an oil loss because of a ruptured line, badly leaking compressor seal, replacement of evaporator, compressor, receiver-dehydrator, or loss due to a collision. Oil is generally added to the system via the oil drain hole in the lower side of the compressor. To add oil to the system via the compressor, the compressor must be removed. If no major loss of oil has occurred and a component (condenser, receiver-dehydrator or evaporator) is removed for servicing, the oil may be added directly to the component. To add oil to a component removed for servicing and when no major loss has occurred, drain and measure oil in component, then replace with a like amount. To add oil to the system when a major loss of oil is evidenced, or when the compressor is being serviced, remove compressor, drain and measure oil, and replace oil amount specified in Figure 13-51.

If foreign material is noted in oil drained from system or evidence of moisture is obvious in the components removed, it is recommended that the entire system be flushed (ref. par. 13-17) and the receiver-dehydrator be replaced. A full oil charge of 10-1/2 oz. of 525 viscosity refrigerant oil should be replaced in the system. It should be noted that all service replacement compressors will be supplied with 10-1/2 oz. of oil. In most cases it will be necessary to drain oil from service replacement compressor and refill it with amount as specified in Figure 13-51.

13-17 FLUSHING THE SYSTEM

Flushing of the system may involve all the components of the system or individual components in the system. The components may be flushed while mounted in the engine compartment or may be removed for flushing. When a component is not removed, disconnect all refrigerant lines or hoses attached to component. To perform flushing operation, connect a cylinder of refrigerant-12 to the component to be flushed, then invert the cylinder and open the cylinder valve so that the liquid refrigerant pours out and through the component.

CAUTION:

When liquid refrigerant-12 reaches atmospheric pressure it immediately drops to -21.7°F. Insure that area immediately surrounding outlet of component is clear of anything that may be damaged by contact because of the sudden drop in temperature.

In all cases where a complete system flushing operation is performed, the receiver-dehydrator and the filter screen on the expansion valve should be replaced. If the evaporator assembly is flushed while installed in the car, the temperature bulb on the evaporator outlet pipe must be disconnected to keep the

CONDITION	AMOUNT OF OIL DRAINED FROM COMPRESSOR	AMOUNT OF 525 OIL TO INSTALL IN COMPRESSOR
1. Major loss of oil and a component (condenser, receiver-dehydrator, or evaporator) has to be replaced.	a. More than 4 oz.	a. Amount drained from compressor plus amount for component being replaced: Evaporator—Add 2 oz. Condenser —Add 1 oz. Receiver Dehydrator-Add 1 oz.
	b. Less than 4 oz.	b. Install 6 oz. plus amount for component being replaced as shown above.
2. Compressor being replaced with a service replacement compressor—no major oil loss.	a. More than 1-1/2 oz.	a. Same amount as drained from compressor being replaced.
	b. Less than 1-1/2 oz.	b. Install 6 oz.
3. Compressor being replaced with a service replacement compressor——major oil loss evident.	a. More than 4 oz.	a. Same amount as drained from compressor being replaced.
	b. Less than 4 oz.	b. Install 6 oz.
4. Compressor being rebuilt or repaired—no major oil loss evident.	a. More than 1-1/2 oz.	a. Same amount as drained from compressor plus 1 oz. additional.
	b. Less than 1-1/2 oz.	b. Install 7 oz.
5. Compressor being rebuilt or repaired—major loss of oil evident.	a. More than 4 oz.	a. Same amount as drained from compressor plus 1 oz. additional.
	b. Less than 4 oz.	b. Install 7 oz.

13-34A

Figure 13-51 Oil Replacement Table

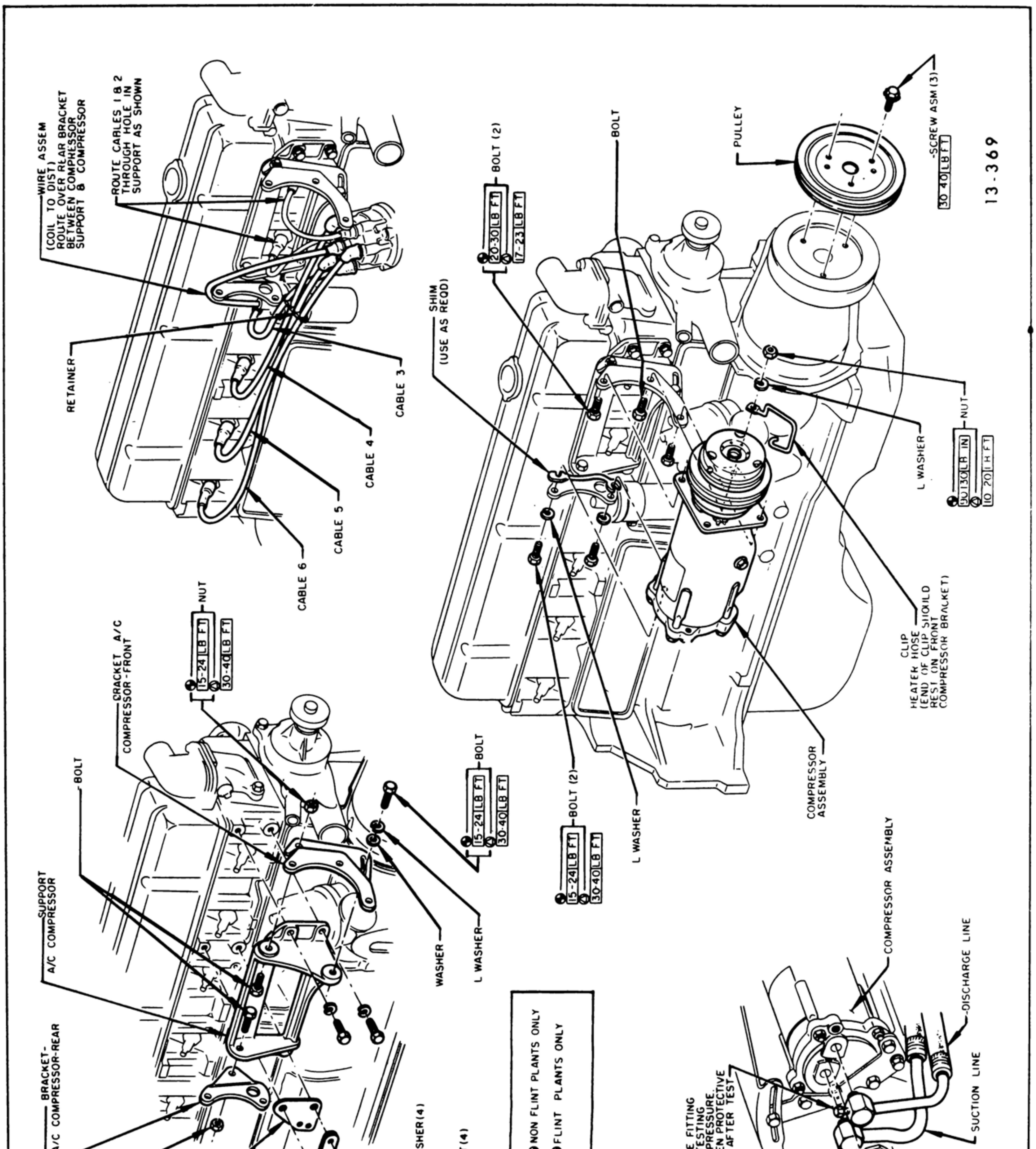


Figure 13-52 Compressor Installation, L-6 Engine

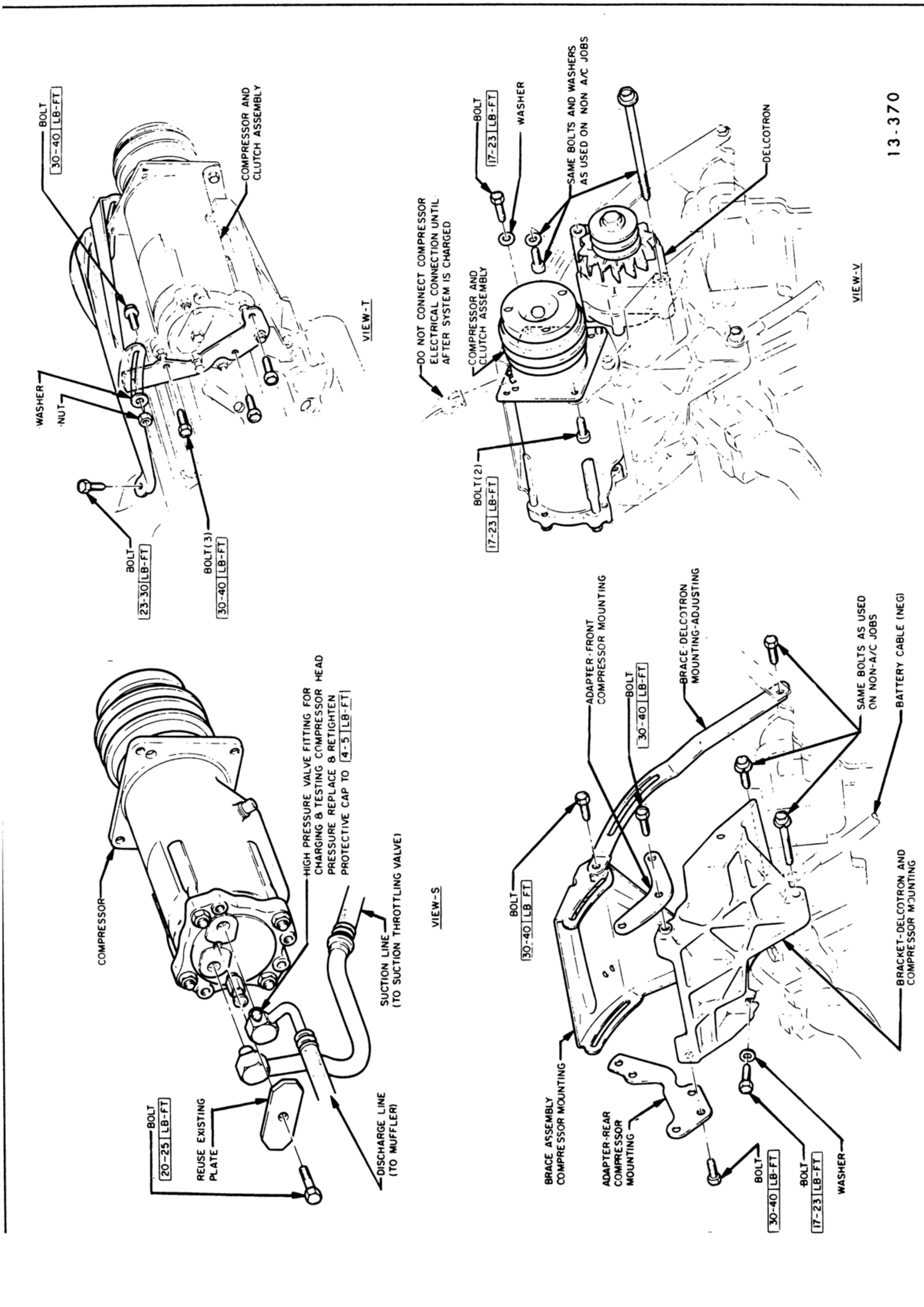


Figure 13-53 Compressor Installation, V-8 Engine

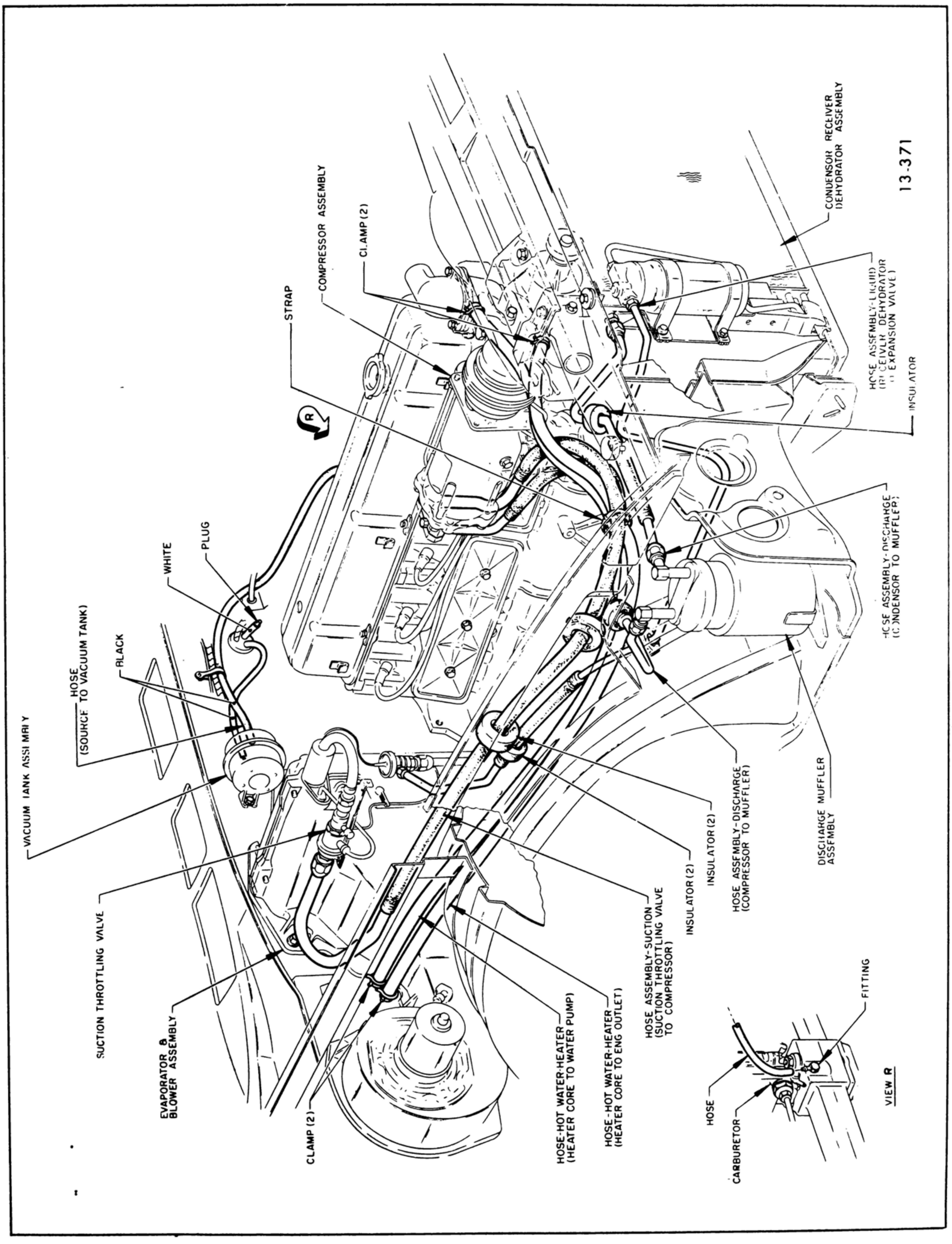


Figure 13-54 Refrigerant Line Installation 43-44000 Series, L-6 Engine

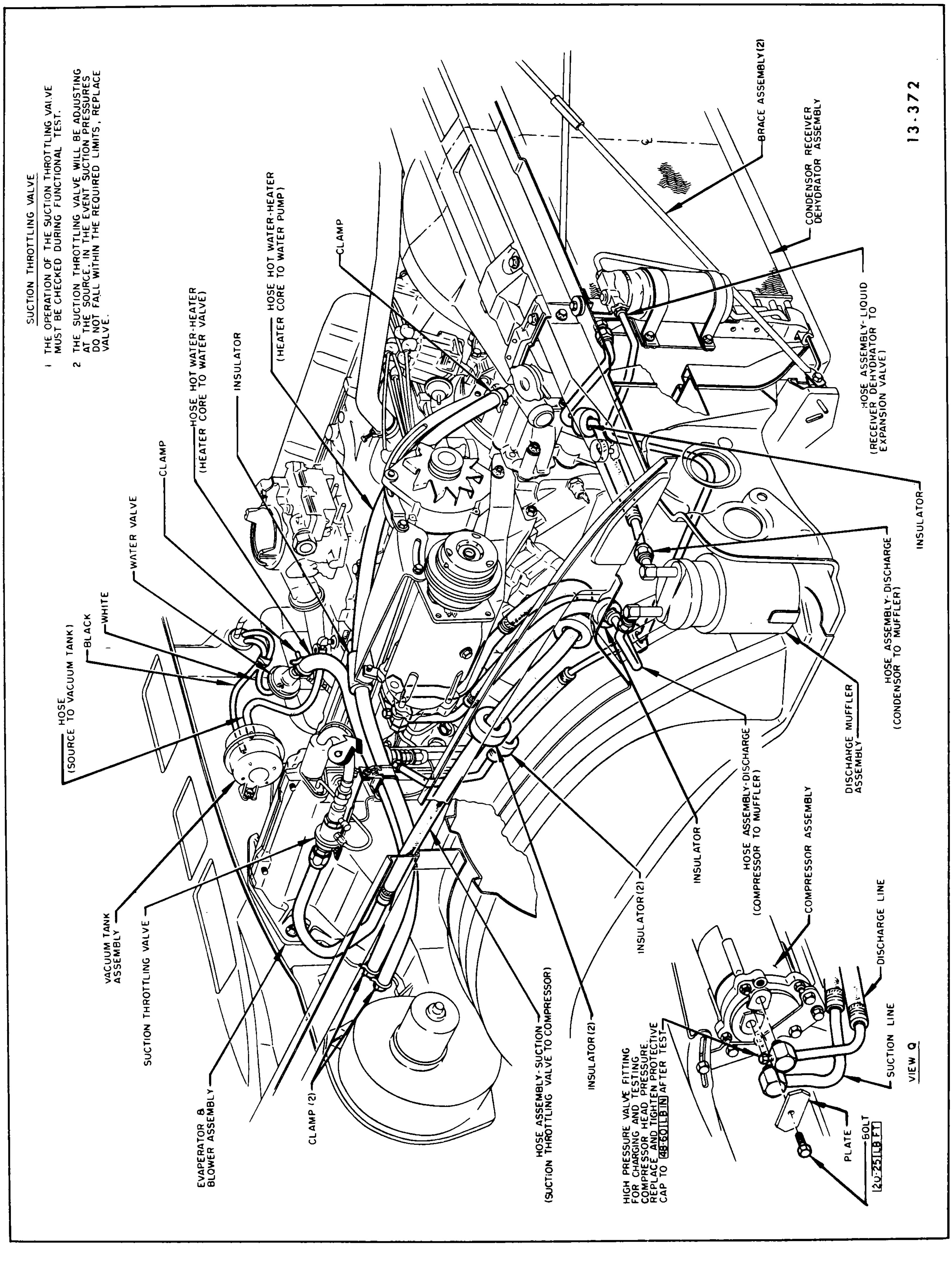


Figure 13-55 Refrigerant Line Installation 43-44000 Series, V-8 Engine

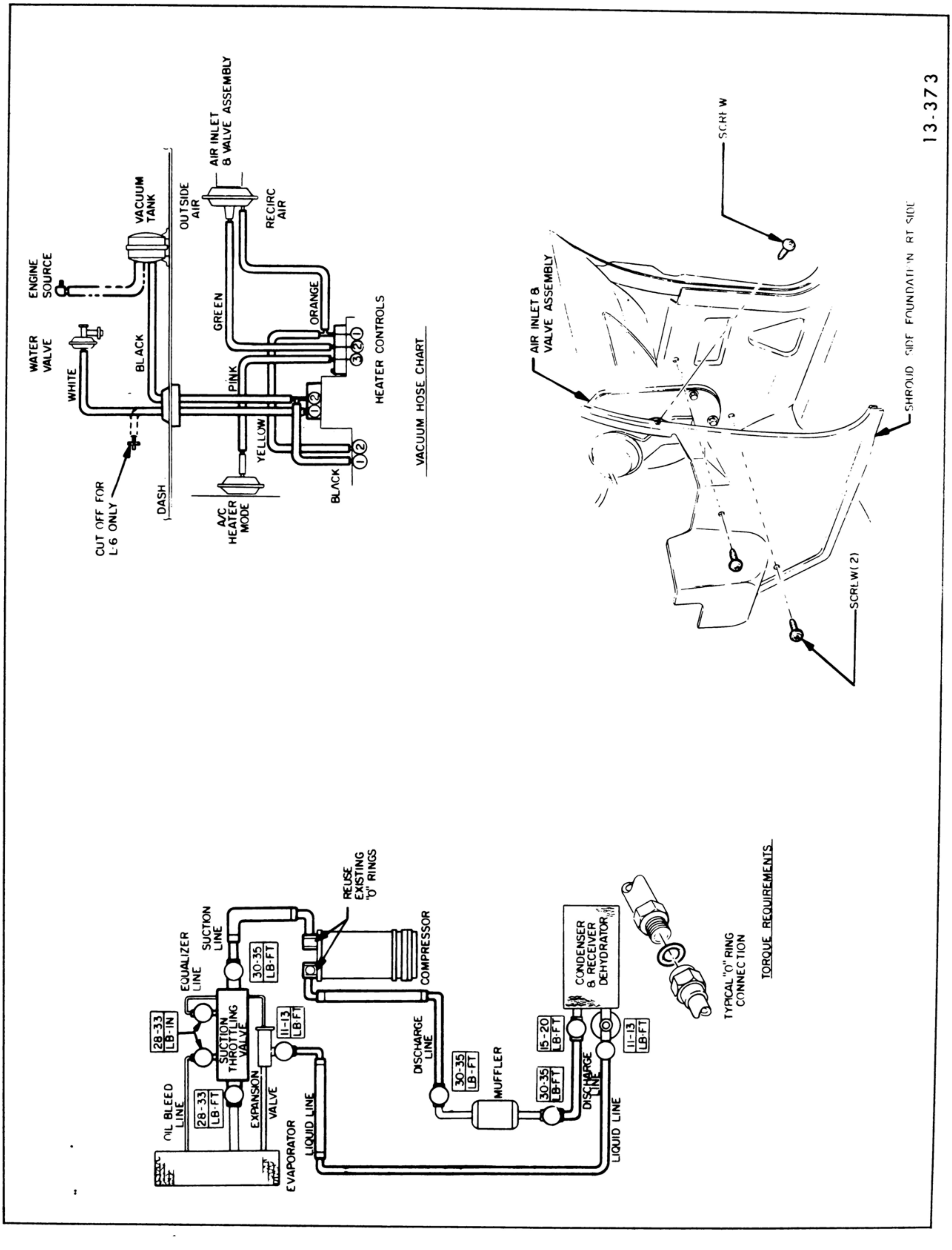


Figure 13-56 Refrigerant Line Torque Requirements and Vacuum Hose Chart 43-44000 Series

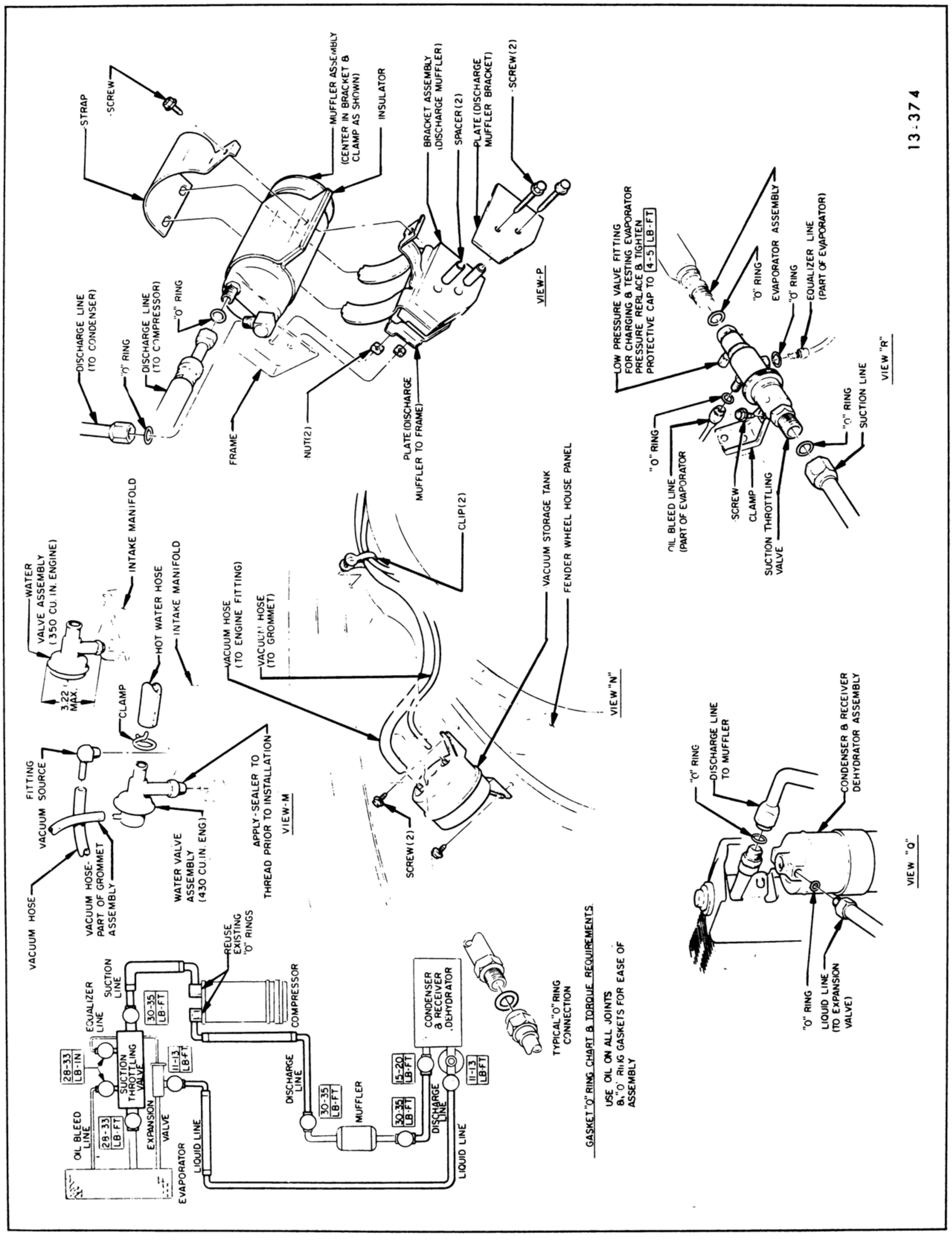


Figure 13-57 Refrigerant Line Installation 45-46-48000 Series